Jørn Olav Strande Gamlemoen & Kristian Bornstedt

The Effects of Reverse Stock Splits

- Of the Oslo Stock Exchange 1996-2015

Sammendrag

Vi studerer effekten av aksjespleiser på avkastning, likviditet og volatilitet i aksjer på Oslo Børs i perioden 1996 - 2015. En aksjespleis er i teorien en kosmetisk endring i aksjen som i utgangspunktet ikke vil ha innvirkning på avkastning til aksjonærene. Allikevel indikerer en rekke studier fra det amerikanske aksjemarkedet at aksjespleiser medfører en negativ avkastning. Våre funn er i samsvar med disse, og vi finner en negativ effekt på avkastningen rundt kunngjøringsdato og gjennomføringsdatoen for en aksjespleis på det norske aksjemarkedet. Videre tyder våre funn på at en aksjespleis øker likviditeten, noe som gjør aksjen mer omsettelig. I perioden etter gjennomføringen ser vi en nedgang i volatilitet, noe som gjør aksjen mindre risikabel og mer stabil.

Abstract

We study the effect of reverse stock splits on the return, liquidity and volatility of stocks at the Oslo Stock Exchange in the period 1996 - 2015. A reverse stock split is theoretically a noneconomic cosmetic change to the stock and should not increase or decrease shareholder return. However, as indicated by numerous studies from the US stock market, reverse splits show decreasing return effects for the stockholders. Our findings are consistent with those from the US, and we find a negative return effect on the announcement and execution date of reverse splits at the Norwegian stock market. Furthermore, our findings indicate an increase in liquidity, making the stocks more marketable, whereas the period after a reverse split shows a reduction in volatility, making the stock less risky and more stable.

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Preface

This thesis is as a part of the Master of Business and Administration program at Oslo Business School, within the field of Finance. It represents the end of an exciting, challenging and interesting journey as students for both of us.

The working process with this thesis has been a great educational experience. During the process, several challenges have occurred, but with hard work and strong passion, we have come forward with interesting findings upon a subject not much researched on the Norwegian stock market. The study has taught us the importance of small details and that unexpected problems are likely to occur when working with large datasets. Furthermore, we have enjoyed our time working with this thesis, and we are happy to feel that we both have put our best efforts to it.

We would like to thank our supervisor Einar Bakke for his intellectual, academic and professional guidance throughout our work with this thesis. In addition, we would like to thank Katrine Skagen Bornstedt for helpful comments. Finally, we wish to thank each other for the many discussions, the great teamwork, and our common willingness to solve complex problems.

Oslo, May 2016.

Jørn Olav Strande Gamlemoen & Kristian Bornstedt

Content

1 Introduction

Although debated, capital markets are in theory efficient and therefore it should be "impossible" to beat the market. This implies that the stock prices always reflect all relevant information available (Fama, Fisher, Jensen & Roll, 1969). However, there are many examples of market anomalies that violates the efficient market hypothesis, and financial newspapers daily writes about investors beating the market earning high profits. This paper will look at reverse stock splits at the Oslo Stock Exchange. It will contribute to the research on whether or not this corporate event will affect the return of the stockholders, and if it violates the assumption of efficient markets.

1.1 Introduction to Reverse Stock Splits

Except minor transaction costs, a stock split is theoretically a noneconomic cosmetic change to the stock and will not increase or decrease shareholder wealth as the cash flow of the firm remains the same. Every stockholder will also hold the same percentage of shares in the company after a split, as all changes are proportional. However, numerous studies on capital markets shows that prices of securities can fluctuate based on information regarding firm events, such as stock splits (Fama et al., 1969). The tendency from previous studies are that direct splits signals a positive market reaction, whereas reverse splits signals a negative one.

A reverse stock split is the opposite corporate event of a normal stock split both when it comes to the handling of the number of shares and how the market looks upon it. Reverse stock splits will immediately increase a stock price by the size of a chosen split factor, which will also decrease the number of outstanding shares at the same factor. Naturally, the market capitalization of the stock will remain the same. The counterpart, direct stock splits are the exact opposite with reduction of the price of the stock, whereas the number of shares increase proportionally. Reverse stock splits are a matter well known in finance, but there is conducted nowhere near as many studies upon the matter as direct stock splits. Grinblatt, Masulis and Titman (1984), amongst others argue that direct splits are anomalies and seem to contradict the efficient market hypothesis. Even in many textbooks and in academic literature direct stock splits are claimed to be a way to increase stock return (Bodie, Kane & Marcus, 2014). In addition, the Oslo Stock Exchange proposes that a direct stock split might make the

price and the liquidity of the stock increase[1]. Therefore, it is natural to conjecture that its counterpart, reverse stock splits, will have a negative impact on the stocks' return. This phenomenon has been narrowly studied using Norwegian data, and this thesis will therefore shed light on this cosmetic corporate event.

1.2 Potential Motives for Reverse Splits

It is important to run through some of the possible explanations to broaden the understanding of why a firm would conduct this firm event when it supposedly does not add any firm-value. Maybe the most important motive for reversed spilt is that many stock exchanges have requirements of obligations a company have to meet in order to remain listed. This also includes Oslo Stock Exchange who in the document "Continuing obligations of stock exchange listed companies" has the requirement:

> The market value of the company's shares shall not be lower than NOK 1. If the market value has been lower than NOK 1 for a six-month period, the board shall implement measures to satisfy the requirement as quickly as is practically possible and in any case no later than four months after the expiry of the six-month period (Oslo Stock Exchange, 2016, 7: 2.4).

If unable to meet this obligation, the company have to initiate the following action:

> If the company is not able to ensure that the requirement is satisfied by other measures, the company shall, no later than four months after receiving notice from Oslo Bors, call a general meeting to consider a proposal for a reverse split of the company's shares (Oslo Stock Exchange, 2016, 7: 2.4).

This implies that many companies have to perform a reverse split to remain listed and tradeable at the exchange. However, there are multiple examples of other motives for performing a reversed split and for instance, Peterson and Peterson (1992) points out other motives for reverse splits based on the U.S stock market. Among these are putting the price of the stock in an optimal price-range. This to avoid the negative association of being a penny

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[1] http://www.oslobors.no/Oslo-Boers/Om-Oslo-Boers/Minileksikon (02.03.2016).

stock – a low price stock. Placing the stock in an optimal price range will also reduce the transaction costs for the stockholders. Another interesting aspect pointed out by Peterson and Peterson (1992) is that it will become easier for the company if they aim to go private. This is because the reversed split supposedly will squeeze out the number of small investors, as stockholders in some markets are not allowed to own fractional shares or trading blocks. Furthermore, Terrence and Webb (2008) who found that the expenses of servicing a small group of investors are less than servicing a larger number of investors, also shares this view. A second motive given by Terrence and Webb (2008) is the possibility of improved share marketability due to the previously mentioned optimal price range.

The motives mentioned above indicate that there are more reasons to perform a reverse split other than potential delisting. However, as already mentioned it is puzzling why firms wants to go through the merely cosmetic event as a reversed stock split. This is especially relevant because most studies indicate that reversed split is something that signals negative information regarding the company.

1.3 Announcement and Execution Date

When an Oslo Stock Exchange listed company chooses to go through a reverse split, the company is obliged to fill out the standardized form "Key information relating to share split" (Appendix 1), which is delivered to Oslo Stock Exchange. In the document, the company gives key information on the split ratio, the new number of shares, and whether if it is a direct or a reverse split. The company also have to announce the date of approval (announcement date), and the execution date (ex-date) which is the trading day the split becomes effective. This information is published to the public via the Oslo Stock Exchange announcement system Newsweb.no and corporate messages, indicating that a corporate event is going to take place.

Wooldridge and Chambers (1983) suggest that in less than perfect capital markets, trading and information imperfections may cause stock price to react to reverse splits on the day the board proposes the reverse split (announcement), and on the day the reverse split becomes effective (ex-date). Therefore, these dates will later be used in our study to measure the impact of reverse splits on the stocks' return. This was also what Grinblatt, Masulis & Titman (1984) found, who on a study on direct stock splits found significant positive abnormal return

on the announcement date at 3% and 1% on the ex-date respectively. The reasons for this are debated, but as we will come back to later, multiple studies indicate the same, both with direct and reverse splits.

1.4 Research Question

Our study uses the event study methodology, and its primary objective is to provide empirically support for an explanation for the reverse split return effect around the announcement and execution date on the Oslo Stock Exchange. Hence, the research question:

"Is there a relationship between reverse stock splits and the return of the stocks at the Oslo Stock Exchange?"

There is, as far as we know not conducted any larger studies regarding reverse stock splits effects at the Oslo Stock Exchange. The only one that briefly dig into the topic is the Master Thesis of Barkovitch and Elboth (2013). Their study focuses mainly on direct stock splits, with the conclusion that direct splits do not cause abnormal returns in the Norwegian market. However, in their brief discussion on reverse splits, they do not find any market reaction around the announcement date, but they do find a significant negative market reaction on the ex-date. This is interesting because in theory the reverse split is purely a cosmetic change to the number of stock, and should not be expected to influence return. Furthermore, it is also interesting that according to efficient market theory the ex-date effect should already be reflected in the stock price from the announcement date. Studies from other markets indicate that direct and reverse splits are related market anomalies where direct splits can increase the shareholder wealth with positive abnormal returns, and reverse splits will decrease it with negative abnormal returns. Therefore, the question regarding returns should interest investors currently holding a stock in a firm that considers conducting a reverse split, either to meet the 1 NOK listing obligation or to raise the stock price up to a more optimal price level.

