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Corporate Insider Trading on the Oslo Stock Exchange

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Preface

This master thesis was written as the final assignment in my master's degree in economic and business administration at Molde university college. This paper is an independent work of 30 credits. I have had a good and educational time at Molde university college!

A special thanks to my supervisor Knud Peder Heen, which has contributed with good tips and pointed me in the right direction for the thesis.

An extra thanks to my fiancé for the support during this period, and for excellent help with reading through my thesis.

Molde, mai 2023

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Stian Beøy Raknes

Abstract

The aim of the thesis was to investigate corporate insider trading on the Oslo stock Exchange. A corporate insider is a person within a company who has price sensitive information. Several studies have shown corporate insiders attain abnormal return on their trades. However, there are few studies on the Oslo Stock Exchange. The media is tracking corporate insider trades, suggesting they are better informed.

This thesis answers whether corporate insider trades perform better than other investors trading on public information on the Oslo Stock exchange. To answer this question, one needs answer to the following: a) Does the market respond on insider trades? b) Do insider trades attain abnormal returns? c) Do the Abnormal returns hold over time?

Used an event study methodology with the market model to estimate predicted returns. Then used a one short-term event study with an event window from 10 days before the announcement and 10 days after the event and used an estimation period of 250 days. Lastly, a long-term event study, with an event window of ten days before the event. A study of 250 days after the event, a 250-day estimation window. There could be disadvantages using long-term event study. Such as all models are only a depiction of the real world, the further the timespan, lesser is the model.

The results from the short-term event study showed that the market reacted on both buy and sell transactions. A positive reaction on buying transactions and negative reaction on sell transaction. This was as predicted and could suggest that the market is semi-strong efficient. However, in the long-term event study the results were not as predicted. The buy transactions showed a significant negative abnormal return, suggesting that corporate insiders perform worse on their trades. On the other hand, corporate insiders selling stocks was predicted to be negative, suggesting one should keep an eye when corporate insiders sell stocks.

Contents

1.0 Introduction

"When corporate insiders buy stocks, you should also buy stocks", a quote from a newspapers tip called "aksjeskolen"[1]. There are several examples in the media following up on corporate insiders. Dagens Næringsliv has "insidebarometer", and Finansavisen has "insideporteføljen". This is under the assumption that corporate insiders are well informed about their company, and corporate insiders could use this information to attain higher returns than outside investors. There are also examples on announcements made by corporate insiders which have been under scrutiny, there are many reasons why corporate insiders would sell stocks. However, sometimes they have remarkable reasons for selling stocks "needs to redecorate my bathroom", "it was much more expensive to run a farm than I thought" Lastly, don´t do what corporate insiders say, do what they do[2].

Do corporate inside trades perform better than those who trade on public information? Does the market react on insider trade announcement on the Oslo stock exchange? These are two important questions for researchers, legislators, and investors. If one follows corporate insider trades and copy them, can one attain an abnormal return? Another important question is whether the market reacts to corporate insider trade announcements. Lastly, there is a replication crisis in economic and business research. Meaning there is a lack of robust reproducibility, and there could exist publication and other selective reporting biases (Ioannidis and Doucouliagos 2013).

Most studies conclude that abnormal returns are attained by corporate insiders (Finnerty 1976; Seyhun 1986; Degryse, de Jong, and Lefebvre 2014). However, there are some studies showing abnormal results (Lakonishok and Lee 2001; Aktas, De Bodt, and Van Oppens 2008). Lakonishok and Lee (2001) found no evidence for abnormal returns in the short-term, but in the long-term they found evidence for abnormal returns for corporate insiders.

[1] «Når innsidere kjøper, bør også du kjøpe» collected from e24.no, https://e24.no/privatoekonomi/i/9OvaPd/aksjeskolen-7-derfor-boer-du-foelge-innside-handlerne

[2] From a podcast called Finansredaksjonen made by Dagens Næringsliv in 12.09.2019. https://www.dn.no/finansredaksjonen/hei-alle-konsernsjefen-ma-pa-do/2-1-671045

There are few studies on the Oslo Stock Exchange, Eckbo and Smith (1998) and, Eckbo and Ødegaard (2020). They found no evidence for abnormal returns on the Oslo Stock Exchange. It could rather be that corporate insiders performed worse. However, for other markets researchers have found evidence for abnormal returns.

Since most studies investigating corporate insider trading, either focusing on short-term effects or long-term effects. Therefore, choose to use both short-term and long-term events study in this thesis, leading to the following research question:
Do inside traders perform better then traders who trades on public information?

a) Does the market respond on insider trades?
b) Do insider trades attain abnormal returns?
c) Abnormal returns hold over time?

In this paper there will be used an event study methodology based on MacKinlay (1997) and (Rose and Søpstad 2015) to answer these questions. There will be used two different event studies. One short-term event study where the event window is 10 days before the corporate insider announcement, and 10 days after the corporate insider trade announcement. The short-term event study will answer if the market reacts to corporate insider trading announcements. The second event study, the event window is 10 days before and 250 days after the corporate insider trade announcement. Investigating whether insiders attain abnormal returns over time. Lastly, this will answer whether corporate inside traders perform better then traders who trade on public information.

This paper will first in chapter 2 discuss corporate insider trading, then a theoretical background and lastly previous research on insider trading. In chapter 3, the event study methodology used in this thesis. Thereafter, how the data was collected, and descriptive statistics on those data. Then the results from the short-term and long-term event study will be presented and discussed in chapter 4. Chapter 5, conclusion, limitations, and future research.

2.0 Theory and previous research

In this part of the thesis definitions and laws will be explained regarding corporate insider trading in Norway. Secondly, relevant theory such as market efficiency, agency costs and asymmetric information and possible signaling effects. Lastly, discussing previous research on insider trading.

2.1 Definitions and Law

2.1.1 Definitions

An insider is a person within the company who has price sensitive information, closely related persons to the insider. Furthermore, insiders are also companies, legal persons, and foundations with the same interests as the former mentioned insider and the closest related (Finanstilsynet 2021; Vphl 2007).

There are four criteria needing to be fulfilled to call it inside information. Firstly, the information needs to be precise. Secondly, not published. Thirdly, the information is related directly, or indirectly to one or several issuers. Lastly, the information is suitable to influence the price on the financial instrument and/or financial derivate that is noticeable if the information was published.

2.1.2 Laws and regulations

The legal precedence is based on Verdipairhandelsloven (2007) and Market Abuse Regulation which entered into force in March 2021 in Norway.

Insiders in companies need to disclose their trades, and what we could call legal insider trades. Trades must be disclosed within three days after the trade. On the other hand, the Norwegian Financial Supervisory Authority recommend that trades must be disclosed immediately after the trade. The amount limit of 5000 EURO, which means that the insider must disclose all trades when reaching the limit.

However, illegal insider trading is to trade on private information, or in other words, trade on information that is not disclosed to the market. Therefore, disclosing rules and blackout periods are to prevent insiders trade on private information. The Blackout period means you are prohibited to trade before a price affecting announcement. According to Norwegian disclosure regulations, the blackout period is 30 days before such an announcement (Finanstilsynet 2021).

There are several arguments on whether insider trading should be legal or not. One of the most common arguments against insider trading is if someone has more information than others, then the rules on the playing field are mismatched. Therefore, insider trading should be illegal to level out the information mismatch. This will also prevent the managers from intentionally make bad decisions to profit on their short selling when the stock prices decrease.

However, Carlton and Fischel (1982) argues against these common arguments. Also, concluding a ban on insider trading not creating a "more even playing field", and rather being a little more costly to attain information. Furthermore, no cause to worry about the intentional making "bad decision problem" as the market for corporal control, and the legislators has not found this as a problem. In Carlton and Fischel (1982) opinion corporate insider trading should be legal because it signals the prices of the firm´s stock continuously and reliable.

A much-cited book on insider trading is "Inside trading and the stock market" by Manne from 1966. In an article from 2005 the author revisited his findings from 1966. Manne had three main arguments on why insider trading was good (Manne 2005). Firstly, corporate insider trading did no harm to long-term investors. Secondly, the compensation argument allowing corporate insider trade, one could achieve an employee compensation. Where the corporate insider selling or buying stocks oversaw their own compensation. This would lead to the best result for all stakeholders. And lastly, corporate insider trading contributes to the efficiency of stock market pricing.

