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Estimating the Returns to Insider Trading on Oslo Børs

- An Empirical Study

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Abstract

In this paper we investigate insider trades on Oslo Børs. More specifically, we explore the market reaction to insider trades, the abnormal returns earned by insiders in the long run, and finally we investigate whether outsiders can earn money by mimicking insider trades. Our analysis is conducted for the period 01.01.2010 – 26.09.2014. Using an event study approach, we document a strong initial market reaction to insider trades, particularly insider trades made by managers and directors, and insider trades in firms with recent financial distress. We also find some evidence of long term abnormal returns for insiders in certain firm categories, and for certain types of insiders. Finally, we develop an insider portfolio that outperforms the benchmark using standard performance measurements, but we do not find any significant alphas. We conclude that there are informational asymmetries between outsiders and insiders, and that the market does not hold strong-form efficiency. Our study has implications for those who seeking to earn abnormal returns by following insider based strategies.

Contents

1. Introduction

Insider trading have been an area of debate for a long-time and maybe even more so in recent years. Academics in economics and law have been debating the cost and benefit to society, and the research in the field is still ongoing. In the governmental- and political sphere the debate seems to be settled and insider trading is deemed as unbeneficial to society. In 1933, the U.S congress imposed regulations on insider trading with the Security and Exchange Act, and since then many countries have followed. Through the EEA agreement, the EU enforced the Insider Dealing Directive on their membership countries in 1989, requiring membership countries to implement a set of minimum rules regarding insider trading. In 2002, the U.S regulations became stricter with the Sarbanes-Oxley Act and the EU followed with the Market Abuse Directive in 2003. These regulations take aim to reduce insiders' ability to trade and profit from information that is not accessible to the public. The main idea is to create a more level playing field that leads to more confidence in fairness and integrity of the security markets. The essence of the existing regulation is to prohibit insiders from taking advantage of information that is both material and non-public. Material non-public information is defined as information that would likely affect prices significantly if made public.

Insiders are still free to trade in their own companies, as long as they do not have access to material and non-public information. It is important to highlight this distinction as the difference between illegal- and legal insider trading may be confusing. Even though insiders are prevented from using material non-public information, it is still reasonable to assume that insiders have better knowledge about their business than what the market has. This informational asymmetry should in theory make insiders capable of better predicting future firm performance. Because of this, they should on average earn superior returns when compared to the market. Indeed, this is what most studies on international markets find, and in the present study, we will explore the long run abnormal returns[1] made by insiders on the Oslo Stock Exchange.

[1] We define abnormal return as the difference between an assets' actual return and the theoretical expected return, where the expected return is calculated using statistical models. Abnormal return can be both positive and negative relative to the expected return.

Further, if insiders indeed have better information than the average investor does, it implies that trades by insiders should convey additional information to the market. This means that if the market believes insiders to have superior information, we should expect to see reactions in the short-term market prices following insider trades. This study will therefore also examine the short-term behavior of market prices in firms with recent insider trades.

Additionally, former studies have found large differences in the magnitude of abnormal returns following insider trades. Firm characteristics, volume of insider trades, and insider type are examples of factors that have been found to be related to the size of abnormal returns following insider trades. This study will further explore these relationships on the Oslo Stock Exchange.

Many former studies have however questioned whether normal investors are able to make any abnormal profits by following insider trades. When accounting for transaction costs, most studies conclude that these strategies fail to capture any abnormal profits. Contrary to what most empirical research find, there are professional managed funds that claim that they beat the market by following insider strategies. In order to test whether it would be possible to outperform the market by following insider trades, we will develop a trading strategy that follows only the most profitable insider trades, and evaluate the performance of this strategy.

Altogether, our methodology will also allow us to assess the market efficiency of Oslo Stock Exchange. If insiders indeed make abnormal profits, it will not be consistent with strong form efficiency, and if it is possible to beat the market by following insider trades, it will not be consistent with semi-strong efficiency.

2. Insider Trading

2.1 Motives for insiders to trade

From an insiders' perspective, there are many potential motives to trade in their own company. In his empirical study Seyhun (1998) suggests it is essentially three reasons for insiders to trade; the profit motive, the liquidity motive, and the manipulation motive. He further argues that motives for trading could be extrapolated from the pattern following insider trades.

First, we have the profit motive. Insider trading indicates a misbelief in the market value and implies that insiders believe the firm's fundamental value to be greater than the value reflected in the market. Thus, insiders trade to make a profit. Seyhun argues that *if* this were the case, one would observe insider purchases until the market value completely reflects the fundamental value of the firm. The same goes for selling. If the insiders believe the market value to be higher than the fundamental value, we would observe subsequent insider sales.

The second motive is need for liquidity. When insiders sell for liquidity-needs, one should see no trading pattern.

The last motive is manipulation of market prices. Manipulations of market prices occur when insiders buy or sell in an attempt to affect security prices. It could be that insiders sell a small amount of stocks in order to depress prices, so that they can buy a larger portion at a later time at a better price. If this is the case, one should find a reversal in the trading pattern.

In his study, Seyhun does find evidence for the first motive, but no evidence for reversing patterns. One reason for the latter could be the extensive regulation on market manipulation. His findings suggest that insiders tend to trade on signals in the company, and insider trades should thus yield correct and credible signals to the market.

There are also other potential reasons for insiders to trade. A motive for selling could be the diversification motive (Lee and Lakonishok, 2001). Because many companies uses options and stocks in their incentive programs, the proportion of investors wealth invested in their own firm can be sub-optimal. According to modern portfolio theory, undiversified investors can increase their expected returns without increasing risk by diversifying. At the same time,

placing savings in the company one works for induces a correlation between human wealth and financial wealth. If the company were to go bankrupt, the insider would lose both his job and his financial savings. One reason to sell could therefore be to decrease this risk.

Another possible reason on the buy side is the power motive. Insiders might want to increase their holdings in order to increase their voting power. This could especially be true for large investors, and for smaller firms.

2.2 Introduction to insider laws

Insider trading is defined as buying, or selling, stocks or other financial instruments, by anyone who has access to material, non-public information.

However, there is a distinction between what is known as legal insider trading and illegal insider trading. For example, SEC defines illegal insider trading as buying or selling a security, in breach of a fiduciary duty or other relationship of trust and confidence, while in possession of material, non-public information about the security. [2]

The Norwegian laws on insider trading follow the *EEA Agreement.*[3] This means regulation in Norway satisfies all the minimum regulation imposed by the EEA agreement. In addition to the EEA Agreement, Norway has imposed a set of stricter rules on insider trading. In the following, we will give a brief introduction to the existing laws in the EEA agreement, followed by a section that describes the insider laws specific to Norway. The reason for this is to give a clearer picture of how insider laws in Norway might lead to differences in abnormal returns when compared to other countries.

[2] http://www.sec.gov/answers/insider.htm

[3] Agreement in the European Economic Area

EEA Agreement

The EEA defines insider information as non-disclosed information of a precise nature relating to one or several issuers of transferable securities or to one or several transferable securities, which, if it were made public, would be likely to have a significant effect on the price of the transferable security. The key here is that the information would be likely to have a significant price impact if disclosed.

The EAA defines transferable securities as:

a) shares and debt securities, as well as equivalents to shares and debt securities;
b) contracts or rights to subscribe for, acquire or dispose of securities referred to in (a);
c) futures contracts, options and financial instruments in respect of securities referred to in (a);
d) index contracts in respect of securities referred to in (a);

Article 2 states that membership states shall prohibit persons possessing inside information from buying or selling securities from the issuer or issuers, with full knowledge of the facts. This inside information must be acquired through the virtue of membership of the management, administrative or supervisory body of the issuer, by the virtue of holding capital in the firm, or by the virtue of exercise of employment, profession or duties. Article 2 further states that this applies to direct- and indirect trading, and to trading on the account of others.

Article 3 states that any persons referred to in article 2 should be prohibited from disclosing insider information to any third party, unless in relation to normal course of exercise of his employment, profession or duties. In addition, article 3 prohibits persons referred to in article 2 to give purchase or sell recommendations to third parties, based on the insider information.

Article 4 states that prohibition should also be imposed on anyone who with full knowledge of the facts, possesses inside information acquired directly or indirectly through persons referred to in article 2.

Article 6 is of particular interest to our study because it regulates disclosure rules. Article 6.1 requires issuers to inform the public of any inside information as soon as possible. The issuer may however delay the public disclosure of inside information, to ensure no prejudice

towards his legitimate business interest, as long as such omission would not likely mislead the public.

Article 6.3 states that issuers are required to draw up lists of people who work for them and that have access to inside information. These lists should be regularly updated and available on request.

Article 6.4 states that persons discharging managerial responsibilities, or persons closely associated with them, shall notify the authorities of any transactions conducted on their own account, in the financial securities in the firm. Member states are then required to ensure that the public has access to this information as soon as possible.

Even though the EEA Agreement gives quite specific guidelines to member states, the willingness and ability to pursue and regulate insider trading still differs across countries. In a study of insider trading laws in a small subset of developed countries, Stamp and Welsh (1996) reported the following: "In conclusion, it is clear that a number of jurisdictions are either not interested in, or are not prepared to devote the necessary resources to implementing their insider dealing legislation."

As mentioned, the countries under the EEA Agreement are free to adopt regulation that is more stringent. Many of the countries have blackout periods where insiders are not allowed to trade. These periods are often weeks or months prior to earnings reports. Some of the countries have regulations requiring insiders to investigate if the information they have is potentially price sensitive before they trade, and some countries requires insiders to ask permission from management before buying or selling.

In addition, many of the countries have applied laws regarding the reporting duty of the insiders. These laws require insiders to report any positions and changes in the positions held to financial institutions. However, the time period that insiders are required to report within differs in many of the countries. In France, insiders are required to announce their insider dealings within two weeks of the trade taking place, while in Sweden, insider must report within 5 trading day.

Norwegian insider laws

On average, the Nordic countries have stricter insider laws than the minimum rules imposed by the EEA directives, and Norway has been a leading nation in regards to insider regulation.

In addition to the minimum rules imposed by the EEA, Norway has extended article 2 to include anyone who is in possession of insider information, not only insiders described in article 2. It is also extended to include all price sensitive information about all companies, not only information linked to the issuer. Norway also requires insiders to investigate whether there is any private information that could significantly alter the price of the company, and to ask for permission for trading from top management, before actually making any transaction. The law also prevents insiders from trading two months prior to annual reports, and one month prior to quarterly reports, effectively preventing trading for five months a year. This rule can however be ignored in certain circumstances, such as when the firm want to protect itself from a hostile takeover. Furthermore, Norway is one of the few countries where insiders are required to notify the authorities no later than the next trading day.

It is especially the last rule that might affect the efficiency of the market. Because other countries allow insiders to wait for a longer period before publically announcing their trades, some of the information value might be lost. This suggests that the abnormal return earned by Norwegian insiders on the day of announcement might be larger than in countries with longer reporting window.

Legal vs. Illegal Insider Trading

Even though there is a sharp legal distinction between legal and illegal insider trades, the practical distinction is harder to define. For example, how to decide on what is a significant effect on prices. Another problem would then be how to measure the performance of the firm, conditioned on the event not taking place: in other words, measuring what the normal performance of the firm would have been if the event had not taken place. Another grey-area is whether many small effects should be viewed as one large impact. For example, if the

insider was aware of three smaller events that each could move prices by 1%, should this amount to 3%?

As we can see, it is hard to monitor and make distinctions between legal and illegal insider trading. A fact that supports this notion is the low percentage of convictions on insider trading. For example, in 2013 Finanstilsynet investigated 72 trades on Oslo Stock Exchange, characterized as being suspicious. Out of these, only two resulted in charges being pressed. It is also worth mentioning that far from all charges results in convictions. Because the chance of being reported is so small, and conviction rate is even smaller, it would be naive to believe that all reported insider trades are strictly legal. Many of these trades are likely in a "grey-area" by the legal definition.

3. Theory

3.1 Asymmetric Information

In theory, the very reason why insiders *might* earn abnormal returns is their access to non-public information. Access to such information gives insiders a superior position compared to ordinary investors, because they are better able to assess the current and future situation of the firm. Asymmetric information, expressed as the information-difference between insiders and the market, is therefore seen as the most essential factor behind abnormal insider returns.

Asymmetric information is usually divided into two main aspects: *moral hazard* and *adverse selection.*

Moral Hazard

Moral hazard occurs when a party is willing to take on more risk because they are somewhat protected, wholly or partially, against the costs that might arise. The party acts differently compared to a scenario where they carry the whole risk themselves, because others will carry some of the burden. Such situation arises when someone deliberately retains relevant information to earn a, possible, personal profit.

Moral hazard often occurs *after* a transaction taken place. Both parties might have access to the same information upon agreement (symmetric information). Once the transaction is completed one part might get incentives to act differently than prior to the agreement. In regards to insider trading, moral hazard is considered a problem related to short selling.

As Carlton and Fischel (1982) points out, moral hazard could - in extreme scenarios - alter the way managers may act. The possibility that insiders may profit from bad information could make managers indifferent as to whether to make an effort to see the firm become successful or ruined.

Carlton and Fischel also debate another way moral hazard may become a problem, as insiders has the possibility to unbundle or undo compensation schemes already agreed with the firm. By short-selling an equivalent amount of stocks insiders can undo the incentive

effects of a stock ownership plan. That way, insiders make themselves unaffected by how the firm performs – and evidently has no preference on whether to contribute or sabotage.

Adverse Selection

Adverse selection is the other type of asymmetric information. Adverse selection occurs when information is deliberately retained *before* an agreement is reached. The reason to retain information is to improve one's own position.

Asymmetrical information is the core of insider trading. Principles related to adverse selection are easily transferable to insider trading. For example, insiders with significant non-public information have a superior position and are more likely to strike a good deal compared to “ordinary” investors. Because of the - allegedly - superior information insiders possess, they can be said to have informational advantages over the counterparty, which would lead to informational asymmetries.

Another way to benefit from asymmetric information is if insiders withhold themselves from trading. Insiders may deliberately *avoid* trading in their own company’s stock because they *know* that bad information is soon to be released. What if insiders delay their own trading until after such “bad news” is made public? The insider is still taking advantage of private and confidential information and, in theory, such behavior is just as harmful as *trading* on private and confidential “good news”.

There are many factors likely to affect the size of the informational asymmetries. Analyst coverage and R&D expenditures are examples of firm specific factors that might affect the informational asymmetries. Furthermore, the position of the insider is likely to affect their access to inside information. There have been extensive research on the subject, which will be investigated in our former research section. In our thesis we will compliment this research by exploring the relationship between factors leading to informational asymmetries, and insider abnormal returns on the Oslo Stock Exchange.

3.2 Market efficiency

Abnormal profits made by insiders can be used to gauge the efficiency of markets. The market efficiency can be described as how efficient the markets are in reflecting information. If it is somehow possible to make abnormal profits by using inside information, it means that this information is not reflected in the market prices.

Eugene Fama wrote an article published in *The Journal of Finance* back in 1970, where he elaborated around a theory he called *efficient market hypothesis (EMH)*. Fama explained his view on efficient markets and defined different "stages" of efficiency.

EMH claims that stock prices, at any given time, reflect all known information about the asset. Under- and overvalued stocks do not exist because all investors have the exact same information. As a result, it is not possible for an investor to predict future changes in share prices and outperform the market.

The theory assumes market participants to be rational in their expectations. The total sum of these expectations will reflect the *average* assumptions and estimate the "correct" market price. As new information continuously gets public, expectations need to be constantly revised. Some investors might exaggerate the new information and some may underestimate the information. Again, the important aspect in the theory is how the *average* investor behaves - the net effect on the market.

Fama (1970) divided market efficiency into three main forms;

Weak-form

Weak-form efficiency claims that stock prices reflect all *past* publicly accessible information - mainly historical prices. In that case, it is not possible to make abnormal profits by analyzing historical price movements.

Semi-strong

If a market's efficiency is semi-strong the prices reflect *all* public information. Prices would constantly change to implement new information. In the market holds semi-strong efficiency, it is not possible to outperform the market by trading on new information, as this

will already be reflected in the prices. Thus, fundamental analysis would not generate any new information and would be useless as a tool to earn abnormal return.

Strong-form

Strong-form efficiency incorporates both weak-form and semi-strong form, and additionally includes private information. So if markets are strong-form efficient, all historical prices, all public information, and all insider information are reflected in the stock prices. Strong-from efficiency thus makes it impossible to consistently beat the market, even for insiders.

The EMH Response

The EMH does not dismiss the possibility for market anomalies that result in abnormal profits. In fact, market efficiency does not require prices to be equal to fair value all the times. Prices may be over- or undervalued only in random occurrences, so they eventually revert to their mean values. Because the deviations from a stock's fair price are in themselves random, investment strategies that result in beating the market cannot be consistent phenomena.

Furthermore, the hypothesis argues that an investor cannot outperform the market based on information or skill. One would have to take on additional risk to beat the market. As gains and losses would be random, it would essentially depend on luck – or chance – whether one made a profit or not.

Market Efficiency Related to Insider Trading

If illegal insider trading does not generate any abnormal profits for the investors, it means the market efficiency holds a strong-form. It would mean that the stock prices already reflect all information related to the stock; both public and non-public. However, if insider trading *does* generate abnormal profit, it would prove that the stock prices do not reflect private information. Then the market is not of "strong-form" efficiency.

In order to test whether the stock market holds a "semi-strong" form, we must test outsiders' possibility to make profit based on insider trading. By this we mean that outsiders develop a

strategy where they buy securities based on published information on insider trades. If it is possible for outsiders to earn an abnormal profit by mimicking insider trades, it would mean the stock prices does not reflect all public information, and the stock market would not hold a "semi-strong" form. On the other hand, if such a strategy fails to yield abnormal profit, it would seem the market prices reflect all relevant public information, and the market would hold a "semi-strong" form.

3.3 Performance Measurement

In order to adequately measure the performance of our insider portfolio, we need to use correct measurements of performance. Because our portfolio differs significantly in risk from well-diversified portfolio, it is essential to account for this when measuring performance. We will therefore briefly describe the theory on the subject.

Risk

Risk is generally divided into two categories: unsystematic risk and systematic risk (also called firm specific risk and market risk). Unsystematic risk is associated with the uncertainty that is related to a specific company or industry. These are risk that only affects a certain company or a certain industry. Examples of unsystematic risk would include new competitors, management change, or regulatory changes. The unsystematic risk can be reduced and even removed completely through diversification. By holding many stocks from many different industries, these risks are evened out. Going further, one can diversify even more by including different asset classes in one's portfolio, such as bonds, property and commodities.

Systematic risk is risk *not* related to any specific company. Systematic risk affects the overall markets, and is something that every company is exposed to in some extent. Examples of systematic risk can be different economic conditions, such as oil prices, interest rates, market expectations, etc. The investor must bear these risks no matter what.

Measuring Portfolio Performance

When analyzing portfolio performance one needs to look beyond absolute returns. In order to get a more accurate assessment one must compare return relative to risk. It is also important to distinguish between different types of risk-estimates. Because unsystematic risk can be diversified away, it must be treated differently than systematic risk when assessing performance. Because of these differences in assessing risk, different performance measurements does not always provide unanimous answers to what portfolios or investments performed better.

Risk differences

To distinguish how well a portfolio performs one must define how to measure risk. Risk is mainly illustrated by either standard deviation or beta.

A rule of thumb; standard deviation is the correct risk measure when the portfolio is one's only asset. The standard deviation does not distinguish unsystematic risk from systematic risk, and is a measure of the variances in the prices of the asset. When assessing performance by total risk, the Sharpe ratio and M^2 are the most appropriate measures. It therefore follows that these measures are most appropriate when evaluating the performance of entire portfolios.

The beta is a measure of the market risk of the asset or portfolio, and is thus the appropriate measure of risk when a portfolio is only one amongst many asset holdings. When measuring performance using systematic risk, the Treynor ratio and Jensen's alpha are commonly used.

Which parameter to emphasize is dependent upon the purpose of the portfolio; is the portfolio your only asset or part of a large portfolio consisting of multiple assets.

It should also be mentioned that there are several different types of risk that are not accounted for using the standard deviation and beta measures, for example short-fall risks and recession risk. However, for the purpose of this master thesis we will not dive further into these.

Sharpe Ratio (S_P)

The Sharpe ratio is defined as an assets ratio between excess return and its standard deviation. Excess returns are defined as the returns of the asset, r_P, minus the risk free returns, r_F. Here the portfolios' standard deviation, σ_P, reflects the total risk of the portfolio:

$$S_P = \frac{r_P - r_F}{\sigma_P} \quad (1)$$

We thus see that the Sharpe ratio measures the excess return of the portfolio per unit of risk. Sharpe is often used to measure a portfolio that represents the investor's entire fortune.

Modigliani and Modigliani (M^2)

The Modigliani measure, M^2, compares a portfolios return to the benchmark's risk, σ_M. M^2 can be seen as an interpretation of the differential return relative to the benchmark.

M^2 combines the portfolios risk with a risk-free alternative, making it possible to downscale the portfolio risk. M^2 therefore enables the possibility to compare a portfolio's returns to the returns of a benchmark, based on the same level of risk.

Put in other words; M^2 is equivalent to the returns a portfolio would have earned *if* it had the same amount of risk as its benchmark. Similar to the Sharpe-ratio, the asset with the highest measure of M^2 will have the highest profits for all risk levels.

$$M^2 = \sigma_M(S_P - S_M) \quad (2)$$

M^2 is based on Sharpe-ratio and, subsequently, ranks different portfolios in the same order as the Sharpe-ratio would.

Beta (β)

The fact that Sharpe-ratio and M^2 does not take into account correlations between portfolios makes them less attractive for investors who are to choose several portfolios, or to add an asset to an already existing portfolio.

The main difference between the previous and the following performance measurements is the type of risk assessed. Beta-values estimate the systematic risk of stocks and portfolios. In other words, beta measures the tendency of a security's returns to respond to swings in the market. A beta of one indicates that the returns of the security will move with the market, a beta greater than one indicates that the returns will be more volatile than the market and a beta in between null and one indicates that the returns will be less volatile than the market. Negative betas indicate that returns of a security moves in opposite direction of the market.

The Treynor Ratio (T)

The Treynor-ratio is defined as the portfolio's excess return relative to the portfolio's systematic risk, β_P.

$$T_P = \frac{r_P - r_F}{\beta_P} \tag{3}$$

The Treynor-ratio expresses risk premium per unit of systematic risk – and not total risk as previous ratios. The Treynor-ratio disregards return earned based on unsystematic risk, as it is possible to "average out" such risk through diversification. It is an appropriate performance measure when the asset is part of a larger, well-diversified investment portfolio.

Like M^2, Treynor's ratio is in percentages. If you subtract the markets excess return from Treynor-ratio, you will obtain *The Adjusted Treynor (T^*)*.

$$T_P^* = \frac{\alpha_P}{\beta_P} \tag{4}$$

The adjusted Treynor-ratio tells us how the abnormal return, α_P, correlates to the portfolios' systematic risk. How to calculate α_P in the following section:

Jensen's alpha (α)

Jensen's alpha is a risk-adjusted measure of performance that shows the return on a portfolio beyond the theoretical expected return - forecasted by the CAPM. It bases its estimate on portfolio's beta and the average return of its benchmark.

$$\alpha_P = (r_P - r_F) - \beta_P(r_B - r_F) \quad (5)$$

Jensen's alpha can be seen as the portfolios return that are not being explained through the portfolios relationship with the market. It is used as a measure of portfolio managers' skill to produce abnormal returns.