Furthermore, since the academic literature and the Oslo Stock Exchange itself specifies that a stock split might be a way to enhance the liquidity, we want to analyze whether a reverse split has this desired effect. Specifically, if it does increase the liquidity of a stock. What is also puzzling is that because reverse stock splits are a cosmetic firm event one might think the volatility of the stock should not be changing. However, due to the incremental price levels

when the share price drops below 1 NOK this may not be the case. Hence, our second research question is:

"In what direction will a reverse stock split affect the liquidity and the volatility of the stocks at the Oslo Stock Exchange?"

Our contribution to the literature is to provide evidence of potential patterns of whether reverse splits have a negative impact on the return, liquidity and volatility. Reverse stock splits have become highly relevant due to the economic recession since the financial crisis of 2008. Given the limited research in this area, we want to fill in this gap using Norwegian data and the Oslo Stock Exchange as a benchmark. Using this information, investors, board of directors and corporate officers can increase their knowledge on how the Norwegian market most often will perceive a reverse stock split. If a negative pattern is found, more firms should consider the upside and downside risks of conducting a reverse split. This unless they are forced to by the stock exchange in order to remain listed. There are conducted 91 reverse stock splits on the Oslo Stock Exchange since 1996, the limited empirical research regarding this subject is therefore to a bit of surprise to us. The study will therefore strive to be regarded as a guidance tool for companies with a low stock price and with the thoughts of performing a reverse split.

The paper will commence with relevant theory important to describe factors influencing reverse stock splits and important to describe our methodical framework. We will then describe the empirical method used to measure the research questions. Finally, we will present a thorough analysis of our findings and conclusion on our answers regarding reverse stock splits at Oslo Stock Exchange.

2 Theoretical Framework

Are direct splits and reversed splits related anomalies that goes directly in different directions when it comes to stockholder return, volatility and liquidity? This chapter will focus on relevant theories and background information needed to understand how a reverse split might affect firm value. Accordingly, it will provide empirical evidence from previous research on reverse split regarding abnormal returns, volatility and liquidity. In the end, it will describe how efficient capital markets works, and a discussion of potential anomalies in the stock market.

2.1 Shareholder Abnormal Return

Do reverse splits affect shareholder wealth? The negative implications of a reverse stock split could potentially give firms shareholders a negative wealth effect when it comes to abnormal return. The abnormal return is the difference between actual and expected return of a stock over a given period. Multiple hypotheses have been developed in order to explain the stock splits effect on price reactions. Lakonhisok and Lev (1987), have classified it into two hypothesises which are used by most researchers as a benchmark for their studies.

2.1.1 Signalling Hypothesis

According to Fama et al., (1969) the market will automatically adjust the stock prices to new information. This includes firm events such as a reverse split. Wooldridge and Chambers (1983), correspondingly show that information given to shareholders by a firm approving and performing a reverse split might be negative or positive. The signal conveyed to the market of the event will make the stock prices adjust to the information accordingly. This assumed that the market is efficient. The implication is that the signal of the firm event will not have a negative or positive effect on the future returns. However, the tendency is that the market adjusts to the information with negative anticipation to the future earnings of the reverse splitting firms, and decrease the stocks return, yielding negative returns compared to the market. In a working paper regarding stock split evidence from the German market, Wulff (1999) suggest that the signal effect associated with stock splits should be incorporated into the stock price on the announcement date, and that no reaction to the price should be expected on the ex-date. However, as we will show later, numerous studies from the U.S market

indicates that this is not the case, and that there does exist an ex-date effect. The explanations for this is yet to be determined, and the effect of the ex-date is still under scrutiny.

Regardless of the potential negative abnormal return firms still takes on a reverse split even though they do not have to conduct one because of stock exchange's listing requirements. For instance, Bacon, Salandro and Shin (1993) surveyed 106 U.S firm managers on their perceptions regarding reverse splits. They divided their sample into one split group with managers from firms that had underwent a reverse split, and one control group with firm managers from firms that had not undergone one, but who shared the same similarities in terms of size, industry and earnings. Interestingly, none in their split group and only 30.4% in the control group perceived the reverse split as something negative. This is quite remarkable, because as we will come back to later, many previous studies indicates that reverse splits give a significant drop in return for the firms. Hence, the expectation is that the signal of a reverse split is something negative, and investors, board of directors and corporate managers should be aware of this potential downside.

2.1.2 Optimal Price Hypothesis

As mentioned earlier, a way to increase the stock price and to move it to an optimal price interval might be one of the most important reasons for conducting a reverse split. This will in turn will make the investors have a more positive perception towards the stock (Peterson and Peterson, 1992). Bacon, Salandro and Shin (1993) found that 72.2% of the split group respondents believed reverse splits moved stock prices to a more favorable range, whereas only 43.5% of the control group respondents agreed with perception. By increasing the stock price with a reverse split, the managers that concurred with the statement suggests that a firm can improve the liquidity of its outstanding shares. Nevertheless, to move to an optimal price is a potential way to get rid of the negative associations of being a low priced stock. For instance, a firm with a very low share price might perform a reverse split in order to move it up a price that matches the firm industry average (Lakonhisok and Lev. 1987).

However, the optimal price interval will be a matter of discussing what this interval actually is. In traditional financial statement analysis firms uses specific ratios in order to be within a range perceived as normal for the industry it operates (Lev, 1969). Furthermore, Lakonhisok and Lev (1987), proposes that these industry norms are arguments for an optimal price

interval, mainly because firms wants to be within a stock price range of what is perceived as normal for its industry. Another, notion is that investors buy stocks in round lots, and not one by one. This means that a high stock price will be expensive for smaller investors due to their financial limitations. On the other hand, this will attract more wealthy investors and institutions as stockholders. One extreme example is the famous investors Warren Buffet's firm Berkshire Hathaway, who has never performed a direct stock split and currently trades at over 216 000 USD. With a low stock price, the fear of a firm's future earnings and a company's ability as a going concern might be questioned. By moving the price up to an optimal price range, investors might perceive the company as having a potentially positive outlook. This instead of further investigating the underlining factors that actually determine the stock price. However, this will have more long term effect on stock returns, and in the short run and around the announcement and ex-date, moving the price into another price interval should not affect returns itself, but in more general the liquidity. With this in mind, the potential liquidity effect will be discussed later in the chapter.

2.1.3 Previous Studies

We will now review previous studies regarding abnormal returns. In their study conducted in 1969, Fama et al, argues that stock prices will adjust quickly to new information, and uses direct stock splits to provide evidence of this hypothesis. The study consisted of 970 direct stock splits in the U.S ranging from 1927 to 1959 and was an event study in order to verify that the assumption of efficient markets would hold. The most notable of the findings was that the execution date of a split does not affect the stock price, because this information already was reflected from the announcement date. Thereby, the conclusion of the study was that there does not seem to be a way to increase the expected return of a stock by performing a direct stock split, unless inside information where available. The study by Fama et al., (1969) is important because it is used as a benchmark when it comes to studying the wealth effects of a direct or a reverse split. Especially the return surrounding the announcement date and ex-date have been subject for a great number of researchers, and an important measure to whether or not there exist an increase or decrease in wealth effects. Although, some studies regarding reverse stock splits agree with Fama et al., (1969) that cosmetic events such as a split follow the efficient market hypothesis and do not have any impact on shareholder wealth, many others show different results.

Historically, direct stock splits have been a more wide covered subject for research than reverse splits. Although Fama (1969) did not find any shareholder wealth effects most studies disagree. For example, Grinblatt et al. (1984), Desai and Jain (1997), and Brennan and Copeland (1988) all conclude that direct splits have a positive effect of the stock return. The list of researchers finding positive abnormal returns could be much longer, but let us shift focus over to reverse splits. It is natural to assume that reverse splits, the counterpart should show negative effects. This is also the evidence in most studies regarding reverse splits, and studies conducted on the U.S market mostly finds a significant negative return for the shareholders. For example, Peterson and Peterson (1992) observe negative abnormal returns of about -4.0 % around the announcement date in their study regarding shareholders' wealth effects of reversed stock splits. This is also in line with Wooldridge and Chambers (1983), who found significant negative abnormal stock returns on and around the announcement, and execution date of the reverse split at -3.0 % and -2.13%, respectively. Multiple other studies, for example Han (1995) and Kim, Klein, and Rosenfeld (2008) backs up these findings with significant negative abnormal return on the announcement and ex-date. Another study, conducted by Lamoureux and Poon (1987), finds like Fama et al., 1969, no significant abnormal return around the execution date, only on the announcement date. All these studies are from the U.S stock market and reversed splits on the NYSE/AMEX and NASDAQ stock exchanges. They mostly provide evidence of a negative trend to the return of reversed splitting firms, even though the studies conducted are over different periods and with different numbers of firms in the dataset.

On markets outside the U.S Wu and Chan (1996) conducted a study based on the stock exchange of Hongkong (SEHK) of all reversed splits between 1986 and 1992. Their findings are consistent with most of the findings on the U.S market with negative abnormal returns surrounding the announcement and ex-date of the reverse split. However, the results are not statistical significant, and Wu and Chan (1996) proposes that this is because of the small number of firms in the reverse split sample. On the Canadian market and the Toronto Stock Exchange, Masse, Hanrahan and Kushner (1997), included 27 firms in their sample of reverse splitting firms, and find in strong contradiction to most studies from the U.S, a significant positive cumulative abnormal return of 9.3% at the announcement date. However, they did not research the effect around the ex-date. Masse et al., (1997) explains the difference between the findings in Canada and other markets with that the Toronto Stock Exchange do not have any minimum price requirement for listing. Thus, the threat of potential delisting is

therefore eliminated as a motive for the reverse split. The firms therefore undertake a reverse split voluntary in order to put the stock into a more favorable price-range, which the market in turn perceived as something positive.