Other studies have shown that strict insider trading regulations could in fact increase stock liquidity and give more informative stock prices (Beny 2004). Bhattacharya and Daouk (2002) investigated countries on how good legislation they had on insider trading. Finding

countries with developed insider trading laws having lower equity cost than countries which did not have strict insider regulations.

2.2 Theoretical Framework

2.2.1 Market efficiency

Fama (1970) in (Dimson and Mussavian 1998) defined an efficient market as a market where trading on available information fails to give abnormal return. The efficient market theory defines three states of market efficiency: Weak form, semi-strong and strong market efficiency. If the market has strong market efficiency all public and private information are incorporated into the stock prices, and one could not achieve abnormal return having insider information. In a semi-strong efficient market, new information is incorporated as soon as the information is disclosed. In a weak form one cannot use information about earlier prices to predict future prices.

For a market to be sufficient efficient there are three conditions, 1) No transaction costs. 2) All information is available at low cost for all. 3) All agree about what the information have to say on the price, and future distribution of prices for that stock. However, the market could be efficient even if not all those conditions are met. The market could still be efficient if enough investors have access to the information (Fama 1970).

Fama (1970) divides the empirically work on market efficiency in three categories. The strong form test for market efficiency is interested in whether individual or groups of investor possesses private/monopolistic information crucial for price formation. Fama (1970) states that such an extreme model is not an exact depiction of the world, rather used as a benchmark for testing deviation from the strong form market efficiency.

Semi- strong form tests want to investigate whether prices fully reflect all public information. The test for the semi-strong efficiency want to measure how prices adjust to new information that is obviously public (Fama 1970). For instance, financial reports, stock splits, mergers and acquisitions, dividend changes and corporate insider trade announcement. One usual way for empirically testing semi-strong market is to use an event study.

Weak-form tests are concerned with whether one can predict future prices by analysing historical prices. If the market is weak form efficient, then one cannot attain an abnormal return by searching for patterns in historical prices. For instance by using technical analysis,

where one tries to recognize patterns in historical prices that could predict future prices (Alexeev and Tapon 2011). In this study they failed to reject the hypothesis that the market was weak-form efficient.

2.2.2 Asymmetric information

There exists an information gap between insiders in the company, who have private information, and traders that needs to do trades based on public information. The information asymmetry between corporate insiders and outside investors can lead to a conflict of interest. Bergstresser and Philippon (2006) and Beneish and Vargus (2002) found evidence for managements trading of stocks, and options could coincide with the quality of earnings accruals.

However, there could be an agency cost related to insider trading. Assuming people in insider-positions, possesses private information, corporate insiders can use this information to buy or sell stocks. Furthermore, corporate insider wants to maximize wealth. If any information asymmetry, the insider can receive better returns than the outside investor. One can say that there exists an agency cost caused by the information asymmetry. Leading to a conflict of interest between corporate inside traders and outside traders. Because the corporate inside traders obtained their return on the expense of the outside traders. Abnormal returns could be a measure on the agency cost of insider trading (Ang and Cox 1997).

2.3 Previous research

Several studies have researched corporate insider trading and concludes these insider trades attain abnormal returns. Most of these studies are conducted on the US stock market. Finnerty (1976) found, after using the Jensen alpha approach with monthly buy and sell portfolios, significant evidence for abnormal returns among inside trades. Seyhun (1986) used an event study and found significant signs that corporate insiders attain abnormal returns, and found the abnormal returns decreased with firm's size (Seyhun 1986). Huddart and Ke (2007) found significant evidence for corporate insiders attaining abnormal returns. Additionally, Huddart and Ke (2007) used a regression analysis with proxies for information asymmetry. These proxies had significant but small explanatory power on the abnormal returns.

However, J. Lakonishok and Lee (2001) found in an event study that corporate insiders do not attain abnormal results in the short term. Instead, they found corporate insiders in the long run attained an abnormal return.

Cohen, Malloy, and Pomorski (2012) argues that some of the trades done by corporate insiders are routine trades. The trades who were not routine trades were classified as opportunistic trades. Routine trades are trades conducted on a regular basis, for instance, the trades that occur at the same time each year with identical amounts. However, opportunistic trades attained abnormal returns, and gave information about future returns.

Biggerstaff, Cicero, and Wintoki (2020) used a Jensen alpha approach, where they used both market model, Fama & French three factor model, and the Carhart four factor model. In this approach they found significant evidence for abnormal returns both in buy and sell portfolios. Biggerstaff, Cicero, and Wintoki (2020) also found that informed corporate inside traders had a specific pattern to maintain their information advantage. If information is short-lived, corporate insiders trade in a short window of time. Corporate insiders stretch their trades over time when having a long-term advantage. Lastly, corporate insiders report their trade after closing to keep their advantage.

Another way event studies have been used is the way of Keown and Pinkerton (1981) investigating if there were signs of insider trading before merger announcements. They could see signs of insider trading 12 days prior to the announcement of a merger.

Aktas, De Bodt, and Van Oppens (2008) used two methods. One was an event study where they calculated 0,1 and 0,4 CAAR. The second approach was an alternative way to use probability of information-based trading (PIN). Where PIN was the ratio between expected absolute order imbalance and the expected volume. The correlation between daily return and relative order imbalance. Relative order imbalance is the ratio between daily imbalance and the daily volume. They found significant but economical weak abnormal returns for buy transactions, and the strange find that the abnormal returns were positive on sell. Further the result of the second approach (PIN) was that corporate insider trades had informational effect on price discovery was hastened.

In Europe there are now several studies conducted. Zingg, Lang, and Wyttenbach (2007) researched the Swiss stock market and used a 30 day before and after event window to see if insiders attained abnormal returns in a market with less strict insider trading laws. They found evidence for significant abnormal return in the buy transactions, but smaller and not significant abnormal returns in the sell transactions. However, Zingg, Lang, and Wyttenbach (2007) could reject the hypothesis that the Swiss market had strong form market efficiency. Since the portfolio, mimicking corporate insider trades, showed signs that one could attain abnormal returns. On the other hand, they could not either confirm or reject the hypothesis of semi-strong form of market efficiency.

In Germany there is no black out period before earnings announcements (Betzer and Theissen 2009). Betzer and Theissen (2009) found in the months before earnings announcement there was significant evidence for abnormal returns among corporate insider trades.

A study done by Gregory, Tharyan, and Tonks (2013) on the London Stock exchange found significant evidence for long term abnormal returns for buy transaction. However, they found no significant abnormal returns on the sell transactions. Another finding, corporate insiders are contrarian investors, which will say buy after the price drop and sell after the price increase. The abnormal returns are largest in the small value stocks.

Degryse, de Jong, and Lefebvre (2014) investigated the information content of trades conducted by corporate insiders in the Dutch stock market. Using an event study in a short term around trading dates. Degryse, de Jong, and Lefebvre (2014) found economical high

abnormal returns surrounding buy transactions. These results suggests the hypothesis as legal corporate insider trading is a channel for information to reach the market. However, market abuse directive implementation lowered the information content of sales by top executives.

A study done by Rose and Søpstad (2015) researched the Danish market and wanted to test the market's reaction on corporate insider transactions. They also tested the Danish markets efficiency and the effect of disclosing trades. Using a standard event study methodology with the market model as prediction for returns. Both buy and sales transaction gave small but significant abnormal returns on the short run. CAR (Cumulative Abnormal Return) stayed positive, implying that the market price reflects on the information about corporate insider trade announcement, and the market is semi-strong efficient. Rose and Søpstad (2015) concludes there were an effect of disclosing corporate insider transactions.

However, there are few studies conducted on the Oslo Stock Exchange (OSE). Studies that have been conducted are E.B. Eckbo and Smith (1998) and E.B. Eckbo and Ødegaard (2020). Eckbo and Smith (1998) is one of few studies concluding that insiders do not attain abnormal returns. When using a standard event study, E.B. Eckbo and Smith (1998) found that the insider's sales transactions had abnormal returns. However, the abnormal returns vanished when they used a value weighted portfolio, and a multifactor market model allowing for time-varying expected returns. On the other hand, Eckbo and Smith (1998) found when using their approach, evidence for negative abnormal performance of insider trades.

