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 per month.

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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.[2] For example, a compliance officer at UBS recently received a three-year sentence for insider trading,[3] 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.

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[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/Primaerinnsiderregister 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] Material information could be obtained in several ways. It might arise from regular work tasks, interactions with co-workers (Hvide and Ostberg, 2015), or as a by-product of attempts to gauge future wage prospects (Van Nieuwerburgh and Veldkamp, 2006, 2010). Consistent with material information being available to employees, Green, Huang, Wen and Zhou (2019), Huang, Li and Markov (2019), and Sheng (2021) show that online feedback from employees at glassdoor.com is informative about the company's stock price (Huang, 2019, report a similar finding for customers' online reviews). Babenko and Sen (2016) show that annual participation rates in employee stock programs are informative about future stock prices. We differ from these studies by examining the return to insider trading using transaction data on stock purchases and sells.

[3] See, e.g., https://www.complianceweek.com/europe/ubs-compliance-officer-convicted-of-insider-trading/27334.article

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 1997 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. 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."[4] 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 factors, 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, the raw returns for non-inside purchases at the 1-month horizon are 44 basis points lower than for non-inside sells. This effectively rules out 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

[4] 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.

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

One possible explanation for why executives obtain abnormal returns could be that they get access to price-sensitive information faster than market participants. For instance, executives could have access to information about customer feedback or worker satisfaction (Green, Huang, Wen and Zhou, 2019; Huang, Li and Markov, 2020; and Sheng, 2021). To the extent that this information is not yet public, this is an example of trading on the basis of material inside information. If this information, on the other hand, is available to market participants, but executives react faster, then executives earn abnormal return on the basis of public information. In relation to this possibility, we note that the calendar-time portfolio approach uses end-of-month stock prices to calculate abnormal returns. Thus, it seems implausible that abnormal returns from the calendar-time portfolio approach are driven by reacting faster to information that has become public.

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.[5] 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 Zeckhauser, 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

[5] 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.

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.[6] We provide evidence of large 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 returns between purchases and sales of company stocks. A positive difference in returns 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. 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.[7] 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.[8] Our study provides evidence of the frequency and the returns to insider trading by individuals who are "just" below the threshold to be considered primary insiders. These results are informative for

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[6] 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).

[7] 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).

[8] 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.

regulators, market participants and the debate about whether a wider group of company employees should be considered primary insiders.[9]

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.

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.[10] 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.[11] 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

[9] 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.

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

[11] 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

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.[12]

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 their advisory team), 18 board members (members and substitutes), and 3 external auditors.[13] 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 following day.[14] 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).

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

[12] 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

[13] 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

[14] The Financial Supervisory Authority of Norway (*Finastilsynet*) 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

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' (anonymized) 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 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.[15] 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. 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.[16]

[15] The data on announced trades by primary insiders to Oslo Stock Exchange contain the names of the primary insider, while the transactions data are anonymized. Norwegian privacy laws do not allow us to merge the two datasets, even if it were technically feasible, as it would identify individuals. One implication of being unable to merge the two datasets is that we are unable to track whether individuals in the transactions data move onto or off the list of primary insiders.

[16] 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.

We obtain individual demographics from Statistics Norway. These data include age, gender, education, income, id of employer, and occupation of the individual (i.e., position 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. 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 company stock 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.[17] We refer to this group of below-the-top executives simply as executives throughout the analysis for brevity.[18] 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, constitute about a third of the market capitalization of Oslo Stock Exchange.[19] Starting out in the early 2000s, both companies were pioneers with employee stock programs as a means of remuneration. Also,

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[17] 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 "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.

[18] 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.

[19] 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.

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.[20] 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 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 pre-announced dates (see Appendix figures B1 and B2), which limits their ability to time the market. 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.[21] 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

[20] 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).

[21] 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.

to 125,300 euros), compared to 620,800 NOK for employees.[22] 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 discount.[23] 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

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

[23] 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.

insider trading by primary insiders). Finally, Panel D shows the returns to non-inside 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, i.e., on days without public announcements of trading by primary insiders, we also report the return to insider trading by executives on days with public announcements of trading by primary insiders in Panel C. Panel E shows the 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.[24]

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 than 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

[24] 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.

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.

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.[25]

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.

[25] Cross-sectional dependence occurs for three reasons: 1) the same individual may make trades whose return horizons overlap; 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.

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 the return that would have been earned 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 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 stock from the same size and market-to-book category, and evaluate the returns of the fictitious trade. Calculating the average returns on fictitious trades across investors yields one observation for the bootstrapped return 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 bootstrapped return distribution for 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 bootstrapped distribution for 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 fictitious buys are the same, the null hypothesis is rejected if the actual returns exceed the $(1-\alpha)$ percentile of the bootstrapped 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 bootstrapped return difference distribution for each actual trade (buy or sell), drawing a random stock within the same size and the same market-to-book category, and repeat this procedure 1,000 times to construct a bootstrapped return 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 fictitious trades are the same, the null hypothesis is rejected if the actual return difference between inside buys and inside sells exceed the (1-α) percentile of the bootstrapped return 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 capture 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, aggregate portfolios consist of one position in each stock for each executive that buys (sells) during the portfolio formation period. We form four portfolios based on whether a position is an inside or non-inside trade and whether the trade is a buy or sell. We further split inside buys (sells) into inside below the radar buys (sells) and inside above the radar buys (sells), depending on whether the trade occurred on a day with an announced trade by a primary insider or not, so that we obtain six portfolios in total.

