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THE INDEX EFFECT – EVIDENCE FROM THE NORDICS

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ABSTRACT OF THE MASTER'S THESIS

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Abstract

The goal of this thesis is to examine if, and to what extent, stock prices and trading volumes are affected by inclusions (exclusions) to (from) the following Nordic indices: OMX Helsinki 25, OMX Stockholm 30, OMX Copenhagen 25, and OMX Copenhagen 20. If observable effects are found, the research aims to examine whether the abnormal price and volume movements are temporary, or if they last over a longer period and whether they are symmetric between inclusions and exclusions. Finally, the thesis will discuss the hypotheses that could explain the findings.

To answer the research questions, relevant empirical evidence and suggested hypotheses are shortly compared and discussed. In addition, quantitative research is conducted using the event study methodology. The final sample of the study consists of 80 index inclusion and exclusion events in the Nordic indices between January 2009 and January 2020. The event study is implemented to determine whether abnormal returns or abnormal trading volumes occur around the events. Finally, conclusions are made.

The results of the thesis suggest that the index effect is evident in the Nordic indices (OMXH25, OMXS30, OMXC25, & OMXC20). However, the effect is rather negligible since no distinct abnormal return patterns are discovered around the index revision events, and only abnormal returns on individual days around the events are measured. In the short-term, temporary price and trading volume occurrences are found, suggesting heavy trading by index funds and investors especially before the changes become effective. Furthermore, the volume effects are found to be somewhat permanent and symmetric between included and excluded stocks indicating improved (impaired) liquidity for stocks that are included (excluded) to (from) the Nordic indices. Moreover, pre-announcement trading volume increase for index additions is observed, which can be explained with anticipatory trading or selection criteria hypothesis. Despite the long-term abnormal trading volume occurrence, no long-term return effects are found. This gives support to the efficient market hypothesis, since stock prices are relatively unaffected by the significantly abnormal trading volumes. The findings of the thesis support the price pressure and liquidity hypotheses. Additionally, the findings do not reject the selection criteria hypothesis, which may explain a part of the results.

While most of the literature on the index effect is conducted on the S&P 500 or other major indices, this thesis provides new insights into the phenomenon by studying the effects in the Nordic indices.

Keywords
Index effect, abnormal returns, abnormal trading volume, Nordic indices

Additional information

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1 INTRODUCTION

Stock market indices are occasionally revised in accordance with the methodology that the index applies. These revisions lead to occasional deletions of one or more participant companies from the index and consequently to inclusions of a new company or companies to the index. Typically, the index methodology that is applied for deciding index changes is based on certain factors that are public information. Therefore, the changes are often considered as events that do not provide any new information to the market participants. The semi-strong form of efficient market hypothesis suggests that stock prices in efficient markets should reflect all publicly available information and adjust immediately to reflect any new information (Fama, 1970). Therefore, stock prices should not be affected by these index composition changes, as stated by the efficient market hypothesis.

Most of the stock market indices are tracked by index funds that are constructed to replicate the performance of a certain market index as closely as possible. When changes are made in the composition of the index, index funds buy (sell) the included (excluded) stocks to track the index precisely, creating high demand (supply) for these stocks. Contradictory with the efficient market hypothesis, researchers have discovered that in addition to this increased demand and supply, a share price movement occurs due to the index inclusions and exclusions. This price movement caused by index composition changes is an anomaly and has been termed the index effect.

Over the past decades, an abundance of research has been conducted on whether index inclusions or exclusions affect stock prices and trading volumes. Earlier studies (see e.g. Chen, Noronha & Singal, 2004; Harris & Gurel, 1986; Kappou, Brooks & Ward, 2010; Lynch & Mendenhall, 1997; Shleifer, 1986) mainly focus on the Standard and Poor's (S&P) 500 index. Most of these studies claim that companies that were included to the S&P 500 index show significant positive share price effect at the time of the inclusion, while those being removed exhibit negative share price movement. However, some of the more recent studies argue that this index effect might have changed or diminished over the years (see e.g. Kappou, 2018; Kim, Li & Perry, 2017;

Ming-Pey & Ahmad, 2019). Therefore, the current situation regarding the index effect and its existence is rather puzzling.

Past studies have suggested different theories and explanations underlying the observed price and trading volume effects. The proposed theories seem to vary, as some of them are demand-based and others information-based. Demand-based theories include downward-sloped demand curve and price pressure hypotheses, whereas information-based theories include awareness, information, liquidity and selection criteria hypotheses. These hypotheses are further reviewed in later sections.

As most of the literature on the index effect is conducted on the S&P 500 or other major indices, this thesis provides new insights into the phenomenon by studying the effects in the Nordic indices, more specifically in the OMX Helsinki 25 (OMXH25), OMX Stockholm 30 (OMXS30), OMX Copenhagen 25 (OMXC25), and OMX Copenhagen 20 (OMXC20)[1] indices. The Nordic indices provide an information free setting to study the index effect. This information free setting results from the selection criteria that are employed in the Nordic indices for index composition changes, as the criteria contains only market capitalization and trading volume. Because the index change decisions are made based on these publicly available criteria, index inclusions and exclusions in the Nordic indices should not provide any new information to the market participants. For many other indices, including the S&P 500 index, the criterion is nonspecific and not explicitly based on public information. From the efficient market hypothesis point of view, it is relevant to assess the existence of the index effect under information free conditions.

The purpose of this thesis is to examine whether the index effect exists in four Nordic indices: OMXH25, OMXS30, OMXC25, and OMXC20. More specifically, stock price and trading volume movements are investigated around announcement date of an index composition changes (the announcement date) and around the date when

[1] OMX Copenhagen 25 replaced OMX Copenhagen 20 on December 18th, 2017 as the leading index for Nasdaq Copenhagen. Therefore, both two Danish indices are under consideration in this thesis. OMX Iceland 10 is not considered in this thesis due to lack of index constitution change events. The Norwegian indices are not considered in this thesis due to minor differences in selection criterion.

composition changes come into effect (the effective date). If there are some observable effects, the research aims to assess whether the abnormal price and volume movements are temporary, or if they last over a longer period. Additionally, the thesis aims to examine whether these movements are symmetric between index inclusions and exclusions. Moreover, the thesis will assess what hypotheses could explain the findings. The research questions are as follows:

1) Is there an index effect on the stocks included or excluded from the OMXH25, OMXS30, OMXC25, and OMXC20 indices?
2) If an index effect is found, are the abnormal price and volume movements temporary or long-standing?
3) Are the effects symmetric between index inclusions and exclusions?
4) What hypotheses could explain the results?

To answer the research questions, quantitative research is conducted using the event study methodology. The event study is commonly applied method to measure the impact of a specific event on the stock price or trading volume of a company. The final sample for the study consists of 80 index inclusion and exclusion events in the Nordic indices between January 2009 and January 2020. The announcement of an index change, and the change becoming effective, are studied separately. The event study is implemented to determine whether abnormal returns or abnormal trading volumes occur around the events. Abnormal return (abnormal volume) is the difference of the actual asset return (volume) and the predicted asset return (volume).

The results of the thesis suggest that the index effect is evident in the Nordic indices (OMXH25, OMXS30, OMXC25, & OMXC20). However, the effect is rather negligible since no distinct abnormal return patterns are discovered around the index revision events and only abnormal returns on individual days around the events are measured. In the short-term, temporary price and trading volume occurrences are found, suggesting heavy trading by index funds and investors especially before the changes come into effect. Furthermore, the volume effects are found to be somewhat permanent and symmetric between included and excluded stocks indicating improved (impaired) liquidity for stocks that are included (excluded) to (from) the Nordic indices. Moreover, pre-announcement trading volume increase for index additions is observed, which can be explained by anticipatory trading or selection criteria hypothesis. Despite the long-term abnormal trading volume occurrence, no long-term return effects are found. This gives support to the efficient market hypothesis, since stock prices are relatively unaffected by the significantly abnormal trading volumes. The findings of the thesis support the price pressure and liquidity hypotheses. Additionally, the findings do not reject the selection criteria hypothesis, which may explain a part of the results.