Eckbo and Ødegaard (2020, under review) researched the differences between the genders on risk taking and insider trading. Also, new regulations on females in leading positions and the board of directors should have a certain percent of females. They found that there were no significant signs of abnormal results in the short term, and no abnormal results in the weighted portfolio in the long run. In the case of female insiders and risk aversion, the female directors did not have higher risk aversion than their male counterparts, rather that they have lower risk aversion. It seems that female directors and executives could: *"require those individuals to be more like men, to break the glass ceiling" (E.B. Eckbo and Ødegaard 2020).*

3.0 Data and Method

There will be use a standard event study methodology such as in Rose and Søpstad (2015) were they used the market model. Unlike Rose and Søpstad, there will be used several different event windows to see how the abnormal returns changes over time.

3.1 Method

In this section, the method of procedure of the event study will be explained. Then discuss strengths and weaknesses about the event study methodology. The methodology is persuaded from (Rose and Søpstad 2015) which are influenced by (MacKinlay 1997).

Event study methodology has been used in its current form since Fama et al 1969 study (Corrado 2011; B.E. Eckbo 2008), mainly the focus in an event study is whether an event has had an impact on a stock price or other financial instruments. Today, we have data on greater detail compared to the novice days of event studies. Then they used monthly returns in event studies, but since we now have daily and intraday updates on return it has become common to use daily returns in event studies.

Using an event study methodology (MacKinlay 1997), the first step is to define an event. In this thesis the event is corporate insiders buying or selling stocks in their own company. Next step is to find out which companies have experienced the event. Then create an event timeline where the event is zero, time before the event will be negative and after the event will be positive. Thereafter define the event window and estimation period.

In this thesis, the event is defined as corporate insiders buying or selling stocks in their own company. This means the day the event is announced is time 0 in the timeline. We use different event windows, 10 days before the event to see if there were any trends before the event. The event windows were: -10 to 10 and 0 to 10 to see what happens directly after the corporate insider transaction was known. Then a separately event study for -10 to 250 days to study what happened in the long term, and whether abnormal returns was attained for a longer period.

The next step was to define the estimation period. The estimation period is outside of the event window to prevent the event affecting the normal performance model parameter estimates (MacKinlay 1997). Using an estimation period of 250 days which will say -11 to -261 before the event. Chose this estimation period because a trading year consists of around 250 trading days dependent on holidays.

Table 1 Notations

AR	**Abnormal returns for a single company at one point of time**
CAR	Cumulative Abnormal Return for a single company over the event window
AAR	Average abnormal return for all companies at one point of time in the event window
CAAR	Cumulative abnormal returns for all companies in the sample over the event window
τ	Returns in event time
$\tau = T_0$ to $\tau = T_1$	Estimation window
L_1	Length of estimation window
$\tau = T_1$ to $\tau = T_2$	Event window
L_2	Length of the event window

Table 1 are a summary of the most used notations and their meaning.

Figure 1 is a graphically depiction of the timeline used in an event study. In the short term the $T_0 = -261$, $T_1 = -10$, $T_2 = 10$. For the long term $T_0 = -261$, $T_1 = -10$, $T_2 = 250$.

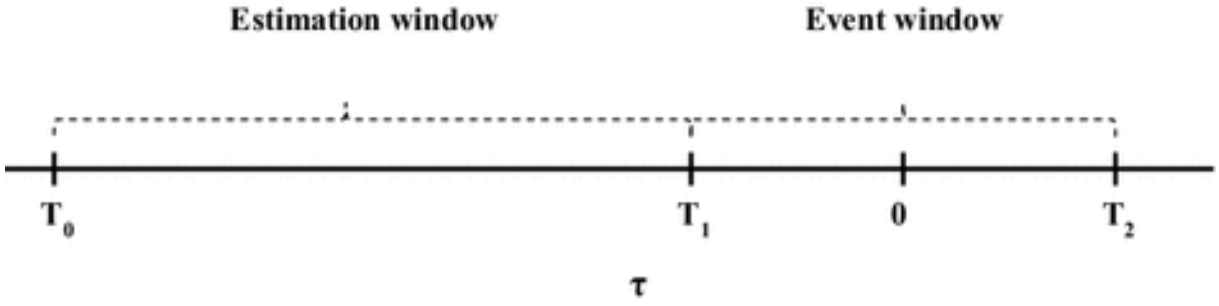

Figure 1 graphical depiction of event timeline(Rose and Søpstad 2015)

Thereafter, one need to find which method for estimating the abnormal returns (MacKinlay 1997).

$$AR_{it} = R_{it} - E(R_{it}|X_t) \quad (1)$$

There are two common ways to create a model for predicting future returns. One could use the constant mean return model then the X_t condition is a constant. Constant means return model is under the assumption that the mean return of a company is constant over time. The market

model has the assumption that there exists a stable linear relation between the market return and the return of the company. The market model is an improvement to the constant mean return model in the way that it removes the portion of the variance related to the variation of the market return (MacKinlay 1997). Therefore, the variance to the abnormal returns will be reduced. The reduced variance can lead to increased ability to detect effects the event causes (MacKinlay 1997). On the other side, one is dependent on a high R^2 on the market model regression to make good predictions.

Whereas the market model is a one factor model, one could alternatively use a multifactor model. A typical approach is to incorporate several factors to the model, such as for instance industry indexes to improve the market model (MacKinlay 1997). Another method using a factor model to calculate the abnormal returns. By taking the difference between the company´s actual return and a portfolio of firms with the same size, measured by market value. However, such models have limited gains in event studies. Adding more factors to the market model does not heightened the explanatory power much, and therefor gives a small reduction in the variance (MacKinlay 1997).

Another way one could estimate the normal performance in an event study is to use economic models such as Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Theory (APT) (MacKinlay 1997). These models can be used as restrictions on the statistical models to provide more constrained normal return models. However, there have been found deviations in the CAPM and that the validity of using the restriction in CAPM on the market model is questionable (MacKinlay 1997). The most important factors using Arbitrage Pricing Theory act as a market factor, and additional factors add relatively small explanatory power (MacKinlay 1997).

Based on MacKinlay (1997) findings chose to use the market model, equation 2. Which is an OLS regression on the firms return on the market return over time. Where R_{it} is the firms return. rm is the market return. Thereafter, the residual term ε_{it} representing the abnormal return. If we rewrite equation 1 and place the ε_{it} on the left-hand side, see equation 3.

$$R_{it} = \alpha + \beta(rm) + \varepsilon_{it} \quad (2)$$

$$\varepsilon_{it} = R_{it} - (\alpha + \beta(rm)) \quad (3)$$

The residual variance is found by the sum of squared residuals in the estimation window, less two observations which is lost finding the mean return for the two-time series equation (4). This means that the H_0 will be that the event does not impact the mean or variance of the return. We then say that any AR should be normally distributed, value of 0, and the variance should be equal to the estimation window Equation (5) (Rose and Søpstad 2015).

$$\hat{\sigma}_{\varepsilon_i}^2 = \frac{1}{L_1-2}\sum_{\tau=T_{0+1}}^{T_1}(R_{it} - (\hat{\alpha}_{it} + \hat{\beta}_{it}R_{mt}))^2 = \sigma^2(AR_{it}) \quad (4)$$

$$AR_{it} \sim N(0, \sigma^2(AR_{it}) = \sigma_{\varepsilon_i}^2 \quad (5)$$

We are interested in the Cumulative abnormal return which is the sum of abnormal returns over the event window, se equation 6.

$$CAR_{it} = \sum_{t-k}^{t+1} AR_{it} \quad (6)$$

Then we want to find the AAR and CAAR, if equally weighted, we have that AAR is the average abnormal return over all firms and events:

$$AAR = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (7)$$

$$var\ (AAR) = \frac{1}{N^2}\sum_{i=1}^{N} \sigma_{\varepsilon_i}^2 \quad (8)$$

CAAR is the sum of the AAR over the event window.

$$CAAR = \sum AAR \quad (9)$$

$$var(CAAR) = \sum_{t=t1}^{t2} var(AAR) = var(AAR)\ x\ L_2 \quad (10)$$

The normal test statistics is the t-test. In the event study, testing whether CAAR or AAR is different from Zero. There is an interested in the ttest for CAAR (11) over the event window and the ttest for AAR (12) for each day in the event window. The test statistic is given by:

$$t = \frac{CAAR\,(\tau_1, \tau_2)}{\sqrt{var(CAAR(\tau_1, \tau_2))}} \quad (11)$$

$$t = \frac{AAR_\tau}{\sqrt{var(\mathrm{AAR}_\tau)}} \quad (12)$$

There are several ways for calculating the returns from daily stock prices. The most common ways are arithmetic returns (simple returns) and natural logarithmic returns. Simple returns and natural logarithmic returns have their strengths and weaknesses (Hudson and Gregoriou 2015). The advantage of using natural logarithm is that one can sum consecutive returns over time. Calculate this way is if you sum up the daily returns in a month it will be approximately the same as holding an asset over a month. Even though simple return and logarithmic returns are approximately the same, there can be differences when comparing different studies. Calculated the returns using the natural logarithm equation 13.

$$R_i = ln(S_i) - ln(S_{i-1)}) = ln\left(\frac{S_i}{S_{i-1}}\right) \quad (13)$$

Interested in whether the market reacts on the announcement day where two hypotheses is tested for this question.