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 below the radar buy will be included in the inside below the radar buy portfolio for the 6 consecutive months. An executive may have purchased the inside stock several times during the portfolio formation period. If so, all purchases are aggregated into one position in the inside below the radar buy portfolio. Each individual-stock-position has equal weight in the portfolio return. In the same manner, we form and calculate returns for the other portfolios. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors.

To implement the calendar-time portfolio approach, we use the method developed by Hoechle, Schmid and Zimmermann (2016) to embed the calendar-time portfolio approach in a regression framework using the Stata command *xtgct*. This allows us to simultaneously evaluate alphas on the six portfolios and obtain standard errors that are robust to cross-sectional dependence.

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 weights 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). By construction, our methodology ensures that time periods with more trading activity (more executives trading) will be given more weight than periods with less trading activity (fewer executives trading).

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. We find a positive and statistically significant difference between the returns of inside buys and inside sells, increasing 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 as benchmark, 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 making inside buys. 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.

Panel A of Table 4 reports abnormal returns for inside buys using the calendar-time portfolio approach.[26] As the calendar-time portfolio approach is estimated using the regression framework

[26] We note that the number of observations in Table 4 differ across columns. In Column 1 the number of observations is the number of executives that trades a specific stock at least once during the last month. In Column 2, the number of observations is the number of executives that trades a specific stock at least once over the last two months. An individual that trades a stock in month t would therefore count as two observations. The number of observations in Column 2 is less than two times the number of observations in Column 1, because some executives trade more than once in the build-up period. Finally, we note that

of Hoechle, Schmid and Zimmermann (2016), each of the six portfolios of interest is represented by an indicator variable. Coefficients on the indicator variables are estimates of the monthly alphas on each portfolio over the evaluation horizon. For instance, "Inside below the radar buy" reports the alpha on the inside below the radar buy portfolio. Thus, Table 4 reports monthly alphas (and corresponding standard errors) for the six portfolios across horizons from 1 to 6 months.

We note that the returns to the portfolio of interest, the inside below the radar buys, is positive and statistically significant. The abnormal returns are also economically significant across the different evaluation horizons: executives earn an abnormal return of 174 basis points in the first month, which increases to 328 basis points (= 2 times 164 basis points) after two months. The abnormal returns persist at longer horizons, where executives earn an abnormal return of 744 basis points (= 6 times 124 basis points) after 6 months.[27]

For the five other portfolios in Panel A we find no evidence of abnormal returns. The abnormal return to inside below the radar sells is positive, but statistically insignificant. Thus, executives do not earn abnormal returns for inside sells below the radar, perhaps suggesting that sales are motivated by portfolio rebalancing or liquidity needs. 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 (alphas) on the inside above the radar buys and inside above the radar sells are both insignificant for all horizons.

Panel B provides estimates of abnormal returns to inside below the radar buys relative to alternative benchmarks (i.e. long-short portfolios), following the same pattern as in Table 3. Panel B shows a positive and statistically significant alpha across horizons for the long-short portfolio comparing inside buys to non-inside buys and for the long-short portfolio comparing the difference between inside buys and sells to the difference between non-inside buys and sells. The comparison of inside buys to inside sells yields positive, but statistically insignificant alphas. In terms of magnitude, the abnormal returns are driven by inside buys: Of the 206 basis points abnormal return on the long-short portfolio comparing the difference between inside buys and sells to the difference between non-inside buys and sells, most of it (174 basis points) can be attributed to the inside below the radar buy portfolio as shown in Panel A. Similarly, the comparison of the inside buys to non-inside buys shows abnormal returns that are both

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the number of observations in Column 1 of Table 4 (45,249) is smaller than the number of trades reported in Panel A of Table 2 (65,140) because the calendar-time portfolio approach reports the number of unique stocks traded by each executive within the calendar month.

[27] 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.

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. Thus, executives earn positive abnormal returns for inside purchases below the radar.

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.[28] In this section we also analyze the returns to insider trading of employees (i.e., non-executives). To preserve statistical power, we rely on the long-short portfolios comparing the difference between inside buys and sells to the difference between non-inside buys and sells.

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.[29] 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 in the 6 months prior to changing job, and consider 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.[30]

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[28] These tests are inspired by the methodology in Hvide and Östberg (2015), who show that employees start to trade the same shares as new co-workers after job changes.

[29] It would be interesting to track the change in inside returns for individuals that move onto or off list of primary insiders; we hypothesize that such individuals obtain lower returns after moving onto the list. However, as explained in Section 2.1, the data do not allow us to make such inferences, as the insider trading announcements identify individuals, while the transactions data are anonymized.