The rest of the thesis is structured as follows: Chapter two gives a description of the Nordic indices and selection criterion used for revisions of the index. The relation between the efficient market theorem and the index effect is introduced in chapter three. Chapter four discusses suggested hypotheses for the index effect and gives an overview of empirical evidence on relevant previous literature. Empirical methodology applied in the thesis is introduced in chapter five, while chapter six shows and discusses the findings. Chapter seven concludes the thesis (and its findings).

2 DESCRIPTION OF THE NORDIC INDICES

In October 2006, the Danish, Finnish, and Swedish stock exchanges were merged to form the Nordic stock exchange Nasdaq OMX Nordic Exchanges. Each country has its leading share index; OMX Helsinki 25 (OMXH25), OMX Stockholm 30 (OMXS30), and OMX Copenhagen 25 (OMXC25). OMXC25 replaced OMX Copenhagen 20 (OMXC20) on December 2017 as the leading index for Nasdaq Copenhagen. Therefore, both Danish indices are under consideration in this thesis. The constituents of these leading share indices include the largest and most actively traded stocks on Nasdaq Helsinki, Nasdaq Stockholm, and Nasdaq Copenhagen. The indices are market weighted price indices and have the same selection criteria of market capitalization and trading volume.

OMXH25, OMXS30, OMXC25, and OMXC20 indices select their constituents based on market capitalizations and trading volume. Information about the market capitalization and trading volume is publicly available and thus inclusions or exclusions from the Nordic indices should not give any new information to the public. The composition of the indices is revised twice a year. This selection criterion differs from most of the major indices, including the S&P 500 index.

The S&P 500 index is designed to reflect the U.S. equity markets. It is a world-renowned and widely followed index that contains 500 leading companies from the United States. Management of the S&P index is maintained by S&P Dow Jones Indices and index constituents are chosen and revised by Standard and Poor’s Index Committee. The Standard and Poor’s Index Committee, that is responsible for the index composition changes, utilizes nonspecific criterion for deciding the index changes. The criterion is not explicitly based on public information. Moreover, changes in the composition of the index are mainly caused by necessity to exit from one or more of the member companies through mergers, takeovers, restructuring, or bankruptcies, leaving only a few pure deletions. According to S&P Dow Jones Indices (2020), the candidate firms for new additions are carefully monitored, and criteria for inclusion are very strict. After the careful screening process replacement pool for potential candidates contains at least 10 firms. A firm is chosen from this pool whenever a new inclusion to the index is needed following the exclusion of a member firm. The list of these inclusion candidates is kept secret by the index committee until the announcement date, and the candidate selection process itself is not publicly specified process. On the report of S&P Dow Jones Indices (2020), some of the criteria includes market capitalization, profitability, float and liquidity requirements, and being a U.S. business. However, companies that are a part of S&P Mid Cap 400, and S&P Small Cap 600 could get included with fewer restrictions. Furthermore, some companies simply cannot get included, for example if the company's structure is too complex, or if the company owns multiple types of shares. The firms must get the approval of the index committee to get into the S&P 500, making it more of an active index than most other indices that simply use mechanical rules to pick their constituents.

For these reasons, one could argue that it is more difficult for investors to predict changes to the S&P 500 index compared to the Nordic indices examined in this study. Petajisto (2008) posits that higher transparency of the index selection rules (less asymmetric information) is related to a lesser extent of the index effects, as the index composition changes can be predicted by market participants. Thus, the Nordic indices offer an interesting setup for studying the index effect that differs from e.g. the S&P 500 index. Moreover, the S&P 500 index is rather unsuitable for studying index deletion effects, as it contains only few pure deletions. In the Nordics, the deletions as well as the additions are usually not based on corporate events, making the effects between the two types of events (deletions and additions) comparable. Furthermore, the period between the index change announcement date and the effective date (when the change takes place) is longer than in other major indices. In the Nordic indices, this time-period is approximately two weeks, whereas in other major indices it is only around one week. This enables to consider the announcement day and effective day effects separately. Therefore, it seems important to study the index effect in the Nordic stock markets more closely.

3 EFFICIENT MARKET HYPOTHESIS AND THE INDEX EFFECT

3.1 Efficient market hypothesis

Fama (1970) introduced the widely discussed theory called efficient market hypothesis (EMH). There are three variations of the efficient market hypothesis – the weak, semi-strong, and strong forms. These variations describe three different assumed levels of market efficiency.

The weak form of efficient market hypothesis implies that future stock prices cannot be predicted based on past stock prices. Therefore, as claimed by the weak form, information incorporated in the past stock prices (e.g. dividends, trading volumes) are reflected or priced in the current stock prices. The weak form of efficient market hypothesis makes technical analysis useless, as it is based on historical price movements.

The semi-strong form suggests that one cannot predict future stock price movements by using information that is available for everyone because all public information is already priced in the current stock price. Therefore, investors that are aware of any publicly known information cannot make profits with it, because the information has already been reflected in the stock price. Public information does not only include past stock prices, but also data reported by the company, for example, in form of financial statements as well as earnings, dividend, and other corporate announcements. The public information does not have to be financial information, as it could also be something else relevant for the company and its business, such as changes in the company's market conditions, competitors' outlook, or consumer behavior. Notably the semi-strong form incorporates weak form efficiency, since all historical price data is public information.

The strong form efficiency states that current stock prices reflect all existing information, both public, and unpublished inside information. The idea behind the strong form efficiency is that even if one has inside information and could legally trade based upon it, one could not profit from it as current stock prices already reflect all the information. Strong form of market efficiency contains the weak and semi-strong forms. However, it must be noted that Fama (1970) concludes that the strong form is not expected to be an exact description of reality and is not valid in real world.

3.2 Market efficiency and the index effect

The index effect can be defined as the price movement that occurs when a stock is included or excluded from an index. This contradicts with the efficient market hypothesis. Moreover, stock's fundamental value is determined by the expected future cash flows that are discounted by the cost of capital. The cost of capital should express a firm's systematic risk. Based on the semi-strong form of the efficient market hypothesis, neither index inclusion or exclusion, or changes in a stock's supply or demand should affect the stock price because no new information that could affect the firm's fundamental value is revealed (Fama, 1970). In other words, as stated by the semi-strong form, new information about a firm's fundamental value should be reflected in a stock price immediately. Instead, for example, changes in a stock's supply or demand should not be reflected, as changes in those do not provide new information.

Nonetheless, Scholes (1972) argues that stock prices are affected by high volumes. It is widely accepted that passive index funds, who track returns of a specific index, are behind the high trading volumes around index change events. Shleifer (1986) demonstrates that passive index funds have increased their ownership of the S&P 500 between 1975 and 1983 from 0.5% to 3.1%. Since then, the index funds have become extremely popular, and during the last decades there has been a clear shift from actively managed funds to passive index funds (Morningstar, 2019). When these index funds track a certain index, their investment decisions are based on the necessary portfolio adjustments that are conducted whenever changes in the benchmark index occur. They aim to minimize the tracking error that potentially arises between the fund and the benchmark index. Tracking error is the difference between an index fund portfolio's returns and the benchmark index's returns that it was meant to mimic. Therefore, funds that focus purely on index tracking must buy (sell) stocks that are included (excluded) to (from) the index. As a result, index trackers ensure that demand will increase for included stocks and supply for excluded stocks. This enormous demand could cause pressure on the included or excluded stock's price, resulting in a price shift (Scholes, 1972). From the efficient market hypothesis' point of view, it is essential to evaluate whether these probable trading volume occurrences around the index change events affect stock prices.

In general, anomalies relate to deviations from the common rule or what is seen as normal. In a way, market anomalies are distortions that contradict the efficient market hypothesis. Thereby, occurrence of market anomalies results in deviations from the efficient market theory and generates opportunities to earn abnormal returns. Thus, the index effect is an anomaly that contradicts the efficient market hypothesis. From the semi strong form of efficient market hypothesis' point of view, this anomaly can be investigated by studying potential stock price reactions and the speed of stock prices reacting to index inclusions or exclusions. If the stock price reactions to index changes were rational or provided new information, the price should find its new equilibrium value immediately after the inclusion or exclusion announcement, in efficient market conditions.