Appraisal-Ratio (AR)

$$AR_P = \frac{\alpha_P}{\sigma(\varepsilon_P)} \quad (6)$$

By selecting a basket of investments, the manager of an active investment portfolio attempt to outperform the returns of a related benchmark. The appraisal-ratio measures a manager's performance by comparing the return of their stock picks to the residual risk, $\sigma(\varepsilon_P)$, of those selections. The higher the ratio, the better the performance of the manager in question.

The appraisal-ratio is a measure of abnormal return per unit of firm-specific risk that could be diversified away by holding a market index portfolio. In our case, the appraisal-ratio is an indicator on how well our strategy generates excess returns through active trading.

Information-Ratio (IR)

$$IR_P = \frac{R_P - R_B}{\sigma(R_P - R_B)} \quad (7)$$

As with the appraisal-ratio, the information-ratio measures portfolio managers' ability to produce excess returns relative to a benchmark. In equation (7), R_i represents returns adjusted for risk-free rate; $r_i - r_f$.

Opposed to the appraisal ratio, the information-ratio is able to detect consistency in returns. In other words, the IR-measure will recognize if a manager has performed slightly better than the benchmark for a long period of time, or done significantly better for a few periods.

IR compares a portfolio returns above its benchmark' returns to the tracking error. Tracking error is being estimated as the standard deviation of the difference between returns of a portfolio and returns of the imitated benchmark. Positive information-ratios indicate consistency in returns and outperformance of the market. On should however not that because the IR does not take systematic risk into consideration, it is unfit for ranking purposes.

4. Introduction to existing literature

According to Jeng, Metrick and Zeckhauser (2003), the research on insider trading have generally had three different motives; policy motive, scientific motive, and profit motive.

The policy motivated research takes aim to determine the effectiveness of insider trading rules, and to decide whether regulation is appropriate in respect to market performance and fairness. Scientific research use insider trading to test insiders' ability to make profit, and thus test the efficiency of the markets. The profit motive is research attempting to develop the optimal trading strategies to profit from insider trading.

4.1 Policy Motive

Most regulatory bodies are in favour of regulation. In a comprehensive survey of insider trading regulations in every country that had a stock market at the end of 1998, Bhattacharya and Daouk (2002) found that all of the 22 developed countries and four out of five of the 81 emerging markets had laws regulating insider trading. However, one should be careful with concluding that the current laws exist only as a result of economic arguments. Some of the reason may be a result of public sentiment and internal power struggles among governmental agencies. According to Dooley (1980), the trend toward further prohibitions of insider trading in the security laws can be explained by how the SEC and other regulatory bodies benefit from it. Governmental agencies will generally try to enlarge their jurisdiction and enhance their prestige. This will allow its administrators to substantially increase their salaries, power and reputation by maximizing the size of their agency's budgets. Because the public opinion is that insider trading is unjust, and because of the media coverage on insider's prosecutions, an effective way of attracting political support for larger budgets would be to enforce a vigorous program on dealing with insider trading.

The SEC argues that insider trading undermines investor confidence in the fairness and integrity of the security markets, which leads to reduced liquidity and less efficient markets. They also argue that allowing insider trading can lead to bad incentives for management in regards to business decisions, because managers will have a greater incentive to boost short

term stock prices and thus their own profits. The Norwegian Ministry of Finance argues the same, and also adds that insider regulation should be regulated based on fairness principle. They also argue that Norwegian markets could be hurt if insider trading laws are not as good as in competing markets, because it would cause investors to withdraw capital.

However, there have been arguments against regulation. In his 1966 book *Insider trading and the Stock Market,* Henry Manne stunned the corporate law academy by arguing against regulation. He argued that market efficiency would increase by allowing insider trading because insider trading effectively produces more facts about a company. Outsiders tend to trade on insider signals, moving stock prices to better reflect the new available information. This will benefit both the firm and society through more accurate pricing of securities.

Manne further argued that insider trading can be used as an incentive scheme for management and corporate entrepreneurs to produce additional information of value for the firm. The empirical evidence of the first argument is mixed. Givoly and Palmon (1985) found that insider purchases had a strong effect on share prices. In another study Inci, Lu and Seyhun (2010) compares insider trades with comparable non-insider trades in the same company. They found that insider trades had a significant positive effect on intraday prices and volume traded. These studies indicate that insider trades signal new information, which gets incorporated by outsiders, thus moving prices towards the correct intrinsic value. In the event that markets immediately incorporates information from insider trades, the markets can be said to be more efficient because prices better reflect all available information.

However, in a similar study with a smaller sample, Kabir and Vermaelen (1996) found no evidence indicating that insider trading moves prices significantly different than non-insider trading. Lee and Lakonishok (2001) found significant price changes in securities following insider trades in the long run, but not significant price changes in the short run. In the study mentioned above, Bhattacharya and Daouk (2002) found a significant decrease in equity cost of capital when a country experienced its first insider persecution. According to Glosten and Milgrom (1985) and Kyle (1985), this suggests that liquidity providers, in markets with insider impunity, protect themselves against insider trading by increasing their sell price and decreasing their buy price. This would raise transaction costs, which in turn would induce stock traders to require a higher cost of capital. The significant decrease in cost of capital signals that the market feel better protected with a more rigorous enforcement of the insider regulation. This goes against the argument Manne (1966) made. According to Manne's

theory shareholders would require a higher return to compensate for higher uncertainty, as regulations would lead to uncertain and more volatile prices.

One should further note that all the mentioned studies investigate reported insider trades. As illegal insider trading is likely to be concealed, conclusions drawn from these studies may not cover all facts about the price and volume effect from illegal insider trading.

The mixed empirical evidence makes it hard to make any claim about whether insider regulation leads to more efficient markets.

In regards to the second point, Bainbridge (1996) contends that insider trading is a poor incentive scheme. He argues that it is hard to assert the true value of the insider trading in advance, and that it will depend on the existing wealth of the insiders. Insiders with little capital to invest would not be able to trade on their superior information. He also argues that it may introduce perverse incentives for managers. If managers are allowed to short sell or sell their stocks, the managers are in effect rewarded from poor performance.

Another argument against regulation is that insider trading is a victimless offence, and that enforcing trading prohibitions is not cost-effective. Indeed, the investor selling would sell anyway and it is just by coincidence that the investor on the other side of the trade is an insider. Interestingly, Jeng, Metrick and Zeckhauser (2003) found that, on average, outsiders only lose 10 cents on a 10,000 dollar sale when an insider is on the other side. However, in the option market the option writer might still face significant losses. One must also take care to include the external costs resulting from the perception that insider trading is unchecked. If investors perceive that insider trading hurts them, they might be more reluctant to trade, which would hurt market liquidity. It could also be argued that insiders are more representative in other markets than the US because of more concentrated ownership structures and less foreign investors, something that would increase the loss for outsiders.

In favor of regulation, Bainbridge (1996) considers the increased incentive for manipulation, the reputational effects on the firm, and interference with corporate plans. By allowing insider trading, managers will have a larger incentive to use accruals in an attempt to affect share prices, and this will harm both the firm and society through less accurate pricing.

The firm might also be hurt if investors demand a premium when trading in stocks where insider trading is known to take place, because it would raise the cost of capital, making financing more expensive.

Finally, if insiders were allowed to trade unregulated, it could interfere with corporate plans because it would make them more visible. If several insiders would trade in a potential takeover target, it could make the planned acquisition more visible, which could results in competing bids or defensive strategies. This would thus hurt the firm by making the acquisition more expensive. However, going through the existing research on the subject, Bainbridge only found mixed evidence to support his arguments. Instead, Bainbridge argues that the most compelling reason for regulation is that insider trading can be thought of as theft of property rights in information. Bainbridge argues that firms should be the one profiting from information value and not the insider. Allowing insider trading would hurt firms' incentive to produce socially valuable information, because it would be the insiders and not the firms who profit from such information.

4.2 Scientific Motive

Over the history, there have been numerous of studies conducted to test different aspects of market efficiency. The early studies attempted to see whether portfolios of stocks picked on insider criteria would outperform the market. Most of these studies concluded that insider portfolios beat the market. Lorie and Niederhoffer (1968) builds on the works of Glass (1966) and Rogoff (1966), and found that US stocks with recent insider activity beat the market for six months following extensive insider trading. This is something that suggests that insiders have predictive power of future firm performance. Lorie and Niederhoffer are however careful to mention that there is large uncertainty around the date and price of the insider trades, which could bias the results. Using another methodology than the traditional event studies, Eckbo and Smith (1998) investigates the performance of insider trades on the Oslo Stock Exchange in the period 1985-1992. Their rationale for using a different model is that the traditional model does not give a correct picture on actual holding period of insiders, because traditional studies estimate abnormal returns in a pre-specified period following

insider trades. Contrary to most other studies, they find no evidence of abnormal returns for the insider portfolios.

Building on the early works, other studies sought to test whether the market adjusted profit of the insider portfolios beat the market. If the insider portfolios that beat the market consisted of more market sensitive stocks, it would still not be a breach of the strong form. Finnerty (1976) used an event-based methodology similar to Rogoff and Glass, but he uses different criteria when choosing insider stocks. He found that insider portfolios seemed to earn market adjusted abnormal profit, suggesting that markets are not strong-form-efficient. Jaffe (1974) came to the same conclusion.

At this time, studies started questioning the validity of the CAPM model. Banz (1981) documented that shares in smaller firms earned higher returns than shares in larger firms. Basu (1983) provided evidence that shares with high earning yields (low price-to-earnings ratios) on average experienced higher returns than firms with low earning yields. Similarly, Rosenberg, Reid and Lanstein (1985) provided evidence that shares with low price-to-book ratios (value firms) earned higher subsequent returns than firms with high price-to-book ratios (growth firms). If the CAPM model is correct, all these studies provide evidence of market anomalies. Alternatively, it could be that the CAPM inefficiently captures the relationship between risk-reward, and that these firm characteristics were rather associated with different levels of risk. Taking this into consideration, many studies attempted to account for such characteristics when calculating the abnormal returns. In fact, it was established that a large fraction of the abnormal return insiders earned stemmed from small stocks and value investing. Jeng, Metrick and Zeckhauser (2003) accounted for these characteristics by using two different approaches. They used the four-factor model of Carhart (1997), and found that size, momentum and value factors accounted for about one quarter of the abnormal returns found using the CAPM. Using the characteristic-selectivity method developed by Daniel et al. (1997), they found the same results. Monthly abnormal returns using the CAPM were found to be 0.68% and 0.52% using the four-factor model. Lee and Lakonishok (2002) came to the same conclusion. They constructed a hedge portfolio where they went long in stocks with the highest net insider purchase, and short in stocks with the lowest net insider purchase, based on the last 6 months of trading. They found the spread between the two portfolios to be 7.7% during the first year, and only 4.8% when adjusting for size and B/M. In effect, these adjusted returns give a better representation of the abnormal returns resulting from “insider” content only.

At the same time, studies began to examine the sources of abnormal insider returns. Since insider returns stem from information asymmetries between the insiders and the outsiders, it was hypothesized that insider returns ware related to the magnitude of asymmetries. In the same study Lee and Lakonishok argue that the information asymmetry in small stocks is greater than in large stocks, and that this likely is the reason for the difference in returns. In other words, efficiency in large stocks is greater than in small stocks because of greater scrutiny and more analyst coverage. As a result, insiders who work in small-stock companies are more likely to profit from such comparative information. The scrutiny might also lead the larger companies to put more effort into discouraging illegal insider trading. Indeed, most studies find evidence for some sort of small firm effect. Jeng, Metrick and Zeckhauser found small-cap firms to yield an average *additional* significant abnormal monthly return in the range of 0.3%-0.5%. The same study found no evidence of abnormal return for the mid- and large cap firms. In their hedging portfolio, Lakonishok and Lee found that small-cap stocks yielded an abnormal spread of 4%. They also found a spread of 2.2% in the mid-cap portfolio, but no difference in the large cap portfolio.

When looking at the book-to-market value (BM ratio), Lakonishok and Lee found an interesting relationship. They decomposed the insider portfolios into nine groups based on size and BM. They found that, when comparing across the BM groups, the insider buy and sell signals did not show any major differences in abnormal returns. However, the insider trades indicated a large difference in the segment consisting of small stocks with a low BM ratio. This segment consist of small growth stocks, often technology-companies in a starting phase, which are generally hard to value, making inside information extra valuable. These firms often also have high research-and-development spending. Because firms tend to give little information on how the R&D costs are utilized, the insiders' advantage should be larger in R&D intensive firms. Investigating this, Aboody and Lev found insider abnormal returns in R&D-intensive firms to be 2% higher than abnormal returns following insider trades in non-R&D intensive firms.

Further investigating the informational asymmetry hypothesis, studies have been conducted to investigate the relationship between abnormal returns and investor's position within a firm. The idea is that higher-positioned insiders have greater access to "inside information". However, another possible effect is that top management is under greater scrutiny and behaves in a more careful manner because of this. Jeng, Metrick and Zeckhauser (2003) divided their insider portfolio into the following categories; top-executives, directors, and

managers. They found that all earned significant abnormal return. However, they found no significant differences between the groups. Lakonishok and Lee divided insiders into "large shareholder" and "managers". They found no support of predicting power for large shareholders, but they did find evidence of significant predicting power from managers' trading. Lakonishok and Lee speculate that the reason for this is that large shareholders are removed from the decision-making process of the firm, and have less ability to affect stock prices.

The relationship between trade-volume and insider returns has also been heavily debated. One might expect high-volume trades to reflect a stronger belief in a firm's future performance, as well as being more credible. If this is the case, high-volume trades should convey stronger positive signals to the market. Other theories, like the S*tealth Trading Hypothesis* developed by Barclay and Warner (1993), claim that insiders may try to suppress their information by not trading in large quantity. They further argue that because transaction costs diminishes the profits from several smaller trades, mid-sized trades send the strongest signal.

Jeng, Metrick and Zeckhauser (2003) investigated trading volumes' relationship to insider trades by dividing all trades into three sizes (Small-, Mid- and Large trades). Their findings imply a statistically significant positive correlation between trade-volume and short-term returns. Their results also indicated the same relationship in for long-term abnormal returns, but the difference in abnormal returns between mid- and large-volume trades return were no longer significantly different.

Another thing that could affect strength and credibility of insider trades is the financial position of the firm. According to Fidrmuc, Goergen and Renneboog (2006), the idea is that insider trades in firms with financial distress and insolvency problems should yield extra strong signals. Indeed they did find evidence that insider purchases were followed by substantially higher abnormal returns in firms that were in financial distress.

Another interesting thing to look at is whether the insider transactions are purchases or sales. The majority of previous studies find that insider purchases leads to both economical and statistically more significant abnormal returns than insider sales. Lakonishok and Lee (2002) argue that there are a variety of reasons for insiders to sell – whereas almost all insider purchases are motivated by profits. Of course, insiders are likely to sell their shares if they

believe firms to be overvalued and expect the stock price to decline. Nevertheless, insiders might sell their shares for totally different reasons as well. Insiders might want to diversify, or they may simply want to free up capital.

More recent studies attempt to explore intraday insider returns. As mentioned, earlier findings have been mixed regarding short-term abnormal returns. However, more recent studies with access to more accurate price data seem to find strong evidence for intraday price changes. Inci, Lu and Seyhun (2010) provide evidence that suggest insider trading contributes to the informational efficiency of the stock market. They found that after insider purchases, prices on average rose 1% on the trade following the insider transaction, and then continued to rise by 0.5% throughout the rest of the day. Insider sales also had a significant immediate price impact, but by the end of the day prices tended to revert. These findings also suggest that insiders are contrarian. Insiders purchase stocks when prices are at their lowest point during the day, and sell stocks when prices are at the top. Insiders also seem able to buy and sell at the lowest points during a 61-day window. Additionally, Seyhun et al. found evidence indicating that price changes after insider trades are caused by the markets reaction to insider trading, and not by the insiders themselves. Trade-volume in the 5 minutes following an insider trade increases significantly. These finds suggests some professional market participants are able to discover insider trades before they are made public.

In their study, Lin and Rozeff (1995) used a different model when testing for short term abnormal returns. However they also found evidence that information from insider trades are incorporated quickly into prices. They find that 85-88% of the private information the informed trader has at the beginning of the day is incorporated into prices by the end of the day.

There have also been studies looking at cross-country differences in abnormal returns following insider trading. Fidrmuc, Goergen and Renneboog (2006) found abnormal returns over a five-day window to be 3 times larger in the UK compared to the US. They argued that difference arises as insider trades, at that time, had to be made public within 6 business days in the UK, compared to 40 days in the US. They also point out the fact that the UK insiders by law comprise a much smaller and more informed group, and that the UK operated with a trading ban during price-sensitive periods. Both these factors would suggest that insider trades in the UK were more informative. This is interesting in relation to our study because the Norwegian insider laws are more similar to the UK.

In their 2010 study, Fidrmuc, Korczak and Korczak looks at abnormal returns following insider trades in the US and 16 different EU countries. Controlling for factors that have been found to affect abnormal returns, they found that differences in shareholder protection contributed to large differences in abnormal. Using the Anti-Self-Dealing index (ASD Index) developed by Djankov et al. (2008), which is a numerical measurement of legal protection of minority shareholders, Fidrmuc et al. divided the countries into high level and low level by creating a dummy variable for countries scoring above the cross-section median. Their findings suggest differences in cumulative abnormal returns to be 1.7% in a five-day window, and 8.4% in a 100-day window. Fidrmuc et al. (2010) argue that insider actions are more transparent, credible and trustworthy in countries with a higher level of shareholder protection, and that this leads to stronger and more precise signals. Insiders are less able to extract private benefits of control in countries with high shareholder protection, and hence, less of the firm-value increased through insider trading is diverted into private pockets.

In sum, there is considerable evidence indicating insiders are able to outperform the market. This would not be consistent with strong-form market efficiency. However, by defining strong-form efficiency as a condition where prices rapidly reflect private information that is traded upon, Lin and Rozeff (1995) argues that evidence suggests that markets are strong-form efficient. Even though most of the studies have found evidence of insiders outperforming outsiders, they are all sceptical about whether it will be possible for outsiders to earn abnormal returns based on mimicking insiders. Because of this, the majority of insider studies conclude that there is no breach of the semi-strong market efficiency hypothesis. Lakonishok et al. argues that most of the abnormal returns comes from insider trading in small, illiquid stocks. Because trading in these stocks are considered to be more costly, they find it hard to believe it is possible for outsiders to make abnormal profit. Evidence of large intraday price changes also indicates the market is at least semi-strong efficient. However, there are at least two things to take into consideration. One is that these studies do not in a large degree attempt to create an optimal trading strategy based on the most profitable insider trades. It could be that there is a way to trade on only specific insider trades with extra strong signals, and make money from this. This is what the for-profit literature tries to investigate. Another point to be made is that transaction costs have declined over the years. This could make previously non-profitable strategies become profitable

4.3 Profit Motive

The research on outsider abnormal returns can be divided into two; the research done through a scientific framework, and research done in the for-profit literature. Even though most studies conclude that insiders tend to earn abnormal profits, there is larger uncertainty about whether outsiders are able to profit from trading on insider news. However, Gelband (2005) criticizes most of the earlier studies. Gelband argues that other studies have only looked at aggregate insider trading. Gelband claims that in order to test the possibility for outsiders to earn abnormal profits, one should use strategies mimicking only the most profitable trades. Gelband also criticizes the fact that these studies often focus on both policy and science. According to Gelband, the consequence of such an approach is that these studies strives to isolate the "insider" content of information in order to answer policy questions, and that this is a wrong approach to test for the semi-strong form of the EMH.

In his paper, Gelband analyzed an outsider's possibility to profit by adjusting for the factors mentioned above. He conducted the study both before and after the enactment of the Sarbanes-Oxley law in the United Sates in 2002. Prior to the Sarbanes-Oxley Act insider trading could take as long as 40 days to become public, whilst after implementation of the act most insider trades became public within two days.

Gelband constructed six experimental groups mimicking insider trades and two control portfolios of similar stocks, but not including insider trading. In his insider portfolio, he bought stock with strong signals and held them for 3-6 months. He also used a signal multiplier to decide how active and aggressive the portfolios were allowed to be.

Trading in only small stocks with high R&D costs with 3 months investments and assuming transaction costs to be 40 basis points, he found that prior to the Sarbanes-Oxley act the insider portfolios earned a 2.8 % abnormal return, but it was not statistically significant. However, in the 17 months after the introduction of the act, his most profitable portfolio earned 17.7% abnormal return after transaction costs. Interestingly, in the next 12 months, the abnormal return disappeared. This suggests that it was at least a momentary breach of the semi-strong EMH. Consequently, markets need time to price in new information. The fact that investors are constantly trying to beat the market, and such opportunities being arbitraged away, makes the market more-or-less efficient in the long run.

5. Our approach

Our thesis will have both a scientific motive and a profit motive. First we will investigate whether Norwegian insiders earn abnormal profit by looking at firm performance in firms with recent insider trading. We will look at both short term and long term abnormal returns. We will use our result from the short term abnormal returns to determine whether insider trades provides the markets with additional information, and thus makes the markets more effective. We will use the long run returns to help us determine if insiders are better able to predict future firm performance than outsiders. In addition to this, we will further investigate whether factors such as market cap, price/book-ratios, insider type and trade size yields different abnormal returns.

Building on our results, we will take a profit approach and build a portfolio based on simple trading rules, and attempt to see whether our portfolio will beat the market.

In regards to the former published studies on Norway, our thesis stands out in a couple of aspects. To our knowledge, this is the first study that attempts to control for firm specific factors such as price/book-ratios and size. We also have access to better data related to trade volumes, so that we are able to better control for insider wealth. Moreover, this study will be the first study on Norway to take the profit approach. Former studies have only been attempted to find abnormal profit earned by insiders, it has never been attempted to make trading-strategies based on only the most profitable insider trades.

6. Hypotheses

In this section, we will formulize the hypotheses we want to test.

It is realistic to assume that employees, managers, etc. have better knowledge and information about "their" firm than outsiders. If this is the case, insiders should on average be able to predict future performance better than outsiders should. If insiders know for a fact that their firm's intrinsic value differ from market expectations, insiders will be able to earn abnormal profits. This is in effect what we are trying to determine with our first hypothesis. When investigating this, we examine firm cumulative abnormal returns for 1, 3 and 6 months following insider trades.

H1: Does insiders on Oslo Stock Exchange on average earn abnormal profit in the a) 1, b) 3 and c) 6 months following insider purchases?

Earlier research has found that insider purchases tend to provide stronger signals to the market than insider sales. As mentioned, this is likely because insider have more motives beside the profit motive to sell their stocks. With this hypothesis, we aim to explore the relationship between insider sales and abnormal returns. However, because most of the earlier research on the subject have found abnormal returns following insider sales to be less significant than returns following purchases, and because of fewer observations, we will restrict ourselves to only analyze returns in a one-month window.

H2: Does insider sales affect abnormal returns in the month following insider sales?

Former research has revealed some interesting relationships between firm characteristics and abnormal returns earned by insiders. It especially seems like the abnormal returns earned by insiders are dependent on the level of informational asymmetries between insiders and outsiders. Firm characteristics like size and P/B-ratios could relate to the information asymmetry. Smaller firms are under less scrutiny and are less monitored by financial

analysts, which would lead to greater information asymmetry. Likewise, growth firms with high P/B-ratios are hard to value because a lot of the value lies in the long-term future performance. Thus, more recent and accurate information should be more important, and allow insiders to earn higher abnormal returns.

H3: Does book-to-market ratios and firm size affect the abnormal returns earned by insiders?

It has also been discovered that insiders' position within the firm seems to affect the size of the abnormal returns earned. As with firm characteristics, the main idea is that an insider's position within the firm is likely affect the size of the informational asymmetries. Insiders with high positions within the firm should have more and better information than insiders in lower positions. We have however seen in former studies that this relationship does not always hold, and that there might be other factors in play. With this hypothesis, we will attempt to discover if there are any significant relationships between abnormal returns and insider type.

