

**Flying below the radar:
Insider trading by executives below the top***

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Abstract

To enforce insider trading laws, financial regulators require top executives in listed companies to make their own-company trades public. One implication of this regulatory focus is that many executives below the top fly under the radar. In this study, we use administrative register data from Norway to examine whether executives below the top in listed companies earn abnormal returns on purchases in own-company stock. We show evidence of positive abnormal returns of own-company purchases using several alternative benchmarks, including own-company sells, purchases and sells of stocks of other companies, and purchases prior to joining the company. The estimates are economically large: about 100 basis points on a 1-month horizon. Our findings suggest the need for a debate on whether executives who are currently flying below the radar should be required to disclose their own-company stock trades.

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A centerpiece of the regulation of insider trading in financial markets is that primary insiders, that is top executives and board members of listed firms, are required to publicly disclose their trading activity.¹ Mandatory disclosure appears to be largely effective in deterring primary insiders from trading on material information, as evidenced by a large body of literature (see review below) which finds modest abnormal returns to such trades. Little is known, however, about whether the threshold for being a primary insider is set right, or whether other company insiders, that fly below the radar, have access to and trade on material information.

In this study, we use administrative register data from Norway to provide the first evidence on the return to inside trading by executives below the top, who are not required to publicly announce their trades. We compare these returns to several benchmarks, including publicly announced insider trades and trades made by executives below the top in non-inside stocks, and find strong evidence of executives below the top making abnormally high returns.

The closeness of below-the-top executives to the top of the corporate hierarchy makes it plausible that they have access to inside information. For example, a compliance officer at UBS recently received a three-year sentence for insider trading,² and more than 50 individuals in the illegal trading networks studied by Ahern (2017) were mid-level managers. Case evidence aside, little systematic knowledge exists about the extent to which below-the-top executives trade on inside information. Our study addresses whether individuals who are “just” below the threshold to be considered primary insiders trade on non-public, material information. We analyze this question by investigating whether executives below the top make abnormal returns on their inside trades.

To analyze the own-company stock trading of below-the-top executives, we use administrative register data from Norway. For each stock transaction (buy or sell) made at the Oslo Stock Exchange between 1998 and 2014, we identify the employer of the investor and which position inside the firm that individual occupies. The positional codes, provided by Statistics Norway, are designed in a way that demarcates below-the-top executives as a separate category.

¹ All developed countries we are aware of have legislation that requires primary insiders to make their trades public. In the US, the primary insiders are required to disclose trades to the SEC via Form 4 under Section 16 of the Securities Exchange Act, and the trades are publicly announced at <https://sec.report/Insider-Trades>. In Norway, publicly listed companies are required to submit a list of primary insiders to the Oslo Stock Exchange, publicly available at <https://www.oslobors.no/layout/set/print/Oslo-Boers/Handel/Markedsovervaaking/Primaerinsiderregister>. The trades are publicly available at <https://newsweb.oslobors.no>. The rules in the EU, regulated by the Market Abuse Regulation (MAR) legislative, are very similar.

² See, e.g., <https://www.complianceweek.com/europe/ubs-compliance-officer-convicted-of-insider-trading/27334.article>

We use announcements of trades by primary insiders (i.e., top executives and board members) to Oslo Stock Exchange to create one of several benchmark portfolios.

For ease of exposition, we refer to any trading in own-company stocks as “inside trading.”³ Following the recommendations of Lyon, Barber, and Tsai (1999), we test for abnormal returns on inside trades made by below-the-top executives by using two different methods. First, we analyze whether inside trades are associated with short-term excess returns using a variant of the control-firm approach employed by, for example, Barber and Lyon (1997) and Doskeland and Hvide (2011). This method compares actual short-term returns on inside purchases with the distribution of short-term returns for hypothetical purchases in stocks with similar market size and book-to-market characteristics. Second, we analyze whether the returns to own-company stock purchases are abnormally high across various portfolio formation periods, using a calendar-time portfolio approach accommodating risk factors according to the Carhart (1997) model.

Our main finding is that below-the-top executives make substantial abnormal returns on purchases in own-company stock. For example, using inside sells as the benchmark portfolio, the raw return difference is close to 100 basis points at the 1-month horizon. Using alternative benchmark portfolios, and adjusting for risk, the results are very similar. In contrast, we find no evidence of abnormal returns on publicly announced trades by primary insiders (top executives and directors).

It is possible that executives below the top have special stock-picking abilities and thus make abnormal returns on *all* their stock investments. However, we show that executives below the top do not earn abnormal returns on non-inside trades. For example, for non-inside purchases, the raw returns at the 1-month horizon are 44 basis points lower than for non-inside sells. This effectively rules out the supposition that executives have high ability, allowing them to earn abnormal returns on all investments. To accommodate the possibility of intrinsic ability in predicting the movements of the inside stock (due to e.g., industry experience or educational background), we test for abnormal returns in the subsample of executives who join a listed company during our sample period. For this subsample, we find negative or small positive abnormal returns to trades in the company stock in the year before joining the firm, and positive abnormal returns in the year after they joined. As this test compares returns to the same stock in an event-window around the change of employer, we conclude that abnormal returns to insider

³ As explained in Section 1, the term “insider trading” legally refers to trading on the basis of non-public material information. We refer to “insider trading” in the text as trading by corporate insiders, and test whether such trades are associated with abnormal returns, an indication that they are based on inside information.

trading by executives below the top cannot be explained by some time-invariant ability in predicting the movements of that stock.

We believe our estimates from Norway likely reflect a lower bound of the extent to which executives below the top benefit from insider trading around the world. Norway was among the first developed countries to introduce insider trading laws, in 1985.⁴ Also, Norway consistently ranks high on transparency and governance indices: Norway ranks 8th out of 190 on the World Bank ease-of-doing-business index and ranks among the ten least-corrupt countries in the world, according to the Corruption Perception Index published by Transparency International. Moreover, Eckbo and Smith (1998) and Eckbo and Ødegaard (2020) study the returns to publicly reported insider trading on Oslo Stock Exchange. Neither study finds evidence of abnormal returns for such trades.

Our study makes three main contributions. First, a large body of research focuses on publicly announced trades made by top executives. This literature generally finds evidence of abnormal returns to inside trading by top executives, mainly driven by insider purchases rather than inside sales (Seyhun, 1986; Lakonishok and Lee, 2001; Jeng, Metrick, and Zechhauser, 2003; Fidrmuc, Goergen, and Renneboog, 2006; Ravina and Sapienza, 2010; Cohen, Malloy, and Pomorski, 2012; and Biggerstaff, Cicero, and Wintoki, 2017). Exceptions are the findings of zero abnormal returns for inside trades by Jenter (2005) in the United States and by Eckbo and Smith (1998) and Eckbo and Ødegaard (2020) in Norway. As pointed out by Ali and Hirshleifer (2017), the magnitude of abnormal returns to insider trading by top executives generally appears small.⁵ We provide evidence of abnormal returns to insider trading by executives below the top. In contrast to the focus on trades by top executives of prior literature, the trades we focus on are “under the radar”—unobserved by market participants. Our findings suggest that executives below the top trade own-company stocks on the basis of non-public, material information.

Our second contribution is methodological. Prior literature calculates the returns to insider trading of top executives as the difference in buy and hold abnormal returns between purchases and sales of company stocks. A positive abnormal return is interpreted as evidence of insider trading on the basis of material, non-public information. However, top executives are highly able individuals, who might perform well in financial markets even in the absence of inside information.

⁴ Bhattacharya and Daouk (2002) list the evolution of insider trading laws around the world. The passage of insider trading laws in the United States in 1934 was followed by Canada in 1966, France in 1967, Sweden in 1971, Singapore in 1973, the United Kingdom in 1980, and Norway in 1985. Stricter, second-generation regulations were introduced in Norway in 1992.

⁵ Abnormal returns to insider trading are larger around “opportunistic trades” (Cohen, Malloy, and Pomorski, 2012; Ali and Hirshleifer, 2017), merger announcements (Keown and Pinkerton, 1981), and in “black-out” periods (Bettis et al., 2000; Jagolinzer, Larcker, and Taylor, 2011).

We therefore exploit the richness of the administrative register data from Norway and evaluate whether executives also earn abnormal returns on non-inside trades. We find no such evidence. We also address the concern that executives possess stock-specific abilities or knowledge by analyzing the return to trades in the company stock before an executive joins the company. We find large differences in abnormal returns in the year before and in the year after joining the firm and becoming an insider. In additional tests, we also find that the return to insider trading increases when employees are promoted to executives below the top. To the best of our knowledge, our study is the first to use these individual-specific benchmarks to rule out ability as an explanation for abnormal returns to insider trading.

Third, for market participants and regulators around the world, regulation of insider trading is an important question.⁶ Regulators have a number of levers in place to detect and deter insider trading, perhaps the most important being the mandatory reporting of trades by primary insiders.⁷ Our study addresses whether individuals who are “just” below the threshold to be considered primary insiders trade on non-public, material information. Our evidence is affirmative, which may suggest to regulators that they should expand the definition of primary insiders.⁸

Our study proceeds as follows. In the following section, we outline the institutional details on insider trading. Section 2 presents our data and provides descriptive statistics. In Section 3, we introduce the methodology for testing abnormal returns to insider trades by executives below the top, while Section 4 reports the main results. In Section 5, we show the results of several additional tests, including the abnormal returns to insider trading by employees (i.e., non-executives) and whether below-the-top executives earn abnormal returns before they join the listed company or around promotions. Section 6 concludes. The Internet Appendix provides additional tests.

⁶ For example, the European Union recently overhauled their insider trading regulative by replacing the the Market Abuse Directive (MAD) of 2003 with the Market Abuse Regulation (MAR) in 2014 (see https://ec.europa.eu/commission/presscorner/detail/en/MEMO_11_715 for details).

⁷ Other levers include flagging of trades around corporate events such as earnings and merger announcements, whistleblower programs (including financial incentives), and black-out periods. See, e.g., <https://www.investopedia.com/articles/investing/092616/how-insider-trading-prevented-corporations.asp>.

⁸ Our study also contributes to the academic debate about the need for regulation of insider trading. Proponents of regulation argue that insider trading laws are fundamental to fair and well-functioning financial markets (e.g., Ausubel, 1990; Bhattacharya and Daouk, 2002; Easley and O’Hara, 2004). Others argue that limiting insider trading makes prices in financial markets less informative about fundamentals (e.g., Leland, 1992; Cornell and Sirri, 1992). Our findings are relevant for both camps. Proponents will point to insider trading among executives below the top as additional evidence in favor of regulation to achieve fairness, while opponents will argue that additional regulation will make prices become less informative.

1. Insider trading rules and reporting of own-company trades

The legal definition of inside trading is trading in a company's securities based on material, non-public information about the company. Thus, in the legal definition of insider trading, *inside* does not refer to the relationship between the investor and the company.⁹ Trading by managers, board members, or employees of a listed company is generally allowed, as long as such trading does not rely on inside information. As noted in the introduction, we will for ease of exposition refer to trading by executives in own-company stocks as "insider trading."