The Nordic indices (OMXH25, OMXS30, OMXC25, and OMXC20) consider only market capitalization and trading volume when new index inclusions and exclusions are determined. The information about market capitalization and trading volume is publicly available and thus inclusions or exclusions from the Nordic indices should not give any new information to investors, especially concerning stock's fundamental value. S&P 500 has an Index Committee that identifies a pool of eligible candidates based on firm-specific qualities that are not nonspecific and based explicitly on public information. The committee has reported that it selects financially healthy and strong candidates to avoid index turnover, referring to the rate at which firms leave the index and are replaced. One could argue that this kind of positive report from S&P regarding the selected stocks, combined with the information asymmetry about the selection process, could be considered as new information to investors. Some claim that this is the reason why index inclusion announcements might be considered as good news about the included company in the S&P 500 index (e.g. Jain, 1987). In the Nordic indices, there should not exist similar information asymmetry issues regarding index composition change announcements. Therefore, Nordic indices offer an interesting environment to study the index effect as a phenomenon from the semi-strong efficient market hypothesis' point of view.

4 EXISTING HYPOTHESES AND EMPIRICAL EVIDENCE

As will be discussed later, a majority of the literature reports significant price and volume effects related to the index changes. Most of the empirical evidence suggest positive (negative) price effects related to index addition (deletion) events. Abnormal trading volume occurring around the events is widely reported. Yet, theories and explanations underlying these effects are controversial. Several theories and possible explanations for the effects have been proposed and discussed in the literature. The suggested theories seem to vary, with some of them being demand-based and others information-based. Additionally, the theories seem to argue whether the effects are temporary or permanent and whether they are symmetric between additions and deletions or not. The suggested hypotheses are not necessarily mutually exclusive and may be even complementary. Thus, focusing on reviewing all the relevant hypotheses in this thesis seems necessary. In the next subsections, the suggested hypotheses are first reviewed and shortly discussed and then the empirical evidence is reviewed.

4.1 Suggested hypotheses for the index effect

4.1.1 Downward-sloped demand curve hypothesis

The downward-sloped demand curve hypothesis suggests that stocks have a long-term downward sloping demand curve and no perfect substitutes. If there were perfect substitutes between stocks, their demand curves should be horizontal because there would be arbitrage opportunities between them (Scholes, 1972). On the contrary, if stocks do not have perfect substitutes their demand curves should be downward sloping because the arbitrage opportunities are then limited. For example, stock X would be the perfect substitute for stock Y, if the demand for the other stock increases when the price of the other increases and vice versa. Because of this, the downward-sloped demand curve hypothesis is often referred to as the imperfect substitute hypothesis. Practically, the hypothesis forecasts temporary excess demand and trading volume after the index change, which will eventually be eliminated by stock prices reaching a new equilibrium value (Kappou, Brooks & Ward, 2008). According to the hypothesis, increase (decrease) in the stock price upon an index inclusion (exclusion) must occur as the excess demand caused by the event must be fulfilled by the stock price reaching a new equilibrium value, in the absence of perfect substitutes or other explanations. Therefore, the excess demand shifts the downward-sloping demand curve outwards. The hypothesis suggests that stock price reactions to index inclusions and exclusions should be symmetric and permanent.

Shleifer (1986) recognizes that stock price reactions followed by index additions or deletions are consistent with stocks retaining downward-sloping demand curves. His results suggest a large increase in trading volumes around the inclusions indicating a shift in demand that is most likely due to index funds rebalancing their portfolios. Furthermore, Shleifer reports a permanent rise in the stock prices following index inclusions, which he argues to be positively related to increases in demand. Lynch and Mendenhall (1997) indicate similar conclusions and claim the demand curves for stocks to be downward-sloping in the long-term. They find weakly positive permanent price effects for index inclusions and significantly negative permanent effects for exclusions. Findings of Wurgler and Zhuravskaya (2002) further support the downward-sloped demand curve hypothesis, as the authors argue that stocks do not have perfect substitutes. Moreover, Bechmann (2004) reports similar long-run effects after index changes and posits that the effects are best explained by the downward-sloped demand curve hypothesis or the liquidity hypothesis that will be assessed later.

4.1.2 Price pressure hypothesis

The price pressure hypothesis, first proposed by Scholes (1972), suggests a downward-sloped demand curve in the short term and a horizontal or fully elastic demand curve in the long term. As specified by the hypothesis, the strong demand resulting from index inclusion generates upward price pressure in the short term (downward sloped demand curve). This excess demand and price increase will drive some of the investors to sell the stock, which will satisfy the excess demand and the price pressure. As a result, the stock price reverts (horizontal demand curve). The effect is contrary to index exclusions, as the exclusions will face excess supply and downward price pressure. (Harris & Gurel, 1986.) The strong demand or supply around index changes has been widely recognized to be mainly caused by index funds that are required to rebalance their portfolios to keep their tracking error as low as possible.

Harris and Gurel (1986) were the first to study the price pressure hypothesis as a potential explanation of shifts to price and volume around index inclusion and exclusion events. They state that in the S&P 500 index, inclusions and exclusions create shifts in demand for the stocks and report immediate price increase for included stocks. Full price reversal occurs after the short-term abnormal returns. Moreover, Harris and Gurel argue that index change events do not offer any new information to the public (the prices would not revert if new information was announced); therefore, the price effects are explained by excess demand and supply. They suggest that demand curves are downward-sloped in the short term and horizontal in the long term.

Lynch and Mendenhall (1997) report evidence (based on their data after the S&P policy change in October 1989, which will be further discussed later) that supports the price pressure hypothesis. They find significantly positive abnormal returns on the announcement day of index inclusion and positive cumulative abnormal returns from the announcement date to one week forward until the effective date. However, following the effective date of index inclusions, significantly negative abnormal returns are reported. This effect is inverted for exclusions. The study claims heavy index fund trading to be the reason for these temporary stock price reactions around the index inclusions and exclusions, supporting the price pressure hypothesis. Lynch and Mendenhall also agree with the arguments of Harris and Gurel (1986) claiming that the index changes seem to not provide any valuable information to investors. Additionally, Mase (2007) argues that the abnormal price pressure potentially explains the index effect. Moreover, he posits that stocks that have been nearly included (excluded) to (from) the FTSE 100 index have had abnormally large trading volumes prior the index composition change announcements, which implies that some traders are speculating with the announcements. Contrary to the price pressure hypothesis and heavy index fund trading, Jain (1987) discovers abnormal returns also for firms included to supplementary indices[2] of S&P that are not tracked by index funds. While the price pressure hypothesis appears to offer a rational explanation for the short-term

[2] According to Jain (1987) these indices covered about 40 firms that are not included in the S&P 500 at the end of 1983. These indices are not named, but are said to include gaming companies, Canadian oil and gas exploration companies, brokerage firms, investment firms and low-priced stocks.

effect it fails to explain the permanent abnormal returns that are reported by some studies (e.g. Chen et al., 2004; Shleifer, 1986; Wurgler and Zhuravskaya, 2002).

4.1.3 Awareness hypothesis

The investor awareness hypothesis states that when a firm is included to an index. the price response should be at least partly due to increased investor awareness of the existence of the firm. Chen et al. (2004) introduce investor awareness as a possible factor to explain the index effect. They find asymmetric responses to index inclusions and exclusions and explain these responses with differences in investors' awareness levels. They propose that investor awareness raises for firms that are included in the S&P 500 index, whereas the decrease in awareness for excluded firms is lower. As a result, the price responses are asymmetric; included firms exhibit permanent price increase (because the investors are more aware of the firm as it now belongs to a recognized index and is followed more) and excluded firms exhibit no permanent negative price effects (because the investor awareness of the firm does not diminish easily following a deletion from an index).