H1: The market reacts with a positive abnormal return on the announcement day when buy transaction, time 0.

H1>0

H2: The market reacts with a negative abnormal return on the announcement day when sell transaction, time 0.

H2<0

Thereafter, test if they attain cumulative abnormal return over the event period so at t2=10. The suggestion is that CAAR over the event window: 0,10 should be positive on buy transaction and negative on sell transactions.

H3: At t2=10 the cumulative average abnormal return should be positive on buy transaction.

H3>0

H4: At t2=10 the CAAR should be negative on sale transactions

H4<0

Lastly, tested whether the abnormal returns hold over time, made the following hypothesis.

H5: CAAR should be positive on buy transaction at t2= (30, 50, 70, 90, 110, 130, 150, 170, 190, 210, 230, 250)

H5>0

H6: CAAR should be negative on sell transaction at t2= (30, 50, 70, 90, 110, 130, 150, 170, 190, 210, 230, 250)
H6<0

These hypotheses were tested against the null hypothesis that the CAARs where zero.
H0: CAAR=0

3.2 Data

Primary insiders are by law (VPHL, 2007) obligated to announce their trades, these announcements one can find on Newsweb[3] on the OSE homepage. From these announcements extracted information on date, name of the company, ticker, position, and volume. The ISIN number was also collected, to easier match the data to the TITLON[4] database.

Collected data from 01.01.2014 to 31.12.2022, these announcements were collected manually and kept the ones containing buy and sell transactions. This means that announcements regarding options, warrants, TRS, share saving plans, long term incentive plans, and remunerations is not included. Thereafter, checked the dataset for duplicates, since often the announcement is both published in English and Norwegian. After this, in total collected 5363 transactions from Newsweb .

Data on stock prices and OSE index was collected on TITLON, this database holds daily financial data from 1980 (UiT). Collected stock prices for each firm using ISIN-code. The OSE All-share Index as market return. OSE All-share Index is a full market capitalization weighted index of all companies listed on OSE.

Combined the stock data and the event data, found there was some events that did not have enough stock data observations. After the combining, there was 5075 corporate insider events, 4233 buy transactions and 842 sell transaction. A total of 232 companies experienced

[3]https://newsweb.oslobors.no/search?category=1102&issuer=&fromDate=&toDate=&market=XOSL&messageTitle=

[4] https://titlon.uit.no/

corporate insider transactions, out of these 221 experienced buy transactions and 163 companies had sell transactions. See table 2. The company with the most buy transactions had 163 transactions, and in sell transaction the highest number of one of the companies had 90 transactions.

Table 2 Number of companies and summary of transactions

	Buy	*sell*	
Companies	221	163	232
Frequences			
mean	22.47	17.71	
median	16	10.5	
max	163	90	
min	1	1	

Table 2 the line Companies describes how many companies that have experienced insider trading from 01.01.2014 to 31.12.2023. Mean and Median describes how many corporate insider trades a company in average has. Max is the maximum number of trades a company in the sample had. Min the lowest number of trades.

Table 3 shows the distribution based on insiders' position in the company. Most of the trades are conducted by corporate insiders in the management or among the board of directors. A total of 1293 and 1450 buy, and 320 and 237 sell respectively. There are more buy then sell transaction. This could be because of signalling effects, selling stocks could mean there are bad news expected or not having faith in your company. Whereas buying could signal good news and faith in the company.

Table 3 Positions and Transaction

	Buy	**Sell**	**Total**
CEO	600	50	650
NA	306	167	473
Closely related	75	30	105
Management	1298	320	1618
Chairman	504	38	542
Board	1450	237	1687
Total	4233	842	5075

Table 3 is a summary over the transactions in the sample by position. CEO is top manager, NA are those where no position was given. Closely related are trades done by closely related persons to an insider. Management is those in the top management which has insider information. Chairman is the chair of the board. Board is those who sit on the board of directors, are observers or deputy board members.

Table 4 Descriptive statistic on volume and value of transaction

	Sell		*Buy*	
Stats	Volume	Value	Volume	Value
N	842	842	4233	4233
Mean	1257198	3.64e+07	1856437	2.25e+07
SD	5927672	1.30e+08	1.98e+07	1.06e+08
Median	24736	1189020	20000	381988
1.quartile	3371	234600	3500	116475.5
3. quartile	281110	1.02e+07	176926	3818000
Min	4	272	1	1
Max	1.00e+08	1.29e+09	8.00e+08	1.29e+09

Table 4 is a summary of the value and volume of transactions in the sample. Where sell transactions are to the left and buy transactions are to the right. The table is showing mean and standard deviation. Since some of the trades were much higher than others, the median, first and third quartile were also included. Values are in NOK, and volume is the number of stocks in one transaction.

It seems like the values for sell transactions are higher than the values for buy transactions. With a mean of 36,400,000 NOK for sell and 22,500,000 NOK for buy. Also found a very high standard deviation, which is higher than the mean. However, there are some transactions in the sample which are very large 1,3 billion NOK. In that case it could be much more enlightening to use the median. It seems like sell transaction still are higher in value than buy transaction with respectively 1,189,020 NOK and 381,988 NOK.

When investigating the volume of trades, the results are that the mean volume for buy transactions are higher than the mean for sell transactions with the volume of 1,856,437 and 1,257,198 respectively. However, the largest trades are much higher for buy transaction with 800,000,000. When using the median, the volume on sell transactions is higher than the median volume for buy 24,736 and 20,000 respectively.

4.0 Results and Discussion

In this section the results will be presented and discussed. Firstly, the results from the short-term event study and a discussion on these findings. Thereafter, presenting the results and discussion from the long-term event study.

4.1 Short-term

The results from the short-term event study will be presented here. The event window was: -10,10. The focus is on the day of the corporate insider trade announcement, and the 10 days following will present the results for the event window: 0,10. Firstly, the buy transactions. Secondly, the sell transaction. Lastly, a discussion on the short-term event study and whether the market reacted to the corporate insider trade announcement.

4.1.1 Short-term buy

Table 5 Short-term buy event study

	Buy	
	Caar (St Err)	AAR (St Err)
0	.006***	.006***
	(0.001)	(0.001)
1	.009***	.003***
	(0.001)	(0.001)
2	.009***	-.001
	(0.002)	(0.001)
3	.008***	-.001
	(0.002)	(0.001)
4	.007***	-.001**
	(0.002)	(0.001)
5	.005**	-.002***
	(0.002)	(0.001)
6	.004**	-.001**
	(0.002)	(0.001)
7	.004**	.0
	(0.002)	(0.001)
8	.004**	.0
	(0.002)	(0.001)
9	.004**	.0
	(0.002)	(0.001)
10	.004**	-.001
	(0.002)	(0.001)

*Table 5 is a summary of the CAAR and AAR of the short term buy event study 0 to t10 . In parentheses are the standard errors. Significance level are marked by stars where: *** p<0.01, **p<0.05 and *p<0.1.*

Does the market react on corporate insider trading announcements? The hypothesis is that the market will react positive on buy transaction, and negative on sell transactions. The market reacts to the announcement with a significant to the 0.01 level and a 0.6 percent raise. Suggesting the market reacts on corporate insider announcements when they buy stocks in their own company.

