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Leveling the Playing Field: Can Private Investors Benefit From Mimicking Insider Trades?

A quantitative study of insider trading

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Abstract

Historically, investors have been searching for strategies to maximize performance in the stock market. It has been shown that corporate insiders can earn abnormal returns by trading in their own companies as they possess superior information and, to a certain degree, market timing ability. As the EU tries to cut down on market abuse, a new regulation was introduced mandating insiders to report and publish trades within three business days. While many studies have investigated the possibility for insiders to earn abnormal returns, far fewer have explored the ability for outsiders to mimic insiders as an investment strategy. This study contributes to this rather scarce research area by investigating the possibility of earning abnormal returns by mimicking insider trades in Sweden, and if the magnitude of the returns depend on the position of the insider that is mimicked. Through the use of an event study, we examine insider buy and sell transactions and aim to answer the following: Can outside investors earn abnormal returns by mimicking insiders in the Swedish stock market and does the position of the insider affect the magnitude of the returns?

We find that outsiders are able to earn abnormal returns in the short term by mimicking insiders' buy and sell transactions. While mimicking an insiders sell transaction is found to be beneficial for up to five days after the event, mimicking buy transactions is only found to be profitable during a three day event window. When comparing these results to the abnormal returns earned by the insiders themselves, we find that they are able to earn abnormal returns for longer as the reaction to the perceived event does not happen during the date of the publication but closer to, or during, the date of the transaction. We hypothesize that the market observes abnormal trading activity during the transaction day and trades are made based on this information. For both buy and sell transactions, company size is found to have the greatest effect where investors trading in smaller companies are able to earn greater abnormal returns. A possible explanation for this relationship is that the information asymmetry present between smaller companies and outsiders is larger than that between larger companies and outsiders. Additionally, we find that mimicking top executives such as CEOs and CFOs as well as board members is superior compared to lower level insiders. While no significant difference is found between top executives and board members, mimicking CFOs enables outsiders to earn the greatest abnormal returns on average.

Keywords: Insider Trading, Abnormal Return, Information Asymmetry, Outside Investors, Investment Strategy, Insider Positions

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1. Introduction

Ever since the establishment of the world's first stock exchange in 1611, investors have been searching for ways to outperform the market. While some attempts have been successful, others have left much to be desired. There are many studies in which different investment strategies and their viability are investigated. According to Jegadeesh and Titman (1993), investors tend to overreact to information and, thus, stock prices tend to follow. Based on this notion, they constructed a number of portfolios where stocks that did well in the past were bought and stocks with a poor historical performance were sold. This is referred to as a momentum strategy and it generated significant positive returns over a 3- to 12-month holding period. Another investment strategy is the contrarian strategy. It is based on the notion that individuals tend to base their future expectations on past data. This can be exploited by selling stocks with high past growth and high expected future growth and buying stocks with low past growth and low expected future growth. In a study conducted by Lakonishok et al. (1994), it is concluded that the low growth stocks outperformed the high growth stocks.

There are also strategies that are based on the informativeness of insider information, also known as insider trading. Insider trading occurs when a person discharging managerial responsibilities, or closely associated persons, perform trades in their associated company (Finansinspektionen, 2022). Lakonishok and Lee (2001) study the American stock market between 1975-1995 and find that insiders better predict market movements than simple contrarian strategies. Further, the ability to predict returns is stronger in smaller firms. The informativeness seems to stem from insider purchases while sales have no predictive ability. A more recent study focused on insider trading is conducted by Mazza and Wang (2021) who find that in the Chinese market, there is a statistically significant positive excess return stemming from insider trades.

The wide array of investment strategies and constant search for ways to exploit the market has led to rules and regulations being introduced to the financial market. In 2014, EU regulation 596/2014 on market abuse was proposed. This was a result of the old directive, 2003/6/EC, being outdated as technological developments resulted in major changes to the financial landscape. The need for a uniform and strong framework that applies to all EU member states has grown larger with increasing trade and the number of cross-border operating firms increasing. This requires full and proper market transparency which can be compromised if market abuse is exerted. Market abuse is defined as unlawful behavior in financial markets which can consist of insider dealing, market manipulation and unlawful disclosure of inside information. Regulation 596/2014 contains many points to prevent such behavior. Article 19 states that persons with managerial responsibilities as well as persons that are closely related to them have a responsibility of notifying the issuer, or the emission

allowance market participant, as well as the competent authority of every transaction conducted on their own account relating to shares or other financial instruments. This should be done as soon as possible, but no later than three business days after the date of the transaction.

Regulation 596/2014 was implemented in Sweden on July 3 in 2016 and led to some changes. In the previous regulation, SFS 2000:1087, an insider trade had to be reported within five business days. Shareholders with a major ownership in the company, which was previously defined as ten percent, no longer fall under the reporting obligation. This differentiates the EU member states from the U.S. where a 10 percent stockholder is an insider according to Rule 10b-5 (SEC, n.d.). Apart from Regulation 596/2014, Sweden has a complimentary law, SFS 2016:1306, which states that Finansinspektionen is the competent authority tasked with handling insider trades. Finansinspektionen is the Swedish Financial Supervisory Authority who authorize, supervise and monitor all companies operating in Swedish financial markets (Government Offices of Sweden, 2015). In Sweden, it is Nasdaq and NGM (Nordic Growth Market) that are licensed to act as stock exchanges and these companies are regulated by Finansinspektionen (Nasdaq, n.d.-a). They are also responsible for maintaining and publishing the PDMR (persons discharging managerial responsibilities) transactions register in which all trades that fall under regulation 596/2014 exist. This register is public as stated by SFS 2018:331.

1.1 Problem

The results found by Lakonishok and Lee (2001) among others have sparked an interest among investors who believe that mimicking insiders is a viable investment strategy. Whether insider trading is beneficial or harmful has been debated for many years (Seyhun, 1998). Voices who argue against the phenomenon claim that the information insiders use ultimately belong to the company and shareholders. By profiting from this information without the approval of shareholders, the insider violates their fiduciary responsibility. They further argue that insider trading could lead to incentives to manipulate management in various decisions in order to maximize trading profits, despite being suboptimal for the company. Not everyone is convinced that insider trading is harmful and some argue that it could even be beneficial for long-term shareholders. By allowing insider trading, shareholders can provide insiders with an efficient compensation contract where both parties benefit from an increase in stock price. It therefore aligns the interests of both parties. Managers could also be willing to accept lower wages as they take the benefits of insider trading into account when evaluating their total compensation (Seyhun, 1998). Regulating insider trading interferes with the efficient contracting between shareholders and managers which ultimately leads to a reduced effort and efficiency. According to Seyhun (1998), there

is no objective answer to this question as insider trading can have beneficial and deleterious effects.

Seyhun (1998) investigated whether insider trading predicted future stock returns between 1975 and 1994. He found that insider buying activity signals a greater than average stock price increase while insider selling signals a less than average stock price increase. On average, stock prices increased following both purchase and sale transactions. However, the stocks purchased by insiders outperformed the market by 4.5 percent and the stocks sold by insiders underperformed the market by 2.7 percent. Insiders therefore earned significant profits from trading in their own firms. The author also found that the predictive ability of the trades increase when a transaction is not preceded by conflicting signals. A firm with insider purchases that were not preceded by sales over the past 12 months appreciated by 30.5 percent on average. It can be concluded that purchases are good news and sales are bad news for the future stock price performance.

Some actors have tried to utilize the notion presented by Seyhun (1998) and others, namely that insider trades are informative. By creating equity funds in which the sole strategy is to invest in companies that are experiencing significant insider trades, they have tried to outperform the market. While some funds have significantly outperformed the market (Alpha Wealth Funds, 2022), others have failed to do the same (Catalyst Funds, 2022). This raises the question whether using this investment strategy is viable. Sha et al. (2020) found that on average, insider trading leads to a negative trading return on the Chinese market. Mazza and Wang (2021) concluded the opposite, namely that insiders did in fact generate statistically significant positive excess returns, despite studying the same market. As the results from previous studies and ventures are ambiguous, more research in the field is motivated. Adding to this, there are multiple studies on the American, Asian and European market (De La Brunière et al., 2020; Mazza & Wang, 2021; Mazza & Ruh, 2022; Eckbo & Smith, 1998; Ahern, 2017), but no published studies in a Swedish setting. As market settings, legal requirements and other contexts seem to impact the results, it further motivates the execution of such a study.

There are many examples of studies that have taken an insider perspective and focused on the timing ability and performance of corporate insiders (De La Brunière et al., 2020; Mazza & Wang, 2021; Mazza & Ruh, 2022). As insiders have access to information restricted from the public, the average investor cannot match this performance. Far fewer studies have examined the possibility for an outside investor to capitalize on insider trades. This study aims to fill that gap by putting the outside investors in focus and examining whether the performance of corporate insiders can be translated into abnormal profits for outsiders by using the informativeness of insider trades as an investment strategy. This also gives rise to the question of which insider, and what type of company, to mimic. Seyhun (1998) found that

there were major differences in the returns of insiders depending on their role in the company. This was explained by top executives having superior information. While the top executives managed to reach a net profit of 5 percent, large shareholders had to settle for 0.7 percent. He also found that the insider trading profitability is generally higher in smaller companies and that other key performance indicators, such as Price-to-Earnings, have implications for the profitability of insider trading.

While numerous studies have concluded that it is possible to make a profit by mimicking insiders, it has been found that selectivity is important. Factors such as firm size, the position of the insider and transaction type all play a part in determining the return for the outsider. The ambiguity in results, lack of studies in a Swedish setting and discrepancies between roles makes for an opportunity to conduct a study that brings more clarity to the field.

1.2 Purpose

The purpose of this study is to investigate how corporate legal insider trading affects market prices and the possibility for outsiders to achieve abnormal returns. In doing so, this study contributes to the scarce research studying how insider trading information can be utilized by outsiders. In order to fulfill the purpose, the study aims to answer the following questions:

- *Can outside investors earn abnormal returns by mimicking insiders in the Swedish stock market?*
- *Does the position of the insider affect the magnitude of abnormal returns earned when mimicking insiders in the Swedish stock market?*

2. Theoretical Framework and Hypothesis Development

2.1 Theoretical Framework

2.1.1 Efficient Market Hypothesis

The Efficient Market Hypothesis (EMH) suggests that the prices of assets within a market are effective and reflect all publicly available information. Thus, when new information is presented, this should be accounted for in the pricing of the given asset. Fama (1970) suggests three different forms of EMH, which represent different levels of efficiency. There is weak form efficiency where all the information, past and present, that is relevant is represented in the price and it is not possible to predict future returns by looking at the past returns. There is semi-strong efficiency which also suggests that all relevant information is present in the price, but also past information. In such a market, making abnormal returns on publicly available information is deemed to be close to impossible. The third and last form is strong efficiency which suggests that all information, public and non-public, is represented in the price. Strong form efficiency suggests that one could not make abnormal returns by using any kind of information, and that things like insider information are obsolete. Generally speaking, markets such as the ones in London and New York are deemed to be semi-strong (ACCA, n.d.).

2.1.2 Asymmetric Information

The Market for 'Lemons': Quality Uncertainty and the Market Mechanism is an article written by George Akerlof in 1970 that presents the concept of asymmetric information. Using the market for used cars as an example, Akerlof demonstrated how a market can be influenced by adverse selection and ultimately collapse. Buyers cannot distinguish between a high-quality car, a peach, and a low-quality car, a lemon. Because of this lack of information, buyers will only be willing to pay the average price of a peach and a lemon together. As opposed to buyers, sellers know the true quality of their car. As sellers with peaches will receive less than the actual value of the car, only sellers with lemons will stay on the market. This in turn leads to the high-quality cars disappearing from the market which reduces the price a buyer is willing to pay. This creates a downward spiral which could ultimately lead to the market collapsing.

Asymmetric information is not unique to used goods markets. In capital markets, some participants have access to inside information and can as a result make more informed decisions regarding trades. This can lead to insiders experiencing greater returns on their investments which is a notion that can be taken advantage of by outsiders. For outsiders, it can be hard to determine if a company is a “peach” or a “lemon”. By studying insider trades,

outsiders can gain insight into the state of the company and reduce the information asymmetry, thus making a more informed decision.

Asymmetric information does not only exist between insiders and outsiders but also within organizations. The informational hierarchy hypothesis suggests that the impact on prices coincides with the level of information possessed by the insider (Betzer & Theissen, 2009). The suggestion is that insiders in C-suite positions or members of the board of directors making trades should affect prices the most. Although some researchers has found this to be the case (Lin & Howe, 1990; Mazza & Ruh, 2022; De la Brunière et al., 2020; Seyhun, 1986), others (Betzer & Theissen, 2009; Fidrmuc et al., 2006) have not been able to prove that the level of information is consistent with the level of impact.

2.2 Hypothesis Development

2.2.1 The Profitability of Insider Trading

Whether legal insider trading creates opportunities for earning abnormal returns or not has been studied in different countries, markets and contexts in the last decades. De La Brunière et al. (2020) studied insider trades of the 120 biggest French large capitalization stocks between 2010 and 2020. They found that on average, both insiders and outsiders were able to beat the market and that the short-term performance was significantly better than the long-term performance. The authors also conducted t-tests comparing the means of the insiders' and outsiders' returns which showed that there was no significant difference between the groups. This shows that an outsider can outperform the index in the short run by mimicking an insider's actions.