Chen et al. (2004) further explain why raised awareness increases the market value of a firm; 1) it improves the monitoring of the firm by investors, and the management is more efficient to satisfy the investors, 2) it enhances firm's access to capital markets, 3) it improves the liquidity of the firm's stock, 4) it reduces information asymmetry related to the bid-ask spread, and 5) it lessens the shadow costs introduced by Merton (1987). Merton's (1987) shadow cost, in his model of market segmentation, represents a situation where under incomplete information some investors are aware only of a subset of all existing stocks and invest only in those. This results in investors being insufficiently diversified and demanding a premium for the nonsystematic risk they face, which is the shadow cost. Being part of a well-known index makes more investors to become aware of a firm's existence and results in more investors starting to invest in this stock. This causes the shadow cost of the stock to decrease which further decreases the required rate of return of the stock, making the stock price increase. Exclusion from index does not necessarily have symmetric effects as investors do not suddenly become unaware of the firm (Chen et al., 2004).

There are some studies supporting the awareness hypothesis. Chen and Lin (2018) examine the index effects by comparing newly S&P 500 included firms to their peers that are not listed in the index. They report findings that support the awareness hypothesis by suggesting that newly included firms experience better investor awareness, stock liquidity, and reduction in information asymmetry, all of which are features of investor awareness hypothesis. Furthermore, they find that index deletions do not have symmetric effects, which supports the findings of Chen et al. (2004). However, Chen and Lin (2018) also discover that newly added firms experience gains in market share and get some competitive advantage over their industry peers that are not listed in the S&P 500 index. Thus, they argue that index inclusion does not only raise investor awareness but also gives a competitive edge for the firm. On the contrary, Mase (2007) offers criticism to the hypothesis. He reports no significant differences between the return effects of first-time additions and additions that have already been in the index but have since been excluded and now are added there again. Therefore, Mase concludes that increased monitoring or higher state of investor awareness cannot explain the index effect in the FTSE 100 index. However, it must be considered that Mase studies the index effect in the FTSE index, while most of previous research examine the S&P 500. Thus, it is possible that the index where the firm is added or deleted might have something to do with the results.

4.1.4 Information hypothesis

Shleifer (1986) remarks that inclusion to the S&P 500 or other indices might provide some valuable information that could lead to abnormal returns. The information hypothesis, sometimes called the certification hypothesis, suggests that inclusion to (exclusion from) index indicates new positive (negative) information about the firm (Chen et al., 2004). Inclusion in a major index may also be taken as information about the firm's position as a leader of its industry (Jain, 1987). One could argue that if index composition changes would provide new information to the market, the authorities that make decisions about the changes must have nonpublic information about firms and use it to make the decisions. On the other hand, Chen et al. (2004) mention that S&P's index committee relies on publicly available information when making decisions regarding the index composition changes. However, analysis they perform on the inclusion candidates, in order to make these change decisions, could potentially propose an excellence of the included firm's quality or competitiveness over its industry peers. Notably, information hypothesis suggests symmetric price reactions for index additions and deletions.

Jain (1987) and Dhillon and Johnson (1991) show findings of persistent stock price reactions to composition changes in the S&P 500 index and argue that index inclusions provide new positive information to the market about the firm. Moreover, Shleifer (1986) and Lynch and Mendenhall (1997) find that permanent stock price effects are related to index changes in the S&P 500. In addition to the downward-sloping demand curve and the awareness hypotheses, one explanation for such positive permanent effects, is the information content that the index change announcements could potentially provide. Nevertheless, the information content of the index changes has also been widely criticized in the literature (e.g. Harris & Gurel, 1986; Lynch & Mendenhall, 1997; Kappou, 2018). Furthermore, if index changes would provide valuable information, then the pricing effect should occur immediately on the announcement day, and no further price shift would occur after that, as the new information is fully priced in on the announcement day (Lynch & Mendenhall, 1997).

4.1.5 Liquidity hypothesis

The liquidity hypothesis is closely related to the information hypothesis. If index changes affect the included or excluded stocks' liquidity, these events would have an effect on the prices of the stocks. If being included to index would alone increase a stock's liquidity, then there should especially be a price increase (decrease) immediately after the announcement of addition (deletion) (Lynch & Mendenhall, 1997). The inclusion of a stock to an index might result in better monitoring by analysts and professional investors. This would likely lead to a better public information available about the stock, further reflecting a decrease in a bid-ask spread (Shleifer, 1986). The bid-ask spread refers to the amount by which the ask price exceeds the bid price for a stock in the market. Dhillon and Johnson (1991) add that more comprehensive monitoring may also lower agency costs. Moreover, improvement in liquidity of the stock included to an index results in a decline in the stock's required rate of return, which should then increase the price of the stock (Shleifer, 1986). Exclusion from an index leads to opposite effects on the stock's liquidity and price.

Studying the liquidity hypothesis often requires examining the market microstructure. Therefore, there are only a few robust studies conducted within the hypothesis. For instance, Hegde and McDermott (2003) study liquidity effects related to index composition changes in the S&P 500 index. Their findings suggest that when a firm is added (deleted) to (from) the index, there is a long-term increase (decrease) in liquidity. Hedge and McDermott discover that analyst monitoring changes a little for included firms, whereas institutional ownership increases significantly. Furthermore, they argue that liquidity is improved mainly because of a decrease in the transaction costs, rather than improvement in the amount of public information or monitoring of the stock. However, Hedge and McDermott (2003) conclude that despite the significant relationship between abnormal returns and better liquidity, liquidity is not the only factor to explain abnormal returns. Additionally, Bechmann (2004) reports long-run stock price effects in the KFX index and argues that the liquidity hypothesis may potentially explain some of the results. On the other hand, Chen et al. (2004) claim that indexing could also reduce the liquidity of included stocks. As mentioned by Hedge and McDermott (2003), inclusions to major indices seem to lead to increased ownership of institutional equity and index funds. As a result, the available float (the number of shares available for trading) should decrease, which might worsen the liquidity of a stock. Moreover, Beneish and Whaley (1996) find nonpermanent decrease in the quoted bid-ask spread after index inclusions, thus concluding that the liquidity hypothesis is not an appropriate explanation for abnormal returns.

4.1.6 Selection criteria hypothesis

Indices apply different criteria when making decisions on index composition changes. The selection criteria hypothesis states that stock price effects resulting from index composition changes are partly driven by these criteria for two major reasons. The first is related to selection bias, as many indices select their new additions based on criteria such as trading volume, market capitalization, or profitability. As a result, stocks that have experienced increase (decrease) in one or more of these variables prior to index change decision are likely to be added (deleted) to (from) the index (Bechmann, 2004). Therefore, it might be possible that a part of the index effect is actually caused by increase in the selection criteria (market capitalization specifically in this example), as it is likely that the added (deleted) stock was selected due to increasing (decreasing) market value of the stock (Bechmann, 2004). Second, the hypothesis is also related to the efficient market hypothesis theorem. For example, Petajisto (2008) suggests that transparency in the index selection criteria might be related to the magnitude of the index effect. He claims that differences in the magnitude of the effects can arise depending on whether the selection rules are transparent and observable (no asymmetric information), or whether they are not freely observable or transparent (more asymmetric information). Furthermore, Petajisto shows that higher transparency of the index selection rules is related to a lesser extent of the index effects as the index composition changes could be predicted by market participants and vice versa.

4.1.7 Summary of the hypotheses

All hypotheses offer diverse explanations for the index effect. If index changes signal or cause changes in a firm's future cash flows or cost of capital, then the information and/or liquidity hypotheses might explain the changes. If so, the price response to inclusions and exclusions should then be symmetric, as illustrated in Table 1. In that case, the effects would be rationally explained and not totally conflicted with the efficient market hypothesis. However, the awareness and selection criteria hypotheses are more information-based in a way that might conflict with the EMH, as according to them index changes do not provide new information about the firm's future cash flows or cost of capital. Notably, all the information-based hypotheses suggest permanent price effects, and only the awareness hypothesis claims the effects for index inclusions and exclusions to be asymmetric. On the other hand, if index changes would be information-free events, the price pressure and downward-sloped demand curve hypotheses would possibly provide explanations. The two hypotheses differ in terms of effect longevity, as the price pressure hypothesis suggests temporary price deviations, and the downward-sloped demand curve hypothesis permanent price deviations. In both cases, the price effects should be symmetric for index inclusions and exclusions.