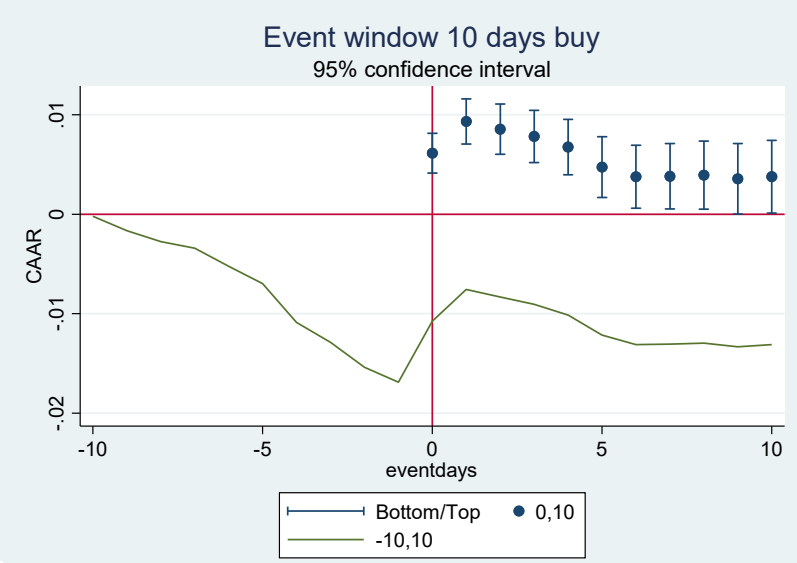

Figure 2 is a graphical presentation of CAARs in the short-term buy transactions. The line (green) is the representation of the event window -10,10. The black dots are each CAAR in the event window 0,10 with a 95 percent confidence

Figure 2 Event window 10 days buy transactions.

In figure 2, the cumulative average abnormal returns (CAAR) are plotted for buy transactions -10,10 (line) and the CAAR from 0,10 with a 95 percent confidence interval. Day 1, after the corporate insider trade announcement the CAAR is significant to the 0.01 level and 0.9 percent up. Day 5, the cumulative abnormal return has dropped to 0.5 percent to 0.05 level. For the next five days there is a 0.4 percent significant to the 0.05 level abnormal return. Suggesting that the corporate insider buy transactions attains a positive abnormal return. The market reacts positive to a buy signal and that it starts to fall slightly and stabilizing.

4.1.2 Short-term Sell

Table 6 Short-term sell event study

	Sell	
	Caar	AAR
	(St Err)	(St Err)
0	-007***	-.007**
	(0.003)	(0.003)
1	-0.009***	-.003**
	(0.003)	(0.002)
2	-.011***	-.002
	(0.003)	(0.002)
3	-.009***	.001
	(0.003)	(0.001)
4	-.011***	-.001
	(0.003)	(0.001)
5	-.011***	-.001
	(0.003)	(0.001)
6	-.012***	-.001
	(0.003)	(0.001)
7	-.012***	0
	(0.003)	(0.01)
8	-.013***	-.001
	(0.003)	(0.001)
9	-.016***	-.003
	(0.004)	(0.001)
10	-.017***	-.001***
	(0.004)	(0.001)

*Table 5 summarises the CAAR and AAR of the short term buy event study 0 to t10. In parentheses are the standard errors. Significance level are marked by stars where: *** p<0.01, **p<0.05 and *p<0.1.*

In the sell transactions there is a significant decrease in the market on the event day on 0.7 percent which means the null hypothesis can be rejected. This could suggest that the market reacts negative on announcement where insiders are selling stocks in their own company. We still see the CAAR decreases during the event period to -1.7 percent on day 10.

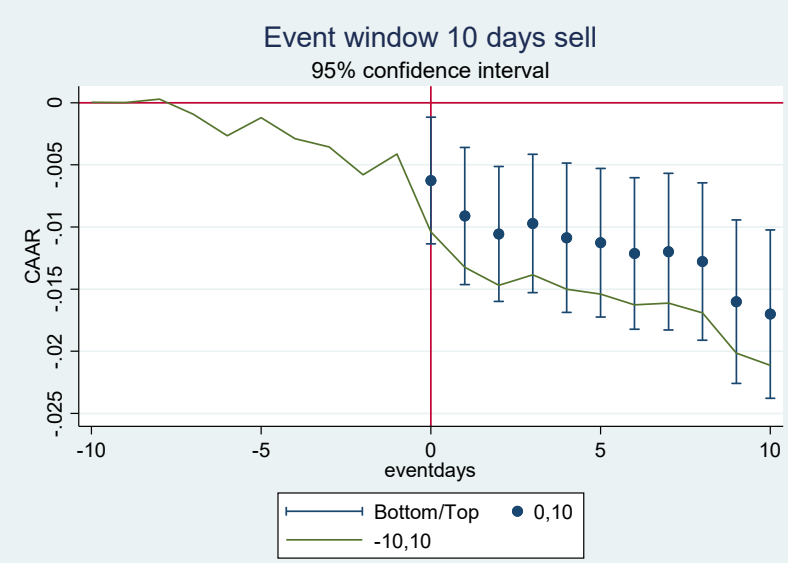

Figure 3 is a graphical presentation of CAARs in the sell short-term event study. The line (green) is the representation of the event window -10,10. The black dots are each CAAR in the event window 0,10 with an 95

Figure 3 Event window 10 day sell transactions.

Thereafter, it keeps dropping stabilizing around -1.0 to -1.2 percent for five days before a drop to -1.7 percent after day 10 which are also significant to the 0.01 level. It seems that the market reacts to sell transactions on the announcement day just as much as for buy transactions. However, it seems like sell transaction in comparison to buy transaction keeps the trend from before the event.

4.1.3 Short-term discussion

The first hypothesis was when a corporate insider bought stocks in his own company, then the abnormal return the day of the announcement would be positive. Which we find in the results positive 0.6 percent in the buy transactions. The second hypothesis was corporate insider sell transaction would produce a negative abnormal return. In the research conducted there is a negative abnormal return on -0.7 percent in the sell transactions.

Although small but consistent with other studies (Bajo and Petracci 2006; Rose and Søpstad 2015). Fidrmuc, Goergen, and Renneboog (2006) reports a market reaction on where CAAR increased by 1.16 percent on event window, 0,1 for buy transactions around the same as the results in this thesis 0.9 percent. The -0.26 percent on sale transaction is a little smaller than the findings in this thesis. According to Aktas, De Bodt, and Van Oppens (2008) which found similar results, these reaction are small in economic value.

These findings can imply the same findings as in Rose and Søpstad (2015) suggesting that the market is semi-strong efficient. Since the market reacted quickly both on buy and sell transaction. This is in line with the semi-strong efficient market test. On the other side, a small correction when studying the buy transactions which can indicate a small overreaction to the announcement. This is not the same as observed by Rose and Søpstad (2015), where the abnormal returns kept moving the same way as the announcement day.

4.2 Long-term

In this part, the results from the long-term event study will be presented. Table 7, showing different event windows for buy and sell from 0 to 250 days after the corporate insider announcement. Figure 4 is a visual presentation on the buy transactions were the black dots representing 0,250 event window with a 95 percent confidence interval, and the line representing -10,250. Figure 5 is the same visual presentation of the sell transactions.

Table 7 Event windows long term

	CAAR BUY	*CAAR SELL*
	(St Err)	*(St Err)*
0	.007***	-.004
	(0.001)	(0.003)
5	.004**	-.01***
	(0.002)	(0.004)
10	.002	-.016***
	(0.002)	(0.004)
30	-.002	-.023***
	(0.005)	(0.008)
50	-.003	-.033**
	(0.005)	(0.017)
70	-.011*	-.044**
	(0.007)	(0.018)
90	-.019**	-.061***
	(0.007)	(0.019)
110	-.025***	-.082***
	(0.009)	(0.021)
130	-.03***	-.074***
	(0.009)	(0.026)
150	-.036***	-.081***
	(0.011)	(0.028)
170	-.04***	-.076**
	(0.011)	(0.030)
190	-.045***	-.112***
	(0.013)	(0.033)
210	-.053***	-.128***
	(0.013)	(0.035)
230	-.058***	-.148***
	(0.015)	(0.036)
250	-.065***	-.168***
	(0.016)	(0.038)

*Table 5 summarises the CAAR in buy and sell transactions for the long-term event study. In parentheses are the standard errors. Significance level are marked by stars where: *** p<0.01, **p<0.05 and *p<0.1.*

4.2.1 Long-term Buy

In the long run, buy transaction, between day 10 and up to 50 days after the event, cumulative abnormal returns are not significant different from 0. However, after 70 days the cumulative abnormal return is negative but significant. The lowest abnormal return is 250 days after the event day with a cumulative abnormal return of -6.5 percent, which is also significant to 0.01 level. Based on the findings in this event study, the positive cumulative abnormal returns do not hold over time, and these findings are significant.