Another European study was conducted by Eckbo and Smith (1998) who studied the performance of insider trades on the Oslo stock exchange between 1985 and 1992. Rather than conducting an event study as many other studies have done, they used a value-weighted portfolio return approach which they argued was more realistic. Unlike De La Brunière et al. (2020), they found that it is almost impossible for outsiders to earn any abnormal return by simply mimicking insiders.

There are also studies on the Asian market with differing results. Sha et al. (2020) studied illegal insider trading on the Chinese market between 1999 and 2007 by investigating 328 insider trading cases prosecuted by China Securities Regulatory Commission. They found that on average, insiders do not earn significant abnormal returns. In fact, the average trading return was -7.80 percent per case. This result is not in line with studies from American counterparts (Meulbroek, 1992; Ahern, 2017) who found that illegal insider trading improves price discovery and generates substantial abnormal returns in the American stock market. Sha

et al. (2020) also discuss their findings in light of the Efficient Market Hypothesis. Their results point toward the strong form of EMH characterizing the Chinese market but this is conflicted by previous studies in the same location. One of these studies is conducted by Mazza and Wang (2021) who investigate the performance of corporate legal insiders and find support for insider transactions being profitable and generating statistically significant positive excess returns. They do, however, conclude that random investors significantly outperform insiders on the Chinese stock market. When conducting another study on the Korean market, Mazza and Ruh (2022) found that corporate insiders possess market timing skills which allows them to outperform random outside investors and highlighted the importance of information asymmetry. Their study confirmed that there is a level of significant information asymmetry not only between outsiders and insiders but between different insiders as well.

A common approach when researching the profitability of insider trading is to divide purchase and sale transactions. Seyhun (1998) found that, while both purchases and sales were followed by an increase in stock price, when insiders purchased a stock it outperformed the market by 4.5 percent and when insiders sold stock it underperformed the market by 2.7 percent. In more recent years, Tavakoli et al. (2012) investigated if different insider roles possess information that can lead to abnormal returns. They found that the signal generated from purchase transactions were stronger than sale transactions. Even though both purchases and sales were able to predict some level of future return, the former proved to be better than the latter. This follows the suggestion that some sales do not represent evidence that the current circumstances within the firm are challenging but rather that the insider was in need of liquidity for some other reasons beyond the firm.

It is suggested by Lynch & Rothchild (2000) that, while purchasing can be an effective signal, an insider sale is rarely a sign that things are going wrong. The suggestion is that very rarely does one purchase a stock without belief that it will perform well in the future. On the other hand, selling a stock could be done for many different reasons. The reasons for selling stock could be plenty fold, including satisfying debt, paying for tuition or purchasing a new house. Degryse et al. (2013) researched the information content behind insider purchasing and selling and the results corresponded with the arguments laid out by Lynch & Rothchild (2000). Degryse et al. (2013) found that purchase transactions were followed by abnormal returns, while selling generated no significant results. This indicates that the reason behind the sale is because of liquidity or diversification purposes for the insider. While some studies have found that purchase transactions generate greater abnormal returns (Degryse et al., 2013; Tavakoli et al., 2012), others have found the opposite (Cheuk et al., 2006; Van Geyt et al., 2013). The varying results motivate separating the purchase and sale transactions in order to establish what outside investors should focus on.

As highlighted by the studies presented above, there is no clear cut consensus regarding the abnormal returns as a result of insider trading. Different markets, contexts and transaction types yield different results which raises questions about the Swedish market. Based on this, the following hypotheses are formulated:

H1a: Outside investors can earn positive abnormal returns by mimicking insider purchases in the Swedish stock market.

H1b: Outside investors can earn negative abnormal returns by mimicking insider sales in the Swedish stock market.

2.2.2 Differences In Profitability Between Insider Positions

The profitability of insider trading has been studied in several different countries where the possibility of abnormal returns under different market conditions was the focus. Some researchers have gone a step further by extending the focus onto information asymmetry within the firm as opposed to the asymmetry between outsiders and insiders. Seyhun (1998) found that there is a hierarchy of knowledge which has decisive effects on the level of insider trading performance possible. He found that top executives are able to ascertain the best performance due to their superior level of knowledge in line with the Informational Asymmetry Hypothesis.

A study performed by Wang et al. (2012) found that the value of insider trades made by CFOs were greater than those made by CEOs. During a 10 year period, the excess return generated by CFOs was 5 percent greater than that of CEOs. Wang et al. (2012) concluded that CFOs are better at including information about future earnings than their managerial counterparts. The explanation given is that CFOs are better at financial decision making. Knewtson and Nofsinger (2013) looked into this phenomenon by exploring two explanations. One, is there a different level of scrutiny associated with being a CEO resulting in less willingness to exploit the asymmetry of information? Or, two, is there simply a difference in financial understanding between CFOs and CEOs? Knewtson and Nofsinger's (2013) findings differ from the explanation given by Wang et al. (2012). The difference in excess return is found to be more correlated with the level of scrutiny being a CEO hindering the freedom to make investing decisions as compared to the CFO. This is found to be the most fitting explanation, as the portfolio excess return is drastically lower post introduction of Sarbanes-Oxley in 2002 making the CFO a more observed figure. Even though the excess returns from CFO portfolios remain the greatest, the difference is not deemed to be significant.

Looking beyond normal circumstances, there are times where the information that is known by insiders is highly important. During times of crises, insiders have a greater understanding than outsiders and company specific information is more valuable under these circumstances. Tavakoli et al. (2014) explored the credit crunch of 2007-2008 and found that persons in senior roles, mainly directors, were aware of the extensive leverage on the financial institutions and were able to sell their shares pre market collapse. They were also able to buy shares when the market was at its lowest. The authors argue that this insight was only common to some officers and directors, and not the rest of management. While Tavakoli et al. (2014) investigated the trading performance of different insiders during the credit crunch, Davis et al. (2017) explored the performance of different insiders during looming cases of class action litigation as well as settlement announcements. They find that these announcements have a significant impact on the share price of the firm in question, and that some insiders are able to take advantage of this and earn abnormal returns. Comparing managers and non-managers, the aforementioned are able to sell prior to the announcement of a lawsuit and make informed decisions prior to the announcement of settlements. The importance of managerial positions for abnormal returns are substantiated by other studies as well (Tavakoli et al., 2012; De La Brunière et al., 2020; Massa & Ruh, 2022).

As highlighted by the studies presented above, the role and seniority of the insider seems to impact if abnormal returns can be generated and if so, the magnitude of these. Insiders are able to take advantage of the position that they hold during normal circumstances and even more so during times of volatility. This raises the question whether the profitability for an outside investor is affected by the choice of which insider to mimic. To understand this further in a Swedish context, the following hypotheses are formulated:

H2a: There is a significant difference in the abnormal returns of purchase transactions depending on which insider position is mimicked.

H2b: There is a significant difference in the abnormal returns of sale transactions depending on which insider position is mimicked.

3. Methodology and Data

3.1 Sample

3.1.1 Data Collection

The insider trading data stems from the PDMR transactions register managed by Finansinspektionen. The register contains data starting from July 3 2016 and features information about the issuer, the nature of the transaction, the role of the person discharging managerial responsibilities, trading volume, price and other information. As insiders are required to report details of their trades, including the transaction category, it makes it possible to solely focus on transactions where the person discharging managerial responsibilities buys or sells shares at the market price (Finansinspektionen, 2021). However, in 2018, changes were made to the reporting format which resulted in a new classification of trades. This classification is necessary to distinguish between stocks, options, grants and other instruments. Therefore, only trades conducted after 17 September 2018 are included in the sample. Further, the sample only includes companies listed on Nasdaq Stockholm, more specifically OMX Stockholm Large Cap, OMX Stockholm Mid Cap and OMX Stockholm Small Cap. Nasdaq First North is excluded as it is an alternative trading platform with its own rules and regulations (Nasdaq, n.d.-b).

Daily stock data is gathered from Yahoo Finance using JupyterHub and the python library yFinance. yFinance can access all financial data available on Yahoo Finance and allows for a simplified extraction of large sets of data. The code for using yFinance to extract historical prices is presented in Appendix 9. After dropping redundant information, the adjusted closing prices are exported to Excel. Even though hourly data would be preferred as the match between price data and events would be more precise, technical limitations hinder this option.

As the adjusted closing prices take stock splits into account while the event data from the PDMR transaction register does not, some adjustments are required. yFinance is used to identify companies in which stock splits occurred in the period of interest. The event data for these companies is then adjusted according to the conditions of the splits. This is done by multiplying (dividing) the number of shares and dividing (multiplying) the price in order to make the market data and event data comparable. For example: Stock A underwent a stock split of 2:1 on 21 March 2022 where the price changed from 100 SEK to 50 SEK. The event data of stock A previous to this date assumes a stock price relative to 100 SEK as it does not take the stock split into account. If left unadjusted, the return between 20 March and 21 March all other events excluded would be -50 percent which we know is not the case. Therefore, the price of all transactions before 21 March are multiplied by 2 and the number of shares in the trade is divided by 2. The total value of the trade therefore remains the same, but

the return, all other events excluded, is 0 percent.

Nasdaq OMX Stockholm is open between 09.00-17.30 on regular weekdays but the PDMR transactions register is open for registration and publication at all hours. Because of this, insider transactions can be published after the market closes, making it impossible for outside investors to mimic the trade during that specific day. To adjust for this, transactions that are published after the market closes are transferred to the next day in an attempt to capture the full effect of the event.

The Fama French factors used in the Four Factor Model, Small Minus Big (SMB), High Minus Low (HML) and Up Minus Down (UMD), are collected from AQR Capital Management and are based on the work of Asness and Frazzini (2013). The risk free rate used in the calculations is the yield from a Swedish 3 month treasury bill which is retrieved from the Swedish Central Bank. In order to retrieve fundamental data for all companies in the sample, Wharton Research Data Services is used. This platform provides access to multiple databases with varying information and areas of use. In this report, Compustat, a data set provided by S&P Global Market Intelligence, is used. Variables such as Total Assets, Total Debt, Net Income and Stockholders Equity are retrieved and used to calculate the control variables. In this study, OMXS30 is used as a proxy for market return. OMXS30 is a stock index of the 30 most traded shares on Nasdaq OMX Stockholm and generally reflects the movements in the Swedish stock market. This data was retrieved from Nasdaq Nordic (2023). In order to generate abnormal return data for all events, the statistics software STATA is used along with the eventstudy2 command.

3.1.2 Exclusions

Due to relevance, some trades are excluded from the data set. As Finansinspektionen provides extensive information about the transactions, it allows for a level of specification. This specification in turn allows for excluding data which is not deemed relevant. (1) Transactions that have been revised and/or canceled are excluded. (2) Previous studies (De La Brunière et al., 2020; Lin & Howe, 1990) have excluded all transactions that are not open-market. This means that grant and award transactions, stock options and acquisitions of shares through bonus or rights issues are excluded. Thus, only transactions which include an insider buying or selling shares are included. (3) Trades that occurred before 17 September 2018 are excluded from the data set as they do not allow for differentiating between open and non-open market transactions. (4) Trades which happen on Nasdaq's First North market are excluded. First North is a Multilateral Trading Facility (MTF) and is, thus, not regulated the same way that Nasdaq OMX Stockholm is. (5) Trades which are reported more than five days after the transaction date are excluded as the relevance is reduced. As insider trades are to be reported within three business days, a limit of five days is set as it takes weekends into

consideration. (6) Due to technical limitations and time constraints, roughly 50 percent of the data is sampled using random selection. (7) Finally, while running the eventstudy2 command in Stata to calculate abnormal returns, some data is lost due to various reasons such as an insufficient number of observations in the security return data during the event period.

Table 3.1 Sample Selection
This table shows the exclusions made from the initial sample.

Initial Sample	**26121**
Exclusions	
Revised and canceled trades	-2255
Financial instruments not including shares	-8702
Non-buy or sell transactions	-517
Not listed on Nasdaq OMX Stockholm	-242
Large gap between transaction date and publication date	-1002
Random sample	-7552
Missing data	-303
Final Sample	**6550**

The initial sample consists of 26 121 observations. Revised and canceled trades are removed from the sample as they lack relevant or timely information. These trades suggest that some, or all, of the information given by the trade has been altered. Due to the uncertainty, these types of trades are therefore removed from the sample. Financial instruments not including shares such as subscription warrants, BTAs and BTUs are also excluded from the sample as these transaction categories are not always possible for an outsider to replicate. Non-buy or sell transactions are removed for the same reason as stated above, namely that outsiders cannot always replicate these trades as they are often traded at a discount. Trades by insiders in companies which are not listed on Nasdaq OMX Stockholm, such as those listed on First North, are removed from the sample due to regulatory differences. Further, trades characterized by a gap of more than five days between the transaction date and the publication date are excluded. This is because the vast majority of these trades fall outside of the legal limit of three business days stated in Article 19 in regulation 596/2014. Due to technical limitations and time constraints, a random sample of roughly 50 percent is utilized. If a company makes it in the random sample, all trades conducted within this entity are included. The reason for this is that if there are multiple trades conducted by insiders of a specific company on recurring days, it may distort the data if only some of those trades are included as events. These exclusions result in a final sample of 6 550 trades. The random sampling is done several times to check for any differences in results.

