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The Index Effect at the Oslo Stock Exchange Benchmark Index

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Preface

Throughout our two years as business students majoring in finance, we have encountered many interesting topics, some more challenging than others. However, we have certainly learned a lot, about economy and finance, as well as about ourselves and our classmates. In class we have gained theoretical knowledge as well as practical applications of theory in the form of assignments and case studies. The case studies were mainly focused on foreign markets, and we found ourselves in a position where we didn't know that much about what goes on in the Norwegian market, other than what we read in the news. Therefore, with the help of our supervisor, we decided upon a thesis that would explore the financial market of Norway.

This thesis is the result of hard work over many long days. We would like to thank our supervisor, Dagfinn Rime, for helping us with the research area and valuable advice. We also extend our gratitude towards family and friends for supporting us during this period, and a special thank you to our cohabitants.

Abstract

In this thesis we study the index effect at the Oslo Stock Exchange Benchmark Index (OSEBX) surrounding the reconstitution of the index that takes place two times a year. This done by calculating expected returns and abnormal returns for each constituent in the period 2002-2018. We also investigate abnormal trading volumes surrounding the reconstitution. We find that there is an index effect surrounding the dates securities are included to and excluded from OSEBX.

We also draw practical implications from our results by using the constituents at each revision to construct trading strategies that beat the market portfolio in most of the reconstitutions.

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1.0 Introduction

According to Fama (1976) efficient capital markets yields the true expected return of any security, which is equal to the market's assessment of the expected return. This because the security prices reflect all publicly available information. Therefore, it should be impossible for investors to outperform the market, as there are no under- or overvalued securities. However, if markets are inefficient, there might exist arbitrage opportunities. In this thesis, we approach this subject by looking at the inclusion (deletion) of a stock to (from) the OSEBX. If these index mechanics results in changes in the price and trading volume of the securities in question, it can be said that there exists an index effect. This would also infer that the Norwegian stock market is inefficient, making this a very interesting topic for all stakeholders in the community.

The index effect has become a known phenomenon over the last decades. The first to be considered to have tested such effects is Andrei Shleifer (1986), who found that there exist permanent positive price effects following index revisions at the S&P 500. Shleifer (1986) explained that the increase in share prices are highly correlated with the increase in index fund buying patterns and that the shift in the demand curve is due to the needs of index funds. This is also in accordance with Nasdaq (2019) definition of the index effect, where they refer to the effect as "The S&P Phenomenon", and that the increase in price is due to large buy orders by index funds.

The index effect has been studied on several indices in different countries, by different researchers. However, there is much more studies on the S&P 500 than other indices. Schleifer (1986), Harris and Gurel (1986) and Jain (1987) all studied the index effect on the S&P 500, finding evidence of abnormal returns from inclusion of a stock to the index.

In Norway, the effect has been studied to a much lesser degree. The most common index to study in Norway is the OBX which consists of the top 25 most traded securities on the Oslo Stock Exchange. OSEBX, the benchmark index of the Norwegian stock market, has very few studies on the index effect. However, per January 2019, there were five index funds following the OSEBX and only two following the OBX (Pedersen, 2019), making a study on OSEBX the obvious choice as we believe it would be of more interest to investors in the Norwegian stock market.

Findings from studies done on Norwegian indices indicate an index effect in the period after 2008, and that the effect is mainly due to the large volume of purchases done by index funds, as shown by both Myhre and Nybakk (2012) and Mæhle and Sandberg (2015). While Myhre and Nybakk (2012) find evidence of a temporary effect, Mæhle and Sandberg (2015) find evidence of a more persistent effect. Mæhle and Sandberg (2015) is the only previous study of the index effect on the OSEBX to our knowledge. Thus, we believe it is a great opportunity to build on their work, and to compare our results as we have more historical data available and might use different assumptions and methods.

Most studies of the index effect, both domestic and foreign, study one side of the index revisions, namely index additions. However, we do observe that more have included the deletions as the research of the area has evolved through the years.

Our analyses are done for several datasets. More specifically, the first dataset contains all inclusions and deletions in the period 2002-2018. The second dataset contains only first inclusions and deletions, and the final dataset consists only of securities that has been added to the index at least once before. The reason for doing this is that we suspected that there might be a more pronounced price and volume effect for first inclusions (deletions) than for those securities that have been included (excluded) once before.

Our results indicate that there is an index effect for securities added to or deleted from the OSEBX in the period 2002-2018. We find that the effect is mainly explained by increased trading volumes at the day before the effective date (ED-1), i.e. the day before the security is implemented to the index. The average abnormal return on ED-1 is 2.1% for additions and -3.2% for deletions for the sample containing all inclusions and deletions. For first inclusions the average abnormal return is also 2.1% for additions and -3.6% for deletions. This is lower than the results for securities that have been included or excluded at least once before, where the results are 2.13% and -2.7% respectively. We also find indications of permanent price effects in all samples, except first-time deletions.

In addition to identifying price and volume effects, we will discuss the obtained results against theories from previous research on the area, trying to explain the reason for the observed effects. We also draw a practical application of the results by constructing different trading strategies that are to be implemented on the index revision of OSEBX. The strategies show that we, in over 80% of the revisions, are able to beat the market.

1.1 Oslo Stock Exchange

The Oslo Stock Exchange (OSE) was established in 1818, and the first trading day was on April 15^{th}, 1819. However, OSE did not become a stock exchange until 1881, before then it was a commodity exchange. Since 1881, the exchange has had several partnerships with other Norwegian and foreign exchanges. Today, it is the only Norwegian stock exchange, and was until recently the only independent stock exchange within the Nordic countries, i.e. not own by other stock exchanges like Nasdaq. Monday 13^{th} of may 2019, the Norwegian Finance Department gave both Nasdaq AB and Euronext N.V. permission to obtain shares in the holding company of OSE, Oslo Børs VPN Holding ASA (Finansdepartementet, 2019). Nasdaq later withdrew their offer, and Euronext currently owns 97.7% of OSE (Hegnar, 2019).

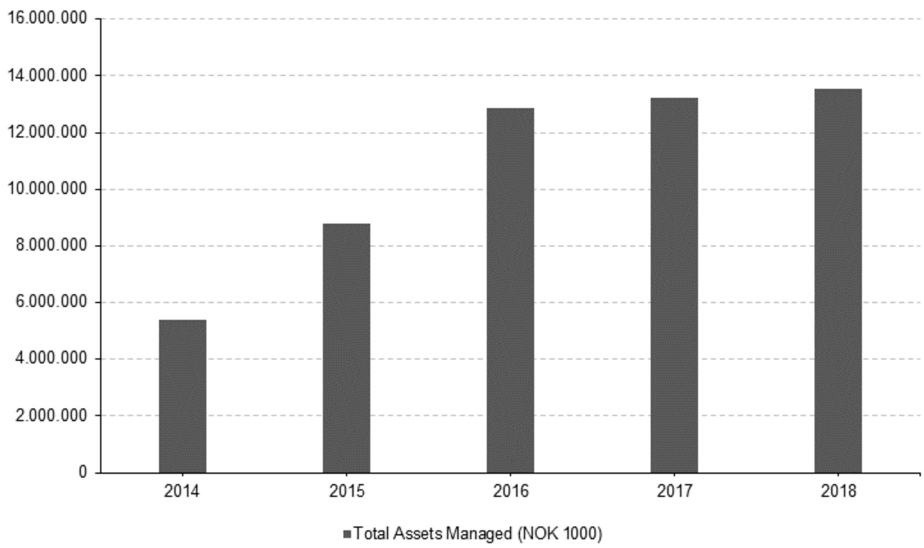
1.2 Stock indices and index funds

A stock index is defined by Standard & Poor's 500 as a market-capitalization-weighted average of a relatively static list of securities (Lo, 2016). This means that the stock market is constructed in such a way so that the index movements depends on firm size. In calculating such weights, a free-float method is used for OSEBX on the Oslo Stock Exchange and is explained in detail for OSEBX later.

As the name implies, an index fund is an investment fund that attempts to replicate the performance of a stock index (Tuchman, 2013). Index funds usually come at a lower cost for the fund-investor than the regular stock investor. This is because there is no need for the investor to pick winners and losers as the fund already own all investments in the index. Thus, there is less maintenance and room for lower investor costs (Tuchman, 2013). One benefit of investing in index funds is that you automatically obtain a diversified portfolio. However, in order to bear only the true market risk, you would need to invest in several index funds that reflects the real world (Tuchman, 2013).

In Norway, we have five funds who follow OSEBX. In *Figure 1.1*, the total assets managed by those funds in the last 5 years are illustrated, which also shows the increasing popularity of such funds.

Figure 1.1 – Total Assets Managed by funds following OSEBX (NOK 1000)

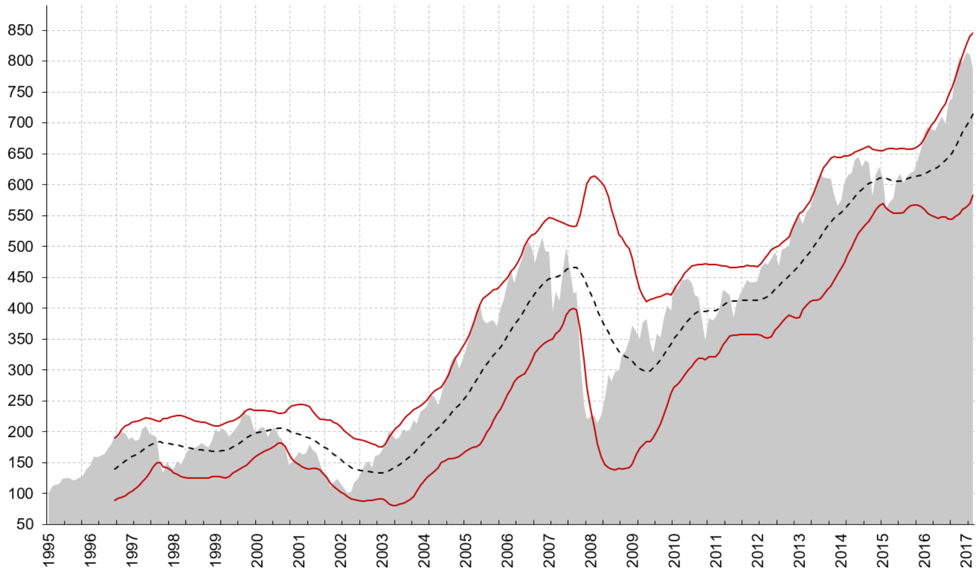


The figure shows the accumulated NOK value of assets held by fund that follow the OSEBX index in Norway. Data retrieved from: Verdipapirfondenes forening / VFF.no)

1.3 The Oslo Stock Exchange Benchmark Index (OSEBX)

OSEBX is the benchmark index in Norway and is comprised by a representative selection of stocks listed on Oslo Børs. The index is used to measure the return of the Norwegian stock market, and it is revised semi-annually at December 1st and June 1st respectively. (Oslo Børs, 2019). OSEBX is the uncapped version of the benchmark index, in contrast to OSEFX which is capped. OSEBX was established in 2001, replacing the old benchmark index, Total Return index (Totalindeksen) (Oslo Børs, 2019). The replacement was done in order to base the index on the more known standard, the Global Industry Classification Standard (GICS) (Hegnar, 2001). The advantage of GICS is that it offers a better classification of industries and is done so at global level, meaning that it better reflects the industry sectors across countries (MSCI, 2019). In return, this classification system makes it easier for investors across the globe to do research on the assets provided on OSEBX (Oslo Børs, 2018, p. 23).

Figure 1.2 – Historical closing price OSEBX



Data collected from Yahoo Finance. The grey area represents the historical monthly closing prices on OSEBX. The dashed line indicates the 20-day simple moving average (SMA). The upper red line is the 20-day upper Bollinger band [SMA + (2 x std. dev.)]. The lower red line is the 20-day lower Bollinger band [SMA – (2 x std. dev.)].

1.3.1 Selection of securities that constitute the index

Oslo Børs uses a four-step process in selecting the securities that constitute the OSEBX (Oslo Børs, 2018, p. 8).

(1) To avoid seasonal fluctuations all eligible securities listed on Oslo Børs are ranked according to the previous 12 months official turnover. The 12 days with the highest turnover are excluded from the calculation.
(2) Securities with the lowest turnover, corresponding to 40% in number are deemed ineligible. Existing constituents are deemed ineligible when ranked at 35% or lower.
(3) The 30 highest ranked securities according to (1) are qualified for inclusion. Existing constituents are qualified if they are ranked at among the 35 highest according to (1).
(4) Within each industry group, securities are ranked according to their free float-adjusted market cap from largest to smallest, and selected top-down until at least 80% of the industry group’s free float-adjusted market cap is reached. Existing constituents are selected unless they are ranked below 90% of the industry group’s free float-adjusted market cap. Securities deemed to qualify according to (3) are added. Securities deemed ineligible according to (2) are removed. Consequently, the target of at least 80% of each industry group’s free float-adjusted market cap may not be reached.

There might also be special cases where securities are deemed to be ineligible (Oslo Børs, 2018, p. 8).

1.3.2 Free-float criteria

According to Oslo Børs (2018, p. 9), free float is defined as the portion of the share capital of a firm that is freely available for trading in the market. The reason for including a free-float criteria is to avoid distortion in the price of a security and to improve the index’ overall investability. Free float is measured by identifying the ownership of the ten largest investors as of October 15th or April 15th, or the next day if no trading is done that day (Oslo Børs, 2018, p. 9). Only publicly available information is used to calculate the free float restriction.

2.0 Theory

2.1 The Efficient Market Hypothesis (EMH)

If prices are at their fair level, given all available information, then only when given any new information will the price experience an increase or decrease. By definition, new information must be unpredictable. If the new information could be predicted, it would be part of the information held today (Bodie, Kane and Marcus, 2014, p. 350). According to Bodie et al. (2014), this is the underlying of the argument that stock prices follows a random walk if markets are to be efficient.

In 1970 Eugene F. Fama presented the efficient market hypothesis which states that a market is efficient if security prices at any time “fully reflect” all available information. There are three relevant subsets in consideration. The weak form, in which the information available is set to historical prices. Second, the semi-strong form in which concern is whether prices adjust to information that is obviously publicly available. Lastly, the strong form allows investors or groups to have inside information.

Apparent by the unpredictability assumed in the efficient market hypothesis (EMH), efforts to trade on stocks are not likely to pay off. Proponents of the theory argues that active trading is mostly a wasted effort and believe that investor should do a passive investment strategy that make no effort to outperform the market. As the EMH indicates that stocks are priced at their fair level, it would make no sense trading stocks frequently as this would generate large transaction costs with no increased performance in expectation (Bodie et al., 2014).

2.2 The price pressure hypothesis (PPH)

The price pressure hypothesis assumes that investors who accommodate demand shifts must be compensated for the transaction cost and risk they bear when they buy or sell securities that they otherwise would not trade (Harris & Gurel, 1986). Like the EMH, the PPH assumes that long run demand is perfectly elastic (horizontal). It differs in that it recognizes that non-information-motivated demand shifts might be costly and therefore the short-term demand curves could be non-perfectly elastic (downward-sloping) (Harris & Gurel, 1986).

In the case of an index revision, these passive suppliers of liquidity are attracted by price increase (decrease) associated with a stock added to (deleted from) an index (Harris & Gurel, 1986). The increase in demand is synonym with an expected increase in trading volume for both additions and deletions. Beneish and Whaley (1996) suggest that index funds will wait until ED to rebalance, to reduce the tracking error in the fund, hence the biggest spikes in trading volume is expected to be close to this date.

2.3 The imperfect substitutes hypothesis (ISH)

The imperfect substitutes hypothesis assumes that securities are not close substitutes for each other, thus long-term demand is non-perfectly elastic (Harris and Gurel, 1986). If a security is added or deleted from an index, the equilibrium price shift to eliminate excess demand or supply. Under this hypothesis, price reversals are not expected because the new price represents the new equilibrium distribution of security holders.

The expected effect on trading volumes is more unclear and could be either short-termed or permanent, depending on the trading behavior of the investors that caused the change in demand (Bechmann, 2004).

2.4 The information cost/liquidity hypothesis

The information cost/liquidity hypothesis assumes that investors demand higher returns for investing in securities with less available information and lower liquidity (Beneish & Gardner, 1995). This to compensate for the fact that acquiring information is costly and less information and liquidity transfers to more risk. Securities included in an index is likely to be more researched and invested in more frequently. Hence, the security becomes less risky and more liquid, consequently lowering the risk and liquidity premiums.

The hypothesis thus states that the price and trading volume will permanently increase as long as it is in the index. Symmetrically one would expect the opposite if the security is excluded from the index (Bechmann, 2002).

2.5 The attention hypothesis

The attention hypothesis was developed by Merton (1987) and assumes that increased attention towards a security will lead to a permanent price increase. News and publicity create market attention and draws the attention of potential new investors. In his model, Merton proposes an environment where each investor knows only about a subset of the available securities. These investors only use a security in their optimal portfolio if they know about the security. Merton (1987) show that the investors market portfolio will not be mean-variance efficient.

First-time additions are likely to have increased attention from media, investors and institutions. Consequently, demand for these securities increase, and a permanent price increase is expected.

The theory does not apply for deletions. Stocks deleted from an index have already experienced increased attention when they were added. Thus, investors are already familiar with these stocks.

As only newly added stocks should experience new attention, the attention hypothesis predicts that these stocks will be more traded than other stocks revised.

2.6 The information Signaling hypothesis

The information signaling, or the certification hypothesis tells how a security's price is affected by an event signal to the marked. According to this hypothesis an important piece of information is revealed that should have a permanent effect on prices and a temporary effect on volume (Brooks, Kappou and Ward, 2008).

Being added to (deleted from) an index is viewed as good (bad) news regarding the security's prospects. There can be many factors and events that decides what signal is sent to the market. One case in which changes in an index can reveal new fundamental information is when an index committee determines the composition of the index. In this case, the addition of a firm's stock can certify the committee's opinion on the firm's life expectancy (Bechmann, 2004). The certification effect can increase firms expected future cash flow as inclusion to an index will help companies attract new capital more easily because financial institutions may be more willing to lend to firms that are index members (Brooks et al., 2008).

2.7 Selection criteria hypothesis

A somewhat different theory is the selection bias or selection criterion hypothesis, which states that the reason for the effects is related to the criterion used to determine the composition of the index. A selection bias could, for instance, be present if only securities with high returns in the period before a revision are added to the index (Bechmann, 2004). Generally, if a firm has performed good in the previous period it is more likely to perform well in the subsequent period as well. Thus, the effect of being included in the index may not be the only reason for the good performance of the stock. (Bechmann, 2004).

3.0 Literature review

There are several previous studies and articles that provide theories on the index effect. However, very few have done a study on this using the Oslo Stock Exchange's benchmark Index, OSEBX. In fact, we have only found one previous study on this index, by Mæhle and Sandberg in 2015. Most of the previous studies and theories is done using other indices such as the OBX in Norway, and in other studies, S&P 500 is given the most attention. The following section contains a selection of literature that is relevant to our topic.

3.1 Articles and previous studies on foreign indices

3.1.1 Schleifer 1986 – Do Demand Curves for Stocks Slope down?

In his research on the slope of the demand curve, Schleifer (1986) studied the inclusion of firms to the S&P 500 in the period 1966-1983. In the years after 1976, inclusion of a stock in the index shows a significant increase in abnormal returns after the announcement date (AD) and a capital gain of about 3%, where most of the gain endure for at least 10 to 20 trading days after the announcement. Schleifer (1986) also argued that most of his findings could be explained in some way by the information signaling hypothesis, stating that an inclusion of a stock into the S&P index serves as a certification of quality of the company included, thus giving a price increase. Another reason for growth in abnormal AD returns in the period after 1976 is that index funds grew massively in this period.

3.1.2 Harris & Gurel 1986 – Price and Volume Effects Associated with Changes in the S&P 500 List: New Evidence for the Existence of Price Pressures

Harris and Gurel (1986) focused their study on the changes in trading volumes arisen from the announcement of index-inclusion of a stock. Using data on S&P 500, they found that growth in trading volumes mostly comes from the period 1978-1983. This is consistent with the fact that index funds who buy large portions of AD stocks grew rapidly in the same period. In light of the no-information assertation, which assumes that any information associated with a

S&P 500 listing will permanently affect prices, Harris and Gurel (1986) tests for a reversal of the price rise. The results show that there is a cumulative reversal over a 11-21-day period. These results show that little to none information about future returns is propagated by the listing announcement. Harris and Gurel (1986) concludes that the post-announcement price increase contradicts the efficient market hypothesis, and that the price-pressure hypothesis can be used as an alternative explanation to the price increase and its reversal. Harris and Gurel (1986) also tested their result by looking at deletions from the S&P 500 list. The results are consistent with the hypothesis of price-pressure. However, the results are very basic as the sample used had few observations and clustering.

3.1.3 Jain 1987 – The Effect on Stock Price of Inclusion in or Exclusion from the S&P 500

Jain (1987) tests the effects on stock price both for inclusion in the S&P 500 and exclusion from index. Where others have argued that the increase in price, post announcement, is due to a price pressure effect, Jain (1987) finds evidence that this is not correct. By using an appropriate control group compiled by various supplementary indices by S&P, he finds that stocks included in these indexes earn close to the same excess return as stocks included in the S&P 500, and therefore argues that the price-pressure hypothesis is not supported. Jain (1987) also presents evidence that exclusion from the S&P 500 list results in negative abnormal return, which is significant at the 5 per cent level.

3.1.4 Banish and Gardner 1995 – Information Costs and Liquidity Effects from Changes in the Dow Jones Industrial Average List

Banish and Gardner studies the stock price and volume effects in the Dow Jones Industrial Average List (DJIA). The study differs from previous studies done on the S&P 500. The reason is that index funds usually purchase on the S&P 500, not the DJIA, so effects shown by examining the DJIA will not likely be due to large trades by index funds. Another reason is that it is easier to examine the deletion of stock on the DJIA than on the S&P 500, since deletion on S&P 500 usually is due to mergers or bankruptcy (Banish and Gardner, 1995).

Banish and Gardner (1965) finds that shareholders of firms that are deleted from the index experience a significant wealth loss, whereas returns from added firms are unaffected at the announcement of the change. This suggests that listings on the DJIA do not provide information on future performance, thus the Information Signaling Hypothesis is not supported. Banish and Gardner (1965) also finds no support for the price-pressure hypothesis or the imperfect substitutes hypothesis. They do however argue that the effect can be explained by Information costs or liquidity effects. Since firms that are deleted get much less attention, their information pool shrinks. Consequently, the price of such stocks will decrease as there is less cost associated with collecting and analyzing the stock.

3.1.5 Polonchek and Krehbiel 1994 – Price and Volume Effects Associated with the Dow Jones Average

Polonchek and Krehbiel (1994) examined the Dow Jones Industrial Average (DJIA) and the Dow Jones Transportation Average (DJTA) in the period 1962 to 1991 and found that firms added to the DJIA had positive abnormal returns and larger trading volumes on the day of inclusion, while firms added to the DJTA did not experience any abnormal returns or trading volumes. News about changes in the DJIA is certainly given more media coverage than changes in the DJTA, and according to Polonchek and Krehbiel (1994), the results are consistent with the attention theory presented by Robert Merton (1967), which stated that investors are more likely to buy stocks that are given more attention than those who are not, and that this can be an explanation to the effects of inclusion (deletion) on indeces.

3.1.6 Bechmann 2004 – Price and Volume Effects Associated with Changes in the Danish Blue-Chip Index – The KFX Index

Bechmann (2004) studied the effects of changes in the composition of the KFX Index in Denmark. In the KFX Index, some stocks are added to or deleted from the index several times, which gives us a unique chance to observe whether it matters if the stock is added or deleted for the first time or not (Bechmann, 2004). This is also the case for our dataset, the OSEBX, and we too will have the opportunity to study whether this is of importance. Bechmann (2004) also states that it is of importance to consider the characteristics of the index and the selection criterion used. The KFX index and the OSEBX are both based on publicly available information, thus, additions to the indices will not reveal any new information.

The result of the study is that stocks that are deleted from the index experience an average abnormal return of -16%, while those included experience abnormal returns of 5%, on average. Bechmann (2004) finds that the price effect is permanent, thus supporting the price-pressure hypothesis. He also finds that firms have higher trading volumes after addition to the index, and lower trading volumes after deletion, which can be explained by the information cost and liquidity hypothesis.

3.2 Studies on indices in Norway

3.2.1 Myhre and Nybakk 2012 – En empirisk studie av pris- og volumeffekter ved inkludering av askjer i OBX-indeksen

The conclusion of the study is that there is no index effect regarding the announcement date (Myhre and Nybakk, 2012). However, there seems to be abnormal returns and trading volumes around the effective date, especially the day before and at the effective date for the revision. Myhre and Nybakk (2012) argues that the price-pressure hypothesis is the most likely hypothesis to explain the index effect, looking at index funds as the main reason for the price pressure. However, they find the effect to be of temporary length. The effect does also seem to be stronger in the period after 2008, which can be attributed to the implications of world-wide financial crisis during that period (Myhre and Nybakk, 2012, p. 84).