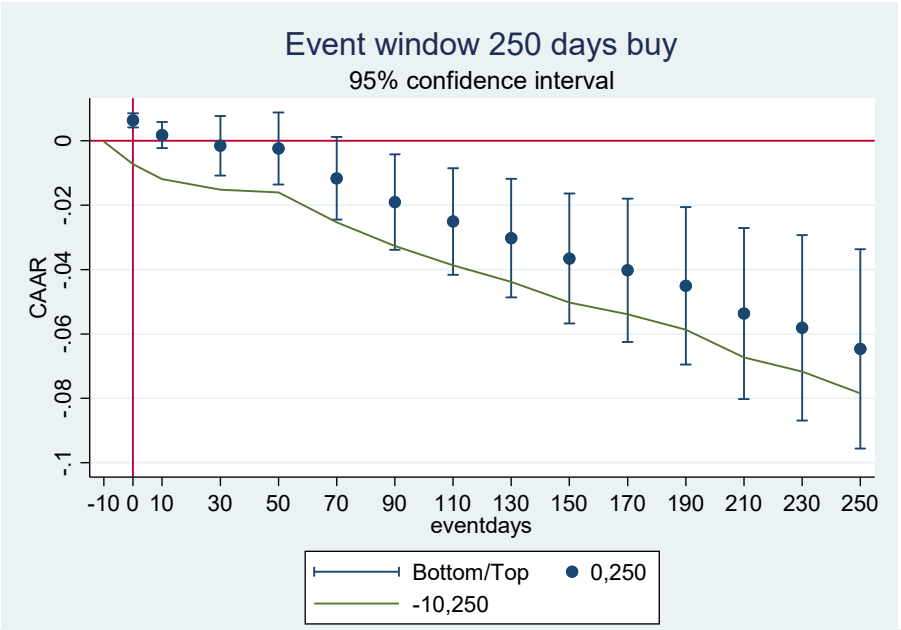

Figure 2 is a graphical presentation of CAARs in the long-term event study buy transactions. Here the line (green) is the representation of the event window -10,10. The black dots are each CAAR in the event

Figure 4 Event window 250 days buy transactions.

However, if we inspect the graph in figure 4 it could seem like there was an effect the first 50 days after the announcement. Whereas the abnormal returns had a positive cumulative average abnormal return lasting at least 10 days. Then the CAAR seems like they are not different from 0 until day 90. It seems like there is a shift after 50 days where the CAAR starts a downward trend.

Another thing to notice is that it seems like the standard error is increasing as one moves away from the announcement day. A standard error of 0.001 at day 0 has increased to 0.016 on day 250. This could suggest that the variance is increasing with time.

4.2.2 Long-term Sell

In the sale transactions we see that it holds a negative abnormal return, they are significant to the 0.01 level. However, after 250 days the cumulative abnormal return is -16.8 percent and significant to 0.01 percent level. It seems that sell transactions holds the cumulative abnormal return, and it keeps negative and significant during the event window. On the other side, the trend before the announcement was also negative.

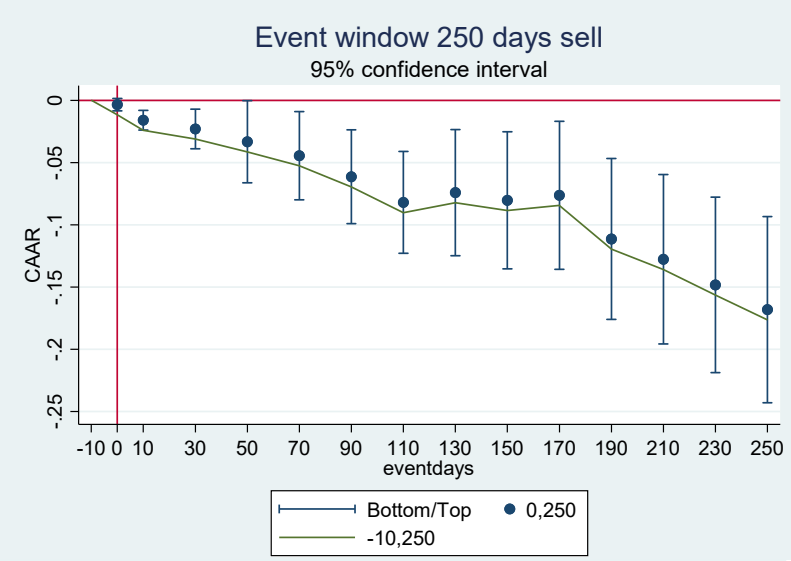

Figure 2 is a graphical presentation of CAARs in the long-term event window sell transactions. The line (green) is the representation of the event window -10,10. The black dots are each CAAR in the event window 0,10 with a 95 percent

Figure 5 Event window 250 days sell.

4.2.3 Long-term discussion

Third hypothesis was that corporate insiders attained a positive cumulative average abnormal return on buy transactions. The fifth was that they attained a positive CAAR over time. Yes, they attained a positive CAAR over a short time. However, finding significant negative CAARs 90 days after the announcement. Fourth and sixth hypothesis, corporate insiders when selling stocks in their own company should attain a negative CAAR and it should also stay negative over time. The results are clearly and significant, suggesting that corporate insiders selling stocks in their company attain an abnormal return.

The results in the long-term event study buy transactions was a little surprising. The corporate insiders, when buying stocks in their own company, do not attain any positive abnormal return. It seems like insiders perform worse than others when they are trading. Even though Eckbo and Smith (1998) found similar results in their study, however using a different methodology. When Eckbo and Smith (1998) used the standard event study methodology, they found only significant results in the sell transactions. However, Bajo and Petracci (2006) found that on the long-term, insiders attained abnormal returns in the Italian stock market.

Since there is no evidence for abnormal returns among corporate inside traders who buy stocks in their own company, one can say that they do not perform better... This can mean that insider trading laws works in the larger picture. No one in corporate insider positions are willing to make themselves criminal (Gangopadhyay and Yook 2015). Another reason could be that those who are in insider positions are more monitored by authorities and media. Corporate insiders do not want attention as someone earning large profits on their trades (Dardas and Güttler 2011).

The CAAR in the sell transactions are significant and negative which indicates that corporate insiders knows when to sell. This could suggest that insiders are good at predicting when the stock price is high, and then sell at “the top”. On the other hand, it could also be because corporate insiders know bad news are coming. However, it seems like CAAR in the period before the corporate insider trade announcement, T_1 to 0 is on a downward trend. Indicating that this abnormal return would happen anyway.

Unfortunately, on longer event windows, are dependent on the model for estimating the predicted return. Fama (1998) states that the models that exist are imperfect in predicting future returns, since "All models for expected returns are incomplete descriptions of the systematic patterns in average returns during any sample period" (Fama 1998). In the short-term, daily expected returns are close to zero then a "bad model" has little or no effect on the abnormal returns. However, the problem becomes larger when the return window becomes larger. As we can see in the results, an increase in standard errors with time.

Another problem which is not addressed is how big the R^2 is. As MacKinlay (1997) states the benefits from market models depends upon the R^2, high R^2 reduces the variance. However, if the R^2 is low the explanatory power of the prediction fails, and one could obtain an incorrect result as the variance will increase.

5.0 Conclusion

5.1 Conclusion

The aim of this study was to determine if corporate inside traders on the Oslo Stock exchange perform better then traders who trades on public information.

The research question that has been discussed in this master thesis, as followed:
Do inside traders perform better then traders who trades on public information?
a) Does the market respond on insider trades?
b) Do insider trades attain abnormal returns?
c) Abnormal returns hold over time?

In this study, two event studies was approached: One short-term event study to see if the market reacts on corporate insider trading announcement. Then a long-term event study to find out if corporate insiders attained abnormal returns over time. The market model was used to predict expected returns.