Table 3.2 presents the characteristics of the final sample. Of the 6 550 transactions included in the final sample, 77.69 percent of these are buy transactions and 22.31 percent are sell transactions. Within the sample, we divide these 6 550 transactions into categories based on the type of insider: CEO, CFO, Board, or Other. The largest of these groups is Other whose transactions constitute 53.33 percent of the sample, followed by Board at 23.38 percent, CEO at 15.49 percent, and finally CFO at 7.05 percent. One potential reason for the uneven distribution between the groups is that there are multiple board members and "others" in a company while there is only one CEO and CFO.

Table 3.2 Description of Sample
This table shows a description of the sample with transactions divided into buy and sell as well as insider position.

Role	Buy	Sell	Total
CEO	910	124	1034
Total %	(13.89)	(1.89)	(15.79)
CFO	411	51	462
Total %	(6.27)	(0.78)	(7.05)
Board	1336	225	1561
Total %	(20.40)	(3.44)	(23.83)
Other	2432	1061	3493
Total %	(37.13)	(16.20)	(53.33)
Total	**5089**	**1461**	**6550**
(%)	**(77.69)**	**(22.31)**	**(100.00)**

3.2 Variable Selection

3.2.1 Dependent Variable and Study Design

In this study, the dependent variable is the cumulative abnormal return. In order to measure the impact of insider trades on stock prices and in turn abnormal returns, an event study approach is used. This approach has been utilized by many researchers and is suitable as it allows for studying specific events and the effects thereof. Previous research on insider trading has used estimation windows between 100-200 trading days (Van Geyt et al., 2013; Chang & Suk, 1998; Betzer & Theissen, 2009). This is in line with Armitage (1995) who stated that an estimation period can be anywhere between 100 to 300 trading days when working with daily observations. This study utilizes an estimation window of 180 trading days. According to MacKinlay (1997), the estimation window and the event window should typically not overlap as it could lead to the event returns heavily affecting the normal return measure. To avoid that the effects of an event are included in the estimation window, a trading day gap of 20 days is set. In order to establish the normal return of a security the Four Factor Model is used.

The Three Factor Model for pricing stocks was developed by Eugene Fama and Kenneth French in 1993, and is commonly referred to as the Fama-French model. The Fama-French model controls for three factors when pricing stocks: risk, price, and company size. These factors are included in the model as β_{market} for systematic risk, SMB (Small-Minus-Big) to control for size and HML (High-Minus-Low) to account for the price of the stock. Later in the 90s, this model was further developed by Mark Carhart who added a momentum factor to the Fama-French Three Factor Model and it is now referred to as the Fama-French-Carhart Model or the Four Factor Model. The momentum factor is included in the model as UMD (Up-Minus-Down) to account for how quickly an individual stock changes its price. The Fama-French-Carhart Four Factor Model, thus, looks as follows:

$$E[R_{i,t}] - r_f = \alpha^c + \beta_{Market}(E[r_m] - r_f) + \beta_{SMB} + \beta_{HML} + \beta_{UMD} + \varepsilon \quad \text{(Eq. 1)}$$

where r_f is the risk free rate, $E[r_m]$ is the expected market return, SMB is Small Minus Big, HML is High Minus Low and UMD is Up Minus Down.

In order to appraise the impact of an event, the abnormal return can be used. This is the actual ex post return of a security over the event window minus the normal return of the company. The abnormal return ($AR_{i,t}$) is calculated as follows:

$$AR_{i,t} = R_{i,t} - E[R_{i,t}] \quad \text{(Eq. 2)}$$

where the abnormal return for firm i on day t ($AR_{i,t}$) is calculated by subtracting the expected return ($E[R_{i,t}]$) from the actual return for firm i on day t ($R_{i,t}$). The abnormal return is then used to calculate the cumulative abnormal return ($CAR_i(t_1, t_2)$):

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \quad \text{(Eq. 3)}$$

The cumulative average abnormal return can be used to analyze the total effect of all events:

$$CAAR(t_1, t_2) = \frac{\sum_{t=t_1}^{t_2} AR_{i,t}}{N} \quad \text{(Eq. 4)}$$

where N is the total number of observations.

Previous studies differ when it comes to the length of event windows (Lakonishok & Lee, 2001; Eckbo & Smith, 1998; Betzer & Theissen, 2009) depending on the type of study. While some studies focus on the long-term effects of insider trading, others have focused on a shorter time horizon. As previous studies have found the effects of insider trading to be greater in the short term (De La Brunière et al., 2020), this study utilizes short event windows. These event windows are: day t_{-5} to day t_{-1}, day t_{-1} to day t_1 and day t_0 to day t_5, where day t_{-1} to day t_1 is considered the main event window of interest. The reason for including the other two windows is to observe if any trends can be distinguished before or after the event. These windows can also act as an indication of the market timing ability of insiders.

When investigating the market reaction to insider trades by looking at share prices, the event date can be defined as the transaction date or the publication date. The difference between these two is that the former is the day the trade is executed while the latter is the day it is made public, often through publication in a PDMR register (Betzer & Theissen, 2009). As this study aims to establish whether an outside investor can achieve abnormal returns by mimicking insider trades, the event of interest that takes place on day 0 is the publication date rather than the transaction date. This is because it is not possible for an outside investor to act on the transaction date given that the information is not yet public. This is true for both hypotheses.

In order to test the hypotheses, a multi-way fixed effects regression model is utilized. This model suits the data well as it can handle cases where there are multiple observations per time unit. The model also eliminates singleton groups which reduces the chance of overstating statistical significance (Correia, 2015).

3.2.2 Independent Variables

In order to determine the impact of the position of the insider and whether it has an effect on abnormal returns, a set of dummy variables are created. All of these variables take on a value of 1 if true and 0 if false. A dummy variable will be created for each of the following: CEOs, CFOs, board of directors, and others. The variable Other includes persons related to the insider, other management, management of parent company or subsidiary, and companies with some type of insider relation. When the variables are assigned to a transaction, a hierarchy is used to determine the position of insiders with two or more roles. The hierarchy is dependent on the perceived level of knowledge possessed by the insider, where CEOs are determined to be first, CFOs second, board of directors third, and others fourth. This imposes that if a person discharging managerial responsibilities is both the CEO and the CFO of a company, the person will be categorized as CEO.

In addition to this, a dummy variable will be created for purchases and sales depending on the type of transaction. Some studies have excluded sell transactions as the reason behind a sale might be unclear. A sale could have numerous explanations, such as liquidity reasons or diversification into other stocks. There are far fewer reasons as to why an insider would purchase shares in their firms and according to Lynch and Rothchild (2000), it is because they believe the stock is undervalued. As this study investigates whether outsiders can earn abnormal returns by mimicking insiders rather than the performance and market timing of the insider, the reason behind a transaction is not of importance. Therefore, both purchase and sale transactions are included.

3.2.3 Control Variables

In order to enhance the internal validity of the study and verify that the result, i.e. the magnitude of abnormal returns, is not influenced by extraneous variables, a set of control variables are included. These specific variables were chosen because they serve as proxies for profitability, leverage, size and growth prospects which covers a wide range of areas that could have an impact on the results. The variables are presented below:

Return On Assets (ROA) is defined as the Net Income divided by the Total Assets of the company. ROA is a commonly used KPI in finance to approximate the profitability of a company. Previous studies (Davis et al. 2017; Betzer & Theissen, 2009; Sha et al., 2020) have included some type of profitability metric as a control variable. The relationship found between this variable and abnormal returns is negative entailing that companies that are more profitable present lesser options for generating abnormal returns.

$$ROA = \frac{Net\ Income}{Total\ Assets} \quad \text{(Eq. 5)}$$

Debt-to-Equity (D/E) is defined as the Total Debt divided by the Book Value of Equity. D/E is commonly referred to as the firm's leverage as it shows how much the company is funded by debt versus equity. According to the Pecking-Order Theory (Myers & Majluf, 1984), less profitable firms are more leveraged as they are less able to fund their growth through internal capital. Further, companies with high leverage are often required to disseminate more information to creditors, and therefore the public. This reduces information asymmetry which is expected to have a negative impact on the abnormal return (Aksu & Kosedag, 2006). This variable is included to test if the way a company is funded has an impact on the possibility of returns made by the investor.

$$D/E = \frac{Total\ Debt}{Book\ Value\ of\ Equity} \quad \text{(Eq. 6)}$$

Size is defined as the natural logarithm of the Total Assets of the given company. Previous studies (Seyhun, 1998; Betzer & Theissen, 2009) found that the insider trading profitability is generally higher in smaller companies. The notion is that in larger firms, a given piece of information is less likely to drastically affect the stock price. As the sample in this study consists of companies of various sizes, including such a variable is important for the quality of the research.

$$Size = Ln(Total\ Assets) \quad \text{(Eq. 7)}$$

Price-to-Earnings (P/E) is defined as the Share Price divided by Earnings-Per-Share (EPS), further divided by 100. This ratio shows the expectations of the market and is therefore used to predict relative future stock returns. Seyhun (1998) found that it also has various implications in the field of insider trading. The P/E ratio has a negative effect on abnormal returns entailing that lower P/E firms are more likely to generate greater abnormal returns than higher P/E firms.

$$P/E = \frac{Share\ Price}{EPS\ x\ 100} \quad \text{(Eq. 8)}$$

3.3 Managing Outliers

There are different methods that can be used in order to deal with extreme values in a data set. Within the field of finance, winsorizing, trimming, and dropping variables are common approaches. According to Adams et al. (2018), a vast majority of finance studies utilize winsorization where extreme outliers are limited to a selected percentile. This allows the observation to stay in the sample rather than removing the entire row observation. In this paper, winsorization is applied to selected variables in order to limit the impact of extraordinary data points. Table A in Appendix 1 presents the variables at varying percentiles before the winsorization. As displayed in the appendix, there are several variables where the minimum value is at a considerable distance from the 1st percentile. Some variables also display maximum values that are far greater than those at the 99th percentile. An initial winsorization at the 1 percent and 99 percent level is carried out. This entails that all values below the 1st percentile are set to the value of the first percentile and all values above the 99th percentile are set to the value of the 99th percentile. Table B in Appendix 1 shows the variables used in this study with those affected by winsorization. All variables except the dummy variables along with *Risk free rate* were winsorized. The reason for excluding *Risk free rate* is that it lacks extreme values with the minimum and maximum value being close to

the next percentile.

When merging the event data containing the trades and the control variable data, the event data is lagged one year so that an event from 2022 is matched with control variables from 2021. This is done as key performance indicators are often presented on an annual basis and matching the observations from 2023 would otherwise not be possible. Lagging the event data one year does however lead to a number of observations being dropped as a result of missing control variable data. Several companies in the sample have only been listed on Nasdaq OMX Stockholm for a few years. As the control variable data builds on input such as share price, calculations for the first year on the stock market is not possible.

3.4 Descriptive Statistics

Illustrated in Table 3.3 is the descriptive statistics for all of the variables used in the analysis. Firstly, looking at the dependent variable, Cumulative Abnormal Return, we observe that all but one of the event windows have a negative skewness. CAR(0;5) Sell is positive indicating a left skew and a median value which exceeds the mean. Looking at the median and mean values, both the three day event, (CAR(-1;1), and the five day event, (CAR(0;5), for buy transactions have positive median values. However, the mean for the five day CAR, CAR(0;5), for buy is negative. This along with having the largest negative skewness of any of the event windows indicates that there are some extreme values which affect the mean negatively while the median value is positive. When examining the kurtosis for each CAR, it can be concluded that all of them express a kurtosis greater than five. This indicates heavy tails and significant outliers which are affecting the mean values.

Looking at the winsorized control variables, all but Size have high kurtosis scores indicating the presence of significant outliers. While Price-to-Earnings and Debt-to-Equity have positive skews and mean values, the opposite is true for ROA. ROA is negatively skewed and has a negative mean, but has a positive median. This indicates that there are some periods of significant loss for the companies in the sample which makes the mean value negative while the median stays positive. This matches what can be seen in the minimum and maximum values for ROA. The minimum value in the sample for ROA is -128.11 percent while the maximum is 31.71 percent. For P/E and D/E, the maximum values are greater than the minimum in absolute value which makes sense as they are positively skewed. Looking at the minimum value for ROA, it could be seen as being quite significant and possibly another outlier. However, when examining the data we observe that there are other data points which are close to the minimum and the jump between each observation is not large. As the sample consists of firms of different sizes in different industries, the control variables can differ significantly in magnitude between the companies. For a newly introduced medtech company, it is not uncommon to see a negative ROA as this type of company is characterized

by large initial investments and R&D costs which usually takes several years to turn into profit. Similarly, an established company in the manufacturing industry, such as a car manufacturer, is expected to have a more stable ROA. In our sample, the ROA of -128.11 percent comes from a medical research company and, thus, is a figure that could be reasonable in that field. The same things can be observed from the P/E ratio, which has a minimum and maximum value that could be considered quite significant. However, as with ROA, there are other data points which are close to the minimum and maximum values and differences between them are considered reasonable. A large P/E ratio, negative or positive, indicates that a firm has a high price or small returns, or a combination of the two. If the returns are positive (negative), the P/E ratio will also be positive (negative).