3.2.2 Mæhle and Sandberg 2015 – Price and Volume Effects Associated with Index Revisions in the OSEBX

Mæhle and Sandberg (2015) studied the index effect on OSEBX as part of their master's thesis, and tested the hypothesis presented by previous literature for this particular index. Their findings suggest that the price-pressure hypothesis is the most likely reason for the index effect, and that it is the index funds large purchasing volumes that creates a short-term downward sloping demand curve. However, they do question the validity of the hypothesis for additions as their results do not seem to give a rapid price correction in accordance with the hypothesis. The results do also provide some evidence for the attention hypothesis, but the due to lack of permanent price changes they argue that the hypothesis is unlikely to hold, even though they fail to reject it completely (Mæhle and Sandberg, 2015, p. 104-105). Mæhle and Sandberg (2015) uses Fama & French's 3-factor model as their measurement for normal returns, which is the same model that we will be using in our study. Therefore, it will be interesting to see whether we find the same results considering we are able to use newer data.

3.3 Comparing studies

From the studies discussed above, we learn that that there are several different reasons as to why we observe effects on the stock price and trading volumes when a stock is included in or deleted from an index. The existing literature show that, in general, there is an index effect. However, the different studies present various results as to, e.g. the longitude of the price effects. For example, Harris and Gurel (1986) finds that the stock price fully reverts to its original level before the announcement about the change is made, whereas Schleifer (1986) finds that the price increase of inclusion is permanent.

It is also important to address that the previous literature studies a numerous of different indices. Therefore, one should to be careful when comparing studies. Although the general framework might be similar, the composition of the indices might be compiled with a different method, i.e. using different selection criterions when deciding which stocks to include or delete from an index. Hence, the general design of the indices might make a direct comparison inadequate.

The literature on the index effect is extensive, but we have tried to cover the key papers on the subject.

4.0 Methodology

4.1 Event studies

There is no standard agreed-upon methodology for identifying and examine long-run stock price effects (Bechmann, 2004). Among others, Fama (1997) and Lyon, Barber and Tsai (1999) discuss how adjusted stock returns should be calculated and tested. Some of these methodologies are more advanced and rely on identifying a selected reference sample of securities or a sample of non-event securities. Non-event securities are securities that have never been included in the index. This framework does not suit our data sample, the main reasons being that OSEBX contain a large number of firms, making it difficult to identify non-event securities.

Therefore, to measure the effect of a stock being included to or deleted from the OSEBX, the event study is an ideal tool. The research methodology can measure effects of an economic event under a simple framework and is widely used in economics and other fields of research. James Dolley is recognized as the first to apply the method in his article from in 1933. Over the years the methodology has been continuously improved. In fact, event study methodology has become the standard method of measuring how security prices react to certain events (Binder, 1998). The event study is mainly used for two reasons: 1) testing that the market efficiently incorporates information and that 2) under the efficient market hypothesis, what is the impact of an event on the wealth of security holder (Binder, 1998).

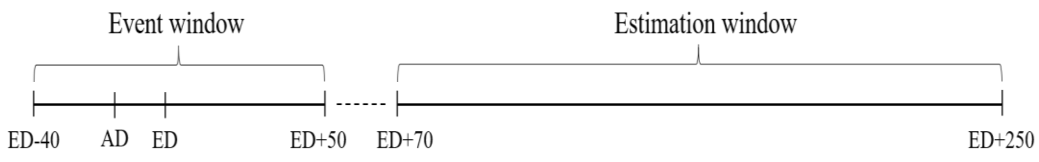
4.1.1 Estimation Window and Event Window

To estimate normal returns for the event window, we first need to define an estimation window. There are a lot of event studies done on the index effect, however, the methodology varies trough the studies, especially when it comes to the length of the estimation period. Further, the position of the estimation period with regards to the event window, also varies a great deal in the previous studies.

There can be either a pre-period estimation window, a post-period or a pooled-period estimation window, which is a combination of pre- and post-periods (Skrepnek & Lawson, 2001). Chung and Kryzanowski (1998), showed that due to a potential selection bias, additions (deletions) are expected to overperform (underperform) in the period before implementation. Therefore, choosing a pre-period estimation window can lead to biased results. Brooks et al. (2008) also show how there exists significant differences in the estimates when using a pre-period and a post-period estimation window. A pooled estimation window could reduce some of the biases, however we argue that a post-estimation window is better as the pooled window might not fully deal with the bias from the pre-period. This is also supported by Bechmann (2004) and Edmister, Graham and Pirie (1994).

We have decided to set the post-period estimation window to begin 20 days after the event window. This “quiet period” is set to make sure that any effects from the event is either reverted or more stabilized at a new level before our estimation of the normal return begins. In that way, we will not capture any effects from the event in estimation our normal returns. Skrepnek and Lawson (2001) does not recommended to exceed 300 days in the estimation window. They also state that the normal length of the estimation window tends to lie around 100-300 days. Our estimation window starts at ED+70 and lasts until ED+250, giving a window of 181 daily observations. Skrepnek and Lawson (2001) further state that it is common to use an event window that range from 21 to 121 days. Our event window ranges from ED-40 to ED+50, consisting of 91 daily observations.

Figure 4.1 – Estimation window and Event window



As seen in *Figure 4.1*, the announcement date (AD) is not set to an exact number of days before ED. This is because the number of days between AD and ED varies from between events and the announcement method of Oslo Stock Exchange, i.e. there could be certain inclusions (exclusions) that are extraordinary.

4.2 The normal return model

To identify abnormal effects in an event study, there need to be a measure of the unobservable normal returns. The definition of normal returns is the expected return without conditioning on the event taking place (MacKinlay, 1997).

The approaches available to calculate the normal return for a given security can loosely be grouped into two categories – statistical and economic (MacKinlay, 1997). Statistical models follow from statistical assumptions and do not depend on economic arguments in contrast to the latter model.

In this section we present various models that are used to estimate normal returns in the event window.

4.2.1 Constant mean return model

One of the simplest models is the constant mean return model which assumes, as its names implies, mean return of a given security to be constant trough time. Even though this model is simple, Brown and Warner (1980, 1985) find that the model often perform similar to the more sophisticated models described below. This could be because the variance of the abnormal return is frequently not reduced by much by choosing the more sophisticated models (MacKinlay, 1997).

The normal return for security *i* at time *t*, R_{it}, equals the mean return for security *i* at time *t*, μ_i,plus a disturbance term, ε_{it}, where $E[\varepsilon_{it}] = 0$ and $var[\varepsilon_{it}] = \sigma_{\varepsilon}^2$.

$$R_{it} = \mu_i + \varepsilon_{it}$$

4.2.2 The market model

The market model is a statistical model which relates the return of any given security to the return of the market portfolio. The stock return, R_{it}, during period t, is expressed mathematically as

$$R_{it} = \alpha_i + \beta_i R_m + \varepsilon_{it}$$

Where R_m is the market's rate of return during the period and ε_{it} is the return resulting from firm-specific events. α_i is the average rate of return security *i* would realize in a period with zero market return. Thus, the return of any asset provides a decomposition of R_t into market a firm-specific return (Bodie et al., 2014).

The market model is a flexible tool, because it can be generalized to include richer models of benchmark returns.

4.2.3 The Capital Asset Pricing Model

The CAPM model, was developed almost simultaneously by Sharpe (1963,1964) and Treynor (1961) (cited in Copeland et al. (2014, p. 145)), and has further developed to be one of the most recognized models in economics and finance. It assumes that the equilibrium rates of return on all risky assets are a function of their covariance with the market portfolio (Copeland et al., 2014, p. 145). Compared to the market model presented above, CAPM implies that α_i should equal $r_f(1-\beta)$. This makes the fitted security market line (SML) of CAPM steeper than for the market model (Bodie et al., 2014, p. 359).

Furthermore, the CAPM is developed in a hypothetical world, with the following assumptions (Copeland et al., 2014, p. 145-146):

1. Investors are risk-averse individuals who maximize the expected utility of their wealth.
2. Investors are price takers and have homogenous expectations about asset returns that have a joint normal distribution.
3. There exists a risk-free rate asset such that investors may borrow or lend unlimited amounts at a risk-free rate.

4. The quantities of assets are fixed. Also, all assets are marketable and perfectly divisible-
5. Asset markets are frictionless, and information is costless and simultaneously available to all investors.
6. There are no market imperfections such as taxes, regulations, or restrictions on short selling

The investors will hold a combination of the risk-free asset and the market portfolio, depending on their risk aversion. As the portfolio is perfectly diversified the only risk involved is systematic risk. The relationship between the expected return of a security, the beta and the risk premium are given as:

$$E[R_i] = r_f + \beta_i[r_m - r_f]$$

The CAPM has strong assumptions and followingly has received a lot of criticism, e.g. for not doing a good job explaining the variance in returns for small firms (Fama and French, 1996). Thus, the use of the CAPM in event studies has almost ceased (MacKinlay, 1997).

4.2.4 The Arbitrage Pricing Theory

Like the CAPM, the APT, developed by Stephen Ross in 1976, predicts a linear relationship between expected returns and risk, but the path it takes to the Security Market Line is different. 1) security returns can be described by a factor model; 2) there are sufficient securities to diversify away idiosyncratic risk; and 3) well-functioning security markets do not allow for the persistence of arbitrage opportunities (Bodie et al., 2014, pp. 327). The model is given as:

$$R_i = \alpha_i + \beta_{i1}F_1 + \ldots + \beta_{in}F_n$$

Some of the downsides with the APT model is that finding the right factors has proven difficult and time consuming (Bodie et al., 2014), and in general the additional factors to the market factor has little explanatory power. Thus, the gains from using an APT model versus the market model are small (Macklin, 1997).

4.2.5 Fama-French Three Factor Model

Fama and French's three factor model (FF3) is among the most recognized APT models. The FF3 is a multi-factor model that can be used to measure normal returns of a stock while capturing more of the systematic risk that cannot be smoothen out by diversification, than what can be done in a single factor model.

The model can be written as Bodie et al. (2014, p. 340) did:

$$R_{it} = \alpha_i + \beta_{iM} R_{Mt} + \beta_{iSMB} SMB_t + \beta_{iHML} HML_t + e_{it}$$

where

SMB = Small Minus Big, i.e. the return of a portfolio of small stocks in excess of the return on a portfolio of large stocks.

HML = High Minus Low, i.e. the return of a portfolio of stocks with a high book-to-market ratio in excess of the return on a portfolio of stocks with a low book-to-market ratio.

Hence, there are two firm-characteristic variables in the model that are chosen because observations have shown that firm size and book-to-market ratios predicts deviations of average stock returns from what is found using the CAPM (Bodie et al., 2014, p. 240-241). Fama and French (1996) point out that firms with low earnings tend to have high book-to-market ratios with positive slope on HML, and vice versa for firms with low book-to-market rations with negative slopes on HML. This implies that SMB and HML can be used to proxy size and financial distress or business cycle risk (Bodie et al., 2014), where SMB mimics the risk factor related to size and HML mimics the risk factor related to book-to-market equity (Fama and French, 1993, p. 9).

4.3 Discussion of normal return models

In addition to the models described above, there are other methods that can be used to estimate normal returns. For instance, Carhart (1997) has developed a model that extends Fama and French's 3-factor model to four factors, including a momentum variable that considers that buying previous winners and selling previous losers will yield a significant positive return, i.e. previous winners and loser has a momentum and is likely to continue the trend in the future.

Another approach is to use companies that does not have an event, i.e. use a non-event sample. In this way, returns from companies with events can be compared to companies with a non-event character. However, due to the size of Oslo Stock Exchange, this method would make it difficult to obtain a sufficient sample size of non-event companies. Another problem is that non-event stocks for additions might be deletions from the index and vice versa (Bechmann, 2004).

4.4 Model of choice

In our analysis, we have decided upon using the 3-factor model presented by Fama and French. One reason for using this as our main method is due to the work done by Næs, Skjeltorp and Ødegaard (2009) on what factors affect the Oslo Stock Exchange. They find that company size turns out to be a factor that demands risk compensation at OSE. However, they do find that the momentum factor is of little significance on the Norwegian market, hence the reason we do not look into the four-factor model of Carhart. Another reason for choosing the 3-factor model over e.g. CAPM is that we have found far less studies done with a factor model than with CAPM and thus want to extend on previous research by choosing a more advanced model. However, the choice of model for calculating expected normal returns might not have much of an impact on inferences about abnormal return as our study is focusing on a relatively short-term window (Fama, 1998).

4.5 Returns

4.5.1 Actual Return & Normal Return

The actual return of firm *i* at time *t* is defined as:

$$R_{it} = \frac{Closing\ price_{it} - Closing\ price_{it-1}}{Closing\ price_{it-1}}$$

where the excess return is defined as the return for security *i* at time *t* minus the risk-free rate: $R_{it} - rf_t$.

A common practice in event study methodology has been to use log excess returns instead of excess dollar returns due to the skewness of dollar prices as prices cannot be negative. However, Silva and Kimel (2014) finds that specifying an event study in terms of excess dollar returns is equivalent to using log excess returns, and that it should lead to the same conclusions. Based on this information, we have decided to use excess dollar returns in our regressions to estimate the expected normal returns.

To calculate the expected normal excess return for each firm, we obtain the parameter estimates of the intercept and the coefficients from the FF3 model:

$$\boldsymbol{E}(R_{it}) - rf_t = \hat{\alpha}_i + \hat{\beta}_{iM}[R_{Mt} - rf_t] + \hat{\beta}_{iSMB}SMB_t + \hat{\beta}_{iHML}HML_t + e_{it}$$

4.5.2 Abnormal Returns

The abnormal returns, AR_{it}, is defined as the difference between actual excess returns and expected normal excess returns for security *i* at time *t*:

$$AR_{it} = (R_{it} - rf_t) - [\boldsymbol{E}(R_{it}) - rf_t]$$

The abnormal returns can then be averaged against the total number of inclusions/deletions in order to check the average cross-sectional effect of index revisions on returns:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it}$$

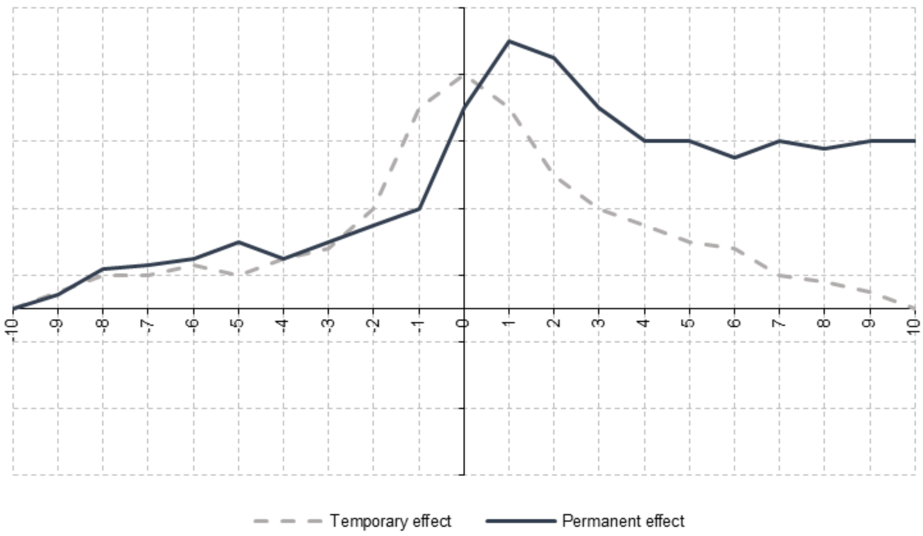
The average abnormal return can then be aggregated across time for any interval in an event window as shown by McKinley (1997) to get the cumulative average abnormal return (CAAR):

$$CAAR_{(t1,t2)} = \sum_{t=t1}^{t2} AAR_t$$

where *t1* and *t2* refers to the interval chosen. The CAAR is a useful tool when it comes to studying the abnormal return of an event when the effect is not restricted to the event date itself. (Brunnermeier, 2003).

Since CAAR can be aggregated for different subperiods, it enables us to test for different investor behaviors at different times. For example, if we choose the period right before the event, the CAAR will illustrate whether there is speculations before an inclusion or deletion from the index. Another property of the CAAR is that, when performed over the whole event window, it can show if the effect of an inclusion or deletion is permanent or temporary. If the effect is permanent, the CAAR should even out at a higher level than before the event, whereas if the effect is temporary, it should move back to its original level as illustrated below.

Figure 4.2 - Illustration of permanent vs temporary effects



The grey (dashed) line is an indication of how temporary effects behave at the CAAR level, while the dark line is an indication of how permanent effects look at the CAAR level. They need not have their "turning point" at different times, this is only done to separate the lines for the illustration.

4.6 Liquidity measures

When analyzing trading activity and determining whether there are changes in trading activity (increase/decrease) when firms are added to or deleted from the index, we use the mean volume ratio (MVR) proposed by Harris & Gurel (1986). The method is widely recognized and used in several studies on the same subject, e.g. Brooks (2008) and Baneish & Gardner (1995).

The volume ratio VR_{it}, is a standardized measure of period *t* trading volume for security *I*, which is then adjusted for market variation (Harris & Gurel, 1986). The expected value of the ratio is 1 if there is no change is trading activity during the event-period measured against the average trading volumes in the estimation period. This would also imply that the ratio would increase (decrease) if the stock volume at day *t* is decreased (increased), given that the market volume at day *t* is held constant.

$$VR_{it} = \frac{V_{it}}{V_{mt}} \times \frac{V_m}{V_i} \qquad (1)$$

V_{it} and V_{mt} reflects the trading volume for the securities and the market during the event window. V_m and V_i is the average trading volume in the estimation period for the market and the security respectively.

$$MVR_{it} = \frac{1}{N}\sum_{i=1}^{N} VR_{it} \qquad (2)$$

From the volume ratio calculated in equation (1) we can simply take the average across the number of securities to obtain the mean volume ratio shown in equation (2).

5.0 Data

5.1 Data collection

The data collected for this study is for companies included and excluded from the OSEBX in the period 2002-2018. More specifically, the firm data was collected from Datastream's database through Thomas Reuters Eikon. We collect daily data on closing price and shares traded, for each company added or deleted in each revision. The price factor is adjusted, which means that it considers stock splits and other corporate events. We were not able to retrieve the full sample data, as there is a problem with missing data for some securities.

For a market proxy we used data from Bernt Arne Ødegaard. His hompage (see references) provides the FF3 factors; HML, SMB and the risk-free rate. The factors are calculated in accordance with Fama & French's methods, but for the Norwegian market. Ødegaard use the Oslo Stock Exchange All Share index (OSEAX) in his calculations. We consider this to be a good fit to our analysis, as the all share index is a better proxy of the market since it includes all stocks in all sectors in the market. Inclusions and deletions on OSEBX can also affect the returns on OSEBX itself, so using this as a market proxy could lead to biased results (Bechmann, 2004).

As the number of shares traded on a daily basis on OSEBX was unavailable on Datastream, we retrieved the data needed from Bloomberg.

5.2 Selection Criteria

There are certain criterions that must be met for a firm to be included in the analysis. The main criteria is that a firm must have been included or deleted from the OSEBX at least once in the period 2002-2018. We received the constituents list from Oslo stock Exchange and collected all inclusions and deletions from Thomas Reuters Eikon. We then used the information received from OSE to confirm that the data from Eikon was correct. We also had to do a manual search through newsweb.no to find the announcement dates (AD). In our dataset, AD is defined as the day after the announcement is made. This is because the announcement is published after OSE is closed for trading activity.

After having found all included and deleted firms for the relevant period, we had to filter the data. The first filtering was done manually and consisted of removing certain firms that had other events with a possible effect on the stock price. This had to be done so that we don't end up with abnormal returns that are really caused by events that has nothing to do with an index inclusion or deletion. Examples of such events is: Rebranding close to the event, demergers, fast entries (i.e. being listed on the index shortly after stock listing. This means there would not be sufficient historical data for the company), delistings and insufficient data. In total, we manually removed 27 additions and 31 deletions.

The second filter consists of removing any firm that did not have enough data to cover the estimation and event window. Each stock must have at least 250 trading days after ED as well as 40 days prior to ED available for data extraction. Firms that did not fulfill these requirements were removed from the sample. Consequently, any firm that were delisted less than 250 days after an index revision was removed from the sample. This filter excluded 30 additions and 21 deletions.

In the last filter we checked that there was no interference with other inclusion/deletion event within the estimation period for each firm. This was to make sure we would not end up with an estimated normal return that is based on a similar event that we want to measure abnormal returns from. This filter excluded 35 additions and 38 deletions from our sample.

After running the data through these filters, we ended up with a sample size of 84 for first-time additions and 59 for first-time deletions. For the full sample size, taking all events into account, we ended up with 135 events for additions and 108 for deletions. This converts to 59.5% of the initial sample for additions and 54.5% for deletions. In comparison, Brooks et al. (2008) ended up using 77% of their initial sample for additions. Harris and Gurel (1986) ended up with 85% of their initial sample. Even more comparable, Maelhe and Sandberg (2015), who did a study on the same index, ended up using 55% of the initial sample for additions and 49 % for deletions. There are several explanations for the differences in the sample size even though the same index is studied. It could be due to the period being studied. We use a longer period, consequently leaving us with more data. Other explanations could be the estimation window used in the study, and how strict the filtering is when examining events that might affect the return around the event window.

6.0 Statistical testing

6.1 Hypotheses

To be able to make inferences from our results, we are conducting statistical tests. In our research question we are interested in both the temporary and the permanent effects. To test if there are temporary effects in our data, we run two-sided t-tests for both AAR and MVR. For AAR we have the null hypothesis of no abnormal returns in the event against the alternative hypothesis that there is an effect present:

$$H_0: AAR_t = 0$$

$$H_A: AAR_t \neq 0$$

For MVR we have the null of MVR equal to 1 against the alternative hypothesis of MVR being different from 1:

$$H_0: MVR_t = 1$$

$$H_A: MVR_t \neq 1$$

We also run a one-sided z-test for AARs to further support the t-statistics. The null hypothesis is that there is no effect against the alternative hypothesis of a positive effect for inclusions and a negative effect for deletions:

$$H_0^{inclusion}: AAR_t = 0$$

$$H_A^{inclusions}: AAR_t > 0$$

$$H_0^{deletions}: AAR_t = 0$$

$$H_A^{deletions}: AAR_t < 0$$

To test if there are permanent effects, we test the CAAR. The null hypothesis states that CAAR is equal to zero, i.e. no permanent effect, and the alternative hypothesis of a CAAR different from zero:

$$H_0: CAAR_t = 0 \quad vs. \quad H_A: CAAR_t \neq 0$$

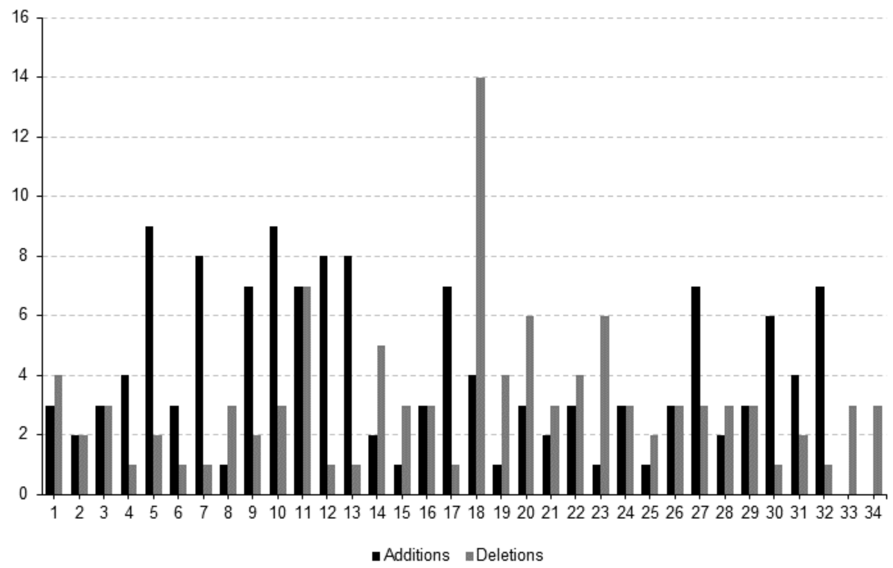
6.2 Statistical issues in the data

Implicit in the t-tests which are used to assess the abnormal results, there are a number of strong assumptions of the security returns, and false inferences could be made if these assumptions are violated (Brown and Warner, 1980). The most definitive violation is that daily returns substantially departures from normality with fat tails. However, Brown and Warner (1985) showed that although the data is highly non-normal, the mean excess return in cross-section of securities converges to normality as the sample size increases.

Clustering, when the event windows overlap in calendar time, is another problem in our financial data. This means that the covariances across abnormal returns will be non-zero and thus the distributional result presented for the aggregated abnormal returns are no longer applicable (McKinley, 1997). Furthermore, the standard deviation would be biased downwards, and the test statistics would be biased upwards, consequently reducing the power of our tests (Kothari and Warner, 2007).

It is impossible to avoid clustering as our event study is naturally clustered. To limit cluster implications, we use t-statistics which take clustering into account as well as a non-parametric test that relaxes the assumptions of the daily returns.