In the short-term event study, findings suggest the market reacted as predicted. The marked reacted positive on buy transaction and reacted negative on insiders selling stocks. The market reacted quickly on the information. This could indicate that the market on OSE is semi-strong efficient. In the long term, buy transaction had a significant negative abnormal return, which was against the hypothesis that corporate insiders should have a positive abnormal return. For sell transaction it seemed like if one sold or short stocks when corporate insiders sell, one could attain significant abnormal return. But on the other side, it was continuing a negative trend seen as the ten days before the sell announcement. Anyway, it reacted as the hypothesis suggested.

According to the research conducted, corporate insider buys trades, do not perform better than those who trade on public information. These findings are significant. However, it could be smart to pay attention when corporate insiders sell stocks as they attained abnormal returns. Finding these result a little puzzling as studies have found that corporate insider who trades in their own company, attains abnormal returns. There are few published studies investigating

corporate insider trading on the Oslo Stock Exchange, Eckbo and Smith (1998) as one of the studies where they conclude with corporate insiders do not attain abnormal returns.

5.2 Limitations and further research

There could be other factors that was not accounted for during the estimation or event window. For instance, adjust for large market movements, since the market dropped considerable during the announcement of COVID-19 restrictions, and during the oil crise in the years between 2014 and 2015. On the other hand, not adjusting for market movements gives an image of the actual returns during the period in this thesis from 2014 to 2022. Additionally, the sample period was over a long duration of 8 years and had 5075 observations.

In this study one of the greatest challenges was to manually collect the data on corporate insider trade announcement. The collection of the data was time consuming since all announcements had to be read and interpret to collect the data one needed.

Not considering that over time the variance could change, and that this could give false result. Also, the lack of not baring in mind how high the R^2 was on the market model, knowing that a bad model gives higher variance. A way one could have researched this, could be to use different models for estimating the predicted returns. However, MacKinlay (1997) claims that using another model then the market model gives small increase in the explanatory power of the prediction model.

Recommendations for future studies, firstly, use different models for predicting expected returns, such as Fama and French three factor model and Carhart four factor model. To investigate if they increase the explanatory power of the prediction model. Secondly, use other approaches in addition to event study, such as Jensens alpha approach and BHAR (Buy-Hold Abnormal Returns), to increase the robustness of the results. Thirdly, increased sample size perhaps twice as many years as in this study. Lastly, it could be interesting to research whether different roles/positions alter the results.

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7.0 Appendix

7.1 One sample t-test for abnormal return Buy

	obs	*AAR*	*St Err*	*t value*	*p value*
-10	4012	0	0.001	-.415	.678
-9	4012	-.002	0.001	-2.99	.003
-8	4012	-.001	0.002	-.789	.43
-7	4012	-.001	0.002	-.472	.638
-6	4012	-.002	0.001	-2.852	.005
-5	4012	-.002	0.002	-1.072	.284
-4	4012	-.004	0.001	-4.856	0
-3	4012	-.002	0.001	-1.899	.058
-2	4012	-.003	0.001	-3.676	0
-1	4012	-.002	0.001	-2.067	.039
0	4012	.006	0.001	6.024	0
1	4012	.003	0.001	5.479	0
2	4012	-.001	0.001	-1.512	.131
3	4012	-.001	0.001	-1.449	.147
4	4012	-.001	0.001	-2.05	.041
5	4012	-.002	0.001	-3.791	0
6	4012	-.001	0.001	-2.071	.038
7	4012	0	0.001	.098	.922
8	4012	0	0.001	.253	.8
9	4012	-.001	0.001	-.737	.462
10	4012	0	0.001	.455	.649

This table shows the average abnormal returns buy transactions for event window -10,10. In this table the results for the t-test is for each day in the event window. If the p-value is less, then 0.05 the average abnormal return is significantly different from zero.

7.2 One sample t-test for CAAR -10,10 buy

	obs	*CAAR*	*St Err*	*t value*	*p value*
-10	4012	0	0.001	-.415	.678
-9	4012	-.002	0.001	-2.408	.016
-8	4012	-.003	0.002	-1.764	.078
-7	4012	-.004	0.002	-1.627	.104
-6	4012	-.005	0.002	-2.374	.018
-5	4012	-.007	0.003	-2.543	.011
-4	4012	-.011	0.003	-3.801	0
-3	4012	-.013	0.003	-4.229	0
-2	4012	-.015	0.003	-4.877	0
-1	4012	-.017	0.003	-5.2	0
0	4012	-.011	0.004	-3.142	.002
1	4012	-.007	0.004	-2.17	.03
2	4012	-.009	0.004	-2.349	.019
3	4012	-.009	0.004	-2.527	.011
4	4012	-.01	0.004	-2.783	.005
5	4012	-.012	0.004	-3.281	.001
6	4012	-.013	0.004	-3.514	.001
7	4012	-.013	0.004	-3.462	.001
8	4012	-.013	0.004	-3.395	.001
9	4012	-.013	0.004	-3.468	.001
10	4012	-.013	0.004	-3.383	.001

This table shows the cumulative average abnormal returns buy transactions for event window -10,10. In this table we have the results for the t-test for each day in the event window. If the p-value is less then 0.05, the cumulative average abnormal return is significantly different from zero.

7.3 One sample t-test for CAAR 0,10 buy

	obs	*CAAR*	*St Err*	*t value*	*p value*
0	4012	.006	0.001	6.024	0
1	4012	.009	0.001	8.018	0
2	4012	.009	0.002	6.617	0
3	4012	.008	0.002	5.850	0
4	4012	.007	0.002	4.766	0
5	4012	.005	0.002	3.051	.003
6	4012	.004	0.002	2.329	.02
7	4012	.004	0.002	2.272	.023
8	4012	.004	0.002	2.247	.025
9	4012	.004	0.002	1.974	.049
10	4012	.004	0.002	2.022	.044

This table shows the cumulative average abnormal returns buy transactions for event window 0,10. In this table shows the results for the t-test for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero.

7.4 One-sample t test for abnormal return -10,10 sell

	AAR	*St Err*	*t value*	*p value*
-10	0	0.001	0.036	0.972
-9	0	0.002	-0.02	0.984
-8	0.001	0.001	0.268	0.789
-7	-0.001	0.001	-1.247	0.212
-6	-0.002	0.002	-0.829	0.407
-5	0.002	0.001	1.177	0.24
-4	-0.002	0.003	-0.606	0.545
-3	-0.001	0.003	-0.25	0.803
-2	-0.002	0.004	-0.609	0.543
-1	0.002	0.003	0.568	0.57
0	-0.007	0.003	-2.413	0.016
1	-0.003	0.002	-2.176	0.03
2	-0.002	0.002	-1.099	0.273
3	0.001	0.001	0.748	0.455
4	-0.001	0.001	-1.089	0.277
5	-0.001	0.001	-0.435	0.664
6	-0.001	0.001	-0.912	0.362
7	0	0.001	0.154	0.877
8	-0.001	0.001	-0.964	0.336
9	-0.003	0.001	-2.635	0.009
10	-0.001	0.001	-1.133	0.258

This table shows the average abnormal returns sell transactions for event window -10,10. In this table the results are showing for the t-test for each day in the event window. If the p-value is less, then 0.05 the average abnormal return is significantly different from zero.

7.5 One-sample t test for CAAR -10,10 sell

	CAAR	*St Err*	*t value*	*p value*
-10	0	0.001	0.036	0.972
-9	0	0.002	0.004	0.997
-8	0.001	0.002	0.15	0.881
-7	-0.001	0.002	-0.43	0.667
-6	-0.003	0.003	-0.823	0.411
-5	-0.001	0.004	-0.341	0.733
-4	-0.003	0.005	-0.616	0.538
-3	-0.004	0.005	-0.66	0.51
-2	-0.006	0.006	-0.983	0.326
-1	-0.004	0.007	-0.639	0.523
0	-0.011	0.007	-1.479	0.14
1	-0.013	0.007	-1.855	0.064
2	-0.015	0.007	-2.083	0.037
3	-0.014	0.007	-1.96	0.051
4	-0.015	0.007	-2.122	0.034
5	-0.015	0.007	-2.208	0.028
6	-0.017	0.007	-2.327	0.02
7	-0.016	0.007	-2.317	0.021
8	-0.017	0.007	-2.381	0.018
9	-0.02	0.007	-2.817	0.005
10	-0.021	0.007	-2.947	0.004

This table shows the cumulative average abnormal returns sell transactions for event window -10,10. In this table the results for the t-test is shown for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero.