Table 3.3 Descriptive Statistics

This table shows descriptive statistics for variables in the study. This includes the number of observations, minimum value, mean, median, maximum value, standard deviation, skewness and kurtosis.

Variable	N	Min	Mean	Median	Max	SD	Skewness	Kurtosis
CAR(-5;-1) Buy	5089	-0.394	-0.006	-0.003	0.304	0.078	-0.460	5.252
CAR(-1;1) Buy	5089	-0.245	0.003	0.004	0.252	0.053	-0.059	5.618
CAR(0;5) Buy	5089	-0.383	-0.003	0.001	0.278	0.069	-0.586	5.813
CAR(-5;-1) Sell	1461	-0.390	0.002	-0.000	0.283	0.066	-0.216	5.734
CAR(-1;1) Sell	1461	-0.202	-0.007	-0.005	0.199	0.043	-0.250	5.962
CAR(0;5) Sell	1461	-0.359	-0.010	-0.006	0.278	0.070	0.340	6.458
SMB	1554	-0.018	-0.000	0.000	0.016	0.006	-0.152	3.519
HML	1554	-0.015	0.000	-0.000	0.016	0.006	0.143	3.543
UMD	1554	-0.022	0.001	0.000	0.020	0.007	-0.178	3.879
Risk free rate	1538	-0.000	-0.000	-0.000	0.000	0.000	2.321	7.943
Market return	1554	-0.034	0.000	0.001	0.033	0.011	-0.195	4.214
Stock return	623974	-0.077	0.000	0.000	0.092	0.026	0.331	5.181
Buy	6853	0.000	0.784	1.000	1.000	0.412	-1.380	2.903
Sell	6853	0.000	0.216	0.000	1.000	0.412	1.380	2.903
CEO	6853	0.000	0.155	0.000	1.000	0.362	1.905	4.630
CFO	6853	0.000	0.072	0.000	1.000	0.258	3.318	12.006
Board	6853	0.000	0.240	0.000	1.000	0.427	1.218	2.484
Other	6853	0.000	0.533	1.000	1.000	0.499	-0.133	1.018
DE	1074	0.000	0.823	0.465	8.878	1.299	4.105	22.812
ROA	1074	-1.281	-0.023	0.044	0.317	0.245	-2.938	13.228
Size	1074	3.339	8.137	8.061	14.694	2.449	0.191	2.562
PE	1074	-2.063	0.170	0.099	3.925	0.623	2.702	20.339

When examining all variables in a study, it is also important to take their interaction with each other into account. According to Shrestha (2020), multicollinearity occurs when a linear regression analysis includes several variables that are significantly correlated with the

dependent variable and each other. Multicollinearity can lead to some significant variables becoming statistically insignificant. Generally, multicollinearity is said to exist if the absolute value of a Pearson correlation coefficient is close to 0.8. In order to control for this, a pairwise correlation test is carried out and the results are presented in Appendix 2. As the highest correlation between two variables, based on the value of the Pearson correlation coefficient, in this sample is -0.600, no further considerations have to be made.

3.5 Model Specification

In order to determine if outsiders can generate abnormal returns by mimicking insiders' trades, cumulative abnormal return is utilized. When conducting tests without control variables, the following model is used:

$$CAR_{(i,t)} = \beta_0 + \varepsilon \quad \text{(Eq. 9)}$$

where $CAR_{(i,t)}$ is the cumulative abnormal return and i represents the sample constituting the dependent variable, where t represents the different event windows, (-5;-1), (-1;1) and (0;5). β_0 represents the intercept of the regression which is the mean of the dependent variable and ε is the error term.

In order to test hypothesis 1a and 1b, the primary hypotheses of this study, Equation 10 is used along with Equation 9 with the only difference being inclusion of the control variables.

$$CAR_{(i,t)} = \beta_0 + \sum_{k=1}^{4} \beta_k Controls + \varepsilon \quad \text{(Eq. 10)}$$

The following regression uses the CAR generated from running the event study for the entire sample of buy and sell transactions respectively, and regressing all roles excluding the group Other. Thus, the following model is used:

$$CAR_{(i,t)} = \beta_0 + \beta_1 CEO + \beta_2 CFO + \beta_3 Board + \varepsilon \quad \text{(Eq. 11)}$$

The first regression is also used for the purposes of answering hypotheses 2a and 2b, which means that the roles need to be introduced into the model. Thus, the following model is used:

$$CAR_{(i,t)} = \beta_0 + \beta_1 Role + \varepsilon \quad \text{(Eq. 12)}$$

The following regression uses the CARs generated from running the study only using the events from specific roles. Thus, there will be a CAR CEO, CAR CFO, CAR Board, and lastly a CAR Other. These CARs are generated using the following model:

$$CAR\ Role_{(i,t)} = \beta_0 + \varepsilon \quad \text{(Eq. 13)}$$

It is common for panel data studies in this field to cluster standard errors on firms. In this study however, robust standard errors are used. The reason for this is that there are several observations per time unit in the data and thus it does not fit into the frame of a traditional panel data study. The standard errors for all models are calculated using Equation 14 for the constant terms (β_0) and Equation 15 for the coefficients (β_i). The equations are as follows:

$$SE(\beta_0) = s\sqrt{\frac{\Sigma x_i^2}{N\Sigma(x_i - \bar{x})^2}} \quad \text{(Eq. 14)}$$

$$SE(\beta_i) = s\sqrt{\frac{1}{\Sigma(x_i - \bar{x})^2}} \quad \text{(Eq. 15)}$$

where s is the standard deviation of the residuals, x_i is the individual observation, $\bar{x}$ is the mean of all observations and N is the sample size.

In addition to the regressions, a number of t-tests are performed in order to determine if there are significant differences in the means of different variables. As the sample sizes differ, Welch's t-test is used. This allows for unequal sample sizes and variances which in turn produces more robust results (Moser & Stevens, 1992).

3.6 Robustness

3.6.1 Transaction Date

In accordance with Regulation 596/2014, insiders must report their trades in their company within three business days of the transaction. Thus, there will be a period between the date of the transaction and the date of the publication where information about the trade is limited. As is reported in Table 3.1, transactions where the date of the transaction and the date of the

publication differ by more than five days are excluded from the sample. Therefore, the sample can contain data that varies from a difference of zero to a difference of five days.

When executing our study, the publication date is used as the measure for when the event occurs, as an outsider can only mimic an insider once they are aware of the transaction. Previous studies (De La Brunière et al. 2020; Mazza & Ruh, 2022) have found that insiders can generate abnormal returns and that they have market timing ability to do so. As a robustness check, a regression using the transaction date instead of the publication date will be performed. If no abnormal return is found in the events using the publication date, we want to observe if this abnormal return is captured using the transaction date. Therefore, the difference in means between the CARs for the transaction and publication date are compared and a regression is run where the event date is set to the transaction date.

3.6.2 Market Adjusted Model

As a robustness check, the calculations of abnormal returns are run using the Market Adjusted Model as opposed to the Four Factor Model. While the Four Factor Model includes factors that control for systematic risk, size, price and momentum, the Market Adjusted Model uses the market's return on a specific date as the expected return for the stock. The abnormal return using the Market Adjusted Model is calculated as follows:

$$AR_{i,t} = R_{i,t} - R_{m,t} \quad \text{(Eq. 16)}$$

where the abnormal return for firm i on day t ($AR_{i,t}$) is calculated by subtracting the return of the reference market m on day t ($R_{m,t}$) from the actual return of firm i on day t ($R_{i,t}$). The cumulative abnormal return and cumulative average abnormal return is then calculated using Equations 3 and 4.

3.6.3 Excluding Others

This study aims to understand if an outsider can mimic the trades of an insider and generate abnormal returns for themselves. In our group of insiders, we have CEOs, CFOs, board members, and lastly a group which have been characterized as Other. In the group Other, there are several different types of insiders included which do not meet the criteria of the remaining groups. These insiders range from other companies, employees in lower level managerial positions, as well as persons related to insiders which have an obligation to report their trades. Previous research (Mazza & Ruh, 2022; Seyhun, 1998) has found that there are differences in the level of abnormal return that can be obtained based on the hierarchical level of the insider. Insiders which are higher up in the hierarchy, i.e. CEOs, CFOs, and board

members, are better able to generate abnormal returns partly due to the increased access to important information. The group Other has differing levels of insider knowledge within the group but also in comparison to the other groups. As the group Other constitutes roughly 53 percent of the total sample and therefore contributes greatly to the total result, it is warranted to run the events while excluding this group to check for differences. Therefore, as a robustness check, we are testing for the difference in means between the CARs for the data set with the group Other and the one without.

3.6.4 Clustered Standard Errors

The structure of the data of buy and sell transactions includes the year of the transaction and the ticker of the associated company which is then matched to yearly control variables. Due to the fact that there are some companies which have more than one transaction in a given year, the sample can not be assumed to be panel data. Therefore, we use robust standard errors in our main regressions instead of clustered standard errors. As a robustness check, a regression using clustered standard errors on firm instead of robust standard errors is run and the results are compared.

4. Results

4.1 The Profitability of Insider Trading

The first test in the results section is to determine if the cumulative abnormal return (CAR) for buy and sell transactions for events t_{-5} to t_{-1}, t_{-1} to t_1, and t_0 to t_5 are significantly different from zero. Table 4.1 illustrates that all CARs are significantly different from zero, except the CAR for sell transactions five days prior to the event; model (4). The main event window, t_{-1} to t_1, is significant at a 1 percent level for both buy and sell transactions. Looking more specifically at the CARs for buy transactions, five days prior to the event the CAR is found to be -0.60 percent, while the three day CAR, model (2), is found to be positive at 0.29 percent. However, looking at model (3) the CAR is negative again at -0.35 percent. The announcement of the event coincides with a positive abnormal return, but it is not significant enough for CAR to be positive the five days after the event. For the sell transactions, the CAR five days prior to the sale (model (4)) is not statistically significant. The three day CAR for sell transactions, model (5), is statistically significant at -0.66 percent. The five days following a sell transaction, the CAR is even more negative at -0.99 percent.

Table 4.1 Test for the significance of CAR, all insiders

This table shows the regression results from Equation 9 where it is tested if CAR is significantly different from zero.

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
Constant	-0.00602***	0.00291***	-0.00345***	0.00204	-0.00664***	-0.00988***
	(0.00109)	(0.000744)	(0.000965)	(0.00171)	(0.00113)	(0.00182)
Observations	5,089	5,089	5,089	1,461	1,461	1,461

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In Appendix 3, the annualized cumulative abnormal return is calculated. For the three day main event window, the annualized CAR for buy transactions is 27.65 percent and -42.87 percent for sell transactions. When annualizing the CAR for day 0, the corresponding values are -14.04 percent and -47.98 percent. These differences are explained by Table 4.2 where the only day with positive CAR is t_{-1} for buy transactions and where the value of t_1 for sell transactions lower the returns in absolute terms.

Table 4.2 shows the average abnormal return (AAR) for buy and sell transactions day by day. For the buy transactions, the only day with a positive AAR is t_{-1} at 0.44 percent. As the main event window is significantly positive, it means that the full effect comes from this day. The results from the sell transactions are somewhat different. AAR is positive for each day

between t_{-5} and t_{-2}, although only significant for half of them. The return changes to negative at t_{-1} and this trend continues until t_5, with the exception of t_3 being positive. Given that several days in the post-event window are significantly negative, it entails that the sell transactions can be utilized for a longer period of time compared to the buy transactions where only one day constitutes a profitable trade. The fact that AAR Sell changes between being significant and not during the event window could potentially be explained by the fact that there are not as many observations in this sample.

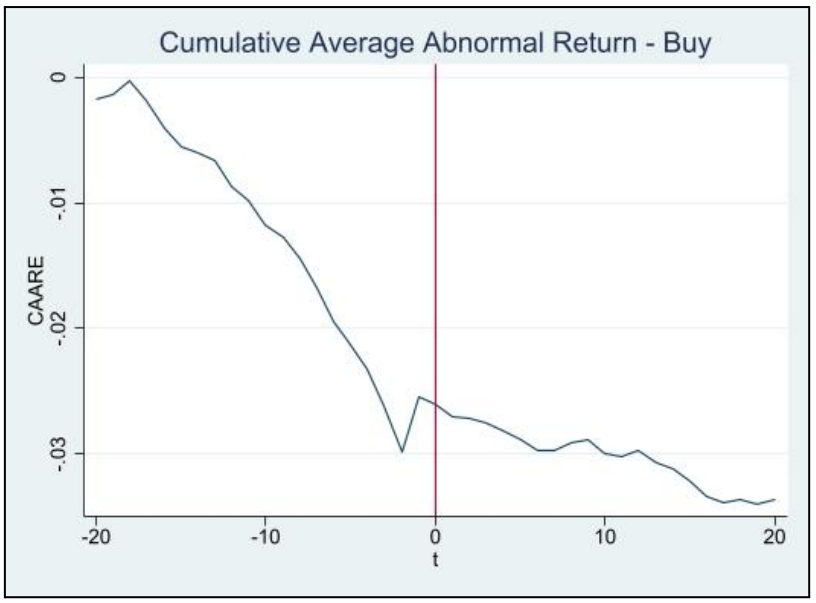
Table 4.2 Daily Average Abnormal Return

This table shows the average abnormal return on a daily basis for buy and sell transactions.