H4: Do different types of insiders earn different abnormal return?

Another factor that could affect the abnormal returns is the size of insider trades. The idea is that insiders' confidence regarding their company correlates with their willingness to invest. Following this logic, we would expect to see that larger trades yield larger abnormal returns. However, because there are huge differences in the wealth of insiders, absolute trade size might be misguiding. We will therefore test this hypothesis using both absolute trade size and a relative trade size.

H5: Does the size of insider trades affect abnormal returns?

Following the study of Inci, Lu and Seyhun (2010), we are interested in investigating whether there are any significant abnormal returns on the trading day prior to the actual announcement of the insider trades. If this is indeed the case, it would mean that some

market participants are able to see when insiders trade, and to act on it. This again would have relevance for others trying to capture abnormal returns following the announcement of insider trades, because some of the information value will already have been traded away.

H6: Is there any abnormal return on the day prior to the announcement of insider trades?

If the market believes insiders possess superior knowledge, the market subsequently assumes insider trades generate new information. Assuming insider trades do generate new information, we expect short-term market prices to adjust to any new information. Given these assumptions, insider trades will make markets more efficient as the new prices better reflect the true value of firms. Any immediate abnormal returns will also imply that the market is not strong for efficient, because insider information should already be priced into the securities. We will also investigate whether the market takes into account the size of the likely informational asymmetries, and how credible the signals are. We will test whether this is the case by measuring and testing cumulative abnormal return on the day of the announcement and the day following the announcement (0, 1]. Similar to Fidermuc et. al. (2006) we will then perform a cross-section multiple regression analysis on the abnormal returns to find the source of the abnormal returns.

H7: Does insider trades provide the markets with new information?

In later years, there have been investment funds claiming to have outperformed the market by following insider strategies. Likewise, the Norwegian financial newspaper *Finansavisen* has claimed that their insider portfolio has beaten the market 12 out of the last 13 years. The logic behind such strategies is straightforward; if insiders indeed earn abnormal profits, it could be possible to earn abnormal returns by constructing a strategy based on mimicking insider trades. We will therefore test this hypothesis by developing a trading strategy based on the results found answering the above hypotheses.

H8: Is it possible to earn abnormal profits by following a strategy based on insider purchases?

7. Methodology

There are many different approaches when measuring abnormal returns. The choice of method will depend on the question at hand. Generally, intensive criteria and event-based methods will be used when determining how informative insider trading is for future returns. In other words, these methods are appropriate when trying to find out if outsiders can earn abnormal returns. The intensive criteria method used by Lee and Lakonishok (2002), have two distinctive features. First, it uses a portfolio approach where it analyses average abnormal returns across firms rather than trades. Secondly, the method uses a filter-rule defined over monthly or longer periods to assign firms into portfolios, which means that firms are only reclassified after each period.

The intensity criteria method might lead to some drawbacks. The first feature means that it will be impossible to determine the value-weighted return to all trades because the stocks with intensive trading may constitute a large or a small part of all insider-trading. Second, because stocks are chosen based on insider trading over a longer period, some abnormal profit might be lost because the immediate abnormal returns are not included. Third, because the intensity method uses a specific filter rule that is chosen subjectively, it can lead to data-snooping bias.

In regards to determining the ability for outsiders to make profit, the first and the last drawback are not really a problem. Since the method makes it impossible to conduct transactions as soon as the insider trades takes place, some of the abnormal short-term profit may be lost. Despite this, such an approach would be viable if one wishes to make a large-scale strategy based on insider trading, because it allows for simple rules to trade on.

Event based methods takes account for the second drawback. Event-based methods make it possible to detect immediate abnormal returns following insider trades. However, the problem with event-based methods is that they face statistical difficulties due to cross-sectional correlation across trades, and that they induce biases in computing long-run abnormal returns (1-5 years). [4]

[4] Barber and Lyon (1997)

Another common approach is the portfolio-mimicking method used by Jeng, Metrick and Zeckhauser (2003). With this method, all firms with insider trades are placed in a value-weighted insider portfolio that acts like a shadow mutual fund. This method therefore represents better proxies for what insiders are able to earn on their own trades. By using this approach, one deals with the drawbacks of the previous mentioned methods. However, this method is not viable when looking at short term market returns because it is not possible to look at subsequent abnormal returns across trades.

In our thesis, we primarily seek to answer two questions. First we will investigate whether insiders make abnormal returns, both in the short run, and in the long run. Second, we will be examining outsider' possibility to make abnormal profit by following a strategy based on insider trades.

In measuring short-term returns, we argue that the event based method will be most applicable because of its strengths in short term windows. We also argue that this method will be the most applicable in detecting the most profitable trades, because it allows us to better measure abnormal returns across different subsets. We will therefore implement the event-based method when analyzing abnormal returns. The weakness with the event based method is the statistical difficulties it faces when calculating abnormal returns over longer periods. Other empirical studies tend to use portfolio-mimicking methods when measuring abnormal returns over more than three months. In order to check the robustness of our long-term results, we choose to supplement our 3- and 6- month's event-method analysis with a portfolio-mimicking method, as well as supplementing our results with non-parametric test statistics. In order to eliminate any potential statistical biases when measuring abnormal returns made by our insider strategy, we also chose to implement the portfolio-mimicking method when performing analysis on our insider strategy.

We implement all of our event studies using the statistical software program STATA, and in some instances we supplement the use of STATA with Microsoft Excel.

7.1 Event Studies

We will use the same approach as described by MacKinlay (1997) when we calculate normal returns, abnormal returns (AR) and cumulative abnormal returns (CAR). In general, event studies tries to measure the effect some specific events have on stock prices. Some examples of events include mergers and acquisitions, earnings announcements and issues of new debt or equity. Event studies are thus effective when measuring how new information is interpreted by the public. In our thesis the event will be the insider trade, and the effect on the stock price will then be measured over different time intervals after the trade.

When conducting an event study, there is generally a procedure to follow (MacKinlay 1997);

1. The initial task will be to decide on the event of interest and to identify the period over which the security prices will be measured.
2. Second, we need to determine the selection criteria for the inclusion of a given firm in the study.
3. Third, we must decide on what method to use when calculating normal returns.
4. Given the selection on normal performance model, we need to decide on the estimation window. This is the period prior to the event that we will base our calculations of normal returns on.
5. Next, we will need to design the testing framework for abnormal returns, such as defining the null hypotheses and determining how to aggregate the individual firm abnormal returns.
6. Finally, we will present the empirical results and comment on weaknesses with our research.

In the following, we will use this list when presenting our method and choices.

7.2 Event of interest and event window

The event of interest will be the actual insider trade when investigating abnormal returns earned by insiders, and the day of publication when looking at abnormal returns to outsiders.

The event window will consist of the days and months following the insider trades. As this thesis is written in cooperation with Dovre Forvaltning, we will use the same time-periods as them when measuring abnormal returns. Abnormal return will be measured for 1, 3 and 6 months following insider trades, and our event window will thus respectively consist of 20, 60 and 120 *trading days* in addition to the announcement day. We will also investigate immediate market reactions by using a two-day event window. When measuring immediate price reactions, we will measure the abnormal returns in a two-day window, the day of the announcement and the subsequent trading day. In some cases, announcements can be made after the closing time of the stock exchange. Because of this, any abnormal returns from the announcement effect will not show up before the next effective trading day. By including both days in the event window, we control for such factor.

When measuring abnormal return to insiders, the event window will include the day of the actual trade, as this better reflects the abnormal return earned by insiders. When we measure abnormal returns for outsiders, we measure abnormal returns from the day of publication.

This means that the event windows measured are (0, 1] (0, 20], (0, 60] and (0, 120].

One of the benefits of using these estimation windows is that it allows us to measure firm performance in the months following insider trades. In that aspect, it gives us a better idea about the size of the information asymmetry than what immediate abnormal returns does. In other words, it will give us a better idea whether insiders are better able to predict future price movements.

Another benefit is that it allows for a pragmatic approach when measuring outsiders' ability to earn abnormal profit. One can easily implement strategies based on holding stocks for these periods, and it allows for less intensive trading.

Selection criteria's for firms

One major decision was whether to use all companies on Oslo Stock Exchange, i.e. the main exchange and Oslo Axess, or only firms on the main exchange. Firms trading on Oslo Axess are generally younger and smaller in size, and the argument for including them would be to give us more observations that would increase the precision and accuracy of our models. It would also be better to include these firms in our insider portfolio in the case that these earned larger abnormal returns following insider trades. However it could also lead to potential biases. Because the stocks on Axess are quite illiquid, it could make the calculated normal returns less accurate, which again would bias abnormal returns. The small correlation between the OSEBX[5] index and the firms on Axess could further lead to biases for the same reason.

We therefore decided on making models for both; one model for all firms and one for firms only listed on the main exchange. However, because of the potential biases arising from using firms listed on Oslo Axess, we will only present our results from using firms listed on the main exchange.

Furthermore, because of data availability we only use trades in regular equity, as opposed to derivatives and bonds.

Another choice we made was to measure abnormal returns in a normal period. With a normal period, we refer to a period where the markets are stable. The reasoning being that trading periods of extraordinary returns might lead to biases. This is because the period on which normal returns are based might differ from the period in which abnormal returns are calculated. In other words, we want the period in which the normal returns are calculated to be similar to the period in which abnormal returns are measured. This leads us to exclude any insider trades before 2010, as the financial crisis and the bounce-back period are phases with returns and volatility out of the ordinary.

In order to estimate normal- and abnormal returns, we need price data from the 205 trading days prior to the insider trades, and data for the whole estimation window.

[5] OSEBX - Oslo Børs Benchmark Index: The main index on Oslo Stock Exchange. Revised semi-annually, consisting of a representative selection of all firms listed on Oslo Stock Exchange. Currently consisting of the 52 most traded shares.

This leads us to exclude any insider trades undertaken in the 10 first months of 2010, and some insider trades in the latter part of 2014 where we don't have data for the whole event window. Another type of insider trades excluded were those where the companies ceased to exist during the estimation windows. As this might induce survivorship bias, we will investigate this more thoroughly later in our thesis.

7.3 Method for calculating normal returns

The normal return is defined as the expected return the security would earn without the insider trade taking place. The abnormal return for time *t* is then calculated by taking the actual ex post return of the security *i* on time *t*, minus the expected normal return for the same asset in the same period.

$$AR_{it} = R_{it} - E(R_{it}|X_t) \tag{8}$$

There are a number of different methods for modelling normal returns. Generally, these methods can be loosely categorized into two groups, either statistical or economic. The statistical models use statistical assumptions concerning the asset behaviour, and they are not dependent on any economic arguments. The economic models use assumptions concerning investors' behaviour, as well as statistical assumptions. The economic model still needs to rely on statistical assumptions, so potential advantage of these models is the opportunity to calculate more precise measures of normal return using economic restrictions. Examples of economic models are the Capital Asset Pricing Model (CAPM) and the Arbitrage Pricing Theory (APT). The CAPM, due to Treynor (1962) Sharpe (1964), Lintner (1965), and Mossin (1966), is an equilibrium model where the expected return of a given asset is determined by its covariance with the market portfolio and the risk free rate. The CAPM was commonly used in event studies in the 1970's, but it has fallen out of favour in later years due to the discovery of deviations from the model. These deviations might affect the validity of results found using the CAPM, and because of this the market model has taken its place. The APT, developed by Ross (1976), is an asset pricing theory where the expected return of the asset is a linear combination of multiple risk factors. It therefore eliminates some of the biases the CAPM leads to. It has however been found that the most important factor in the

APT behaves like the market factor, so that the gain from using the APT over the market model is small. We chose to use a statistical model because of the arguments given above, and because this is widely used in similar studies.

There are two common statistical methods for modelling normal returns, the market model and the constant mean return model. The constant mean return model assumes that the mean return of a security is constant throughout time. The market model assumes there is a linear relationship between returns of a security and the market return. The only assumption imposed in the models is that asset returns are normally distributed and errors are independently distributed throughout time. Although these assumptions are strict, in practice it does not lead to problems because empirically they are reasonable, and interference using the models has been found to be robust to deviations from the assumptions. In addition, it is easy to modify the statistical framework to account for heteroskedasiticity and autocorrelation. Even though the constant mean return model is very simple, it has been found to yield similar results to more sophisticated models, as shown by Brown and Warner (1980, 1985). These findings make this model very viable when no pre-event window is available. However, because of our access to historical data, we will be employing a market model. A market model yields an improvement as it removes the portion of return related to the market's return, which will cause less variance in the abnormal return. This again will decrease standard errors and allow for us to more easily make statistical interference.

As mentioned earlier, we will follow MacKinlay' (1997) approach. In the following we will go through the model and the process as described by MacKinlay.

The market model

The market model is linear in its specification, and for any security *i,* the market model is

$$R_{it} = \alpha_i + \beta_{it} R_{mt} + \varepsilon_{it} \tag{9}$$

$$E(\varepsilon_{it} = 0)$$
$$var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$$

where R_{it} is the specific firm return in period t, and R_{mt} is the market return in period t. ε_{it} is the error term, and σ_{it}^2, β_{it} and α_i are the parameters of the model. The error term is the

difference between the actual return and the normal return in the estimation window. Estimates of α_i and β_{it} is found using ordinary least squares method (OLS), which is the best linear unbiased estimator (BLUE), given that the assumptions hold.

The Multifactor Model

The market model can also be considered a one-factor model. Factor models are motivated by reducing the variance in the abnormal returns by explaining more of the variance in the abnormal return. This could also eliminate potential biases stemming from spurious relationships. Based on earlier research we know that small firms and firms with low P/B-ratios tend to have higher subsequent returns than large firms and firms with high P/B-ratios. If insiders on average tend to trade more in small firms than large firms, this could bias the measures to make it seem like insiders on average earn higher returns than what is the case. We will employ a three factor model based on the works of Fama and French. We will do so by including small-minus-big (SMB) and high-minus-low (HML) factors when calculating normal returns in the estimation window. The SMB-factor will be generated by creating a portfolio of the 33% smallest firms and the 33% largest firms. We will then measure the daily returns for these portfolios, and create the SMB variable by subtracting the returns in the big portfolio from the returns in the small portfolio. We will use the same method when creating the HML factor. We will create portfolios based on the relative book-to-market value (BM). The BM-ratio is the inverse of the P/B ratio, so that firms with high P/B values (usually growth firms) have low BM values. The HML portfolio is then created by measuring the daily returns of the high BM-portfolio (value) and low BM-portfolio (growth), and subtracting the returns of the low BM portfolio from the returns of the high BM portfolio. The model used to measure abnormal returns would thus look like the following;

$$R_{it} = \alpha_i + \beta_{it}R_{mt} + \gamma_{it}SMB_t + \delta_{it}HML + \varepsilon_{it} \quad (10)$$

$$E(\varepsilon_{it} = 0)$$
$$var(\varepsilon_{it}) = \sigma_{\varepsilon_i}^2$$

The only difference from the *Market Model* being the inclusion of SMB- and HML-factors, and their parameters γ and δ.

7.4 Estimation window and event day

The estimation window is the time period prior to the event. It is important to choose an estimation window that is long enough to give an accurate picture of the volatility of the security, while still being relevant when the event occurs. Estimation windows that are too long run the risk of including crisis and structural changes that can give a wrong picture of normal returns. However, the window must be long enough to give a statistical significant picture of the normal periods. Peterson (1989) finds that event studies usually operate with event windows consisting of 100-300 *trading days*, and MacKinlay argues that it is optimal to use a window between 180 and 250 trading days. We therefore chose an estimation window of 200 trading days, which is a little less than one calendar year. We also chose to disregard the last 5 days of trading before the insider trades, in case insiders trade on news or events that could lead to abnormal returns. Including these days could potentially lead to biases on normal returns of the firm if this is the case.

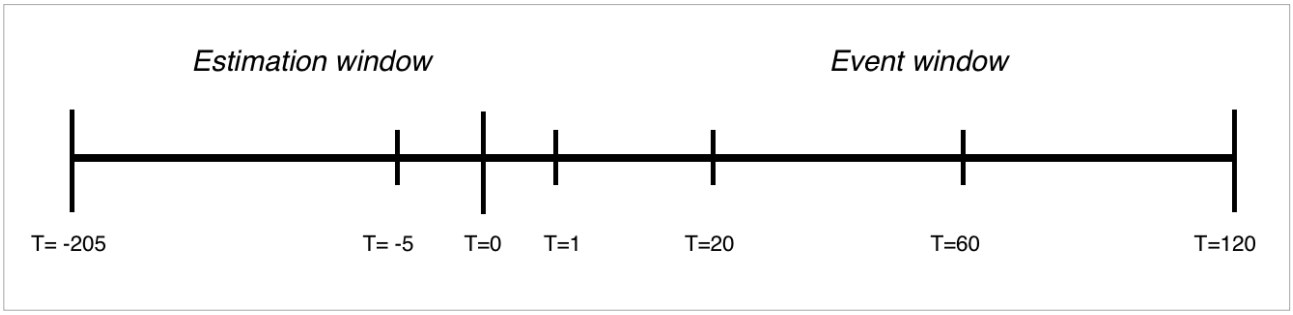


Figure 1: Time-horizon for our event studies. T=0 is the time of announcement for insider trades. The estimation window and the event window are also referred to as L_1 and L_2 respectively. Note that T indicates trading days. Thereby, one month consists of 20 days additional to the announcement day, and so on.

7.5 Testing framework for abnormal returns

Estimation of the market model

As long as the abovementioned assumptions[6] hold, OLS is both efficient and consistent. The OLS estimators of the market model parameters are the following:

Beta, Gamma & Delta[7]

$$\hat{\beta}_i = \frac{\sum_{t=T_{-205}}^{T_{-5}} (R_{it} - \bar{R}_i)\,(R_{mt} - \bar{R}_m)}{\sum_{t=T_{-205}}^{T_{-5}} (R_{mt} - \bar{R}_m)^2} \tag{11}$$

$$\hat{\gamma}_i = \frac{\sum_{t=T_{-205}}^{T_{-5}} (R_{it} - \bar{R}_i)\left(SMB_t - \widehat{SMB}\right)}{\sum_{t=T_{-205}}^{T_{-5}} \left(SMB_t - \widehat{SMB}\right)^2} \tag{12}$$

$$\hat{\delta}_i = \frac{\sum_{t=T_{-205}}^{T_{-5}} (R_{it} - \bar{R}_i)\left(HML_t - \widehat{HML}\right)}{\sum_{t=T_{-205}}^{T_{-5}} \left(HML_t - \widehat{HML}\right)^2} \tag{13}$$

As specified earlier (9), we find the parameters β, γ and δ through an OLS-regression. The parameters indicate the level of exposure to different risks; β represent the level of exposure to market-risk (11). γ represent the level of exposure to size-risk (12). δ represent the level of exposure to value-risk (13).

Alpha

Market Model

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i \hat{\mu}_m \tag{14}$$

[6] Normally distributed returns and errors are independently distributed throughout time

[7] " ^ " above a parameter mean it is *estimated,* while " ¯ " above the parameter imply it is *average.*

Multifactor Model

$$\hat{\alpha}_i = \hat{\mu}_i - \hat{\beta}_i\hat{\mu}_m - \hat{\gamma}_i SMB_t - \hat{\delta}_i HML_t \quad (15)$$

where (16)

$$\hat{\mu}_i = \frac{1}{L_1}\sum_{t=T_{-205}}^{T_{-5}} R_{it}$$

and

$$\hat{\mu}_m = \frac{1}{L_1}\sum_{t=T_{-205}}^{T_{-5}} R_{mt} \quad (17)$$

$L_1$is the length of the estimation window.[8] From the OLS-method, α, represents the point on the y-axis where the linear regression intercepts. As earlier, the *Multifactor Model* accounts for the SMB- and HML-factors in addition to the factors included in the *Market Model.*

Variance of the error term

Market Model

$$\sigma_{\epsilon i}^2 = \frac{1}{L_1 - 2}\sum_{t=T_{-205}}^{T_{-5}} \left(R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt}\right)^2 \quad (18)$$

Multifactor Model

$$\sigma_{\epsilon i}^2 = \frac{1}{L_1 - 2}\sum_{t=T_{-205}}^{T_{-5}} \left(R_{it} - \hat{\alpha}_i - \hat{\beta}_i R_{mt} - \hat{\gamma}_i SMB_t - \hat{\delta}_i HML_t\right)^2 \quad (19)$$

After we have estimated the parameters in the model, we can calculate the normal return of firm *i* in the event window for every trade. The abnormal return is then found by subtracting the estimated normal return from the actual return in the event window.

[8] L_1 is the period from T=-205 to T=-5, consisting of 200 *trading days.*

Abnormal return (AR)

Given the parameter estimated from the models, one can calculate and analyze abnormal returns. When calculating abnormal returns the time parameter, *t*, will be within L_2 – meaning returns will be measured in the event window[9] and compared to the same assets' returns in the estimation window.

$$\widehat{AR}_{it} = R_{it} - (\hat{\alpha}_i - \hat{\beta}_i R_{mt}) \tag{20}$$

Market Model

Multifactor Model
$$\widehat{AR}_{it} = R_{it} - (\hat{\alpha}_i - \hat{\beta}_i R_{mt} - \hat{\gamma} SMB_t - \hat{\delta} HML_t) \tag{21}$$

Variance of abnormal returns

As the market model assumes abnormal returns to be jointly distrubuted, with a zero conditional mean, based on market returns in the even window – the conditional variance is:

$$\sigma^2\left(\widehat{AR}_{it}\right) = \sigma_{\varepsilon_i}^2 + \frac{1}{L_1}\left[1 + \frac{(R_{mt} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2}\right] \tag{22}$$

From (22), the conditional variance of the abnormal return consists of two components. The first is the variance of noise-residuals, the same as in (9) and (10). The second part consists of additional variance given due to random sampling errors in α_i and β_i. MacKinlay (1997) argue that if the estimation window (L_1) becomes large, the second variance component will tend towards zero as the sampling errors of the parameters vanish. Thus, we assume $\frac{1}{L_1}\left[1 + \frac{(R_{mt} - \hat{\mu}_m)^2}{\hat{\sigma}_m^2}\right]$ is equal to zero. The variance of the abnormal return is then given by,

$$\sigma^2\left(\widehat{AR}_{it}\right) \simeq \sigma_{\varepsilon_i}^2 \tag{23}$$

[9] The time period from T_0 till T_{120}.

Cumulative abnormal returns (CAR)

To draw any overall conclusion of abnormal returns we need to aggregate the returns along two dimensions; time and across shares/firms. To aggregating through time MacKinlay uses the concept of cumulative abnormal returns. We define $CAR_i(t_0, t_j)$ as cumulative abnormal return from t_0 to t_j, where t_j[10] represents the length of the event window.

$$\widehat{CAR}_i(t_0, t_j) = \sum_{t=t_1}^{t_j} \widehat{AR}_{it} \tag{24}$$

Same assumptions as earlier (23) give variance of $\widehat{CAR}_i$ to be;

$$\sigma^2(t_0, t_j) \simeq (t_j - t_0)\sigma_{\varepsilon_i}^2 \tag{25}$$

Average abnormal return (AAR)

We also need to aggregate abnormal returns of all insider traded shares. This is simply done by aggregating the abnormal returns and dividing by the number of firms.

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} \widehat{AR}_{it} \tag{26}$$

Variance of abnormal returns

The variance of abnormal returns for all events N at time t, for large L_1, can be found by calculating the average of variance of error-terms on all stocks in the event window.