[30] We have rearranged order of results from the control-firm approach in Appendix 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

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 approach. 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 weeks 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, and consider 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. When focusing on buys in Panel B, we confirm these findings.

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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).

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, we use the returns made by non-executive employees (simply "employees" henceforth) as an alternative benchmark. 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 D3 reports the results using the control-firm approach.[31]

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 on buys, rather than all trades. In addition, Appendix Table D3 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

[31]As 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).

suggests that executives below the top make large abnormal returns when they trade own-company stocks.

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 provides evidence of the frequency and the returns to insider trading by individuals who are "just" below the threshold to be considered primary insiders. These results are informative for the debate about whether a wider group of company employees should be considered primary insiders.

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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**
A. Individual characteristics		
Age	46.9	43.4
Male (%)	78.6	66.4
Tenure	6.7	5.9
Income (1,000 NOK)	1002.5	620.8
B. Average number of transactions per year		
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
C. Average value of transactions per year (1,000 NOK)		
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								
	1 week	**2 weeks**	**3 weeks**	**1 month**	**2 months**	**3 months**	**4 months**	**6 months**	**N**
A. All trades									
Buys	0.0021	0.0067	0.0075	0.0093	0.0184	0.0303	0.0256	0.0481	39,003
Sells	0.0009	0.0030	0.0045	0.0074	0.0146	0.0235	0.0271	0.0373	26,137
B. Inside trades below the radar									
Buys	0.0024	0.0149	0.0142	0.0195	0.0332	0.0546	0.0657	0.0858	12,744
Sells	0.0031	0.0061	0.0062	0.0102	0.0192	0.0363	0.0441	0.0578	5,837
C. Inside trades above the radar									
Buys	0.0103	0.0122	0.0186	0.0242	0.0434	0.0493	0.0589	0.0859	2,059
Sells	-0.0011	-0.0039	0.0048	0.0132	-0.0021	0.0114	0.0180	0.0299	137
D. Non-inside trades									
Buys	0.0009	0.0019	0.0030	0.0021	0.0086	0.0158	0.0178	0.0250	24,200
Sells	0.0005	0.0021	0.0040	0.0065	0.0133	0.0199	0.0223	0.0314	20,163
E. Announcement of trades by primary insiders									
Buys	0.0090	0.0094	0.0092	0.0116	0.0243	0.0384	0.0482	0.0646	17,072
Sells	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 six portfolios: the inside below the radar buy, inside below the radar sell, inside above the radar buy, inside above the radar sell, non-inside buy and non-inside sell. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. 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 below the radar buy will be included in the inside below the radar buy portfolio for the next 6 months. The unit of observation is at the calendar-time individual-stock level, as explained in Section 4. Panel A reports alphas for the six portfolio of interests, whereas Panel B reports alphas for various long-short portfolios with p-values in brackets. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside below the radar buy	0.0174**	0.0164***	0.0152***	0.0148***	0.0124***
	(0.0076)	(0.0049)	(0.0046)	(0.0045)	(0.0043)
Inside below the radar sell	0.0038	0.0072	0.0071	0.0066	0.0080
	(0.0069)	(0.0050)	(0.0051)	(0.0052)	(0.0052)
Inside above the radar buy	0.0081	0.0041	0.0057	0.0060	0.0046
	(0.0070)	(0.0067)	(0.0067)	(0.0068)	(0.0093)
Inside above the radar sell	0.0154	0.0098	0.0075	0.0135	0.0191
	(0.0135)	(0.0105)	(0.0092)	(0.0102)	(0.0082)
Non-inside buy	-0.0021	0.0003	0.0016	0.0037	0.0040
	(0.0053)	(0.0055)	(0.0058)	(0.0059)	(0.0063)
Non-inside sell	0.0050	0.0070	0.0082	0.0095	0.0067
	(0.0050)	(0.0054)	(0.0057)	(0.0058)	(0.0055)
R^2	0.079	0.036	0.023	0.020	0.011
N	45,249	81,292	113,769	143,606	198,777

Panel B. Long-short portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside buy – Inside sells	0.0136	0.0092*	0.0081	0.0082*	0.0044
	[0.174]	[0.065]	[0.116]	[0.071]	[0.306]
Inside buys – Non-inside buys	0.0194**	0.0161***	0.0136***	0.0111**	0.0084**
	[0.011]	[0.001]	[0.003]	[0.011]	[0.043]
(Inside buy – Inside sells) -	0.0206*	0.0159***	0.0147***	0.0141***	0.0071
(Non-inside buys – Non-inside sells)	[0.051]	[0.005]	[0.004]	[0.002]	[0.102]

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 and following the same methodology as in Table 4. 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≥2) joining the company as an executive. Panel A and B report long-short portfolio alphas, depending on timing of the trade relative to joining the firm. 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. Long-short portfolio alphas for (Inside buy – Non-inside buys)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Year -1 (before joining)	0.0197	0.0147	0.0137	0.0135	0.0181***
	(0.0151)	(0.0131)	(0.0111)	(0.0094)	(0.0070)
Year +1	0.0229	0.0178*	0.0125	0.0078	0.0070
	(0.0096)	(0.0094)	(0.0089)	(0.0095)	(0.0087)
Year >=+2	0.0141	0.0132	0.0083	0.0059	0.0048
	(0.0092)	(0.0085)	(0.0081)	(0.0074)	(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	0.0031	0.0012	-0.0057	-0.0111
	[0.823]	[0.808]	[0.912]	[0.538]	[0.222]