Figure 6.1 - Clustering



The figure shows clustering for index additions and deletions. The X-axis indicate the event, while the Y-axis represent the number of additions or deletions that happens at the same calendar date.

6.3 Testing Abnormal Returns

6.3.1 Parametric test

To account for cross-sectional dependence in the security-specific excess returns we apply the crude dependency adjusted t-test from Brown and Warner (1985). The test uses the variance from the abnormal returns in the estimation period and incorporate the cross dependence in the excess returns.

The test statistical significance of the AAR's and CAAR's, the two tailed t-test is defined as for AAR's

$$t - stat = \frac{AAR_t}{\hat{S}(AAR_t)}$$

where $AAR_t$is the average abnormal return in the event window, $\hat{S}(AAR_t)$ is the standard deviation of the average abnormal returns over the estimation period,

$$\hat{S}(AAR_t) = \sqrt{\frac{1}{180}\sum_{t=70}^{250}(AAR_t - \overline{AAR_t})}$$

The same test is applied to CAAR:

$$t - stat = \frac{CAAR_{t1,t2}}{\hat{S}(AAR_t)\sqrt{t2 - t1}}$$

where, $CAAR_{t1,t2}$is the cumulative average abnormal returns from day $t1$ to day $t2$.

6.3.2 Non-Parametric test

To relax the assumptions of the financial data, we also apply a binomial sign test to test the significance of stocks that have positive abnormal returns for joiners and negative abnormal returns for the leaver's samples. Non-parametric tests are less restrictive and allow for fat tails in the data but assume symmetry. One potential problem is that there is generally evidence of right skewness in financial data, and consequently the inferences from the binomial test could be wrong as the non-parametric test would reject the null hypothesis "too often" (Brown and Warner, 1980). To avoid this problem, we apply Cowan´s (1992) generalized sign test where we relax the symmetry assumption by estimating p, taking the skewness in the data into account.

$$Z - stat = \frac{A_t - E}{\sqrt{Np(1-p)}}$$

Where N is the number of firms, A_t is the actual number of positive (negative) abnormal return at time t, E is the expected number of positive (negative) abnormal returns $(E = Np)$ and p is the estimated percentage of positive (negative) abnormal returns in the estimation period for the joiners (leavers).

6.4 Testing Abnormal Trading Volumes

To run statistical tests on abnormal trading volumes, we run the standard t-test on the mean volume ratio (MVR):

$$\frac{\widehat{MVR}_t - H_0}{\sigma(\widehat{MVR}_t)\sqrt{n}}$$

where H_0 is assumed to be 1 and n is the number of events.

6.5 Best Linear Unbiased Estimator (BLUE)

The classical linear regression model (CLRM) is applied to conduct the event study of the index effect. The CLRM uses ordinary least squares (OLS) to find the best linear unbiased estimators (BLUE) and have five assumptions underlying the model (Brooks, 2014).

TECHNICAL NOTATION	INTERPRETATION
1) $E(u_t) = 0$	The errors have zero mean
2) $Var(u_t) = \sigma^2 < \infty$	The variance of the errors is constant and finite over all values of x_t
3) $cov(u_t, u_j) = 0$	The errors are linearly independent of one another
4) $cov(u_t, x_t) = 0$	There is no relationship between the error term and the corresponding x variate
5) $u_t \sim N(0, \sigma^2)$	u_t is normally distributed

If assumption 1-4 hold, the estimators are known as BLUE. Under these assumptions the OLS estimators can be shown to be consistent, unbiased and efficient.

6.5.1 OLS Diagnostics

Assumption 1: $E(u_t) = 0$

The first assumption of the CLRM is that the mean of the errors is zero. This assumption will never be violated if a constant term is included in the regression equation, which is the case for all our regressions.

Assumption 2: $Var(u_t) = \sigma^2 < \infty$

The CRLM assumes constant variance in the error terms, or *homoscedasticity*. If errors do not have constant variance, they are *heteroscedastic.*

With heteroscedastic error terms the OLS estimators would still give unbiased estimates but they are no longer BLUE. (Brooks, 2014). Thus, standard errors could be wrong and consequently inference made from test statistics may be misleading.

To test for violations of assumption 2 in our sample, we run White's test of heteroscedasticity. The idea of the test is to regress the independent variables, as well as the squared terms and cross products on the estimated residuals of the estimated normal returns model. If the f- test shows that the regressors are jointly significantly different from zero, there is evidence of heteroscedasticity in the data.

To conserve degrees of freedom, while preserving the validity of the White's test, we implement the regression using the fitted values as presented in Wooldridge (2016):

$$\hat{u}_t = \beta_0 + \beta_1 \hat{y}_t + \beta_2 \hat{y}_t^2 + v_t$$

Following from the f-tests, we find evidence of heteroscedasticity in 10.4% of our addition sample, and 15.7% for deletions. To deal with this problem we apply heteroscedastic robust standard errors where residual variance is non-constant.

Due to a large sample size, we will show a randomly selected subsample of the test values. This is done for all the following assumptions.

Assumption 2

JOINERS		LEAVERS	
TICKER	WHITE	TICKER	WHITE
FRO	2,1741	NSG	0,7944
KOG	0,5353	PAR	0,5643
SRBANK	18,0774	HEX	0,2944
ALGETA	0,1421	ITER	10,3352
NOD	1,7366	TRIBN	1,3872
KP5	1,0458	AUSS	0,7454
AKBM	0,8118	ORIGIO	0,1445
MORPOL	1,3065	ASD	0,5804
NRC	0,4684	SOIF	0,9974
VEI	0,0725	VEI	0,7710

Red numbers indicate heteroscedasticity

Assumption 3: $cov(u_t, u_j) = 0$

It is assumed that the covariance in the error terms over time is zero. Put differently, the errors are assumed to be uncorrelated with each other. If errors are correlated with each other it would be stated that they are "autocorrelated" (Brooks, 2014).

The consequence of presence of autocorrelation in the data is similar to what we had with heteroscedasticity. The OLS estimates are still unbiased, but they are inefficient, i.e. not BLUE even asymptotically. So, the standard errors could be wrong and wrong inference could be made.

To test for correlation in the error terms, we run the Breusch-Godfrey test for autocorrelation on our sample regressions. We estimate the model by OLS and obtain the residuals, $\hat{u}_t$, before we run the following regression:

$$u_t = x_{t1} + x_{t2} + \ldots + x_{tk} + \hat{u}_{t-1} + \hat{u}_{t-2} + \ldots + \hat{u}_{t-q} + e_t$$

for all $t \ = \ (q + t), \ldots, n.$

Then we compute the jointly significance of the parameters and find that there is evidence of autocorrelation in 17.8 % of additions and 28% for deletions.

Assumption 3

JOINERS		LEAVERS	
TICKER	BG-TEST	TICKER	BG-TEST
FRO	11,3443	NSG	4,3193
KOG	21,2377	PAR	7,5803
SRBANK	6,5817	HEX	9,7952
ALGETA	4,6969	ITER	20,0709
NOD	4,2518	TRIBN	12,8830
KP5	10,8612	AUSS	8,6546
AKBM	9,6308	ORIGIO	28,5346
MORPOL	20,4544	ASD	9,1067
NRC	11,8905	SOIF	8,9764
VEI	17,9865	VEI	12,7451

Red numbers indicate auto-correlation

Assumption 4: $cov(u_t, x_t) = 0$

The fourth assumption states that the independent variables and the error term has zero covariance.

If one or more of the explanatory variables is contemporaneously correlated with the error term, the OLS estimator will not even be consistent. This because the estimator is assigning explanatory power to the variables that is arising from the correlation between the error term and y_t (Brooks, 2014).

For each event we run the covariance between the residuals and all three explanatory variables. We find no evidence of violation of assumption 4 in our full sample when running the test, as illustrated by the subsample results below.

Assumption 4

JOINERS				LEAVERS			
TICKER	RISK PREM.	SMB	HML	TICKER	RISK PREM.	SMB	HML
FRO	0,000	0,000	0,000	NSG	0,000	0,000	0,000
KOG	0,000	0,000	0,000	PAR	0,000	0,000	0,000
SRBANK	0,000	0,000	0,000	HEX	0,000	0,000	0,000
ALGETA	0,000	0,000	0,000	ITER	0,000	0,000	0,000
NOD	0,000	0,000	0,000	TRIBN	0,000	0,000	0,000
KP5	0,000	0,000	0,000	AUSS	0,000	0,000	0,000
AKBM	0,000	0,000	0,000	ORIGIO	0,000	0,000	0,000
MORPOL	0,000	0,000	0,000	ASD	0,000	0,000	0,000
NRC	0,000	0,000	0,000	SOIF	0,000	0,000	0,000
VEI	0,000	0,000	0,000	VEI	0,000	0,000	0,000

The table shows the correlation between the explanatory variables and the disturbance term.

Assumption 5: $u_t \sim N(0, \sigma^2)$

Assumption 5 is not required for the estimators to be BLUE. It is required however to make valid inferences about the population parameters from the sample parameters estimated (Brooks, 2014).

To test for normality in the OLS residuals we implement the Jarque-Bera test. The test statistic is defined as:

$$W = T\left[\frac{b_1^2}{6} + \frac{(b_2-3)^2}{24}\right]$$

Where the coefficients of skewness and kurtosis can be expressed as

$$b_1 = \frac{E[u^3]}{(\sigma^2)^{2/3}} \quad and \quad b_2 = \frac{E[u^4]}{(\sigma^2)^2}$$

The test statistic follows a $\chi^2(2)$ under the null hypothesis of zero excess skewness and kurtosis (Brooks, 2014).

We find that only 8.14% and 6.5% of the estimated residuals in our sample are normally distributed for additions and deletions respectively.

Assumption 5

JOINERS		LEAVERS	
TICKER	JB-TEST	TICKER	JB-TEST
FRO	15,1350	NSG	19,4148
KOG	22,0250	PAR	168,1731
SRBANK	139,3350	HEX	1803,4208
ALGETA	224,5251	ITER	7,6296
NOD	14,7343	TRIBN	128,3375
KP5	5,0874	AUSS	58,7843
AKBM	295,3150	ORIGIO	15,3600
MORPOL	316,1736	ASD	7,8407
NRC	1743,2965	SOIF	2,5488
VEI	93,0087	VEI	14,6622

Red numbers indicate normality

7.0 Results

In this section we will present the result of our empirical analyses. The section is divided into several sub-sections as we have done analyses on multiple samples. First, we will present the results regarding the announcement day (AD). In the next section, the results from the effective enter day (ED) will be shown. In both these sections, there will be a comparison between the sample that uses all events in the event window, the sample only containing first-time inclusions and exclusions form the index and on the joiner side we will also add the sample consisting of all events but the first inclusions.

7.1 Results surrounding the announcement date (AD)

7.1.1 All-events sample

For all inclusions and exclusions in the event window, we do find significant average abnormal returns (AAR). However, the AAR itself is not particularly large. The largest AAR for inclusions is 0.643% at AD-1. This is significant at the 1% level using the crude dependency t-test. For exclusions, we do not find significant AAR’s around AD-1, but rather at AD+1 with an AAR of -0.871%. Even if we have some highly statistically significant abnormal returns, the economic significance of events around the announcement dates seem to be of little importance throughout the samples. This is shown by the low average abnormal returns.

Looking at the CAAR around the announcement day, i.e. the cumulative average abnormal returns over sub-periods within the event window, we observe several statistically significant periods for additions and deletions. The economic effect also tends to be larger for deletions than for additions, with the period [AD-10:AD+5] being the most significant period for deletions, with a CAAR of -6.1%. In the sub-period ranging from AD-3 to AD+3, which is much more centered around the announcement date, we see that the effect is much lower, and that the statistical significance is lower for both additions and deletions. This can be the result of the Oslo Stock Exchange’s announcement methods. Up until January 2008, OSE gave out a preliminary constituent report before the actual announcement of constituents for the next period. Since this happened in about half the sample, it might give some spurious results surrounding the announcement date, and it might also be the reason why we observe a larger effect in the period before the announcement date.

The Mean Volume Ratio (MVR) for the days surrounding AD show significant abnormal trading volumes for additions on all days ranging from AD-9 to AD+5. For deletions we find little significance results besides AD-9 and AD+1, where AD+1 is the only significant negative effect, meaning there is less than normal trading activity. Thus, is seems like there is less trading in general for deletions than additions around the announcement date.

Table 7.1 - Average Abnormal Return (AAR), Cumulative Average Abnormal Return (CAAR) and Mean Volume Ratio (MVR) for all-event sample – AD

AVERAGE ABNORMAL RETURN (AAR)								
	Additions				Deletions			
	No. of events:	134			No. of events:	87		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
AD-10	-0,0040	-1,6583 *	-0,4730	46 %	0,0000	-0,0010	-0,6571	49 %
AD-9	-0,0022	-0,9001	-0,9919	43 %	0,0003	0,0945	0,6317	56 %
AD-8	0,0021	0,8694	1,0838	52 %	-0,0056	-1,5656	0,6317	56 %
AD-7	-0,0012	-0,4797	-0,1270	47 %	-0,0038	-1,0576	0,8465	57 %
AD-6	0,0055	2,2678 **	3,5055 ***	63 %	-0,0136	-3,8218 ***	0,6317	56 %
AD-5	-0,0018	-0,7452	-0,1270	47 %	-0,0052	-1,4595	-0,6571	49 %
AD-4	0,0040	1,6617 *	2,2947 **	57 %	-0,0056	-1,5638	-0,0127	53 %
AD-3	0,0006	0,2394	-0,9919	43 %	-0,0037	-1,0370	0,6317	56 %
AD-2	-0,0048	-1,9547 *	-2,3758	37 %	-0,0032	-0,8931	2,3500 ***	66 %
AD-1	0,0064	2,6398 ***	2,1217 **	57 %	-0,0045	-1,2550	0,2021	54 %
AD	0,0054	2,2055 **	2,8136 ***	60 %	0,0008	0,2265	-0,6571	49 %
AD+1	0,0038	1,5532	1,9487 **	56 %	-0,0087	-2,4471 **	2,1353 **	64 %
AD+2	0,0043	1,7815 *	1,6028 *	54 %	0,0027	0,7488	-0,8719	48 %
AD+3	0,0009	0,3496	-0,6460	45 %	-0,0026	-0,7422	1,4909 *	61 %
AD+4	0,0014	0,5575	0,3919	49 %	-0,0003	-0,0881	-0,0127	53 %
AD+5	0,0006	0,2579	0,7379	51 %	-0,0080	-2,2540 **	1,2761	60 %

CUMULATIVE AVERAGE ABNORMAL RETURN (CAAR)						
	Additions			Deletions		
	No. of events:	134		No. of events:	87	
Period	*CAAR*	T-value	% positve AR	*CAAR*	T-value	% negative AR
[-10:+5]	0,0211	2,1614 **	50 %	-0,0610	-4,2790 ***	56 %
[-10:0]	0,0101	1,2500	50 %	-0,0439	-3,7187 ***	55 %
[-5:+5]	0,0208	2,5768 **	51 %	-0,0383	-3,2456 ***	56 %
[-5:0]	0,0099	1,6520	50 %	-0,0213	-2,4421 *	55 %
[0:+5]	0,0163	2,7374 **	52 %	-0,0162	-1,8600	56 %
[-7:0]	0,0142	2,0629 *	51 %	-0,0387	-3,8401 ***	55 %
[-6:0]	0,0154	2,3866 *	52 %	-0,0349	-3,7054 **	55 %
[-4:0]	0,0117	2,1429 *	51 %	-0,0161	-2,0224	56 %
[-2:0]	0,0070	1,6689	51 %	-0,0068	-1,1094	56 %
[-3:+3]	0,0166	2,5756 **	50 %	-0,0192	-2,0406 *	57 %
[-5:+3]	0,0188	2,5770 **	51 %	-0,0300	-2,8074 **	56 %
[-3:+5]	0,0186	2,5432 **	50 %	-0,0276	-2,5803 **	57 %
[-3:0]	0,0076	1,5650	49 %	-0,0105	-1,4793	56 %
[0:+3]	0,0143	2,9450 *	57 %	-0,0079	-1,1070	54 %
[-1:+2]	0,0199	4,0900 **	57 %	-0,0097	-1,3633	54 %
[-1:+1]	0,0156	3,6942 *	57 %	-0,0124	-2,0066	56 %

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	134	No. of events:	87
Time *t*	*MVR*	T-value	*MVR*	T-value
AD-10	3,7210	1,5508	1,3615	0,7932
AD-9	2,5202	3,1773 ***	1,4706	2,0259 **
AD-8	1,5766	2,9826 ***	1,2323	0,6788
AD-7	1,6672	2,1772 **	1,5038	0,9481
AD-6	2,0268	2,9016 ***	1,3369	1,2003
AD-5	1,9206	2,8978 ***	1,5402	1,5567
AD-4	2,2462	2,8292 ***	0,9454	-0,5117
AD-3	1,4427	2,5330 **	0,8896	-0,8403
AD-2	2,0517	2,3582 **	1,1400	0,6532
AD-1	1,5537	2,3768 **	0,9163	-0,5843
AD	1,4355	2,1871 **	0,9863	-0,0988
AD+1	1,8351	2,2266 **	0,6991	-4,0617 ***
AD+2	1,4432	2,7429 ***	0,8694	-0,8276
AD+3	1,8067	2,8276 ***	1,1907	0,9347
AD+4	1,3197	2,2479 **	0,9475	-0,3818
AD+5	1,4721	2,0229 **	1,3279	1,0020

AARs, CAARs and MVRs are tested using two-sided t-tests. The AARs are also tested using one-sided generalized sign tests (z-test).

*, ** and *** represent the significance level, 10%, 5% and 1% respectively.

7.1.2 First inclusions vs. Non-first inclusions

Over the samples event-period we have 83 first-time additions and 51 non first-time additions for the AD. For securities being added to the index for the first time, the most significant AAR is 0.7% at the announcement date with 61% of the securities showing a positive abnormal return. For non-first addition, the similar observation is made at AD-1, with an AAR of 1.1% and 63% showing positive abnormal returns. We also find that securities included in the index for the first time is much more likely to show abnormal levels of trading activity around the announcement date, than securities that has been included at least once before. The tables for AAR and MVR for first-time additions and non-first-time additions can be found in appendix B.

7.1.3 First deletions and Non-first deletions

For securities being excluded from OSEBX, first-time exclusions show a significant negative effect on AD-2, with 69% of the securities showing negative abnormal returns, and an average abnormal return (AAR) of -0.87%. For non-first exclusions, we find no significant effects using the one-sided z-test, but we do find significant effects using a two-sided t-test at AD-6. However, as mentioned, the economic significance of abnormal returns around AD is small and might not be of much impact.

For securities leaving the index for the first time, we find a significant decrease in trading volume on AD+1. For securities that have left the index at least once before, we find the same effect of a decrease in trading volumes. However, for these firms, the results show significant effects on all dates ranging from ED-3 to ED+2.

7.2 Results surrounding the effective date (ED)

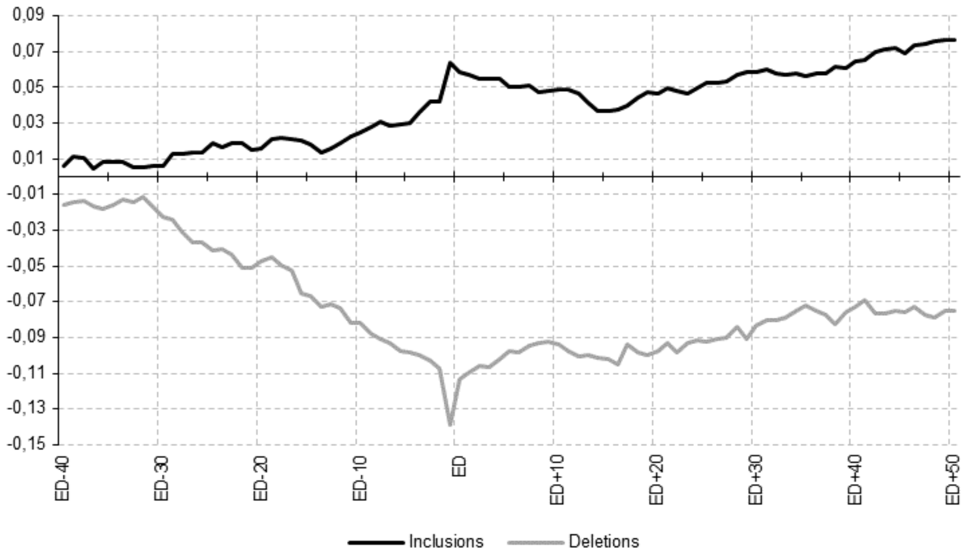
7.2.1 All-events sample

The all-event sample surrounding the effective date (ED) consists of 135 additions and 108 deletions from OSEBX during the event-period.
The results indicate significant temporary price effects for index additions on ED-1, and on ED-1 and ED for index deletions. The average abnormal return (AAR) is 2.1% for additions and -3.2% and 2.6% for deletions on the respective dates. An interesting observation for deletions is that there is a significant negative effect on ED-1, whereas the effect is positive on the effective date. This can be the result of investors who overreact on the day before the effective date, thus we get a correction of the overreaction on ED. On ED-1, the number of securities yielding positive abnormal return is 79% for additions. Conversely, 78% of excluded securities gave a negative abnormal return on ED-1.

The results also imply a far more pronounced effect in the trading activity at ED-1 for both additions and deletions. The Mean Volume Ratio (MVR) for additions were significantly 4,52 and 6,91 for additions and deletions respectively. We also observe that the MVR is higher for deletions on ED than it is for additions. This supports the theory about an overreaction on the investor-side when it comes to deletions. On ED-3 and ED-2, the abnormal trading level is higher for additions than for deletions, which is also the case on average in the period
[ED-10 : ED+10].

The cumulative average abnormal return (CAAR) is measured over several "short-term" and "long-term" sub-periods. This is done in order to test the significance of potential permanent effects. By examining *Figure 7.1* below, showing the CAAR for additions and deletions in the event-window for the all-event sample, we observe that both experience a “spike” around ED before they even out to a certain degree or experience a slower growth in the cumulative value. This might suggest that there are permanent effects following an index revision.

Figure 7.1 - Cumulative Average Abnormal Returns in event-window



The dark line represents the CAAR of inclusions. The grey line represents the CAAR of deletions. Both for the full sample, i.e. all inclusions and deletions.

From *Table 7.1 – CAAR*, we see that there are significant CAARs in several sub-periods for both additions and deletions. For the whole period, additions show a CAAR of 7.6% significant at the 1% level. For deletions in the same period, the results are slightly less significant and show a CAAR of -7.5%. In the period leading up to the effective date (ED) [-40:0], we observe statistically significant results for both additions and deletions, with their respective CAARs being 5.8% and -11.3%. However, for the period after ED [0:+50], we only get significant results for deletions, with a positive CAAR of 6.3%. This can reflect a stabilization of the CAAR for deletions and a permanent effect. For additions, we cannot give the same conclusion.