[10] Thus, t_j indicate either t_2, t_{20}, t_{60} or t_{120}.

$$\sigma^2(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N}\sigma_{\varepsilon_i}^2 \tag{27}$$

Cumulative average abnormal returns (CAAR)

A this point we are able to average abnormal returns across shares *and* time. By doing this, we will end up with the average accumulated abnormal returns for insider stocks in the given event window.

$$CAAR(t_0, t_j) = \sum_{t=T_0}^{T_j} AAR_t \tag{28}$$

Variance of cumulative average abnormal returns

As with abnormal returns (22), we can find the variance of the cumulative abnormal returns by aggregating the variance of the abnormal returns in the given time interval in the event window.

$$\sigma^2\big[CAAR(t_0, t_j)\big] = \sum_{t=T_0}^{T_j} \sigma^2(ARR_t) \tag{29}$$

Parametric Test Estimator

When testing whether abnormal returns are significant, we will use the test estimator given by MacKinlay, which is a version of the standard t-test.

$$\theta_1 = \frac{CAAR(t_0, t_j)}{\sqrt{\sigma^2\big(CAAR(t_0, t_j)\big)}} = \frac{1}{\sqrt{t_z - t_1}} \times \frac{CAAR(t_0, t_j)}{\sigma\big(CAAR(t_0, t_j)\big)} \sim N(0,1) \tag{30}$$

It is important to note a couple of things. Our model is not value weighted. This means the "portfolio" of companies with insider trades is equally weighted. In effect, the possible abnormal returns we might find will be the average abnormal return earned by insiders. It is also worth noting how multiple trading in the same company works. When calculating abnormal returns, these models takes the average of the abnormal returns after insider trades. Therefore, if a company experience two or more insider trades within a short time period, the same abnormal returns will be included more than once. This means that in effect, firms that expericence more insider trades are weighted heavier in the "insider portfolio" than firms with fewer insider trades, which again means that these firms has a stronger influence on the abnormal returns.

Two-sided t-test for difference in means

In order to test whether insiders across different subsets earn different cumulative abnormal returns, we will employ a two-sided t-test where we assume unequal variances in order to make the results more robust. The test-estimator estimates whether there is a difference in means, and is expressed as:

$$t = \frac{(\bar{x}_1 - \bar{x}_2) - (\bar{\mu}_1 - \bar{\mu}_2)}{\sqrt{\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}}} \tag{31}$$

Where x_i is the cumulative abnormal return in subset *i,* u_i is the expected cumulative abnormal returns, σ_i^2 is the variance of the CARs, and n_i is the number of observations. The test statistic distribution is approximated as an ordinary t-distribution with the degrees of freedom calculated using:

$$v = \frac{\left(\frac{\sigma_1^2}{n_1} + \frac{\sigma_2^2}{n_2}\right)^2}{\frac{\left(\frac{\sigma_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{\sigma_2^2}{n_2}\right)^2}{n_2 - 1}} \tag{32}$$

All calculated p-values from running the above test is found in appendix B.

Other Choices

When calculating returns, we chose to use logatihmic form. Returns are thus calculated using the following formula:

$$r_{i,t} = ln\left(\frac{P_{i,t}}{P_{i,t-1}}\right) \tag{33}$$

There was two reasons for chosing logarithmic form over simple form. The first reason is that the use of the logarithmic form gives geometric returns, which can be used to aggregate returns across time periods. Because we wish to find cumulative abnormal returns, the logatihmic form is the most applicable. The other reason is that the normality assumption is needed when using the market model and the multifactor model. The normality assumption assume that returns follow a normal distribution. Geometric returns has been shown to exhibit stronger normality than arithmetric returns (Henderson 1990), which makes interference using logarithmic-form more valid.

7.6 Multiple Regression Analysis Abnormal Returns

In order to get a better idea of what factors the market reacts the strongest to, we need to use a multiple regression. In our data descriptive section, we establish that our factors are confounding. For example, top management and board members tend to trade in large volumes than managers. If we simply investigate the abnormal returns earned by each insider position, we will not be able to account for the fact that insiders in different positions trades in different volumes. In order to control for these factors and better estimate the abnormal returns to different insider positions, firm characteristics, and trade size, we will run a multiple regression analysis on the two days abnormal returns. This will allow us to better evaluate the source of the market reaction. The multiple regression takes the following form;

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_k x_k + \varepsilon_k \tag{34}$$

where y is the dependent variable and $x_1, x_2, \ldots, x_k$ are the independent variables. β_0 is the constant, $\beta_1, \beta_2, \ldots \beta_k$ are the coefficients of the independent variables, and ε_k is the error term. The coefficients are found through an OLS-regression, and in order for our estimates to be efficient and consistent we need to assume that errors are i.d.d, and that the independent variables are linearly independent of each other. In order to test the significance of the coefficients, we use the same test-estimator as in (30).

7.7 Methodology Portfolio-Mimicking Method

In order to check the robustness of the long-term abnormal returns found using the event-based method, we also perform a simple analysis using the portfolio-mimicking method, similar to the one used by Zeckhauser et. al. (2003). We first construct our insider portfolio by including all stocks that experienced insider purchases in the last 3- and 6- month periods. In line with the event-based method, we construct our portfolio so that firms experiencing more than one insider trade in a short window are weighted more heavily than firms with only single insider trades. We then measure the average daily equal weighted return of the insider portfolio. We then employ portfolio performance measurements on the returns of the portfolio, using the CAPM with the returns of OSEBX as benchmark. We also perform an analysis where we use the multifactor model by controlling for the SMB and HML portfolio returns. We use the daily changes in the 10-year govermental bonds as the risk free rate[11]. In order to get cumulative monthly abnormal returns, we simply sum the insider portfolio return in each month and subtract the market-, SMB-, and HML-adjusted returns.

CAPM
$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i RMRF_t + \varepsilon_{i,t} \quad (35)$$

where $R_{i,t}$ is the return on the insider portfolio in month t, $R_{f,t}$ is the risk free return in month t, and RMRF is the value weigthed return in month t minus the risk free return in month t. In this model, the α_i is the intercept and it can be interpreted as the abnormal return made by the portfolio in month t.

Three-Factor Model
$$R_{i,t} - R_{f,t} = \alpha_i + \beta_i RMRF_t + \widehat{\gamma_i} SMB_t + \widehat{\delta_i} HML_t + \varepsilon_{i,t} \quad (36)$$

[11] http://www.norges-bank.no/Statistikk/Rentestatistikk/Statsobligasjoner-Rente-Daglige-noteringer/

where $R_{i,t}$, $R_{f,t}$, and $RMRF_t$ are defined as in equation (32). The SMB_t and HML_t are the month *t* returns to the small-minus-big, and high-minus-low portfolios.

7.8 Methodology Insider Portfolio

When investigating whether one could earn abnormal profits by following insider trades, we will employ the following methodology: First, we use the results from our regressions to decide on what firms to include in the portfolio. Next, we will use the data on insider trades to decide when (what dates) to include different firms in our portfolio. We will construct two insider portfolios - one with a holding period of 3 months, and another with a holding period of 6 months. Next, we will calculate daily, equally weighted returns of our portfolio in the 01.12.10-15.08.14 period. Finally, we will use an appropriate benchmark and a variety of different performance measures to evaluate our portfolio's risk-adjusted returns.

In order to adequately measure the profits an outsider would be able to earn by mimicking insiders, we included stocks into our insider portfolio on the day of *announcement*, as opposed to the day of the actual insider trade – which would be more adequate when studying insiders' returns.

As mentioned, former studies often make the mistake of including all insider purchases when deciding on whether outsiders would be able to make profits from an insider strategy. Like Gelband, we argue that one should rather only include the insider trades with the highest *likely* abnormal returns. Based on our findings, we decided to only including small cap companies with a low price-to-book ratio. More specifically, in our insider portfolio we only include companies with a market capitalization of less than USD 100m, and a P/B ratio below one. In addition to choosing these stocks for their abnormal returns, we chose these stocks because of the sound economic rationale behind the abnormal return. Insider trades in smaller firms should yield larger abnormal returns because of the larger informational asymmetries, and insider trades in firms with recent financial distress should yield stronger signals because the convey insider confidence in these firms. We also chose to disregard insider sales because they at large seem to be a poor predictor of abnormal returns.

Our strategy requires us to rebalance the portfolio after any inclusion or exclusion of stocks. The portfolio is at all times equally weighted, and we place no restrictions on how much our portfolio can invest in any single stock. For example, if the portfolio at any time consists of three stocks, the weights are 33.33% and the return of the portfolio is calculated as the average return earned by these stocks on that given time. If another stock were included, the rebalancing mechanism would work so that 8.33% of the holdings in each stock are sold, and 25% of the portfolio is used to purchase the new stock. The new portfolio return is now calculated as the average return of the four existing stocks.

We analyzed two different strategies, one with a holding period of 3 months, and one with a holding period of 6 months. Based on the abnormal returns we found using the event-method, we would ideally like to hold the stocks for only 3 months. However, as insider trades in these types of companies are rather rare, we also decided on investigating holding periods of 6 months – hoping to increase the number of stocks in our portfolio. For the same reason, we decided to start measuring the portfolio performance after a date where we had at least three stocks in the portfolio. We therefore measure portfolio performance in the period 01.12.10-15.08.14.

If a second insider trade takes place in the same share within the holding period, the period will be extended adequately. In other words, we keep the position for respectively 3 or 6 months from the *last* insider transaction. This may result in longer holding periods than first expected. One might end up holding the same position for years. We chose not to increase the weights in companies experiencing multiple trading, as this in our view only would lead to an unnecessary increase in trading costs.

The three months portfolio has between 1-10 stocks at any given time, and holds 4.4 stocks on average. The six months portfolio holds between 2-12 stocks at any given time, and holds an average of 6.6 stocks.

Returns for the portfolio are logarithmically measured on a daily basis, and we find the yearly return and standard deviations by the following formulas;

$$r_{yearly} = \left(1 + r_{daily}\right)^{trading\ days} - 1 \tag{37}$$

$$\sigma_{yearly} = \sigma_{daily} \times \sqrt{trading\ days} \tag{38}$$

The given period, on average, consist of 251 trading days. Daily returns are measured as the average daily return in same period.

When measuring portfolio performance, the choice of benchmark is critical. Generally, the benchmark should consist of assets with a similar asset composition and risk profile. Considering how our portfolio only consists of small-cap stocks on Oslo Stock Exchange, we argue that the most reasonable index to use as a benchmark is the Oslo Small Cap Index (OSESX[12]). However, because of the underperformance of said index in recent years, we chose to perform our analysis on both OSEBX and OSESX in order to get a clearer and more robust picture of the portfolio performance.

[12] OSESX - Oslo Børs Small Cap Index – consisting of the 10% lowest capitalized shares on the Oslo Stock Exchange.

8. Data Sources and Descriptive Data

Our data covers daily prices of publically traded firms on Oslo Stock Exchange, company specific information such as market and book values, and information on insider purchases.

The price data was obtained from Dovre Forvaltning, which obtained the data from Macro-Bond. It includes daily prices on all publically traded firms on Oslo Stock Exchange from 1986 until today. The dates are following the calendar year, meaning prices on dates with no trading are the same as the previous trading day. We obtained the OSEBX, OSESX and OAAX index returns from the Oslo Stock Exchange web page[13].

The data on the insider trades was also obtained from Dovre Forvaltning. The data consists of 4927 insider trades from 10.11.2008-25.09.2014. It also includes information on which company the trade was made in, the name of the insider, the position of the insider, whether it was a purchase or sale, the number of shares, the price, the value of the trade, the holdings after the trade was completed, and the relative change in holdings. The dataset also contains data on the date of the trade and on the date of the announcement of the trades.

The dataset contains insider trades in 279 public and private companies. After eliminating data on private companies, and periods of no interest, we end up with 2625 relevant insider trades in 142 firms. After aggregating insider trades made by the same person on the same day, we end up with 2360 insider trades. (e.g we view a purchase of 10000 shares and a purchase of 5000 shares as a purchase of 15000 shares). Removing the trades on Oslo Axess, we finally end up with 1998 trades to analyze. It is worth noting that only 101 of the insider trades were reported on the same day as the actual trade took place. The rest were reported on the following day. Out of the 1998 trades, 1559 were purchases and 439 were sales. Over the whole period, the average firm reported 10.9 insider trades, and on average, the insiders bought for NOK 3.600.000. However, because of some extreme outliers, the median was only NOK 204.412, which better depicts the average purchase value. Looking at relative changes, we find that on average the investors increased their holdings by 36% when using mean, and 22% when using the median. The following panel reports the mean, median, number of trades, 25% and 75% percentiles, and minimum and maximum values for insider purchases. These statistics are reported for both the absolute value of the purchase in NOK,

[13] http://www.oslobors.no/markedsaktivitet/stockIndexList?newt__menuCtx=1.6

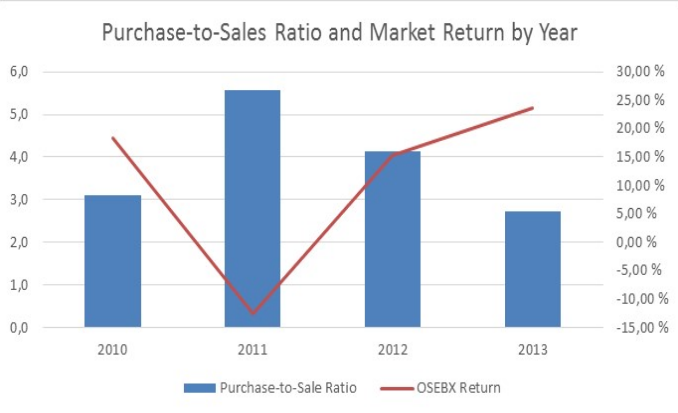
and for the relative change in holdings. Furthermore, because we have access to data on change in holdings, we were able to look if the first purchase undertaken by insiders differs from subsequent purchases. We therefore also report the statistics on the relative change excluding the first purchase, and the absolute values of the first purchase.

All Purchases	Observations	Mean	Median	25 %	75 %	Min	Max
Number of trades	1559	10.9	8	4	14	1	57
Net Value	1559 kr	3 600 000 kr	204 412 kr	87 600 kr	751 000 kr	1 250 kr	900 000 000
Change	1559	36 %	20 %	4 %	58 %	0	1
Change Excluding first purchase	1296	22 %	13 %	3 %	33 %	0	0.99
Net Value First Trade	263 kr	579 518 kr	193 320 kr	90 000 kr	460 656 kr	4 100 kr	1 680 000

Panel 1a): Descriptive statistics for trade volume and number of trades, all purchases

When looking at yearly statistics, we find that 2011 was the year with both the highest number of reported purchases, and the highest purchase-to-sales ratio. We also find that 2013 was the year with the lowest purchase-to-sales ratio. Interestingly, 2011 was the year with the worst performance on Oslo Børs, and 2013 was the year with the best performance. This could indicate that the Insiders are contrarian.

When looking at monthly statistics, we notice that the highest percentage of trades takes place in the month after the quarterly reports. This is because of the blackout period that restricts insiders from trading during the one-month prior to quarterly reports. We also note that insiders tend to purchase earlier in the year, and that 20% of all sales comes in November. This is likely because of tax purposes where insiders sell to realize losses and gain the tax benefits.



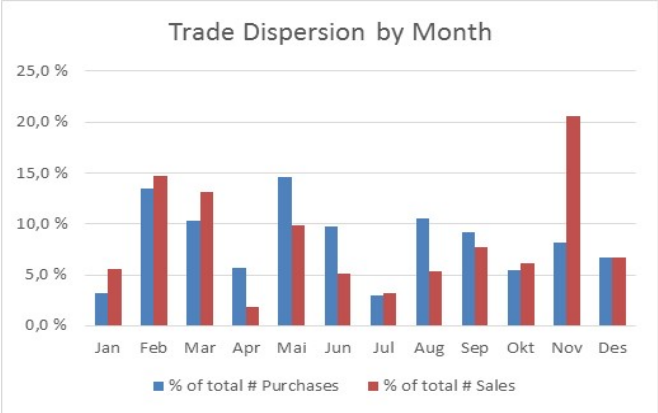


Figure *2a: Purchase to sales ratio vs. market return by year* *Figure 2b: Insider trades dispersion by month*

As mentioned, the insider data discloses the position of the insiders. The original dataset we received had quite detailed data on insider positions as seen in the appendix. Given that we wanted to test the information asymmetry hypothesis, we decided to divide insiders into the following five categories; Top management, board member, managers, primary insiders, and others.

In the first category, we chose to put CEO's and CFO's. These are likely to have the most accurate and most recent information on the firm. Under board members, we put all people on the board, both regular board members and chairmen. In the manager category, we put all managers and directors who were not CEO's or CFO's. The idea is that these managers are likely to have less information regarding the firm as a whole, for example the direction and the strategy of the firm. The primary insider category is simply all the insiders listed as primary insiders in the dataset we got from Dovre. The legal definition of a primary insider is insiders who are directly linked to the company. We therefore we suspect that this category was used to gather the insiders they were unable to assign to any other categories. In the last category, we put all the other insiders such as relatives, consultants, and insiders in affiliated companies, large shareholders etc. In the following table, we present the data on trade volume in the different insider categories. Again, we urge the reader to pay particular attention to the median averages rather than the mean averages because of outliers.

Trade Volume by Insider Position		Observations	Mean	Median	25 %	75 %	Min	Max
Other	Net Value	671	kr 6 166 117.00	kr 256 000.00	kr 82 500.00	kr 1 227 000.00	kr 2 500.00	kr 900 000 000.00
	Change	663	0.35	0.15	0.02	0.56	0	1
	Change ex. first purchase	551	0.2	0.09	0.01	0.31	0	0.98
Primary Insider	Net Value	105	kr 861 375.00	kr 212 500.00	kr 37 440.00	kr 500 000.00	kr 2 500.00	kr 17 500 000.00
	Change	105	0.29	0.11	0.01	0.5	0	1
	Change ex. first purchase	90	0.17	0.05	0.01	0.26	0	0.97
Manager	Net Value	229	kr 369 034.00	kr 137 700.00	kr 59 500.00	kr 274 800.00	kr 4 000.00	kr 6 905 800.00
	Change	227	0.43	0.3	0.12	0.68	0	1
	Change ex. first purchase	183	0.29	0.23	0.09	0.47	0.01	0.99
Board Member	Net Value	258	kr 3 901 672.00	kr 132 758.00	kr 312 068.00	kr 1 000 000.00	kr 7 921.00	kr 540 000 000.00
	Change	258	0.37	0.25	0.02	0.62	0	1
	Change ex. first purchase	206	0.21	0.09	0.01	0.38	0	0.99
Top Management	Net Value	296	kr 1 023 837.00	kr 181 350.00	kr 89 400.00	kr 455 100.00	kr 2 325.00	kr 73 100 000.00
	Change	296	0.33	0.07	0.18	0.5	0	1
	Change ex. first purchase	255	0.22	0.14	0.07	0.29	0	0.99

Panel 1b: Descriptive statistics for trade volume by insider position

We note that the "other" category on average trades in higher volume. This can be explained by the fact that relatives and large shareholders often tend to trade in large volumes. When looking at board members, top management and managers, we find that board members on average trade in the largest absolute volumes, followed by top management and then

managers. This is in line with what we would expect based on income. When looking at relative volumes, we see that managers trade in the largest volumes, followed by board members and then top management. We also notice that the discrepancies between the categories are smaller with the relative measure.

The firm specific information was obtained from Damodarans web page[14]. We gathered year-end data on market cap and P/B-ratios, and used these to assign firms in t+1 (ex. we used the size and BM-ratios for year end 2009 to assigning the firms into groups in 2010). The data obtained from Demodaran was not complete, so we used Bloomberg to obtain data on the firms and years where data was missing. We also crosschecked the data from the two sources, and found the data to be very similar. However, we were not able to find data on size and value for 92 of the insider trades, which accounts for 6% of the sample.

When assigning firms to size and BM categories, we chose to categorize them in order to maximize the informational asymmetries and signal strength. We also take into consideration their relative values when choosing our categories. For the size category, we define small-cap as firms with market capitalization under USD 100M, which roughly translates to the 35th percentile. We define the mid-cap firms as firms with a market capitalization between USD 100M and USD 1000M, which roughly translates to firms between the 85th percentile and the 35th percentile. Finally, we define large-cap firms as firms with a market capitalization above USD 1000M, which are the firms in the 85th percentile. Large-cap firms are likely to have the smallest informational asymmetries, and small-cap firms the largest. This categorization is also in line with other empirical studies on insider trading.

We used slightly different percentiles when categorizing firms after BM-ratios. We chose to define value firms as firms with a P/B under 0.75, which roughly translates to the 25th percentile. We categorized growth firms as firms with a P/B-ratio above 2.5, which roughly translates to the 85th percentile. The mid-BM firms are the firms in between. We chose these P/B ratios in order to get a clear distinction of value and growth firms. This is because the insider information in these firms is likely to be extra valuable. Even though growth firms are often popular among the public, and thus actively followed by analysts[15], inside information in these firms is likely to be particularly valuable because a large part of the

[14] http://pages.stern.nyu.edu/~adamodar/New_Home_Page/data.html

[15] Barth, Kasznik and McNichols (2001)

values in these firms is derived from expectations of future performance. These expectations are again very sensitive to information on current performance and information that is hard to come by, such as R&D expenditures. Firms in the value category are often recent losers who have fallen out of favor, and who have experienced financial distress. These firms receive less analyst coverage meaning higher informational asymmetries, and because of the danger of bankruptcy, the inside information in these firms should also be particularly valuable.

Trade Volume by Firm Size		Observations	Mean	Median	25 %	75 %	Min	Max
SmallCap	Net Value	417	kr 881 525	kr 132 000	kr 52 200	kr 345 000	kr 1 250	kr 73 100 000
	Change	412	0.36	0.16	0.03	0.54	0	1
	Change ex. first purchase	344	0.23	0.13	0.02	0.33	0	0.98
MediumCap	Net Value	753	kr 2 622 660	kr 245 485	kr 100 794	kr 819 750	kr 3 925	kr 405 000 000
	Change	745	0.34	0.2	0.03	0.55	0	1
	Change ex. first purchase	627	0.21	0.13	0.02	0.33	0	0.99
LargeCap	Net Value	297	kr 10 200 000	kr 311 600	kr 140 678	kr 1 555 800	kr 4 000	kr 900 000 000
	Change	297	0.37	0.21	0.06	0.65	0	1
	Change ex. first purchase	243	0.23	0.14	0.05	0.35	0	0.99

Panel 1c: Descriptive statistics for trade volume by firm size

Trade Volume by Firm Value		Observations	Mean	Median	25 %	75 %	Min	Max
Value	Net Value	353	kr 2 225 714.00	kr 272 000.00	kr 99 793.00	kr 1 083 360.00	kr 2 325.00	kr 73 700 000.00
	Change	412	0.36	0.16	0.03	0.54	0	1
	Change ex. first purchase	303	0.22	0.13	0.03	0.35	0	0.99
MidBM	Net Value	819	kr 4 238 292.00	kr 210 686.00	kr 92 000.00	kr 770 700.00	kr 1 250.00	kr 900 000 000.00
	Change	809	0.35	0.19	0.03	0.61	0	1
	Change ex. first purchase	660	0.2	0.11	0.02	0.32	0	0.99
Growth	Net Value	295	kr 881 525.00	kr 132 000.00	kr 52 200.00	kr 345 000.00	kr 3 925.00	kr 405 000 000.00
	Change	295	0.38	0.21	0.05	0.5	0	1
	Change ex. first purchase	251	0.22	0.14	0.03	0.35	0	0.97

Panel 1d: Descriptive statistics for trade volume by book-to-market value

We observe that absolute trade volume increases with firm size, as expected. However, relative trade volumes are about the same across the different firm sizes.