To facilitate monitoring, many jurisdictions require companies to keep a list of primary insiders (i.e., managers and directors who have access to inside information). The primary insiders are required to report their trades in the company to market participants within a short period after the trade took place. In the United States, corporate officers, directors, and significant shareholders are required to file a Form 4 with the Securities and Exchange Commission before the end of the second business day following a trade involving own-company stocks.

Insider trading rules in Norway follow the example of the United States and many other jurisdictions.¹⁰ The rules define a primary insider as a person who is a member of the management or board of directors of a listed company and has access to inside information. Each listed company is responsible for identifying its primary insiders and for providing an up-to-date list of its primary insiders to the Oslo Stock Exchange.¹¹

As an example of how this rule works in practice, take Orkla ASA (ticker: ORK), a large cap food conglomerate. As of January 2021, Orkla maintains a list of 36 primary insiders, which include 15 company officers (CEO, top executives, and its advisory team), 18 board members (members and substitutes), and 3 external auditors.¹² Similarly, Nordic Semiconductor ASA, a small cap producer of wireless internet equipment, has 11 managers, 11 board members, and 1 auditor on its list of primary insiders.

All primary insiders are required by the Securities Trading Act to notify Oslo Stock Exchange of any transaction they carry out in financial securities (i.e., shares, equity certificates, warrants, options, bonds, etc.) issued by the company no later than the start of trading on the

⁹ "Material information" means information that is relevant for thus for investors' demand for the securities, and thus for security prices.

¹⁰ Oslo Stock Exchange maintains a website that details the regulation of insider trading in Norway as well as providing useful links to relevant legislation:

<https://www.oslobors.no/ob.eng/Oslo-Boers/Trading/Market-surveillance/Insider-trading>

¹¹ Oslo Stock Exchange maintains a list of primary insiders for all listed companies on its website:

<https://live.euronext.com/en/markets/oslo/primary-insiders>

¹² Orkla's list of primary insiders is published on Oslo Stock Exchange's webpage:

<https://live.euronext.com/en/product/equities/NO0003733800-XOSL/primary-insiders>

following day.¹³ The notification requirement also applies to transactions carried out by a primary insider's family members, including his or her spouse or a partner with whom they co-habit in a relationship akin to marriage, as well as their under-age children. Oslo Stock Exchange publishes information about the trade (i.e., number of securities purchased or sold by the primary insider, date, and the identity of the primary insider) under the heading “Mandatory notification of trade – primary insiders” in a publicly available database (newsweb.no).

As mentioned in the Introduction, the primary insider list is a practical solution that helps companies and regulators monitor trading activity by individuals who have access to inside information, but also implies that a large number of executives fly under the radar. Prior literature does not examine whether executives below the top trade on the basis of inside information. Our study provides the first evidence on the return to trades for executives below the top, who are not required to publicly announce their trades.

2. Data and descriptive statistics

2.1 Data sources

Our data cover all transactions of common stocks in personal brokerage accounts in Norway from 1997 to 2014 and contain economic and personal information about individuals, as well as stock characteristics and transaction prices. The data are from three sources: all transactions (buy and sells) are from the Norwegian Central Securities Depository (Verdipapirsentralen), which is the central securities depository in Norway that keeps records of all stock transactions on Oslo Stock Exchange. Our transaction data include purchases based on the exercise of stock options, but does not allow us to identify whether a given inside purchase result from exercise of stock options or not.

For each transaction made by an individual, the data include date of the transaction, the international securities identification number (isin) of the security, the number of shares bought or sold, and the individuals' personal identification number, which is equivalent to the social security number in the United States. For individuals that made several purchases of the same stock on the same day, we aggregate the purchases at the individual-stock-date level. We do the same for sells. As the transaction data do not include transaction prices, we use the closing price

¹³ The Financial Supervisory Authority of Norway (*Finanstilsynet*) provides an English translation of the Securities Trading Act (*Lov om verdipapirhandel*) on its website: <https://www.finanstilsynet.no/globalassets/laws-and-regulations/laws/securities-trading-act.pdf>

on the trading day as the transaction price. Although we are unable to capture returns within the trading day, this ensures that our returns do not pick differences between exercise (purchase) prices and market prices when exercising stock options or warrants (employee stock programs).

Daily stock prices and company information such as market capitalization are from the Oslo Stock Exchange (OSE). We supplement these data with company announcements of insider trades, also from the OSE. The Norwegian Securities Trading Act requires primary insiders, i.e., individuals who are members of the board of directors or management of a listed company, to notify Oslo Stock Exchange of any transaction they carry out in financial instruments issued by the company no later than the start of trading on the following day. This requirement applies to transactions in all financial instruments, i.e., shares, equity certificates, warrants, convertible bonds, subscription rights, warrants, options, etc., and to transactions carried out by the family of a primary insider (spouse, partner, and under-age children). We use these data to classify whether a trade made by an executive occurs on days with reported insider trading by primary insiders or not. As Norwegian law requires top executives to announce their insider trades to the stock market before the opening of trading the following trading day, we use the announcement day and the trading day before to classify trades occurring on days with trading by primary insiders.¹⁴

We obtain individual demographics from Statistics Norway. These data include age, gender, education, income, id of employer, and occupation of the individual (i.e., positions inside the firm). Data on positions inside the firm are based on the International Standard Classification of Occupations (ISCO-88), which is a classification system prepared by the International Labor Organization (ILO). Occupations are classified using 3- or 4-digit codes, providing a detailed breakdown of job categories that allow us to identify executives below the top. To preserve anonymity, Statistics Norway provides an anonymized version of the data in which all personal identification numbers are substituted with a unique personal id. Collectively, these data sources allow us to identify own-company stock trades (and other trades) made by executives between 1997 and 2014.

The starting point of our analysis is identifying individuals who hold positions as executives of listed companies. Using the ISCO occupational classifications codes, we then classify managers and general managers as executives below the top.¹⁵ We refer to this group of below-the-top

¹⁴ For example, if the company CEO announces a trade on trading date t , we classify both trading date t and trading date $t-1$ as days where an announced trade by an insider took place. In some cases, the announcement text classifies the exact date on which the trade took place (i.e., on trading date t or trading date $t-1$), but as this is not generally the case we opt for a conservative approach in defining inside dates.

¹⁵ Specifically, we classify job titles based on 3-digit ISCO-88 codes as follows: Top executives (121 “Managing directors and chief executives”), executives below the top (122, 123 “Managers” and 124

executives simply as executives throughout the analysis for brevity.¹⁶ The residual group of individuals who are working for listed companies are classified as employees. We then merge the occupations data with the trading data to classify insider trades and non-insider trades.

As mentioned in the Introduction, data availability limits prior literature to analyses of returns to insider trades by top executives and/or primary insiders. In contrast, our approach allows us to observe trades by executives who do not feature on the primary insider list. We then use public announcements on insider trading by primary insiders to analyze the return to insider trading by primary insiders, and more importantly to capture trades by executives who do not appear on the list. As indicated by the title, we refer to such trades by executives as insider trades flying below the radar.

The Norwegian economy has traditionally been focused on energy production. This focus is reflected in the stock market, where two large oil companies, Norsk Hydro and Statoil, have constituted about a third of the market capitalization of Oslo Stock Exchange.¹⁷ Starting out in the early 2000s, both companies were pioneers with employee stock programs as a means of remuneration. Also, both companies have a highly skilled workforce and a relatively high fraction of employees with an executive title; many are engineers with senior responsibilities in drilling. The extensive use of stock as employee remuneration, and the large number of executives in Norsk Hydro and Statoil, has implications for our sample composition: about two-thirds of trades in own-company stocks in companies listed on the Oslo Stock Exchange during our sample period are by Norsk Hydro or Statoil executives.¹⁸ To ensure that our results are not driven by the employee stock programs of these two companies, we perform the analysis in three steps. First, we exclude executives in Norsk Hydro and Statoil and focus our main analysis on the approximately 250 other companies on Oslo Stock Exchange for which inside trades by employees have been recorded. Second, we show in Appendix tables B1 and B2 that our main results are qualitatively similar, but statistically weaker, when including Norsk Hydro and Statoil in the

“General Managers”) and the residual group of employees (all other ISCO-88 codes). See <https://www.ilo.org> for background and a general description of the ISCO classification system.

¹⁶ Due to the pyramid-shape of the corporate hierarchy, the below-the-top category of executives typically captures a larger set of individuals than the top category. For example, in 2005 Orkla has 7 executives in the top category making inside trades, while the corresponding number for the below-the-top category is 40.

¹⁷ During our sample period, the combined market capitalization of Norsk Hydro and Statoil ranged between about 20 and 40 percent of the total market capitalization on Oslo Stock Exchange. Statoil and the energy division of Norsk Hydro merged in 2007, in one of the largest mergers worldwide in that year.

¹⁸ Appendix Figure B1 shows the number of inside buys by executives below the top during our sample period. We report the number of inside trades by executives of Norsk Hydro, Statoil, and Hydro Statoil (the name changed back to Statoil in 2009 and subsequently to Equinor in 2018).

analysis. This is as expected because many of the trades by executives below the top at Norsk Hydro and Statoil result from stock purchase programs in which employees are encouraged to buy company stocks on specific dates (see Appendix figures B1 and B2). Third, we show in Appendix tables B3 and B4 that we obtain results that are stronger both economically and statistically when we exclude buys that are likely to result from stock purchase programs.¹⁹ Specifically, we exclude purchases of own-company stock on dates where 100 or more executives of the same company made a purchase. In unreported tests, we find similar results if we alternatively define stock purchase programs as inside buys on dates where 50 or more executives of the same company traded. Thus, the results we present in the main analysis are not an artifact of the exclusion of Norsk Hydro and Statoil.

2.2 Summary statistics on insider trading activity

Table 1 provides descriptive statistics for executives who are active in the stock market, i.e., have purchased or sold a stock at some point during the sample period. For sake of comparison, we include the corresponding statistics for employees. Executives are, as expected, older and more likely to be male than are employees. The average executive in our sample is 46.9 years old, and 79% are male. In terms of income, the average executive earns about 1 million NOK (equivalent to 125.300 euros), compared to 620.800 NOK for employees.²⁰ Panel B shows the average trading activity for each group. Executives on average make 4.7 transactions per year of which 1.5 are in the stock of their employer. Non-executive employees have about the same level of activity. In terms of trading volume, the average transaction for executives is worth 168,200 NOK (21,000 euros), implying that on average executives have transactions with a market value around 800.000 NOK (100.000 euros) per year, close to the average pre-tax annual income. Panel C shows that the market value of insider trades in the stock of the employer is larger than trades in other stocks. Finally, Panel C also shows that transactions by executives are economically larger than trades by employees.

Individuals employed by a publicly traded company might purchase own-company stocks for reasons other than inside information. During our sample period, a number of companies have stock purchase programs that allow employees to purchase a small amount of company stock at a

¹⁹ Appendix Figure B2 shows the number of inside buys by executives below the top after we exclude purchases on dates where 100 or more executives of a company trade own-company stock. We note that concerns about stock purchase programs relate mainly to Norsk Hydro and Statoil, providing further evidence in support of our decision to exclude executives from these two firms from the main analysis.