Since our study focus on firms listed at the Oslo Stock Exchange it is natural to see what other studies on Nordic markets have found. The study from Eriksson, Enquist, Nisson and Wikberg (2003) on the Stockholm Stock Exchange found negative abnormal return on -4.1% at the announcement date and -6.5% at the execution date of the split. In Norway, Barkovitch and Eboth (2013) finds no significant effect around the announcement date, but a significant negative cumulative abnormal return around the execution date at -7.77%. This is a result similar with the U.S studies from Lamoureux and Poon (1987) and Fama et al, (1969). Our study contributes to the literature by filling the gap in the Norwegian market on whether or not a reversed split shows significant effects on changes in the shareholders' abnormal return. Studies regarding reverse stock splits outside the U.S are very rare, and this phenomenon is something we wish to study with Norwegian data.

2.2 Liquidity

Liquidity is an important measure for describing the easiness of selling a stock at a given price, and it refers to the speed and ease with which one can convert an asset into cash. Moreover, it is the relationship between how long it takes to sell a stock and if any discount from the market price is needed (Bodie et al., 2014). A high liquid stock will sell fast and without any deviation from the fair market price, and liquidity is therefore an important measure to prices and expected returns. A market is liquid if traders can quickly buy or sell larger numbers of stocks with little price impact (Næs, Skjeltorp and Ødegaard, 2008). A possible way to find the liquidity of a stock is by looking at the bid-ask spread, which measures the difference between the bid and ask price in relative terms. If the bid-ask spread is high, this means that there is a higher cost of trade, and the stocks liquidity is low.

For low priced stocks, the relative bid-ask spread can be high, giving a greater cost of the stock compared to the quoted stock price when trading. As an example, if holding a low priced stock with a bid on 0.02 NOK, and ask on 0.03 NOK, this gives a relative bid-ask spread of 40 %. At the other end, looking at higher priced and liquid stocks, the relative spread can be very low. Consider a stock having bid of 200.00 NOK and ask of 200.10 NOK,

this gives a relative bid ask of 0.05%. The spread can be measured as a direct cost as the difference between bid and ask is what you are missing when trying to unwind immediately. If you hold the more expensive share, and you wish to sell, the unwinding cost is 0.10 NOK for every 200.10 NOK, giving a loss of ~0.05% of your investment due to the bid-ask differences. Consider then if wanting to sell an amount of shares valued at 0.03 NOK, but the only bid at the time is at 0.02 NOK. If you want to sell without any uncertainty and delay, you lose 0,01 NOK for every stock due to the illiquidity and lack of levels between the present bid and ask prices of the stock. This total up to a loss of 33% of your investment, just because of the high level of bid-ask spread. If instead, the low priced, non-liquid stock you own, are being reverse split in a 1000 to 1 ratio, the bid and ask will now be 20 NOK and 30 NOK. The bid and ask will due to market reactions now convey against each other, ending in an interval between the two, and the incremental change between possible bids and asks are now not such a big percentage change. The new bid and ask makes it possible for investors to unwind with less of a loss. Liquidity is important, as one of the main hypothesises for a reverse split is to put it in the optimal price interval. This will supposedly make the stock more marketable, as it now is located in a price range perceived as more normal for investors as they now reduce risk of high bid ask costs.

Regarding liquidity for reversed stock splits, the research is more limited compared to research regarding shareholder returns. Using bid-ask spreads, trading volume and the number of non-trading days as input Han (1995) finds that reverse splits increase the liquidity of stocks. His results indicate a decrease in bid-ask spread, an increase in trading volume, and that the number of non-trading days' declines significantly after a reversed split. In addition, Han (1995) proposes that a motive for reverse splits might be to enhance the liquidity, and his findings supports this. Lamoureux and Poon (1987), finds that a direct split will increase the liquidity, whereas a reversed split will reduce the liquidity. However, there is no indication from the study that the market sees any value in this change. Interestingly, the two studies go directly against each other regarding the liquidity question.

2.3 Volatility

The volatility measures how much a stock deviates from a given market index, usually measured through a given period. This is important, because in most cases, higher volatility means a higher impact on the stock price, and a greater risk for the investor. It is important to

notice that the more the stock fluctuates, the greater the volatility (Bodie et al., 2014). High volatility increases the impact of the stock and the risk of holding it. With this in mind, it is important for stockholders to understand the relationship between volatility and reverse splits, and the effects of conducting this firm decision. Especially because some investors with low risk aversion tends to go after high volatile stocks, whereas more careful investors seek historically safer stocks with lower volatility.

Regarding volatility and reverse stock splits, Koski (2007), found a decrease in the volatility of the stocks that had performed a reverse split. The firms also experienced a significant negative change in their market capitalization. In her study from the US market, she found that the relative decrease of the observed volatility was at 25%. Furthermore, Koski (2007) points out that the connection between reverse splits and the volatility is important to understand to make managers aware of the effects following the corporate decision of reversely splitting the stock. Another study, which also finds a significant decrease in volatility, is Dravid (1987). His study ranging from 1962 to 1981 on the US market included 57 events in his "pure" sample, and he found that reverse splits on the contrary to direct splits, decrease the volatility. Dravid (1987) again opens the possibility that direct and reverse splits indeed are market anomalies driven in opposite directions of each other when it comes to volatility. However, the research upon volatility and reverse splits are very limited and the market in the US is the only one thoroughly studied.

2.4 Efficient Market Hypothesis

In his paper "Efficient Capital Markets" from 1970, Eugene Fama presented the assumption that stock prices at all time fully reflect all available information. This implies that stock prices do not follow any specific pattern, and that past prices could not be used to predict the future price of the stock (Fama, 1995). This in turn means that speculating on stocks would not be rational, because there will not be possible to find a stock that has an "artificially" low price. The interesting point is that for a market to be efficient there have to be a number of investors that believe it is not, because the liquidity of stocks will be very low if that is not the case (Fama, 1970). However, people working in the financial sector would argue that there indeed exist ways to beat the market, such as exploiting the documented negative return effect from reverse splitting firms.

2.4.1 Market Anomalies

Market anomalies are patterns that seem to violate the efficient market hypothesis (EMH), giving abnormal returns in a given period compared to a chosen index. This is the case when a stock performs in contradiction to the assumption of efficient markets. Since anomalies mostly comes from publicly available information, they are questioning the validity of the semi-strong form of the EMH (Bodie et al., 2014). The study of anomalies suggest that an investor can beat the market and use technical analysis of past performance of stocks, and insider trading in order to generate abnormal returns (Latif, Arshad, Fatima and Farooq, 2011). Even though Fama (1970) provided substantial arguments of the EMH, many studies have shown that market anomalies might exist. This is off course interesting for investors and thus studies regarding this phenomenon are often a subject for research.

Looking at studies regarding reverse splits, the matter of anomalies due to firm events is interesting. As markets are efficient, new information will rapidly adjust into a stocks' price. As showed, this most often sends the stock price down, generating negative returns (Fama, 1969). As indicated, previous literature on the announcement effects regarding direct splits and reverse split shows that in most cases there do exist an opportunity to exploit the market to the investors advantage. Especially because both the announcement and ex-date in previous studies indicate negative returns, an investor could potentially sell off his shares in the days between the two dates to avoid further losses. As Bodie et al., (2014), puts it, there possibly exists a way of earning abnormal profits just by waiting for firm announcements, and then go long or short in the stock based on what the information signals before the firm event is executed. However, this assumed that the stock is liquid and easily marketable.

Fama (1998), argue that anomalies are a matter of chance results, and that over and under reaction of stock prices to new information are not usual. Another explanation pointed out is data mining. After all, when analyzing large dataset of past returns many times, coincidences and simple chance might appear giving the impression that you have found an anomaly. A third reason to market anomalies might be behavioral finance. Behavioral finance is a relative new phenomena and it characterize that investors are irrational in their decision-making. This in turn might be the reason for several market anomalies (Bodie et al., 2014). In behavioral finance, individual characteristics of the investor influence decisions. Barberis and Thaler (2003), claims that there are two cornerstones in behavioral theory. The first is limits to

arbitrage. This implies that if there exist possibilities to exploit mispricing in the market, the market will not be an efficient one. The second cornerstone by Barberis and Thaler (2003) is common psychology. In other words, described as systematic biases that arise because of individual preferences and beliefs of investors. For instance, this could be overconfidence, forecasting errors, conservatism (too slow on responding to new evidence), information processing or optimism (Bodie et. al, 2014).

The three-abovementioned factors have received attention as potential explanations for many anomalies. That is to say, the explanations for anomalies are still under scrutiny and subject for numerous studies. As Fama (1998) puts it, most anomalies tend to disappear due to the change in methodology technique from different researchers. In addition, the problem with many anomalies are that when one is found and presented, the effect will tend to be neutralized due to the many investors who will try to exploit the anomaly. To measure firm specific events, such as a reverse stock split is interesting because the new information might lead to an increase or decrease to the stocks return. Having said that, whether or not investors can exploit new information to earn excess return is something that still is a subject for discussion. Nevertheless, to measure the impact of a reverse split leads us to the next important section in our thesis where we foremost will describe our methodology framework.