When looking at PB-ratios and medians, we notice that insiders in the value category trade in the highest volumes, followed by the MidBM category and then the growth category. Again, relative trades volumes are about the same in the different categories.

9. Results

In this chapter, we introduce the results from our analysis. We first give a brief overview of how we test each hypothesis, and then we present the relevant results in a panel with a brief presentation of our findings. Finally we interpret the results and its' implication towards our hypotheses. Additionally, we relate our findings towards existing empirical findings and economic theory.

We use a standard two sided t-test in all of our estimations, and a one sided t-test if results are barely insignificant. We refer to results as highly significant if they are statistically significant at a 1% level and significant if they are statistically significant at a 5% level. Results found to be significant are referred to as barely insignificant. We show the results for both the Market Model (MM) and the Multifactor Model (MF). We will also report the results from the portfolio mimicking method when looking at total insider returns in the 3- and 6- month window. All the panels report the cumulative abnormal return as CAAR, and standard errors are given in the parenthesizes. Statistical significance is denoted by the * signs following the alpha, where one star indicates statistical significance at a 10% level, two stars at a 5% level, and three stars at a 1% level. The reported N is the number of analyzed insider trades. Bear in mind that all the abnormal returns calculated are in absence of transaction costs.

With the exception of hypothesis 3, we used the standard event study approach where we aggregate cumulative abnormal returns over all companies and test whether they differ from zero.

9.1 Hypothesis 1: Long-Term Abnormal Return Purchases

H1: Does insiders on Oslo Stock Exchange on average earn abnormal profit in the 1, 3 and 6 months following insider purchases?

In testing this hypothesis, we use the event approach for all of the periods, and we use the portfolio-mimicking approach to supplement our findings in the three- and six month windows.

All Purchases Event Studies

	MM1	MF1	MM3	MF3	MM6	MF6
CAAR	1.73%***	3.03%***	1.44%	1.56%	-0.759%	-1.90%
	(0.00478)	(0.00989)	(0.0157)	(0.0119)	(0.0146)	(0.0150)
N	1249	1248	1216	1218	1164	1166

Panel 2a: Abnormal Returns All Purchases, Event Study method

Mimicking Portfolio 3 months

	CAPM	3 Factor Model
RMRF	0.866***	0.938***
	(0.156)	(0.148)
SMB		0.299*
		(0.178)
HML		0.251
		(0.184)
CAAR	-1.12%*	-0.66%
	(0.00628)	(0.00573)
R^2	0.402	0.545
N	48	48

Mimicking Portfolio 6 months

	CAPM	3 Factor Model
RMRF	1.024**	1.082**
	(0.410)	(0.416)
SMB		0.329
		(0.498)
HML		0.763
		(0.515)
CAAR	-1.88%	-0.99%
	(0.0166)	(0.0161)
R^2	0.119	0.241
N	48	48

Panel 2b and 2c: Cumulative Abnormal Returns

3 and 6 Months All-Purchases, Portfolio-Mimicking Method

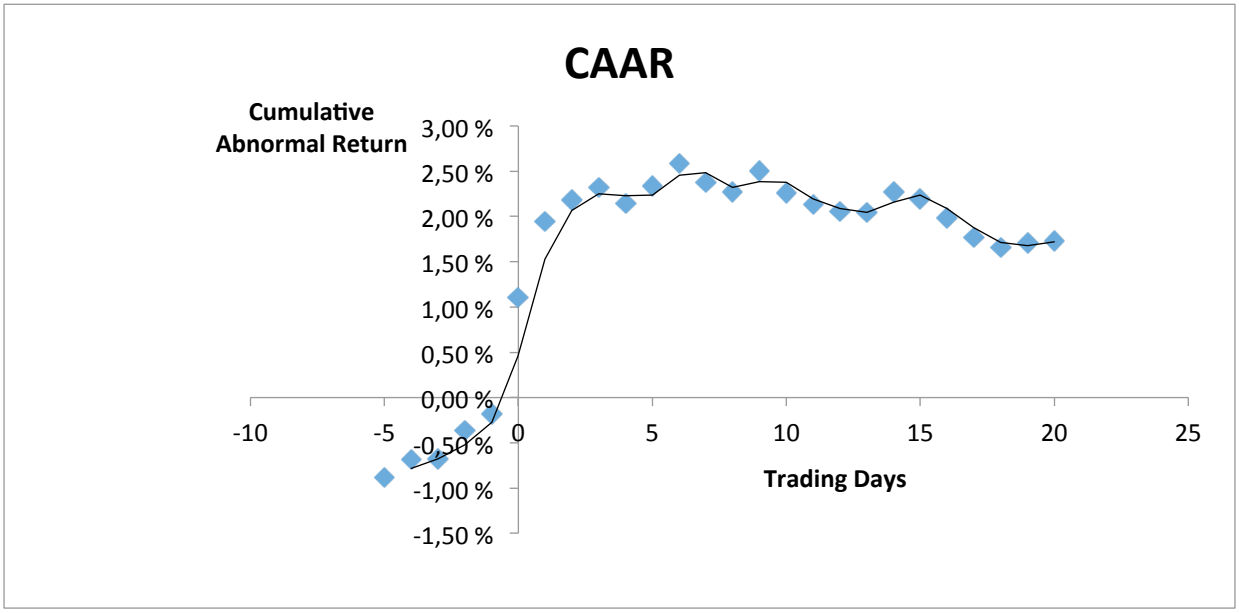


Figure 3: Cumulative Abnormal Returns One Month Following Insider Trades

1 month

Using the Market Model, we can see from table xxx that insiders on average earn a highly significant abnormal return of 1.7 % in the 20 days following the insider purchase. Using the Multifactor Model, we find a highly significant abnormal return of 3.03 %. It is somewhat surprising to see that the CAAR found using the multifactor model is larger than the CAAR found using the market model. Earlier empirical research has usually found that when controlling for size and BM-value, insiders seem to earn less than when using the market model. The reason for the increase in abnormal returns when using the multifactor model is the trend that we documented earlier. As we can see from the descriptive section, insiders on average trade more in small firms and value firms than in large firms and growth firms. Because the SMB- and HML-portfolios have underperformed compared to the OSEBX in the short term, and because insiders trade more in small companies and value companies, it produces a downward bias when not accounting for size and BM-values.

3 Months

Using the market model, we find that insiders on average earn a cumulative abnormal return of 1.4% in the 60 days following insider trades. Using the multifactor model, we find a CAAR of 1.6%. However, the 3 months CAARs results are not significant for either model. The reason for the loss in significance is both larger standard errors in the abnormal returns and smaller CAARs.

Using the portfolio mimicking method, we find a negative CAAR of -1.1% using the CAPM model, and a CAAR -0.7% using the 3-factor model. We notice that neither of these are significant using the two-sided t-test, but the CAAR of the CAPM model becomes significantly smaller than zero at a 5% level using a one-sided t-test. The reported RMRF is interpreted as the beta of the portfolio, and in the CAPM model we notice that is smaller than one, indicating that insiders on average trades in less market-sensitive stocks than the average investor. We also note that neither the SMB nor the HML factors are significant in the 3-factor model, which means the size and value factor explains little of the returns of the insider portfolio. We also notice that the reported R^2 values are quite low. An R^2 of 0.402 means that 40.2% of the variation in the returns of the insider portfolio is explained by the variation in the returns of the market.

6 months

Neither of the models finds any statistical significant abnormal returns in the 6 months following insider trades. We also note that the RMRF betas increase, and that the explaining power of the model decrease.

Results Discussion

On average, we find evidence for insiders earning abnormal returns in the month following insider trades, but not in a 3- and 6- month period. Using the portfolio mimicking method and CAPM, we surprisingly find some weak evidence for insiders underperforming the market in a 3-month period. However, do to the fact that the CAPM have been found to poorly model risk, we conclude that insiders on average are no better than the average investor at predicting future long run performance. We do however find abnormal performance in the 1-month window following insider trades. This is in line with our expectations, and in accordance with the informational asymmetry theory. However, by looking at graph xxx, we see that most of the abnormal returns accumulate within the first two trading days following the insider trade. This implies that most of the abnormal returns are a result of the markets reacting to the information signal from the insider trade, and not by abnormal firm performance in the following months. It also implies that the market quickly incorporates new information into the prices. In fact, by looking at the graph we see that cumulative abnormal return decreases over time, which could imply that long-term firm performance is worse than the initial expectations of the market. In relation to the market efficiency theory, our results indicate that the market holds strong form efficiency in the long run. It is interesting to note that because insiders are prevented from short term trading due to the laws on manipulation; it implies that insiders on average do not earn abnormal returns at all.

It is also worth noting that the reported R^2 values of our models are quite low. This implicates that insider on average trade in companies that are different from the market.

Our results are on average in line with previous empirical research. Using the market model on the UK market in the 1991-1998 period, Fidermuc et. al.(2006) found a significant CAAR of 1.65% in the five day window following insider trades. Looking at the graph xxx, we see

that our 5 day CAAR using the market model is approximately 2.3%. Most likely, the largest reason for the difference is the much speedier reporting in the Norwegian markets. In the UK, insiders are required to report their transactions to the market within 6 days. Because the time between the actual trade and the announcement of the trade is longer, it is likely that some of the informational value of the transaction is lost, as argued by Fidermuc. et. al(2010).

Comparing our long run results, we find some differences. Using the portfolio-mimicking method and Four-Factor Model on the US market in the 1976-1996 period, Zeckhauser et. al. found a six month CAAR f 4.3%. It is worth noting that the only 0.3% of the total CAAR came from after the first month. They found the 1-month CAAR to be 3.9%, which is approximately in line with our 1 month CAAR using the multifactor model. Many potential factors can account for the differences in the long-term results. We perform our study using data that are more recent. Technological innovations and analyses that are more sophisticated have increased the efficiency of the markets, which makes it harder to make abnormal returns. Furthermore, in addition the differences in regulation between the countries, there can be many cultural differences. In line with our research on Oslo Børs, Smith and Eckbo did not find any long run abnormal returns in the 1985-1992 period, using a more sophisticated portfolio approach that accounted for the actual insider holding periods. They hypothesize that compared to other markets, insiders on Oslo Børs only rarely possess inside information. They also argue that the explanation could be that the value of maintaining corporate control benefits offset the value of trading on insider information.

In graph xxx we also observe that CAARs prior to insider trades seem to be negative. This is in line with what Seyhun et. al. (2010) and Fidermuc et. al (2006) found, and indicates insider timing ability. In other words, insiders seem to act contrarian.

9.2 Hypothesis 2: One-Month Abnormal Returns Sales

H2: Are insider sales on average followed by negative abnormal returns in the following month?

In testing this, we employ the market model over a 1-month period. Because earlier research has found sales to be little informative, we chose to yield the insider sales less attention so that we can concentrate on insider purchases. When testing this hypothesis, we will use exactly the same method as when testing H1. One thing worth noting is that we only end up with 354 insider sales, which is a lot less than for purchases.

	MarketModel
CAAR	-1.55% (0.0159)
N	354

Panel 3: One-month cumulative abnormal returns sales

Results Discussion

On average, we find a CAAR of -1.6%, but this is not statistically significant due to large variations in the abnormal returns. Overall, insider sales seem to be less informative than purchases, which is in line with our expectations and former research. This is because there are many more potential reasons for selling, whereas purchases are most often undertaken because of a profit motive. However we do find it somewhat peculiar that we are unable to find significant CAARs at the whole.

We also broke down the analysis further, and a couple of findings are worth mentioning. Looking at firm characteristics, we found a statistically significant CAAR of -1.2% following insider sales in large firms, and CAAR of -4.9% in value firms.

One potential explanation for the significant CAAR in the large firm category is that large firms often receive a lot of attention, and it is likely that the market follows insider trades more closely in such companies. A quick google search will reveal that Norwegian financial newspapers are quick to point out any insider sales in the most prominent firms, and the negative CAAR can possible be explained by the market reacting to these articles. The negative CAAR in value firms is quite reasonable. Value firms are often firms that have

recently experienced financial distress. Insider sales in value firms could thus potentially lead to stronger market reactions because the downside in these firms is larger. We also point out that the underperformance following insider trades in value firms is quite large, which makes economic sense.

We also notice that insiders tend to sell in much larger volume when they first sell. Only 20% of the sales were sales for less than kr 200.000, as opposed to purchases where 45% consisted of less than kr 200.000.

9.3 Hypothesis 3: Firm Characteristics

H3: Does book-to-market ratios and firm size affect the abnormal returns earned by insiders?

In order to test this hypothesis, we aggregate the abnormal returns of the firms in each size and value category, and use the same method as before in detecting abnormal returns.

As mentioned, we were unable to find data on market-cap and P/B for about 6.5% of the firms at the time of the insider trade. However, we chose not to remove these trades as it could bias our results. This is because the type of firms with missing values is likely to differ from the average type of firms. For example, if there was a higher proportion of small firms with missing values, and if insiders in these firms on average earned higher abnormal returns, removing these firms would result in a downward bias.

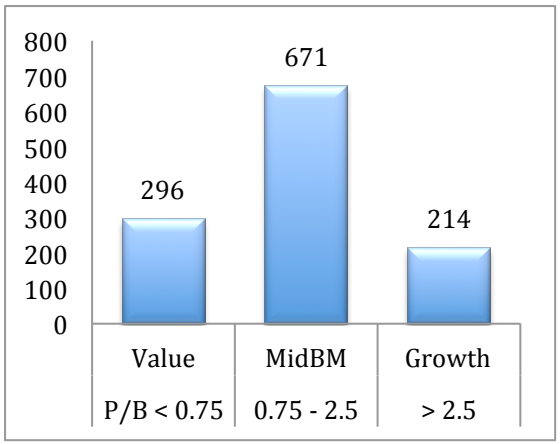


Figure 4a: Insider trades across BM-ratio

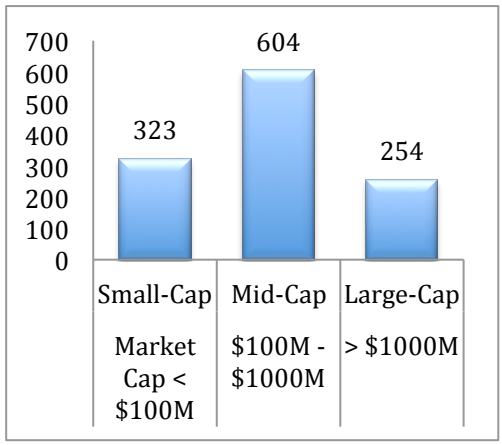


Figure 4b: Insider trades across firm size

	All	Smallcap	Midcap	Largecap	Value	MidBM	Growth	Small Value
CAAR 1m	1.73%***	5.74%***	-0.271%	0.519%	4.57%***	0.489%	0.532%	12.9%***
	(0.00478)	(0.00971)	(0.00775)	(0.00574)	(0.0105)	(0.00693)	(0.00786)	(0.0208)
N	1249	323	604	254	296	671	214	102
CAAR 3m	1.44%	6.52%***	-1.91%	-0.429%	6.60%***	-2.11%	-0.553%	17.1%***
	(0.0157)	(0.0193)	(0.0297)	(0.0106)	(0.0197)	(0.0267)	(0.0200)	(0.0328)
N	1216	319	594	236	290	653	206	102
CAAR 6m	-0.759%	4.97%	-6.8%***	-1.99%	6.39%**	-9.9%***	-0.291%	27.2%***
	(0.0146)	(0.0346)	(0.0202)	(0.0155)	(0.0311)	(0.0177)	(0.0338)	(0.0526)
N	1164	303	571	229	289	606	208	99

Panel 4a: ***Market Model*** *– Cumulative abnormal returns firm characteristics*

	All	Smallcap	Midcap	Largecap	Value	MidBM	Growth	Small Value
CAAR 1m	3.03%***	5.38%***	2.74%	0.327%	4.12%***	2.97%	1.01%	11.5%***
	(0.00989)	(0.00886)	(0.0196)	(0.00565)	(0.00941)	(0.0181)	(0.00783)	(0.0178)
N	1248	324	606	250	307	652	221	102
CAAR 3m	1.56%	5.88%***	-0.991%	-0.594%	5.30%***	-1.78%	1.05$	16.1%***
	(0.0119)	(0.0177)	(0.0216)	(0.0105)	(0.0172)	(0.0195)	(0.0201)	(0.0262)
N	1218	320	592	239	301	636	214	102
CAAR 6m	-1.90%	3.79%	-7.5%***	-1.92%	6.02%**	-10.5%***	-1.52%	26.8%***
	(0.0150)	(0.0328)	(0.0231)	(0.0154)	(0.0295)	(0.0201)	(0.0330)	(0.0468)
N	1166	303	568	234	289	607	209	99

Panel 4b: ***Multifactor Model*** *– Cumulative abnormal returns firm characteristics*

1 month

Looking at panel 4 a) and b), when comparing abnormal returns across different firm sizes we see that only insiders in small firms seem to be making abnormal returns in the first month following insider trades. Using the market model, we find the small-cap CAAR to be 5.7% and highly statistically significant. Looking at the BM category, we notice a highly significant CAAR of 4.6% for value firms. Note that both these are larger than insider returns across all purchases.

Following Lakonishok et. al., we wanted to look at abnormal returns when combining size and BM values. We did find a highly interesting relationship, namely that insiders in small, value firms earns huge abnormal returns. More specifically, we found a highly significant CAAR of 12.9% in the 20 days following insider trades.

Using the multifactor model, we end up with the same conclusions. Only insider trades in small-cap firms and value firms yield statistically significant CAARs. As expected, we see that CAARs in the multifactor model are marginally smaller than CAARs of the market model. However, they are not significantly different.

3 Months

Interestingly, all the statistical interference made in the 1 month model holds, even though the overall CAAR no longer is significant. We notice that the CAAR for small firms increases only slightly, indicating that most of the abnormal returns is made in the first month. We also notice that CAARs for value firms increases to 6.7%, indicating that insiders in these firms continue to earn abnormal profits after the first month of trading. The CAARs of the small, value firms increases to 17.1%, and are still highly statistically significant. The CAARs of the multifactor model are on average about 1 % smaller than in the market model.

6 Months

We find a couple of interesting results when looking at a 6-month window. First we notice that CAARs for small-cap firms disappear in both models. The size of the CAARs is still

quite large, so the loss of statistical significant is due to larger variation in small firm performance. CAAR in value firms however seem to persist. Moreover, CAARs in small, value firms are still both highly economically and statistically significant with 120 day CAARs of 27.2% in the market model, and 26.8% in the multifactor model.

Another thing we notice is that CAARs for firms with P/B between 0.75 and 2.5 suddenly becomes highly statistically significant with a CAAR of -9.9% in the market model, and -10.5% in the multifactor model. The same effect is seen with the mid-cap firms with negative CAARs of respectively -6.8% and -7.5%.

Results Discussion

In line with our expectations and economic theory, we do find evidence that insiders in firms with different firm characteristics earn different abnormal returns that are significantly different. In relation to our hypothesis, we find that size and value factors do affect abnormal returns earned by insiders. The informational asymmetry seems to hold in that insiders in small firms earns higher abnormal returns compared to insiders in larger firms. This is likely because smaller firms are less thoroughly analyzed and insiders in these firms should therefore have a larger informational advantage. Another possible reason is that these insiders feel less scrutinized, and thus takes greater risks and trades on information that is in the grey area. We also note that our model does not find any CAARs for midcap and largecap firms.

Looking at the BM values, we find that only insiders in value firms earn significant abnormal returns. We chose our value firms to have a relative low P/B ratio compared to other studies. This means that our value firms have likely experienced financial distress in the period prior to the insider trades. The economic reasoning for the abnormal returns earned by these investors is that these firms have likely experience financial distress lately. With a P/B-ratio under 0.75, the market believed these firms to be destroying value at the start of the year. This is something we often see in financial distressed firms, where agency and direct & indirect financial distress cost destroys firm value. Assuming insiders are rational and do not trade to manipulate the market, insider purchases in these firms should give extra strong signals. Because there often are fears of these firms going bankrupt, insider trades in these firms effectively removes some of the concern that these firms will go

bankrupt and thus limits the potential downside. Firms with a low P/B ratio are also often stocks that are unpopular among the public. Because of this, fewer analysts tend to follow these stocks. As with firm size, this would lead to informational asymmetries. This could also contribute in explaining why we did not find any abnormal returns for growth firms. These firms are often past winners and glamour stocks, and analysts extensively follow them, which effectively decreases the information asymmetry.

The same economical reasoning can be used when explaining the huge abnormal returns in the small, value firms. However, the risk of insolvency and bankruptcy is even larger in these firms due to their size, which could explain the larger abnormal returns.

Considering that the abnormal returns across all purchases disappeared when looking at longer periods, we find it interesting that the abnormal returns in the smallcap subset persist in the three-month period and that the abnormal returns in the value subset persist in the six-month window. This further supports the informational asymmetry hypothesis, because insiders in these firms seem to be able to predict future performance better than the market, implying that they have access to better information.

We also find it particularly interesting to look at the long term abnormal returns of the small, value subset. The CAAR in this subset actually increases over time, and remains highly statistically significant in all models and all periods. As we have argued, the size of the abnormal returns is likely due to large informational asymmetries. It is also interesting to see that the size of the CAARs remains large after controlling for the SMB and HML factors. If we correctly control for these factors, it means that the abnormal returns are most likely due to insider content only.

Finally, we notice the large negative 6-month CAARs following insider trades in the midcap and midvalue subset. We have not seen this effect in any other studies, and we are not able to come up with any economic reasoning to explain this effect.

Our results differ somewhat in regards to former studies. However, the results are not directly comparable doe to the fact that we employ different cut offs when categorizing after size and value. Similar to our results, Zeckhauser et. al. and Lakonishok et. al. found evidence of abnormal returns for small firms, but not large and medium firms when using a 1/3 cutoff. When looking at BM-ratios, we find some differences. Zeckhauser et. al. did not find any abnormal performance in any of their value categories, but their results indicated

that insiders in growth firms performed better. The most likely reason for the difference is that they used 1/3 cut offs, which means that on average, their value stocks had higher P/B ratios than our value stocks. This again would decrease the likelihood of financial distress in their value portfolio.

9.4 Hypothesis 4: Insider Position

H4: Does different types of insiders earn different abnormal return?

The method when testing for CAARs is the same as before. We simply aggregate abnormal returns across all of the categories we made in the descriptive data section and test them. In the following we present the results.

	All	Top Management	Board Members	Managers	Primary Insiders	Others
CAAR 1m	1.73%***	1.99%*	2.34%*	3.45%***	-0.0366%	0.861%
	(0.00478)	(0.0117)	(0.0132)	(0.0104)	(0.0105)	(0.00746)
N	1249	242	230	211	87	479
CAAR 3m	1.44%	2.92%	6.54%***	5.75%***	0.297%	-3.36%
	(0.0157)	(0.0290)	(0.0202)	(0.0191)	(0.0246)	(0.0356)
N	1216	238	222	201	86	469
CAAR 6m	-0.759%	-2.28%	7.25%**	5.64%*	0.354%	-6.64%***
	(0.0146)	(0.0361)	(0.0340)	(0.0339)	(0.0429)	(0.0234)
N	1164	235	210	190	82	447

Panel 5a: ***Market Model*** *– Cumulative abnormal returns insider position*

	All	Top Management	Board Members	Managers	Primary Insiders	Others
CAAR 1m	3.03%***	2.84%***	2.19%*	3.62%***	-0.268%	3.86%
	(0.00989)	(0.0104)	(0.0129)	(0.0104)	(0.00858)	(0.0239)
N	1248	242	231	209	86	480
CAAR 3m	1.56%	-1.21%	9.23%**	6.29%***	-1.47%	-2.14%
	(0.0119)	(0.0243)	(0.0418)	(0.0191)	(0.0206)	(0.0178)
N	1218	238	223	200	88	469
CAAR 6m	-1.90%	-4.90%	6.10%*	5.58%*	-3.23%	-7.05%***
	(0.0150)	(0.0434)	(0.0330)	(0.0332)	(0.0374)	(0.0227)
N	1164	235	210	190	82	447

Panel 5b: ***Multifactor Model*** *– Cumulative abnormal returns insider position*

1 Month

We find using the market model that top management earn a CAAR of 2%, significant on a 10% level using a two-sided t-test, and 5% using a one-sided t-test. Moreover, board members earn a 10% statistically significant CAAR of 2.3% using a two-sided t-test, and 5% significant using a one-sided t-test. Managers earn a highly significant CAAR of 3.5%. None of the other two categories earn any CAAR. We make the same statistical interference using the multifactor model. However, we also notice that CAARs earned by top managers have increase to 2.8% and that the results have become highly significant. This suggests that top management more often trades in smaller and/or firms with lower P/B-ratios.