Table 7.2 - Average Abnormal Return (AAR), Cumulative Average Abnormal Return (CAAR) and Mean Volume Ratio (MVR) for all-event sample – ED

AVERAGE ABNORMAL RETURN (AAR)								
	Additions				Deletions			
	No. of events:	135			No. of events:	108		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
ED-10	0,0026	1,0754	2,2042 **	57 %	0,0000	0,0111	-1,1908	47 %
ED-9	0,0029	1,1868	0,8255	51 %	-0,0061	-1,7114 *	1,1226	58 %
ED-8	0,0030	1,2249	0,8255	51 %	-0,0028	-0,7845	0,9298	57 %
ED-7	-0,0019	-0,7653	0,9978	52 %	-0,0026	-0,7187	1,5082 *	60 %
ED-6	0,0006	0,2405	0,1362	48 %	-0,0045	-1,2725	-0,4197	51 %
ED-5	0,0008	0,3160	0,8255	51 %	-0,0002	-0,0506	-0,0341	53 %
ED-4	0,0059	2,4236 **	0,6532	50 %	-0,0017	-0,4667	-0,4197	51 %
ED-3	0,0059	2,4051 **	1,5149 *	54 %	-0,0028	-0,7878	1,8938 **	62 %
ED-2	0,0005	0,1876	1,5149 *	54 %	-0,0045	-1,2599	1,3154 *	59 %
ED-1	0,0211	8,6482 ***	7,3743 ***	79 %	-0,0320	-8,9923 ***	5,1711 ***	78 %
ED	-0,0047	-1,9310 *	-1,2425	42 %	0,0259	7,2760 ***	-5,8176	25 %
ED+1	-0,0016	-0,6737	-0,8979	44 %	0,0034	0,9510	0,5443	56 %
ED+2	-0,0026	-1,0718	-0,5532	45 %	0,0040	1,1174	-1,9619	44 %
ED+3	0,0005	0,1876	0,6532	50 %	-0,0012	-0,3459	0,1587	54 %
ED+4	-0,0005	-0,2151	-2,2766	38 %	0,0051	1,4352	-1,7691	44 %
ED+5	-0,0038	-1,5656	-2,6212	36 %	0,0040	1,1244	-1,7691	44 %
ED+6	-0,0003	-0,1246	0,6532	50 %	-0,0008	-0,2297	0,1587	54 %
ED+7	0,0010	0,4241	1,3425 *	53 %	0,0038	1,0540	0,3515	55 %
ED+8	-0,0044	-1,8061 *	-1,9319	39 %	0,0016	0,4361	-0,4197	51 %
ED+9	0,0011	0,4436	0,8255	51 %	0,0011	0,3192	-0,2269	52 %
ED+10	0,0004	0,1707	0,8255	51 %	-0,0014	-0,4002	0,1587	54 %

CUMULATIVE AVERAGE ABNORMAL RETURN (CAAR)						
	Additions			Deletions		
	No. of events:	135		No. of events:	108	
Period	*CAAR*	T-value	% positve AR	*CAAR*	T-value	% negative AR
[-10:+10]	0,0263	2,3526 **	50 %	-0,0117	-0,7192	53 %
[-10:0]	0,0366	4,5262 ***	54 %	-0,0312	-2,6404 **	55 %
[0:+10]	-0,0150	-1,8579 *	46 %	0,0454	3,8405 ***	48 %
[-10:+5]	0,0284	2,9183 **	50 %	-0,0159	-1,1188	53 %
[-5:+10]	0,0190	1,9547 *	49 %	0,0042	0,2951	52 %
[-5:+5]	0,0212	2,6264 **	49 %	0,0000	0,0002	52 %
[-5:0]	0,0293	4,9192 ***	55 %	-0,0152	-1,7478	55 %
[0:+5]	-0,0128	-2,1513 *	43 %	0,0412	4,7186 ***	44 %
[-3:+3]	0,0189	2,9300 **	53 %	-0,0073	-0,7716	54 %
[-5:+3]	0,0256	3,4972 ***	52 %	-0,0091	-0,8529	53 %
[-3:+5]	0,0145	1,9904 *	49 %	0,0018	0,1727	52 %
[-40:+50]	0,0762	3,2797 ***	48 %	-0,0751	-2,2117 **	54 %
[-40:0]	0,0587	3,7670 ***	50 %	-0,1131	-4,9586 ***	55 %
[0:+50]	0,0127	0,7330	47 %	0,0638	2,5105 **	52 %
[-25:0]	0,0627	5,0466 ***	50 %	-0,0385	-2,1182 **	55 %
[-25:+50]	0,0627	2,9518 ***	48 %	-0,0385	-1,2389	53 %
[-25:+25]	0,0387	2,2245 **	49 %	-0,0559	-2,1984 **	53 %
[0:+25]	-0,0112	-0,9045	47 %	0,0464	2,5552 **	51 %
[-40:+25]	0,0522	2,6390 **	49 %	-0,0926	-3,2001 ***	54 %

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	135	No. of events:	108
Time *t*	*MVR*	T-value	*MVR*	T-value
ED-10	1,5106	2,7420 ***	2,2758	1,1698
ED-9	1,5381	2,5112 **	0,9187	-0,4590
ED-8	1,9374	2,6084 ***	0,9528	-0,3315
ED-7	1,4859	2,2929 **	1,1947	0,9969
ED-6	1,5091	2,2563 **	1,5644	1,8529 *
ED-5	2,0163	2,7038 ***	1,3738	1,7310 *
ED-4	1,5511	2,2190 **	1,1334	1,1203
ED-3	1,9358	3,4470 ***	1,6092	2,7981 ***
ED-2	2,0465	2,5878 **	1,3945	2,9762 ***
ED-1	4,5249	6,2900 ***	4,1116	6,9129 ***
ED	1,4060	3,6277 ***	2,0276	3,0321 ***
ED+1	1,2593	1,7717 *	1,4297	1,4720
ED+2	1,2486	1,9867 **	1,3524	2,0369 **
ED+3	1,0111	0,1109	2,0092	1,7676 *
ED+4	0,7978	-3,1785 ***	1,0798	0,4277
ED+5	0,9261	-0,8063	0,9321	-0,6753
ED+6	1,1898	0,8523	1,2726	1,2115
ED+7	0,9938	-0,0585	1,2755	1,4086
ED+8	1,1082	0,8907	1,4107	1,7267 *
ED+9	1,1378	0,6816	1,0306	0,1946
ED+10	1,3632	1,5055	1,2058	1,5930

AARs, CAARs and MVRs are tested using two-sided t-tests. The AARs are also tested using one-sided generalized sign tests (z-test).

*, ** and *** represent the significance level, 10%, 5% and 1% respectively.

7.2.2 First inclusions vs. Non-first inclusions

For securities added to OSEBX for the first time, we observe a statistically positive price effect at ED-1 represented by a positive AAR of 2.09%. For securities that have been added at least once before, the AAR is 2.12% and significant at the 1% level. However, for these securities, we also observe significant effects at ED and ED+1 using the t-statistics. The AARs at these dates are however negative, which can reflect an overreaction by investors at ED-1, and indicate a temporary effect.

Table 7.3 - AARs first inclusions

AVERAGE ABNORMAL RETURN (AAR)				
	Additions			
	No. of events:	84		
Time *t*	*AAR*	T-value	Z-value	% positve AR
ED-10	0,0015	0,5035	1,1458	54 %
ED-9	0,0024	0,7854	0,7087	51 %
ED-8	0,0038	1,2698	1,1458	54 %
ED-7	-0,0016	-0,5208	1,3643 *	55 %
ED-6	0,0016	0,5310	0,4902	50 %
ED-5	0,0004	0,1262	0,9272	52 %
ED-4	0,0037	1,2273	0,0531	48 %
ED-3	0,0053	1,7636 *	-0,3839	45 %
ED-2	-0,0023	-0,7611	0,9272	52 %
ED-1	0,0209	6,9217 ***	6,6090 ***	83 %
ED	-0,0031	-1,0359	-0,3839	45 %
ED+1	0,0030	0,9912	0,4902	50 %
ED+2	-0,0051	-1,6978 *	-1,0395	42 %
ED+3	0,0028	0,9271	0,9272	52 %
ED+4	-0,0025	-0,8391	-1,9136	37 %
ED+5	-0,0045	-1,4817	-2,1322	36 %
ED+6	0,0001	0,0471	1,3643 *	55 %
ED+7	0,0021	0,6857	1,1458	54 %
ED+8	-0,0065	-2,1585 **	-2,3507	35 %
ED+9	-0,0001	-0,0169	0,4902	50 %
ED+10	-0,0039	-1,2997	0,0531	48 %

Table 7.4 - AARs non-first inclusions

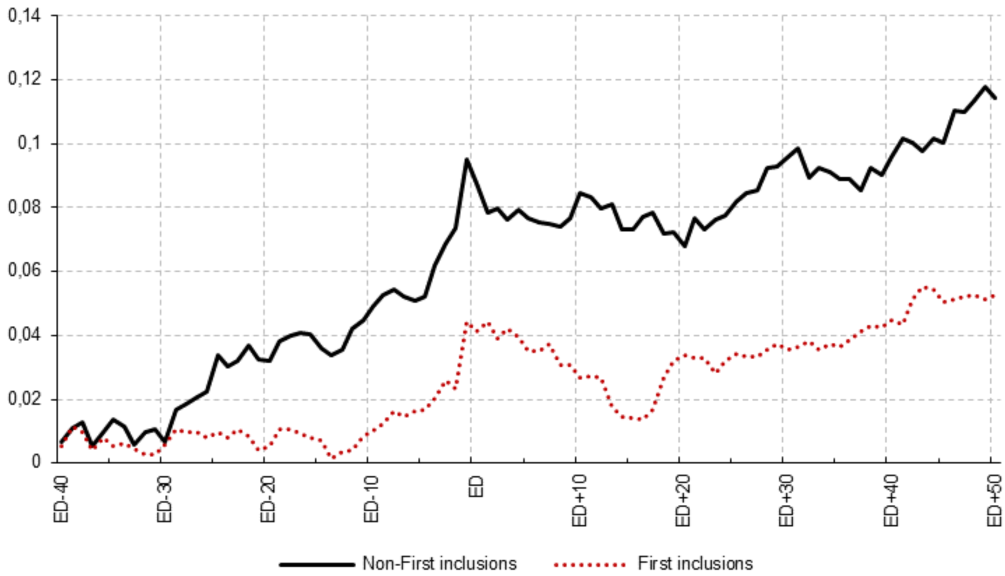
AVERAGE ABNORMAL RETURN (AAR)				
	Additions			
	No. of events:	51		
Time *t*	*AAR*	T-value	Z-value	% positve AR
ED-10	0,0044	1,1416	2,1154 **	63 %
ED-9	0,0037	0,9644	0,4336	51 %
ED-8	0,0016	0,4046	-0,1270	47 %
ED-7	-0,0023	-0,6035	-0,1270	47 %
ED-6	-0,0011	-0,2829	-0,4073	45 %
ED-5	0,0014	0,3634	0,1533	49 %
ED-4	0,0096	2,4804 **	0,9942	55 %
ED-3	0,0067	1,7331 *	2,9562 ***	69 %
ED-2	0,0050	1,2913	1,2745	57 %
ED-1	0,0213	5,4855 ***	3,5168 ***	73 %
ED	-0,0073	-1,8804 *	-1,5284	37 %
ED+1	-0,0093	-2,3962 **	-2,0890	33 %
ED+2	0,0016	0,4008	0,4336	51 %
ED+3	-0,0034	-0,8806	-0,1270	47 %
ED+4	0,0028	0,7217	-1,2482	39 %
ED+5	-0,0027	-0,6988	-1,5284	37 %
ED+6	-0,0010	-0,2680	-0,6876	43 %
ED+7	-0,0007	-0,1764	0,7139	53 %
ED+8	-0,0009	-0,2283	-0,1270	47 %
ED+9	0,0029	0,7599	0,7139	53 %
ED+10	0,0076	1,9561 *	1,2745	57 %

AARs are tested using two-sided t-tests and one-sided generalized sign tests (z-test).

*, ** and *** represent the significance level, 10%, 5% and 1% respectively.

The fact that we observe a slightly lower AAR at ED-1 for first-time additions is supported by Mase (2008) who finds that securities included in an index for the first time, comove less with the index or the market, before inclusion, but comove more after inclusion. This means that new constituents will have a more similar return to the market than constituents who have already been on the index, consequently giving lower abnormal returns.
This can also be shown by looking at the CAARs in figure *Figure 7.2*. In this case, the CAAR of first-time inclusions should be below that of non-first inclusions.

Figure 7.2 - CAARs for first inclusions and non-first inclusions



The dashed red line is the CAAR for first inclusions only. The dark line is the CAAR for securities that have previously been included on OSEBX

Looking at the trading activity, there is an apparent increase in trading around ED for additions that have been on the index before than for first-time inclusions. On ED-1, the MVR for non-first inclusions were 5,39 compared to 3,99 for first inclusions, both statistically significant at 1%. More can be found in the tables in appendices D-H.

7.2.3 First-time deletions vs. Non first-time deletions

For first-time exclusions, we find that ED-1 show a negative AAR of -3.5% which is significant at the 1% level. For securities that have been excluded from OSEBX once before, the results show a statistically significant negative AAR of -2.7% at ED-1. The percentage of securities in the two samples that show negative abnormal returns are similar, 78% and 77% respectively. Following the comovement theory by Mase (2008), the negative AAR should be greater for first time deletions at dates after ED than for non-first deletions. Looking at the CAARs we do find a similar effect as we did for additions to the index, however the CAAR in the whole event-window is not statistically significant for first deletions.

The trading volumes surrounding the ED for first exclusions and non-first exclusions show the same trend. ED-1 is the most significant date, with MVRs of 5,49 and 4,16 respectively. On average, it seems that the trading volume is higher for first-time deletions than for securities that have been out of the index at least once before. Appendices F and H provides more information about the trading volumes.

Figure 7.3 - CAARs for first deletions and non-first deletions

The dashed red line is the CAAR for first deletions only. The dark line is the CAAR for securities that have previously been deleted from OSEBX.

Table 7.5 - AARs first deletions

AVERAGE ABNORMAL RETURN (AAR)				
	Deletions			
	No. of events:	59		
Time *t*	*AAR*	T-value	Z-value	% negative AR
ED-10	-0,0015	-0,3585	-0,6343	49 %
ED-9	-0,0070	-1,6711 *	1,1922	61 %
ED-8	0,0014	0,3283	-0,3734	51 %
ED-7	-0,0075	-1,7851 *	1,7141 **	64 %
ED-6	-0,0012	-0,2856	-1,9390	41 %
ED-5	0,0048	1,1469	-1,4171	44 %
ED-4	-0,0063	-1,5066	-0,1124	53 %
ED-3	-0,0040	-0,9618	1,4532 *	63 %
ED-2	-0,0029	-0,6924	0,1485	54 %
ED-1	-0,0355	-8,4512 ***	3,8016 ***	78 %
ED	0,0258	6,1382 ***	-4,2874	25 %
ED+1	0,0035	0,8448	-0,1124	53 %
ED+2	0,0011	0,2552	-0,3734	51 %
ED+3	0,0007	0,1685	-0,1124	53 %
ED+4	0,0023	0,5568	-1,6781	42 %
ED+5	0,0028	0,6606	-1,4171	44 %
ED+6	0,0014	0,3405	-0,1124	53 %
ED+7	0,0131	3,1304 ***	-0,6343	49 %
ED+8	0,0041	0,9823	-1,4171	44 %
ED+9	0,0063	1,5114	-1,4171	44 %
ED+10	-0,0088	-2,0884 **	0,9313	59 %

Table 7.6 - AARs non-first deletions

AVERAGE ABNORMAL RETURN (AAR)				
	Deletions			
	No. of events:	48		
Time *t*	*AAR*	T-value	Z-value	% negative AR
ED-10	0,0035	0,6786	-1,1654	44 %
ED-9	-0,0051	-0,9839	0,5683	56 %
ED-8	-0,0057	-1,0898	1,7241 **	65 %
ED-7	0,0024	0,4569	0,5683	56 %
ED-6	-0,0094	-1,7914 *	1,7241 **	65 %
ED-5	-0,0045	-0,8591	1,4351 *	63 %
ED-4	0,0042	0,8034	-0,5875	48 %
ED-3	-0,0010	-0,2004	1,1462	60 %
ED-2	-0,0076	-1,4520	2,0130 **	67 %
ED-1	-0,0272	-5,2030 ***	3,4577 ***	77 %
ED	0,0276	5,2830 ***	-4,0548	23 %
ED+1	-0,0009	-0,1677	1,1462	60 %
ED+2	0,0090	1,7226 *	-2,6101	33 %
ED+3	-0,0018	-0,3466	0,2794	54 %
ED+4	0,0063	1,2150	-0,5875	48 %
ED+5	0,0060	1,1560	-1,1654	44 %
ED+6	-0,0027	-0,5215	0,2794	54 %
ED+7	-0,0092	-1,7579 *	1,4351 *	63 %
ED+8	0,0002	0,0320	0,8573	58 %
ED+9	-0,0044	-0,8457	1,1462	60 %
ED+10	0,0078	1,4983	-0,8764	46 %

AARs are tested using two-sided t-tests and one-sided generalized sign tests (z-test).

*, ** and *** represent the significance level, 10%, 5% and 1% respectively.

8.0 Comparing the results to previous literature and theories

In this section we will use the results presented above to shed light upon which of the theories from previous literature is best suited to explain the index effect, as well as discussing our results compared to other studies.

8.1 Price Pressure Hypothesis (PPH)

The theory of price pressure presented by Harris & Gurel (1986) assumes that investors must be compensated for the transaction cost and risk they take when buying or selling securities. This means that in case of increased demand for a security, the price should also increase. The long run demand is assumed to be perfectly elastic, whereas the short-term demand curves could be non-perfect elastic (Harris & Gurel, 1986). Implied by the theory, when a stock is added to the index, a shock in demand will shift the demand curve outwards, consequently giving higher prices in the short run but have little effect in the long run (*Appendix M*). For deletions, we would expect an opposite effect with the demand curve shifting inwards temporarily, resulting in lower prices.

From our CAARs, we see that neither additions nor deletions fully reverses over the event-window, which can be an indication of permanent effects. This would be in conflict with the price pressure theory which assumes only a temporary price pressure.

The price pressure should be at its peak the night before ED, as index funds try to minimize their tracking error in their portfolios (Beneish and Whaley, 1996). Thus, we should observe the most economical significant positive (negative) abnormal returns for additions (deletions) at this particular day. This is supported in our findings for all samples. Further, the effect seems to be stronger for deletions than additions. This could be the result of index funds supplying excess supply to the market simultaneously as there is less demand for deletions at this point of time. In order to be consistent with the price pressure hypothesis, there should be a full reversal of the CAARs after the spike at ED-1. We find evidence of a reversal for both additions and deletions, where the reversal is bigger for deletions than additions. However, the reversal is not complete, and the CAAR stabilizes on a new, higher (lower) level for additions (deletions).

As for volume effects, both additions and deletions have high trading levels close to ED. Following the partial reversal, the volume is less consistent and lack statistical significance.

Based on these findings, we would argue that there is evidence favoring the price pressure perspective in the short term. In the long term, however, the price level fails to reverse, which is against the theory.

8.2 The Imperfect Substitutes Hypothesis (ISH)

The imperfect substitutes hypothesis states that securities are not close substitutes for each other, and that long-term demand is non-perfectly elastic (Harris & Gurel, 1986). This implies that the demand curve essentially is downward sloping, and as demand shifts outwards, the price increases. In contrast to the price pressure hypothesis, we now do not expect a reversal of the prices, as the new price level would represent a new equilibrium.

Under this hypothesis we investigate the permanent effects, i.e. the CAARs of the analysis, as the hypothesis looks at the long-term demand. We observe that the CAAR for the full sample does not fully reverse for either additions to or deletions from OSEBX in the event window chosen [ED-40 : ED+50]. This is also the case in the samples containing only first-time inclusions and exclusions, as well as the samples of re-entries and non-first deletions. This is consistent with the imperfect substitute hypothesis, as we do observe permanent effects.

According to Bechmann (2004), the effect on trading volumes is more unclear, and can be either temporary or permanent.

Considering this, we find support of the imperfect substitute hypothesis.

8.3 The Information cost/liquidity hypothesis

The information cost and liquidity hypothesis assume that stocks included to an index will be more researched and be invested in more frequently as more information is available. This would also lower the risk premiums and give a permanent price effect. Thus, we would expect the results to show an increase in trading activity for both inclusions and exclusions, and a permanent higher (lower) price for inclusions (exclusions).

As mentioned, for all samples, the CAARs do not fully reverse, indicating a permanent price effect resulting from the index inclusions (exclusions). However, both the CAARs and AARs do fluctuate quite a lot at times, which might indicate corrections from investors. The permanent effect found for the CAARs would be in accordance with the hypothesis.

For trading activity, we observe an increase in the mean volume ratio (MVR) around ED-1 for all samples, for both additions and deletions from OSEBX. However, the high increase in trading around ED-1 cannot be said to be permanent after ED. This means we find it difficult to explain the price and volume effect of index revisions based on the information cost/liquidity hypothesis.

8.4 The attention hypothesis

The attention hypothesis assumes that prices will show a permanent positive effect for securities included in the index. This is because being on the index will result in the security gaining more attention, possibly attracting new investors that consequently drive up prices. One important aspect of this hypothesis is that the effect should not apply to deletions, as firms that are deleted from the index already have received a fair amount of attention from when they were included.

For the attention hypothesis, it makes sense to compare the permanent effects by examining the CAARs for first-time additions and deletions to OSEBX. This is because securities that has already been on the index before, should not have an equally pronounced effect as attention does not disappear, i.e. they should already have a higher price level due to previous attention.

For first inclusions and non-first inclusions, we have CAAR values of 5.26% and 11.44% respectively. This is not consistent with the attention hypothesis, as first-additions are expected to outperform non-first additions, not vice versa. Further, the CAAR for first inclusions are only significant at the 10% level, hence, we cannot even determine if there is a permanent effect for this sample.

Therefore, we exclude the attention hypothesis from plausible explanations of our empirical findings.

8.5 The information Signaling Hypothesis

The hypothesis of information signaling assumes that prices will have a positive (negative) permanent effect for additions (deletions) and that the volume effect is temporary (Brooks et al., 2008).

For the sample consisting of first-time inclusions and deletions, we observe CAARs of 5.3% and -4.3% respectively for the full event-window. For the full sample, i.e. all inclusions and exclusions, we observe a CAAR of 7.6% and -7.5%. Thus, there seem to be a permanent price effect.

For trading volumes, we have a period of great statistical significance before ED, and less the following period. Hence, we cannot say much about the permanent effect of the trading volume. The volume ratios before ED varies widely for both additions and deletions, before it spikes at ED-1.

Hence, our empirical findings are only partially consistent with the information signaling hypothesis.

8.6 Selection Criteria Hypothesis

This hypothesis states that the index effect is related to the criterions that determines which securities that make up the index. This means that there could be a selection bias, and that e.g. a positive price effect can be the result of the index only consisting of securities that have performed well in the past and is more likely to perform well in the future. This might be the case for index inclusion on OSEBX. As mentioned previously, Oslo Børs uses a four-step process in selection the securities that constitute the OSEBX. The 30 highest ranked securities, measured in turnover over the past 12 months are eligible for inclusion, whereas existing constituents are deemed ineligible if they are ranked at 35% or lower.

8.7 Best-fitting hypothesis

We now have several possible explanations of the observed index effect at OSEBX. The attention hypothesis does not fit our findings, and we found it difficult to explain the effect as a result from the information cost/liquidity hypothesis. However, the rest of the hypotheses are all plausible explanations. The Selection Criteria hypothesis do fit considering that OSE does pick securities to constitute the index based on the official turnover of a security. For the information signaling hypothesis we find that the hypothesis can be partially accepted as an explanation, and we have results that are supported by both the imperfect substitute hypothesis and price pressure hypothesis, where the price pressure developing from index funds rebalancing their portfolios and the imperfect substitute hypothesis seem to be the best match. However, the index effect found at OSEBX could very well be a combination of several hypotheses. The selection criteria hypothesis can be very relevant in combination with either the price pressure hypothesis or the imperfect substitute hypothesis. The same applies for the information signaling hypothesis. E.g. when an index fund rebalances their portfolio, it can send an even stronger signal to other investors of which securities to buy and sell, possibly creating even more price pressure.

As mentioned, we believe that price pressure is an important reason for the observed effect, especially for a short-term window. However, our results indicate that there is a permanent positive (negative) effect for additions (deletions), which is inconsistent with the hypothesis. We therefore believe that the effect must be a combination of several hypotheses, first and foremost the price pressure hypothesis and the imperfect substitute hypothesis.

8.9 Comparing the results to previous studies

Mæhle and Sandberg (2015) is the only previous study on the index effect on the same index as we have studied in our thesis, and we therefore compare our results to their study.

In their study, Mæhle and Sandberg found that the liquidity hypothesis does not explain the index effect observed on OSBEX, while the attention hypothesis might be a plausible explanation at best. We agree with their assessment of the liquidity hypothesis, but we do find clear evidence that the attention hypothesis is inconsistent with our findings, resulting in a full rejection of the hypothesis. Mæhle and Sandberg also find evidence of the price pressure hypothesis where there is a rapid price correction after ED for deletions. However, they did not find the same correction for additions. This is partially consistent with our findings, where we find a larger correction for deletions than for additions, even if the correction is not a full reversal. Where we find that the imperfect substitute hypothesis and the selection criteria can be explanations of the observed index effects, Mæhle and Sandberg (2015) found no that these hypotheses were unlikely to explain the effects.

9.0 Trading Strategies

In this section, based on our empirical findings, we will showcase the practical implications to be made from the index effect identified on OSEBX trough suggested trading strategies.

We find evidence of temporary effects surrounding AD and ED for both additions and deletions. Further, we find a trend of positive (negative) abnormal returns in the period from AD to the day before ED for additions (deletions). Then, at ED, the trend reverses and we find negative (positive) abnormal returns for additions (deletions). Following the price adjustment, the abnormal returns seem to stabilize. Thus, we have evidence of short-term effects around AD and ED, and some evidence, or an indication of a permanent effect. Our empirical findings indicate that there are market inefficiencies at the OSEBX revisions. This implies that there could exists profitable trading strategies that can exploit these inefficiencies.

In this section we will create two trading strategies constructed from our empirical findings and apply them to the OSEBX revision in the period 2002-2018. By doing this, we want to test if there are practical implications from the results, even if some data cannot be confirmed on a statistical level.

9.1 Previous studies on trading strategies

Beneish and Whaley (1996) propose a simple strategy of buying the stock and shorting the future contract at the day following the announcement day and closing the position on the effective day. This strategy yielded 4.011% abnormal return on the S&P 500 index in the period 1989-1994.

Madhavan (2003) created an equally weighted portfolio of long additions and short deletions in the Russell index. He showed that this portfolio had a mean return of 14.94% in June alone, the month of the index revisions.

Lui and Dash (2008) created two short-term strategies using options. The first strategy consists of buying at-the-money call options added to S&P 500 from outside the S&P 1500 on the day after the announcement date and sell the option at the effective date. This strategy yields an average return of 31%. The second strategy was selling at-the-money put options added to the S&P 500, that were already in the S&P 1500 and selling the put at the effective date. This yields 10% on average.