3 Method, Data and Description

The following section describes the method, data and description necessary to investigate the problem definition. Regarding abnormal returns, there are important to note that both the announcement and ex-date effects are included and treated as individual events. This due to the assumption of efficient markets, that there should not occur an ex-date effect on the stock price because it is not new information. The event study methodology used to calculate the impact of returns following a reverse split use the framework by Campbell, Lo and MacKinlay (1998). To test our second hypothesis the liquidity measurements follows Han (1995), whereas the volatility calculation follows the methodology of Koski (2007).

3.1 Sample

In this thesis, the sample is defined by all firms that have conducted a reverse split at the Oslo Stock Exchange in the period ranging from January 1996 until December 2015. January 1996, was a natural starting point due to the lack of available data prior to this date. To find all firms that match our selection criteria, we manually searched in Newsweb[2] for all reverse splits conducted. In addition, we used Thomson Reuters Eikon as a supplement as Newsweb does not have any statements further back than year-end 1999. During the period, 72 different firms executed 91 reverse splits. In order to isolate the extraordinary event of a reverse split a further revision of the firms were necessary. This was necessary mostly because of potential bias that could affect our calculations of the reverse split event. The revision of the sample made us exclude 22 events as seen in table I. After revising the sample, our final list consisted of 69 reverse stock splits. All firms including their announcement and execution date are included in appendix 2.

We used the Oslo Stock Exchange Benchmark Index (OSEBX) as our market index. The index contains a representative selection of all stocks listed at the Oslo Stock Exchange, and currently consists of 57 companies[3]. The membership of firms is reviewed twice a year in June 1st and December 1st. Furthermore, we obtained daily market data from Thomson Reuters Eikon during our period of research (1996-2015).

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[2] Newsweb.no is Oslo Stock Exchange's stock announcement portal. Companies listed on Oslo Stock Exchange are responsible for distributing all notifiable information that require disclosure and Newsweb is the main information portal for this matter.

[3] http://www.oslobors.no/ob_eng/markedsaktivitet/#/details/OSEBX.OSE/overview (27.04.2016)

Table I

Reasons to Exclude Firms

This table lists the number of firms taken out from our sample, and the reason they were excluded.

# of firms excluded	Reason
8	Lack of stock price observations.
3	Reverse split executed before listing at the Oslo Stock Exchange.
3	Delisted within 2 months after the reverse split.
7	Confounding events such as large equity issuance, firm name changes, larger board changes or other firm events that could affect the stock price during the event window.
1	Bank trading equity certificates

Our sample had certain characteristics. Throughout the 69 reverse splits, 13 splits where conducted in the year of 2011, and the when looking at the number year by year in figure 1, the tendency is that the use of reverse splits have increased in later years. A tendency, which seems to have increased especially after the 2008 financial crisis.
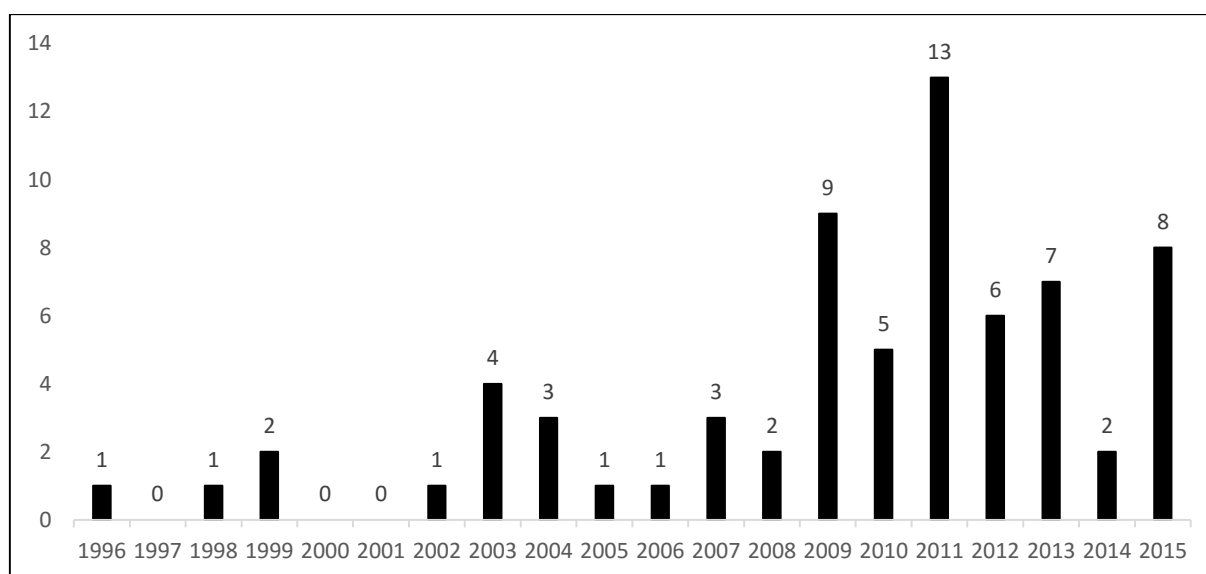
Figure 1. Reverse splits per year. This figure shows the number of reverse splits per year at the Oslo Stock Exchange.

Table II reports descriptive statistics from our sample. As showed in panel A, 56 of the 69 firms in our sample had a stock price below 1 NOK. Hence, the obligations for continued listing at Oslo Stock Exchange is interesting. This indicates that the firms with a price below 1 NOK most likely conducted the reverse split because it was necessary in order to remain

listed and tradeable at the exchange. Another explanation might be the supposed liquidity effect. It is also interesting to see that some firms with a low stock price choose to reverse split to raise their stock price to a higher level. Hence, the Optimal Price Hypothesis are a probable motive in order to give investors a more positive perception towards the stock (Peterson and Peterson, 1992). As presented in panel B, the average market capitalization was at 665 380 292.67 NOK, whereas the median was at 135 806 496.93 NOK. This indicates that a few large firms drive the average high. It is also interesting to see that the days between announcement and execution are very short with a median of 4 days and average at 9.84 days. As indicated by panel C, the most common split factor was a 10:1 split with 33 of the reverse splits using this as the split factor.

Table II

Descriptive Statistics

This table presents descriptive statistics of the 69 reverse splitting firms in the sample.

Panel A: Number of firms in sample with a presplit stock price over/under 1 NOK.	
# of total reverse splits in sample	69
# of firms with presplit value >0	13
# of firms with presplit value <0	56

Panel B: Summary firm characteristics in the sample.				
	Stock Price before split (NOK)	Stock Price after split (NOK)	Market Capitalization (NOK)	Days between announcement and ex-date
Average	0.86	15.34	665 380 292.67	9.84
Median	0.46	4.2	135 806 496.93	4
Max	7.08	180	15 171 971 966.06	150
Min	0.02	0.7	6 378 259.68	0
SD	1.31	29.76	2 025 850 826.03	20.53

Table II - *Continued*

Panel C: Most common split factors.			
Split factor	# of reverse splits	Split factor	# of reverse splits
10:1	33	6:1	1
100:1	11	80:1	1
20:1	8	11:1	1
5:1	3	8:1	1
4:1	2	2:1	1
1000:1	2	40:1	1
30:1	2	25:1	1
2,5:1	1	Total	69

3.2 Event Study

Economic events take place every day. Firm events such as mergers, acquisitions, earnings announcements, new debt or equity issuance are common and announced to the public through firm announcements. A question that always remains in such events are how these affect firms' value. To measure this effect, the event study methodology is useful because it measures the impact of the event. The purpose of an event study is to compare the actual return for an event with the estimated (abnormal) returns, where calculations of estimates are from historical values (MacKinlay 1997).

Given the assumption of efficient markets, the impact of an event will immediately be reflected into the stock price, and thus it is in theory possible to measure the effect on the value of the event for the firm (MacKinlay 1997). Event studies are therefore a good measure for the semi-strong form of market efficiency, testing the effect of new public information regarding a company (Bodie et al., 2014). For instance, the event of conducting a reverse split has previously led to significant negative abnormal returns in many studies, and the event study methodology will make it possible to test return effect at the Norwegian market. When studying this event, the announcement date is theoretically the interesting date, and not the date of execution. This because of the notion that public information should immediately be reflected in the stock price due to market efficiency (Campbell et al., 1998). However, as indicated by many studies, there exist an effect surrounding both dates, suggesting that ex-date have an impact on the value of the firm too. Therefore, it is necessary to treat it as two

separate events in our thesis in order to verify if there exist an effect in firm value upon both dates. Hence, testing if the assumption of efficient markets holds.

3.2.1 Time Horizon

The time horizon of conducting an event study consists of three periods, the estimation, the event and the post event window.
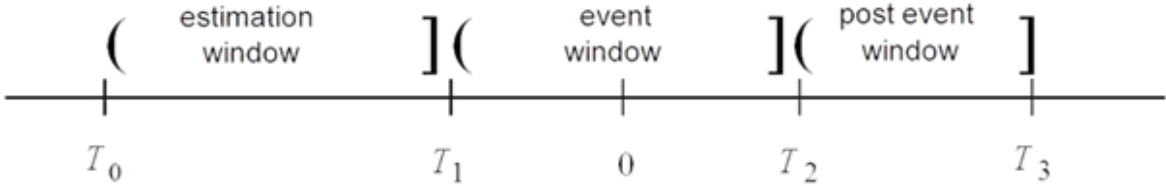

Figure 2. Timeline for an event study. This figure shows the different windows of interest when calculating the impact of an event, as described by MacKinlay (1997).