3 Months

Looking at the 3-month window, we find a couple of notable changes. Top Management does not seem to make any abnormal returns at all. The CAARs of management increases to 5.8% in the market model and 6.3% in the multifactor model, and remains highly significant. The CAARs of board members increases considerably to 6.5% in the market model and 9.2% in the multifactor model. Because of the sizable increase, both become significant at a 5% level. CAARs of the two other categories remain insignificant.

6 Months

In the 120-day window following insider purchases, only board members in the market model earn CAARs that are significant at the 5% level using the two-sided t-test. We do however also find that managers in both models earn significant abnormal returns using a one-sided t-test. The sizes of the abnormal returns are about the same as in the 3-month window, indicating that abnormal returns persists, but do not increase.

We also notice that the insiders in the “other” category earn a negative CAAR of around -6.6% in the market model, and -7% in the multifactor model, both highly statistically significant.

Results Discussion

Overall, our results confirm our hypothesis. Different types of insiders earn different abnormal return. However, because of the different magnitudes and interferences across the different models, this relationship does not seem to be as straightforward as we would expect. There seem to be more factors than the information asymmetry that states that the insiders with the most superior information should earn the highest significant returns. Our results indicate that managers and board members are the ones that earn the highest abnormal returns, with abnormal returns that are statistically different from the abnormal returns in the other groups.

As mentioned, one potential factor could be that different insiders experience different levels of scrutiny, which would affect their willingness to make questionable insider trades. Top management is especially prone to this type of scrutiny because they are more visible, and this can explain why we fail to find any abnormal returns for top management in the long run.

Another factor for the difference could be to what degree insiders are aware of the firm strategy and long-term direction. This could explain why managers outperform board members in the short run and vice versa in the long run. These differences are however not statistically different.

The sizable increase in abnormal returns for managers and board members between the 1-month model and 3-month model is also interesting. Our results suggest that these two groups are able to predict future performance better than the market in a 3 months perspective. This would again break with strong-form market efficiency because not all inside information is reflected in the prices.

Finally, we notice the significantly negative returns earned by “others” in the six-month period. One possible explanation could be that these investors do not have an as good understanding of the business as other insiders, and misapprehend the business and the signals in the business. In everyday life, a parallel would be small-time investors who pick stocks based on opinions made by reading the financial times. As this group also contains large shareholders, a possible motivation behind purchases is to increase corporate control. Lakonishok and Lee also argue that these shareholders are removed from the decision

making process. However, because the composition of insiders in the "other" category is so diverse, it is hard to say what the real reason is.

Again, comparisons to other studies are problematic because of different categorizations of different insiders. Lakonishok et. al. divided his sample into managers and large shareholders, and only found evidence for significant abnormal returns in a one year period for managers. Fidermuc et. al.(2006) looked at short term abnormal returns and divided their sample into CEOs, all top executive directors, chairmen, other incumbent directors, former directors, and all incumbent directors. They found all categories except former directors to be significant, and they found the market reaction to CEOs to be smaller than the other categories, which is similar to what we find when looking at short-term returns.

9.5 Hypothesis 5: Trade Volume

H5: Does the size of insider trades affect abnormal returns?

When testing this hypothesis, we first categorize the insider trades into categories based on trade volume, and then we aggregate the CAARs in each category and test for significance. We chose to use both absolute and relative sizes. This is because of the differences in wealth across investors. An investment of NOK 100 000 would likely be much more significant for a regular manager than it would be for a wealthy CEO or CFO. Additionally, absolute trade volume is highly correlated with trade volume so that the results may confound firm-size, and trade-volume effects. We used arbitrary values with consideration to their relative values within the set. Small absolute trades are defined as trades for NOK 50 000 or less, and amounts to around 12% of the sample. Medium absolute trades are trades in between NOK 50 000 and NOK 200 000, and amounts to around 33% of the sample. Large trades are trades over NOK 200 000, and amounts to 55% of the sample. We believe this categorizing to be reasonable when looking at the average income in Norway. NOK 50 000 amounts to a sizable 10,2% of the average Norwegian yearly income before taxes (2013)[16], and NOK 200 000 amounts to 40,9%.

[16] http://www.ssb.no/lonnansatt

When deciding on relative value of trades, we would ideally like to control for insider wealth, but unfortunately, we did not have access to this data. We did however have access to data on change in each insider's share positions. This will work as a proxy since the size of change is likely to be positively correlated with insiders' confidence in the firm. Insiders who has a strong belief in the future of their firm are more likely to purchase relatively more stocks than insiders with less confidence about the future. We used the same approach as with the absolute sizes, and chose relative sizes arbitrary. We also chose to include a new category for insiders who made their first purchase. We believe that, from an insider's perspective, the first trade could feel emotionally different from subsequent trades, meaning that the emotional toll on these insiders is bigger. Because of this, we hypothesize that the first purchase will convey a more credible signal. Additionally, the effort it takes to purchase stocks is probably higher the first time, which means that insiders would need to expect higher returns to justify the effort. To our knowledge, there have not been any other studies investigating such an effect. Small relative trades are defined as trades that change current standings with less than 20%, medium relative trades are defined as trades that change current standings between 20% and 50%, and large relative trades are trades that change current standings more than 50%. The small category amounts to around 55% of the sample, the medium category amounts to around 20%, the large category amounts to around 11%, and the first purchase category amounts to around 17% of the sample.

One should note that the proportion of firms in the small, medium and large category is quite different between absolute and relative size. This is a result of our arbitrary choice of categories, and because of the inclusion of the first trade category. However, all our categories should be large enough to discover any potential CAARs.

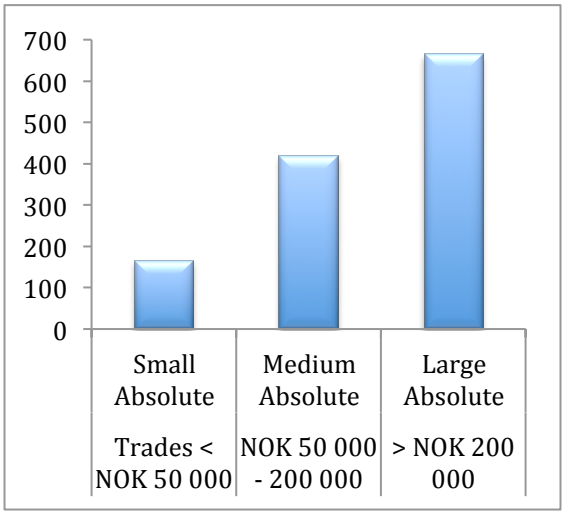


Figure 5a: Absolute trade volume

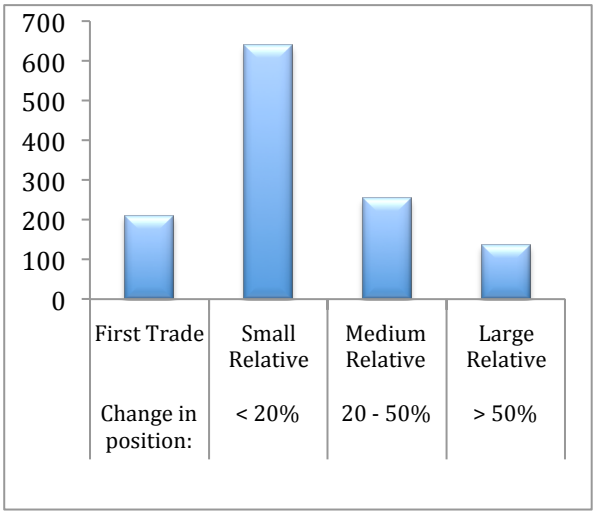


Figure 5b: Relative trade volume

	All	Small Absolute	Medium Absolute	Large Absolute	Small Relative	Medium Relative	Large Relative	First Trade
CAAR 1m	1.73%***	1.16%	2.76%***	1.22%*	0.320%	1.20%	3.67%***	5.06%***
	(0.00478)	(0.0109)	(0.00863)	(0.00660)	(0.00619)	(0.0102)	(0.0123)	(0.0150)
N	1249	166	419	664	638	253	136	210
CAAR 3m	1.44%	-1.13%	1.63%	1.96%	-2.24%	1.81%	11.3%**	5.40%*
	(0.0157)	(0.0243)	(0.0162)	(0.0272)	(0.0249)	(0.0239)	(0.0542)	(0.0303)
N	1216	160	410	646	620	243	130	212
CAAR 6m	-0.759%	-9.79%**	1.04%	0.415%	-6.9%***	0.320%	10.7%**	7.82%*
	(0.0146)	(0.0399)	(0.0259)	(0.0196)	(0.0187)	(0.0334)	(0.0415)	(0.0413)
N	1164	158	394	612	597	237	127	192

Panel 6a: ***Multifactor Model*** *– Cumulative abnormal returns trade volume*

	All	Small Absolute	Medium Absolute	Large Absolute	Small Relative	Medium Relative	Large Relative	First Trade
CAAR 1m	3.03%***	1.38%	2.56%***	3.73%**	2.61%	1.42%	2.50%	6.33%***
	(0.00989)	(0.0108)	(0.00845)	(0.0176)	(0.0164)	(0.0101)	(0.0237)	(0.0243)
N	1248	166	419	663	636	253	135	213
CAAR 3m	1.56%	-0.795%	2.56%	1.51%	-0.857%	0.537%	7.09%***	6.15%
	(0.0119)	(0.0236)	(0.0256)	(0.0144)	(0.0112)	(0.0224)	(0.0258)	(0.0521)
N	1218	162	410	646	619	248	133	207
CAAR 6m	-1.90%	-8.97%**	-0.049%	-1.24%	-7.9%***	-0.494%	9.88%**	5.69%
	(0.0150)	(0.0387)	(0.0247)	(0.0216)	(0.0211)	(0.0325)	(0.0409)	(0.0371)
N	1166	161	394	611	602	233	125	195

Panel 6b: ***Multifactor Model*** *– Cumulative abnormal returns trade volume*

1 Month

Using the market model, we find highly significant CAARs of 2.8% for absolute medium sized trades, and a CAAR of 1.9 % for absolute large trades, significantly larger than zero at a 5% level. Small absolute trades yield positive CAARs, but they are not statistically significant.

Using the multifactor model, we find some noticeable differences, both in regards to interference and economic size. For absolute size, medium volume trades remain highly statistically significant and high volume trades becomes significant at a 5% level using a two-sided t-test. However, while the CAAR of medium trades stay the same, we see that the CAAR of large trades increases to 3.7%. This is a quite big increase, and it indicates that there is a spurious relationship between large trades and firm characteristics. In other words, that large absolute purchases are undertaken more often in smaller firms and value firms that on average earn less than the market.

Looking at relative sizes, we now find that only first trades remain statistically significant with a CAAR of 6.3%. Large relative trades lose its significance due to standard errors doubling, and a 1.2% decrease in CAAR.

3 Months

In the three-month window, all of the absolute sized trades lose their significance. The size of the CAARs remains about the same, so the loss of significance is explained by higher variability in the abnormal returns.

In the market model, we find that CAARs for relative large sales has increased to 11.3%, which is statistically significant at a 5 % level. First purchases earn about the same CAAR, but they are now only significantly larger than 0 at a 5% level. Using the multifactor model, we find a sizable and highly significant CAAR of 7.1% for large relative purchases. First purchases still remain quite sizable with a CAAR of 6.2%, but is no longer significant.

6 Months

In the 6 months window, we find a couple of interesting results. The interference from the large relative purchase persists in both models persists. The size of the CAAR in the market model persists, while it increases to 9.9% in the multifactor model. The CAAR for first purchases in the market model increases to 7.8%, and remains significantly larger than 0 at a 5 % significance level.

It is also worth noting that CAARs of both relative and absolute small volume trades become highly significant with negative values in between 7%- 10%.

Results Discussion

Overall, our results confirm our hypothesis that trade volume is related to subsequent abnormal returns. More specifically, higher trade volumes seem to yield higher subsequent abnormal returns than lower volume trades. This makes economic sense because larger trades reflect a more positive outlook on the firm's prospects, and because the market interprets larger trades as a more credible signal. However, we do not find any significant differences in abnormal returns when looking at absolute trade volumes. Looking at relative values, we find significant differences in all models.

Relative trade volumes seem to give a better indication of future firm performance than absolute trade volumes, especially in the long run. This is also in line with what we expected because relative volume should better reflect the strength of the investor's belief. With the exception of the one-month model, absolute volume trades give no indication towards long run performance, while high relative trade volumes yield higher abnormal returns in the three-month period than in the one-month period. Abnormal returns in the six-month window also remain significant with the same size as in the three-month window. The fact that the CAAR for large relative purchases increases between the first and the third month, indicates that insiders trading in relative large volumes are able to predict future performance better than the market, implying that markets are not strong form efficient. This could also suggest that insiders are more thorough and considerate with their analyses when investing larger sums, and that they trade on stronger beliefs.

We also found that first time insiders earn significant abnormal returns. In fact, in the one-month window, the first trade category earned the highest abnormal returns. In the longer run, the large volume trades yielded the highest CAARs. This is an interesting finding. There could be a couple of reasons for first time investors to perform relatively better at short term compared to long term. One explanation could be that the markets interpret first purchases as a relatively strong signal and reacts on it. Another explanation could be that insiders making their first purchase trade based on specific short-term news-related events. In other words, that specific firm related news or events work as catalysts for the first trades. Strictly speaking, these insider trades would be in the legal grey area, but as mentioned in the legal section, this is not impossible.

Finally, we would like to comment on the negative six-month performance following small trades. The size of these negative abnormal returns is quite significant, and statistically significant in all models. One possible explanation for this could be that insiders do not really take future performance of the firms into consideration when making small adjustments to their position.

Overall, our findings are in line with former studies. However, comparisons are hard to make in this case as well, because both Zeckhauser et. al. and Fidermuc et. al used the fraction of firm equity traded in each transaction as a measure of relative trade volume. Fidermuc et. al. found the five day CAAR for trades of at least 0.1% of market cap to be 4.6%, and the five day CAAR for trades consisting of less than 0.1% of market cap to be 1.7%. Zeckhauser found the same short-term relationship, and in the long run they also found larger abnormal returns following large and medium trade sizes compared to small trade sizes. We would like to point out that we believe we better control for relative trade size by using change in holdings. This is because it better captures the strength of the belief of the insider trading. Using the fraction of firm equity as a measure of relative wealth takes account of confounding effects, but it does not effectively control for relative investor wealth.

9.6 Hypothesis 6: Abnormal Returns Prior to Announcement

H6: Is there any abnormal return on the day prior to the announcement of insider trades?

In order to test this hypothesis, we chose the following methodology. We drop all observations when the date of the insider trades coincides with the date of the announcement. This leaves us with the all the insider trades where the announcement of the insider trade is on the day following the insider trade. We then simply calculate the one-day abnormal returns on the day of the insider trade using the market model, and aggregate this across all firms. Because the insider trade is yet to be made public, we should see no abnormal return if no one trades on this information. In the event that someone manages to discover insider trades before they are made public, we should see abnormal returns.

	All Trades
CAAR	1.02%***
	(0.00181)
N	1204

Panel 7: One day abnormal return prior to announcement

As we can see, the abnormal return on the day of the trade is highly significant with abnormal returns of 1%. This is about the same as Inci, Lu and Seyhun (2010) found when using intraday prices in the US. This is a quite sizable one-day abnormal return. These results suggest that there are market participants that are able to discover insider trades and trade on this new information before the public announcement of the trade. It also suggests that the biggest adjustment to new information happens even before the announcement of the news.

9.7 Hypothesis 7: Short-Term Market Reactions

H7: Do insider purchases provide the markets with new information?

In order to test H2, we simply test the short-term cumulative abnormal return on the day of- and on the day following the announcement (0, 1]. Although our above results indicate that here is a quite large market reaction even before the announcement of the insider trade, we chose only look at the reaction prior to the announcement in order to be consistent with other studies. In doing this, we only use the market model to calculate normal returns. This is because SML and HML factors should have no immediate effect on short-term returns. One should note that some of the abnormal returns following insider trades might disappear if anyone discovers the insider trades before the public announcement. Therefore, these measures are not valid when measuring short-term abnormal returns to insiders. They simply test whether markets reacts to the announcement of insider trades.

	All Purchases	Smallcap	Midcap	Largecap	Value	MidBM	Growth	Small Value
CAAR	0.611%***	1.08%***	0.365%*	0.532%***	0.771%**	0.396%**	0. 938%***	0. 754%
	(0.00134)	(0.00308)	(0.00205)	(0.00132)	(0.00300)	(0.00182)	(0.00287)	(0.00656)
N	1285	328	628	260	306	681	229	102

Panel 8a: ***Market Model*** *– Two day cumulative abnormal returns firm characteristics*

	All	Top Management	Board Members	Managers	Primary Insiders	Others
CAAR	0.611%***	0.270%	0.364%	1.19%***	0.516%	0.657%***
	(0.00478)	(0.0117)	(0.0132)	(0.0104)	(0.0105)	(0.00746)
N	1285	246	235	218	92	494

Panel 8b: ***Market Model*** *– Two day cumulative abnormal returns insider position*

	All Purchases	Small Absolute	Medium Absolute	Large Absolute	Small Relative	Medium Relative	Large Relative	First Trade
CAAR	0.00611***	0.411%	0.581%**	0.681%***	0.446%**	0.547%**	1.17%***	0.775%*
	(0.00134)	(0.00358)	(0.00254)	(0.00174)	(0.00175)	(0.00253)	(0.00438)	(0.00423)
N	1285	176	428	681	649	268	138	218

Panel 8c: ***Market Model*** *– Two day cumulative abnormal returns trade volume*

Looking at panel 8 a-c, we find the 2 days cumulative abnormal return to be 0.61% and highly statistically significant. This confirms our hypothesis H2, and we conclude that insider trades produce new information to the markets, making markets more efficient. Our results are also in line with former research in other countries. Fidermuc et. al. (2006), reported a two-day CAAR following the announcement of 1.16%. However, the size of the two-day abnormal return is quite economically small, which would make it hard to make a strategy of short-term trading on insider purchases if one is not able to discover insider trades before they are made public. We also keep the results in hypothesis 6 in mind, and conclude that the total market reaction to insider trades is most likely larger than what the results in this section suggest.

It is also interesting to look at how the market interprets different types of insider trades. In other words, does differences in factors such as trade size, BM-ratios, market cap and insider type have an effect on the strength of the market reaction? In accordance with former research and economic theory, we argue that the market reaction should be strongest when informational asymmetries are large and when signals are credible.

When looking at the size of trades, our results are in line with the earlier research and economic theory. We find that the abnormal short-term return is highly significant for all types of trades except small absolute trades. However, the sizes of the CAARs differ quite much, with investors putting more weight on larger and relative sizes. The likely reason for this is that the market perceives these signals to be stronger and more credible. The reader should also note that these were the categories found to yield the highest abnormal returns in the long-run. It is also interesting to notice that the CAAR of the first time traders yields the largest short term market reaction when comparing across relative sizes, indicating that investors are aware of the high CAAR earned by these investors in the short run. However, they are not statistically different from larger relative trades.

When looking at different insider types, we find highly significant CAARs for the categories “Board Member”, “Managers”, and “Others”. The reaction to insiders’ trades in the “Board Member” and “Other” category are about the same, and half of that of “Managers”. Again, with the exception of “others”, it is interesting to see that the strongest market reaction follows the trades of the largest long-run abnormal returns.

It is noteworthy that the market does not react significantly to trades by top management. According to informational asymmetry theory, these insiders should have better information than other insiders should, and the market reaction should thus be largest following these trades. Fidermuc. et. al found that the market to react less to trades by CEOs, but they did find a statistically significant market reaction. As mentioned under the other hypothesis discussions, top management operates under greater scrutiny, and might therefore be extra careful when trading in their own firm.

When looking at firm categories, we find a couple of interesting results. We find highly significant CAARs in all categories except "Small-Value", which is the category that yields highest abnormal returns over all time periods. Other than that, the market reaction in all categories is about the same, with the exception of "Smallcap" and "growth", where abnormal returns are almost twice as big as in the other categories. It is not surprising that the market reacts so strongly to trades in these categories, as these are the categories where the informational asymmetries should be largest. It is however really interesting to see that trades in small-value firms do not lead to a significant market reaction. This suggests that the *market on average* is unaware of the huge abnormal returns earned by these firms following insider trades. We also note that standard deviation in short-term abnormal returns in the small firm category is 2-3 times larger than in other categories. This implies that the market reaction following insider trades in these firms varies a lot more than performance in other firms.

Overall, we do find evidence for the market reacting more strongly to insider trades where the informational asymmetries are large, and where the signals should be more credible. We also find evidence for the market reaction being stronger for the insider trades that earn the largest long-term abnormal returns, indicating that the market is aware of these returns. These results imply that the market is not strong form efficient. They also suggest that insider trades contribute to the informational efficiency of the markets.

Cross-sectional Multiple Regression on Abnormal Returns

In running the multiple regression, we regress the abnormal returns on firm size, P/B ratio, trade volume, and insider type. We chose to implement all factors as dummy variables in order to make sure that the explanatory variables are linearly independent of each other. We

chose our default dummies to be the categories with the smallest abnormal returns from our other regression. We thus use largecap, top management, midBM, and small trades as default dummies. That means that the constant measures abnormal returns earned by top management when they trade in small volumes in large firms with medium P/B ratios. We run regressions with both absolute and relative trades, but we will only show the results for relative trades because we made the same interference. We run two different models, one with both market cap and BM categories, and on with only the market cap category. The categories are the same as in the rest of the paper. We thus run the following regressions;

Model 1

$$Abnormal\ returns = \beta_0 + \beta_1 smallcap + \beta_2 midcap + \beta_3 mediumvolume + \beta_4 largevolume + \beta_5 firstpurchase + \beta_6 boardmember + \beta_7 managers + \beta_8 other + \beta_9 primaryinsider + \varepsilon_k \quad (39)$$

Model 2

$$Abnormal\ returns = \beta_0 + \beta_1 smallcap + \beta_2 midcap + \beta_3 mediumvolume + \beta_4 largevolume + \beta_5 firstpurchase + \beta_6 boardmember + \beta_7 managers + \beta_8 other + \beta_9 primaryinsider + \beta_{10} growth + \beta_{11} value + \varepsilon_k \quad (40)$$

	Model 1	Model 2
Smallcap	0.375%**	-0.182%
	(0.00165)	(0.00266)
Midcap	-0.333%**	-0.627%***
	(0.00168)	(0.00205)
Medium Purchase	0.0566%	-0.0158%
	(0.00352)	(0.00349)
Large Purchase	0.676%	0.480%
	(0.00452)	(0.00448)
First Purchase	0.238%	0.229%
	(0.00379)	(0.00374)
Board Member	0.0638%	0.0817%
	(0.00440)	(0.00435)
Manager	0.930%**	1.06%**
	(0.00451)	(0.00448)
Primary insider	0.318%	0.506%
	(0.00589)	(0.00583)
Others	0.356%	0.489%
	(0.00376)	(0.00373)
Growth		-0.0498%
		(0.00300)
Value		0.901%***
		(0.00156)
_cons	0.204%	0.169%
	(0.00339)	(0.00343)
R^2	0.010	0.035
N	1285	1285

Panel 8d: Two day abnormal return multiple regression

Overall, the results from the multiple regression analysis are in line with the results from the simple two day regression above. However, we notice that many of the categories from the simple regression become insignificant when we control for all variables.