9.2 Proposed trading strategies

From previous studies, we see that there are numerous ways of constructing a trading strategy on the index effect. In the trading strategies we propose, we want to minimize the number of transactions to lower transaction costs. Thus, we adopt the simplicity of Madhavan's (2003) long-short portfolio and design it to fit our empirical findings.

The first strategy we propose is a long-short portfolio in the period from AD to ED+5. We want to capture the identified positive (negative) abnormal returns from AD to ED-1 for additions (deletions), and the reversal effect following the effective date. The argument behind the reversal period of five days following ED, comes from our empirical findings on CAAR values from ED to ED+5. We have a negative (positive) CAAR on the 10% (1%) level for additions (deletions), that we want to capture in the trading strategy. The strategy is to create an equal weighted portfolio long in additions and short in deletions in the period from AD to ED-1, then at ED we close the position and go short additions and long deletions until we once again close the position at ED+5.

Our second strategy is a deconstruction from our first strategy. By breaking the initial strategy into parts, we identify the main driver of the returns in each subperiod. The new strategy is simply buying additions at AD then selling at ED-1, then at the end of the day of ED-1, we buy deletions and hold them until ED+5. This strategy has support in our research where deletions has more statistical and economical significance in the second subperiod from ED to ED+5.

In the period 2002-2018 the trading strategies is implemented on all revisions, which accounts for 182 additions and 143 deletions in total. To compare our strategy against a passive trading strategy, we take an equal weighted position in the marked portfolio each year. Then, we calculate the returns of the active trading strategy in excess the passive strategy of holding the market portfolio to see if we can "beat the market" with the trading strategies constructed.

9.2.1 Results

Strategy I

The trading portfolio is constructed for each half year and the returns from each revision is presented below:

Table 9.1 – Strategy I

Index Revision	Stock Excess Return	Market Excess Return	Beating the Market	Market beat by:
2018 FHY	-0,0714	-0,0253	No	-0,0461
2018 SHY	0,1158	0,0165	Yes	0,0994
2017 FHY	0,0414	-0,0234	Yes	0,0648
2017 SHY	0,0754	-0,0011	Yes	0,0765
2016 FHY	0,0885	0,0560	Yes	0,0324
2016 SHY	0,0957	0,0403	Yes	0,0554
2015 FHY	-0,0011	-0,0096	Yes	0,0085
2015 SHY	0,0992	-0,0177	Yes	0,1169
2014 FHY	0,0672	-0,0609	Yes	0,1280
2014 SHY	0,0604	0,0400	Yes	0,0204
2013 FHY	0,0197	-0,0066	Yes	0,0263
2013 SHY	0,1002	-0,0186	Yes	0,1188
2012 FHY	0,1454	0,0267	Yes	0,1186
2012 SHY	0,1374	-0,0367	Yes	0,1741
2011 FHY	0,0970	-0,0319	Yes	0,1288
2011 SHY	0,1771	-0,0176	Yes	0,1947
2010 FHY	0,0275	0,0177	Yes	0,0098
2010 SHY	0,1437	-0,0723	Yes	0,2160
2009 FHY	0,1448	0,0479	Yes	0,0970
2009 SHY	n.a.	n.a.	n.a.	n.a.
2008 FHY	0,0602	-0,0926	Yes	0,1528
2008 SHY	0,0382	-0,0293	Yes	0,0675
2007 FHY	0,0233	0,0492	No	-0,0259
2007 SHY	0,0467	-0,0295	Yes	0,0762
2006 FHY	0,0313	0,0443	No	-0,0130
2006 SHY	0,0646	0,0425	Yes	0,0221
2005 FHY	0,0060	0,0743	No	-0,0683
2005 SHY	0,0444	0,0068	Yes	0,0376
2004 FHY	0,0472	-0,0137	Yes	0,0609
2004 SHY	0,0411	0,0404	Yes	0,0007
2003 FHY	n.a.	n.a.	n.a.	n.a.
2003 SHY	0,0578	-0,0003	Yes	0,0581
2002 FHY	0,0123	0,0219	No	-0,0097
2002 SHY	0,0070	0,0485	No	-0,0415
Mean	**6,39 %**	**0,27 %**	**81,25 %**	**6,12 %**
Median	**5,90 %**	**-0,07 %**		**5,95 %**
Min	**-7,14 %**	**-9,26 %**		**-6,83 %**
Max	**17,71 %**	**7,43 %**		**21,60 %**
Vol	**5,28 %**	**4,02 %**		**7,11 %**
Sharpe	**1,21**	**0,07**		

FHY = First half year, SHY = Second half year

This strategy yields an average return of 6.39%, outperforming the market portfolio in 81.25% of the instances with an average of 6.12%.

Strategy II

Table 9.2 - Strategy II

Index Revision	Stock Excess Return	Market Excess Return	Beating the Market	Market beat by:
2018 FHY	-0,0340	-0,0132	No	-0,0209
2018 SHY	0,0502	-0,0009	Yes	0,0511
2017 FHY	0,0331	-0,0131	Yes	0,0462
2017 SHY	0,0420	-0,0028	Yes	0,0448
2016 FHY	0,1307	0,0431	Yes	0,0875
2016 SHY	0,0265	0,0357	No	-0,0092
2015 FHY	-0,0588	0,0048	No	-0,0636
2015 SHY	0,0538	-0,0192	Yes	0,0730
2014 FHY	0,0504	-0,0490	Yes	0,0994
2014 SHY	0,0927	0,0420	Yes	0,0507
2013 FHY	0,0397	-0,0110	Yes	0,0507
2013 SHY	0,1018	-0,0146	Yes	0,1164
2012 FHY	0,3456	0,0248	Yes	0,3209
2012 SHY	0,0998	-0,0345	Yes	0,1343
2011 FHY	0,0413	-0,0196	Yes	0,0609
2011 SHY	0,1762	-0,0245	Yes	0,2008
2010 FHY	0,0584	0,0127	Yes	0,0458
2010 SHY	0,0658	-0,0570	Yes	0,1228
2009 FHY	0,1783	0,0575	Yes	0,1208
2009 SHY	n.a.	n.a.	n.a.	n.a.
2008 FHY	0,0214	-0,0777	Yes	0,0991
2008 SHY	0,0302	-0,0028	Yes	0,0330
2007 FHY	0,0372	0,0453	No	-0,0081
2007 SHY	0,0427	-0,0151	Yes	0,0578
2006 FHY	0,0445	0,0548	No	-0,0103
2006 SHY	0,1141	0,0375	Yes	0,0767
2005 FHY	0,0448	0,0431	Yes	0,0017
2005 SHY	0,0832	-0,0035	Yes	0,0867
2004 FHY	0,0865	-0,0154	Yes	0,1019
2004 SHY	0,2250	0,0405	Yes	0,1844
2003 FHY	n.a.	n.a.	n.a.	n.a.
2003 SHY	0,0379	0,0095	Yes	0,0284
2002 FHY	0,1044	0,0216	Yes	0,0828
2002 SHY	0,0716	0,0446	Yes	0,0270
Mean	**7,62 %**	**0,45 %**	**84,38 %**	**7,17 %**
Median	**5,21 %**	**-0,19 %**		**5,93 %**
Min	**-5,88 %**	**-7,77 %**		**-6,36 %**
Max	**34,56 %**	**5,75 %**		**32,09 %**
Vol	**7,49 %**	**3,42 %**		**7,31 %**
Sharpe	**1,02**	**0,13**		

FHY = First half year, SHY = Second half year

This strategy yields an average return of 7.62%, outperforming the market portfolio in 84.4% of the instances with an average of 7.17%

9.2.2 Comparing the strategies

To compare the two strategies, we apply the Sharpe ratio. This reward-to-volatility measure is widely used to evaluate the performance of portfolios (Bodie et al., 2014), and is defined as:

$$S_p = \frac{E[R_p - R_f]}{\sigma_p}$$

where R_p and σ_p is the return and volatility of the portfolio, and R_f is the risk-free rate. Thus, the Sharpe ratio essentially is an excess return to volatility ratio.

The first strategy has a Sharpe ratio of 1.21, and even though the second trading portfolio outperforms the first strategy with over a percent point on average, the higher volatility leads to a lower sharp ratio of 1.02. However, even though the second trading strategy is more volatile, the spikes in returns mostly come from large positive returns (see *Figure 9.1*). Thus, though the Sharpe ratio is higher for trading strategy I, it does not necessarily mean that strategy I is better than II. Further, on average, strategy II delivers higher returns than strategy I throughout the period in 2002-2018. However, the last 10 years, strategy I outperforms strategy II in 62% of the instances.

To sum up, it is hard to tell which is better. Nevertheless, they both perform exceptionally well, both having positive returns in 93.75% of the revisions and outperforms the market almost every year. A matter to consider however, is that strategy I could be impossible to fully implement, as there might be limits to short selling.

Figure 9.1 – Strategy I vs. Strategy II

The Black line represents the returns of strategy I on each revision of OSEBX. The red line represents strategy II.

9.2.3 Risks and limitations in the analysis

Even though these strategies have significant positive returns on average, they are not considered as arbitrage. Arbitrage is defined as when an investor can earn riskless without making a net investment (Bodie et al., 2014). First, beating the market several years in a row could be pure luck. There are dozens of stories of traders being declared as geniuses, beating the market several years in a row, only to fail to repeat the success in the years to come. This is known as "the lucky event issue" in finance (Bodie et al., 2014). Second, the number of stocks added or deleted each revision varies over the years. Consequently, the diversification will vary substantially through the years, leaving you to "put all your eggs in one basket" at some revisions.

We have not considered financial frictions in our analysis of trading strategies such as transaction cost, bid-ask spreads and limits to short-selling. These financial frictions would shave of some of the surplus from the trading strategies. Furthermore, limits so short selling could mean that we would not be able to apply strategy I in the first place.

Further, our historical data is based on daily closing returns. Hence, the true effects reveled in the intraday data could be masked in the format of the data. There could be other traders or funds that create imbalances that might give rise to sharp price movements within the dates that we cannot observe within the data (Madhavan, 2003). Thus, there could be substantial timing risk that is unobservable within the data.

Another limitation of our analysis of the trading strategies, is the impact of missing data. We were only able to analyze 82% of the additions and 65% of the deletion in the period 2002-2018. Hence, there is probably bias that would lead us to over- or underestimate the results from our trading strategies.

9.2.4 Concluding remarks on trading

By implementing two trading strategies in the event of OSEBX revisions, we would argue that we have created two trading strategies that are profitable excess of any transaction costs.

The strategies implemented are very simplistic, and there are probably many trading strategies that are more sophisticated and can extract surplus in each period. However, the idea behind creating trading strategies was testing our findings in practice. We tried to construct trading strategies that are designed around the statistical findings, and in that way test if the result had a practical implication on raw data. In this way we can test effects that are significant on a statistical level, but also trends that we would see in our data that we cannot make inference about.

It is important to address that even though the profitability of the trading strategies could in some way confirm our empirical findings. This is not part of the statistical analysis. This is solely a platform for showcasing the practical implications from our analysis.

10.0 Conclusions

Our findings indicate that there is an index effect for securities added to and deleted from the OSEBX on the Oslo Stock Exchange. On AD we find positive and statistically significant results for additions in the full sample and first-time additions. For securities that have been included previously, we find significant abnormal returns on AD-1 which could be an indication of information about the inclusion of the security being leaked before the announcement. This is an even bigger concern for first-time deletions where we find significant results at AD-2. Comparing this with abnormal trading volumes surrounding the AD, we find that there is a higher level of trading before the AD than after the announcement is made for additions. This cannot be said for deletions, and the high trading volumes before AD for additions is therefore assumed to be a result of the securities having a good period prior to the announcement, which is likely considering the selection criteria set by OSE for the OSEBX.

Findings around ED, the effective date show that there are abnormally high (low) returns on ED-1 for all samples for additions (deletions), indicating temporary effects. For the all inclusions and exclusions, i.e. the full sample, we observe AARs of 2.1% and -3.2% respectively. We believe that the differences in abnormal returns between additions and deletions is mainly caused by the information signaling hypothesis and the price pressure hypothesis, and that investors take the negative news of deletion harder than the positive news of an inclusion to the index. This is also supported by the fact that the mean volume ratio (MVR) on ED-1 is almost tripled for deletions but only doubled for additions in the full sample.

Looking at permanent effects through the CAARs we find that there is no full reversal over the event-window. For the full sample we do see a slight reversal after ED-1, however, the CAARs stabilizes at a higher level after some time. This indicates that the index effect on OSEBX is a permanent effect, supported by the imperfect substitute hypothesis. However, we do not find permanent effects for first time deletions.

We believe that the index effect found on OSEBX cannot be explained by a single hypothesis, but rather a combination of price pressure, information signaling, selection criteria and that the securities are not perfect substitutes for each other.

In addition, we have also identified higher returns on trading strategies with portfolios constituted with the index revisions, than what can be obtained by investing in the market.

11.0 Critique and limitations

Arguably, the biggest issue in our study is the amount of missing data. Not all data were available from Datastream, and after filtering the data on sufficient length and excluding events with interference from other events, we end up with 59.5% and 54.5% for additions and deletions respectively. Further, some of the subsamples are quite small, and could mean that the results are not representative.

Another issue in the data is that there could be other events or news that are not captured in the manual filtering of the data. E.g. we could have missed a news event that affect the returns of the security, thus giving us biased abnormal returns. However, we believe that we have done a thorough investigation into news events surrounding index inclusions and deletions for all constituents.

When testing the regressions used to find estimates to calculate expected returns for the constituents, we found that the estimators used is not BLUE in all instances. This can make it more difficult to draw reliable conclusions and is something that needs to be considered when reading into the results of this thesis.

12.0 Further research

Due to time restrictions and the size of the datasets, there are a few aspects of our thesis we were not able to investigate that we think could be interesting for further research.

First, we have identified a clear difference for first-time and non-first-time revisions for both additions and deletions. As we found little support for the attention hypothesis, the theory of comovement by Mase (2008) could be a determining factor. Therefore, we think it could be interesting to investigate further on the comovement effect on OSEBX.

Further, it could be interesting to go deeper into testing the hypotheses that might explain the index effect on OSEBX. A suggestion could be to apply the framework of Elliot, Van Ness, Walker and Warr (2006) that uses different methods to find evidence of hypotheses that explain the effect than what is done in this thesis.

We found some interesting and profitable trading strategies on average, with simplistic trading strategies. It could be interesting to see what other strategies that could be created, and if a more sophisticated strategy would outweigh the transaction costs.

A final suggestion for further research, could be to take the perspective of behavioral finance. We think that investor irrationality could explain some of the asymmetry between additions and deletions, and that this could be an interesting topic to investigate further.

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14.0 Appendices

Appendix A

This appendix shows which securities were removed in the manual filtering for additions and deletions.

ADDITIONS MANUALLY REMOVED

Company	Ticker	ED	CAUSE
Wallenius wilhelmsen	WALWIL	03.12.2018	Rebranding
Otello Corp	OTELLO	01.06.2018	Rebranding
Equinor	EQNR	01.06.2018	Rebranding
Wallenius wilhelmsen	WALWIL	01.06.2017	Rebranding
Treasure	TRE	08.06.2016	Demerged from Wallenius W
Schibsted B	SCHB	01.06.2016	Demerged from SCH
Schibsted A	SCHB	01.06.2016	Demerged from SCH
Aker solution	AKSO	30.09.2014	Demerged from holding company
EVRY	EVRY	01.06.2012	Rebranding
Archer	ARCHER	01.06.2011	Rebrand right after announcment of being taken of OSE
Gjensidige	GJF	13.12.2010	Fast Entry
Weifa	WEIFA	01.06.2010	Merged
BIONOR	SOLON	01.06.2010	Bionor is merged and restructured to Solon
PCI Biotech	PCIB	18.06.2008	Demerged from PHO and no prior data
Prosafe	PRS	18.05.2008	Cannot find AD
Aker Biomarine	AKBM	02.07.2007	Merger. Earlier data is Natural, which has never been on index.
DNO	DNO	25.06.2007	Demerged and merged to create DNO
Aker Biomarine	AKBM	02.07.2007	Previously called Natural and merged with them in June
Steen & Strom	SST	02.07.2007	Delisted in september
REC Silicon	REC	10.05.2006	Fast Entry
Frontline	FRO	09.12.2004	Can't find reason for inclusion
Atea	ATEA	22.10.2004	Can't find reason for inclusion
Frontline	FRO	04.06.2004	Can't find reason for inclusion
Apptix	APP	08.04.2002	Fast entry
Hydralift	TTS	21.12.2001	Aquired by TTS in des 2001
Yara Intl	YAR	25.03.2004	Can't find reason for inclusion
Tandberg Storage	TST	02.10.2003	Listed on OSE on ED

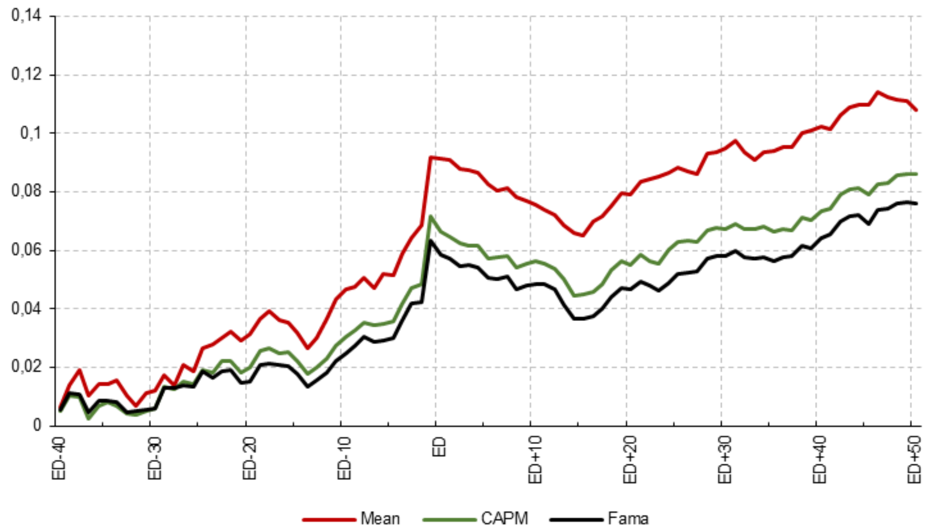
DELETIONS MANUALLY REMOVED

Company	Ticker	ED	CAUSE
FunCom	FUNCOM	03.12.2018	Not sufficient market data
Hexagon comp	HEX	03.12.2018	Not sufficient market data
Otello	OTELLO	03.12.2018	Not sufficient market data
Questerre Energy	QEC	03.12.2018	Not sufficient market data
Targowax	TRVX	03.12.2018	Not sufficient market data
WWH	WWIB	03.12.2018	Not sufficient market data
LINK MOBILITY GR	LINK	11.10.2018	Delisted from OSE
EKORNES	EKO	06.08.2018	Delisted from OSE
WEIFA	N/A	05.10.2017	Delisted from OSE
Opera	OTELLO	26.05.2016	Opera bought by OTELLO
Royal Carib Crus	RCL	09.03.2016	Delisted from OSE
REC Solar	RECSOL	13.08.2015	Delisted from OSE
Eltek Power Stms	ELT	12.02.2015	Delisted from OSE
BWG Homes	BWG	11.06.2014	Delisted from OSE
Algeta	ALGETA	25.02.2014	Delisted from OSE
Pronova Biopharm	PRON	22.01.2013	Delisted from OSE
Golar LNG	GOL	03.09.2012	Delisted from OSE
Crcle K	SFR	21.06.2012	Delisted from OSE
Subsea 7	SUB	10.01.2011	Delisted from OSE
Tandberg	N/A	07.12.2009	Delisted from OSE
Axel Springer No	STP	05.11.2009	Delisted from OSE
Profdoc	PRFD	27.08.2008	Delisted from OSE
Norgani Hotels	NORGAN	26.09.2007	Delisted from OSE
Altinex	ALTIN	20.08.2007	Delisted from OSE
Ericsson Tv	TAT	21.03.2007	Sold and delisted
Teekay Petrojarl	TPO	23.10.2006	Delisted from OSE
Nera	NER	19.10.2006	Merged with ELTEK
Staples Norway	ATG	18.09.2006	Sold and delisted
Fara	FARA	02.01.2006	Demerger and little data
Gjensidige NOR	GNO	05.12.2003	Delisted from OSE
Tandberg Data	TAD	02.10.2003	Demerger and delisted

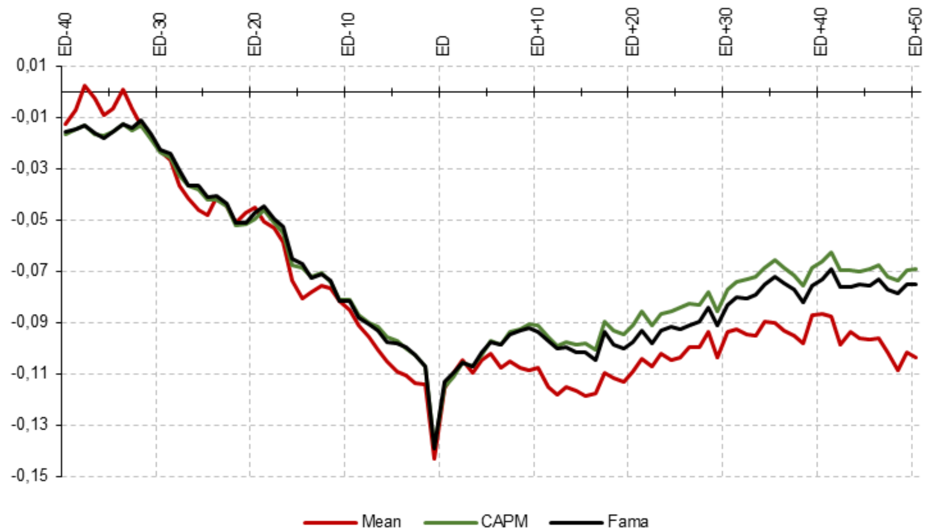
Appendix B

This appendix shows the differences on CAARs when using different normal return models.