Table 1. Overview of characteristics of the hypotheses

	Downward-sloped Demand Curve hypothesis	Price Pressure hypothesis	Awareness hypothesis	Information hypothesis	Liquidity hypothesis	Selection criteria hypothesis
Demand or information based	Demand-based	Demand-based	Information-based	Information-based	Information-based	Information-based
Temporary or permanent effects	Permanent	Temporary	Permanent	Permanent	Permanent	Permanent
Symmetric or asymmetric effects	Symmetric	Symmetric	Asymmetric	Symmetric	Symmetric	Symmetric

As stated earlier, the hypotheses are not mutually exclusive. Scholars have offered empirical evidence that supports the different hypotheses, without agreeing on the most appropriate one. The reasons for such conflicting empirical findings and suggestions regarding the hypotheses are still unclear.

4.2 Review of the empirical evidence

Relevant studies are shortly examined to gain greater understanding of the index effect and its magnitude. Most of the empirical evidence focuses on the S&P 500 index and uses the standard event study methods. The earliest evidence stems from the 1970s when the index composition change practices in the S&P 500 index were different from the current. The market has also changed when it comes to the amount of index tracking funds' ownership. In addition to the evolution of the market conditions over-time, research made in the 21st century starts to question the magnitude and existence of the index effect. There has been a proliferation of research throughout the years, and the effect has been studied in a more diverse range of indices, markets, time frame, and data. Still, notable studies have not been conducted on the index effect in the Nordic indices.

Shleifer (1986) was one of the first academics who reported significant positive abnormal returns for the stocks at the announcement of an inclusion to the S&P 500 index. These positive returns exist for at least ten days after the inclusion event since the index funds try to rebalance their portfolios over a longer period. He argues that the demand curve for stocks should therefore be downward-sloped. Hence, Shleifer is the first to suggest the downward-sloped demand curve hypothesis as a possible explanation for the index effect. In addition, he notes that the relative ownership of S&P500 by passive index funds started to increase after 1975 and reports that these funds have increased their ownership since then until 1983 from 0.5% to 3.1%. Furthermore, Shleifer finds that the abnormal returns began to increase gradually starting from 1976, as the index funds began to grow their relative ownership of the S&P 500. Therefore, he suggests positive relation between the abnormal returns and index funds ownership. This relation lays the foundation of the index effect.

Another pioneering study by Harris and Gurel (1986) reports significant positive abnormal returns after the announcement of an inclusion to the S&P 500 index. Contrary to Shleifer's (1986) findings, they report that the abnormal returns occur immediately after the announcement and fully reverse after two weeks. Harris and Gurel are the first to provide evidence that abnormal returns around index changes are likely created due to temporary shocks to the stock's demand. Furthermore, the temporary demand shocks are reported to be mostly caused by index funds that purchase included stocks and sell excluded stocks. According to the authors, at the end of 1983 there were 2.96% of the total market value of the S&P 500 invested in public index funds and possibly same portion in privately held funds. Harris and Gurel are the first to introduce the price pressure hypothesis as a possible explanation for the index effect.

Findings of Jain (1987) and Dhillon and Johnson (1991) re-examine the earlier evidence and suggest new hypotheses to explain the index effect. Jain's (1987) findings are consistent with previous research reporting positive (negative) average abnormal returns on the announcement day for S&P 500 additions (deletions). However, he argues against earlier evidence and claims that these effects are not due to excess demand caused by index funds because he discovers abnormal returns also for firms included to supplementary indices of S&P that are not tracked by index funds. As a conclusion, he suggests that the inclusion (exclusion) in the index conveys positive (negative) information to the market about the included firm, which gives the basis for the information hypothesis. Similarly, Dhillon and Johnson (1991) argue that index inclusions (exclusions) provide new positive (negative) information to the market and posit that all the evidence they suggest supports the information hypothesis. Their findings show that index addition announcements in the S&P 500 index result in increase on the prices of the firm's stocks, bonds, and call options, while the firms' put option prices decrease. They claim that the prices do not revert after the announcements. Thus, they interpret the announcements to be information contained.

S&P's policy to announce and implement index composition changes was updated in October 1989. Prior to 1989 the policy was to announce and carry out changes in the composition of the index at the same time. Since October 1989, the policy has been to announce changes approximately one week before the changes take place. Lynch and Mendenhall (1997) analyze price and volume data in the S&P 500 from 1990 to 1995 for firms that were added to or deleted from the index. Their study was one of the first to provide new information to the field of research since the new policy. Despite the policy change, the results are consistent with earlier studies, as Lynch and Mendenhall document significantly positive abnormal returns on the announcement day for inclusions. Furthermore, they find cumulative abnormal returns on the event window between the announcement and effective date. However, the returns are partly reversed after the effective date. The findings are similar but inverted for index exclusions. Because the results indicate temporary price shocks likely due to high index fund trading, the authors suggest the price pressure hypothesis to be an explanation and argue strongly against the information hypothesis. Moreover, for the pre-October 1989 data, they find different results indicating weakly positive permanent effects for inclusions and significantly negative permanent effects for exclusions. They argue that these pre-policy change results support the findings of Shleifer (1986) and agree with the downward-sloped demand curve hypothesis.

Lynch and Mendenhall (1997), as well as Beneish and Whaley (1996), were amongst the first to provide new evidence on the index effect within the new announcement policy of Standard and Poor's. Beneish and Whaley argue that the price increase around the index inclusions is mostly permanent and higher after the new announcement policy, compared to the same effects before the policy change. They say that the price increase is due to the index funds buying the stocks, as has been proposed on earlier papers. The results of both Beneish and Whaley (1996) and Lynch and Mendenhall (1997) suggest that the price increase appears to take the form of a multiday drift (from the announcement date till the effective date), likely due to the index policy change. Under the new announcement policy, there are normally five days between the announcement and effective date. In addition to minimize the tracking error, index funds are buying the stocks mostly on the effective date. Therefore, Beneish and Whaley suggest that traders can make successful trades if they buy the included shares before the S&P 500 index funds (right after the announcement) and sell the shares after index fund demand is fulfilled (after the effective date) – what they call to be the S&P 500 game. However, the authors say that if more index funds would start to rebalance their portfolios right after the announcement, the price movement would happen without further delay after the announcement. Consequently, the price increase between the first morning after the announcement and the effective day might become near nonexistent and thus they expect this trading opportunity between announcement and effective date to disappear over time.

Chen et al. (2004) report findings indicating permanent price increase for firms that are newly included to the S&P 500 index, being in line with most of the earlier research. However, they are likely first to report that the price response is asymmetric for excluded stocks, as there is no permanent price decline. Furthermore, the price decline after exclusions is reported to recoup over 60 days after the announcement, whereas the price increase after inclusions is constant over 60 days after the announcement. This finding questions the validity of the hypotheses suggested by earlier research. The study argues and provides evidence that investor awareness is potentially the explanation for the asymmetric effects, as awareness about a firm rises following an inclusion to the index but do not mitigate considerably following an exclusion. Due to this, Chen et al. are the first to introduce the awareness hypothesis as an explanation for the index effect.

While most of the earlier evidence studies the effects in the S&P 500 index, from the beginning of the 21st century the research diversifies in terms of the indices under examination. Bechmann (2004) considers the effects of changes in the composition of the Danish KFX index between 1989 and 2001. He claims that KFX index uses only public information when making index changes. Thus, the study is conducted in an environment where the index effect cannot be explained by new information. The results of the study report positive abnormal average returns for included stocks and even higher negative abnormal average returns for excluded stocks in a six-month period. The majority of the effects are observed prior to the changes. Furthermore, Bechmann reports that the effects are long-lasting, frequent, and have increased over time in terms of the size. Temporary price pressure around the event date is reported, as exclusions experience significant trading volume drop and inclusions weak increase in trading volume. As stated by him, these trading volume differences between index inclusions and exclusions can explain the asymmetry in the size of the stock price reactions between inclusions and exclusions found in his paper. As a conclusion, he argues that the downward-sloped demand curve hypothesis and liquidity hypothesis are probably the most accurate explanations for the effects. Furthermore, Bechmann is the first to introduce the selection criteria hypothesis and declares that the selection criterion employed by the index likely explains at least part of the effects.