²⁰ All amounts are in year 2014 Norwegian kroner (NOK). One euro equals 8 NOK during our sample period.

discount.²¹ As our data do not include the transaction price, we cannot infer whether employees buy company stocks at a discount or not. To address this issue, we limit our sample to trades with a market value of at least 1,000 NOK and show in Appendix A that we obtain similar results if we alternatively only use trades with a market value of at least 5,000 or 10,000 NOK. Further, Panel C in Table 1 shows that the average market value of trades by executives below the top far exceeds a level that can plausibly be motivated by tax incentives.

2.3 Summary statistics on trading returns

To examine the returns that executives earn on trading stocks, Table 2 reports the average buy and hold return over horizons from 1 week to 6 months. As explained above, the sample includes trades with market value of at least 1,000 NOK (125 euros). Panel A of Table 2 reports buy and hold returns for all buys and sells by executives. Buys are on average associated with positive returns ranging from 21 basis points in the first week to 481 basis points on the 6-month horizon. Stock prices also tend to increase after sells. The return to stocks that executives sell increases from 0.1 basis points in the first week to 373 basis points after 6 months. Panels B, C, and D split the trades into three types: Panel B reports returns to insider trades below the radar (i.e., trades by executives on days without a reported insider trade by primary insiders), while Panel C reports returns to insider trades above the radar (i.e., trades by executives on days with reported insider trading by primary insiders). Finally, Panel D shows the returns to non-insider trades (i.e., trades in other stocks), while Panel E reports the return to publicly announced insider trades by primary insiders.

Across the panels B, C, and D, we notice interesting differences in returns. Panel B shows large positive returns on insider trades below the radar. Stock prices increase by 24 basis points in the first week, reach 195 basis points after 1 month, and 858 basis points after 6 months. Stock prices also increase after sells, reaching 102 and 578 basis points after 1 month and 6 months, respectively. Across the horizon of buy-and-hold returns, we notice that the stock prices increase by more for buys than for sells when executives make inside trades below the radar.

Although our focus is the return to insider trading by executives who fly under the radar, we report, for transparency reasons, the return to insider trading by executives below the radar on days with public announcements of trading by primary insiders in Panel C. Panel E shows the

²¹ These programs are encouraged by tax incentives: the difference between the market value and the purchase prices is taxable income, but the amount taxed is reduced by 20%, subject to a cap at around 1,500 NOK (200 euros). Thus, purchases of company stocks for up to 7,500 NOK per year (1,000 euros) could be motivated by subsidies and tax incentives.

return to publicly announced insider trades by primary insiders. We note that a small positive return difference appears to exist at the short-term horizon, whereas the return difference between inside buys and inside sells of primary insiders is negative at the long-term horizon.²²

In summary, Table 2 provides evidence that is consistent with executives benefiting from material information when they trade own-company's stock. One potential alternative explanation for the positive difference in buy and sell return is that executives on average might possess industry knowledge or expertise that makes them good investors. Panel D provides evidence on this alternative interpretation by analyzing the return to executives' investments when they buy and sell other company stocks. In contrast to panels B and C, we find little evidence to suggest that executives are skillful investors. Buy returns are positive and increase over the horizon to 250 basis points after 6 months. Sell returns are also positive and increase to 314 basis points after 6 months. The difference in returns between buys and sells is negative for all horizons, except the first week, in which they are both close to 0 basis points. Table 2 thus suggests that executives profit from inside trades, but that this result is not due to their high general investment ability.

Figure 1 plots the average returns for various types of trades over holding horizons from 1 week to 6 months. Inside buys for executives have the highest returns, substantially larger than returns to inside sells. This contrasts with trades in other stocks, where non-inside sells have higher buy-and-hold return than non-inside buys. Taken together, Figure 1 shows that executives do very well when they trade their own-company stock, and less well when they trade stocks of other companies.

Figure 2 provides further detail on the return to trades in own-company stocks by comparing the return to inside buys and inside sells of executives below the top with the return to inside buys and inside sells by primary insiders. Consistent with the findings by Eckbo and Smith (1998) and Eckbo and Ødegaard (2020), Figure 2 shows that primary insiders do not seem to earn abnormal returns when they trade own-company stocks. We also note that the return to own-company stocks by executives below the top exceeds the return earned by primary insiders.

The large difference in returns documented in Table 2 and Figure 1 motivates a more careful analysis of the return to insider trading for executives below the top. In the next section, we discuss the empirical methodologies we use to draw meaningful statistical inferences.

²² See Eckbo and Smith (1998) and Eckbo and Ødegaard (2020) for a detailed analysis of the return to insider trading by primary insiders in Norway. In Appendix D, we use the calendar-time portfolio approach to evaluate the return to publicly announced inside trades by primary insiders during our sample period. Consistent with Eckbo and Smith (1998) and Eckbo and Ødegaard (2020), Appendix D shows no evidence of abnormal returns to insider trading by primary insiders.

3. Methodology

If inside trading by executives is driven by non-public material information, we would expect those investments to generate positive abnormal returns. On the other hand, if inside trading stems from familiarity with the stock, loyalty, or signaling of commitment to the company, such investments would likely not earn an abnormal return. Two methodological issues arise when testing whether inside trades are associated with abnormal returns. First, when calculating test statistics, we need to compare the returns of inside trades against an appropriate benchmark. Second, cross-sectional dependence in portfolio returns across trades makes distributional properties of test statistics difficult to evaluate; test statistics that assume independence in returns across individual portfolios will produce excessive t -statistics and thus cannot be employed.²³

We address these methodological issues in the following way. We analyze whether the returns of inside buys exceed those of two different benchmark returns: (i) the returns to inside sells, and (ii) the returns to non-inside buys and non-inside sells. In keeping with prior literature, we focus on purchases because they occur more frequently and because purchasing is a precondition for selling. In order to construct valid test statistics, we follow the recommendations of Lyon, Barber, and Tsai (1999) and employ two different approaches, a control-firm approach and the calendar-time portfolio approach.

3.1 Control-firm approach

To capture the abnormal return that investors earn on short-term pieces of information, we use a variant of the control-firm approach analyzed by Barber and Lyon (1997). This method allows us to test for abnormal returns of inside buys against three different benchmarks, using a bootstrapped empirical distribution to address concerns about cross-sectional dependence in stock returns.

As a first step, we test whether inside buys yield an abnormal return relative to what would have been made by investing in a different but similar stock. While the returns for inside buys are given by the data (see Figure 1), we construct the distribution of returns for the “fictitious” buys in the following way. For each year, we start out by ranking all companies according to their market values at the end of the previous year. Within each size quartile, we split the companies into

²³ Cross-sectional dependence occurs for three reasons: 1) the same individual may make trades having return horizons that overlap in time; 2) more than one executive in a firm may trade at the same time; and 3) returns of stocks are positively correlated (and executives across firms may trade at the same time). See, e.g., Kothari and Warner (2007) for a methodology survey.

quartiles according to their market-to-book values evaluated at the end of the previous year. For each inside buy, we randomly draw (with replacement) a security from the same size and the same market-to-book category, and evaluate the returns of the replacement security. Calculating the average returns across the fictitious trades in the randomly chosen replacement securities yields one observation from the empirical distribution. We repeat this procedure 1,000 times. To test for abnormal returns of inside buys, we compare the actual inside buy return with the empirical return distribution of fictitious buys (this test is recommended in Lyon, Barber, and Tsai, 1999, listed as Alternative C on page 175). The null hypothesis posits that the returns of inside buys equal the mean return of the empirical distribution of fictitious buys. Under a one-sided test with α confidence level, and under the assumption that the return distributions of the actual buys and the replacement buys are the same, the null hypothesis is rejected if the actual returns exceed the $(1-\alpha)$ percentile of the simulated return distribution.

We use a slightly modified procedure to test for abnormal returns of inside buys against other benchmarks. First, consider inside sell returns. Under the null hypothesis, the returns of inside buys are the same as the returns of inside sells. We test whether inside buys have abnormal returns compared to inside sells by first computing the inside buy minus the inside sell returns (as illustrated in Figure 1). We then create one observation of the simulated return difference distribution for each actual trade (buy or sell), drawing a replacement security within the same size and the same market-to-book category, and repeat this procedure 1,000 times to construct a simulated distribution. Under the null hypothesis, the returns of inside buys equal the returns of inside sells. Under a one-sided test with α confidence level, and under the assumption that the return distributions of the actual trades and the replacement trades are the same, the null hypothesis is rejected if the actual return difference between inside buys and inside sells exceed the $(1-\alpha)$ percentile of the simulated distribution. The procedure for testing whether inside buys have abnormal returns compared to non-inside buys is the same.

3.2 Calendar-time portfolio approach

To address excess returns on a longer horizon, we use the calendar-time portfolio approach. This approach eliminates the problem of cross-sectional dependence in returns by bundling trades into aggregate portfolios. For each calendar month t , we calculate the excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We compute separate portfolios depending on whether the trade was made on a day with or without inside trading announcements (i.e., inside above the radar and inside below the radar,

respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. A stock may have been purchased (sold) several times during the portfolio formation period. If so, each purchase is aggregated into one position in the inside buy (sell) portfolio. Each individual-stock-position has equal weight in the regression. In the same manner, we form and calculate returns for portfolios consisting of non-inside buys and sells. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors.

A critique of all methods that test for long-run abnormal returns, including the calendar-time portfolio approach, is their lack of power (e.g., Kothari and Warner, 2007; Nekrasov, Shroff, and Singh, 2009). One reason for the limited power of the calendar-time portfolio approach, in its standard implementation, is that different time periods have equal weight even if they contain a different number of observations (see Loughran and Ritter, 2000). This aspect is particularly relevant in the current context, as the number of inside trades varies considerably over time (see Appendix, Figure B2). To increase power, we use a weighting scheme closely related to the suggestion of Fama (1998) and assign equal weight to each executives' trading activity in a given stock in a given month.²⁴

4. Returns to insider trading below the radar

Do executives make abnormally high returns on their under-the-radar trades? Table 3 reports the average excess return (return minus the risk-free rate) in basis points for horizons of 1 week, 2 weeks, 3 weeks, and 1 month following buys and sells using the control-firm approach. Panel A of Table 3 compares the average return to inside buys by executives to the return to fictitious buys. Inside buys are associated with positive excess returns, increasing from 31 basis points at the 1-week horizon to 195 basis points at the 1-month horizon. In comparison, the return to the fictitious buys is 19 and 143, respectively. The differences in returns are statistically significant at conventional levels at all horizons.