Full Sample - Additions



Full Sample - Deletions



Appendix C

This appendix shows the AARs and MVRs surrounding AD for all samples

First additions and deletions

AVERAGE ABNORMAL RETURN (AAR)								
	Additions				Deletions			
	No. of events:	83			No. of events:	42		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
AD-10	-0,0045	-1,4974	-0,7219	43 %	0,0000	0,0057	-1,0437	45 %
AD-9	-0,0014	-0,4753	-0,2822	46 %	0,0062	1,4797	0,5027	57 %
AD-8	0,0026	0,8475	0,5972	51 %	-0,0054	-1,2877	0,8120	60 %
AD-7	-0,0013	-0,4242	0,1575	48 %	-0,0021	-0,4999	0,1934	55 %
AD-6	0,0043	1,4203	2,3559 ***	60 %	-0,0047	-1,1178	-0,4251	50 %
AD-5	0,0014	0,4665	1,0369	53 %	0,0006	0,1344	-0,7344	48 %
AD-4	0,0042	1,4006	2,1361 **	59 %	-0,0081	-1,9286 *	-0,4251	50 %
AD-3	0,0032	1,0431	-0,2822	46 %	-0,0072	-1,7204 *	0,5027	57 %
AD-2	-0,0053	-1,7536 *	-2,4806	34 %	-0,0087	-2,0655 **	2,0490 **	69 %
AD-1	0,0036	1,1981	1,0369	53 %	0,0021	0,5002	-0,4251	50 %
AD	0,0072	2,3834 **	2,5758 ***	61 %	-0,0032	-0,7569	0,1934	55 %
AD+1	0,0040	1,3093	1,4765 *	55 %	-0,0125	-2,9690 ***	1,1212	62 %
AD+2	0,0051	1,6754 *	1,4765 *	55 %	0,0014	0,3407	-0,7344	48 %
AD+3	0,0004	0,1455	-0,5020	45 %	-0,0082	-1,9556 *	1,4305 *	64 %
AD+4	0,0047	1,5462	1,6964 **	57 %	0,0006	0,1415	-0,1158	52 %
AD+5	-0,0025	-0,8117	-0,2822	46 %	-0,0090	-2,1388 **	1,1212	62 %

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	83	No. of events:	42
Time *t*	*MVR*	T-value	*MVR*	T-value
AD-10	2,2125	2,6502 ***	2,0432	1,1246
AD-9	3,1247	2,8459 ***	1,5604	1,6596 *
AD-8	1,6281	2,2841 **	1,6046	0,8911
AD-7	1,7180	1,5754	2,3593	1,2628
AD-6	2,2584	2,2792 **	1,5135	1,0806
AD-5	2,2658	2,5476 **	1,0482	0,2997
AD-4	1,9886	2,5929 **	0,9353	-0,4208
AD-3	1,5432	2,2333 **	0,9310	-0,3080
AD-2	2,6507	2,3279 **	1,6502	1,5598
AD-1	1,7099	2,0225 **	1,1866	0,6931
AD	1,5644	1,8711 *	1,0987	0,4970
AD+1	1,8273	2,2065 **	0,7291	-2,6870 ***
AD+2	1,5832	2,5777 **	1,0008	0,0025
AD+3	1,8382	2,0361 **	1,4804	1,2549
AD+4	1,3130	1,7120 *	1,1227	0,5529
AD+5	1,1944	0,7988	1,2385	0,8383

Non-first inclusions and deletions

	AVERAGE ABNORMAL RETURN (AAR)							
	Additions				Deletions			
	No. of events: 51				No. of events: 46			
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
AD-10	-0,0032	-0,8354	0,1533	49 %	-0,0011	-0,2104	0,0029	53 %
AD-9	-0,0034	-0,8824	-1,2482	39 %	-0,0117	-2,2335 **	0,2981	56 %
AD-8	0,0014	0,3587	0,9942	55 %	0,0005	0,0865	0,0029	53 %
AD-7	-0,0010	-0,2530	-0,4073	45 %	0,0070	1,3395	0,8884	60 %
AD-6	0,0075	1,9401 *	2,6759 ***	67 %	-0,0164	-3,1494 ***	1,1836	62 %
AD-5	-0,0071	-1,8237 *	-1,5284	37 %	-0,0061	-1,1682	-0,2922	51 %
AD-4	0,0037	0,9642	0,9942	55 %	-0,0058	-1,1024	0,0029	53 %
AD-3	-0,0036	-0,9306	-1,2482	39 %	0,0055	1,0465	0,2981	56 %
AD-2	-0,0039	-0,9994	-0,6876	43 %	-0,0067	-1,2822	1,1836	62 %
AD-1	0,0110	2,8369 ***	2,1154 **	63 %	-0,0086	-1,6461	0,8884	60 %
AD	0,0024	0,6130	1,2745	57 %	0,0019	0,3612	-1,4729	42 %
AD+1	0,0035	0,9011	1,2745	57 %	0,0038	0,7238	1,4787 *	64 %
AD+2	0,0031	0,8127	0,7139	53 %	-0,0026	-0,5041	-0,2922	51 %
AD+3	0,0015	0,3925	-0,4073	45 %	-0,0010	-0,1847	0,5932	58 %
AD+4	-0,0040	-1,0448	-1,5284	37 %	0,0004	0,0800	0,0029	53 %
AD+5	0,0056	1,4578	1,5548 *	59 %	0,0019	0,3730	0,2981	56 %

	MEAN VOLUME RATIO (MVR)			
	Additions		Deletions	
	No. of events: 51		No. of events: 46	
Time *t*	*MVR*	T-value	*MVR*	T-value
AD-10	6,1950	1,1400	0,8374	-1,1645
AD-9	1,4962	1,7524 *	1,2917	0,9500
AD-8	1,4913	2,0188 **	0,8265	-1,0683
AD-7	1,5793	1,8169 *	0,7954	-1,1364
AD-6	1,6516	2,7267 ***	1,1076	0,3471
AD-5	1,3683	1,9214 *	1,9702	1,4912
AD-4	2,6773	1,7098 *	0,9721	-0,1839
AD-3	1,2812	1,2015	0,7311	-2,7205 ***
AD-2	1,1052	0,7554	0,5976	-4,5289 ***
AD-1	1,2987	1,3571	0,6125	-3,7263 ***
AD	1,2318	1,2777	0,7323	-1,8080 *
AD+1	1,8479	1,0875	0,6916	-2,7237 ***
AD+2	1,2135	1,0161	0,7201	-2,6250 ***
AD+3	1,7554	2,2139 **	0,9366	-0,3894
AD+4	1,3304	1,4463	0,6221	-3,6288 ***
AD+5	1,9219	1,9829 **	1,4806	0,8338

All inclusions and deletions

AVERAGE ABNORMAL RETURN (AAR)

	Additions				Deletions			
	No. of events:	134			No. of events:	87		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
AD-10	-0,0040	-1,6583 *	-0,4730	46 %	0,0000	-0,0010	-0,6571	49 %
AD-9	-0,0022	-0,9001	-0,9919	43 %	0,0003	0,0945	0,6317	56 %
AD-8	0,0021	0,8694	1,0838	52 %	-0,0056	-1,5656	0,6317	56 %
AD-7	-0,0012	-0,4797	-0,1270	47 %	-0,0038	-1,0576	0,8465	57 %
AD-6	0,0055	2,2678 **	3,5055 ***	63 %	-0,0136	-3,8218 ***	0,6317	56 %
AD-5	-0,0018	-0,7452	-0,1270	47 %	-0,0052	-1,4595	-0,6571	49 %
AD-4	0,0040	1,6617 *	2,2947 **	57 %	-0,0056	-1,5638	-0,0127	53 %
AD-3	0,0006	0,2394	-0,9919	43 %	-0,0037	-1,0370	0,6317	56 %
AD-2	-0,0048	-1,9547 *	-2,3758	37 %	-0,0032	-0,8931	2,3500 ***	66 %
AD-1	0,0064	2,6398 ***	2,1217 **	57 %	-0,0045	-1,2550	0,2021	54 %
AD	0,0054	2,2055 **	2,8136 ***	60 %	0,0008	0,2265	-0,6571	49 %
AD+1	0,0038	1,5532	1,9487 **	56 %	-0,0087	-2,4471 **	2,1353 **	64 %
AD+2	0,0043	1,7815 *	1,6028 *	54 %	0,0027	0,7488	-0,8719	48 %
AD+3	0,0009	0,3496	-0,6460	45 %	-0,0026	-0,7422	1,4909 *	61 %
AD+4	0,0014	0,5575	0,3919	49 %	-0,0003	-0,0881	-0,0127	53 %
AD+5	0,0006	0,2579	0,7379	51 %	-0,0080	-2,2540 **	1,2761	60 %

MEAN VOLUME RATIO (MVR)

	Additions		Deletions	
	No. of events:	134	No. of events:	87
Time *t*	*MVR*	T-value	*MVR*	T-value
AD-10	3,7210	1,5508	1,3615	0,7932
AD-9	2,5202	3,1773 ***	1,4706	2,0259 **
AD-8	1,5766	2,9826 ***	1,2323	0,6788
AD-7	1,6672	2,1772 **	1,5038	0,9481
AD-6	2,0268	2,9016 ***	1,3369	1,2003
AD-5	1,9206	2,8978 ***	1,5402	1,5567
AD-4	2,2462	2,8292 ***	0,9454	-0,5117
AD-3	1,4427	2,5330 **	0,8896	-0,8403
AD-2	2,0517	2,3582 **	1,1400	0,6532
AD-1	1,5537	2,3768 **	0,9163	-0,5843
AD	1,4355	2,1871 **	0,9863	-0,0988
AD+1	1,8351	2,2266 **	0,6991	-4,0617 ***
AD+2	1,4432	2,7429 ***	0,8694	-0,8276
AD+3	1,8067	2,8276 ***	1,1907	0,9347
AD+4	1,3197	2,2479 **	0,9475	-0,3818
AD+5	1,4721	2,0229 **	1,3279	1,0020

Appendix D

This appendix contains the AARs and the test values for first inclusions and deletions.

	AVERAGE ABNORMAL RETURN (AAR)							
	Additions				Deletions			
	No. of events:	84			No. of events:	59		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
ED-40	0,0054	1,7996 *	0,9272	52 %	-0,0202	-4,8081 ***	2,4969 ***	69 %
ED-39	0,0061	2,0216 **	2,6755 ***	62 %	0,0036	0,8665	-1,9390	41 %
ED-38	-0,0018	-0,6011	-0,3839	45 %	0,0036	0,8473	2,2360 **	68 %
ED-37	-0,0056	-1,8552 *	0,4902	50 %	0,0010	0,2335	0,4094	56 %
ED-36	0,0038	1,2400	0,4902	50 %	-0,0024	-0,5718	1,1922	61 %
ED-35	-0,0023	-0,7661	-1,2581	40 %	0,0053	1,2680	-0,3734	51 %
ED-34	0,0005	0,1509	0,4902	50 %	0,0047	1,1227	0,6704	58 %
ED-33	-0,0016	-0,5389	-0,8210	43 %	-0,0049	-1,1601	0,4094	56 %
ED-32	-0,0017	-0,5659	0,0531	48 %	0,0029	0,6935	-1,4171	44 %
ED-31	0,0000	-0,0058	-0,8210	43 %	-0,0032	-0,7615	-0,3734	51 %
ED-30	0,0030	1,0068	-1,0395	42 %	-0,0057	-1,3677	1,9751 **	66 %
ED-29	0,0050	1,6506	1,8014 **	57 %	-0,0021	-0,5027	-0,1124	53 %
ED-28	-0,0009	-0,2973	0,7087	51 %	-0,0036	-0,8678	0,6704	58 %
ED-27	-0,0002	-0,0524	-1,4766	39 %	-0,0029	-0,6847	-0,8953	47 %
ED-26	-0,0015	-0,4918	-1,4766	39 %	-0,0009	-0,2099	0,1485	54 %
ED-25	0,0016	0,5368	0,4902	50 %	-0,0026	-0,6123	0,4094	56 %
ED-24	-0,0019	-0,6286	-0,3839	45 %	-0,0022	-0,5274	1,9751 **	66 %
ED-23	0,0026	0,8516	0,7087	51 %	-0,0052	-1,2316	1,1922	61 %
ED-22	-0,0022	-0,7256	-0,3839	45 %	-0,0084	-2,0116 **	0,1485	54 %
ED-21	-0,0044	-1,4382	-1,2581	40 %	0,0069	1,6409	-1,4171	44 %
ED-20	0,0016	0,5187	0,7087	51 %	0,0095	2,2548 **	-1,1562	46 %
ED-19	0,0053	1,7410 *	0,7087	51 %	0,0015	0,3635	0,1485	54 %
ED-18	-0,0002	-0,0629	-0,6025	44 %	-0,0008	-0,2007	0,1485	54 %
ED-17	-0,0014	-0,4730	-0,3839	45 %	0,0016	0,3746	0,4094	56 %
ED-16	-0,0010	-0,3246	-0,3839	45 %	-0,0067	-1,5999	-0,3734	51 %
ED-15	-0,0009	-0,2917	0,4902	50 %	0,0003	0,0721	-0,1124	53 %
ED-14	-0,0059	-1,9440 *	-1,4766	39 %	-0,0061	-1,4528	0,4094	56 %
ED-13	0,0021	0,7017	-0,3839	45 %	-0,0037	-0,8862	0,1485	54 %
ED-12	0,0006	0,2095	1,5828 *	56 %	-0,0033	-0,7799	1,1922	61 %
ED-11	0,0044	1,4651	1,3643 *	55 %	-0,0045	-1,0611	0,9313	59 %
ED-10	0,0015	0,5035	1,1458	54 %	-0,0015	-0,3585	-0,6343	49 %
ED-9	0,0024	0,7854	0,7087	51 %	-0,0070	-1,6711 *	1,1922	61 %
ED-8	0,0038	1,2698	1,1458	54 %	0,0014	0,3283	-0,3734	51 %
ED-7	-0,0016	-0,5208	1,3643 *	55 %	-0,0075	-1,7851 *	1,7141 **	64 %
ED-6	0,0016	0,5310	0,4902	50 %	-0,0012	-0,2856	-1,9390	41 %
ED-5	0,0004	0,1262	0,9272	52 %	0,0048	1,1469	-1,4171	44 %
ED-4	0,0037	1,2273	0,0531	48 %	-0,0063	-1,5066	-0,1124	53 %
ED-3	0,0053	1,7636 *	-0,3839	45 %	-0,0040	-0,9618	1,4532 *	63 %
ED-2	-0,0023	-0,7611	0,9272	52 %	-0,0029	-0,6924	0,1485	54 %
ED-1	0,0209	6,9217 ***	6,6090 ***	83 %	-0,0355	-8,4512 ***	3,8016 ***	78 %
ED	-0,0031	-1,0359	-0,3839	45 %	0,0258	6,1382 ***	-4,2874	25 %
ED+1	0,0030	0,9912	0,4902	50 %	0,0035	0,8448	-0,1124	53 %
ED+2	-0,0051	-1,6978 *	-1,0395	42 %	0,0011	0,2552	-0,3734	51 %
ED+3	0,0028	0,9271	0,9272	52 %	0,0007	0,1685	-0,1124	53 %
ED+4	-0,0025	-0,8391	-1,9136	37 %	0,0023	0,5568	-1,6781	42 %
ED+5	-0,0045	-1,4817	-2,1322	36 %	0,0028	0,6606	-1,4171	44 %
ED+6	0,0001	0,0471	1,3643 *	55 %	0,0014	0,3405	-0,1124	53 %
ED+7	0,0021	0,6857	1,1458	54 %	0,0131	3,1304 ***	-0,6343	49 %
ED+8	-0,0065	-2,1585 **	-2,3507	35 %	0,0041	0,9823	-1,4171	44 %
ED+9	-0,0001	-0,0169	0,4902	50 %	0,0063	1,5114	-1,4171	44 %
ED+10	-0,0039	-1,2997	0,0531	48 %	-0,0088	-2,0884 **	0,9313	59 %

ED+11	0,0006	0,2062	0,0531	48 %	-0,0062	-1,4806	-0,3734	51 %
ED+12	-0,0006	-0,1866	-0,3839	45 %	-0,0005	-0,1166	-0,6343	49 %
ED+13	-0,0092	-3,0292 ***	-1,0395	42 %	-0,0040	-0,9550	1,1922	61 %
ED+14	-0,0032	-1,0568	0,7087	51 %	-0,0027	-0,6528	-0,3734	51 %
ED+15	0,0000	-0,0109	0,4902	50 %	-0,0028	-0,6560	0,6704	58 %
ED+16	-0,0007	-0,2404	-0,3839	45 %	0,0040	0,9524	-0,6343	49 %
ED+17	0,0033	1,0960	2,4570 ***	61 %	0,0134	3,1802 ***	-0,1124	53 %
ED+18	0,0101	3,3276 ***	2,8940 ***	63 %	-0,0057	-1,3470	-0,6343	49 %
ED+19	0,0050	1,6425	0,7087	51 %	-0,0041	-0,9766	0,4094	56 %
ED+20	0,0018	0,5811	-0,1654	46 %	0,0065	1,5542	-0,3734	51 %
ED+21	-0,0007	-0,2271	-0,6025	44 %	0,0007	0,1765	-1,6781	42 %
ED+22	-0,0002	-0,0572	-0,1654	46 %	-0,0062	-1,4724	0,6704	58 %
ED+23	-0,0046	-1,5340	-1,4766	39 %	0,0017	0,3960	0,1485	54 %
ED+24	0,0038	1,2625	0,9272	52 %	0,0063	1,5008	-1,4171	44 %
ED+25	0,0023	0,7617	0,0531	48 %	-0,0032	-0,7511	0,4094	56 %
ED+26	-0,0011	-0,3684	-1,2581	40 %	0,0013	0,3097	-0,3734	51 %
ED+27	0,0003	0,1051	0,0531	48 %	-0,0024	-0,5737	-1,1562	46 %
ED+28	0,0022	0,7299	0,0531	48 %	-0,0044	-1,0541	-0,8953	47 %
ED+29	0,0017	0,5735	-0,8210	43 %	-0,0007	-0,1700	-0,3734	51 %
ED+30	-0,0018	-0,6007	-0,1654	46 %	0,0105	2,4966 **	0,9313	59 %
ED+31	0,0008	0,2531	-0,3839	45 %	0,0053	1,2619	-0,8953	47 %
ED+32	0,0017	0,5604	0,0531	48 %	-0,0022	-0,5141	1,4532 *	63 %
ED+33	-0,0025	-0,8345	-0,6025	44 %	0,0045	1,0728	-1,4171	44 %
ED+34	0,0019	0,6265	0,0531	48 %	-0,0005	-0,1155	0,9313	59 %
ED+35	-0,0010	-0,3255	0,2717	49 %	0,0027	0,6532	-1,1562	46 %
ED+36	0,0020	0,6468	0,2717	49 %	-0,0060	-1,4240	0,1485	54 %
ED+37	0,0028	0,9331	-0,6025	44 %	-0,0040	-0,9641	1,9751 **	66 %
ED+38	0,0018	0,5811	-0,1654	46 %	-0,0028	-0,6723	0,4094	56 %
ED+39	-0,0002	-0,0793	-0,1654	46 %	0,0022	0,5335	0,6704	58 %
ED+40	0,0021	0,7014	0,7087	51 %	0,0070	1,6725 *	-0,8953	47 %
ED+41	-0,0014	-0,4520	0,2717	49 %	0,0102	2,4347 **	-1,6781	42 %
ED+42	0,0079	2,6149 ***	1,5828 *	56 %	0,0006	0,1432	-1,1562	46 %
ED+43	0,0040	1,3190	1,3643 *	55 %	0,0009	0,2209	0,1485	54 %
ED+44	-0,0010	-0,3408	-0,6025	44 %	-0,0048	-1,1403	1,1922	61 %
ED+45	-0,0041	-1,3505	-1,9136	37 %	-0,0028	-0,6553	-0,3734	51 %
ED+46	0,0009	0,3043	-0,8210	43 %	0,0033	0,7862	-1,1562	46 %
ED+47	0,0010	0,3230	0,2717	49 %	-0,0068	-1,6235	0,1485	54 %
ED+48	0,0005	0,1721	0,4902	50 %	0,0006	0,1478	-0,3734	51 %
ED+49	-0,0016	-0,5185	0,0531	48 %	0,0054	1,2828	0,1485	54 %
ED+50	0,0015	0,4853	0,4902	50 %	-0,0014	-0,3335	0,1485	54 %

Appendix E

This appendix contains the CAARs of first inclusions and deletions.

CUMULATIVE AVERAGE ABNORMAL RETURN (CAAR)				
	Additions		Deletions	
	No. of events:	84	No. of events:	59
Time *t*	*CAAR*	T-value	*CAAR*	T-value
ED-40	0,0054	1,7996 *	-0,0202	-4,8081 ***
ED-39	0,0116	2,7020	-0,0165	-2,7872
ED-38	0,0097	1,8591	-0,0130	-1,7865
ED-37	0,0041	0,6824	-0,0120	-1,4304
ED-36	0,0079	1,1649	-0,0144	-1,5351
ED-35	0,0056	0,7507	-0,0091	-0,8837
ED-34	0,0060	0,7520	-0,0044	-0,3939
ED-33	0,0044	0,5129	-0,0092	-0,7786
ED-32	0,0027	0,2949	-0,0063	-0,5029
ED-31	0,0027	0,2780	-0,0095	-0,7179
ED-30	0,0057	0,5686	-0,0153	-1,0969
ED-29	0,0107	1,0209	-0,0174	-1,1953
ED-28	0,0098	0,8984	-0,0210	-1,3891
ED-27	0,0096	0,8517	-0,0239	-1,5215
ED-26	0,0082	0,6958	-0,0248	-1,5241
ED-25	0,0098	0,8079	-0,0274	-1,6288
ED-24	0,0079	0,6314	-0,0296	-1,7081
ED-23	0,0105	0,8143	-0,0347	-1,9502 *
ED-22	0,0083	0,6261	-0,0432	-2,3597 **
ED-21	0,0039	0,2887	-0,0363	-1,9330 *
ED-20	0,0055	0,3949	-0,0268	-1,3944

ED-19	0,0107	0,7570	-0,0253	-1,2849
ED-18	0,0106	0,7272	-0,0261	-1,2985
ED-17	0,0091	0,6154	-0,0246	-1,1947
ED-16	0,0081	0,5380	-0,0313	-1,4905
ED-15	0,0073	0,4704	-0,0310	-1,4474
ED-14	0,0014	0,0875	-0,0371	-1,6999
ED-13	0,0035	0,2185	-0,0408	-1,8368 *
ED-12	0,0041	0,2536	-0,0441	-1,9497 *
ED-11	0,0086	0,5168	-0,0485	-2,1106 **
ED-10	0,0101	0,5989	-0,0500	-2,1407 **
ED-9	0,0125	0,7283	-0,0571	-2,4024 **
ED-8	0,0163	0,9382	-0,0557	-2,3085 **
ED-7	0,0147	0,8350	-0,0632	-2,5805 **
ED-6	0,0163	0,9127	-0,0644	-2,5916 **
ED-5	0,0167	0,9210	-0,0596	-2,3642 **
ED-4	0,0204	1,1102	-0,0659	-2,5798 **
ED-3	0,0258	1,3816	-0,0699	-2,7016 **
ED-2	0,0235	1,2419	-0,0728	-2,7776 ***
ED-1	0,0444	2,3207 **	-0,1083	-4,0789 ***
ED	0,0413	2,1304 **	-0,0825	-3,0703 ***
ED+1	0,0443	2,2579 **	-0,0790	-2,9031 ***
ED+2	0,0391	1,9725 *	-0,0779	-2,8303 ***
ED+3	0,0419	2,0898 **	-0,0772	-2,7725 ***
ED+4	0,0394	1,9413 *	-0,0749	-2,6585 **
ED+5	0,0349	1,7016 *	-0,0721	-2,5321 **
ED+6	0,0351	1,6903 *	-0,0707	-2,4553 **
ED+7	0,0371	1,7716 *	-0,0575	-1,9778 *
ED+8	0,0306	1,4451	-0,0534	-1,8172 *
ED+9	0,0306	1,4281	-0,0471	-1,5852
ED+10	0,0266	1,2321	-0,0558	-1,8620 *
ED+11	0,0273	1,2488	-0,0620	-2,0493 **
ED+12	0,0267	1,2113	-0,0625	-2,0459 **
ED+13	0,0175	0,7878	-0,0665	-2,1568 **
ED+14	0,0143	0,6381	-0,0693	-2,2251 **
ED+15	0,0143	0,6310	-0,0720	-2,2929 **
ED+16	0,0136	0,5936	-0,0680	-2,1465 **
ED+17	0,0169	0,7323	-0,0547	-1,7103 *
ED+18	0,0269	1,1593	-0,0603	-1,8712 *
ED+19	0,0319	1,3617	-0,0644	-1,9816 *
ED+20	0,0337	1,4249	-0,0579	-1,7663 *
ED+21	0,0330	1,3845	-0,0572	-1,7296 *
ED+22	0,0328	1,3662	-0,0634	-1,9013 *
ED+23	0,0282	1,1638	-0,0617	-1,8369 *
ED+24	0,0320	1,3114	-0,0554	-1,6365
ED+25	0,0343	1,3952	-0,0586	-1,7165 *
ED+26	0,0332	1,3397	-0,0573	-1,6658
ED+27	0,0335	1,3426	-0,0597	-1,7231 *
ED+28	0,0357	1,4207	-0,0641	-1,8375 *
ED+29	0,0374	1,4790	-0,0648	-1,8446 *
ED+30	0,0356	1,3973	-0,0543	-1,5353
ED+31	0,0364	1,4174	-0,0490	-1,3759
ED+32	0,0381	1,4732	-0,0512	-1,4266
ED+33	0,0356	1,3663	-0,0467	-1,2922
ED+34	0,0375	1,4295	-0,0472	-1,2969
ED+35	0,0365	1,3827	-0,0444	-1,2134
ED+36	0,0384	1,4474	-0,0504	-1,3678
ED+37	0,0413	1,5437	-0,0544	-1,4682
ED+38	0,0430	1,5993	-0,0573	-1,5345
ED+39	0,0428	1,5804	-0,0550	-1,4652
ED+40	0,0449	1,6486	-0,0480	-1,2703
ED+41	0,0435	1,5886	-0,0378	-0,9937
ED+42	0,0514	1,8660 *	-0,0372	-0,9719
ED+43	0,0554	1,9988 **	-0,0363	-0,9420
ED+44	0,0544	1,9500 *	-0,0410	-1,0602
ED+45	0,0503	1,7930 *	-0,0438	-1,1246
ED+46	0,0512	1,8153 *	-0,0405	-1,0339
ED+47	0,0522	1,8394 *	-0,0473	-1,2011
ED+48	0,0527	1,8473 *	-0,0467	-1,1786
ED+49	0,0512	1,7823 *	-0,0413	-1,0368
ED+50	0,0526	1,8234 *	-0,0427	-1,0661

Appendix F

This appendix contains the MVRs of first inclusions and deletions.