Looking at model 1, we see that the market reaction to insider trades by managers is significantly larger than the market reaction following insider trades by top management. The market reaction to others is no longer significantly different than the market reaction to top management, and the reason is likely that we now control for trades size.

We also see that the market reaction following insider trades in small cap firms is significantly stronger than to insider trades in large cap firms. We also notice that insider trades in large cap firms are followed by stronger market reactions than insider trades in mid cap firms.

However, when looking at model 2 we notice something interesting. The small size dummy loses its significance, while the market reaction to insider trades in value firms becomes significantly larger than the market reaction following insider trades in mid BM firms. The reason for this is that many of the small firms also are value firms, and that these were the firms were insider trades lead to the largest market reaction. We also notice that the R^2 of the second model is larger, meaning that this model better explain abnormal returns.

In regards to the coefficients on medium and large trades, we see that both are positive, indicating that larger trades are followed by a stronger market reaction. They are however not significant.

Overall, the results of the multiple regressions suggest that trades by managers are followed by the strongest market reaction. One possible reason for this is the possibility that these managers are more likely to trade on news specific short term events. Our results also indicate that overall, the market reaction is largest in firms with recent financial distress, something that makes economic sense. We also note that the different market reaction is quite sizable, with differences up to 1%.

Using a comparable analysis, Fidermuc et. al (2006) came to similar conclusions as us. They found that the market reaction was stronger to trades made by managers and directors compared to trades made by CEOs. Further, using omitted dividends, interest coverage ratio, and earnings losses as control factors for financial distress, they found the market reaction to

be stronger in financial distressed firms. They did not find that trade size or firm size had any effect on the market reaction.

9.8 Hypothesis 8: Abnormal Returns Insider Strategy

H8: Is it possible to earn abnormal profits by following a strategy based on insider purchases?

	Insider - 3 months	Insider - 6 months	OSEBX	OSESX
Geometric Returns	29.9 %	18.0 %	11.9 %	3.9 %
Arithmetric Returns	37.4 %	22.4 %	13.8 %	5.3 %
Standard Deviation	33.6 %	27.0 %	18.4 %	15.9 %
Sharpe Ratio	1.03	0.73	0.61	0.16

Panel 8a: Annualized performance statistics insider portfolios

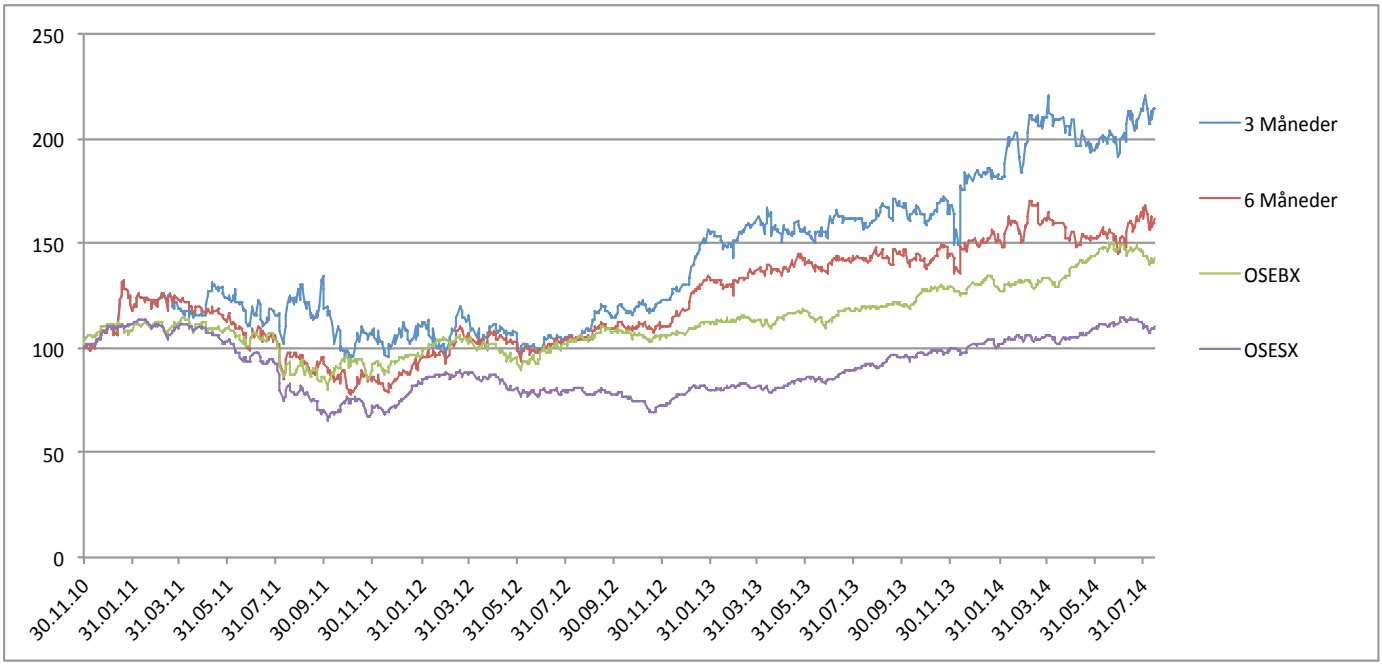


Figure 8: Insider portfolio performance

In panel 8a, we present a summary of statistics for the two insider portfolios and the two indexes. Confirming our prior results, we find that insider portfolio with a holding period of 3 months outperforms the 6 months holding period portfolio.

In the period 01.12.10-15.08.14, our 3 months insider portfolio has earned annualized returns of 37.4%, and our 6 months insider portfolios has earned annualized returns of 22.42%, both before transaction costs. In comparison, we see that the OSEBX has yielded an annualized return of 13.8%, and the OSESX an annualized return of 5.26%. However, we also notice the huge risk our portfolios have taken, with annualized standard deviations of 33.64% and 26.97% respectively. Given the fact that our insider portfolios contain large amounts of firm-specific risk, this comes as no surprise. Also, note the underperformance of the OSESX index compared to the OSEBX. Because our portfolio only consists of small cap stock, the outperformance of the index is remarkable.

It is also worth noting that, based on the Sharpe-ratios, both our portfolios outperform the benchmark portfolios - taking into consideration that our portfolios are undiversified.

In order to get a better picture of our portfolio performance, we turn to the other performance measurements. These measurements are more viable when considering whether to include the portfolio in a larger diversified portfolio, and because of this, we consider them more appropriate when measuring the performance of our portfolios. Based on the annualized rate of a Norwegian 10-year government bond – monthly publicized on Oslo Børs' webpage[17], we calculated the average annual risk-free rate to be 2,65%.

Insider - 3 months	Beta	M2	Treynor	Adjusted Treynor	Alpha	AR	IR	Adjusted R2
OSEBX	0.44	7.83 %	78.19 %	67.02 %	29.80 %	0.91	0.69	5.87 %
OSESX	0.54	13.77 %	64.25 %	61.64 %	33.35 %	1.03	0.96	6.41 %

Panel 8b: Three-month insider portfolio performance evaluation

Insider - 6 months	Beta	M2	Treynor	Adjusted Treynor	Alpha	AR	IR	Adjusted R2
OSEBX	0.42	2.31 %	46.89 %	35.73 %	15.06 %	0.57	0.3	8.25 %
OSESX	0.56	9.01 %	35.23 %	32.61 %	18.30 %	0.71	0.67	10.80 %

Panel 8c: Six-month insider portfolio performance evaluation

In the following, we will use the measurements found using the 3 months insider portfolio and OSESX as a benchmark when explaining the results.

As we can see, the betas are well below one. This is in line with betas of small-cap value firms elsewhere[18], and suggest our portfolios' returns are weakly related to fluctuations in

[17] http://www.norges-bank.no/Statistikk/Rentestatistikk/Statsobligasjoner-Rente-Daglige-noteringer/

[18] http://www.dows.com/Publications/growth_versus_value_investing.htm

the general market's returns. A beta of 0.54 implies that a 1% return in the market index, on average, is followed by a 0.54% return in the insider portfolio. We also note that betas are higher when comparing to the OSESX, suggesting that this is a more sensible benchmark that better track the portfolio.

As mentioned, M^2follows directly from the Sharpe ratios. $M^2$of 13.77% means that our portfolio would have outperformed the benchmark by 13.77% on a yearly basis, given the same level of risk. However, as with the Sharpe ratio the M^2inadequately captures the fact that our portfolios are undiversified.

Turning to the Treynor-ratio, which is a measure of systematic risk-adjusted performance, we are better able to incorporate the low beta values of our portfolios. A Treynor of 78.19% means that our portfolio earned an excess of 78.19% over the risk-free rate, per unit of market risk. When comparing to the market using the adjusted Treynor, we find that our portfolio outperforms the market by 67.02%, per unit of market risk. This is a huge Treynor ratio compared to other funds, and it suggests that our portfolios could be a valuable addition to a diversified portfolio.

Looking at Jensen's alpha, we find a remarkable α of 33.35%. This means that our fund has earned an excess of 33.35% annualized, compared to theoretically expected returns, calculated using the OSESX. In detecting whether the alpha is significant, we run regression tests in STATA where we regress the returns of our insider portfolios on the benchmark portfolios with both monthly and daily returns. All of the alphas have t-values in the 0.9-1.4 region, so none of the alphas found are statistically larger than zero.

Because our portfolios consist of so few stocks, it takes a huge active risk. Because of this, it is interesting to look at the AR ratio. We find an AR of 1.03, meaning that our portfolio earns an alpha of 1.03% per unit of active risk taken. This indicates that one could achieve substantial gains by including our portfolio in a diversified portfolio, where one could reduce systematic risk.

We further find an IR of 0.96, which also indicate outperformance of the market. Because high beta portfolios would outperform lower beta portfolios on IR-ratio in bull markets, it is not an ideal tool when comparing performances across funds. We did however manage to

find a list of Norwegian funds' IR the last 5 years. Even considering the low beta of our portfolio, our portfolio outperforms all other mutual funds based on the IR-ratio. [19]

The last value, R^2, measures how active a fund is. More specifically, it measures how much of the variability in the returns of our portfolio is explained by the variability in the returns of the benchmark. R^2 can range from 0 to 1, where R^2 equal to 1 can be interpreted as a "perfect match", as every movement of an asset can be explained based on the movement of its benchmark. Index funds strive to get as high R^2 as possible. R^2 for our portfolio relative to OSESX is 6.41%. This means that variability in the returns of OSEBX only explains 6.41% of the variability in the returns of our portfolio, which again means that our portfolio is extremely active. In relative terms, very active funds seldom operate with R^2s below 50%. Also here we see that OSESX yields higher a R^2 than OSEBX, again indicating that this is a more appropriate benchmark. We also notice that the R^2s are higher for the 6-months portfolio, something that is a result of the portfolio being more diversified.

Because the firms in our portfolio have experience financial distress, they are more likely than the average firm to go bankrupt. This means that the problem of survivorship bias is very prominent in our portfolio. In order to gauge the potential survivorship bias, we looked up all the firms that were removed from our sample due to it having too few days in the event window. We found that the all the firm were removed due to either name change, stock change, or change of size/value category. We therefore conclude that our portfolio contains no survivorship bias.

Results Discussion

Somewhat surprisingly, given the large amount of undiversified risk, our portfolios outperform the market on all of our performance measures. However, despite the indications of outperformance, we are unable to find any statistical significant alphas. Moreover, all reported values are before accounting for transaction costs and bid-ask spreads. Because of the rebalance mechanism, maintaining this portfolio would require a lot of trading,

[19] http://digilib.lib.unipi.gr/dspace/bitstream/unipi/4699/1/Gkogkaki.pdf

something that would lead to high transaction costs. Because all stocks in our portfolio are small stocks, it is reasonable to assume that the bid-ask spread can be substantial. It is also worth noting that one could question the use of OSESX as a benchmark. We therefore conclude that we are unable to find any statistically significant evidence of outsiders being able to outperform the market. In relation to the market efficiency hypothesis, this means that we cannot conclude that the market does not hold semi-strong form.

In relation to former studies, only Gelband's study is comparable. The methods for choosing firms are similar, and so are the methods of rebalancing the portfolios. The differences are that Gelband chose his firms based on size and R&D expenditures, and he held a more diversified portfolio. Also Gelband found his portfolio to outperform the market on conventional measures, but he was unable to find any long-lasting abnormal returns.

In general, we would not recommend this portfolio if investing *only* in this portfolio because the portfolio is not very diversified. We would rather suggest that this portfolio would be best combined in a larger diversified portfolio. Even though we find no statistical significant alphas, the evidence for outperformance is quite substantial. Even though the outperformance found in absence of transaction costs, we argue that one would be able to make a similar portfolio without significant transaction costs if one were to drop the rebalancing mechanism. One would therefore likely be able to increase ones risk-adjusted returns by including this portfolio in one's total portfolio.

9.9 Robustness Check Event Studies

Because the assumption on identically distributed standard errors is questionable, we also calculate test-estimators that are non-parametric and thus not subjected to the assumptions of standard errors being i.d.d. Non-parematric tests can be used without assuming normality. There are many potential non-parametric tests to chose from, but we decide on using the Wilcoxon signed-rank tests. We chose this test over the sign test and the corrado rank test because these tests have been shown to have poor performance over longer event windows. It shuld however be mentioned that Brown and Warner (1980) showed that the signed-rank test had lower power than the t-test. This means that it more often than the t-test fail to discover abnormal returns. The Wilcoxon signed-rank test ranks the absolute differences in

abnormal returns, and then test whether the median of the abnormal returns is larger than zero. This way outliers have a much smaller impact. The only assumpions required is that data are paired and come from the same population, that each pair is chosen randomly and independent, and that data are measured on at least an ordinal scale. For a more thourough description, we refer to Wilcoxon (1945) and Siegel (1956).

By looking at the abnormal return distributions and skewness and kurtiosis measures, we do find evidence of non-normal abnormal returns in most of our tests, meaning that the resiudals are not i.d.d. On further investigation, we found that the reason for this was outliers, which caused heavy tailes in the distribution of abnormal returns. MacKinlay advocates using non-parametric tests as a robustness check when this is the case. We use the Wilcoxon signed rank test as our non-parametric test, and report all p-values of both the the t-test and the Wilcoxon t-test in the appendix C.

Using the Wilcoxon t-test, we make different interference in 12 out of the 140 tests we performed. In six of the cases, the Wilcoxon t-test reported significant abnormal returns when the t-test reported highly insignificant abnormal returns. In the other six cases, the interference went from borderline insignificant to significant, or significant to boarderline insignificant. The reason for the different interference is that the outliers are weighted less heavily. In the cases when the interference went from highly insignificant to significant, we found that the distributions had more extreme negative abnormal returns than extreme positive abnormal returns.

In the cases with very different interference, the Wilcoxon t-test reported the overall abnormal returns to be significantly larger than zero in the three-month period in both the market model and the multifactor model. Analysing trade volume, the Wilcoxon t-test reported significant abnormal returns for medium absolute purchases in the three-month market model, for large relative purchases in the one-month multifactor model, and for first purchases in the three-month multifactor model. Analysing insider position, the Wilcoxon t-test reported significant abnormal returns to board members in the two-day model.

In the cases with small changes in interference, the most notable change is that the Wilcoxon t-test did not find any abnormal returns for board members in the six-month periods. The Wilcoxon test also reported significant two-day abnormal returns following trades by board members.

Overall, the conclusions of our t-tests are confirmed, with the exception of board members. However, the performed robustness check yields valuable insights to the three-month abnormal returns. It seems that in the average insider earn abnormal returns in a three-month window, but that there are many insiders that earn extreme abnormal returns, so that the average abnormal return earned by insiders is zero.

10. Weaknesses with our Models

Risk Measurement

We would argue that there are a couple of potential weaknesses with our multifactor model. This is because our calculation of the SMB and HML factors are questionable, and because we find SMB and HML portfolios to underperform compared to the market, which is the opposite of what we have seen in other countries. Additionally, we find somewhat surprising results when comparing our findings in the market model to the results in the multifactor model, which could imply that there is a misspecification in our multifactor model. Our calculation of the SMB and HML factors differs from Fama and Frenchs' calculations in that they construct three different portfolios in each category, and then take the average of these three portfolios. Because Oslo Stock Exchange has a lot fewer stocks than are found in the US market, we had to take the averages across the top and bottom 33% percentiles. Another potential weakness is that we also included firms listed at Oslo Axess when calculating the SMB and HML portfolios. Because Axess mostly consists of smaller firms, and has performed better compared to the small cap firms on the main exchange, it biases the SMB effect.

In addition, we do not control for momentum- and liquidity factors found in the Fama French five-factor model. This could potentially lead us to inadequately measure risk for the subsets consisting of small stocks. Illiquid stocks often trade on a premium, and not taking account for this premium could lead us to overestimate abnormal returns for these stocks.

However, we chose to include the multifactor model in our results because we believe it still yield some good insight and a better measure of risk than the market model. Additionally, we have an indication that our measurements are at least reasonable correct considering the strong underperformance of OSESX compared to OSEBX. However, because of the uncertainty imposed by this, one should be especially careful when looking at the results in the "Firm Characteristics Section". If our model inadequately captures the SMB and HML effects, it makes it harder to say whether the abnormal returns we found in fact is due to additional risk in these firms.

Survivorship Bias

Our model is quite prone to any potential survivorship bias in the long term. This is because we exclude all firms that cease to exist during the event window. This likely inflates the estimates of abnormal returns in the long run because firms with extremely negative abnormal returns are removed. This could particularly be a problem in the "value" and "small-value" categories. This is because firms in these categories are especially prone to going bust. This means that the abnormal returns in these categories are possible more inflated compared to the abnormal returns in the other categories.

Oslo Axess Listings

In our dataset, we use the listings as of September 2014 when allocating stocks to Oslo Axess or Oslo Stock Exchange. This could potentially lead to some bias. It is likely that some of the stocks currently listed on the main exchange previously were listed on Oslo Axess. Because of this, the use of OSEBX as the market could potentially bias the calculation of the normal returns for such firms, and thus the calculation of abnormal returns. However, we only found this to happen five times in the whole sample. We therefore believe this bias to be very small, and because of this we will not investigate further.

Outliers & Extreme Events

Some events can have a huge impact on firm prices. This could potentially affect our results in two ways. The first way is that these few outliers could have a very large impact on our calculated abnormal returns, which could lead to a bias if there are more extreme events in one direction; For example if there is a merger two weeks after an insider purchase. The other potential reason is that having extreme events in the estimation window could bias the calculation of normal returns. For example, if some event in the estimation window leads to a CAAR of 20% over 1 month, it would cause normal returns in the event window to be inflated, which again would decrease our estimation of abnormal returns. We have however decided not to adjust for these. With the first example, we argue that these events should be included because it gives a more accurate picture of the actual abnormal returns earned by insiders. We also believe that it is correct to include firms with extreme events in our insider

portfolio, as these better reflect the return we would make. With the second example, we argue that as long as extreme events are distributed evenly in regards positive and negative signals, it would not lead to any biases in the CAARs. Moreover, removing them would possible impose another even bigger bias, namely selection bias. If there were any systematic patterns to the kind of firms being removed, it could greatly bias our results. We therefore chose to include all firms with extreme events.

Unusual Returns in the Estimation Periods

As mentioned, estimating normal returns in unordinary periods such as recessions and booms could cause the normal returns to be inaccurately measured. In our sample period, we include the 2011 Euro crisis. The crisis had a quite profound effect on OSEBX, causing it to drop by almost 30% from the top in early April 2011 to the bottom in mid May 2011. However, we chose to include this period for two reasons. The first reason is that it gives us a lot more observations, which allows us to a greater extent investigate abnormal returns across small subsets. The other reason is that we use estimation windows consisting of about 10 months of daily returns. Seeing as this drop occurred in less than 2 months, we argue that the effect on the normal returns calculation is rather small.

Interference with Clustering

One weakness with our model over the 1, 3 and 6 months horizons is event clustering. Event clustering is when event windows of the included securities in the analysis overlap. This renders the independence assumption for abnormal returns incorrect because event clustering could induce covariance in abnormal returns across securities. On other words, one macroeconomic event at time t could affect all the abnormal returns of firms with date t in their event windows. This is particularly a problem when estimating abnormal returns over longer horizons. Event clustering could potentially lead to two things. The first thing is that it could bias the estimated CAARs. However, as long as these events are randomly distributed, it will not lead to a bias on average. Because it is reasonable to assume that this is the case, we should not worry about this given our large sample window. The biggest problem is that event clustering could bias the standard deviation estimate downward

because there is less variability in the abnormal returns across firms. This would lead to inflated test statistics, which could cause us to make wrong interference. In other words, it could cause us to wrongfully reject the null hypothesis, also known as a type 2 error. This effect is particularly pronounced when the sample selection is homogeneous, and when events tend to happen in the same period. On average, our sample consists of securities from a multitude of industries, which means that they are rather heterogeneous. However, this could be a problem in our subsamples where we examine CAARs across firm characteristics. However, our sample is quite prone to the second effect. Because insiders are inhibited from trading two months prior to earnings reports, and because earnings reports tend to come in the same period, it could mean that on average insider trading across all firms is clustered around the 8 months where insider trading is legal.

According to MacKinlay (1997), there are generally two ways of accommodating clustering. One is to use the Jensens-alpha approach where one aggregates abnormal returns into a portfolio, and then apply the analysis to the portfolio. This will address the problems because the variability of the portfolio returns will be influenced by the cross-correlation in the data. The other approach is to analyze the abnormal returns without aggregation. Khotari and Warner further explore ways of dealing with clustering in their 2006 paper.

In our model, we do not account for clustering. This is because it is a quite complicated process. The reader should also note that event clustering does not affect any of our conclusions regarding our insider portfolio. It is also worth to mentioning a couple of points that reduce the impact clustering have on our results. The first is that the problem of clustering is reduced when controlling for firm characteristics such as size and PB-values. We can see that some of our interference changes when using the multifactor model due to significant increases in standard errors. This suggests that the multifactor model takes clustering more into account. Moreover, Khotari and Warner (2006) points out that adjusting for clustering is critical with event windows that span over a year, but not as critical for shorter time periods. Khotari and Warner find that using the market model on an 11 day window, the results on specification is not profoundly altered in the event of clustering. They further find that goodness of fit test typically fail to detect misspecification in the model. However, we still urge the reader bear in mind the potential bias arising from clustering when reading our results.

Thin Trading

Another potential problem with event studies is thin trading. Thin trading simply means that stocks are seldom traded. As mentioned, this can lead to biases when calculating the beta, and thus normal returns and abnormal returns. Scholes and Williams (1997) found the beta of thinly traded securities to be underestimated by approximately 10%-20%. This would again inflate abnormal returns. On average, thin trading should not pose a problem to our model. It may however lead to a positive bias when estimating abnormal returns for small cap stocks.