Panels B, C, and D compare the returns to inside buys to alternative benchmarks. In Panel B, we use inside sells as a benchmark, to ensure that the excess returns documented in Panel A are not due to firm specific events or momentum. Again, we find a positive and statistical significance

²⁴ The weight assigned to inside buys in a particular month will be proportional to the number of executives making inside buys in that month; whether an executive makes one or more inside buys will not play a role. The same weighting scheme applies to inside sells, non-inside buys, and non-inside sells.

between return to inside buys and inside sells. The difference increases from 7 basis points at the 1-week horizon to 93 basis points at the 1-month horizon. In Panel C, we use non-inside buys, whereas Panel D compares the difference between inside buys and inside sells to the difference between non-inside buys and non-inside sells. Thus, panels C and D examine whether excess returns are driven by executives' investment ability. Consistent with the evidence in Panels A and B, executives earn excess returns when they trade the stock of their employers. The magnitudes are large; for example, inside buys earn 174 basis points higher returns than non-inside buys on the 1-month horizon. Appendix A, tables A1 and A2 show that these results are robust to excluding small trades with a market value below 5,000 NOK (625 euros) and 10,000 NOK (1,250 euros), respectively.

Table 4 reports abnormal returns for inside buys using the calendar-time portfolio approach.²⁵ We note that the variable of interest, the interaction between buy and inside below the radar, is positive and statistically significant. The abnormal returns are also economically significant across the different evaluation horizons: executives earn an abnormal return of 206 basis points in the first month, which increases to 318 basis points (= 2 times 159 basis points) after two months. The abnormal returns persist at longer horizons, where executives earn an abnormal return of 426 basis points (= 6 times 71 basis points) after 6 months.

We also note from Panel A of Table 4 that little evidence exists of abnormal returns for executives for their inside trades above the radar (i.e., trades on days with reported insider trading by primary insiders). The coefficients on the interaction between buys and the indicator for inside buys above the radar are insignificant for all horizons. Panel B confirms these findings when we evaluate the abnormal returns to buys only. Executives earn positive abnormal returns for inside purchases below the radar. The abnormal returns are both economically and statistically significant, increasing from 194 basis points at the 1-month horizon to 504 basis points (= 6 times 84 basis points) at the 6-month horizon. Again, we find no evidence of abnormal returns to insider trading by executives on days on which insider trades by primary insiders to the stock exchange are announced. Appendix tables A3 and A4 further show that these results are robust to excluding small trades with a market value below 5,000 NOK (625 euros) and 10,000 NOK (1,250 euros), respectively.

²⁵ The number of observations in Table 4 is smaller than the number of trades reported in Table 2 because the calendar-time portfolio approach aggregates trades within the same calendar month. As a result, the 65,140 trades in Panel A of Table 2 are aggregated into 45,249 observations in Column 1 of Table 4. Across columns in Table 4, the number of observations is lower than the number of months times the number of observations in Column 1 of Table 4 because some individuals trade more than once in the build-up period.

In summary, we find evidence of positive excess returns using a control-firm approach as well as evidence of positive abnormal returns using a calendar-time portfolio approach. Collectively, these findings suggest that executives trade on non-public material information and that these trades fly under the radar of regulators and market participants.

5. Do executives trade on material information?

Although the evidence in the prior section is consistent with executives trading on non-public material information, assessing this case convincingly is difficult. One alternative explanation is that executives possess detailed industry or firm-specific knowledge that increases their ability to earn abnormal returns, rather than benefiting from non-public material information. We address this concern by analyzing the returns around the event of being promoted or externally recruited to the executive position.²⁶ In this section we also analyze the returns to insider trading of employees (i.e. non-executives).

5.1 Abnormal stock returns around job changes

To address the concern that abnormal returns might reflect executives' industry knowledge or firm-specific knowledge, we analyze returns for a subsample of executives who change employers during our sample period. We follow these executives in the years around joining the firm and compare the returns they make in the firm's stock prior and during employment. To ensure that the evaluation period is not overlapping, we exclude trades that occur 6 months prior to changing job, i.e., the year before joining evaluated trades that occurred 6 to 18 months before changing employer. Table 5 reports the results using the calendar-time portfolio approach, while Appendix Table C1 reports the results using the control-firm approach.²⁷

Table 5 shows a zero abnormal return when executives trade the stocks before they join their new employer. The zero negative abnormal returns contrast the return executives earn after they join the new company. In their first year of employment, executives earn positive abnormal returns on the horizons of 1, 2, 3, and 4 months. The abnormal returns disappear on the long-term horizon. Table 5 displays no abnormal returns to insider trading for newly hired executives with two or more years of tenure. Appendix Table C1 provides evidence from the control-firm

²⁶ These tests are inspired by the methodology in Hvide and Östberg (2017), who show that employees start to trade the same shares as new co-workers after job changes.

²⁷ We have rearranged order of results from the control-firm approach in Table C1 to facilitate a comparison with results from the calendar-time portfolio approach in Table 5. Thus, Panel A of Appendix Table C1 reports results for all trades (i.e., the difference between inside buys and sells, and non-inside buys and sells, equivalent to the difference in Panel D of Table 3), and buys (i.e., the difference between inside buys and non-inside buys, equivalent to the difference in Panel C of Table 3).

approach that is less conclusive. In Panel A the abnormal return in the year before joining the company is -282 basis points at the 1-month horizon, while the abnormal returns are positive, but insignificant in the year after joining the company. In the follow years, there is a positive and statistically significant abnormal return at the three week and one month horizons. In summary, results in Table 5 and Appendix Table C1 show that executives do not seem to possess industry or firm-specific knowledge that allows them to earn abnormal returns before they join a new company. Rather, we find that executives earn abnormal returns only after they have joined the new company. Collectively, these findings bolster the interpretation that executives earn abnormal returns because they trade on non-public material information.

As a second step to address the concern that abnormal returns might reflect executives' industry knowledge or trading experience, we analyze abnormal returns to insider trading around promotions to becoming an executive. One potential caveat with this analysis is that "star" employees might gradually take over executive responsibilities in the period leading up to their formal promotion. If this is the case, changes in the return to insider trading might not align that well with the timing of promotions.

We compare the return to insider trading in the year before promotion to the return to insider trading in the year after promotion. Again, we ensure that the evaluation periods are not overlapping, by excluding trades that occur 6 months prior to promotion, i.e., the year before joining, by evaluating trades that occurred 6 to 18 months before the promotion. Table 6 reports calendar-time portfolio approach estimates, while Appendix Table C2 reports the results from the control-firm approach.

Table 6 shows positive returns to insider trading before and after promotion to executive below the radar. The abnormal returns to insider trading are higher after promotion at horizons of 3 and 4 months. Appendix C2 provides evidence that is broadly consistent with Table 6. In Panel A, abnormal returns from the control firm approach are positive and statistically significant in the year after promotion on the 3-week and 1-month horizon, whereas they tend to be negative and significant before promotion. For buys, the differences in abnormal returns around promotion seems less pronounced.

The analysis of trading around hirings and promotions to executive level broadly suggest that such events are associated with a significant improvement in the returns to buying the inside stock. We conclude that the abnormal returns for executives below the radar evidenced in Section 4 are unlikely to be due to industry knowledge or firm-specific knowledge that are individual-specific and present prior to being hired or promoted.

5.2 Return to insider trading of non-executives

To further examine abnormal returns to insider trades made by executives below the radar to the returns made by non-executive employees (simply “employees” henceforth). While it is both plausible and possible for employees to trade on the basis of inside information, we would expect executives to be in a better position because they are closer to the top of the hierarchy. Table 7 reports the results using the calendar-time portfolio approach, while Appendix Table C1 reports the results using the control-firm approach.²⁸

In Panel A of Table 7, we analyze the abnormal returns to insider trading by employees. We find positive and statistically significant abnormal returns for employees in both Panel A and Panel B of Table 7. Panel A shows that the magnitude of the abnormal returns to insider trades by employees is smaller than the return to insider trades by executives, in particular at the 1-month horizon. Panel B shows similar results when we focus the test on buys, rather than all trades. In addition, Appendix Table C3 shows results of similar magnitude when we focus on short-term returns using the control-firm approach. We conclude that both executives and employees appear to trade on the basis of inside information, and that executives tend to earn higher abnormal returns from insider trading than employees.

Conclusion

We have used administrative register data from Norway to examine whether executives below the top make abnormal returns on their purchases of own-company stocks. We find evidence of large abnormal returns of such “under the radar” purchases, using several alternative benchmarks, including inside sells, and purchases of non-inside stocks. Overall, the evidence suggests that executives below the top make large abnormal returns as a consequence of inside trading.

For regulators around the world, including the SEC in the United States, an important question remains: how to regulate trading by corporate insiders in order to ensure efficiency and fairness in financial markets? Our study addresses the question of whether individuals who are “just” below the threshold to be considered a primary insider are likely to trade on non-public,

²⁸As in appendix Table C1, we have rearranged the order of results in Appendix Table C3 from the control-firm approach to facilitate a comparison with results from the calendar-time portfolio approach in Table 5. Thus, Panel A of Appendix Table C3 reports results for all trades (i.e., the difference between inside buys and sells, and non-inside buys and sells, equivalent to the difference in Panel D of Table 3), and buys (i.e., the difference between inside buys and non-inside buys, equivalent to the difference in Panel C of Table 3).

material information. Our evidence is affirmative, which may suggest to regulators that they should consider widening the definition of primary insiders.

References

- Ahern, K. 2017. Information networks: Evidence from illegal insider trading tips. *Journal of Financial Economics* 125(1): 26–47.
- Ali, U., and D. Hirshleifer. 2017. Opportunism as a managerial trait: Predicting insider trading profits and misconduct. *Journal of Financial Economics* 126(3): 490–515.
- Ausubel, L.M. 1990. Insider trading in a rational expectations economy. *American Economic Review* 80 (5): 1022–1041.
- Banerjee, A., and E.W. Eckard. 2001. Why regulate insider trading? Evidence from the First Great Merger Wave (1897–1903). *American Economic Review* 91 (5): 1329–1349.
- Barber, B.M., and J.D. Lyon. 1997. Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics* 43 (3): 341–372.
- Bettis, C., J.L. Coles, and M. Lemmon. 2000. Corporate policies restricting trading by insiders. *Journal of Financial Economics* 57: 191–220.
- Berkman, H., P.D. Koch, and P.J. Westerholm. 2013. Informed trading through accounts of children. *Journal of Finance* 69 (1): 363–404.
- Bhattacharya, U., and H. Daouk. 2002. The world price of insider trading. *Journal of Finance* 57 (1): 75–108.
- Biggerstaff, L., D.C. Cicero, and M.B. Wintoki. 2017. Insider trading patterns. Working paper.
- Carhart, M.M. 1997. On the persistence in mutual fund performance. *Journal of Finance* 52 (1): 57–82.
- Cohen, L., C. Malloy, and L. Pomorski. 2012. Decoding inside information. *Journal of Finance* 67 (3): 1009–1043.
- Cornell, B., and E.R. Sirri. 1992. The reaction of investors and stock prices to insider trading. *Journal of Finance* 47 (3): 1031–1059.
- Cziraki, P., and J. Gider. 2019. The dollar profits to insider trading. Forthcoming, *Review of Finance*.
- Doskeland, T., and H.K. Hvide. 2011. Do individual investors have asymmetric information based on work experience? *Journal of Finance* 66: 1011–1041.
- Easley, D., and M. O'Hara. 2004. Information and the cost of capital. *Journal of Finance* 59: 1553–1583.
- Eckbo, B.E., and D.C. Smith. 1998. The conditional performance of insider trades. *Journal of Finance* 53 (2): 467–498.
- Eckbo, B.E., and B.A. Ødegaard. 2020. Insider trading, risk aversion, and gender. Working paper.
- Fama, E.F. 1998. Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics* 49: 283–306.
- Fidrmuc, J.P., M. Goergen, and L. Renneboog. 2006. Insider trading, news releases and ownership concentration. *Journal of Finance* 61: 2931–2973
- Hvide, H.K., and P. Östberg. 2015. Social interaction at work. *Journal of Financial Economics* 117 (3): 628–652.
- Jagolinzer, A.D., D.F. Larcker, and D.J. Taylor. 2011. Corporate governance and the information content of insider trades. *Journal of Accounting Research* 49 (5): 1249–1274.