Mase (2007) investigates the effects on changes in the composition of the FTSE 100 index. The FTSE 100 index is composed of the 100 largest companies that are listed in the London Stock Exchange (LSE). Similar to the Nordic indices, the index composition changes in the FTSE 100 are based on market capitalization and should not provide any new information content about the fundamentals of the firms. The findings of the study suggest that there is temporary price pressure and movement prior the effective date of the index changes for both index inclusions and exclusions. Furthermore, the author notes that there is abnormal volume prior to the announcement day indicating speculation by some traders. These abnormal trading volumes occur for inclusions but not for exclusions. Mase (2007) concludes that the investor awareness hypothesis does not explain the results, as he finds that the price effects are of equal magnitude between the firms that are included for the first time and firms that have been part of the index previously but have been excluded and now are included again. Instead, his findings support the price pressure hypothesis, as he reports temporary price effects and abnormal trading volume around the events.

Maheshwari (2015) studies the price and volume effects of inclusions in the S&P CNX Nifty index, which is an index endorsed by Standard and Poor’s and composed of 50 of the biggest stocks of Indian’s National Stock Exchange. The results of the study are in-line with most of the research made earlier, as included stocks earn significant positive abnormal returns on the inclusion day and three more days after that. CNX Nifty index has almost one month between the announcement and effective date. Regardless of the relatively long-time frame between these events, he finds significant positive abnormal returns also on the effective (inclusion) day. As claimed by the study, this can be attributed to the abnormal demand on the effective day caused by index funds restructuring their ownership. Furthermore, Maheshwari argues that the significant return effects on the effective day (after one month from the announcement of the event) indicate that the information hypothesis does not explain the results, as the returns should have been priced in fully right after the announcement day. Instead, the author reports evidence that supports mainly the assumptions of price pressure hypothesis, as he finds abnormal volume effects around both events. The findings of Maheshwari's research prove evidence that the index effect exists also in emerging markets.

Research on the index effect has got more diverse also in terms of the study methods and perspectives at the 21st century. For example, Kappou et al. (2010) study the overnight and tick-by-tick abnormal returns and trading volumes in the S&P 500 index and report trading patterns. More specifically, they posit that the effective date (inclusion date) abnormal returns have decreased over time and are now reflected into the stock prices before the effective date. This finding supports the earlier suggestions of Beneish and Whaley (1996) regarding the future disappearance of the profitable trading opportunities that were available back then by simply buying included stocks on the announcement day and selling them on the effective date. For excluded stocks, Kappou et al. indicate a price drop following the announcement (overnight effect that is not tradable) and further price decrease on the effective date. They also define a tick-by-tick based trading strategy, where short and long positions are taken in the included companies resulting in a profit of 7% on average, transaction costs not included.

Chen and Lin (2018) add a new dimension to earlier literature suggesting that index inclusion itself gives competitive advantage to firms that are added to the S&P 500 over their non-S&P 500 included industry peers. They compare the stock performance of newly S&P 500 included and excluded firms to their industry competitors over the period of 1976 to 2011. They report results similar to earlier studies and confirm that newly added firms earn positive abnormal returns around the announcement.

Moreover, the findings of the study suggest that industry peers that are not included in the S&P 500 index suffer from significantly negative stock price effect at the same time. Chen and Lin find that following the inclusion, for example financial constraints and the cost of equity are significantly reduced, whereas capital investments are increased for the included firms. As the capital investments increase faster than those of the industry peers' that are not part of the index, the included firms are also reported to earn more market share. Nonetheless, exclusion from the S&P 500 index is claimed to have negative price effects for the excluded firms. However, exclusion events do not have significant price effects for the peers. The authors suggest that index exclusions do not have significant effects on competitive advantages. The findings of the study are to some extent consistent with the awareness and liquidity hypotheses.

Petajisto (2008) studies the index effect from the point of view of index funds and investors that aim to track the index. He claims that the index effect causes a puzzle from their point of view: to minimize their tracking errors, index funds must buy the included stocks with price premium and sell the excluded stocks without the premium. As the majority of the studies suggest that most of the price shift caused by the index changes usually occurs around the announcement date, while index funds are forced to balance their positions around the effective date in order to minimize their tracking error. Therefore, Petajisto argues that index funds happen to buy (sell) the stocks after majority of the price increase (decrease) effect has already occurred. Thus, index funds seem to end up buying high and selling low. However, for instance Kim et al. (2017) suggest that nowadays index funds and institutional investors seem to be rebalancing their portfolios earlier near the index change announcement, rather than on the effective date. This indicates that the dilemma introduced by Petajisto (2008) might be disappearing, as it seems that some of the index funds prefer buying (selling) the included (excluded) stocks before or at an early stage of the price shift, rather than track the index as perfectly as possible and overpay for the stock. Nevertheless, it appears relevant to consider the viewpoint of the index trackers and the possible changes in their behavior when making conclusions.

Contrary to earlier research, there have been findings in recently published studies reporting no significant return effects around the index change events. These studies imply that over time, there might have occurred disappearance or change in the index effect. For instance, Kim et al. (2017) find no significant abnormal returns related to index inclusions between 2010 and 2013 in the S&P 500 index. However, the findings indicate a slight price movement on the announcement day. They claim that there are no more profitable trading opportunities with the trading strategy of buying the stocks at the close on the announcement date of index inclusion and selling at the close on the effective date when the inclusion becomes effective, which was previously proved to be successful by Beneish and Whaley (1996). Kim et al. (2017) further claim that the index effect in general is getting smaller and will likely disappear eventually over time. They discuss whether professional investors are now rebalancing their portfolios right after the announcement date instead of waiting until the effective date. This kind of behavior could potentially explain their findings of price shift happening on the announcement date rather than price drifting positively until the effective date like it used to according to earlier findings (e.g. Beneish & Whaley, 1996; Lynch & Mendenhall, 1997).

Additionally, Kappou (2018) supports the findings of Kim et al. (2017) by providing evidence that there are no abnormal return effects related to index changes in the S&P 500 index after October 2008. The findings indicate that the index effect has changed dramatically after the financial crisis. According to Kappou, these significant changes in the effects are due to better market information by market participants. The author says that for example, professional investors and analysts might have become better at predicting the changes in advance, which could potentially reduce the magnitude of the effects. Furthermore, Kappou claims that these diminished returns might be caused by more developed algorithm trading. More developed algorithms likely take into account the potential price effects caused by high volumes. Therefore, the algorithms might be programmed to diversify the trades that they execute in a way that price effects are minimized. Furthermore, as the effect disappearance appears to start after the financial crisis, the author says that new regulation may have changed the way index funds and professional investors rebalance their positions and could be one explanation for the change in the index effect.

Ming-Pey and Zamri (2019) study the composition changes in FBM KLCI index (FTSE Bursa Malaysia Kuala Lumpur Composite Index) between 2001 and 2014. Their findings are contradictory to most of the research papers, suggesting that index inclusion events have more negative impacts on the stock prices than index exclusion events. Hence, excluded stocks exhibit better performance than included stocks. Furthermore, they posit that included stocks' trading volume decreases. Ming-Pey and Zamri suggest Opinion Divergence Theory, first introduced by Miller (1977), as a possible explanation for their relatively different findings. In addition, they mention that the FBM KLCI index's selection criterion is based on public information, and for that reason it is possible for investors to predict the composition changes beforehand. Thus, the selection criterion might explain part of their relatively contradicted findings.

5 DATA AND METHOD

5.1 Data collection and description

The purpose of this thesis is to measure the impact of index composition change events in the OMXH25, OMXC20, OMXC25, and OMXS30 indices. To achieve this goal, data on index composition changes, daily stock prices, and trading volumes of firms are collected. Additionally, data on the proxy indices' daily prices are collected. The data are employed to perform an event study that measures abnormal returns and abnormal volumes around the events of interest. Furthermore, the findings are interpreted and compared to previous evidence of the effect, and suggested hypotheses are discussed.