Panel B. Long-short portfolio alphas for (Inside buy – inside sell) – (Non-inside buy – Non-inside sell)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Year -1 (before joining)	-0.0042	0.0035	-0.0027	-0.0055	0.0015
	(0.0145)	(0.0109)	(0.0087)	(0.0079)	(0.0061)
Year +1	0.0445***	0.0324***	0.0239***	0.0138*	0.0102
	(0.0090)	(0.0107)	(0.0080)	(0.0072)	(0.0067)
Year ≥+2	0.0111	0.0066	0.0038	0.0019	0.0026
	(0.0070)	(0.0067)	(0.0059)	(0.0053)	(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***	0.0359**	0.0266***	0.0193**	0.0087
	[0.001]	[0.015]	[0.007]	[0.031]	[0.248]

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 and following the same methodology as in Table 4. 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≥+2) an individual is promoted to executive below the radar. Panel A and B report long-short portfolio alphas, depending on timing of the trade relative to earning promotion. 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. Long-short portfolio alphas for (Inside buy – Non-inside buy)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Year -1 (before promotion)	0.0140	0.0114*	0.0106*	0.0129*	0.0111**
	(0.0081)	(0.0067)	(0.0111)	(0.0057)	(0.0047)
Year +1	0.0086	0.0105**	0.0085*	0.0075*	0.0063
	(0.0055)	(0.0047)	(0.0051)	(0.0043)	(0.0039)
Year >=+2	0.0071	0.0062	0.0048	0.0037	0.0035
	(0.0060)	(0.0046)	(0.0040)	(0.0074)	(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	-0.0009	-0.0022	-0.0054	-0.0048
	[0.567]	[0.894]	[0.731]	[0.362]	[0.338]

Panel B. Long-short portfolio alphas for (Inside buy – inside sell) – (Non-inside buy – Non-inside sell)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Year -1 (before promotion)	0.0178	0.0149	-0.0155	-0.0164	0.0182
	(0.0177)	(0.0151)	(0.0137)	(0.0094)	(0.0350)
Year +1	0.0352***	0.0254***	0.0233**	0.0201**	0.0016
	(0.0115)	(0.0103)	(0.0102)	(0.0088)	(0.0067)
Year ≥+2	0.0234*	0.0392***	0.0270**	0.0253**	0.0258***
	(0.0130)	(0.0124)	(0.0103)	(0.0110)	(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	0.0243	0.0378***	0.0326**	-0.0167
	[0.346]	[0.512]	[0.006]	[0.032]	[0.641]

Table 7. Returns to insider trading by employees

This table reports the return to insider trading to employees using a calendar-time portfolio approach and following the same methodology as in Table 4. We estimate the returns to insider trading for *executives below the top* (managers and general managers) and *employees* (the residual). Panel A and B report long-short portfolio alphas, depending on whether the trade is made by an executive below the top or an employee. We report a t-test of differences in the estimated return to insider trading by executives below the top and employees at the bottom of the table. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Long-short portfolio alphas for (Inside buy – Non-inside buy)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Executives below the top	0.0203**	0.0173***	0.0161***	0.0140***	0.0113**
	(0.0076)	(0.0052)	(0.0050)	(0.0048)	(0.0048)
Employees	0.0080	0.0117**	0.0116**	0.0101**	0.0076
	(0.0070)	(0.0054)	(0.0050)	(0.0046)	(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***	0.0055*	0.0045*	0.0039	0.0037
	[0.009]	[0.066]	[0.077]	[0.106]	[0.111]

Panel B. Long-short portfolio alphas for (Inside buy – inside sell) – (Non-inside buy – Non-inside sell)

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Executives below the top	0.0198*	0.0132***	0.0114**	0.0099**	0.0037
	(0.0104)	(0.0052)	(0.0049)	(0.0041)	(0.0039)
Employees	0.0012	0.0082*	0.0098**	0.0113***	0.0086**
	(0.0076)	(0.0047)	(0.0046)	(0.0042)	(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**	0.0050	0.0016	-0.0014	-0.0049
	[0.030]	[0.320]	[0.710]	[0.721]	[0.228]

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.