- Jeng, L., A. Metrick, and R. Zeckhauser. 2003. Estimating the returns to insider trading: A performance-evaluation perspective. *Review of Economics and Statistics* 85: 453–471.
- Jenter, D. 2005. Market timing and managerial portfolio decisions. *Journal of Finance* 60: 1903–1949.
- Keown, A.J., and K.M. Pinkerton. 1981. Merger announcements and insider trading activity: An empirical investigation. *Journal of Finance* 36 (4): 855–869.
- Kothari, S.P., and J.B. Warner. 2007. Econometrics of event studies. In *Handbook of Empirical Corporate Finance*, Vol. 1, edited by B.E. Eckbo, pp. 3–36.
- Lakonishok, J., and I. Lee. 2001. Are insiders' trades informative? *Review of Financial Studies* 14: 79–112.
- Leland, H.E. 1992. Insider trading: Should it be prohibited? *Journal of Political Economy* 100 (4): 859–887.
- Lee, Y.T., Y.J. Liu, and N. Zhu. 2008. The costs of owning employer stocks: Lessons from Taiwan. *The Journal of Financial and Quantitative Analysis* 43 (3): 717–740.
- Loughran, T. and J. Ritter. 2000. *Journal of Financial Economics* 55 (3): 361-389.
- Lyon, J.D., B.M. Barber, and C.-L. Tsai. 1999. Improved methods for tests of long-run abnormal stock returns. *Journal of Finance* 41 (1): 165–201.
- Nekrasov, A., P. Shroff, and R. Singh. 2009. Tests of long-term abnormal performance. Working paper.
- Ravina, E., and P. Sapienza. 2010. What do independent directors know? Evidence from their trading. *Review of Financial Studies* 23: 962–1003.
- Seyhun, H.N. 1986. Insiders' profits, costs of trading, and market efficiency. *Journal of Financial Economics* 16: 189–212.

Table 1. Descriptive statistics

This table provides descriptive statistics for our sample of individual investors trading stocks on Oslo Stock Exchange between 1997 and 2014. The unit of observation is individual-years. We classify individuals into executives below the top (managers and general managers) and employees (the residual group). In Panel A, we report individual characteristics: *age* is measured in years; *male* is an indicator for males; *tenure* at current employer is measured in years; and *income* is the before-tax annual income measured in 1,000 NOK. In Panel B, we report the number of transactions (i.e., buys and sells) per year, and the number of inside trades, inside trades on days with announcements of trading by primary insiders, and non-inside trades. Panel C reports the average transaction value of all transactions, inside trades, and non-inside trades.

	Executives (Below the top)	Employees
<i>A. Individual characteristics</i>		
Age	46.9	43.4
Male (%)	78.6	66.4
Tenure	6.7	5.9
Income (1,000 NOK)	1002.5	620.8
<i>B. Average number of transactions per year</i>		
All trades	4.7	4.4
Inside trades	1.5	1.6
Inside trades on days with reported trading by primary insiders	0.2	0.1
Non-inside trades	3.2	2.8
<i>C. Average value of transactions per year (1,000 NOK)</i>		
All trades	168.2	79.2
Inside trades	219.8	87.7
Non-inside trades	77.4	76.8
N	17,969	105,372

Table 2. Average returns to trading by executives below the top

This table reports average buy-and-hold returns in percent following buys and sells of stocks by executives below the top over horizons from 1 week to 6 months. Panel A reports average buy-and-hold returns for all trades by executives below the top. Panel B reports buy-and-hold returns for inside trades below the radar (i.e., inside trades on days without announcements of trades by primary insiders). Panel C reports buy-and-hold returns for inside trades above the radar (i.e., inside trades on days with announcements of trades by primary insiders). Panel D reports buy-and-hold returns for non-inside trades by executives below the top. Panel E reports buy-and-hold returns for announcement of trades by primary insiders. The unit of observation is a trade.

	Horizon							N	
	1 week	2 weeks	3 weeks	1 month	2 months	3 months	4 months		6 months
<i>A. All trades</i>									
Buy	0.0021	0.0067	0.0075	0.0093	0.0184	0.0303	0.0256	0.0481	39,003
Sell	0.0009	0.0030	0.0045	0.0074	0.0146	0.0235	0.0271	0.0373	26,137
<i>B. Inside trades below the radar</i>									
Buy	0.0024	0.0149	0.0142	0.0195	0.0332	0.0546	0.0657	0.0858	12,744
Sell	0.0031	0.0061	0.0062	0.0102	0.0192	0.0363	0.0441	0.0578	5,837
<i>C. Inside trades above the radar</i>									
Buy	0.0103	0.0122	0.0186	0.0242	0.0434	0.0493	0.0589	0.0859	2,059
Sell	-0.0011	-0.0039	0.0048	0.0132	-0.0021	0.0114	0.0180	0.0299	137
<i>D. Non-inside trades</i>									
Buy	0.0009	0.0019	0.0030	0.0021	0.0086	0.0158	0.0178	0.0250	24,200
Sell	0.0005	0.0021	0.0040	0.0065	0.0133	0.0199	0.0223	0.0314	20,163
<i>E. Announcement of trades by primary insiders</i>									
Buy	0.0090	0.0094	0.0092	0.0116	0.0243	0.0384	0.0482	0.0646	17,072
Sell	0.0035	0.0048	0.0070	0.0107	0.0259	0.0483	0.0655	0.0849	6,007

Table 3. Control-firm analysis of returns to insider trading below the radar

Average excess returns (raw returns minus the risk-free interest rate) in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A: Inside buys				
Inside buy	0.0031	0.0152	0.0143	0.0195
Fictitious buy	0.0019	0.0109	0.0128	0.0143
Difference	0.0011***	0.0043***	0.0015**	0.0053***
P-value	[0.00]	[0.00]	[0.03]	[0.00]
N	12,556	12,558	12,749	12,863
Panel B: Inside buys – Inside sells				
Difference	0.007	0.0091***	0.0080***	0.0093***
P-value	[0.20]	[0.00]	[0.00]	[0.00]
N	18,322	18,337	18,492	18,685
Panel C: Inside buys – Non-inside buys				
Difference	0.0021***	0.0134***	0.0113***	0.0174***
P-value	[0.00]	[0.00]	[0.00]	[0.00]
N	36,575	36,628	36,768	37,045
Panel D: (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Difference	0.0003	0.0094***	0.0093***	0.0137***
P-value	[0.45]	[0.00]	[0.00]	[0.00]
N	63,343	62,377	62,518	63,033

Table 4. Calendar-time estimates of returns to insider trading below the radar

This table reports results from the calendar-time portfolio approach. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We construct separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the next 6 months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. The unit of observation is at the calendar-time individual level. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only for purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	-0.0071** (0.0035)	-0.0066** (0.0029)	-0.0066** (0.0027)	-0.0058** (0.0023)	-0.0027 (0.0024)
Inside below the radar	-0.0012 (0.0073)	0.0002 (0.0051)	-0.0010 (0.0048)	-0.0029 (0.0046)	0.0013 (0.0041)
Buy * Inside below the radar	0.0206* (0.0105)	0.0159*** (0.0055)	0.0147*** (0.0051)	0.0141*** (0.0044)	0.0071 (0.0043)
Inside above the radar	0.0104 (0.0129)	0.0028 (0.0097)	-0.0006 (0.0086)	0.0040 (0.0096)	0.0124 (0.0079)
Buy * Inside above the radar	-0.0003 (0.0141)	0.0010 (0.0099)	0.0048 (0.0080)	-0.0017 (0.0084)	-0.0118* (0.0070)
R ²	0.075	0.032	0.020	0.016	0.008
N	45,249	81,292	113,769	143,606	198,777

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Inside below the radar	0.0194** (0.0075)	0.0161*** (0.0049)	0.0136*** (0.0046)	0.0111** (0.0043)	0.0084** (0.0041)
Inside above the radar	0.0101 (0.0081)	0.0038 (0.0063)	0.0041 (0.0060)	0.0023 (0.0062)	0.0006 (0.0079)
R ²	0.088	0.037	0.023	0.019	0.010
N	32,506	60,015	85,459	109,203	154,095

Table 5. Returns to insider trading by executives who change employer

This table reports results from the return to insider trading by executives who change employers using the calendar-time portfolio approach. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We construct separate portfolios depending on whether the trade was made the year before (year -1), the year after (year+1), or two or more years after (year \geq 2) joining the company as an executive. We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Standard errors are reported in parentheses. We report a t-test of differences in the estimated return to insider trading in year -1 (before joining) and year +1 (after joining) at the bottom of the table, and report p-values in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Year -1 (before joining)	-0.0042 (0.0145)	0.0035 (0.0109)	-0.0027 (0.0087)	-0.0055 (0.0079)	0.0015 (0.0061)
Year +1	0.0445*** (0.0090)	0.0324*** (0.0107)	0.0239*** (0.0080)	0.0138* (0.0072)	0.0102 (0.0067)
Year \geq +2	0.0111 (0.0070)	0.0066 (0.0067)	0.0038 (0.0059)	0.0019 (0.0053)	0.0026 (0.0056)
R ²	0.199	0.194	0.196	0.195	0.197
N	22,291	38,367	52,262	65,060	88,345
Difference: Year -1 vs. Year 1	0.0487*** [0.001]	0.0359** [0.015]	0.0266*** [0.007]	0.0193** [0.031]	0.0087 [0.248]

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Year -1 (before joining)	0.0197 (0.0151)	0.0147 (0.0131)	0.0137 (0.0111)	0.0135 (0.0094)	0.0181*** (0.0070)
Year +1	0.0229 (0.0096)	0.0178* (0.0094)	0.0125 (0.0089)	0.0078 (0.0095)	0.0070 (0.0087)
Year \geq +2	0.0141 (0.0092)	0.0132 (0.0085)	0.0083 (0.0081)	0.0059 (0.0074)	0.0048 (0.0070)
R ²	0.042	0.026	0.021	0.021	0.021
N	15,897	28,245	39,301	49,765	69,157
Difference: Year -1 vs. Year 1	0.0032 [0.823]	0.0031 [0.808]	0.0012 [0.912]	-0.0057 [0.538]	-0.0111 [0.222]