The estimation window is a selected period set before the event window so the event itself does not influence the estimation factors. In this window, we use historical stock performance prior to the event to generate a normal return estimate for the event period. The estimation window in our study consist of market data of up to one year of trading days until ten days prior the announcement date. The window chosen is to have enough data, but also to prevent the estimated returns to be biased from inside information (MacKinlay 1997).

The event window is usually a period surrounding the actual event, and not limited to the specific day. Usually, the window includes some days before and after the event due to the ability to capture information leakage and aftermath of the event. In event studies where the event is of a sudden origin, it is unnecessary to include any days before the event in the window (Campbell et al., 1998). For our event study, we have two events for each reverse split, where the announcement date and the reverse split date both are treated as individual events. As seen in figure 2, we set each of these event dates as $T = 0$. The event window is the days surrounding the event and stretches from T_1 to T_2, capturing all abnormal returns on and around the event date for both the announcement and reverse split ex-date.

Since the announcement and ex-date of reverse split on the Oslo Stock Exchange most often are close to each other we have chosen to look closer upon the event windows for the

announcement date as [-1.0] and [-1.1]. For the execution date, the windows are set at [0.1] and [-1.1]. The period between the announcement and execution date of a reverse stock split in our sample is short, at average 9.84 days, with a median of 4 days. In 28 of the reverse splits, the execution date event follows the first trading day after the announcement. Potentially we could have increased the event windows, but this could lead to misleading results because we then risk capturing the announcement effect into the execution date effect, or the other way around. This due to the overlapping time windows. However, it is also possible to test our return hypothesis with several event windows with different number of days included to look for significant findings of interest.

The post event window ranges from T_2 until T_3. In this study, we will not use a post event window to study the long-term effects of returns. However, we will use it to investigate the possible effects in volatility and liquidity after a reverse split. Table III describes the timeframe for the different calculations in the study regarding returns, liquidity and volatility.

Table III

Time Horizon

This table describes the time horizon of the study. It shows what time windows that are used in the calculations of returns, liquidity and volatility.

	Estimation window (Days prior to announcement)	Event window	Post event window (Days after ex-date)
Returns	[-250.-10]	[-1.0] and [0.1]	-
Liquidity	[-50.-2]	-	[2.50]
Volatility	[-250.-10]	-	[10.250]

3.3 Calculating Returns

When calculating returns for an asset, it is possible to choose among using arithmetic returns or logarithmic returns. The arithmetic return of an asset is given by:

$$R = \frac{D_t + (P_t - P_{t-1})}{P_{t-1}} \qquad (1)$$

Whilst the logarithmic return is given by the formula:

$$r = ln\frac{P_t + D_t}{P_{t-1}} = \ln(1 + R) \tag{2}$$

When transforming the returns to the natural logarithm, we make the returns time insensitive. For all returns, we have the approximation between logarithmic and arithmetic returns with the formula:

$$R_{log} = R_{arit} - \frac{1}{2}\sigma^2 \tag{3}$$

3.3.1 Normal Returns

Normal returns are given by a choice among multiple models that calculates estimates of market returns based on historical data using OLS. The least advanced one, the Constant Mean Model, bases the future returns solely on the mean of past returns. With returns (R) based on past returns (μ) plus an error term (ϵ) with expectation zero and normally distributed, it is derived as:

$$R_{i,T} = \mu_i + \epsilon_{i,T} \tag{4}$$

Another, more advanced approach is the Market Return Model. The Market Return Model gives an expected return from the alpha (α), a beta (β), that acts as an interaction with the market, giving the expected return of the asset given market return, and an error term (ϵ) with expectation of zero and normal distribution.

$$R_{i,T} = \alpha_i + \beta_i R_{M,T} + \epsilon_{i,T} \tag{5}$$

Other even more advanced models that could be used are the CAPM, which takes into account the risk free returns, the Fama and French Three Factor, or the Carhart Four Factor Model.

To calculate the normal (expected) return of a firms stock we have chosen the Market Return Model approach. The Market Model explains a bit more than the Constant Mean Model as it includes movements in the market, where the constant mean only bases expectations on historic mean returns. When comparing the Market Model to the other multifactor models,

several studies such as MacKinlay (1997) have stated that the Market Return Model is sufficient, as the gain in explanatory power by using a multi factor model is very small. The Market Return Model then serves as a benchmark when we later calculate the abnormal returns.

Thereby, when calculating the normal returns by using the Market Model using equation 5, we estimate the beta and alpha for each firm from historical data during the estimation window. As described in our time horizon we use observations from the estimation window, ranging from 250 trading days until 10 days before announcement. The betas for each firm are derived from the formula:

$$\beta_i = \frac{Cov(R_i, R_m)}{Var(R_m)} \tag{6}$$

Where $Cov(R_i, R_m)$ is the covariance between a given firm(i) and the market return (Oslo Stock Exchange Benchmark Index), whereas $Var(R_m)$ is the variance of the market return. The alphas for each firm are then calculated by the formula:

$$\alpha_i = \bar{R}_i = (\beta_i \bar{R}_m) \tag{7}$$

Using the $\bar{R}_i$ as the average return of the firm, and $\bar{R}_m$ as average return from the market. Finally, the error term (residuals) is formulated by:

$$u_i = R_i - (\alpha_i + \beta_i R_m) \tag{8}$$

Where R_i is the firms' return and R_m is the return of the market.

3.3.2 Abnormal Returns

Abnormal returns are a way to see if the stocks are over- or underperforming the estimates given market return. The abnormal returns ($AR_{i,T}$) of one firm(i) at any day(T) is given by subtracting the previously calculated normal returns ($R_{i,T}$) from the actual returns ($K_{i,T}$). This derived from the formula:

$$AR_{i,T} = K_{i,T} - R_{i,T} \tag{9}$$

The average abnormal returns of all firms in total for each day are found by calculating the mean of all observed abnormal returns. This gives us the average abnormal returns of all firms on the day of interest.

$$AAR_T = \frac{\sum_{i=1}^{n} AR_{i,T}}{n} \qquad (10)$$

By summing up the average abnormal returns over all days in the event window we get the cumulative average abnormal returns (CAAR). This yield the total abnormal returns over the event window. The cumulative average abnormal return indicates whether there exist a positive or negative effect on the stock return when conducting a reverse split, which is necessary to answer when answering our problem definition.

$$CAAR_T = \sum_{i=1}^{t} AAR_T \qquad (11)$$

3.3.3 Testing Procedure

With the estimates for cumulative average abnormal returns in place, it is necessary to define a testing framework to test if it is significantly different from zero. The normal procedure when commencing testing is to establish a null hypothesis. Here it is normal to assume that returns equals zero in the given time period. If this hypothesis holds, there are no signs of any cumulative average abnormal returns in the event period, while if the hypothesis is rejected, there may exist a significant positive or negative effect.

To test our findings, we conducted a statistical hypothesis test. This with a null hypothesis stating that the cumulative average abnormal returns equals zero, meaning no difference from the expected return. The alternative hypothesis is stated by the other possible alternative, which is that cumulative abnormal returns does not equal zero. Our hypothesis forms like this:

H_0: Cumulative abnormal returns $= 0$

H_A: Cumulative abnormal returns $\neq 0$

To test the hypothesis, we use the equations based on residuals from MacKinlay (1997). The Squared sum of residuals (RSS) is found by squaring and summing the residuals (u) for each firm. The RSS is then divided by the number of the observations (T) on the firm, minus the number of explanatory variables (k) to get an estimation of the variance ($\hat{\sigma}_i^2$).

$$\widehat{\sigma_i}^2 = \frac{RSS_i}{T-k} \text{ , where } \quad RSS_i = \sum u^2 \tag{12}$$

The estimation of variance for all firms is the summed and divided by number of firms squared to find the estimated variance for average abnormal returns. In addition, we multiply the variance by the squared numbers of days in the event window (n) to find the variance for the cumulative average abnormal returns. Now we can test against the hypothesis that they are equal to zero by dividing the cumulative average abnormal returns by the variance.

$$t = \frac{CAAR}{\widehat{Var}(CAAR)}, where \quad \widehat{Var}(CAAR) = \sqrt{n}\frac{1}{N^2}\sum_{i=1}^{N}\widehat{\sigma}_i^2 \tag{13}$$

This gives us a t-estimator, which depending on its value can show us if the results from our findings are significant, and on which level. If the absolute value of the t-test does not exceed the critical value, we keep the null hypothesis. If the t-value exceeds the critical value ($|1.9955[4]|$), we reject the null hypothesis and accept the alternative hypothesis.

3.3.4 Cross-sectional analysis

MacKinlay (1997) suggest using a cross-sectional analysis on the data to control if there are any firm specific variables that explain the results. The method used is a multiple regression analysis as given in equation 14. We used the cumulative abnormal return of all reverse splits as a dependent variable, and multiple other independent variables to try to explain if any of them significantly influence our findings. The cross-sectional analysis could indicate how much of the results in cumulative abnormal return that are explained by different characteristics of the reverse splitting firms in the sample.

$$CAR_i = \beta_0 + \beta_1 X_{i1} + \cdots + \beta_n X_{in} + \varepsilon_i \tag{14}$$

3.4 Calculating Liquidity

There are several ways to measure a firm's liquidity. Turnover, the number of non-trading days and bid-ask spread are three possible methods. Liquidity acts as a measure in several dimensions where cost, quantity, time and elasticity are all different measures on the term

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[4] Critical value |1.9955| at 5% significance level with 68 degrees of freedom.

liquidity (Næs, 2008). We find that bid-ask spread is the most reasonable one to use in our case, as it gives a good pointer if the stock is easy marketable. The mechanics of the bid-ask spread is that the spread act as a measure on the cost of terminating your holdings, as the market price differs from the current bid price and vice versa, this spread can be seen as a direct cost when trying to sell your assets.