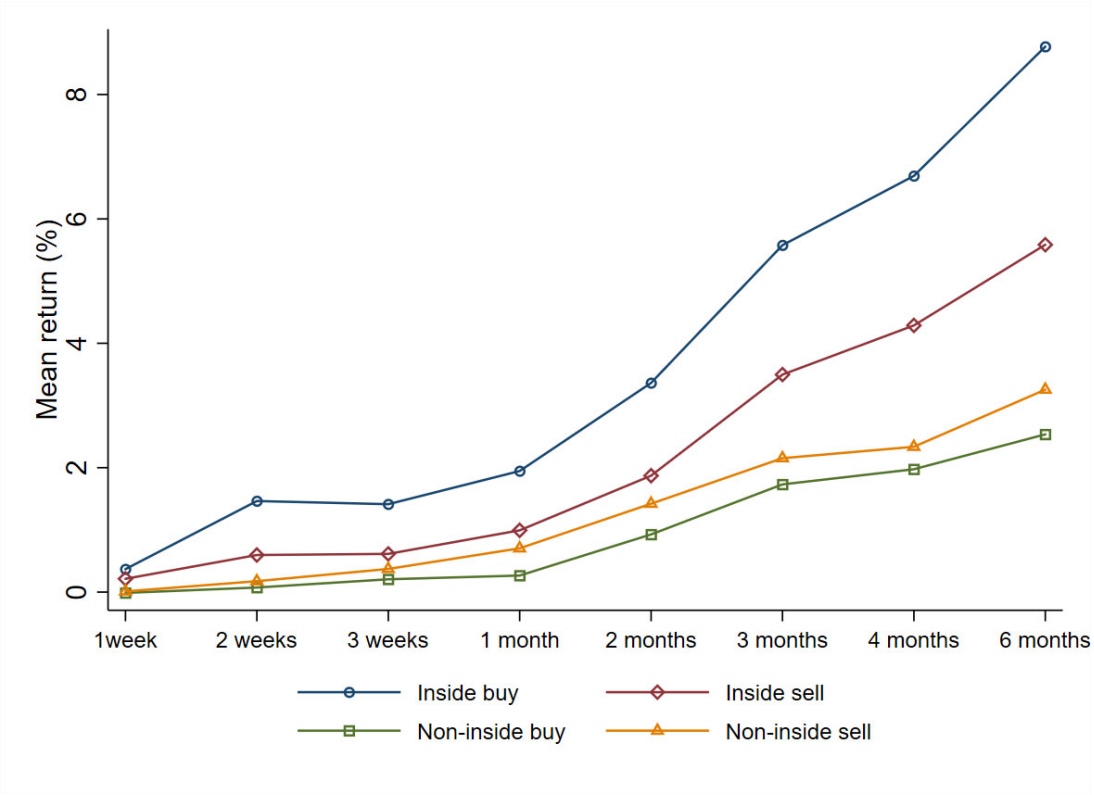
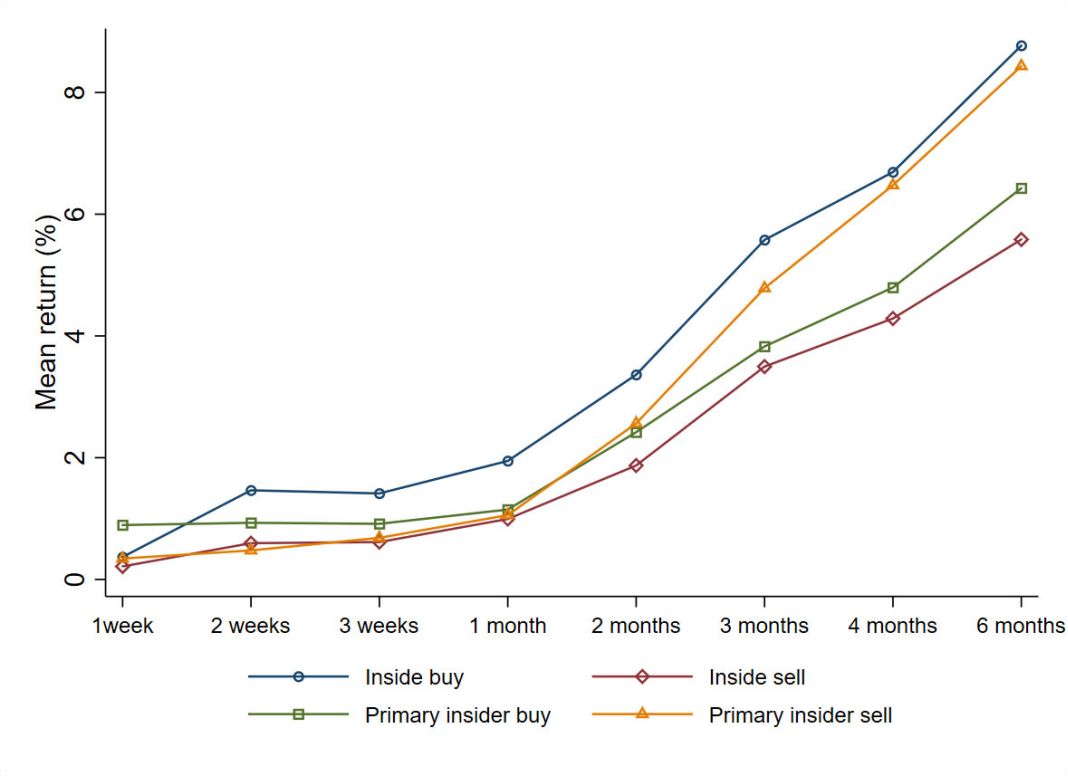