Table 6. Returns to insider trading by employees around promotion to executive below the radar

This table reports results from the return to insider trading by individuals who are promoted to executive (below the radar) using the calendar-time portfolio approach. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We construct separate portfolios depending on whether the trade was made the year before (year -1), the year after (year+1), or two or more years after (year \geq +2) an individual is promoted to executive below the radar. We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Standard errors are reported in parentheses. We report a t-test of differences in the estimated return to insider trading in year -1 (before promotion) and year +1 (after promotion) at the bottom of the table, and report p-values in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Year -1 (before joining)	0.0178 (0.0177)	0.0149 (0.0151)	-0.0155 (0.0137)	-0.0164 (0.0094)	0.0182 (0.0350)
Year +1	0.0352*** (0.0115)	0.0254*** (0.0103)	0.0233** (0.0102)	0.0201** (0.0088)	0.0016 (0.0067)
Year \geq +2	0.0234* (0.0130)	0.0392*** (0.0124)	0.0270** (0.0103)	0.0253** (0.0110)	0.0258*** (0.0089)
R ²	0.209	0.209	0.210	0.204	0.208
N	13,949	23,471	31,622	39,057	52,244
Difference: Year -1 vs. Year 1	0.0173 [0.346]	0.0243 [0.512]	0.0378*** [0.006]	0.0326** [0.032]	-0.0167 [0.641]

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Year -1 (before joining)	0.0140 (0.0081)	0.0114* (0.0067)	0.0106* (0.0111)	0.0129* (0.0057)	0.0111** (0.0047)
Year +1	0.0086 (0.0055)	0.0105** (0.0047)	0.0085* (0.0051)	0.0075* (0.0043)	0.0063 (0.0039)
Year \geq +2	0.0071 (0.0060)	0.0062 (0.0046)	0.0048 (0.0040)	0.0037 (0.0074)	0.0035 (0.0030)
R ²	0.060	0.049	0.048	0.044	0.045
N	11,983	20,754	28,539	35,770	48,943
Difference: Year -1 vs. Year 1	-0.0054 [0.567]	-0.0009 [0.894]	-0.0022 [0.731]	-0.0054 [0.362]	-0.0048 [0.338]

Table 7. Returns to insider trading by employees

This table reports the return to insider trading to employees using a calendar-time portfolio approach. We estimate the returns to insider trading for *executives below the top* (managers and general managers) and *employees* (the residual). For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We construct separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. The unit of observation is at the calendar time individual level. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only from purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Executives below the top	0.0198* (0.0104)	0.0132*** (0.0052)	0.0114** (0.0049)	0.0099** (0.0041)	0.0037 (0.0039)
Employees	0.0012 (0.0076)	0.0082* (0.0047)	0.0098** (0.0046)	0.0113*** (0.0042)	0.0086** (0.0043)
R ²	0.062	0.028	0.017	0.014	0.007
N	265,380	475,464	664,105	836,211	1,156,101
Difference: executives vs. employees	0.0210** [0.030]	0.0050 [0.320]	0.0016 [0.710]	-0.0014 [0.721]	-0.0049 [0.228]

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Executives below the top	0.0203** (0.0076)	0.0173*** (0.0052)	0.0161*** (0.0050)	0.0140*** (0.0048)	0.0113** (0.0048)
Employees	0.0080 (0.0070)	0.0117** (0.0054)	0.0116** (0.0050)	0.0101** (0.0046)	0.0076 (0.0047)
R ²	0.068	0.022	0.014	0.011	0.006
N	188,995	349,109	497,068	633,895	893,419
Difference: executives vs. employees	0.0123*** [0.009]	0.0055* [0.066]	0.0045* [0.077]	0.0039 [0.106]	0.0037 [0.111]

Figure 1. Return to executive trading, by type of trade

This figure reports the average return to trading by executives below the top. We report the average buy-and-hold return following inside buys, inside sells, non-inside buys, and non-inside sells over horizons from 1 week to 6 months. To facilitate a comparison, we also include the buy-and-hold return to announcements of purchases by primary insiders.

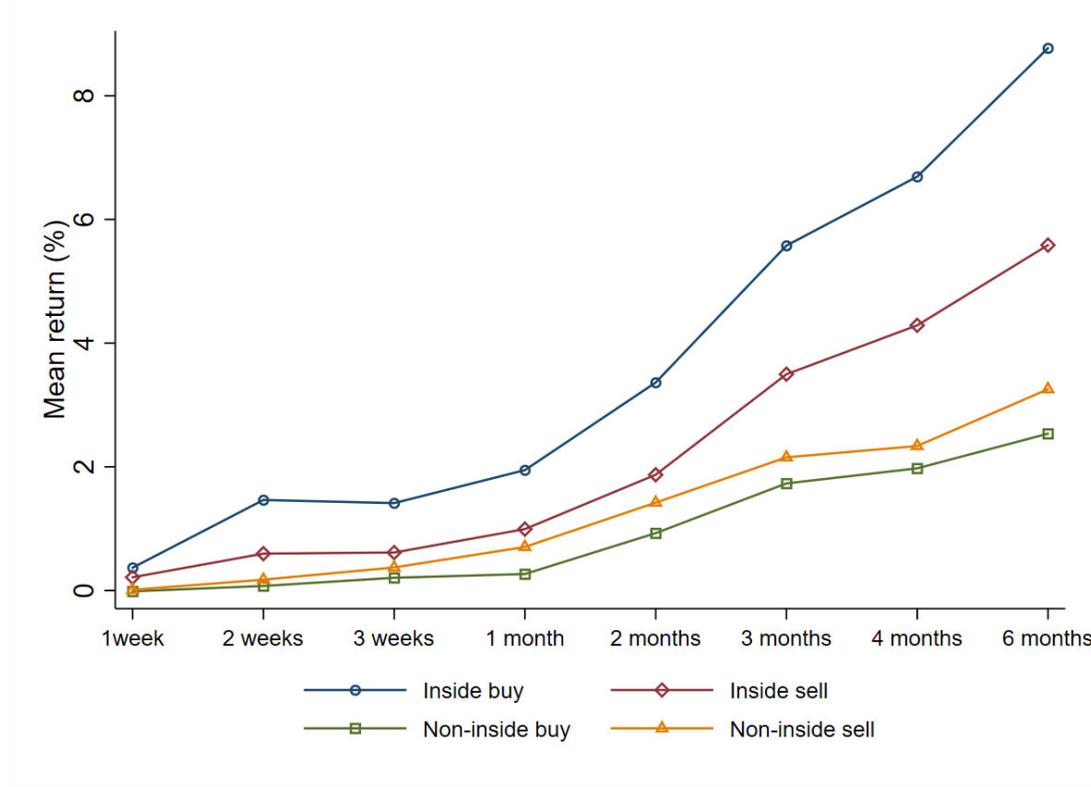
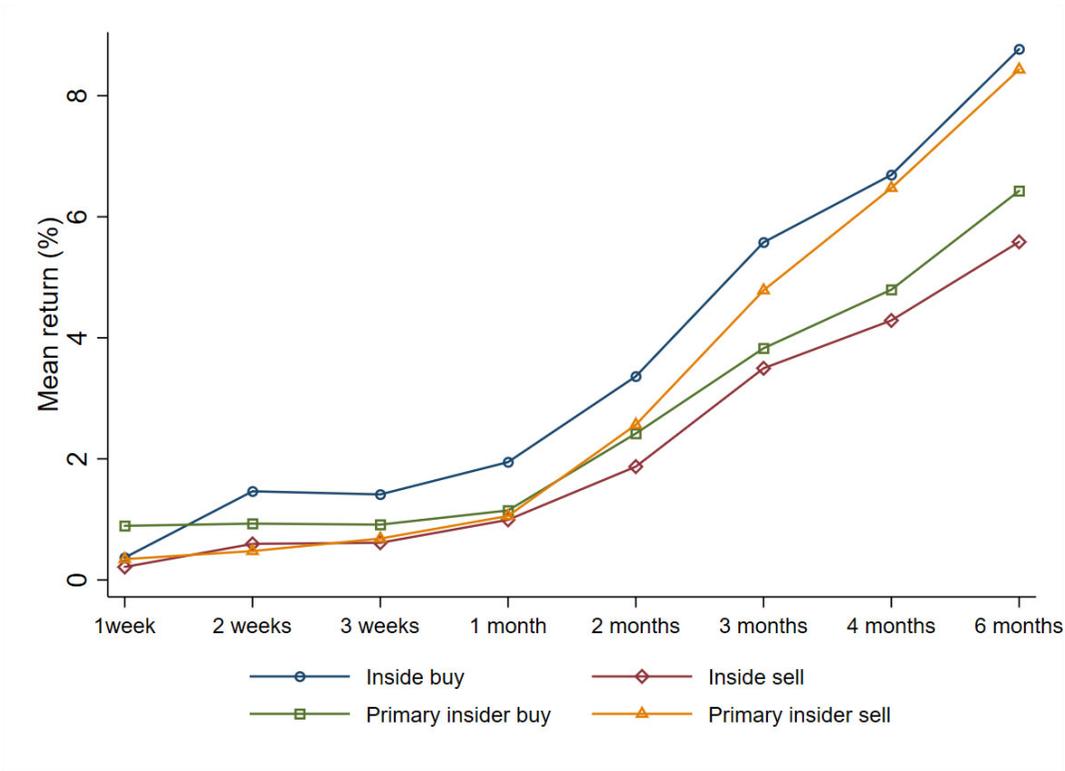


Figure 2. Return to primary insiders and executives trading below the radar

This figure reports the average return to trading by executives below the top. We report the average buy-and-hold return following *inside buys* and *inside sells* over horizons from 1 week to 6 months. To facilitate a comparison, we also include the buy-and-hold return to announcements of buys and sells by primary insiders.