The relative bid-ask spread (s) is the quoted price divided by the midpoint price and can be seen as a cost of trading the stock, as the bid (ask) is at a price lower (higher) than the market price.

$$s = \frac{P_{ask} - P_{bid}}{\frac{P_{ask} + P_{bid}}{2}} = 2 * \frac{P_{ask} - P_{bid}}{P_{ask} + P_{bid}} \tag{15}$$

To test if there is a difference pre-reverse split and post-reverse split we compared the average relative bid-ask spreads. As showed in table III, this was calculated by using a pre-reverse split window of 50, until 2 days before the announcement date, compared to the post reverse split window of 2, until 50 days after the ex-date. To test if the two samples were equal or different, we applied a paired t-test to test if the differences (d) between post- (s_2) and pre-split (s_1) equal zero.

$H_0: \bar{d} = 0$

$H_A: \bar{d} \neq 0$

$$where \; \bar{d} = \frac{\sum d_i}{n} \quad and, \quad d_i = s_1 - s_2 \tag{16}$$

When testing the mean of the differences, it is necessary to calculate a t-value. This is calculated by dividing the mean by the standard error of the mean, which is found by dividing the standard deviation (σ) by the square root of firms (n).

$$T = \frac{\bar{d}}{SE(\bar{d})} \quad where, \quad SE(\bar{d}) = \frac{\sigma_d}{\sqrt{n}} \tag{17}$$

With the t-value now calculated, it can be tested against the critical value given at a chosen confidence level under a t-distribution. We have the same significance level as earlier and operates with a critical value of |1.9955|. If the t-value is below the critical value, we keep the null hypothesis, while if it exceeds the critical value we can reject the null hypothesis of no

difference in liquidity after a reverse split. In that case, we keeping the alternative hypothesis, stating there exist a difference in the pre- and post-windows.

In addition, we have included a Wilcoxon signed rank test. This test is used when it cannot be assumed that the selection is normal distributed. The Wilcoxon test is a paired differences test which compares two selections and if their means differ from each other. The Wilcoxon p-value returned tells what the probability of commencing a type I error, given that the hypothesis that the means differ from each other are true.

3.5 Calculating Volatility

To measure the change of volatility, one common method is to compare the volatility in the selection of a period before and after the event window, as done by Koski (2007). This done by measuring the mean of the volatility in the estimation window, and compare it with the mean of the post-event window. As described in table III, the estimation window ranges from 250, until 10 trading days prior the announcement date. In the other end, the post-event window ranges from 10, until 250 trading days after the event window. The calculation of volatility is derived in formula 18:

$$\sigma_i = \sqrt{\sigma_i^2}, \quad where \quad \sigma_i^2 \quad = \sum_{i=1}^{n} \frac{(X_i - \bar{X})^2}{n-1} \tag{18}$$

To test if the volatilities are equal or differ, a paired t-test and Wilcoxon-test are applied on the two selections, following the same procedure as when testing significance of the liquidity. The null hypothesis states that the two selections are equal, while the alternative is that they differ from each other during the two periods.

4 Analysis and Results

Do reverse splits have any effect of a stocks return for its stockholders? This knowledge would be valuable to corporate managers and members of board of directors that are currently evaluating whether to initiate a reverse split or not, in addition to the current stockholders. Our results and findings aims to contribute to the existing literature upon this interesting phenomenon with data from the Norwegian stock market. The chapter will give a detailed presentation of our analysis and results. The first three sections contains findings surrounding the stockholder return hypothesis, and investigate if there exist a relationship between reverse splits and the returns surrounding the announcement and ex-date. Section four presents the effects on liquidity and its implications, whereas the last section reviews our findings regarding volatility effects.

4.1 Announcement Date Effects

Summary statistics for daily average abnormal returns around the announcement date of the 69 firms included in the sample are presented in detail in table IV. The daily results indicate that there do exist a negative market reaction around the announcement date of a reverse split. When excluding the day after the announcement date, which could interfere with the ex-date, we get a significant negative return. Our results are therefore consistent with the previous literature, which is that the announcement date often is synonymously with negative average abnormal returns.

As showed in table IV, at the day of the announcement (day 0), we observe a negative average abnormal return at -2.59%, significant at the 5% level. The days' prior the announcement [-5.-1] are mostly insignificant, but show tendencies of negative average abnormal returns. The most notable is that at 4 days prior to the announcement, we observe a negative return effect of -1.93%, which is barely significant. Nevertheless, on this day, the reverse split is yet to be publicly announced, and therefore the effect on this date is most likely not related to the upcoming announcement of the reverse split. In the days following the announcement [1.5] we observe barely significant results at days 2 and 4, with an average abnormal return of -2.0% and 2.02%, respectively. One possible explanation might be that the market underreacts to the reverse split announcement, and then adjust itself accordingly.

Table IV

Average Abnormal Returns around the Announcement Date

This table presents the results of daily average abnormal returns at days [-5.5] around the announcement date. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Days around announcement	AAR	T-Value	P-Value
- 5	- 1.26 %	- 1.22	0.22584
- 4	- 1.93 %	- 1.86	0.06674 *
- 3	0.57 %	0.55	0.58459
- 2	- 0.55 %	- 0.54	0.59343
- 1	- 1.28 %	- 1.24	0.22066
0	- 2.59 %	- 2.51	0.01447 **
1	- 0.54 %	- 0.52	0.60555
2	- 2.00 %	- 1.94	0.05697 *
3	- 0.76 %	- 0.74	0.46477
4	2.02 %	1.96	0.05428 *
5	- 0.30 %	- 0.29	0.77204

During our event window, the cumulative average abnormal return is significant for both event periods as presented in table V. The CAAR at window [-1.0] is significant (t-value at – 2.65) and at -3.87%, whereas on days [-1.1] is significant (t-value at - 2.46) at -4.41%. This indicates that there does exist an announcement date effect surrounding reverse split. Keeping in mind that the announcement date is the day in which the proposal of a reverse spilt first appeared in Newsweb and became publicly available information for the company shareholders, the stock prices initially react to this information as something negative (Woolridge and Chambers, 1983). The findings are in contrast to Barkovitch and Elboth (2013) who did not find any signal effect surrounding reverse split using Norwegian data, but it is in line with most of the previous research conducted from other markets. Based on our findings, investors which holds stocks in a firm that proposes a reverse split should consider selling off the shares or going short (if possible) due to the decline in return. This is also proposed by Wooldridge and Chambers (1983), who in addition points out that financial managers are advised to consider the benefits of proposing and conducting a reverse split carefully due to the decline in market capitalization for the stockholders. This again is a matter of the stock price level, if the bid-ask spread is very high, you risk losing more by selling before the reverse split than holding for a sell afterwards due to the high relative price change of every incremental price level. For instance, if the bid-ask is around 30%, the bid

price pre-split could be a lot lower than after the reverse split, where the new price level is ranging between the former bid and ask price.

Table V

Cumulative Average Abnormal Returns in the Announcement Date Event Windows

This table presents the results of cumulative average abnormal returns in the event windows for the announcement date. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

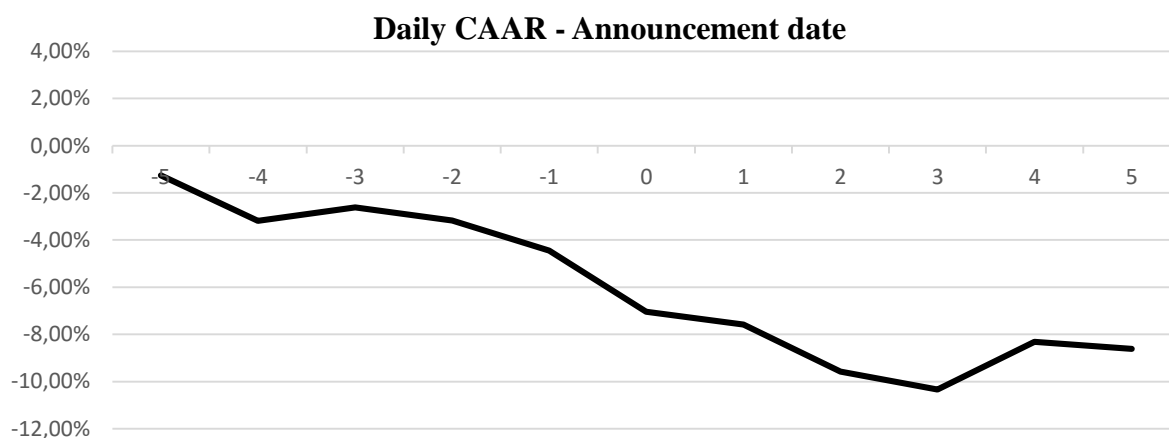| Event Window	CAAR	T-Value	P-Value
[-1.0]	- 3.87 %	- 2.65	0.00502 ***
[-1.1]	- 4.41 %	- 2.46	0.0082 ***

Figure 3. Daily Cumulative Average Abnormal Returns. This figure shows the cumulative average abnormal returns for all firms across a period starting 5 days before, and ending 5 days after the announcement date.