Figure 2. Return to primary insiders and executives trading below the radar

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). For each calendar month *t*, we calculate the 1-month excess return on six portfolios: the inside below the radar buy, inside below the radar sell, inside above the radar buy, inside above the radar sell, non-inside buy and non-inside sell. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. 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 below the radar buy will be included in the inside below the radar buy portfolio for the next 6 months. The unit of observation is at the calendar-time individual-stock level, as explained in Section 4. Panel A reports alphas for the six portfolio of interests, whereas Panel B reports alphas for various long-short portfolios with p-values in brackets. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside below the radar buy	0.0174**	0.0164***	0.0152***	0.0148***	0.0124***
	(0.0076)	(0.0049)	(0.0046)	(0.0045)	(0.0043)
Inside below the radar sell	0.0038	0.0072	0.0071	0.0066	0.0080
	(0.0069)	(0.0050)	(0.0051)	(0.0052)	(0.0052)
Inside above the radar buy	0.0081	0.0041	0.0057	0.0060	0.0046
	(0.0070)	(0.0067)	(0.0067)	(0.0068)	(0.0093)
Inside above the radar sell	0.0154	0.0098	0.0075	0.0135	0.0191**
	(0.0135)	(0.0105)	(0.0092)	(0.0102)	(0.0082)
Non-inside buy	-0.0020	0.0003	0.0016	0.0037	0.0040
	(0.0053)	(0.0055)	(0.0058)	(0.0059)	(0.0063)
Non-inside sell	0.0049	0.0070	0.0081	0.0094	0.0066
	(0.0050)	(0.0054)	(0.0057)	(0.0058)	(0.0055)
R^2	0.079	0.036	0.023	0.020	0.011
N	45,212	81,215	113,653	143,452	198,556

Panel B. Long-short portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside buy – Inside sells	0.0136	0.0092*	0.0081	0.0082*	0.0044
	[0.173]	[0.065]	[0.116]	[0.072]	[0.307]
Inside buys – Non-inside buys	0.0194**	0.0161***	0.0136***	0.0111**	0.0084**
	[0.011]	[0.001]	[0.003]	[0.011]	[0.043]
(Inside buy – Inside sells) -	0.0206*	0.0159***	0.0147***	0.0141***	0.0071
(Non-inside buys – Non-inside sells)	[0.052]	[0.005]	[0.005]	[0.002]	[0.108]

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). For each calendar month *t*, we calculate the 1-month excess return on six portfolios: the inside below the radar buy, inside below the radar sell, inside above the radar buy, inside above the radar sell, non-inside buy and non-inside sell. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. 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 below the radar buy will be included in the inside below the radar buy portfolio for the next 6 months. The unit of observation is at the calendar-time individual-stock level, as explained in Section 4. Panel A reports alphas for the six portfolio of interests, whereas Panel B reports alphas for various long-short portfolios with p-values in brackets. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside below the radar buy	0.0174**	0.0164***	0.0151***	0.0148***	0.0124***
	(0.0076)	(0.0049)	(0.0046)	(0.0045)	(0.0043)
Inside below the radar sell	0.0037	0.0071	0.0071	0.0065	0.0079
	(0.0069)	(0.0050)	(0.0052)	(0.0052)	(0.0052)
Inside above the radar buy	0.0081	0.0042	0.0058	0.0061	0.0046
	(0.0069)	(0.0067)	(0.0067)	(0.0068)	(0.0093)
Inside above the radar sell	0.0151	0.0091	0.0071	0.0132	0.0191**
	(0.0136)	(0.0106)	(0.0092)	(0.0102)	(0.0082)
Non-inside buy	-0.0021	0.0002	0.0015	0.0036	0.0040
	(0.0053)	(0.0055)	(0.0058)	(0.0059)	(0.0063)
Non-inside sell	0.0050	0.0070	0.0081	0.0095	0.0065
	(0.0050)	(0.0054)	(0.0057)	(0.0058)	(0.0055)
R^2	0.079	0.036	0.023	0.020	0.011
N	45,045	80,896	113,207	142,880	197,762

Panel B. Long-short portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside buy – Inside sells	0.0137	0.0093*	0.0080	0.0083*	0.0045
	[0.167]	[0.065]	[0.116]	[0.071]	[0.306]
Inside buys – Non-inside buys	0.0195***	0.0162***	0.0136***	0.0112**	0.0084**
	[0.010]	[0.001]	[0.003]	[0.010]	[0.042]
(Inside buy – Inside sells) -	0.0208**	0.0161***	0.0146***	0.0142***	0.0070
(Non-inside buys – Non-inside sells)	[0.050]	[0.004]	[0.005]	[0.002]	[0.105]