Low Power of Long Horizon Tests

In their 2006 working paper, Khotari and Warner investigate the effect time-horizon has on power in event studies. Power is defined as the inability of a model to detect abnormal performance when it really exists. Using parameters of 10% and a sample size of 100 securities, they found the power of a one month event-window to be 99%, and the power of a six month event window to be 40%. Even for a sample size of 200 securities, they only found the power to be a little less than 70%. In other words, the model did not detect the 10 % abnormal returns in 40% of the samples. This is something that potentially could explain why our models fail to detect long term abnormal returns, especially in the subsamples, where we have fewer observations.

Inappropriate Choice of Benchmark in Regards to the Insider Portfolio and Survivorship Bias

Because of the firms in our insider portfolio likely differs from the stocks on OSESX in that our stocks are more risky, it is possible that OSESX makes for a poor benchmark. Because more risky stocks have higher expected returns, it means that part of the alphas found using the OSESX as an index could in fact be compensation for risk. A better idea would be to use a benchmark with a more similar risk profile. Because there are no indices of small-cap value firms on Oslo Stock Exchange, one potential idea would be to create a portfolio consisting of similar stocks and use this as a benchmark.

11. Proposition to Further Studies

In our research, we have made a couple of discoveries that we have not seen investigated in other studies. The first one is the strong subsequent performance in firms where insiders make their first purchase. It would be exciting to see whether the same relationship exists across countries.

Furthermore, to our knowledge, we are the first ones to investigate the relationship between short-term market reactions and actual long-term abnormal returns. All in all, the market seems to be rational in their reactions. We did however discover some cases where short-term reactions differed from what one would expect given long-term performance. It would be interesting to further investigate whether this in fact is a market anomaly, or if there are some rational explanations.

It is possible that our model fails to adequately capture risks. Given the weaknesses mentioned in regards to the SMB and HML portfolio, it would also be interesting to more accurately control for these factors. One idea would be to assign stocks on a half-yearly basis. It would also be interesting to control for liquidity and momentum. Controlling for these additional risk factors would allow for making better interference.

As mentioned in the weakness section, our model does not take into account potential event clustering. This possibly inflates our standard errors, and makes our model more prone to make type two errors. It would therefore be of interest to see whether the interferences we made holds when using other methods.

In regards to our insider portfolio, there are many potential ways to build on our results. One could for example try to construct portfolios based on different insider trade characteristics. One idea would be to include trade volume or insider type when constructing the insider portfolio. Another possibility would be to explore different holding periods. Yet another possibility would be to impose different rules in the insider portfolio. One could be to impose a maximum weight rule in order to reduce risk, and another could be to come up with a rule to reduce the number of transactions. As mentioned, having an equal weighted portfolio at all times imposes a lot of transaction costs. It would be interesting to see how well a less trading intensive strategy would do, as it would be much easier to estimate the transaction costs. It would especially be interesting to see whether our portfolio would

generate a significant alpha including transaction costs. Another way to improve on our studies would be to find a more appropriate benchmark. This would give more credibility to any potential alphas found.

12. Conclusion

In this study, we investigate abnormal returns made by insiders on Oslo Børs in both the short run and the long in the 01.01.2010-15.08.2014 period. We also analysed insider returns across insider positions, trade volume, market cap, and price-to-book values. These analyses were performed using an event-study methodology with both the market model and the multifactor model to calculate abnormal returns. Using the most profitable insider trades, we then developed an insider based strategy and analysed its performance using a portfolio-mimicking method.

In our short-run analysis, we looked at the two day market reaction to insider trades. We found the two day abnormal return across all insider trades to be 0.61%. Looking across firm characteristics, we found the market to react to trades in all subsets, with the strongest reaction to trades in small cap firms and growth firms, followed by value firms. Looking at trade size, we found the market to react to all trade volumes, with the exception of small absolute trades. The size of the market reaction increases as trade volume increase, with the biggest reaction following large relative trades. Looking at insider position, we found significant market reactions to trades by managers, others, and board members using a non-parametric test. The strongest reaction followed trades by managers. Because of confounding factors, we used a multiple regression analysis to better find the source of the market reaction. We found that when controlling for all factors, we found the greatest source of market reaction to be insider trades made by managers, and insider trades in value firms. These results suggest that the market is not strong-form efficient, and that there are informational asymmetries between insiders and outsiders. We also conclude that insider trades make the market more efficient, because insider information is incorporated into the market prices.

We also did an analysis on abnormal returns when the date of the insider trade and the date of the announcement of the insider trade differed. We found a highly significant abnormal return of 1 percent on the day of the insider trade when the trade had yet to be announced, suggesting that there are market participants who are able to immediately discover insider trades as they take place.

In our long-term analysis, we wanted to see whether insiders were able to better predict future performance than the market. We found that insiders on average earn a one month cumulative abnormal returns of 1.73% using the market model, and 3.03% using the multifactor model. However, these abnormal returns disappear when looking at a 3-month and 6-month window. These results suggest that on average, insiders are unable to predict long term firm performance. We also looked one-month abnormal returns following insider sales, and found no evidence that insiders on average earned any abnormal returns.

However, we did find evidence of abnormal returns in certain subsets. Notably, insiders in small firms earned statistically significant cumulative abnormal returns of 5.88% in the three months following the insider trades. Moreover, insiders in value firms earned statistically significant cumulative abnormal returns of 6.30 % in the three-month window, and 6.02% in the six-month window. These finds are in line with former studies and the informational asymmetry hypothesis. We also found evidence of extremely large abnormal returns in small, value firms. The abnormal returns persisted in all the periods investigated, and are likely a result of large informational asymmetries and financial distress.

When looking at insider positions, we found that managers and board members earn statistically significant abnormal returns in the month following insider trades. However, at longer horizons we only find evidence for abnormal returns in the managers and board members. In the one-month perspective managers earns the highest abnormal returns, while board members earn the highest abnormal returns in the three- and six-month perspective. We argue that the reason for this is that board members have a better idea of the firm direction, and are not subjected to as much scrutiny as top management.

We also looked at trade size. When looking at absolute trade size, we found significant returns in a one- month perspective for medium and large trades. When looking at relative sizes, we found evidence for large abnormal returns in the three- and six-months periods following the large insider trades. We also found that the insiders making their first insider purchases tend to earn large significant abnormal returns in a one-month perspective.

Finally, we constructed an insider portfolio with small, value firms using the portfolio mimicking method, and measured its' performance. Our analysis indicates that our portfolio

outperformed the markets, but we did not find any statistically significant alphas, meaning that we conclude that markets are at least semi-strong efficient.

13. References

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14. Appendix

Appendix A – Descriptive Statistics

A1: Insider transactions by year

Year	2010	2011	2012	2013	2014
OSEBX Return	18.35 %	-12.46 %	15.36 %	23.59 %	
Purchase	354	428	257	330	190
Sale	114	77	62	121	65
Purchase-to-Sale Ratio	3.1	5.6	4.1	2.7	2.9

A2: Insider Transactions by month

Month (2010-2013)	Jan	Feb	Mar	Apr	Mai	Jun	Jul	Aug	Sep	Okt	Nov	Des
Purchases	44	184	141	78	200	134	41	144	125	75	112	91
% of total # Purchases	3.2 %	13.4 %	10.3 %	5.7 %	14.6 %	9.8 %	3.0 %	10.5 %	9.1 %	5.5 %	8.2 %	6.6 %
Sales	21	55	49	7	37	19	12	20	29	23	77	25
% of total # Sales	5.6 %	14.7 %	13.1 %	1.9 %	9.9 %	5.1 %	3.2 %	5.3 %	7.8 %	6.1 %	20.6 %	6.7 %
Purchase-to-Sale Ratio	2.10	3.35	2.88	11.14	5.41	7.05	3.42	7.20	4.31	3.26	1.45	3.64

A3: Example of insider data

Publ.Date	Date	Ticker	Position	Action	Price	Value.In.NOK	Change	Holdings.after.trade
12.05.2010	11.05.2010	GSF	CEO	BUY	17	178500	18 %	60000
12.05.2010	11.05.2010	ASC	primary insider	BUY	6.7	2680000	1 %	35400000
12.05.2010	11.05.2010	ASC	primary insider	BUY	6.7	1005000	26 %	575000
12.05.2010	11.05.2010	ASC	chairman	BUY	6.7	670000	5 %	2090934
12.05.2010	11.05.2010	ASC	board member	BUY	6.7	268000	67 %	60000
12.05.2010	11.05.2010	REC	SVP Technology & CTO	SELL	18.21	206392	-2 %	492023
13.05.2010	12.05.2010	SPOG	related to Morten André Yttreeide	BUY	33	99000	100 %	3000
13.05.2010	12.05.2010	NORH	main shareholder	BUY	1.97	82740	0 %	12559126
13.05.2010	12.05.2010	HRG	managing director	BUY	5.3	503453	8 %	1119040
13.05.2010	12.05.2010	HRG	board member	BUY	5.3	53000	50 %	20000
13.05.2010	12.05.2010	HRG	board member	BUY	5.33	266500	100 %	50000
13.05.2010	12.05.2010	AFG	related to Tore Thorstensen, primary insi	BUY	38.5	3850000	37 %	272000
13.05.2010	12.05.2010	AKBM	controller	BUY	1.63	40750	100 %	25000
14.05.2010	13.05.2010	STB	board member	SELL	42.5	54825	-100 %	0
17.05.2010	14.05.2010	TSU	board member and vice president busine	BUY	0.27	61470	7 %	3450924
17.05.2010	14.05.2010	DAT	chairman	BUY	8.4	210000	30 %	84684
17.05.2010	14.05.2010	DAT	CFO	BUY	8.4	84000	14 %	70000
17.05.2010	14.05.2010	DAT	CTO	BUY	8.4	84000	14 %	71596
17.05.2010	14.05.2010	DAT	group controller	BUY	8.4	84000	100 %	10000
17.05.2010	14.05.2010	EKO	related to Nora F. Larssen, board membe	BUY	125.25	142323830	21 %	5455194
17.05.2010	14.05.2010	KOM	related to Peter A. Ruzicka and Nils Selte	BUY	37	2264696	1 %	9482053
17.05.2010	14.05.2010	HEX	CFO	BUY	6.93	6930	100 %	1000
17.05.2010	14.05.2010	DNO	chairman	SELL	8.28	16550000	-6 %	30102504
19.05.2010	18.05.2010	AKBM	board member	BUY	1.61	201250	100 %	125000
19.05.2010	18.05.2010	MHG	senior accounting manager	SELL	5.85	35100	-51 %	5756
20.05.2010	19.05.2010	APP	board member	BUY	2.5	1265000	54 %	942694
20.05.2010	19.05.2010	KOM	related to Peter A. Ruzicka and Nils Selte	BUY	37	41403	0 %	9482053
20.05.2010	19.05.2010	GYL	chairman	BUY	280	25200	0 %	1997191
20.05.2010	19.05.2010	NORTH	chairman	BUY	20.4	102000	0 %	1341610
21.05.2010	20.05.2010	STB	related to Annika Lundius, board membe	BUY	39.2	101920	100 %	2600
21.05.2010	20.05.2010	MORG	primary insider	BUY	185	34225	8 %	2185
21.05.2010	20.05.2010	GSF	related to Per Grieg, chairman	BUY	18.1	905000	0 %	48558010
21.05.2010	20.05.2010	HNA	CEO	BUY	62.5	75000	8 %	15756
21.05.2010	20.05.2010	ASD	chairman	BUY	27.61	138031	40 %	12500
21.05.2010	20.05.2010	ASD	CEO	BUY	27.07	93409	16 %	22015
21.05.2010	20.05.2010	ASD	group finance director	BUY	27.5	275000	20 %	50375
21.05.2010	20.05.2010	ASD	non-executive director	BUY	27.28	83213	100 %	3050
21.05.2010	20.05.2010	SADG	risk manager	SELL	120	20520	-5 %	3462
21.05.2010	20.05.2010	DNBNOR	employee elected board member	SELL	62.1	62100	-87 %	151
24.05.2010	21.05.2010	TOM	SVP technology	BUY	25.2	151200	20 %	29600
24.05.2010	21.05.2010	TFSO	chairman	BUY	6.99	27960	4 %	105250
24.05.2010	21.05.2010	HNA	CEO	BUY	59	47200	5 %	16556
24.05.2010	21.05.2010	ASD	non-executive director	BUY	27	270000	67 %	15000
24.05.2010	21.05.2010	GSF	related to Per Grieg, chairman	BUY	17.04	851795	0 %	48608010
24.05.2010	21.05.2010	TFSO	CEO	BUY	6.99	48930	0 %	2857649
24.05.2010	21.05.2010	SVEG	chairman	BUY	42.67	640050	68 %	22200
26.05.2010	25.05.2010	SCH	EVP	BUY	124.26	62130	6 %	8157
26.05.2010	25.05.2010	ASC	board member	BUY	5.9	118000	50 %	40000
26.05.2010	25.05.2010	ODF	primary insider	BUY	38.62	1931000	31 %	163900
26.05.2010	25.05.2010	HNA	board member	BUY	57.6	46080	100 %	800
26.05.2010	25.05.2010	HNB	board member	BUY	55.5	11100	100 %	200
26.05.2010	25.05.2010	ASD	non-executive director	BUY	26	130000	25 %	20000
27.05.2010	26.05.2010	COMROD	chairman	BUY	12.7	3248089	4 %	5787278
27.05.2010	26.05.2010	TSU	board member and vice president busine	BUY	0.25	187660	18 %	4214924

Appendix B: Tests for differences in means

In the following, we will present the p-values of the two-sided t-tests that test whether differences between groups are statistically different. Differences that are found significant at a 5% level using a one-sided t-test are marked with a star (*).Significant values at a 5% level are bold and underlined.

B1: Market Model 2 days

Firm Size	Midcap	Largecap
Smallcap	**0.056**	0.106
Midcap		0.493

BM-Ratio	MidBM	Growth
Value	0.286	0.688
MidBM		0.112

Absolute Volume	Medium	Large
Small	0.698	0.499
Medium		0.747

Relative Volume	First	Medium	Large
Small	0.473	0.743	0.124
First		0.644	0.512
Medium			0.215

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	**0.090***	**0.019**	0.120	0.163
Board Member		0.849	0.522	0.791
Top Management			0.274	0.617
Other				0.755

B2: Market Model 1 Month

Firm Size	Midcap	Largecap
Smallcap	**0.000**	**0.000**
Midcap		**0.000**

BM-Ratio	MidBM	Growth
Value	**0.001**	**0.002**
MidBM		0.968

Absolute Volume	Medium	Large
Small	0.252	0.936
Medium		0.167

Relative Volume	First	Medium	Large
Small	**0.004**	0.398	**0.016**
First		**0.040**	0.475
Medium			0.143

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.51	0.395	**0.043**	**0.019**
Board Member		0.901	0.328	0.159
Top Management			0.361	0.169
Other				0.487

B3: Multifactor Model 1 Month

Firm Size	Midcap	Largecap
Smallcap	0.219	**0.000**
Midcap		0.238

BM-Ratio	MidBM	Growth
Value	0.574	**0.011**
MidBM		0.321

Absolute Volume	Medium	Large
Small	0.389	0.245
Medium		0.531

Relative Volume	First	Medium	Large
Small	0.205	0.580	0.971
First		**0.070***	0.261
Medium			0.710

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.390	0.665	0.926	**0.004**
Board Member		0.114	0.539	0.210
Top Management			0.736	**0.0164**
Other				0.105

B4: Market Model 3 Months

Firm Size	Midcap	Largecap
Smallcap	**0.018**	**0.002**
Midcap		0.639

BM-Ratio	MidBM	Growth
Value	**0.009**	**0.011**
MidBM		0.640

Absolute Volume	Medium	Large
Small	0.345	0.386
Medium		0.899

Relative Volume	First	Medium	Large
Small	**0.052***	0.219	**0.025**
First		0.380	0.346
Medium			0.112

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.778	0.449	**0.024**	**0.082***
Board Member		0.334	**0.016**	**0.051***
Top Management			0.159	0.459
Other				0.400

B5: Multifactor Model 3 Months

Firm Size	Midcap	Largecap
Smallcap	**0.014**	**0.002**
Midcap		0.869

BM-Ratio	MidBM	Growth
Value	**0.007**	0.108
MidBM		0.321

Absolute Volume	Medium	Large
Small	0.336	0.391
Medium		0.74

Relative Volume	First	Medium	Large
Small	0.190	0.529	**0.005**
First		0.340	0.871
Medium			**0.064***

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.524	**0.018**	**0.001**	**0.006**
Board Member		**0.035**	**0.013**	**0.022**
Top Management			0.713	0.889
Other				0.808

B6: Market Model 6 Months

Firm Size	Midcap	Largecap
Smallcap	**0.004**	**0.067***
Midcap		**0.061***

BM-Ratio	MidBM	Growth
Value	**0.000**	0.146
MidBM		**0.012**

Absolute Trade Volume	Medium	Large
Small	**0.024**	**0.021**
Medium		0.873

Relative Trade Volume	First	Medium	Large
Small	**0.001**	**0.051***	**0.000**
First		0.174	0.621
Medium			**0.058***

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.739	0.122	**0.003**	0.334
Board Member		**0.062***	**0.001**	0.210
Top Management			0.285	0.671
Other				0.154

B7: Multifactor Model 6 Months

Firm Size	Midcap	Largecap
Smallcap	**0.005**	0.115
Midcap		**0.043**

BM-Ratio	MidBM	Growth
Value	**0.000**	**0.089***
MidBM		**0.020**

Absolute Trade Volume	Medium	Large
Small	**0.079***	**0.053***
Medium		0.739

Relative Trade Volume	First	Medium	Large
Small	**0.002**	**0.050**	**0.000**
First		0.230	**0.054***
Medium			**0.064***

Insider Position	Board Member	Top Management	Other	Primary Insider
Manager	0.913	**0.062***	**0.002**	**0.079***
Board Member		**0.050**	**0.001**	**0.063***
Top Management			0.628	0.803
Other				0.384

Appendix C: Non-parametric test output

In the following panel, we report the p-values of both the t-test and the Wilcoxon ranked sign test. The p-values are reported by category, and values found significant at a 5% significance level using a one-sided t-test are marked with a star (*). Significant values at a 5% level are bold and underlined. The gray shades indicate where the two tests make different interference. Heavy shading indicates a strong difference in interference, and weak shade indicates a small difference. Red p-values indicate negative coefficients. We refer to the market model as MM and the multifactor model as MF.

C1: P-values parametric and non-parametric tests

Firm Category

t-test p > |t|	All Trades	Smallcap	Midcap	Largecap	Value	MidBM	Growth	Small Value
MM 2 days	**0.000**	**0.001**	**0.076***	**0.000**	**0.011**	**0.030**	**0.001**	0.253
MM 1 Month	**0.000**	**0.000**	0.727	0.366	**0.000**	0.480	0.499	**0.000**
MM 3 Months	0.361	**0.001**	0.521	0.686	**0.001**	0.429	0.783	**0.000**
MM 6 Months	0.603	0.152	**0.001**	0.202	**0.041**	**0.000**	0.931	**0.000**
MF 1 Month	**0.002**	**0.000**	0.163	0.562	**0.000**	0.102	0.199	**0.000**
MF 3 Months	0.191	**0.001**	0.647	0.573	**0.002**	0.363	0.604	**0.000**
MF 6 Months	0.206	0.248	**0.001**	0.212	**0.042**	**0.000**	0.646	**0.000**
Wilcoxon p > |z|	**All Trades**	**Smallcap**	**Midcap**	**Largecap**	**Value**	**MidBM**	**Growth**	**Small Value**
MM 2 days	**0.000**	**0.001**	**0.037**	**0.000**	**0.007**	**0.003**	**0.002**	0.195
MM 1 Month	**0.001**	**0.000**	0.892	0.846	**0.000**	0.549	0.751	**0.000**
MM 3 Months	**0.010**	**0.004**	0.608	0.076	**0.000**	0.842	0.634	**0.000**
MM 6 Months	0.706	0.198	0.064	0.246	**0.013**	**0.000**	0.749	**0.000**
MF 1 Month	**0.000**	**0.000**	0.519	0.663	**0.000**	0.269	0.337	**0.000**
MF 3 Months	**0.014**	**0.002**	0.788	0.944	**0.002**	0.703	0.825	**0.000**
MF 6 Months	0.354	0.275	**0.043**	0.295	**0.020**	**0.000**	0.530	**0.000**

Trade Volume

t-test p > |t|	All Trades	Small Absolute	Medium Absolute	Large Absolute	Small Relative	Medium Relative	Large Relative	First Purchase
MM 2 days	**0.000**	0.253	**0.023**	**0.000**	**0.011**	**0.032**	**0.008**	**0.069***
MM 1 Month	**0.000**	0.288	**0.001**	**0.067***	0.606	0.241	**0.003**	**0.001**
MM 3 Months	0.361	0.642	0.314	0.471	0.369	0.450	**0.040**	**0.077***
MM 6 Months	0.603	**0.015**	0.689	0.832	**0.000**	0.924	**0.011**	**0.060**
MF 1 Month	**0.002**	0.204	**0.003**	**0.034**	0.112	0.163	0.293	**0.010**
MF 3 Months	0.191	0.737	0.318	0.293	0.444	0.811	**0.007**	0.240
MF 6 Months	0.206	**0.022**	0.985	0.566	**0.000**	0.879	**0.017**	0.126
Wilcoxon p > |z|	**All Trades**	**Small Absolute**	**Medium Absolute**	**Large Absolute**	**Small Relative**	**Medium Relative**	**Large Relative**	**First Purchase**
MM 2 days	**0.000**	0.081	**0.006**	**0.000**	**0.006**	**0.029**	**0.014**	**0.001**
MM 1 Month	**0.001**	0.505	**0.001**	0.107	0.441	0.306	**0.002**	**0.003**
MM 3 Months	**0.010**	0.920	**0.044**	0.055	0.925	0.268	**0.016**	**0.008**
MM 6 Months	0.706	**0.029**	0.197	0.703	**0.010**	0.690	**0.017**	0.340
MF 1 Month	**0.000**	0.227	**0.000**	**0.028**	0.137	0.187	**0.001**	**0.003**
MF 3 Months	**0.014**	0.908	0.099	0.057	0.745	0.489	**0.009**	**0.018**
MF 6 Months	0.354	**0.037**	0.366	0.372	**0.002**	0.785	**0.027**	0.377

Insider Position

t-test p > |t|	All Trades	Top Management	Board Members	Managers	Primary Insiders	Others
MM 2 days	**0.000**	0.341	0.370	**0.000**	0.202	**0.002**
MM 1 Month	**0.000**	**0.09***	**0.077***	**0.001**	0.972	0.249
MM 3 Months	0.361	0.315	**0.001**	**0.003**	0.904	0.346
MM 6 Months	0.603	0.527	**0.034**	0.097	0.934	**0.005**
MF 1 Month	**0.002**	**0.007**	**0.092***	**0.001**	0.756	0.107
MF 3 Months	0.191	0.617	**0.028**	**0.001**	0.477	0.232
MF 6 Months	0.206	0.260	**0.066***	**0.094***	0.389	**0.002**
Wilcoxon p > |z|	**All Trades**	**Top Management**	**Board Members**	**Managers**	**Primary Insiders**	**Others**
MM 2 days	**0.000**	0.180	**0.040**	**0.000**	0.518	**0.002**
MM 1 Month	**0.001**	**0.014**	0.125	**0.008**	0.630	0.223
MM 3 Months	**0.010**	0.677	**0.001**	**0.024**	0.551	0.811
MM 6 Months	0.706	0.370	0.082	**0.034**	0.780	**0.010**
MF 1 Month	**0.000**	**0.003**	0.108	**0.005**	0.811	0.111
MF 3 Months	**0.014**	0.851	**0.001**	**0.010**	0.441	0.872
MF 6 Months	0.354	0.319	0.120	**0.033**	0.351	**0.006**