Days relative to event	AAR Buy	t-stat	AAR Sell	t-stat
-5	-0.00182***	-5.34	0.00313***	5.04
-4	-0.00204***	-6.01	0.00022	0.35
-3	-0.00286***	-8.40	0.00164***	2.66
-2	-0.00374***	-11.00	0.00040	0.65
-1	0.00443***	13.04	-0.00335***	-5.41
0	-0.00060*	-1.77	-0.00259***	-4.19
1	-0.00093***	-2.72	-0.00070	-1.13
2	-0.00015	-0.45	-0.00365***	-5.90
3	-0.00040	-1.17	0.00047	0.76
4	-0.00065*	-1.90	-0.00080	-1.29
5	-0.00072**	-2.12	-0.00261***	-4.21

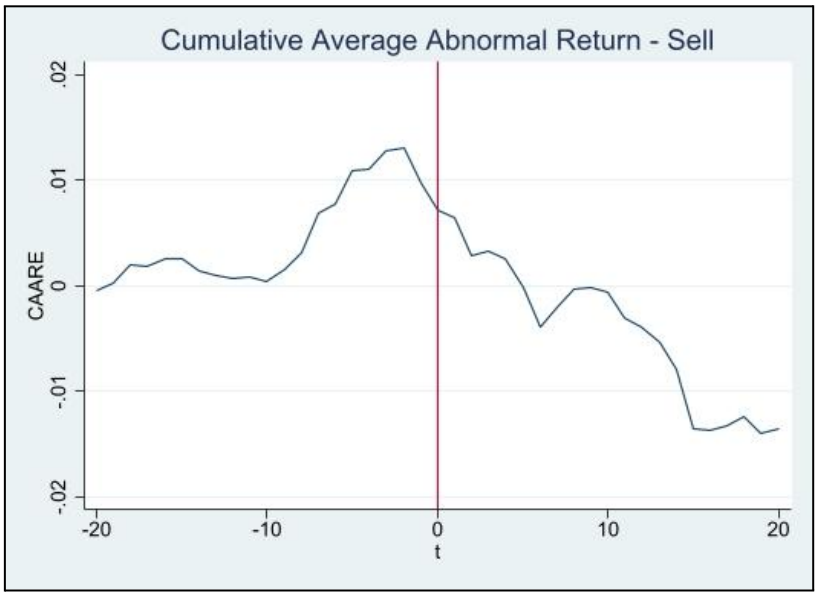
*** p<0.01, ** p<0.05, * p<0.1

Graph 4.1 displays the cumulative average abnormal returns (CAARE) from t_{-20} to t_{20} for the buy transactions in the sample. CAARE reaches its peak of 0 at t_{-19} and declines until t_{-2} where the direction changes. After the small increase in CAARE between t_{-2} and t_{-1}, the downward trend continues. As illustrated in the graph, the downward trend is followed by a jump in the price. This jump happens two days prior to the publication of the transactions, which coincides with the average number of days between the date of the transaction and the date of the publication. Thus, the positive abnormal return found in Table 4.1 for model (2), is more likely to stem from the transaction rather than the publication. The downward trajectory before t_0 illustrated in Graph 4.1 indicates that, on average, insiders buy shares when their company is performing worse than expected.



Graph 4.1 Cumulative Average Abnormal Return - Buy

Graph 4.2 displays the cumulative average abnormal returns (CAARE) from t_{-20} to t_{20} for the sell transactions. CAARE reaches its peak at t_{-3} before starting to decline. Similarly to the buy transactions, t_0 is right of the turning point illustrated in the graph. The downward trajectory, which was preceded by an upward trajectory a number of days prior, comes two days prior to the date of the publication at t_0. Similarly to the buy transactions, the difference in days between the date of the transaction and the date of the publication is roughly two days. Thus, the negative CAR illustrated in Table 4.1 for the three day sell transactions is more likely to stem from the negative reaction to the transaction rather than the publication. The positive CAARE before t_0 in Graph 4.2 indicates that, on average, insiders sell shares when their company is performing better than expected.



Graph 4.2 Cumulative Average Abnormal Return - Sell

In Table 4.3 the regression results from Equation 10, where control variables are included, are presented. The first control variable, D/E, shows no significance for five out of six models, indicating that it has no effect on the magnitude of cumulative abnormal returns. For model (5), the significance is partial at a 10 percent level. The next variable, ROA, is significantly negative at a 1 percent level in model (1) and an increase of one standard deviation entails a decrease in CAR of 3.67 percentage points. Model (6) shows a negative significant relationship at a 5 percent level. The relationship indicates that after the event, an increase by one standard deviation in ROA is associated with a decrease of 4.57 percentage points in CAR. This implies that higher ROA firms generate greater abnormal returns in absolute terms after the event. The control variable for size (Size) is negative and significant at a 1 percent level for models (1) and (2) while positive in model (3). For the sell transactions, Size is not significant before the event but models (5) and (6) are significant at a 1 percent level. The results for models (1) and (2) indicate that the CAR is negatively affected by an increase in firm size where an increase of one standard deviation decreases CAR by 0.42 percent and 0.12 percent respectively. For sell transactions, an increase in Size by one standard deviation increases CAR by 0.17 percent and 0.38 percent for models (5) and (6) respectively. This implies that smaller companies generate greater abnormal returns in absolute terms for both buy and sell transactions. The last variable, Price-to-Earnings (P/E), shows no significance for the buy transactions in model (1) through (3). For the sell transactions, model (6) shows a partial negative significant relationship at a 10 percent level.

Table 4.3 Regression results, including controls

This table shows the regression results of Equation 10 where control variables are included.

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
DE	0.00106	0.00080	-0.00008	-0.00152	0.00254*	0.00220
	(0.00085)	(0.00058)	(0.00079)	(0.00215)	(0.00142)	(0.00232)
ROA	-0.03670***	0.00054	0.00389	0.00332	-0.00102	-0.0457***
	(0.00964)	(0.00561)	(0.00774)	(0.0293)	(0.0116)	(0.0153)
Size	-0.00420***	-0.00120***	0.00125***	-0.00154	0.00166***	0.00379***
	(0.00043)	(0.00031)	(0.00040)	(0.000953)	(0.000553)	(0.000792)
PE	0.00071	0.00210	0.00418	0.00392	-0.00260	-0.00527*
	(0.00261)	(0.00171)	(0.00277)	(0.00424)	(0.00421)	(0.00278)
Constant	0.03210***	0.01270***	-0.01560***	0.0160*	-0.0228***	-0.0420***
	(0.00403)	(0.00295)	(0.00379)	(0.00966)	(0.00518)	(0.00745)
Control variables	YES	YES	YES	YES	YES	YES
Observations	5,089	5,089	5,089	1,461	1,461	1,461
R-squared	0.052	0.011	0.018	0.027	0.030	0.042

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

4.2 Differences In Profitability Between Insider Positions

Table 4.4 shows the results for a test of the significance of CAR, using the regression model in Equation 11, where each insider's contribution to the total CAR for the different event windows is illustrated while excluding the group Other. The first regression that includes all insiders looks at the effect of each insider on the total CAR while adjusting for each of the other groups and holding Other as constant. Firstly, looking at the regression run using CEO, CFO, and Board we observe that the CFO is significant in model (1) at a 5 percent significance level. Thus, the CAR for CFO transactions prior to the event is contributing significantly to the total CAR and is associated with a 0.98 percent decrease in CAR. For the remaining insider positions, no significance is found prior to the event. Turning to model (2), all insiders have a significant impact on the total CAR at a 1 percent level. While CEOs and board members' buy transactions contribute to the total CAR at 0.60 percent and 0.55 percent respectively, CFO transactions seem to have the largest impact at 0.91 percent. Finally, observing the results for model (3) for buy transactions it is only board member transactions that are contributing significantly to the total CAR and it is significant at a 1 percent level. The remaining insider positions show no significance.

When examining the sell transactions for insiders, it is only model (4) where significance is found in one of the independent variables. Board is contributing 1.03 percent to the total CAR at a 5 percent significance level. Looking at models (4) and (5), only CFO sell transactions are associated with a negative CAR. Thus, prior to the event a CFO sale is negatively associated with CAR and is associated with a 1.03 percentage point decrease in CAR. Both for sell transactions for CEOs and board members, the announcement of the sale of shares does not mean that the CAR for that period will be negative.

Table 4.4 Regression results, including roles

This table shows the regression results of Equation 11 where the dependent variable is CAR for the entire buy sample and sell sample respectively.

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
CEO	0.00407	0.00595***	0.00046	-0.00036	0.00047	0.00095
	(0.00312)	(0.00209)	(0.00267)	(0.00520)	(0.00335)	(0.00513)
CFO	-0.00978**	0.00911***	0.00587	-0.00603	-0.00476	-0.00054
	(0.00425)	(0.00308)	(0.00383)	(0.00607)	(0.00369)	(0.00573)
Board	-0.00107	0.00553***	0.00794***	0.01030**	0.00296	0.00523
	(0.00264)	(0.00178)	(0.00229)	(0.00402)	(0.00271)	(0.00440)
Constant	-0.00568***	-0.00035	-0.00609***	-0.00029	-0.00711***	-0.01150***
	(0.00151)	(0.00107)	(0.00147)	(0.00252)	(0.00171)	(0.00292)
R-squared	0.026	0.012	0.017	0.029	0.019	0.016
F	2.785	6.082	4.680	3.323	1.365	0.584
Observations	5,089	5,089	5,089	1,461	1,461	1,461

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Illustrated in Table 4.5, is the regression results for Equation 12 where each insider group is regressed by itself. CEO buy transactions are significant at a 10 percent level in models (1) and (2), but show no significance for model (3) or the sale transactions illustrated in models (4), (5) and (6). For CEO buy transactions, the association with CAR is positive for model (1) and model (2). CEO transactions five days before the announcement are associated with a 0.54 percent increase in CAR and CEO transactions during the three day window are associated with a 0.33 percent increase in CAR.

In Table 4.5, looking at the results for CFOs, models (1) and (2) are significant at a 5 percent level and model (5) is significant at a 10 percent level. When the regression is run for CFOs holding other roles constant, the effect on CAR is larger than the effect recorded in Table 4.4. Comparing the results for model (5) in the first and second regression, the coefficient is insignificant in the first regression and significant at a 10 percent level in the second regression. The opposite is true for model (2) where the coefficient for the first regression illustrated in Table 4.4. is larger at 0.91 percent than the second regression illustrated in Table 4.5 at 0.64 percent.

Turning to the board member transactions, model (2) for Board is significant at a 10 percent level but is found to be greater in the first regression with a 1 percent level significance. In both regressions, Board is significant at a 1 percent level in model (3) with a 0.72 percent effect in the second regression. Board member transactions are also found to be significant in

model (4) at 1 percent significance level while only a 5 percent significance level in the first regression. Finally, the reference group Other is significant at a 1 percent level in two of the three models, (2) and (3), for the buy transactions but no significance in the models for the sell transactions. Interestingly, unlike the other insider groups, both coefficients for the group Other in the second regression are negative when holding the other groups constant. Thus, buy transactions made by Other seem to be negatively associated with a 0.62 percent decrease in CAR for model (2) and associated with a 0.51 percent decrease in model (3).

Table 4.5 Regression results, separated roles

This table shows the regression results from Equation 12 where each insider group is regressed with the dependent variable being the CAR for the entire buy sample and sell sample respectively .

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
CEO	0.00537*	0.00327*	-0.00268	-0.00322	5.74e-06	-0.00081
	(0.00299)	(0.00198)	(0.00248)	(0.00489)	(0.00312)	(0.00465)
Constant	-0.00698***	0.00232***	-0.00297***	0.00259	-0.00664***	-0.00974***
	(0.00119)	(0.00083)	(0.00109)	(0.00185)	(0.00122)	(0.00200)
R-squared	0.025	0.009	0.015	0.023	0.016	0.014
F	3.240	2.727	1.166	0.435	3.37e-06	0.0304
CFO	-0.01030**	0.00636**	0.00349	-0.00929	-0.00581*	-0.00241
	(0.00414)	(0.00299)	(0.00368)	(0.00579)	(0.00346)	(0.00527)
Constant	-0.00519***	0.00239***	-0.00373***	0.00294	-0.00607***	-0.00965***
	(0.00113)	(0.00077)	(0.00100)	(0.00180)	(0.00120)	(0.00194)
R-squared	0.026	0.009	0.015	0.024	0.018	0.015
F	6.156	4.509	0.897	2.568	2.812	0.209
Board	-0.00098	0.00308*	0.00719***	0.01120***	0.00351	0.00507
	(0.00251)	(0.00168)	(0.00211)	(0.00373)	(0.00249)	(0.00392)
Constant	-0.00576***	0.00210**	-0.00534***	-0.00120	-0.00765***	-0.0113***
	(0.00125)	(0.00087)	(0.00115)	(0.00205)	(0.00134)	(0.00218)
R-squared	0.025	0.009	0.017	0.028	0.017	0.016
F	0.151	3.373	11.61	8.978	1.986	1.673
Other	0.00066	-0.00623***	-0.00507***	-0.00417	-0.00086	-0.00291
	(0.00217)	(0.00149)	(0.00196)	(0.00347)	(0.00230)	(0.00374)
Constant	-0.00634***	0.00588***	-0.00103	0.00388	-0.00626***	-0.00859***
	(0.00156)	(0.00104)	(0.00128)	(0.00236)	(0.00152)	(0.00232)
R-squared	0.025	0.011	0.016	0.024	0.016	0.015
F	0.0922	17.43	6.713	1.446	0.139	0.606
Observations	5,089	5,089	5,089	1,461	1,461	1,461

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

The results from testing the significance of CAR for all roles is presented in Table 4.6. Model (2) shows that the CEO group has a positive CAR of 0.49 percent at a 1 percent significance level. This is followed by a negative CAR of -0.69 percent for the days after the event. For

the sell transactions, model (6) is the only one showing significance with a CAR of -2.55 percent. The buy transactions for the CFO group show similar results but the CAR in model (2) is higher at 0.92 percent. This group also shows significant results for the sell transactions in model (5) at -1.58 percent. Similarly to CEO, the return for the five days following the event is significantly different from zero with a CAR of -1.62 percent. When examining the results for the Board, it can be seen that for the three day buy event displayed in model (2), a CAR of 0.52 percent is reached at a 1 percent significance level. For the corresponding sell transaction, the CAR is -0.57 percent. The last group, Other, is the only group showing no significance for the three day buy window displayed in model (2). The group does however yield a negative CAR of -0.63 percent for the corresponding sell event in model (5). For all buy transactions, model (1) shows that the CAR is negative during the days leading up to the event. For the sell transactions, an opposite trend can be seen in model (4) with the exception of the CFO group. This indicates that for the days leading up to a buy event, the cumulative abnormal return is lower than expected. Similarly, it shows that for the days leading up to a sell event, the CAR is higher than expected.