7.6 One-sample t test for CAAR 0,10 sell

	CAAR	*St Err*	*t value*	*p value*
0	-0.007	0.003	-2.413	0.016
1	-0.009	0.003	-3.239	0.001
2	-0.011	0.003	-3.816	0
3	-0.009	0.003	-3.424	0.001
4	-0.011	0.003	-3.546	0.001
5	-0.011	0.003	-3.692	0
6	-0.012	0.003	-3.902	0
7	-0.012	0.003	-3.728	0
8	-0.013	0.003	-3.961	0
9	-0.016	0.004	-4.774	0
10	-0.017	0.004	-4.92	0

This table shows the cumulative average abnormal returns sell transactions for event window 0,10. In this table the results are shown for the t-test for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero.

7.7 One sample t-test for CAAR -10,250 buy

	obs	*CAAR*	*St Err*	*t value*	*p value*
-10	3433	-.001	0.001	-.499	.618
-5	3433	-.005	0.004	-1.619	.105
0	3433	-.007	0.004	-1.841	.066
5	3433	-.01	0.005	-2.316	.021
10	3433	-.012	0.005	-2.671	.007
30	3433	-.015	0.006	-2.445	.015
50	3433	-.016	0.007	-2.296	.022
70	3433	-.026	0.007	-3.265	.001
90	3433	-.033	0.009	-3.776	0
110	3433	-.038	0.009	-4.038	0
130	3433	-.044	0.011	-4.162	0
150	3433	-.05	0.011	-4.413	0
170	3433	-.054	0.013	-4.354	0
190	3433	-.059	0.013	-4.364	0
210	3433	-.068	0.015	-4.646	0
230	3433	-.072	0.015	-4.607	0
250	3419	-.079	0.017	-4.719	0

This table shows the cumulative average abnormal returns buy transactions for event window -10,250. In this table the results are showing for the t-test for each day in the event window. If the p-value is less, then 0.05 the average abnormal return is significantly different from zero.

7.8 One sample t-test for CAAR 0,250 buy

	obs	*CAAR*	*St Err*	*t value*	*p value*
0	3433	.007	0.001	5.723	0
5	3433	.004	0.002	2.268	.024
10	3433	.002	0.002	.862	.389
30	3433	-.002	0.005	-.322	.748
50	3433	-.003	0.005	-.413	.679
70	3433	-.011	0.007	-1.782	.075
90	3433	-.019	0.007	-2.523	.011
110	3433	-.025	0.009	-2.97	.003
130	3433	-.03	0.009	-3.21	.002
150	3433	-.036	0.011	-3.554	.001
170	3433	-.04	0.011	-3.539	.001
190	3433	-.045	0.013	-3.615	.001
210	3433	-.053	0.013	-3.958	0
230	3433	-.058	0.015	-3.953	0
250	3419	-.065	0.016	-4.098	0

This table shows the cumulative average abnormal returns buy transactions for event window 0,250. In this table the results for the t-test is showing for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero.

7.9 One sample t-test abnormal returns -10,250 sell

	obs	*CAAR*	*St Err*	*t value*	*p value*
-10	700	0	0.001	.129	.898
-5	700	.001	0.002	.177	.859
0	700	-.004	0.003	-1.312	.19
5	700	-.001	0.001	-.542	.588
10	700	-.001	0.001	-1.16	.246
30	700	.003	0.001	2.357	.018
50	700	-.002	0.001	-1.649	.1
70	700	-.002	0.001	-1.773	.076
90	700	-.002	0.001	-1.863	.063
110	700	-.003	0.001	-2.018	.044
130	700	-.004	0.004	-1.129	.259
150	700	-.002	0.002	-.871	.385
170	700	-.001	0.001	-.52	.604
190	700	-.005	0.004	-1.355	.176
210	700	0	0.002	.089	.929
230	700	-.002	0.001	-1.269	.205
250	697	-.001	0.001	-.32	.749

This table shows the cumulative average abnormal returns sell transactions for event window -10,250. In this table the results are showing for the t-test for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero.

7.10One sample t-test for CAAR 0,250 sell

	obs	*CAAR*	*St Err*	*t value*	*p value*
0	700	-.004	0.003	-1.312	.19
5	700	-.01	0.004	-2.876	.004
10	700	-.016	0.004	-3.957	0
30	700	-.023	0.008	-2.821	.005
50	700	-.033	0.017	-1.967	.05
70	700	-.044	0.018	-2.453	.015
90	700	-.061	0.019	-3.188	.002
110	700	-.082	0.021	-3.927	0
130	700	-.074	0.026	-2.865	.005
150	700	-.081	0.028	-2.857	.005
170	700	-.076	0.030	-2.51	.013
190	700	-.112	0.033	-3.379	.001
210	700	-.128	0.035	-3.676	.001
230	700	-.148	0.036	-4.12	0
250	697	-.168	0.038	-4.404	0

This table shows the cumulative average abnormal returns sell transactions for event window 0,250. In this table the results are showing for the t-test for each day in the event window. If the p-value is less, then 0.05 the cumulative average abnormal return is significantly different from zero

7.11Stata script

Script based on the script found on the Princeton library (https://libguides.princeton.edu/eventstudy)

Have made some alteration to better suit my event study. Used this script for each event study.

```
*Combining event and stock
use event_dates, clear
sort ISIN
by name: gen eventcount=_N

by name: keep if _n==1
sort ISIN
keep ISIN eventcount
save eventcount, replace



*merge stock og event_count
use stockdata, clear
sort ISIN
merge m:1 ISIN using eventcount
tab _merge
keep if _merge==3
drop _merge



*copy stock data so we have one for each event date
expand eventcount

drop eventcount
```

```
sort ISIN date
by ISIN date: gen set=_n
sort ISIN set
save stockdata2, replace

use event_dates, clear
sort ISIN
by name: gen set=_n
sort ISIN set
save eventdates2, replace
use stockdata2, clear
merge m:1 ISIN set using eventdates2
tab _merge
list name if _merge==2
keep if _merge==3
drop _merge

egen group_id = group(ISIN set)

*CLEAN DATA AND CALCULATE THE EVENT

sort group_id date
by group_id: gen datenum =_n
by group_id: gen target= datenum if date==event_date
egen td=min(target), by(group_id)
drop target
gen dif=datenum-td

by group_id: gen event_weindow=1 if dif>=-10 & dif <=X
egen count_obs=count(event_weindow), by(group_id)
by group_id: gen estimation_window=1 if dif<-11 & dif>=-261
egen count_est_obs=count(estimation_window), by(group_id)
```

```
replace event_weindow=0 if event_weindow==.
replace estimation_window=0 if estimation_window==.

*create a list of those companies that do not have enough observations.
tab group_id if count_obs<X
tab group_id if count_est_obs < 250

*drop those who do not have enough observations.
drop if count_obs<21
drop if count_est_obs < 250

drop Freq
drop Var1

*generate the predicted return

gen predicted_return=.
egen id=group(group_id)
sort group_id when
xtset date
/* for multiple event dates, use: egen id = group(group_id) */
forvalues i=1(1)N{ /*note: replace N with the highest value of id*/
    id group_id if id==`i' & dif==0
     reg Return market_return if id==`i' & estimation_window==1
     predict p if id==`i'
     replace predicted_return = p if id==`i' & event_weindow==1

     drop p
  }

*abnormal return
sort id date
```

```
gen abnormal_return= Return-predicted_return if event_weindow==1


*CAR -10,X
sort group_id
foreach v of var dif{
        by group_id: gen car= sum(abnormal_return)
}

*car 0,X
sort group_id
foreach v of var dif{
        by group_id: gen car2 if dif>=0 = sum(abnormal_return)
}

drop if abnormal_return==.

*AAR
bys dif: egen AAR= mean(abnormal_return)
*t-test
sort dif
by dif: ttest car==0, replace
by dif: ttest car2==0 if dif>=0, replace
by dif: ttest abnormal_return==0, replace
```