The data of index addition and deletion events and announcements between January 2009 and January 2020 are collected manually from Nasdaq OMX Nordics' news archive where the semi-annual reviews of the indices are published. The list of additions and deletions are then compared to Thomson Reuters' "Leaver – Joiner"-list to check the validity of the sample. Some of the observations are deleted due to a lack of price data, spin-offs, or mergers and acquisitions. The final sample consists of 80 observations, of which 43 are addition events and 37 deletion events. The distribution of the events over time is displayed in Figure 1. Additional information about the inclusion and exclusion events can be found from appendices 1,2,3, and 4. Daily price and trading volume data as well as number of current shares outstanding are collected from Bloomberg for each stock in the sample and for reference indices OMX Helsinki PI, OMX Stockholm PI, and OMX Copenhagen PI.

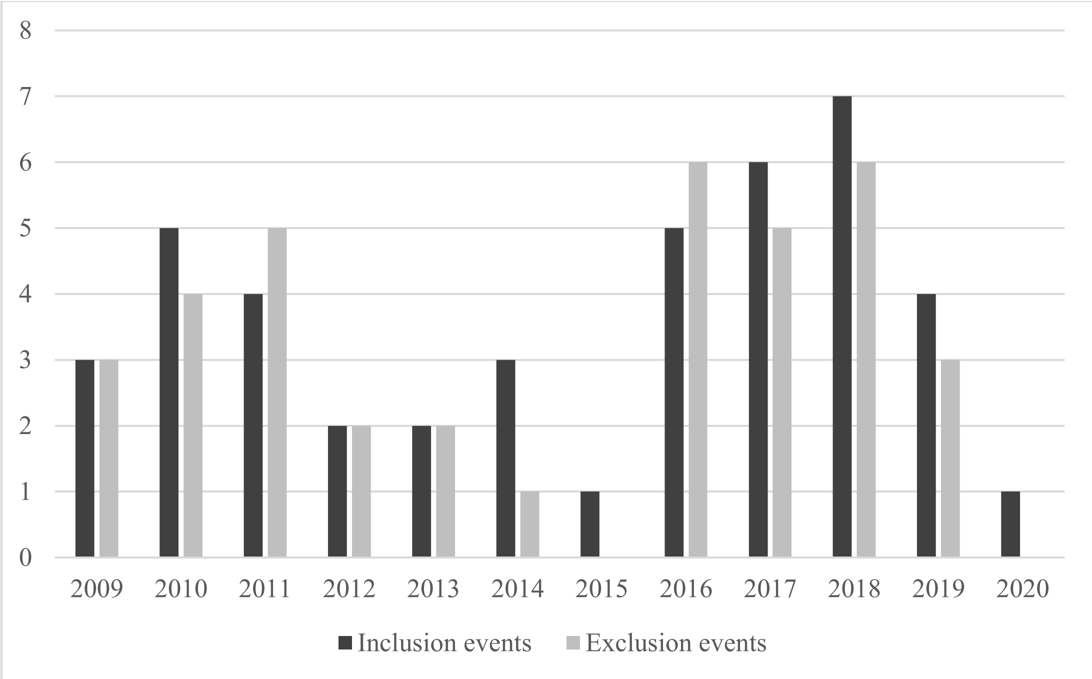

Figure 1. Events by year

Table 2 shows the distribution of the observations between the Nordic indices and the type of event (additions and deletions). The table illustrates the fact that most of the total events (68 %) occurred in the Danish indices, and thus the overall sample is quite heavily governed by OMXC20 and OMXC25. Therefore, it is relevant to perform the event study also separately for all the indices to identify possible issues related to this.[3] Moreover, OMXS30 and OMXH25 have relatively few index change events despite the fact that they consist of more companies (55) than OMXC20 and OMXC25 indices (45). This is likely due to differences in selection criteria: OMXS30 and OMXH25 make constitution changes based only on trading volume, whereas OMXC20 and OMXC25 use trading volume and market capitalization.

[3] Because the overall sample is heavily governed by the events occurred in the OMXC20 and OMXC25, the overall sample results could be affected in a way that the results represent the situation in the two governing indices, while the results in the OMXH25 and OMXS30 could differentiate. Therefore, the overall sample results might not be a truthful description of the index effect in all four Nordic indices, if this possible problem would not be taken into account.

Table 2. Observations

	OMXH25	OMXS30	OMXC20	OMXC25	All
Additions	9	6	18	10	43
Proportion	21 %	14 %	42 %	23 %	100 %
Deletions	6	5	18	8	37
Proportion	16 %	14 %	49 %	22 %	100 %
Total events	15	11	36	18	80
Proportion	19 %	14 %	45 %	23 %	100 %

5.2 Methodology

Event study methodology is used to measure the stock market effects. Event study methodology is commonly implemented to examine the impact of a specific event on the stock price or trading volume of a firm. The method is widely employed for examining market reactions to a variety of events in the research of accounting, finance, and economics. Additionally, the method is highly applied in research on the index effect. The idea in event studies is to determine whether abnormal returns or volumes are associated with an announcement or an event. The representation of the event study methodology is more specifically introduced in the following subsections. In subsections 5.2.2 – 5.2.5, descriptions and formulas of the method are based on a study by MacKinlay (1997).

5.2.1 Events of interest

Press releases announcing the changes on the index compositions in the Nordic indices are published before the market opens at 08:30:00 CEST. Therefore, any effect of the announcement should be visible the same day. The effective date, when the addition or/and deletion takes place, is released in the press release. Moreover, on the announced effective date, the index change becomes effective when the market opens. Consequently, the announcement date (AD) is defined as the press releases' date of publication, and the effective date (ED) as the date when the index change takes place. The time period between the AD and ED in the sample is approximately 11 to 16 trading days.

5.2.2 Estimation period and event windows

The event window is the time period in which the effect of the price or volume changes of the firms is studied (MacKinlay, 1997). In this thesis, two events are identified and studied separately. The first event is the announcement of index inclusion (exclusion), and the second event is the inclusion (exclusion) becoming effective. The event windows and estimation window employed in this thesis are illustrated in Figure 2. To examine the short-term effects, the event window periods of -1 to +1 and -5 to +5 days around the announcement dates (AD) and effective dates (ED) are used. To capture the long-term effects, event windows starting from 20 and 50 days before the AD until the day 0, and event windows starting from the ED and ending 20 and 50 days later are employed. The event windows that take place after the ED allows us to investigate whether the price effects are permanent or temporary. The event windows prior the AD make it possible to capture potential pre-event effects.

The estimation window represents the time-frame when the parameters of the expected returns are estimated. MacKinlay (1997) suggests an estimation period from 90 days up to 250 days and says that estimation window and event windows should not overlap. In this thesis, an estimation period of 120 days is chosen. The estimation window starts 180 days prior the events and ends 60 days prior the events, to avoid overlapping with the event windows (Figure 2).

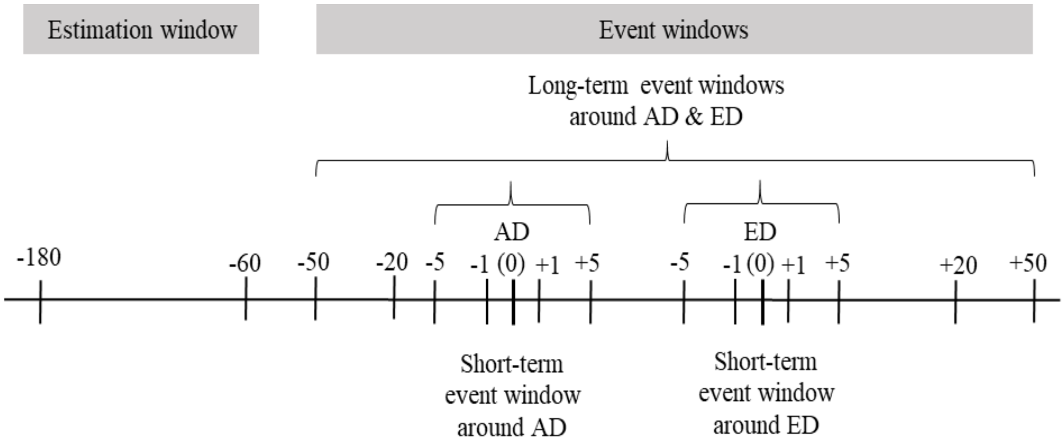

Figure 2. Estimation window and event windows

5.2.3 Measuring normal returns

Normal return represents a stock's theoretical or expected return without the event occurring. Abnormal return (AR) is the component of actual return that is not predicted by the market movement alone. More specifically, abnormal return is the return difference (positive or negative) between a stock's actual return and normal return. For stock i and event date t, abnormal return, $AR_{i,t}$, is the difference between the stock's actual return $R_{i,t}$, and the expected return $E(R_{i,t}|X_t)$ at time t:

$$AR_{i,t} = R_{i,t} - E(R_{i,t}|X_t) \quad (1)$$

where X_t represents the conditioning information at time t. To calculate abnormal returns, the normal return must be modeled. There are three popular ways for modeling the normal return: 1) the constant mean return model, 2) the market model, and 3) the adjusted market model.