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	84	No. of events:	59
Time *t*	*MVR*	T-value	*MVR*	T-value
ED-40	2,1940	2,6392 ***	1,7289	1,0919
ED-39	3,1903	2,9577 ***	1,4656	1,7908 *
ED-38	1,6615	2,4166 **	1,5477	1,0899
ED-37	1,7958	1,7414 *	1,9298	1,2076
ED-36	2,2696	2,3268 **	1,3494	1,0191
ED-35	2,2763	2,5992 **	1,2188	1,0576
ED-34	2,0105	2,6779 ***	1,3597	1,1218
ED-33	1,5658	2,3444 **	1,3105	1,0482
ED-32	2,6646	2,3756 **	1,8849	2,2212 **
ED-31	1,7159	2,0638 **	1,1257	0,5979
ED-30	1,5634	1,8905 *	1,0175	0,1133
ED-29	1,8072	2,1758 **	0,8272	-1,3948
ED-28	1,5660	2,5243 **	1,0138	0,0590
ED-27	2,2387	2,1700 **	1,3875	1,2420
ED-26	1,3328	1,8325 *	1,1924	0,7871
ED-25	1,3850	1,2664	1,2907	1,2509
ED-24	1,6314	1,3377	1,2310	0,5389
ED-23	1,3201	1,2742	1,0912	0,2634
ED-22	1,1353	1,0670	1,1165	0,3879
ED-21	1,3094	1,7104 *	0,9946	-0,0333
ED-20	1,5136	1,3012	0,9360	-0,3304
ED-19	1,9271	2,8297 ***	1,8821	1,9415 *
ED-18	1,2020	1,0246	1,0702	0,3449
ED-17	1,3857	2,2099 **	0,9611	-0,2533
ED-16	1,1278	0,9695	1,0389	0,2039
ED-15	1,4740	2,4357 **	1,1759	0,7188
ED-14	1,3014	2,1196 **	1,0234	0,1293
ED-13	1,5616	2,3071 **	1,0468	0,2387
ED-12	1,3940	2,3395 **	1,4416	1,3016
ED-11	2,0656	3,0140 ***	1,1285	0,7639
ED-10	1,6590	2,3948 **	3,2892	1,1506
ED-9	1,7366	2,2586 **	0,8079	-1,2952
ED-8	1,8973	2,0560 **	0,9301	-0,4460
ED-7	1,4641	1,6892 *	1,5029	1,4907
ED-6	1,7949	2,2747 **	1,5330	1,2691
ED-5	2,0046	2,0723 **	1,4602	1,2975
ED-4	1,5484	1,5021	1,1853	1,0659
ED-3	1,9833	2,4630 **	1,8063	2,2619 **
ED-2	2,2335	1,9548 *	1,4878	2,3644 **
ED-1	3,9971	5,0219 ***	4,1299	5,4912 ***
ED	1,3598	2,3003 **	2,4047	2,5008 **
ED+1	1,1648	1,0119	1,8646	1,6814 *
ED+2	1,1801	1,1696	1,5000	1,9183 *
ED+3	0,9910	-0,0775	2,9053	1,8497 *
ED+4	0,7240	-3,3454 ***	1,2156	0,6599
ED+5	1,0184	0,1444	0,8889	-1,0465
ED+6	0,9858	-0,1023	1,6277	1,5926
ED+7	1,0968	0,5979	1,4145	1,2346
ED+8	1,2185	1,2561	1,4040	1,2591
ED+9	1,1607	0,5195	1,1194	0,5153
ED+10	1,3437	0,9760	1,2576	1,3280

ED+11	1,2851	1,3849	1,0721	0,4834
ED+12	0,9886	-0,0815	1,3302	0,9191
ED+13	0,9907	-0,0713	1,0730	0,5037
ED+14	1,2599	1,4924	1,6341	1,0862
ED+15	1,2211	0,8856	2,3642	1,3033
ED+16	1,2182	1,1662	1,4445	1,1864
ED+17	1,0619	0,5445	1,2082	1,0250
ED+18	1,3122	1,7778 *	0,9838	-0,1044
ED+19	1,3370	1,6055	0,8103	-1,5446
ED+20	1,2699	1,0613	1,0963	0,6463
ED+21	1,3990	2,1607 **	1,0617	0,3792
ED+22	1,1278	0,9110	1,1048	0,3317
ED+23	1,0773	0,5336	0,7242	-3,5747 ***
ED+24	1,1472	0,9045	0,9684	-0,1812
ED+25	0,9712	-0,2835	0,7542	-2,1345 **
ED+26	1,1709	1,2890	2,6644	1,0370
ED+27	1,4831	1,8552 *	1,0103	0,0354
ED+28	1,0255	0,1550	1,2802	0,8104
ED+29	1,0543	0,3482	0,8800	-0,7020
ED+30	0,8985	-0,8248	2,3162	0,9985
ED+31	1,1531	1,1493	0,8493	-0,9365
ED+32	0,8567	-1,4662	1,1426	0,5344
ED+33	1,9587	1,0777	0,8974	-0,5300
ED+34	1,0134	0,0844	1,1085	0,5482
ED+35	1,0952	0,5756	1,0274	0,1644
ED+36	0,9902	-0,0621	2,0686	1,0065
ED+37	1,2461	0,9137	0,7984	-1,8451 *
ED+38	1,4433	1,7492 *	1,7313	1,0358
ED+39	1,1291	0,9315	0,7983	-1,4353
ED+40	0,9507	-0,4672	1,7559	1,5166
ED+41	1,1281	0,8905	0,9656	-0,2105
ED+42	1,5919	1,4875	0,9382	-0,3329
ED+43	1,0750	0,4435	1,0462	0,2291
ED+44	1,2882	1,5052	0,8715	-0,9805
ED+45	1,0851	0,5619	1,2886	0,6960
ED+46	1,3338	1,3586	1,3937	1,0794
ED+47	1,0941	0,5663	1,3015	0,9491
ED+48	1,1632	0,8862	0,9963	-0,0266
ED+49	1,4480	1,4809	1,1628	0,8528
ED+50	1,0840	0,6032	1,0684	0,4073

Appendix G

This appendix contains the AARs and the test values for non-first inclusions and deletions.

	AVERAGE ABNORMAL RETURN (AAR)							
	Additions				Deletions			
	No. of events:	51			No. of events:	48		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
ED-40	0,0065	1,6668 *	0,4336	51 %	-0,0104	-1,9961 **	3,1688 ***	75 %
ED-39	0,0046	1,1766	1,2745	57 %	0,0002	0,0446	-0,2985	50 %
ED-38	0,0016	0,4227	1,2745	57 %	-0,0014	-0,2640	0,8573	58 %
ED-37	-0,0074	-1,8990 *	-0,1270	47 %	-0,0064	-1,2249	2,0130 **	67 %
ED-36	0,0045	1,1532	0,4336	51 %	-0,0030	-0,5658	1,1462	60 %
ED-35	0,0038	0,9789	1,2745	57 %	-0,0035	-0,6639	1,4351 *	63 %
ED-34	-0,0022	-0,5640	-0,1270	47 %	0,0029	0,5535	-0,2985	50 %
ED-33	-0,0056	-1,4515	-1,8087	35 %	0,0019	0,3605	-1,1654	44 %
ED-32	0,0042	1,0722	0,7139	53 %	0,0045	0,8694	-0,2985	50 %
ED-31	0,0007	0,1803	0,9942	55 %	-0,0087	-1,6605 *	2,3020 **	69 %
ED-30	-0,0039	-1,0010	-0,9679	41 %	-0,0051	-0,9719	0,8573	58 %
ED-29	0,0102	2,6326 ***	0,7139	53 %	-0,0059	-1,1243	-0,2985	50 %
ED-28	0,0016	0,4128	0,9942	55 %	-0,0077	-1,4742	0,8573	58 %
ED-27	0,0023	0,5816	0,4336	51 %	-0,0105	-2,0122 **	0,8573	58 %
ED-26	0,0016	0,4114	-0,1270	47 %	0,0009	0,1649	-0,8764	46 %
ED-25	0,0113	2,9248 ***	0,9942	55 %	-0,0072	-1,3763	1,7241 **	65 %
ED-24	-0,0033	-0,8585	-2,0890	33 %	0,0049	0,9426	-0,8764	46 %
ED-23	0,0017	0,4491	-0,9679	41 %	0,0005	0,0946	0,8573	58 %
ED-22	0,0047	1,2141	0,1533	49 %	-0,0052	-0,9899	1,4351 *	63 %
ED-21	-0,0045	-1,1538	-0,4073	45 %	-0,0058	-1,1078	1,1462	60 %
ED-20	-0,0004	-0,1098	0,7139	53 %	0,0038	0,7320	-0,8764	46 %
ED-19	0,0063	1,6257	0,7139	53 %	0,0016	0,3050	-1,4543	42 %
ED-18	0,0016	0,4099	-0,1270	47 %	-0,0070	-1,3331	1,4351 *	63 %
ED-17	0,0011	0,2961	0,7139	53 %	-0,0104	-1,9936 **	0,8573	58 %
ED-16	-0,0005	-0,1332	-0,4073	45 %	-0,0163	-3,1251 ***	0,8573	58 %
ED-15	-0,0046	-1,1775	-1,5284	37 %	-0,0070	-1,3484	0,8573	58 %
ED-14	-0,0021	-0,5338	-0,9679	41 %	-0,0001	-0,0207	-0,2985	50 %
ED-13	0,0018	0,4637	0,1533	49 %	0,0049	0,9305	-0,0096	52 %
ED-12	0,0063	1,6328	1,2745	57 %	-0,0030	-0,5827	-0,2985	50 %
ED-11	0,0027	0,6914	0,9942	55 %	-0,0109	-2,0835 **	1,7241 **	65 %
ED-10	0,0044	1,1416	2,1154 **	63 %	0,0035	0,6786	-1,1654	44 %
ED-9	0,0037	0,9644	0,4336	51 %	-0,0051	-0,9839	0,5683	56 %
ED-8	0,0016	0,4046	-0,1270	47 %	-0,0057	-1,0898	1,7241 **	65 %
ED-7	-0,0023	-0,6035	-0,1270	47 %	0,0024	0,4569	0,5683	56 %
ED-6	-0,0011	-0,2829	-0,4073	45 %	-0,0094	-1,7914 *	1,7241 **	65 %
ED-5	0,0014	0,3634	0,1533	49 %	-0,0045	-0,8591	1,4351 *	63 %
ED-4	0,0096	2,4804 **	0,9942	55 %	0,0042	0,8034	-0,5875	48 %
ED-3	0,0067	1,7331 *	2,9562 ***	69 %	-0,0010	-0,2004	1,1462	60 %
ED-2	0,0050	1,2913	1,2745	57 %	-0,0076	-1,4520	2,0130 **	67 %
ED-1	0,0213	5,4855 ***	3,5168 ***	73 %	-0,0272	-5,2030 ***	3,4577 ***	77 %
ED	-0,0073	-1,8804 *	-1,5284	37 %	0,0276	5,2830 ***	-4,0548	23 %
ED+1	-0,0093	-2,3962 **	-2,0890	33 %	-0,0009	-0,1677	1,1462	60 %
ED+2	0,0016	0,4008	0,4336	51 %	0,0090	1,7226 *	-2,6101	33 %
ED+3	-0,0034	-0,8806	-0,1270	47 %	-0,0018	-0,3466	0,2794	54 %
ED+4	0,0028	0,7217	-1,2482	39 %	0,0063	1,2150	-0,5875	48 %
ED+5	-0,0027	-0,6988	-1,5284	37 %	0,0060	1,1560	-1,1654	44 %
ED+6	-0,0010	-0,2680	-0,6876	43 %	-0,0027	-0,5215	0,2794	54 %
ED+7	-0,0007	-0,1764	0,7139	53 %	-0,0092	-1,7579 *	1,4351 *	63 %
ED+8	-0,0009	-0,2283	-0,1270	47 %	0,0002	0,0320	0,8573	58 %
ED+9	0,0029	0,7599	0,7139	53 %	-0,0044	-0,8457	1,1462	60 %
ED+10	0,0076	1,9561 *	1,2745	57 %	0,0078	1,4983	-0,8764	46 %
ED+11	-0,0010	-0,2587	-1,5284	37 %	-0,0015	-0,2784	1,4351 *	63 %
ED+12	-0,0037	-0,9561	-0,6876	43 %	-0,0063	-1,2101	0,2794	54 %
ED+13	0,0013	0,3243	0,4336	51 %	0,0076	1,4491	-0,5875	48 %
ED+14	-0,0078	-2,0222 **	-2,3693	31 %	-0,0016	-0,3053	1,1462	60 %
ED+15	0,0002	0,0446	-0,4073	45 %	0,0002	0,0292	-0,5875	48 %

ED+16	0,0037	0,9640	-0,1270	47 %	-0,0101	-1,9433 *	2,3020 **	69 %
ED+17	0,0014	0,3514	0,1533	49 %	0,0080	1,5373	-0,2985	50 %
ED+18	-0,0064	-1,6590 *	-1,5284	37 %	-0,0041	-0,7892	0,2794	54 %
ED+19	0,0002	0,0573	-1,5284	37 %	0,0037	0,7106	-1,7432	40 %
ED+20	-0,0042	-1,0958	0,7139	53 %	-0,0057	-1,0859	1,7241 **	65 %
ED+21	0,0088	2,2738 **	1,2745	57 %	0,0070	1,3400	-1,1654	44 %
ED+22	-0,0037	-0,9434	-0,9679	41 %	-0,0042	-0,8002	1,7241 **	65 %
ED+23	0,0030	0,7684	0,4336	51 %	0,0106	2,0384 **	-1,1654	44 %
ED+24	0,0015	0,3801	1,2745	57 %	-0,0031	-0,5908	0,2794	54 %
ED+25	0,0042	1,0880	0,9942	55 %	0,0006	0,1086	-1,1654	44 %
ED+26	0,0026	0,6683	0,4336	51 %	0,0024	0,4637	-0,5875	48 %
ED+27	0,0011	0,2824	0,1533	49 %	0,0064	1,2236	-0,8764	46 %
ED+28	0,0071	1,8250 *	0,1533	49 %	0,0193	3,7033 ***	-0,0096	52 %
ED+29	0,0002	0,0479	0,1533	49 %	-0,0138	-2,6361 ***	0,2794	54 %
ED+30	0,0030	0,7835	0,4336	51 %	0,0053	1,0220	-0,2985	50 %
ED+31	0,0027	0,7058	2,3956 ***	65 %	0,0007	0,1247	0,2794	54 %
ED+32	-0,0089	-2,3056 **	-2,9299	27 %	0,0011	0,2164	-0,0096	52 %
ED+33	0,0029	0,7594	0,1533	49 %	-0,0016	-0,3152	1,1462	60 %
ED+34	-0,0015	-0,3888	-0,9679	41 %	0,0078	1,4998	-0,0096	52 %
ED+35	-0,0022	-0,5550	-1,2482	39 %	0,0042	0,8005	-1,7432	40 %
ED+36	0,0001	0,0154	-0,9679	41 %	0,0009	0,1815	0,2794	54 %
ED+37	-0,0033	-0,8468	-2,0890	33 %	-0,0037	-0,7089	1,7241 **	65 %
ED+38	0,0068	1,7590 *	2,1154 **	63 %	-0,0081	-1,5456	2,0130 **	67 %
ED+39	-0,0024	-0,6096	0,4336	51 %	0,0106	2,0284 **	-2,6101	33 %
ED+40	0,0060	1,5614	1,8351 **	61 %	-0,0029	-0,5605	0,8573	58 %
ED+41	0,0054	1,3830	0,9942	55 %	-0,0030	-0,5765	1,7241 **	65 %
ED+42	-0,0013	-0,3292	0,4336	51 %	-0,0097	-1,8635 *	-0,0096	52 %
ED+43	-0,0024	-0,6194	-0,6876	43 %	0,0022	0,4303	0,2794	54 %
ED+44	0,0038	0,9751	-0,1270	47 %	0,0042	0,8099	-0,8764	46 %
ED+45	-0,0012	-0,3150	-1,2482	39 %	0,0011	0,2131	0,8573	58 %
ED+46	0,0098	2,5360 **	0,1533	49 %	-0,0001	-0,0230	-0,5875	48 %
ED+47	-0,0002	-0,0508	0,1533	49 %	0,0008	0,1448	-0,8764	46 %
ED+48	0,0035	0,9054	0,7139	53 %	-0,0050	-0,9662	1,4351 *	63 %
ED+49	0,0043	1,1010	0,7139	53 %	0,0024	0,4533	-1,4543	42 %
ED+50	-0,0034	-0,8773	-0,4073	45 %	0,0012	0,2371	-0,0096	52 %

Appendix H

This appendix contains the MVRs of non-first inclusions and deletions.

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	51	No. of events:	48
Time *t*	*MVR*	T-value	*MVR*	T-value
ED-40	6,1950	1,1400	0,7958	-1,5363
ED-39	1,4962	1,7524 *	1,4418	1,4340
ED-38	1,4913	2,0188 **	0,9136	-0,4762
ED-37	1,5793	1,8169 *	0,7662	-1,3782
ED-36	1,6516	2,7267 ***	1,1467	0,4939
ED-35	1,3683	1,9214 *	1,8715	1,4240
ED-34	2,6773	1,7098 *	0,9824	-0,1209
ED-33	1,2812	1,2015	0,8519	-1,0509
ED-32	1,1052	0,7554	0,6800	-2,9838 ***
ED-31	1,2987	1,3571	0,6625	-3,3328 ***
ED-30	1,2318	1,2777	0,8439	-0,8537
ED-29	1,8479	1,0875	0,6721	-3,0753 ***
ED-28	1,2135	1,0161	0,7339	-2,5985 **
ED-27	1,7554	2,2139 **	0,8995	-0,6527
ED-26	1,3304	1,4463	0,7681	-1,4784
ED-25	1,9219	1,9829 **	1,4013	0,7411
ED-24	1,5704	1,1906	0,8396	-0,9072
ED-23	1,6313	1,5421	0,9647	-0,1726
ED-22	1,1142	0,7544	0,8456	-1,2600
ED-21	1,3033	1,1300	0,7536	-2,2154 **
ED-20	1,3270	0,9467	0,9629	-0,1853
ED-19	1,8089	1,9753 **	0,7282	-1,5292
ED-18	1,3924	1,4575	1,3587	0,9123
ED-17	1,6332	2,0736 **	1,1030	0,5471
ED-16	1,3287	1,4717	1,2525	1,0388
ED-15	1,5075	1,8470 *	1,3801	1,4317

ED-14	1,6824	1,9531 *	1,0369	0,2183
ED-13	1,5141	1,9457 *	1,0247	0,0727
ED-12	1,3281	1,6337	1,4152	0,5669
ED-11	1,2001	1,2245	1,2790	0,7015
ED-10	1,2691	1,3976	1,0579	0,3328
ED-9	1,2086	1,1749	1,0502	0,1412
ED-8	2,0019	1,5934	0,9894	-0,0410
ED-7	1,5223	1,5600	0,8565	-1,0759
ED-6	1,0496	0,3470	1,6212	1,3647
ED-5	2,0355	1,7266 *	1,2870	1,3200
ED-4	1,5555	2,0546 **	1,0757	0,4645
ED-3	1,8561	2,9033 ***	1,3913	1,7963 *
ED-2	1,7473	2,8534 ***	1,3064	1,9550 *
ED-1	5,3943	3,9626 ***	4,1656	4,3111 ***
ED	1,4827	3,2704 ***	1,5945	1,8745 *
ED+1	1,4160	1,4839	0,9156	-0,5311
ED+2	1,3639	1,6984 *	1,1767	0,8000
ED+3	1,0458	0,2514	0,9243	-0,6120
ED+4	0,9239	-0,7760	0,9166	-0,6731
ED+5	0,7758	-1,8489 *	0,9993	-0,0038
ED+6	1,5243	0,9639	0,8722	-0,9832
ED+7	0,8234	-1,9721 *	1,1171	0,7624
ED+8	0,9329	-0,4642	1,4466	1,2254
ED+9	1,1005	0,5982	0,9417	-0,2775
ED+10	1,3950	1,4551	1,1663	0,9979
ED+11	1,1575	1,0997	0,9407	-0,4008
ED+12	1,0136	0,1137	1,1621	0,7014
ED+13	1,6963	2,0034 **	1,0528	0,2862
ED+14	1,0080	0,0567	1,4060	0,6250
ED+15	1,2869	1,2721	0,8732	-0,7487
ED+16	1,8813	1,8422 *	1,0425	0,1747
ED+17	1,2957	1,4513	1,5655	1,5751
ED+18	1,5301	2,2487 **	1,1226	0,5525
ED+19	1,0646	0,4657	1,1097	0,4986
ED+20	1,4506	1,3395	1,0868	0,4540
ED+21	1,0097	0,0752	0,7084	-2,9104 ***
ED+22	1,1828	1,0490	0,9313	-0,4354
ED+23	0,9787	-0,1366	1,5491	0,9963
ED+24	1,0662	0,2752	0,8617	-0,8652
ED+25	1,3020	1,3898	0,8064	-1,3168
ED+26	0,8575	-1,5360	0,9677	-0,1289
ED+27	1,0793	0,4017	0,9088	-0,3087
ED+28	0,8963	-0,8675	1,1353	0,3008
ED+29	0,9227	-0,6478	1,0001	0,0004
ED+30	1,0002	0,0010	1,3313	0,8469
ED+31	0,9924	-0,0507	1,0562	0,1759
ED+32	0,6621	-4,3331 ***	3,2937	1,1969
ED+33	0,7817	-1,7029 *	1,3209	0,5973
ED+34	0,6585	-4,1863 ***	1,4389	0,8175
ED+35	0,8741	-0,6589	1,3774	0,7941
ED+36	0,7552	-2,2142 **	1,1830	0,9890
ED+37	1,6742	1,1039	0,8418	-0,9682
ED+38	0,7317	-2,4898 **	0,9385	-0,3842
ED+39	0,8020	-2,5486 **	0,9568	-0,2190
ED+40	0,6927	-3,8530 ***	0,6624	-4,2559 ***
ED+41	0,6817	-4,4745 ***	1,8433	0,7942
ED+42	1,4503	0,5283	1,2486	0,9038
ED+43	1,1103	0,2594	0,8130	-1,4266
ED+44	0,8871	-0,8916	2,1674	0,9264
ED+45	0,9590	-0,3313	1,2394	0,4024
ED+46	1,6357	0,8050	0,7627	-1,7702 *
ED+47	1,7168	0,8896	0,8667	-0,7048
ED+48	0,7857	-2,1742 **	1,0728	0,2356
ED+49	1,1085	0,6333	0,7871	-0,7705
ED+50	1,0216	0,1309	0,9520	-0,2260

Appendix I

This appendix contains the AARs and the test values for all inclusions and deletions.