Online Appendix for
“Flying below the radar? Insider trading by executives below the top”

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Appendix A. Excluding trades with low market value

Table A1. Control-firm analysis of returns to insider trading below the radar

This table replicates Table 3 for trades with a market value of at least 5,000 NOK (625 euros). Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. Inside buys				
Inside buy	0.0008	0.0083	0.0108	0.0160
Fictitious buy	0.0020	0.0073	0.0116	0.0140
Difference	-0.0012**	0.0010***	-0.0009**	0.0020***
P-value	[0.96]	[0.00]	[0.97]	[0.00]
N	9,976	10,002	10,162	10,272
Panel B. Inside buys – Inside sells				
Difference	-0.0015*	0.0020*	0.0040***	0.0056***
P-value	[0.94]	[0.06]	[0.01]	[0.00]
N	15,449	15,457	15,613	15,797
Panel C. Inside buys – Non-inside buys				
Difference	0.0001	0.0065***	0.0076***	0.0132***
P-value	[0.49]	[0.00]	[0.00]	[0.00]
N	32,217	32,262	32,397	32,661
Panel D. (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Difference	-0.0017*	0.0025*	0.0052***	0.0094***
P-value	[0.92]	[0.06]	[0.00]	[0.00]
N	56,553	56,578	56,714	57,198

Table A2. Control-firm analysis of returns to insider trading below the radar

This table replicates Table 3 for trades with a market value of at least 10,000 NOK (1,250 euros). Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. Inside buys				
Inside buy	0.0016	0.0067	0.0106	0.0157
Fictitious buy	0.0031	0.0064	0.0119	0.0149
Difference	-0.0015**	0.0002	-0.0013***	0.0008
P-value	[0.98]	[0.38]	[0.99]	[0.28]
N	6,952	6,857	6,987	7,046
Panel B. Inside Buys – Inside Sells				
Difference	-0.0004	0.0008	0.0051***	0.0062***
P-value	[0.61]	[0.29]	[0.00]	[0.00]
N	11,574	11,466	11,593	11,716
Panel C. Inside Buys – Non-inside Buys				
Difference	0.0006*	0.0043***	0.0069***	0.0117***
P-value	[0.25]	[0.00]	[0.00]	[0.00]
N	26,733	26,649	26,758	26,947
Panel D. (Inside Buys – Inside Sells) – (Non-inside Buys – Non-inside Sells)				
Difference	-0.0011	0.0009	0.0055***	0.0087***
P-value	[0.80]	[0.29]	[0.00]	[0.00]
N	48,626	48,516	48,623	49,008

Table A3. Calendar-time estimates of returns to insider trading below the radar

This table replicates Table 4 for trades with a market value of at least 5,000 NOK (625 euros). This table reports results from the calendar-time portfolio approach. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We compute separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only from purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	-0.0069*	-0.0066**	-0.0065**	-0.0057**	-0.0026
	(0.0035)	(0.0029)	(0.0027)	(0.0023)	(0.0024)
Inside below the radar	-0.0011	0.0002	-0.0009	-0.0028	0.0014
	(0.0073)	(0.0051)	(0.0047)	(0.0046)	(0.0042)
Buy * Inside below the radar	0.0205*	0.0158***	0.0145***	0.0140***	0.0070
	(0.0105)	(0.0055)	(0.0051)	(0.0044)	(0.0043)
Inside above the radar	0.0105	0.0029	-0.0005	0.0041	0.0125
	(0.0129)	(0.0097)	(0.0086)	(0.0096)	(0.0079)
Buy * Inside above the radar	-0.0004	0.0010	0.0047	-0.0018	-0.0119*
	(0.0141)	(0.0099)	(0.0080)	(0.0084)	(0.0070)
R ²	0.075	0.032	0.020	0.016	0.008
N	45,212	81,215	113,653	143,452	198,556

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Inside below the radar	0.0194**	0.0161***	0.0136***	0.0111**	0.0084**
	(0.0075)	(0.0049)	(0.0046)	(0.0043)	(0.0041)
Inside above the radar	0.0101	0.0038	0.0041	0.0023	0.0006
	(0.0081)	(0.0063)	(0.0060)	(0.0062)	(0.0079)
R ²	0.088	0.037	0.023	0.019	0.010
N	32,485	59,972	85,391	109,110	153,954

Table A4. Calendar-time estimates of returns to insider trading below the radar

This table replicates Table 4 for trades with a market value of at least 10,000 NOK (1,250 euros). This table reports results from the calendar-time portfolio approach. For each calendar month t , we calculate the excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We compute separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only from purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	-0.0071** (0.0036)	-0.0067** (0.0029)	-0.0066** (0.0027)	-0.0058** (0.0023)	-0.0026 (0.0024)
Inside below the radar	-0.0013 (0.0069)	0.0001 (0.0050)	-0.0011 (0.0049)	-0.0030 (0.0047)	0.0014 (0.0045)
Buy * Inside below the radar	0.0208** (0.0106)	0.0160*** (0.0056)	0.0147*** (0.0051)	0.0141*** (0.0044)	0.0070 (0.0043)
Inside above the radar	0.0101 (0.0130)	0.0021 (0.0098)	-0.0010 (0.0087)	0.0038 (0.0096)	0.0126 (0.0079)
Buy * Inside above the radar	0.0001 (0.0142)	0.0019 (0.0100)	0.0053 (0.0081)	-0.0014 (0.0084)	-0.0119* (0.0070)
R ²	0.075	0.032	0.020	0.016	0.008
N	45,045	80,896	113,207	142,880	197,762

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Inside below the radar	0.0195*** (0.0075)	0.0162*** (0.0049)	0.0136*** (0.0046)	0.0112*** (0.0043)	0.0084** (0.0041)
Inside above the radar	0.0102 (0.0081)	0.0040 (0.0063)	0.0042 (0.0060)	0.0024 (0.0062)	0.0006 (0.0079)
R ²	0.088	0.038	0.023	0.019	0.010
N	32,387	59,779	85,119	108,765	153,469

Appendix B. Results with Norsk Hydro and Statoil

Table B1. Control-firm analysis of returns to insider trading below the radar

This table replicates Table 3 for the sample that includes executives in Norsk Hydro and Statoil. Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. Inside buys				
Inside buy	0.0024	0.0171	0.0095	0.0115
Fictitious buy	-0.0031	0.0092	0.00101	0.0086
Difference	0.0055***	0.0079***	-0.0007**	0.0029***
P-value	[0.00]	[0.00]	[0.96]	[0.00]
N	46,602	46,695	46,852	46,986
Panel B. Inside buys – Inside sells				
Difference	0.0013***	0.0133***	0.0043***	0.0031***
P-value	[0.00]	[0.00]	[0.00]	[0.00]
N	60,256	60,345	60,483	60,741
Panel C. Inside buys – Non-inside buys				
Difference	0.0027***	0.0170***	0.0088***	0.0120***
P-value	[0.00]	[0.00]	[0.00]	[0.00]
N	96,162	96,273	96,390	96,867
Panel D. (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Difference	0.0010*	0.0138***	0.0058***	0.0071***
P-value	[0.06]	[0.04]	[0.00]	[0.00]
N	149,353	149,462	149,541	150,045

Table B2. Calendar-time estimates of returns to insider trading below the radar

This table replicates Table 4 for the sample that includes executives in Norsk Hydro and Statoil. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We compute separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only from purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	-0.0085*** (0.0031)	-0.0061** (0.0028)	-0.0070*** (0.0024)	-0.0055** (0.0021)	-0.0027 (0.0022)
Inside below the radar	0.0035 (0.0054)	0.0041 (0.0043)	0.0009 (0.0042)	-0.0006 (0.0045)	-0.0001 (0.0053)
Buy * Inside below the radar	0.0066 (0.0077)	0.0053 (0.0077)	0.0079 (0.0062)	0.0078 (0.0060)	0.0067 (0.0062)
Inside above the radar	0.0106 (0.0093)	0.0011 (0.0101)	-0.0059 (0.0098)	-0.0062 (0.0100)	-0.0051 (0.0097)
Buy * Inside above the radar	-0.0059 (0.0101)	0.0056 (0.0119)	0.0135 (0.0117)	0.0121 (0.0111)	0.0064 (0.0105)
R ²	0.070	0.051	0.035	0.025	0.013
N	195,781	287,082	366,988	441,706	571,164

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Inside below the radar	0.0101 (0.0063)	0.0094 (0.0069)	0.0089 (0.0059)	0.0072 (0.0053)	0.0066 (0.0049)
Inside above the radar	0.0047 (0.0068)	0.0067 (0.0069)	0.0076 (0.0069)	0.0060 (0.0066)	0.0012 (0.0067)
R ²	0.076	0.058	0.041	0.030	0.015
N	171,418	247,193	314,802	379,491	493,345

Table B3. Control-firm analysis of returns to insider trading below the radar after screening for stock purchase programs

This table replicates Table 3 for the sample that includes executives in Norsk Hydro and Statoil, but excludes inside buys that are likely to result from stock purchase programs. To screen for stock purchase programs, we exclude inside buys in a given company if 100 or more executives of that company purchase the company stock on the same date. Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. Inside buys				
Inside buy	0.0007	0.0067	0.0087	0.0132
Fictitious buy	0.0009	0.0059	0.0089	0.0125
Difference	-0.0001	0.0007***	-0.0002	0.0007
P-value	[0.57]	[0.00]	[0.67]	[0.12]
N	14,918	15,011	15,168	15,302
Panel B. Inside buys – Inside sells				
Difference	-0.0003	0.0029***	0.0035***	0.0048***
P-value	[0.70]	[0.00]	[0.00]	[0.00]
N	28,464	28,553	28,691	28,949
Panel C. Inside buys – Non-inside buys				
Difference	0.0010**	0.0069***	0.0079***	0.0133***
P-value	[0.03]	[0.00]	[0.00]	[0.00]
N	63,210	63,321	63,438	63,915
Panel D. (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Difference	-0.0007	0.0037***	0.0048***	0.0083***
P-value	[0.80]	[0.00]	[0.00]	[0.00]
N	116,255	116,364	116,443	117,357

Table B4. Calendar-time estimates of returns to insider trading below the radar after screening for stock purchase programs

This table replicates Table 4 for the sample that includes executives in Norsk Hydro and Statoil, but excludes inside buys that are likely to result from stock purchase programs. To screen for stock purchase programs, we exclude inside buys on dates where 100 or more executives of the same company traded. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for each inside buy (sale) during the portfolio formation period. We compute separate portfolios depending on whether the trade was made on a day with or without announcements of trading by primary insiders (i.e., inside above the radar and inside below the radar, respectively). We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside trade will be included in the inside buy portfolio for the 6 consecutive months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Panel A reports results for all trades (i.e., buys and sells), whereas Panel B reports results only from purchases. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. All trades

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	-0.0085*** (0.0031)	-0.0067** (0.0026)	-0.0073*** (0.0023)	-0.0061*** (0.0021)	-0.0031 (0.0023)
Inside below the radar	0.0042 (0.0055)	0.0039 (0.0044)	0.0010 (0.0043)	-0.0005 (0.0046)	-0.0001 (0.0053)
Buy * Inside below the radar	0.0096 (0.0065)	0.0100** (0.0048)	0.0121*** (0.0043)	0.0108** (0.0043)	0.0085 (0.0054)
Inside above the radar	0.0151 (0.0101)	0.0056 (0.0085)	-0.0018 (0.0078)	-0.0046 (0.0084)	-0.0052 (0.0097)
Buy * Inside above the radar	-0.0075 (0.0109)	-0.0024 (0.0084)	0.0057 (0.0071)	0.0069 (0.0072)	0.0052 (0.0096)
R ²	0.065	0.032	0.019	0.015	0.008
N	76,977	134,817	186,047	232,911	318,739

Panel B. Buys

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Inside below the radar	0.0138*** (0.0048)	0.0139*** (0.0041)	0.0131*** (0.0040)	0.0103** (0.0040)	0.0084** (0.0039)
Inside above the radar	0.0076 (0.0071)	0.0032 (0.0061)	0.0039 (0.0053)	0.0023 (0.0055)	-0.0001 (0.0073)
R ²	0.071	0.036	0.022	0.017	0.009
N	53,788	96,604	135,691	172,221	240,988

Figure B1. Number of inside buys by executives below the top

This figure reports the number of inside buys per year by executives below the top across the sample period from 1997 to 2014. The red bars show the number of inside buys in the main analysis, while the yellow bars show the number of inside buys by executives at Norsk Hydro and Statoil. As mentioned in Section 2, Statoil merged with the oil division of Norsk Hydro in 2007 to form Hydro Statoil (name changed back to Statoil in 2009 and subsequently to Equinor in 2018).