Table 4.6 Test for the significance of CAR, separated roles

This table shows the regression results from Equation 13 where it is tested if the CAR for each role is significantly different from zero

ROLE	MODEL VARIABLE	(1) Buy CAR(-5;-1)	(2) Buy CAR(-1;1)	(3) Buy CAR(0;5)	(4) Sell CAR(-5;-1)	(5) Sell CAR(-1;1)	(6) Sell CAR(0;5)
CEO	Constant	-0.00324 (0.00270)	0.00489*** (0.00179)	-0.00693*** (0.00218)	0.00027 (0.00591)	-0.00715 (0.00445)	-0.02550*** (0.00644)
	Observations	910	910	910	123	123	123
CFO	Constant	-0.01430*** (0.00395)	0.00917*** (0.00285)	-3.91e-05 (0.00354)	-0.01160 (0.0117)	-0.01580** (0.00644)	-0.01620* (0.00856)
	Observations	411	411	411	50	50	50
Board	Constant	-0.00673*** (0.00217)	0.00518*** (0.00143)	0.00172 (0.00176)	0.00595 (0.00473)	-0.00570* (0.00325)	0.00205 (0.00519)
	Observations	1,336	1,336	1,336	225	225	225
Other	Constant	-0.00528*** (0.00149)	-0.00014 (0.00105)	-0.00556*** (0.00144)	0.00211 (0.00194)	-0.00634*** (0.00125)	-0.01030*** (0.00204)
	Observations	2,432	2,432	2,432	1,061	1,061	1,061

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

In order to determine the difference in abnormal return between the different insider groups, a Welch's t-test is carried out between each of the groups and the results are illustrated in Appendix 4. Some observations are dropped which is a result of singleton observations being removed. When comparing the difference in means between CEO and CFO, there is a

significant difference between two of the six CARs. A significant difference at a 5 percent level can be found between the CAR for buy transactions five days before the event and a significant difference at a 10 percent level can be found for CAR five days after the event. When comparing the difference in means between CEO and Board, a significant difference at a 1 percent level is found for both buy and sell transactions five days after the event. When examining the buy transactions, the CAR for CEO is negative at -0.70 percent for the five days after the publication, while the CAR for board members is positive at 0.20 percent in the same time span. Comparing the difference in means between CEO and Other, a significant difference is found at a 5 percent level for buy transactions during the three day event and for the sell transactions five days after the event. Comparing the difference in means between CFO and board members buy and sell transaction, there is very little significant difference to be found. Only the CAR for buy transactions five days prior to the event and the five days after the event for sell transactions are found to be significant at a 10 percent level. Comparing the difference in means between CFOs and Other, there is a significant difference at a 5 percent level for buy transactions five days prior to the event and a significant difference at a 1 percent level for buy transactions during the three day event. Finally, when comparing board members' transactions versus that of others, a significant difference is found in three of the six event periods. There is a significant difference at a 1 percent level for buy transactions during the three day event and the five days after the event. There is also a significant difference at a 5 percent level during the five days after the event for the sell transactions.

4.3 Summary of Results

The results in section 4.1 support hypothesis 1a and the null hypothesis is rejected as the main event window, CAR(-1;1), is significantly positive. For sell transactions, hypothesis 1b is supported and the null hypothesis is rejected as the main event window is significantly negative. The results in section 4.2 support hypothesis 2a and the null hypothesis is rejected as there is a significant difference in CAR found for the main event window. However, no such difference can be found for sell transactions between the roles in the main event window and, thus, the null hypothesis cannot be rejected and no reliable support is found for hypothesis 2b.

4.4 Robustness

4.4.1 Transaction Date

Illustrated in Appendix 5 is a test of difference in means of CAR between the publication date sample and the transaction date sample. Looking at the amount of observations included in each sample, we observe that seven more observations are now included in the sample of buy transactions while five more observations are included in the sample of sell transactions using

the transaction date sample. This could be a result of the fact that some observations in the publication date sample lack actual return data for the entire event window. Excluding these observations from both samples yielded no difference in the significance of the results. When examining the results for the test of difference in means, there are some significant differences in the buy and sell transactions. For the five day window leading up to the event, there are significant differences in both buy and sell transactions. For the sell transactions, the publication date sample generated a mean CAR of 0.20 percent while the corresponding number for the transaction date sample was 1.05 percent. For the remaining sell event windows, there were no significant differences. For the buy transactions, there are significant differences in both the five day event window before the event as well as the five day window after the event. The most notable difference here is that CAR(0;5) is negative at -0.04 percent for the publication date sample while the transaction date sample is positive at 0.24 percent.

The regression results from Equation 9 with the transaction date sample is presented in Appendix 5. We find that the main difference between this result and that of the main regression is that the CAR for all event windows in the transaction date sample are significantly different from zero. In Table 4.1, the CAR for sell transactions five days prior to the event, no significance is found. Meanwhile, the CAR for the same event using the transaction date sample is significant at a 1 percent level. Another relevant difference between the two results is the CAR from five days after the event. In Table 4.1, this CAR is significantly different from zero but negative. For the transaction date sample, this CAR is positive and significantly different from zero at a 5 percent level. This, in conjunction with Graph 4.1 and 4.2, supports the notion that stock price reactions from the insider trade are more likely to be closer to the date of the transaction rather than the date of the publication.

These results prompt the question whether it is more appropriate to use the publication date or the transaction date for this type of study. While the transaction date generates more significant results and lies closer in time to the perceived market reaction, this study attempts to answer whether it is possible to earn abnormal returns mimicking insiders. An outside investor could trade solely on the observation of abnormal trading activity. However, before the transaction is published the outside investor cannot know who performed the trade. It is therefore not possible to know if you are mimicking an insider, and what position this insider holds. This entails that utilizing the publication date is the appropriate method for this study.

4.4.2 Market Adjusted Model

Appendix 6 shows the result of comparing the means of CAR for all event windows using the Market Adjusted Model as well as the Four Factor Model. For the buy transactions, the only statistically significant difference is that the CAR five days prior to the event using the Four

Factor model results in a mean of -0.60 percent and using the Market Adjusted Model generates a mean of -0.20 percent. This results in a significant difference between the two at a 5 percent confidence level. For the sell transactions, the means are significantly different for all variables. Worth noting is that all means that are positive (negative) in the Four Factor model are also positive (negative) in the Market Adjusted Model.

Appendix 6 shows the regression results using Equation 16, the Market Adjusted Model. All variables are significantly different from zero which is not true for the main regression model presented in Table 4.1. When using the Four Factor Model, model (4) depicting CAR(-5;-1) for sell transactions was not significantly different from zero. Apart from this, there are other differences in the level of significance obtained. As the only variable separating the Four Factor Model from the Market Adjusted Model is the expected return where the former estimates normal return using a number of variables while the latter only uses the actual return of the market, the difference could be explained by this variable.

4.4.3 Excluding Others

Illustrated in Appendix 7 is a test of difference in means comparing the CAR of the total sample with the CAR of a sample excluding the group Other. When excluding the group Other, 2 432 out of 5 089 buy transactions are removed from the sample. For the sell transactions, 1 061 out of 1 461 observations are removed. The difference in the amount of buy transactions removed from the sample versus the amount of sell transactions that are removed shows the difference in the frequency that top executives like CEOs, CFOs, and board members purchase and sell their shares. These groups are not as keen to sell their shares as they are to buy. Moreover, observing the difference in means between the two samples we see that for the most part, there is not a significant difference between them. The only significant difference is the three day event window for buy transactions. The mean CAR generated by purchasing shares in the sample excluding Other is 0.57 percent, while the mean CAR generated by purchasing shares in the total sample is 0.29 percent. Looking at the five day CAR after the event for buy transactions, the mean CAR including Other is -3.5 percent while the mean CAR excluding Other is -1.5 percent which could seem like a significant difference. However, due to the size of the standard error, there is no significant difference found in those means.

Illustrated in Appendix 7 is the result from the regression run on the sample excluding the group Other. In comparison to the main regression, where others are included, there is less significance. CAR is found to be significantly different from zero at a 1 percent level for buy transactions during the five days prior to the event and the three day event. CAR is also found to be significantly different from zero for sell transactions at a 1 percent level for the three day event and a 5 percent level for the five days after the event. While there are less events

where significance is found, CAR is found to be greater in absolute value for buy transactions five days prior to the event and during the three day event window. Unlike the main regression, no significant difference from zero can be found for buy transactions during the five days after the event. This is because the CAR is greater in the regression excluding the group Other, but is still very close to zero. During the three day CAR for sell transactions, the CAR is found to be greater in absolute value in the three day event window but less in absolute value for the five days after the event. Finally, even though there are some differences between the samples, they are deemed to be small enough to not alter the results of the study.

4.4.4 Clustered Standard Errors

Illustrated in Appendix 8 is the results from regressing CAR while clustering standard errors on firms as opposed to utilizing robust standard errors which is the method used throughout the study. The results show that model (1) is significant at a 10 percent level, model (5) at a 1 percent level and model (6) at a 5 percent level. This can be compared to the regression model presented in Table 4.1 where it is concluded that all CAR except model (4) is significantly different from zero at a 1 percent significance level. The choice of standard errors can therefore be said to affect the results of this study. As previously discussed, using clustered standard errors is not the preferred choice in this study as a result of the structure of the data where several observations per time unit can occur.

5. Analysis & Discussion

5.1 The Profitability of Insider Trading

In line with previous studies defining the event date as the publication date (De la Brunière et al., 2020; Chang et al., 1998; Wang et al., 2012) cumulative abnormal returns can be found in the short term for both buy and sell transactions. This indicates an ability for outside investors to mimic insiders as an investment strategy to generate abnormal returns. The strong-form efficient market hypothesized by Fama (1970) does not hold as both insiders, and to a certain degree outsiders mimicking insiders, are able to generate abnormal returns with the use of inside information. It is rarely the case that markets are completely strong-form efficient. Sha et al. (2020) found strong form efficiency in their study of the Chinese market but Mazza and Wang (2021) found that insiders were able to generate abnormal returns in the same market. Our research falls in line with De la Brunière et al. (2020) who found semi-strong form efficiency. Both insiders and outsiders were able to generate abnormal returns, but outsiders were only able to take advantage of this for a limited period of time as the cumulative abnormal return was positive during the three day event window but negative, or very close to zero, the five days following the event. This suggests that, even though insiders and outsiders were able to take advantage of the situation, the market corrected itself quickly.

Some previous studies (Degryse et al., 2013; Tavakoli et al., 2012) have found greater abnormal returns for buy transactions than for that of sell transactions. Our findings are in line with another group of studies (Cheuk et al., 2006; Van Geyt et al., 2013) who show that sell transactions generate greater abnormal returns in absolute value for outsiders. One potential explanation to this phenomena, proposed by Cheuk et al. (2006), is that there are far fewer sell transactions than buy transactions in the period studied. A sell transaction might therefore stand out more to outside investors who believe that the reason behind the sale is valuable private information.

The sample of buy transactions finds significant negative abnormal returns prior to the event and the opposite for sell transactions, indicating a level of market timing on that of the insider. This means that the insider demonstrates an ability to buy on a low and sell on a high. Our results are consistent with other studies (Mazza & Ruh, 2022; De la Brunière et al., 2020) who conclude that insiders do in fact possess a market timing ability. In our case, the insider purchase generates a slight upward trajectory and is able to generate abnormal returns for up to five days after the event. However, this is not true for outsiders. During the date of the publication, there is a perceived reaction to the announcement and significant cumulative abnormal returns can be found in the short term. However, looking at outsiders' ability to mimic insiders over five days after the event, negative cumulative abnormal return is found. This indicates that the market reaction happens prior to the date of the publication and closer

to the date of the transaction. A potential explanation to this is that outsiders observe an abnormal trading volume or a significant buy (sell) order during the transaction day and react to this by buying (selling) shares within the given company. This allows the insider to earn abnormal returns while the outsider can only benefit in the short term.