4.2 Execution Date Effects

Summary statistics for daily average abnormal returns from our event study surrounding the ex-date return effects are presented in table VI. The results clearly indicate an ex-date effect. The ex- day effect is puzzling, because the date usually is known in advance and the prices should according to the efficient market theory already reflect the information available.

As showed in table VI, at the date of execution (day 0), we observed a significant average abnormal return at -2.76%. In addition, the day before the ex-date (day -1) indicates a significant negative average abnormal return at -3.30%. The day before ex-date is significant, and have a high negative abnormal return. This could be cross data from the announcement, but seeing that the day after announcement date is on -0.54%, and a strong -2.76% abnormal return on the ex-date this does not seem to be the issue. We can therefore observe strong

market reactions on both the day before and on the ex-date itself. The other days before the reverse split shows insignificant numbers, except at day -5, where we find a significant negative reaction at -2.37%. Why we observe this effect up to 5 days before the ex-date might be a coincident, but it could also be an effect from the announcement due to the announcement and ex-date are close to each other in time for most of the firms in our sample. Hence, we might capture the effect from the announcement into the ex-date window as discussed earlier. After the ex-date, our numbers show insignificant values, but the tendency is that after the ex-date the average abnormal returns finds a more consistent pattern with less high drops.

Table VI

Average Abnormal Returns around the Ex-Date

This table presents the results of daily average abnormal returns at days [-5,5] around the execution date. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Days around execution	AAR	T-Value	P-Value
- 5	- 2.37 %	- 2.29	0.025 **
- 4	0.05 %	0.05	0.959
- 3	- 1.14 %	- 1.11	0.273
- 2	- 0.84 %	- 0.81	0.42
- 1	- 3.30 %	- 3.19	0.002 ***
0	- 2.76 %	- 2.68	0.009 ***
1	- 1.58 %	- 1.52	0.132
2	- 0.02 %	- 0.02	0.988
3	- 0.37 %	- 0.35	0.724
4	0.91 %	0.89	0.379
5	- 0.30 %	- 0.29	0.772

During our event window, the cumulative average abnormal return is significant for both event periods, as presented in table VII. The window [0.1] is significant (t-value at -2.97) with a CAAR at -4.34%, whereas at days [-1.1] are significant (t-value at -4.27) with a CAAR at -7.64%. The results indicate that there exists a signal effect to the market, and that the stock returns are underperforming compared to their normal return of the same period. This implies that our result is in contradiction to the efficient market hypothesis, and that the market reacts negatively on the ex-date. Interestingly, this is consistent with Barkowitch and Elboth (2013), who found a significant CAAR at -7.77% using a window of [-1.1], with Norwegian data. In

terms of research from other markets, our findings surrounding the ex-date matches what most other studies have concluded.

Nevertheless, a reverse split can be interpreted as sending a negative signal to the market, giving a firm a bad perception, with increased negative returns. This indicates that the reverse splits indeed are an anomaly, which investors potentially could exploit. However, because the reverse split ex-date usually is known in advance, the reasons why investors do not sell their stocks prior to this date remains a puzzle. Thus, based on our findings investors holding stocks on the Norwegian stock market and who are able to liquidate their positions without taking too big losses due to the possibly high bid-ask spreads have an incentive of selling off their stocks in the time period between the announcement and ex-date to avoid further losses.

Table VII

Cumulative Average Abnormal Returns in the Ex-Date Event Windows

This table presents the results of cumulative average abnormal returns in the event windows for the execution date. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

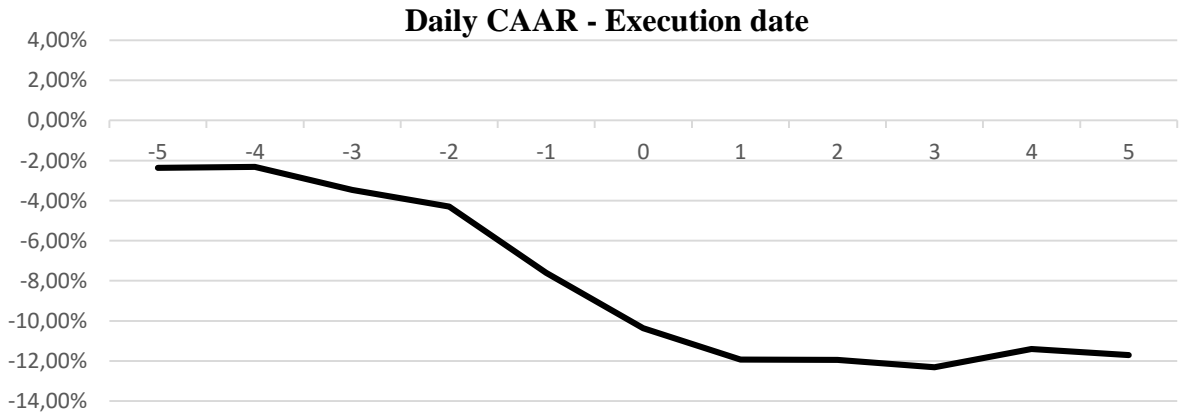| Event Window	CAAR	T-Value	P-Value
[0.1]	-4.34 %	-2.97	0.002 ***
[1.1]	-7.64 %	-4.27	0.00003 ***

Figure 4. Daily Cumulative Average Abnormal Returns. This figure shows the cumulative average abnormal returns for all firms across a period starting 5 days before, and ending 5 days after the execution date.

4.3 Cross-Sectional Analysis Regarding Returns

To further investigate our findings regarding returns we carried out a cross-sectional firm analysis with the cumulative abnormal return of every firm as the dependent variable. As independent variables, we used stock price, market value, reverse split ratio, if reverse split was performed before or after the financial crisis of 2007-08, and the days between announcement and ex-date. However, the regression did not give any information of significance, but we observed a tendency that the number of days between announcement and execution date divided our sample.

We then divided our sample into two groups based on the different time intervals. As showed in table VIII, 28 reverse splits had a short time span with maximum one trading day between announcement and execution, whereas 41 reverse split had a larger time span. We observed that firms having announcement and ex-date with the shortest time span (on the following trading day) had a cumulative average abnormal return in the event window [0.1] of -8.32 %, significant at 1% level. The other group of firms with larger time span (more than one trading day) between announcement and ex-date had a cumulative average abnormal return of -1.62%, although not significant. This result indicates that reverse splits announced and executed the following trading day have a larger negative return effect than reverse splits with a longer time interval.

Table VIII

CAAR on firms, divided by days between announcement and execution

This table presents the CAAR and t-values of event window [0.1] around execution for the two groups, where the first group has announcement and execution on the next trading day, while the second group has one or more trading days between announcement and execution date. The ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Time between announcement and ex-date	N	CAAR	T-Value	P-Value
Following day	28	- 8.32 %	3.58	0.001328 ***
More than one day	41	- 1.62 %	0.8	0.39

4.4 Changes in Liquidity

The liquidity changes we have taken a closer look upon is the measure of the relative bid-ask spread. Our findings are presented in table IX. We compared the average of the bid-ask spread in period [-50.2] before the announcement with the period [2.50] after the ex-date of the reverse split. In the period before the reverse split, we found a relative bid-ask spread of 7.30% in our selection, while in the period after the reverse split we observed a relative bid-ask of 4.66%. The observed bid-ask is a reduction of 2.64%, which is equalled a relative reduction of 36.18% after the reverse split compare to the bid-ask before. The reduction in the bid-ask tells us that the effective cost of selling off a position would decrease with the same amount, seen only as the specific cost of bid-ask spread. Testing the selections before and after against each other using a paired t-test and Wilcoxon signed rank test, we find that the change is significant on 5% level.

The reduction in the relative bid-ask spread indicates an increase in liquidity, which is consistent with the findings of Han (1995), but against the findings of Lameroux and Poon (1987) who found the opposite. The increase in liquidity means that the stock becomes more marketable, something that could be positive regarding attraction of investors, as it is easier to buy and sell the stocks.

Table IX

Liquidity Changes Subsequent to Reverse Splits

This table presents the results the change in average bid-ask spread in the period [-50.2] days prior the announcement date, compared to period [2.50] days after the ex-date. To test if the liquidity is equal or differ, a paired t-test and Wilcoxon-test are applied on the two selections. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Average bid-ask spread		Change	T-value (paired)	Wilcoxon signed rank test
Before reverse Split	After reverse Split			
7.30%	4.66%	-2.64%	2.26 **	0.02574 **

4.5 Changes in Volatility

Regarding volatility changes, we looked upon the average standard deviation of the firms. As showed in table X we compared the volatility from the pre-split with the post-split period. We can see an average standard deviation of 8.70% before the reverse split, while after the reverse split, we observed that the standard deviation decreases with 1.65% to 7.11%. We compared the volatility of the selection before and after using a paired t-test and a Wilcoxon signed rank test. Both test show a significant on 1% level difference in the selections. Overall, this corresponds to a relative reduction of 18.28% in the volatility.

Our findings indicate that the overall of the stocks have become a bit more stable. This is not a surprising observation due to the earlier very low stock prices and high bid-ask spreads on some of the stocks. These results are consistent with the findings of both Koski (2007) and Dravid (1987) who both found that a reverse split reduces volatility significantly.