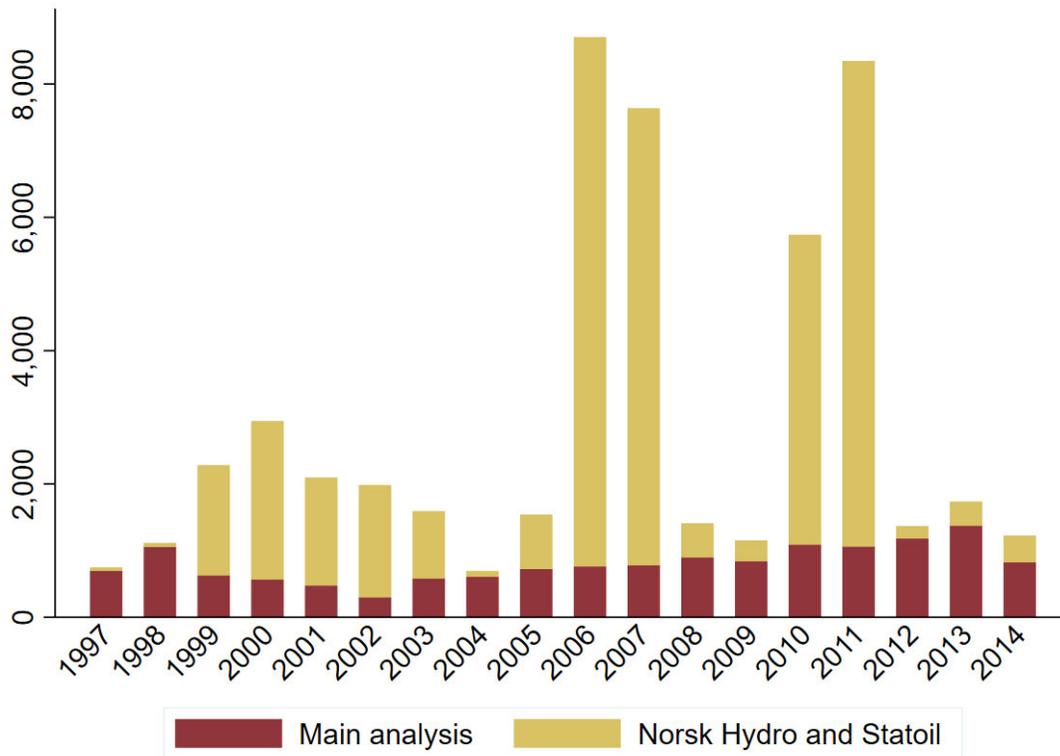
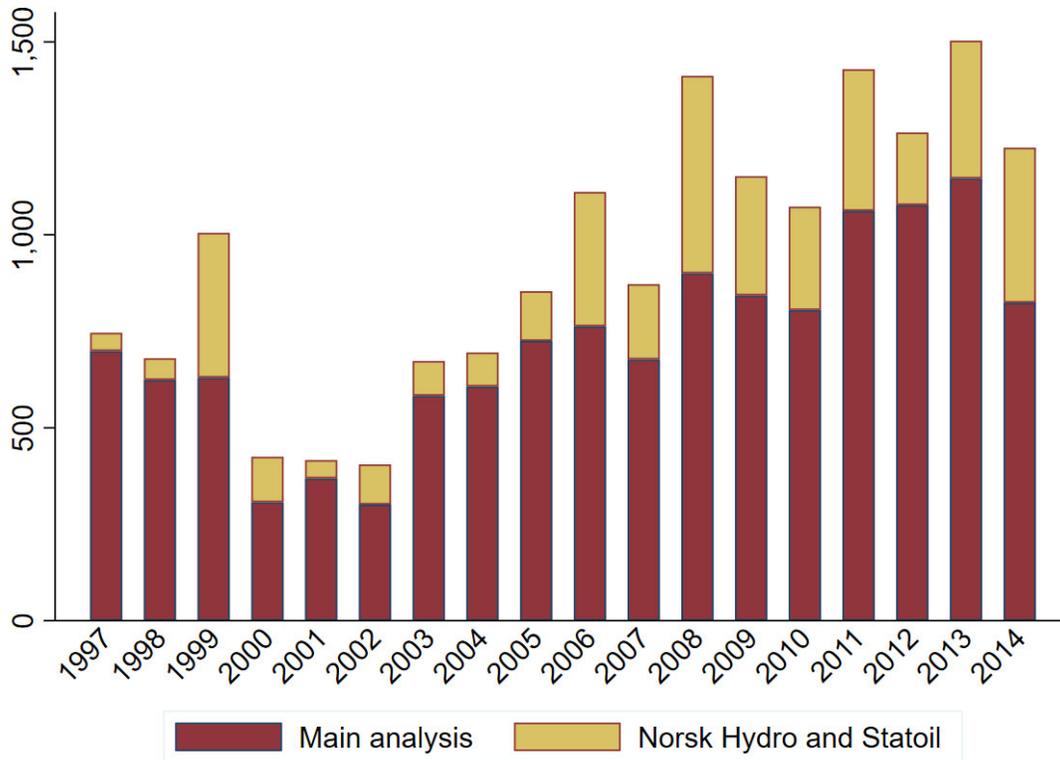


Figure B2. Number of inside buys by executives below the top after screening for stock purchase programs

This figure reports the number of inside buys per year by executives below the top after excluding inside buys that are likely to result from stock purchase programs. To screen for stock purchase programs, we exclude inside buys on dates where 100 or more executives of the same company traded. The red bars show the number of inside buys in the main analysis, while the yellow bars show the number of inside buys by executives at Norsk Hydro and Statoil. As mentioned in Section 2, Statoil merged with the oil division of Norsk Hydro in 2007 to form Hydro Statoil (name changed back to Statoil in 2009 and subsequently to Equinor in 2018).



Appendix C. Control-firm analysis of additional results

Table C1. Control-firm analysis of return to insider trading by executives who change employer

This table reports a control-firm analysis of return to insider trading by executives who change employer as a supplement to the calendar-time portfolio approach reported in Table 5. Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. All trades				
Difference of (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Year -1 (before joining)	-0.0103***	-0.0185***	-0.0121***	-0.0282***
Year +1	0.0030	0.0068	0.0078	0.0055
Year >=+2	-0.006	-0.0003	0.0056*	0.0178**
N	14,284	14,287	14,273	14,390
Panel B. Buys				
Difference of (Inside buys – Non-inside buys)				
Year -1 (before joining)	0.0014	0.0058*	0.0127***	0.0124**
Year +1	0.0026	0.0064**	0.0062*	0.0055
Year >=+2	0.0049**	0.0099***	0.0119***	0.0139***
N	8,298	8,306	8,302	8,363

Table C2. Control-firm analysis of return to insider trading by employees who are promoted to executives below the radar

This table reports a control-firm analysis of return to insider trading by employees who are promoted to executives below the bar as a supplement to the calendar-time portfolio approach reported in Table 6. Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by executives below the top. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected with the given p -values that are reported in brackets. ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. All trades				
Difference of (Inside buys – Inside sells) – (Non-inside buys – Non-inside sells)				
Year -1 (before joining)	-0.0116**	-0.0071	-0.0135*	-0.0233***
Year +1	-0.0087*	0.0094	0.0181**	0.0192**
Year >=+2	-0.0051*	0.0060	0.0104	0.0184*
N	7,645	7,652	7,687	7,715
Panel B. Buys				
Difference of (Inside buys – Non-inside buys)				
Year -1 (before joining)	-0.0063**	0.0030	0.0016	0.0024
Year +1	-0.0054**	0.0148***	0.0181***	0.0202***
Year >=+2	-0.0040	0.0110***	0.0126***	0.0180***
N	4,646	4,660	4,687	4,705

Table C3. Control-firm analysis of return to insider trading by employees

This table reports a control-firm analysis of return to insider trading by employees as a supplement to the calendar-time portfolio approach reported in Table 7. Average excess (returns minus the risk-free interest rate) returns in percent are calculated for horizons of 1 week (5 trading days), 2 weeks (10 trading days), 3 weeks (15 trading days), and 1 month (21 trading days) following buys and sells by top executives, executives below the top, and employees. We report the difference between the actual returns to inside trades and a fictitious benchmark of non-inside trades. The fictitious benchmark consists of fictitious non-inside trades from the same size and same market-to-book category. Using a bootstrapped empirical distribution for the difference in returns following buys and following sells, the null hypothesis of zero difference in returns can be rejected at the 1%, 5% or 10% level. Thus, ***, **, and * denote significance at the 1%, 5%, and 10% level, two-sided test.

	Horizon			
	1 week	2 weeks	3 weeks	1 month
Panel A. All trades				
Difference of (inside buys – inside sells) – (non-inside buys – non-inside sells)				
Executives below the top	0.0003	0.0094***	0.0093***	0.0137***
Employees	-0.0005	0.0041***	0.0020***	0.0023***
N (Employees)	273,883	273,869	274,708	276,983
Panel B. Buys				
Difference of (Inside buys – Non-inside buys)				
Executives below the top	0.0021***	0.0134***	0.0113***	0.0174***
Employees	0.0025***	0.0091***	0.0085***	0.0100***
N (Employees)	161,998	162,013	162,912	164,119

Appendix D. Return to insider trading by primary insiders

Table D1. Calendar-time estimates of returns to announcement of insider trades by primary insiders

This table reports the return to insider trading by primary insiders using the calendar-time portfolio approach. The sample consists of publicly announced insider trades from Oslo Stock Exchange. For each calendar month t , we calculate the 1-month excess return on a portfolio with one position in each stock for months with buys (sales) of primary insiders during the portfolio formation period. We consider portfolio formation periods of 1, 2, 3, 4, and 6 months prior to calendar month t . For example, under a 6-month portfolio formation period, a given inside buy (sell) by a primary insider will be included in the inside buy (sell) portfolio for the next 6 months. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. Panel A reports results for firms in the main analysis (i.e., excluding Hydro and Statoil), whereas Panel B reports results for all firms (i.e., including Hydro and Statoil). Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Firms in main analysis

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	0.0003 (0.0039)	-0.0004 (0.0032)	-0.0013 (0.0031)	-0.0017 (0.0029)	-0.0027 (0.0027)
R ²	0.149	0.152	0.143	0.138	0.129
N	6,320	10,315	13,349	15,553	18,919

Panel B. All firms

	Horizon				
	1 month	2 months	3 months	4 months	6 months
Buy	0.0004 (0.0038)	-0.0003 (0.0031)	-0.0012 (0.0030)	-0.0016 (0.0029)	-0.0026 (0.0027)
R ²	0.153	0.155	0.146	0.140	0.131
N	6,498	10,543	13,612	15,843	19,249