Previous studies (Seyhun, 1998; Betzer & Theissen, 2009; Cheuk et al., 2012; Davis et al., 2017; Lakonishok & Lee, 2001; Sha et al., 2020*)* have found that controlling for other firm specific characteristics has had an effect on the abnormal return that can be generated by insider trading. Several studies (Seyhun, 1998; Betzer & Theissen, 2009; Cheuk et al., 2012; Davis et al., 2017; Lakonishok & Lee, 2001) found that size has a significant impact on the abnormal return, where a negative relationship exists. Smaller companies are more likely to experience abnormal returns for both buy and sell transactions, partly due to the greater level of information asymmetry between insiders and outsiders. The argument made is that bigger companies are under greater scrutiny and have a harder time masking their actions and performance. For smaller companies receiving less attention, this is fairly simple. Thus, the reactions to trades in smaller companies are more severe as it might be unexpected.

Our results show that size has a significant impact on the cumulative abnormal return in all event windows for buy transactions. However, unlike previous studies, our findings show that the relationship between cumulative abnormal return and size is negative for the window before the event and during the three day event window, but that it is positive during the five days after the event. This suggests that smaller companies in our sample have greater reactions to the buy transaction prior to, and during, the event. The result is in line with previous studies (Seyhun, 1998; Betzer & Theissen, 2009; Cheuk et al., 2012; Davis et al., 2017) and could be explained by the level of information asymmetry present between smaller companies and outsiders. However, unlike the studies mentioned we find a significant positive effect for size five days after the event. This would suggest that while the effect for smaller companies is greater in the short run, the effect for bigger companies is less volatile and more sustained. When the bigger companies have abnormal returns, it is less likely that investors are able to sell quickly at a profit as the prices return to the expected level rapidly.

These results, while different from previous studies, could possibly be explained by the same thing, i.e. information asymmetry. In smaller companies where the level of transparency is lower, outsiders value the information received from insider trades higher. A purchase or sale can be interpreted as a signal of a major forthcoming event. For larger companies, events of this size are generally harder to mask as the scrutiny they are under is much greater. If an outside investor purchases a share in a given company based on the actions of insiders, then the hope is that the purchase by the insider is based on things trending upwards. If the outside investor now finds out that this is not indeed the case or other investors believe that the price has reached its peak, they might be inclined to dispose of their holdings. On the contrary, this

would rarely be true for larger companies as the transparency and level of visibility for these companies is way larger. For sell transactions, however, a negative relationship exists before the event but a significant positive relationship is observed during and after the event. This implies that investors are also able to earn the greatest abnormal returns trading smaller firms for sell transactions. This is likely due to the same reasons as for the buy transactions, i.e. information asymmetry. What could also be contributing to the greater abnormal returns in absolute terms for smaller companies is the sensitivity of investors. Investors generally have a stronger relationship with larger companies that have formed over many years. These companies are also known to be less volatile and more sustainable than smaller companies are. This may result in investors being more likely to sell when an insider in a smaller company is selling as compared to a larger company as other factors are considered.

Seyhun (1998) found that the Price-to-Earnings ratio has a negative effect on abnormal returns for insider trading. Lower P/E firms are more likely to generate greater abnormal returns than higher P/E firms. The natural inference in this case is that it is likely that outside investors are going to believe that firms that are already perceived as being "overpriced" are going to be growing a lot more. Unlike Seyhun (1998), our study finds that the P/E ratio has no significant impact on the cumulative abnormal returns for buy transactions. However, for sell transactions the relationship is significant and positive five days after the event. This implies that for this event window, higher Price-to-Earnings firms are associated with lower abnormal returns. This indicates that our results do not follow that of Seyhun (1998).

Turning to leverage, previous studies (Sha et al., 2020; Betzer & Theissen, 2009) have found that leverage and cumulative abnormal return have a negative relationship for purchases and positive for sales. In our sample, the buy transactions have no significant relationship with Debt-to-Equity, which is the proxy used for leverage in this study. For sell transactions, a partially significant relationship is present during the three day event window. This relationship is positive during the event, which indicates that the more the company is funded by debt the less likely a shareholder is going to be able to generate abnormal returns by selling shares in the given company. This supports the notion of Aksu and Kosedag (2006), namely that higher leverage is associated with lesser abnormal return. However, as only one event window is partially significant, we conclude that it lacks effect in most cases.

For Return on Assets, significance is found for both buy and sell transactions. Previous studies (Davis et al. 2017; Betzer & Theissen, 2009; Sha et al., 2020) have found a negative relationship between profitability metrics, such as ROA and Return On Equity (ROE), and abnormal returns generated by insider buy and sell transactions. This is not the case in our study, where the only negative significant relationship that is found is the five days before the event for buy transactions. This suggests that prior to the event, higher ROA stocks were performing worse than lower ROA stocks. A high ROA is often related to a company in a

growth phase as the more seasoned companies often have a lower but more stable ROA. For sell transactions, ROA and cumulative abnormal return has a negative significant relationship after the event. This means that when insiders sell, higher ROA stocks experience a more negative reaction than that of lower ROA stocks. This could be due to the fact that higher ROA companies are often smaller and less established and thus more volatile. This suggests that investors in these types of companies take more consideration to an insider trade and consider it as a warning signal.

5.2 Differences In Profitability Between Insider Positions

Previous studies investigating whether the role an insider holds within a company, and the access to information that follows, affects the ability to generate abnormal returns differ in their results. While some found this to be true (Lin & Howe, 1990; Mazza & Ruh, 2022; De la Brunière et al., 2020; Seyhun, 1986), others have found no support for this notion (Betzer & Theissen, 2009; Fidrmuc et al., 2006). Our findings show that some insider groups do in fact perform better than others when engaging in buy transactions. This is in accordance with the Informational Hierarchy Hypothesis which states that greater access to information can lead to greater abnormal returns. For sell transactions, our results indicate that there is no significant difference between the roles. In contrast to the Informational Hierarchy Hypothesis, the difference in access to critical information seems to have no impact.

When examining the results of each role in isolation, CFO has the highest cumulative abnormal return for the main event window for buy transactions followed by Board and CEO. The CFOs also experienced the most negative abnormal return for the three day sell window. This shows that on average, CFOs in this sample perform better than the other groups. There is however no statistically significant difference in the means of cumulative abnormal return between CFOs, CEOs and board members which entails that it could be a coincidence, or that other factors are influencing this difference.

When comparing the means in cumulative abnormal returns between CEOs, CFOs and board members, there are no significant differences in the three day event window for buy or sell transactions. There are however some significant differences in the period leading up to the event as well as the following five days. One group that stands out is Other, where lower level employees, persons related to the insider and other companies are included. This is the only group who did not experience any significance for the three day buy window. When comparing the means in cumulative abnormal returns of CEOs, CFOs and board members to the group Other, there are significant differences between all of them. Further, when excluding the group Other from the sample, the cumulative abnormal return for the three day buy event window was significantly higher. This result could be explained by the Informational Hierarchy Hypothesis, namely that differences in access to vital information

impacts the possibility to generate abnormal returns. As CEOs, CFOs and board members can be assumed to have greater insight in the company than the parties included in the group Other, this explanation seems plausible.

Some authors have argued that the scrutiny top executives are under can restrict them in their trades and lower the excess returns generated (Knewtson & Nofsinger, 2014; Fidrmuc et al., 2009). This is not entirely in line with the results in this study where top executives such as the CEO and CFO on average perform equally well, if not better, than board members who presumably receive less attention. There is however a possibility that the top executives would perform even better if not monitored as closely, which was the case for CFOs before the introduction of the Sarbanes-Oxley Act. One result that is in line with Knewtson and Nofsinger (2014) is that the CFOs generate the greatest excess return on average. This can however not be said with statistical significance as no such significance was found when comparing the means in cumulative abnormal returns of CFOs to that of CEOs and board members.

6. Conclusion

Ever since the opening of the first stock market, investors have been trying to find ways to outperform the market. In a time where this is becoming increasingly hard, investors try to utilize all the information they can get their hands on in order to make more informed decisions. As the current EU regulation on market abuse requires insiders to report and publish all transactions within three business days, it presents an opportunity for outside investors to reduce the information asymmetry between the parties.

Our sample consists of 6 550 trades performed by insiders, and related persons, in Swedish firms listed on OMX Stockholm between 17 September 2018 and 3 February 2023. Using an event study methodology, we aim to investigate whether outside investors can earn abnormal returns by mimicking insiders and if the position of the insider affects the magnitude of the returns.

Our results indicate that on average, it is possible for an outside investor to generate abnormal returns by simply mimicking an insider's buy or sell transactions. For buy transactions, outsiders are able to earn abnormal returns in the short term but are unable to keep this up for the days following the event. However, for sell transactions the outsider is able earn abnormal returns both in the short term and five days after the event. We find that the market reaction to the event occurs during the transaction date and not during the publication date. We argue that outside investors observe abnormal trading activity, and take action accordingly. An outsider mimicking an insider on the date of the publication only earns a fraction of the return generated by the insider. These results are somewhat affected by the control variables. Size is found to have the most impact where smaller companies generated greater abnormal returns. Additionally, our results show that the position of the insider does impact the ability to generate abnormal returns when buying shares. The CEOs, CFOs and board members experienced significantly higher returns than the group Other which was the only group that did not generate a positive abnormal return. These results can be explained by the Informational Hierarchy Hypothesis as top executives and board members generated greater abnormal returns. For the sell transactions, there is no significant difference between the groups meaning that for these transactions, the difference in access to critical information seems to lack impact.

While we have shown that it is possible for outside investors to generate abnormal returns by mimicking insiders, the viability of using it as an investment strategy remains to be discussed. Our results show that for buy transactions, only one out of eleven days experienced a positive average abnormal return. This imposes that the investor would have to be very active and closely monitor the market in order to time this window of opportunity which is time consuming. Active trading strategies are often associated with a higher risk. A high frequency

of trades also imposes high transaction costs in the form of commissions and the bid-ask spread. Whether this constitutes a viable investment strategy depends on the investor's risk profile and time constraints. An option to this active strategy could be investing in a fund with the strategy of mimicking insider trades. These types of funds have seen mixed results, but could be an option for investors who believe in the sentiment but strive for a more passive alternative.

Our findings contribute to the existing literature on insider trading. While there are many studies exploring the market timing ability and performance of corporate insiders, there are far fewer who approach the topic from an outsider perspective. This study shows that there are significant differences between trading on the transaction day and the publication day. Despite the return being negatively affected by the time between these days, outsiders were still able to capitalize on the events in the short run. In addition to this, no published studies investigating outsiders' ability to earn abnormal returns by mimicking insiders in a Swedish setting were found. Our findings further contribute to prior research by showing that there are differences in performance between insider groups. This constitutes a vital piece of information for investors seeking to adopt insider mimicking as an investment strategy.

One limitation of this study is the lack of hourly stock price data. The result of this is that a trade occurring midday in an open market becomes hard to match to the correct price. Measures were taken to correct for this but it is likely that the effects were diminished. One aspect that this study does not answer is the relationship between lower level employees and top executives as the category Other includes related persons, executives from subsidiaries and more. Therefore, a suggestion for further research is to examine this relationship more closely. Another suggestion for further research is to perform a similar study but using holding periods of several months. While our study is focused on the short-term effects, a study observing the abnormal returns over several months would add to the understanding of the viability of using insider mimicking as an investment strategy. As company structures vary across different industries, both in terms of financing and assets, future research could also include an industry variable to control for differences between them.