Table X

Volatility Changes Subsequent to Reverse Splits

This table presents the results of change in volatility measured by the mean of standard deviation [-250. -10] days prior the announcement date, compared to the mean [10. 250] days after the ex-date. The standard deviation is measured by the total sum of squares. To test if the periods are equal or differ, a paired t-test and Wilcoxon-test are applied on the two selections. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Average standard deviation				
Before reverse split	After reverse split	Change	T-value (paired)	Wilcoxon signed rank test
8.70%	7.11%	-1.59%	3.21 ***	0.0067 ***

5 Conclusion

Several studies have previously indicated that reverse stock splits are signaling something negative to the market. Furthermore, the limited liquidity and volatility research are divided concerning what extent the reverse split do something positive or negative for the stockholders. Our sample consisted of 69 reverse split from the Oslo Stock Exchange in the period 1996-2015, and we followed MacKinlay (1997) in our methodology for our calculation of the impact of the event.

Regarding our main hypothesis, *"Is there a relationship between reversed stock splits and the return of the stocks at the Oslo Stock Exchange?"* we observed a significant negative average abnormal return on both the announcement date and execution date, at -2.59% and -2.76%, respectively. This implies that the market reacts negative of both the news of a reverse stock split and on the actual reverse split day, which indicates that there do exist a relationship between reverse splits and return. For the reaction on the announcement date, a possible reason of the negative findings might be the signal a reverse split emits. The signal from a reverse split is often interpreted as a stocks inability to recover to higher stock prices by itself purely driven by demand, but rather help is needed from a cosmetic change as a reverse split. This interpretation might be perceived as bad signal, giving the investors an incentive to sell off their positions. On the ex-date, the information should, according to the efficient market hypothesis already be reflected into the stock price. However, as indicated by our findings this is not the case on the Norwegian market, and it seems that the reverse split violates this the efficient market assumption. This in turn indicates that stockholders could sell of their shares in the period between announcement and execution to avoid further losses. However, we observed a difference in cumulative average abnormal returns on firms when divided in groups by the number of days between announcement and execution. The reverse splits with announcement and execution on the following day shows a significant CAAR of -8.32%, while the firms with one or more trading days shows a CAAR of -1.62 %, although not significant. Our findings are consistent with most of the previous studies conducted on other markets, and our study contributes to the literature of putting reverse split as a potential anomaly that investors theoretically could exploit.

Regarding our second hypothesis, *"In what direction will a reverse stock split affect the liquidity and the volatility of the stocks at the Oslo Stock Exchange?"* we found a significant

reduction of the bid-ask spread of 36.18%. This corresponds to an increase in liquidity, which can be interpreted as the stocks becomes more marketable. Regarding volatility, we observed a significant reduction in the standard deviation of 1.59%. This gives an indication of less fluctuating shares, which in turn implies a reduction in the volatility. Both are reactions in reasonable directions as a higher stock price decrease the percentage change when a stock changes by the same amount of NOK before and after a reverse split. The results indicate that there do exist a liquidity and volatility change on the stocks in the Norwegian market after a reverse split. However, further investigations are necessary to provide sufficient evidence to back up these findings.

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Appendix

A1: Form to fill out for companies undertaking a reverse split at the Oslo Stock Exchange

Key information relating to the share [split] [reverse split] to be carried out by [COMPANY NAME]

Date on which the corporate action was made public: [Split] [Reverse split] ratio: [*xx*] old shares give [*xx*] new shares Last day including right:

Ex-date:

Record date:

Date of approval:

Other information (optional):

This information is published in accordance with the requirements of the Continuing Obligations.

_____

Explanations of the information that is to be provided in the above fields (not to be included in the stock exchange announcement):

Key information relating to the share [split] [reverse split] to be carried out by [COMPANY NAME]: Specify 'split' or 'reverse split' as appropriate.

Date on which the corporate action was made public: Insert the date on which information about the transaction was made public.

[Split] [Reverse split] ratio: [*xx*] old shares give [*xx*] new shares: Insert the ratio for the share split or reverse split.

Last day including right: The date of the last trading day on which the shares will be traded including the right to receive shares according to the exchange ratio once the split/reverse split is carried out.

Ex-date: The date of the first trading day on which the shares will be traded without the right to receive shares according to the exchange ratio. Shareholders who acquire shares on or after this trading day will not receive shares according to the exchange ratio once the share split/reverse split is carried out.

Record date: The date on which the copy of the shareholder register will be taken. This will be used to identify who is entitled to receive shares once the share split/reverse split is carried out. The new number of shares following the split/reverse split accrues to those shareholders who are registered as shareholders on the shareholder register on the record date. With a normal settlement cycle (T+2), the record date will be the day that occurs T+1 after the ex-date.

Date of approval: The date on which the share split/reverse split was approved/is due to be approved by the competent corporate body.

Other information (optional): Provide further information if required.

A2: Companies included in the sample

Company	Announcement date	Ex-date	Split factor
Seabird Exploration	10.12.2015	11.12.2015	1000:1
Polarcus Limited	23.11.2015	27.11.2015	10:1
African Petroleum Corporation Ltd	23.10.2015	26.10.2015	10:1
Weifa ASA	08.10.2015	15.10.2015	2:1
Archer Limited	21.09.2015	28.09.2015	10:1
Scana Industrier ASA	10.07.2015	14.07.2015	10:1
Interoil Exploration and Prod ASA	03.07.2015	06.07.2015	10:1
Norwegian Energy company ASA	13.05.2015	15.05.2015	100:1
Cellcura ASA	25.02.2014	28.02.2014	20:1
Marine Harvest ASA	30.12.2013	21.01.2014	10:1
RomReal Ltd	10.12.2013	18.12.2013	2,5:1
Axactor AB	12.12.2013	13.12.2013	10:1
Northland Resources SE	14.08.2013	19.08.2013	100:1
NEL ASA	15.08.2013	16.08.2013	10:1
Scana Industrier ASA	27.05.2013	28.05.2013	10:1
Eitzen Chemical ASA	05.02.2013	06.02.2013	100:1
Domstein ASA	14.12.2012	02.01.2013	10:1
Norda ASA	03.07.2012	04.07.2012	100:1
Rocksource ASA	14.06.2012	21.06.2012	4:1
Oceanteam ASA	04.06.2012	05.06.2012	10:1
Seabird Exploration	20.04.2012	05.06.2012	10:1
Norse Energy Corp ASA	29.05.2012	30.05.2012	10:1
Goodtech ASA	25.04.2012	07.05.2012	10:1
EMS Seven Seas ASA	20.12.2011	22.12.2011	10:1
Jason Shipping ASA	09.12.2011	21.12.2011	10:1
Axactor AB	22.11.2011	08.12.2011	80:1
Sevan Marine ASA	30.11.2011	01.12.2011	100:1
Nattopharma ASA	31.10.2011	03.11.2011	100:1
SinOceanic Shipping ASA	05.09.2011	08.09.2011	10:1
Transeuro Energy Corp	04.08.2011	08.08.2011	5:1
Aqua Bio Technology ASA	23.06.2011	27.06.2011	20:1
Repant ASA	15.06.2011	16.06.2011	10:1
EMS Seven Seas ASA	03.06.2011	06.06.2011	10:1
NEL ASA	26.05.2011	30.05.2011	10:1
Reach Subsea ASA	01.04.2011	02.05.2011	40:1
Codfarmers ASA	09.03.2011	10.03.2011	10:1
Reservoir Exploration Technology ASA	21.12.2010	22.12.2010	100:1
FARA ASA	19.11.2010	06.12.2010	5:1
Crew Gold Corporation	23.07.2010	05.08.2010	20:1

Petrolia SE	08.06.2010	30.06.2010	10:1
SAS AB	01.06.2010	07.06.2010	30:1
Dockwise Ltd	30.09.2009	02.12.2009	20:1
Wentworth Resources Limited	13.10.2009	15.10.2009	100:1
Gaming Innovation Group Inc	04.06.2009	08.06.2009	10:1
Dolphin Group ASA	29.05.2009	03.06.2009	10:1
SinOceanic Shipping ASA	28.05.2009	02.06.2009	6:1
Rocksource ASA	20.05.2009	26.05.2009	4:1
Norda ASA	14.05.2009	15.05.2009	10:1
Crew Gold Corporation	19.02.2009	23.02.2009	8:1
Wega Mining ASA	13.01.2009	14.01.2009	11:1
Apptix ASA	12.06.2008	16.06.2008	5:1
Tandberg Data	09.04.2008	10.04.2008	100:1
Ignis ASA	07.06.2007	09.07.2007	25:1
Altinex ASA	12.06.2007	14.06.2007	10:1
Component Software Group ASA	26.02.2007	27.02.2007	20:1
Atea ASA	28.04.2006	02.06.2006	10:1
StrongPoint ASA	06.05.2005	09.05.2005	10:1
Marine Harvest ASA (Pan Fish)	19.08.2004	20.08.2004	100:1
Stepstone ASA	28.05.2004	01.06.2004	20:1
Andvord Tybring-Gjedde ASA	30.04.2004	21.05.2004	10:1
Sinvest AS	19.12.2003	22.12.2003	100:1
Crystal Production ASA	11.04.2003	08.09.2003	100:1
Ocean Rig ASA	20.05.2003	21.05.2003	10:1
Kværner ASA	16.05.2003	19.05.2003	20:1
Goodtech ASA	19.04.2002	25.04.2002	10:1
Ocean Rig ASA	30.11.1999	01.12.1999	30:1
Waterfront Shipping AS	14.05.1999	14.05.1999	1000:1
Visma AS	13.11.1998	19.11.1998	10:1
Iby Eiendom ASA	26.07.1996	05.08.1996	10:1