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 six portfolios: the inside below the radar buy, inside below the radar sell, inside above the radar buy, inside above the radar sell, non-inside buy and non-inside sell. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. 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 below the radar buy will be included in the inside below the radar buy portfolio for the next 6 months. The unit of observation is at the calendar-time individual-stock level, as explained in Section 4. Panel A reports alphas for the six portfolio of interests, whereas Panel B reports alphas for various long-short portfolios with p-values in brackets. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside below the radar buy	0.0064	0.0083	0.0085	0.0089	0.0089*
	(0.0059)	(0.0074)	(0.0062)	(0.0056)	(0.0048)
Inside below the radar sell	0.0083	0.0091*	0.0075	0.0067	0.0049
	(0.0057)	(0.0047)	(0.0047)	(0.0051)	(0.0061)
Inside above the radar buy	0.0010	0.0057	0.0072	0.0077	0.0035
	(0.0060)	(0.0067)	(0.0066)	(0.0064)	(0.0070)
Inside above the radar sell	0.0154	0.0062	0.0007	0.0011	-0.0002
	(0.0101)	(0.0114)	(0.0111)	(0.0114)	(0.0106)
Non-inside buy	-0.0037	-0.0010	-0.0004	0.0017	0.0023
	(0.0057)	(0.0058)	(0.0061)	(0.0061)	(0.0065)
Non-inside sell	0.0048	0.0050	0.0066	0.0073	0.0050
	(0.0048)	(0.0049)	(0.0052)	(0.0054)	(0.0056)
R^2	0.071	0.054	0.038	0.029	0.015
N	195,781	287,082	366,988	441,706	571,164

Panel B. Long-short portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside buy – Inside sells	-0.0019	-0.0008	0.0010	0.0022	0.0040
	[0.807]	[0.917]	[0.883]	[0.704]	[0.516]
Inside buys – Non-inside buys	0.0101	0.0093	0.0089	0.0072	0.0066
	[0.109]	[0.178	[0.134]	[0.180]	[0.179]
(Inside buy – Inside sells) -	0.0066	0.0052	0.0080	0.0078	0.0067
(Non-inside buys – Non-inside sells)	[0.389]	[0.495]	[0.205]	[0.198]	[0.284]

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 six portfolios: the inside below the radar buy, inside below the radar sell, inside above the radar buy, inside above the radar sell, non-inside buy and non-inside sell. To control for market movements, we use the Carhart (1997) four-factor model and include market, market-to-book, beta, and momentum factors. 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 below the radar buy will be included in the inside below the radar buy portfolio for the next 6 months. The unit of observation is at the calendar-time individual-stock level, as explained in Section 4. Panel A reports alphas for the six portfolio of interests, whereas Panel B reports alphas for various long-short portfolios with p-values in brackets. Standard errors are reported in parentheses. ***, **, and * denote significance at the 1%, 5%, and 10% level, respectively.

Panel A. Portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside below the radar buy	0.0100*	0.0122**	0.0124***	0.0115**	0.0103**
	(0.0052)	(0.0048)	(0.0046)	(0.0046)	(0.0045)
Inside below the radar sell	0.0090	0.0090*	0.0076	0.0068	0.0049
	(0.0057)	(0.0047)	(0.0048)	(0.0052)	(0.0061)
Inside above the radar buy	0.0038	0.0016	0.0033	0.0035	0.0019
	(0.0066)	(0.0074)	(0.0069)	(0.0052)	(0.0098)
Inside above the radar sell	0.0198*	0.0106	0.0048	0.0027	-0.0002
	(0.0106)	(0.0095)	(0.0088)	(0.0095)	(0.0106)
Non-inside buy	-0.0038	-0.0016	-0.0007	0.0012	0.0019
	(0.0058)	(0.0059)	(0.0062)	(0.0063)	(0.0067)
Non-inside sell	0.0048	0.0051	0.0066	0.0073	0.0050
	(0.0048)	(0.0049)	(0.0052)	(0.0054)	(0.0056)
R^2	0.066	0.033	0.021	0.016	0.009
N	76,977	134,817	186,047	232,911	318,739

Panel B. Long-short portfolio alphas

	Horizon				
	1 month	**2 months**	**3 months**	**4 months**	**6 months**
Inside buy – Inside sells	0.0011	0.0032	0.0048	0.0047*	0.0054
	[0.869]	[0.511]	[0.297]	[0.313]	[0.325]
Inside buys – Non-inside buys	0.0139**	0.0138***	0.0131***	0.0103**	0.0084**
	[0.005]	[0.001]	[0.001]	[0.010]	[0.032]
(Inside buy – Inside sells) -	0.0097	0.0099**	0.0121***	0.0105**	0.0085
(Non-inside buys – Non-inside sells)	[0.141]	[0.042]	[0.005]	[0.014]	[0.117]

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).