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Appendix 1 - Winsorization

Table A Pre-winsorized Variables

Variable	N	Min	1st Perc.	p5	Mean	Median	p95	99th Perc.	Max
SMB	1554	-0.039	-0.018	-0.011	-0.000	0.000	0.010	0.016	0.026
HML	1554	-0.023	-0.015	-0.009	0.000	-0.000	0.010	0.016	0.025
UMD	1554	-0.068	-0.022	-0.012	0.001	0.000	0.013	0.020	0.037
Risk free rate	1538	-0.000	-0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
Market return	1554	-0.106	-0.034	-0.018	0.000	0.001	0.018	0.033	0.071
Stock return	623974	-0.977	-0.077	-0.041	0.001	0.000	0.044	0.092	8.793
DE	1074	-8.495	0.000	0.008	0.920	0.464	2.410	8.373	64.563
ROA	1074	-2.172	-1.281	-0.518	-0.027	0.044	0.181	0.317	0.489
Size	1074	2.641	3.339	4.040	8.137	8.061	12.178	14.694	15.055
PE	1074	-20.923	-2.063	-0.302	0.239	0.099	1.032	3.925	46.875
Buy	6853	0.000	0.000	0.000	0.784	1.000	1.000	1.000	1.000
Sell	6853	0.000	0.000	0.000	0.216	0.000	1.000	1.000	1.000
CEO	6853	0.000	0.000	0.000	0.156	0.000	1.000	1.000	1.000
CFO	6853	0.000	0.000	0.000	0.072	0.000	1.000	1.000	1.000
Board	6853	0.000	0.000	0.000	0.240	0.000	1.000	1.000	1.000
Other	6853	0.000	0.000	0.000	0.533	1.000	1.000	1.000	1.000

Table B Winsorized Variables

Variable	N	Min	1st Perc.	p5	Mean	Median	p95	99th Perc.	Max
SMB	1554	-0.018	-0.018	-0.011	-0.000	0.000	0.010	0.016	0.0164
HML	1554	-0.015	-0.015	-0.009	0.000	-0.000	0.010	0.016	0.016
UMD	1554	-0.022	-0.022	-0.012	0.001	0.000	0.013	0.020	0.020
Risk free rate	1538	-0.000	-0.000	-0.000	0.000	-0.000	0.000	0.000	0.000
Market return	1554	-0.034	-0.034	-0.018	0.000	0.001	0.018	0.033	0.033
Stock return	623974	-0.077	-0.077	-0.041	0.000	0.000	0.044	0.092	0.092
DE	1074	0.000	0.000	0.008	0.823	0.465	2.423	8.878	8.878
ROA	1074	-1.281	-1.281	-0.518	-0.023	0.044	0.181	0.317	0.317
Size	1074	3.339	3.339	4.040	8.137	8.061	12.179	14.694	14.694
PE	1074	-2.063	-2.063	-0.302	0.170	0.099	1.032	3.925	3.925
Buy	6853	0.000	0.000	0.000	0.784	1.000	1.000	1.000	1.000
Sell	6853	0.000	0.000	0.000	0.216	0.000	1.000	1.000	1.000
CEO	6853	0.000	0.000	0.000	0.155	0.000	1.000	1.000	1.000
CFO	6853	0.000	0.000	0.000	0.072	0.000	1.000	1.000	1.000
Board	6853	0.000	0.000	0.000	0.240	0.000	1.000	1.000	1.000
Other	6853	0.000	0.000	0.000	0.533	1.000	1.000	1.000	1.000

Appendix 2 - Correlation Matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) CAR(-5;-1) Buy	1.000															
(2) CAR(-1;1) Buy	0.346	1.000														
	(0.000)															
(3) CAR(0;5) Buy	0.018	0.499	1.000													
	(0.202)	(0.000)														
(4) CAR(-5;-1) Sell	-0.028	-0.072	-0.041	1.000												
	(0.279)	(0.006)	(0.121)													
(5) CAR(-1;1) Sell	-0.016	-0.008	0.013	0.285	1.000											
	(0.539)	(0.773)	(0.619)	(0.000)												
(6) CAR(0;5) Sell	0.047	-0.009	-0.015	-0.147	0.482	1.000										
	(0.073)	(0.734)	(0.576)	(0.000)	(0.000)											
(7) Buy	0.004	-0.024	-0.043	-0.002	-0.049	-0.057	1.000									
	(0.769)	(0.090)	(0.002)	(0.946)	(0.061)	(0.028)										
(8) Sell	-0.004	0.024	0.043	0.002	0.049	0.057	-1.000	1.000								
	(0.769)	(0.090)	(0.002)	(0.946)	(0.061)	(0.028)	(1.000)									
(9) CEO	0.012	-0.039	-0.031	-0.027	-0.014	-0.003	0.104	-0.104	1.000							
	(0.390)	(0.006)	(0.027)	(0.298)	(0.583)	(0.904)	(0.000)	(0.000)								
(10) CFO	-0.004	0.001	0.007	0.032	0.035	-0.023	0.073	-0.073	-0.119	1.000						
	(0.759)	(0.926)	(0.637)	(0.217)	(0.178)	(0.389)	(0.000)	(0.000)	(0.000)							
(11) Board	-0.002	-0.016	-0.049	-0.040	-0.004	0.024	0.106	-0.106	-0.241	-0.156	1.000					
	(0.901)	(0.264)	(0.000)	(0.124)	(0.881)	(0.359)	(0.000)	(0.000)	(0.000)	(0.000)						
(12) Other	-0.005	0.040	0.061	0.038	-0.005	-0.007	-0.203	0.203	-0.458	-0.297	-0.600	1.000				
	(0.728)	(0.004)	(0.000)	(0.150)	(0.849)	(0.792)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
(13) DE	-0.042	-0.055	-0.046	0.037	0.018	0.031	0.021	-0.021	-0.028	0.062	-0.031	0.017	1.000			
	(0.164)	(0.069)	(0.136)	(0.230)	(0.550)	(0.308)	(0.497)	(0.497)	(0.363)	(0.041)	(0.309)	(0.572)				
(14) ROA	-0.058	0.017	0.055	-0.030	-0.056	-0.064	-0.026	0.026	0.052	0.009	-0.087	0.037	-0.023	1.000		
	(0.058)	(0.586)	(0.073)	(0.320)	(0.065)	(0.037)	(0.390)	(0.390)	(0.090)	(0.776)	(0.005)	(0.225)	(0.454)			
(15) Size	-0.047	0.004	0.081	-0.091	-0.040	0.048	-0.053	0.053	0.017	-0.018	-0.036	0.029	0.243	0.430	1.000	
	(0.123)	(0.904)	(0.008)	(0.003)	(0.189)	(0.115)	(0.082)	(0.082)	(0.579)	(0.546)	(0.240)	(0.343)	(0.000)	(0.000)		
(16) PE	0.058	0.031	-0.011	-0.044	-0.083	-0.048	0.061	-0.061	0.025	-0.032	-0.021	0.017	0.005	0.161	0.040	1.000
	(0.057)	(0.308)	(0.707)	(0.152)	(0.006)	(0.114)	(0.045)	(0.045)	(0.417)	(0.299)	(0.492)	(0.589)	(0.880)	(0.000)	(0.185)	

Appendix 3 - Annualized CAR

Event	Buy (%)	Sell (%)
t_{-1} to t_1	27.65	-42.87
t_0	-14.04	-47.98
Difference	41.69	5.11

The cumulative abnormal return in this appendix is calculated using the following equation:

$$Annualized\ CAR\ =\ (1\ +\ CAR)^{(Trading\ Days/Days\ in\ Event\ Window)}\ -\ 1$$

where there are an estimated 252 trading days in a year.

Appendix 4 - Differences In Means Between Insiders

	CFO		Board		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	411	-0.015*	1336	-0.007*	-1.65
Buy CAR(-1;1)	411	0.009	1336	0.005	1.25
Buy CAR(0;5)	411	0.000	1336	0.002	-0.45
Sell CAR(-5;-1)	51	-0.012	225	0.006	-1.30
Sell CAR(-1;1)	51	-0.016	225	-0.006	-1.45
Sell CAR(0;5)	51	-0.017*	225	0.000*	-1.85

	CEO		CFO		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	910	-0.003**	411	-0.015**	2.25
Buy CAR(-1;1)	910	0.005	411	0.009	-1.25
Buy CAR(0;5)	910	-0.007*	411	0.000*	-1.65
Sell CAR(-5;-1)	124	0.000	51	-0.012	0.85
Sell CAR(-1;1)	124	-0.007	51	-0.016	1.20
Sell CAR(0;5)	124	-0.025	51	-0.017	-0.70

*** p<0.01, ** p<0.05, * p<0.1

	CFO		Other		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	411	-0.015**	2432	-0.006**	-2.10
Buy CAR(-1;1)	411	0.009***	2432	0.000***	3.05
Buy CAR(0;5)	411	0.000	2432	-0.002	1.45
Sell CAR(-5;-1)	51	-0.012	1061	0.002	-1.10
Sell CAR(-1;1)	51	-0.016	1061	-0.007	-1.45
Sell CAR(0;5)	51	-0.017	1061	-0.011	-0.07

	CEO		Board		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	910	-0.003	1336	-0.007	1.00
Buy CAR(-1;1)	910	0.005	1336	0.005	-0.15
Buy CAR(0;5)	910	-0.007***	1336	0.002***	-3.05
Sell CAR(-5;-1)	124	0.000	225	0.006	-0.80
Sell CAR(-1;1)	124	-0.007	225	-0.006	-0.20
Sell CAR(0;5)	124	-0.025***	225	0.002***	-3.20

*** p<0.01, ** p<0.05, * p<0.1

	Board		Other		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	1336	-0.007	2432	-0.006	-0.55
Buy CAR(-1;1)	1336	0.005***	2432	0.000***	3.00
Buy CAR(0;5)	1336	0.002***	2432	-0.002***	3.15
Sell CAR(-5;-1)	225	0.006	1061	0.002	0.75
Sell CAR(-1;1)	225	-0.006	1061	-0.0065	0.20
Sell CAR(0;5)	225	0.000**	1061	-0.011**	2.20

	CEO		Other		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	910	-0.003	2432	-0.006	0.65
Buy CAR(-1;1)	910	0.005**	2432	0.000**	2.40
Buy CAR(0;5)	910	-0.007	2432	-0.002	-0.50
Sell CAR(-5;-1)	124	0.000	1061	0.002	-0.35
Sell CAR(-1;1)	124	-0.007	1061	-0.0065	-0.10
Sell CAR(0;5)	124	-0.025**	1061	-0.011**	-2.10

Appendix 5 - Transaction Date

Table C Test for difference in means, Transaction vs. Publication

	Publication date		Transaction date		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	5089	-0.0060***	5096	-0.0129***	4.36
Buy CAR(-1;1)	5089	0.0029	5096	0.0042	-1.16
Buy CAR(0;5)	5089	-0.0035***	5096	0.0024***	-4.23
Sell CAR(-5;-1)	1461	0.0020***	1466	0.0105***	3.44
Sell CAR(-1;1)	1461	-0.0067	1466	-0.0059	0.44
Sell CAR(0;5)	1461	-0.0099	1466	-0.0118	-0.75

*** p<0.01, ** p<0.05, * p<0.1

Table D Test for the significance of CAR, Transaction date

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
Constant	-0.0129***	0.00417***	0.00236**	0.0105***	-0.00589***	-0.0118***
	(0.00111)	(0.000787)	(0.000963)	(0.00173)	(0.00123)	(0.00170)
Observations	5,096	5,096	5,096	1,466	1,466	1,466

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 6 - Market Adjusted Model

Table E Test for difference in means, Four Factor Model vs. Market Adjusted Model

	Four Factor Model		Market Adjusted Model		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	5089	-0.006**	5089	-0.002**	-2.52
Buy CAR(-1;1)	5089	0.003	5089	0.004	-1.53
Buy CAR(0;5)	5089	-0.003	5089	-0.001	-1.56
Sell CAR(-5;-1)	1461	0.002**	1461	0.007**	-2.05
Sell CAR(-1;1)	1461	-0.007**	1461	-0.003**	-2.51
Sell CAR(0;5)	1461	-0.010***	1461	-0.003***	-2.61

*** p<0.01, ** p<0.05, * p<0.1

Table F Test for the significance of CAR, Market Adjusted Model

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
Constant	-0.00235**	0.00446***	-0.00142*	0.00682***	-0.00269**	-0.00350**
	(0.000951)	(0.000690)	(0.000857)	(0.00155)	(0.00108)	(0.00162)
Observations	5,089	5,089	5,089	1,461	1,461	1,461

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 7 - Excluding Others

Table G Test for difference in means, Including vs. Excluding Other

	Including Other		Excluding Other		
VARIABLE	N	Mean	N	Mean	t-stat
Buy CAR(-5;-1)	5089	-0.00602	2657	-0.00670	0.35
Buy CAR(-1;1)	5089	0.00291**	2657	0.00570**	-2.17
Buy CAR(0;5)	5089	-0.03449	2657	-0.00151	-1.19
Sell CAR(-5;-1)	1461	0.00204	400	0.00184	0.00
Sell CAR(-1;1)	1461	-0.00664	400	-0.00743	0.29
Sell CAR(0;5)	1461	-0.00988	400	-0.00867	-0.29

*** p<0.01, ** p<0.05, * p<0.1

Table H Test for the significance of CAR, Excluding Other

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
Constant	-0.00670***	0.00570***	-0.00151	0.00184	-0.00743***	-0.00867**
	(0.00157)	(0.00105)	(0.00129)	(0.00359)	(0.00246)	(0.00376)
Observations	2,657	2,657	2,657	400	400	400

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 8 - Clustered Standard Errors

MODEL	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLE	Buy CAR(-5;-1)	Buy CAR(-1;1)	Buy CAR(0;5)	Sell CAR(-5;-1)	Sell CAR(-1;1)	Sell CAR(0;5)
Constant	-0.00602*	0.00291	-0.00345	0.00204	-0.00664***	-0.00988**
	(0.00332)	(0.00180)	(0.00212)	(0.00298)	(0.00195)	(0.00450)
Observations	5,089	5,089	5,089	1,461	1,461	1,461

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix 9 - Python Code

Import packages

In [ ]:
```
import numpy as np
import pandas as pd
import pandas_datareader as pdr
import pandas_datareader.data as web
from datetime import datetime
import yfinance as yfin
```

Create a list of tickers for which you want to fetch data

In [2]:
```
ticker_list = ["AAPL","MSFT"]
```

In [3]:
```
tickers = sorted(ticker_list)
```

Use the yfin.download script to fetch data for all tickers in ticker_list

In [4]:
```
data = yfin.download(tickers, start="2016-01-01", end="2023-03-03")

data
```

...

Export data to a csv file

In [5]:
```
data.to_csv("Shareprice.csv")
```