AVERAGE ABNORMAL RETURN (AAR)								
	Additions				Deletions			
	No. of events:	135			No. of events:	108		
Time *t*	*AAR*	T-value	Z-value	% positve AR	*AAR*	T-value	Z-value	% negative AR
ED-40	0,0058	2,3931 **	0,9978	52 %	-0,0158	-4,4465 ***	4,0144 ***	72 %
ED-39	0,0055	2,2701 **	2,8936 ***	60 %	0,0014	0,3978	-1,5764	45 %
ED-38	-0,0005	-0,2107	0,4808	50 %	0,0011	0,3084	2,2793 **	64 %
ED-37	-0,0063	-2,5756 **	0,3085	49 %	-0,0030	-0,8367	1,7010 **	61 %
ED-36	0,0040	1,6517	0,6532	50 %	-0,0017	-0,4861	1,5082 *	60 %
ED-35	0,0000	-0,0040	-0,2085	47 %	0,0022	0,6099	0,5443	56 %
ED-34	-0,0005	-0,2223	0,3085	49 %	0,0034	0,9458	0,3515	55 %
ED-33	-0,0031	-1,2890	-1,7596	40 %	-0,0017	-0,4741	-0,6124	50 %
ED-32	0,0005	0,2068	0,4808	50 %	0,0029	0,8026	-1,1908	47 %
ED-31	0,0003	0,1038	-0,0362	47 %	-0,0054	-1,5235	1,1226	58 %
ED-30	0,0004	0,1768	-1,4149	41 %	-0,0058	-1,6151	2,0865 **	63 %
ED-29	0,0070	2,8583 ***	1,8595 **	56 %	-0,0018	-0,4918	-0,4197	51 %
ED-28	0,0000	0,0183	1,1702	53 %	-0,0065	-1,8181 *	1,1226	58 %
ED-27	0,0008	0,3090	-0,8979	44 %	-0,0058	-1,6323	-0,2269	52 %
ED-26	-0,0003	-0,1330	-1,2425	42 %	-0,0001	-0,0381	-0,4197	51 %
ED-25	0,0053	2,1728 **	0,9978	52 %	-0,0043	-1,2061	1,3154 *	59 %
ED-24	-0,0024	-1,0019	-1,5872	41 %	0,0003	0,0738	0,9298	57 %
ED-23	0,0023	0,9283	-0,0362	47 %	-0,0029	-0,8271	1,5082 *	60 %
ED-22	0,0004	0,1686	-0,2085	47 %	-0,0075	-2,0977 **	1,1226	58 %
ED-21	-0,0044	-1,8054 *	-1,2425	42 %	-0,0001	-0,0153	-0,2269	52 %
ED-20	0,0008	0,3350	0,9978	52 %	0,0041	1,1410	-1,3836	46 %
ED-19	0,0057	2,3231 **	0,9978	52 %	0,0024	0,6779	-0,9980	48 %
ED-18	0,0005	0,1977	-0,5532	45 %	-0,0052	-1,4470	1,1226	58 %
ED-17	-0,0005	-0,1877	0,1362	48 %	-0,0030	-0,8406	0,7371	56 %
ED-16	-0,0008	-0,3310	-0,5532	45 %	-0,0122	-3,4283 ***	0,3515	55 %
ED-15	-0,0023	-0,9331	-0,5532	45 %	-0,0021	-0,5785	0,3515	55 %
ED-14	-0,0044	-1,8238 *	-1,7596	40 %	-0,0056	-1,5664	0,1587	54 %
ED-13	0,0020	0,8212	-0,2085	47 %	0,0015	0,4256	-0,0341	53 %
ED-12	0,0028	1,1433	2,0319 **	56 %	-0,0025	-0,7042	0,5443	56 %
ED-11	0,0038	1,5483	1,6872 **	55 %	-0,0082	-2,3028 **	1,8938 **	62 %
ED-10	0,0026	1,0754	2,2042 **	57 %	0,0000	0,0111	-1,1908	47 %
ED-9	0,0029	1,1868	0,8255	51 %	-0,0061	-1,7114 *	1,1226	58 %
ED-8	0,0030	1,2249	0,8255	51 %	-0,0028	-0,7845	0,9298	57 %
ED-7	-0,0019	-0,7653	0,9978	52 %	-0,0026	-0,7187	1,5082 *	60 %
ED-6	0,0006	0,2405	0,1362	48 %	-0,0045	-1,2725	-0,4197	51 %
ED-5	0,0008	0,3160	0,8255	51 %	-0,0002	-0,0506	-0,0341	53 %
ED-4	0,0059	2,4236 **	0,6532	50 %	-0,0017	-0,4667	-0,4197	51 %
ED-3	0,0059	2,4051 **	1,5149 *	54 %	-0,0028	-0,7878	1,8938 **	62 %
ED-2	0,0005	0,1876	1,5149 *	54 %	-0,0045	-1,2599	1,3154 *	59 %
ED-1	0,0211	8,6482 ***	7,3743 ***	79 %	-0,0320	-8,9923 ***	5,1711 ***	78 %
ED	-0,0047	-1,9310 *	-1,2425	42 %	0,0259	7,2760 ***	-5,8176	25 %
ED+1	-0,0016	-0,6737	-0,8979	44 %	0,0034	0,9510	0,5443	56 %
ED+2	-0,0026	-1,0718	-0,5532	45 %	0,0040	1,1174	-1,9619	44 %
ED+3	0,0005	0,1876	0,6532	50 %	-0,0012	-0,3459	0,1587	54 %
ED+4	-0,0005	-0,2151	-2,2766	38 %	0,0051	1,4352	-1,7691	44 %
ED+5	-0,0038	-1,5656	-2,6212	36 %	0,0040	1,1244	-1,7691	44 %
ED+6	-0,0003	-0,1246	0,6532	50 %	-0,0008	-0,2297	0,1587	54 %
ED+7	0,0010	0,4241	1,3425 *	53 %	0,0038	1,0540	0,3515	55 %
ED+8	-0,0044	-1,8061 *	-1,9319	39 %	0,0016	0,4361	-0,4197	51 %
ED+9	0,0011	0,4436	0,8255	51 %	0,0011	0,3192	-0,2269	52 %
ED+10	0,0004	0,1707	0,8255	51 %	-0,0014	-0,4002	0,1587	54 %

ED+11	0,0000	0,0040	-0,8979	44 %	-0,0038	-1,0532	0,5443	56 %
ED+12	-0,0018	-0,7189	-0,7255	44 %	-0,0030	-0,8406	-0,4197	51 %
ED+13	-0,0052	-2,1471 **	-0,5532	45 %	0,0006	0,1676	0,5443	56 %
ED+14	-0,0049	-2,0324 **	-0,8979	44 %	-0,0018	-0,4973	0,3515	55 %
ED+15	0,0000	0,0184	0,1362	48 %	-0,0003	-0,0933	-0,0341	53 %
ED+16	0,0010	0,3935	-0,3809	46 %	-0,0029	-0,8241	1,1226	58 %
ED+17	0,0026	1,0586	2,0319 **	56 %	0,0111	3,1209 ***	-0,4197	51 %
ED+18	0,0038	1,5758	1,3425 *	53 %	-0,0048	-1,3609	-0,4197	51 %
ED+19	0,0032	1,3044	-0,3809	46 %	-0,0015	-0,4081	-0,8052	49 %
ED+20	-0,0005	-0,2093	0,3085	49 %	0,0024	0,6859	0,7371	56 %
ED+21	0,0029	1,1909	0,3085	49 %	0,0044	1,2339	-2,1547	43 %
ED+22	-0,0015	-0,6112	-0,7255	44 %	-0,0048	-1,3565	1,5082 *	60 %
ED+23	-0,0018	-0,7242	-0,8979	44 %	0,0048	1,3522	-0,6124	50 %
ED+24	0,0029	1,2046	1,5149 *	54 %	0,0017	0,4810	-0,8052	49 %
ED+25	0,0030	1,2428	0,6532	50 %	-0,0011	-0,3159	-0,6124	50 %
ED+26	0,0003	0,1168	-0,7255	44 %	0,0015	0,4178	-0,6124	50 %
ED+27	0,0006	0,2510	0,1362	48 %	0,0014	0,3934	-1,3836	46 %
ED+28	0,0040	1,6611 *	0,1362	48 %	0,0057	1,6050	-0,6124	50 %
ED+29	0,0011	0,4722	-0,5532	45 %	-0,0071	-2,0011 **	-0,0341	53 %
ED+30	0,0001	0,0294	0,1362	48 %	0,0080	2,2340 **	0,5443	56 %
ED+31	0,0015	0,6199	1,1702	53 %	0,0031	0,8712	-0,4197	51 %
ED+32	-0,0023	-0,9523	-1,7596	40 %	-0,0004	-0,1032	0,9298	57 %
ED+33	-0,0004	-0,1629	-0,3809	46 %	0,0015	0,4181	-0,2269	52 %
ED+34	0,0006	0,2507	-0,5532	45 %	0,0036	1,0187	0,5443	56 %
ED+35	-0,0014	-0,5852	-0,5532	45 %	0,0032	0,8918	-1,9619	44 %
ED+36	0,0012	0,5093	-0,3809	46 %	-0,0027	-0,7497	0,1587	54 %
ED+37	0,0005	0,2125	-1,7596	40 %	-0,0022	-0,6315	2,4721 ***	65 %
ED+38	0,0037	1,5064	1,1702	53 %	-0,0053	-1,4946	1,7010 **	61 %
ED+39	-0,0010	-0,4277	0,1362	48 %	0,0067	1,8918 *	-1,3836	46 %
ED+40	0,0036	1,4807	1,6872 **	55 %	0,0026	0,7249	-0,2269	52 %
ED+41	0,0012	0,4817	0,8255	51 %	0,0038	1,0666	-0,0341	53 %
ED+42	0,0044	1,8239 *	1,5149 *	54 %	-0,0070	-1,9689 *	-0,8052	49 %
ED+43	0,0016	0,6476	0,6532	50 %	-0,0001	-0,0209	0,3515	55 %
ED+44	0,0008	0,3225	-0,5532	45 %	0,0011	0,3124	0,1587	54 %
ED+45	-0,0030	-1,2334	-2,2766	38 %	-0,0005	-0,1444	0,1587	54 %
ED+46	0,0044	1,8175 *	-0,5532	45 %	0,0028	0,7734	-1,3836	46 %
ED+47	0,0005	0,2192	0,3085	49 %	-0,0042	-1,1862	-0,4197	51 %
ED+48	0,0016	0,6772	0,8255	51 %	-0,0014	-0,3978	0,5443	56 %
ED+49	0,0006	0,2608	0,4808	50 %	0,0034	0,9515	-0,8052	49 %
ED+50	-0,0004	-0,1521	0,1362	48 %	0,0001	0,0268	-0,0341	53 %

Appendix J

This appendix contains the CAARs of all inclusions and deletions.

CUMULATIVE AVERAGE ABNORMAL RETURN (CAAR)				
	Additions		Deletions	
	No. of events:	135	No. of events:	108
Time *t*	*CAAR*	T-value	*CAAR*	T-value
ED-40	0,0058	2,3931 **	-0,0158	-4,4465 ***
ED-39	0,0114	3,2974	-0,0144	-2,8629
ED-38	0,0108	2,5706	-0,0133	-2,1595
ED-37	0,0046	0,9384	-0,0163	-2,2885
ED-36	0,0086	1,5780	-0,0180	-2,2643 *
ED-35	0,0086	1,4389	-0,0159	-1,8180
ED-34	0,0080	1,2481	-0,0125	-1,3257
ED-33	0,0049	0,7118	-0,0142	-1,4077
ED-32	0,0054	0,7400	-0,0113	-1,0596
ED-31	0,0057	0,7349	-0,0167	-1,4870
ED-30	0,0061	0,7540	-0,0225	-1,9048 *
ED-29	0,0131	1,5470	-0,0243	-1,9657 *
ED-28	0,0131	1,4914	-0,0307	-2,3928 **
ED-27	0,0138	1,5198	-0,0365	-2,7420 **
ED-26	0,0135	1,4339	-0,0367	-2,6589 **
ED-25	0,0188	1,9315 *	-0,0410	-2,8760 **
ED-24	0,0164	1,6309	-0,0407	-2,7722 **
ED-23	0,0186	1,8037 *	-0,0437	-2,8890 **
ED-22	0,0190	1,7943 *	-0,0511	-3,2932 ***
ED-21	0,0147	1,3452	-0,0512	-3,2133 ***
ED-20	0,0155	1,3859	-0,0471	-2,8868 ***

ED-19	0,0211	1,8493 *	-0,0447	-2,6759 **
ED-18	0,0216	1,8498 *	-0,0499	-2,9188 ***
ED-17	0,0211	1,7726 *	-0,0528	-3,0290 ***
ED-16	0,0203	1,6706	-0,0651	-3,6534 ***
ED-15	0,0181	1,4551	-0,0671	-3,6959 ***
ED-14	0,0136	1,0769	-0,0727	-3,9283 ***
ED-13	0,0156	1,2127	-0,0712	-3,7771 ***
ED-12	0,0184	1,4039	-0,0737	-3,8421 ***
ED-11	0,0222	1,6630	-0,0819	-4,1980 ***
ED-10	0,0248	1,8291 *	-0,0818	-4,1277 ***
ED-9	0,0277	2,0101 *	-0,0879	-4,3653 ***
ED-8	0,0307	2,1926 **	-0,0907	-4,4352 ***
ED-7	0,0288	2,0289 *	-0,0933	-4,4927 ***
ED-6	0,0294	2,0403 **	-0,0978	-4,6432 ***
ED-5	0,0302	2,0645 **	-0,0980	-4,5867 ***
ED-4	0,0361	2,4348 **	-0,0997	-4,6010 ***
ED-3	0,0419	2,7927 ***	-0,1025	-4,6678 ***
ED-2	0,0424	2,7867 ***	-0,1070	-4,8093 ***
ED-1	0,0634	4,1191 ***	-0,1390	-6,1707 ***
ED	0,0587	3,7670 ***	-0,1131	-4,9586 ***
ED+1	0,0571	3,6179 ***	-0,1097	-4,7525 ***
ED+2	0,0545	3,4121 ***	-0,1057	-4,5265 ***
ED+3	0,0549	3,4014 ***	-0,1069	-4,5269 ***
ED+4	0,0544	3,3313 ***	-0,1018	-4,2624 ***
ED+5	0,0506	3,0641 ***	-0,0978	-4,0500 ***
ED+6	0,0503	3,0132 ***	-0,0986	-4,0402 ***
ED+7	0,0513	3,0428 ***	-0,0949	-3,8458 ***
ED+8	0,0469	2,7536 ***	-0,0933	-3,7440 ***
ED+9	0,0480	2,7887 ***	-0,0922	-3,6613 ***
ED+10	0,0484	2,7851 ***	-0,0936	-3,6812 ***
ED+11	0,0484	2,7587 ***	-0,0974	-3,7917 ***
ED+12	0,0467	2,6338 **	-0,1004	-3,8712 ***
ED+13	0,0415	2,3171 **	-0,0998	-3,8124 ***
ED+14	0,0365	2,0219 **	-0,1015	-3,8446 ***
ED+15	0,0366	2,0063 **	-0,1019	-3,8226 ***
ED+16	0,0375	2,0407 **	-0,1048	-3,8981 ***
ED+17	0,0401	2,1620 **	-0,0937	-3,4546 ***
ED+18	0,0439	2,3488 **	-0,0985	-3,6023 ***
ED+19	0,0471	2,4975 **	-0,1000	-3,6249 ***
ED+20	0,0466	2,4502 **	-0,0976	-3,5072 ***
ED+21	0,0495	2,5816 **	-0,0932	-3,3221 ***
ED+22	0,0480	2,4840 **	-0,0980	-3,4665 ***
ED+23	0,0463	2,3740 **	-0,0932	-3,2703 ***
ED+24	0,0492	2,5051 **	-0,0915	-3,1854 ***
ED+25	0,0522	2,6390 **	-0,0926	-3,2001 ***
ED+26	0,0525	2,6335 **	-0,0911	-3,1251 ***
ED+27	0,0531	2,6445 **	-0,0897	-3,0543 ***
ED+28	0,0572	2,8252 ***	-0,0840	-2,8389 ***
ED+29	0,0583	2,8614 ***	-0,0911	-3,0577 ***
ED+30	0,0584	2,8447 ***	-0,0832	-2,7710 ***
ED+31	0,0599	2,8979 ***	-0,0801	-2,6490 ***
ED+32	0,0576	2,7666 ***	-0,0804	-2,6428 **
ED+33	0,0572	2,7289 ***	-0,0789	-2,5763 **
ED+34	0,0578	2,7396 ***	-0,0753	-2,4415 **
ED+35	0,0564	2,6543 ***	-0,0721	-2,3230 **
ED+36	0,0576	2,6951 ***	-0,0748	-2,3933 **
ED+37	0,0581	2,7018 ***	-0,0770	-2,4495 **
ED+38	0,0618	2,8542 ***	-0,0824	-2,6021 **
ED+39	0,0607	2,7884 ***	-0,0756	-2,3742 **
ED+40	0,0643	2,9357 ***	-0,0730	-2,2790 **
ED+41	0,0655	2,9709 ***	-0,0692	-2,1473 **
ED+42	0,0700	3,1532 ***	-0,0763	-2,3504 **
ED+43	0,0715	3,2050 ***	-0,0763	-2,3387 **
ED+44	0,0723	3,2211 ***	-0,0752	-2,2910 **
ED+45	0,0693	3,0693 ***	-0,0757	-2,2932 **
ED+46	0,0737	3,2465 ***	-0,0730	-2,1971 **
ED+47	0,0743	3,2513 ***	-0,0772	-2,3110 **
ED+48	0,0759	3,3048 ***	-0,0786	-2,3401 **
ED+49	0,0766	3,3139 ***	-0,0752	-2,2268 **
ED+50	0,0762	3,2797 ***	-0,0751	-2,2117 **

Appendix K

This appendix contains the MVRs of all inclusions and deletions.

MEAN VOLUME RATIO (MVR)				
	Additions		Deletions	
	No. of events:	135	No. of events:	108
Time *t*	*MVR*	T-value	*MVR*	T-value
ED-40	3,6981	1,5491	1,3080	0,8311
ED-39	2,5661	3,2830 ***	1,4465	2,2722 **
ED-38	1,5980	3,0973 ***	1,2644	0,9227
ED-37	1,7171	2,3278 **	1,3804	0,8863
ED-36	2,0355	2,9472 ***	1,2522	1,1041
ED-35	1,9297	2,9472 ***	1,5304	1,8012 *
ED-34	2,2580	2,8763 ***	1,1821	0,9746
ED-33	1,4575	2,6277 ***	1,0944	0,5418
ED-32	2,0649	2,4046 **	1,3191	1,3930
ED-31	1,5586	2,4152 **	0,9243	-0,6055
ED-30	1,4359	2,2054 **	0,9453	-0,4672
ED-29	1,8225	2,2082 **	0,7732	-2,6985 ***
ED-28	1,4335	2,6980 ***	0,8942	-0,7778
ED-27	2,0561	2,7987 ***	1,1665	0,9033
ED-26	1,3319	2,3428 **	0,9969	-0,0205
ED-25	1,5884	2,2802 **	1,3305	1,2206
ED-24	1,6086	1,7699 *	1,0537	0,2179
ED-23	1,4362	1,9887 **	1,0352	0,1684
ED-22	1,1275	1,3128	0,9916	-0,0486
ED-21	1,3071	2,0351 **	0,8875	-1,1107
ED-20	1,4452	1,6053	0,9520	-0,3482
ED-19	1,8832	3,4634 ***	1,3588	1,3536
ED-18	1,2741	1,7247 *	1,1963	0,9506
ED-17	1,4780	3,0240 ***	1,0250	0,2121
ED-16	1,2024	1,7230 *	1,1242	0,8293
ED-15	1,4866	3,0628 ***	1,2604	1,4641
ED-14	1,4468	2,8119 ***	1,0282	0,2281
ED-13	1,5438	3,0082 ***	1,0335	0,1823
ED-12	1,3688	2,8598 ***	1,4177	1,1205
ED-11	1,7419	3,2161 ***	1,1889	0,9523
ED-10	1,5106	2,7420 ***	2,2758	1,1698
ED-9	1,5381	2,5112 **	0,9187	-0,4590
ED-8	1,9374	2,6084 ***	0,9528	-0,3315
ED-7	1,4859	2,2929 **	1,1947	0,9969
ED-6	1,5091	2,2563 **	1,5644	1,8529 *
ED-5	2,0163	2,7038 ***	1,3738	1,7310 *
ED-4	1,5511	2,2190 **	1,1334	1,1203
ED-3	1,9358	3,4470 ***	1,6092	2,7981 ***
ED-2	2,0465	2,5878 **	1,3945	2,9762 ***
ED-1	4,5249	6,2900 ***	4,1116	6,9129 ***
ED	1,4060	3,6277 ***	2,0276	3,0321 ***
ED+1	1,2593	1,7717 *	1,4297	1,4720
ED+2	1,2486	1,9867 **	1,3524	2,0369 **
ED+3	1,0111	0,1109	2,0092	1,7676 *
ED+4	0,7978	-3,1785 ***	1,0798	0,4277
ED+5	0,9261	-0,8063	0,9321	-0,6753
ED+6	1,1898	0,8523	1,2726	1,2115
ED+7	0,9938	-0,0585	1,2755	1,4086
ED+8	1,1082	0,8907	1,4107	1,7267 *
ED+9	1,1378	0,6816	1,0306	0,1946
ED+10	1,3632	1,5055	1,2058	1,5930

ED+11	1,2374	1,7108 *	1,0011	0,0109
ED+12	0,9979	-0,0220	1,2452	1,1099
ED+13	1,2559	1,6358	1,0572	0,5036
ED+14	1,1645	1,3611	1,5308	1,2392
ED+15	1,2457	1,3911	1,6903	1,1928
ED+16	1,4694	2,1765 **	1,2721	1,1769
ED+17	1,1493	1,4290	1,3657	1,8844 *
ED+18	1,3943	2,8025 ***	1,0416	0,3215
ED+19	1,2338	1,6608 *	0,9506	-0,4145
ED+20	1,3373	1,6673 *	1,0991	0,8451
ED+21	1,2515	2,0032 **	0,9223	-0,7522
ED+22	1,1483	1,3618	1,0303	0,1634
ED+23	1,0395	0,3674	1,1118	0,4473
ED+24	1,1173	0,8652	0,9224	-0,6554
ED+25	1,0930	0,8942	0,7776	-2,4637 **
ED+26	1,0522	0,5781	1,9108	1,0304
ED+27	1,3290	1,8417 *	0,9665	-0,1633
ED+28	0,9758	-0,2170	1,2040	0,7451
ED+29	1,0047	0,0441	0,9350	-0,4368
ED+30	0,9373	-0,6288	1,8479	1,1471
ED+31	1,0915	0,9126	0,9405	-0,3580
ED+32	0,7824	-3,2064 ***	2,0643	1,2307
ED+33	1,4934	0,8866	1,0963	0,3697
ED+34	0,8810	-1,1449	1,2796	1,0692
ED+35	1,0130	0,1033	1,1947	0,8491
ED+36	0,9018	-0,9192	1,6576	1,1243
ED+37	1,4100	1,4419	0,8587	-1,4112
ED+38	1,1764	1,0692	1,3881	0,9886
ED+39	1,0083	0,0906	0,9169	-0,6736
ED+40	0,8532	-2,0168 **	1,2898	1,0407
ED+41	0,9645	-0,3736	1,3888	0,8104
ED+42	1,5380	1,3306	1,1595	0,9223
ED+43	1,0882	0,4616	0,9508	-0,3950
ED+44	1,1398	1,0832	1,4585	0,8122
ED+45	1,0398	0,3789	1,3127	0,8956
ED+46	1,4453	1,3346	1,1085	0,5178
ED+47	1,3282	1,0235	1,1243	0,6418
ED+48	1,0286	0,2363	1,0269	0,1716
ED+49	1,3190	1,6032	1,0047	0,0293
ED+50	1,0603	0,5671	1,0218	0,1662

Appendix L

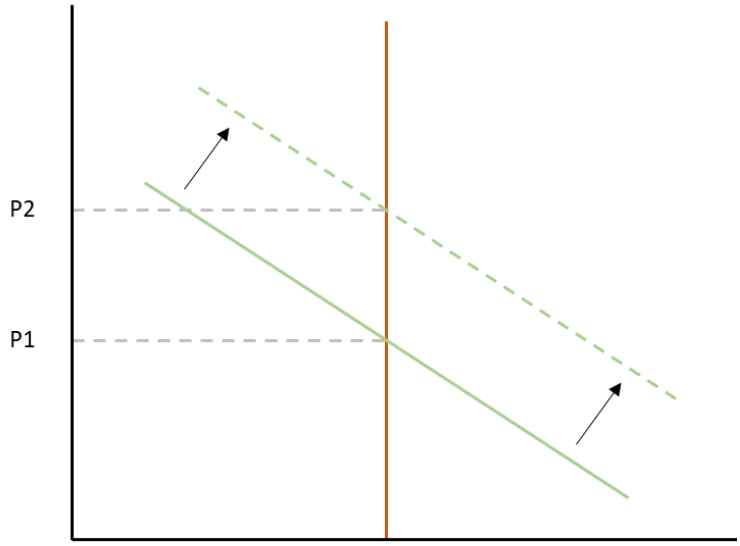
This appendix contains the number of clusters happening at different event dates in the full sample.

Date of additions	No. of additions	Date of deletions	No. of deletions
02.01.2002	3	02.01.2002	4
01.07.2002	2	01.07.2002	2
01.07.2003	3	01.07.2003	3
02.01.2004	4	02.01.2004	1
01.07.2004	9	01.07.2004	2
03.01.2005	3	21.10.2004	1
01.07.2005	8	08.12.2004	1
19.12.2005	1	03.01.2005	3
02.01.2006	7	01.07.2005	2
03.07.2006	9	02.01.2006	3
02.01.2007	7	03.07.2006	7
02.07.2007	8	02.01.2007	1
02.01.2008	8	22.06.2007	1
01.07.2008	2	02.07.2007	5
02.01.2009	1	02.01.2008	3
01.12.2009	3	01.07.2008	3
01.06.2010	7	02.07.2008	1
01.12.2010	4	02.01.2009	14
01.06.2011	1	01.12.2009	4
01.12.2011	3	01.06.2010	6
01.06.2012	2	01.12.2010	3
03.06.2013	3	01.06.2011	4
02.12.2013	1	01.12.2011	6
02.06.2014	3	01.06.2012	3
03.06.2014	1	03.12.2012	2
01.12.2014	3	03.06.2013	3
01.06.2015	7	02.12.2013	3
01.12.2015	2	02.06.2014	3
01.06.2016	3	01.12.2014	3
01.12.2016	6	01.06.2015	1
01.06.2017	4	01.12.2015	2
01.12.2017	7	01.06.2016	1
		01.12.2016	3
		01.06.2017	3

Appendix M

This appendix contains illustrations of shocks in supply and demand considering temporary effects (downward sloping demand curve) and permanent effects (horizontal demand curve).

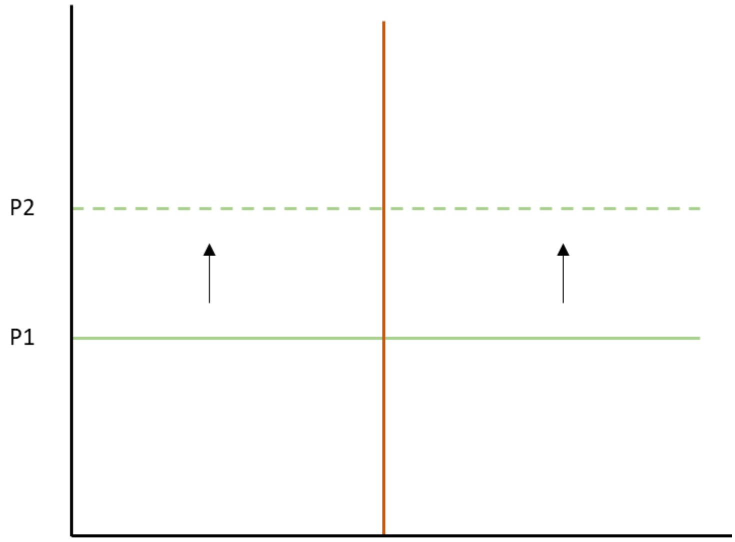
Downward sloping demand curve



The orange line represents the supply curve. The solid green line represents the original demand cuve, while the dashed green line is the demand curve after an outward shift. P1 and P2 represents the old and new price level.

An outward shift in the supply curve would give a lower price.

Horizontal demand curve



The orange line represents the supply curve. The solid green line represents the original demand cuve, while the dashed green line is the demand curve after an outward shift. P1 and P2 represents the old and new price level.

Conversely, a downward shift in demand would lower the price.