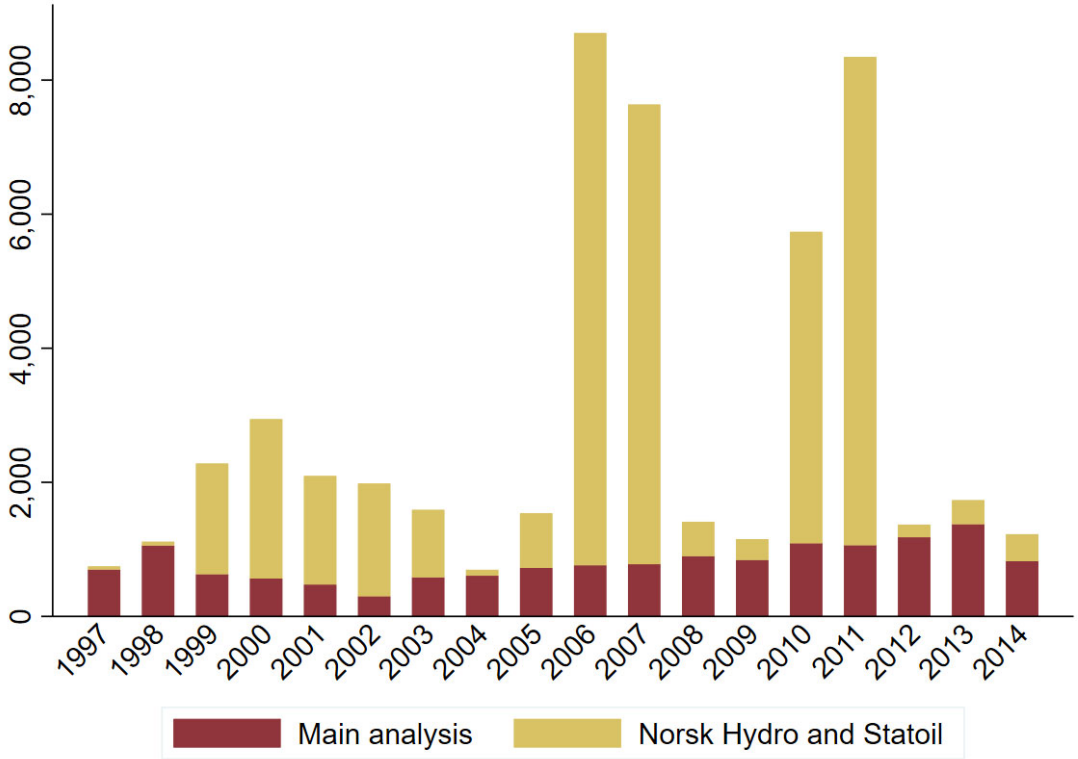
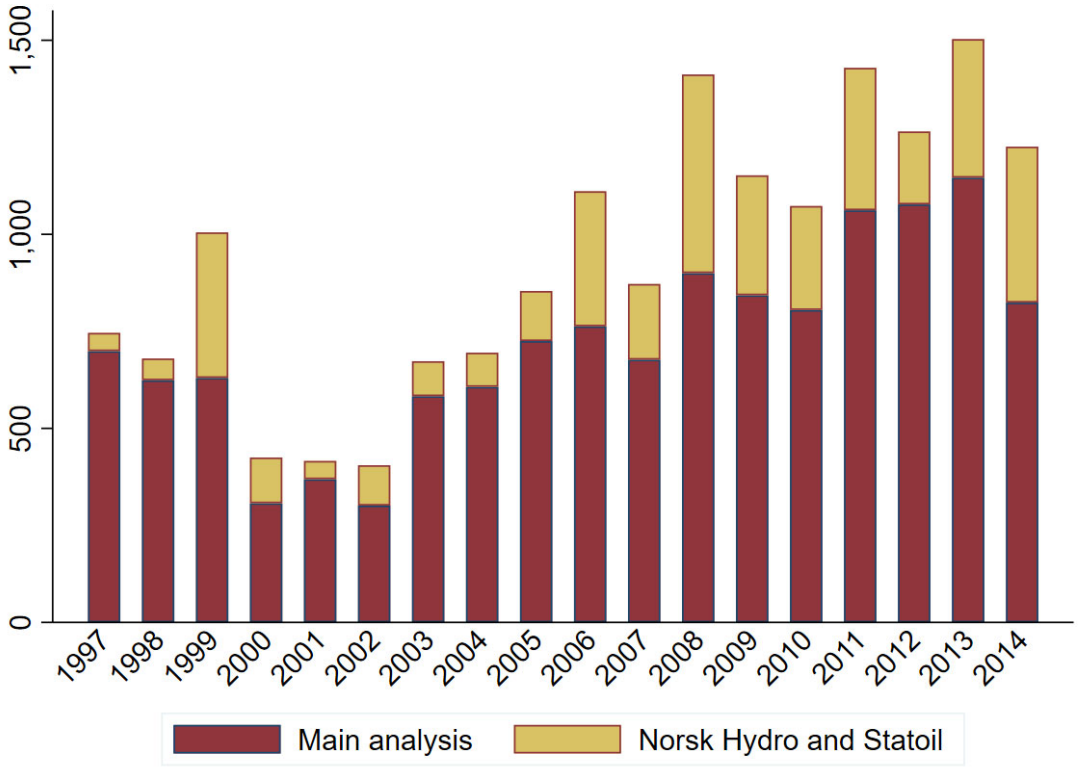


Figure B2. Number of inside buys by executives below the top after screening for stock purchase programs

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 promotion)	-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 promotion)	-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	-0.0004	-0.0013	-0.0017	-0.0027
	(0.0039)	(0.0032)	(0.0031)	(0.0029)	(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	-0.0003	-0.0012	-0.0016	-0.0026
	(0.0038)	(0.0031)	(0.0030)	(0.0029)	(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