The first option, constant mean return model, assumes that the normal return for stock i can be calculated simply by computing the mean return from the past returns of the stock:

$$R_{i,t} = \mu_i + \varepsilon_{i,t} \quad (2)$$

$$E(\varepsilon_{it} = 0) \qquad\qquad var\ (\varepsilon_{it}) = \sigma^2_{\varepsilon_i}$$

where $R_{i,t}$ is the return on stock i at time t, μ_i is the mean return for the stock *i*, and $\varepsilon_{i,t}$ is the disturbance term for security *i* at time *t* (with expectation of 0 and variance of $\sigma^2_{\varepsilon_i}$). Notably, the constant mean return model appears to not be commonly applied in studies of the index effect. This might be due to the fact that the market model can be easily applied in this context.

The second option, the market model, is commonly employed in studies of the index effect (see e.g. Harris & Gurel, 1986; Shleifer, 1986; Jain, 1987; Dhillon & Johnson, 1991; Mase, 2007; Chen & Lin, 2018). The market model is a statistical one factor model. As stated by the model, the return for any chosen stock is conditional on the return of the market portfolio. As stated by the market model, each stock's normal return can be determined with the following formula:

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \varepsilon_{i,t} \tag{3}$$

$$E(\varepsilon_{it} = 0) \qquad\qquad var\ (\varepsilon_{it}) = \sigma^2_{\varepsilon_i}$$

where $R_{i,t}$ is the return for stock *i* at time *t,* and $R_{m,t}$ is the market's return at time *t*. $\varepsilon_{i,t}$ is the idiosyncratic zero mean disturbance term for the stock *i*. α_i, β_i, and $\sigma^2_{\varepsilon_i}$ are the estimated parameters in the model.

Market-adjusted return model is the third frequently utilized method in the literature on the index effect (see e.g. Beneish & Whaley, 1996; Lynch & Mendenhall, 1997; Wurgler & Zhuravskaya, 2002; Chen et al., 2004; Kim et al., 2017; Kappou, 2018). When calculating the abnormal returns $AR_{i,t}$, with the market-adjusted return model, the $AR_{i,t}$ is simply the difference between the stock's observed actual return $R_{i,t}$ and the market's return $R_{m,t}$:

$$AR_{i,t} = R_{i,t} - R_{m,t} \tag{4}$$

Market-adjusted return model is restricted because of the constraints (illustrated in Formula 3) of α_i being 0 and β_i being 1. Therefore, the market-adjusted return model asserts that the normal return is just the return of the market. Because of this restriction of the model, MacKinlay (1997) suggests that the market-adjusted return model should only be used when no other model can be easily applied. This is due to the restrictions, as they might lead to biases. As specified by him, the model might be useful, for example, when pre-event estimation period is not possible to obtain (e.g. when studying initial public offerings).

Other types of statistical models could also be employed for modeling the normal return. For instance, multifactor models are quite widely used in the literature on finance. These multifactor models often incorporate multiple factors (e.g. macroeconomic or fundamental factors) in addition to the market factor. However, Campbell, Lo and MacKinlay (1997, p. 155-156) argue that the benefits from using these more complicated multifactor models are limited in event studies. This is due to the fact, that multiple factors that are incorporated in these models have often only a slight explanatory significance beyond the market factor. Therefore, multifactor models are not utilized or further examined in this thesis.

When the three simple models that were introduced are compared, it can be noted that the market model is potentially more precise than the two other models. Campbell et al. (1997) point out that compared to the constant mean return model, the market model reduces the part of return that is caused by the variation in the market's return, resulting in reduction of variance of the abnormal return. Moreover, as MacKinlay (1997) argued, the market-adjusted return model is restricted and should only be applied when no other models can be easily used. Hence, the market model is chosen to model the normal return in this thesis, as it is potentially the most accurate among the three options.

MacKinlay (1997) suggests that a broad stock index should be chosen as a proxy for market index when the market model is applied. For the Nordic indices, broad and widely used index for all shares listed in the Nordics do not exist. Therefore, the following OMX all-share indices are chosen as a proxy for the respective countries' stocks; OMX Helsinki PI, OMX Stockholm PI, and OMX Copenhagen PI. These three all-share indices are value weighted indices of all listed shares in each respective country. This means that separate indices are used as a proxy for Finnish, Swedish, and Danish stocks to minimize the potential bias caused by unsuitable proxies.

5.2.4 Measuring abnormal returns

As expressed earlier in Formula 1, the abnormal return is simply the return difference between the stock's actual and normal return. Theoretically, if no new events occur, the abnormal return for a stock should be zero. The formula for estimating abnormal returns when the market model is applied to measure the normal return is:

$$AR_{i,t} = R_{i,t} - \alpha_i - \beta_i R_{m,t} \tag{5}$$

where abnormal returns ($AR_{i,t}$) are calculated for each security *i* for each day *t* in the event window, and the parameters α_i, and β_i are estimated by the market model (Formula 3) over the estimation window.

As the market model is applied, the conditional variance of abnormal returns is defined as:

$$\sigma^2(AR_{i,t}) = \sigma^2_{\varepsilon_i} + \frac{1}{L}[1 + \frac{(R_{m,t}+\mu_m)^2}{\hat{\sigma}^2_m}] \tag{6}$$

where L represents the length of the estimation window. When L gets large, the second term moves towards zero and the conditional variance of AR can be approximated by the first term (the squared standard error). Hence, choosing a long estimation window makes estimating the variance of AR less problematic, as it can be then assumed that the second term of the variance is simply zero.

As the aim of this thesis is to determine whether index composition changes affect the stock prices, the daily average abnormal returns (AAR) for the stocks in the event window are calculated. The formula for calculating the stocks' average abnormal return AAR_t for period *t* is defined as:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{i,t} \tag{7}$$

where $AR_{i,t}$'s are the abnormal returns for each event period and N represent the number of events.

When the length of the estimation window (L) is large, the variance for AAR_t is:

$$\sigma^2(AAR_t) = \frac{1}{N^2}\sum_{i=1}^{N} \sigma_{\varepsilon_i}^2 \tag{8}$$

Using these formulas, the abnormal returns for the events can be calculated and used for further analysis.

5.2.5 Measuring cumulative abnormal returns

The observations of abnormal returns are collected and accumulated to conduct a comprehensive analysis of the event of interest. Moreover, the CAR across the event window t_1 to t_2, for an asset *i* can be defined as the sum of the included ARs:

$$CAR_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AR_{i,t} \tag{9}$$

As the length of the estimation window becomes longer, the variance of CAR_i is given by the following formula:

$$\sigma^2(t_1, t_2) = (t_2 - t_1 + 1)\, \sigma_{\varepsilon_i}^2 \tag{10}$$

The average abnormal returns (AARs) can be further utilized and accumulated over the event window t_1 to t_2 using the following formula of cumulative average abnormal returns $CAAR$:

$$CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} AAR_t \tag{11}$$

The variance of $CAAR$ over any specified period is as follows:

$$\sigma^2 CAAR(t_1, t_2) = \sum_{t=t_1}^{t_2} \sigma^2(AAR_t) \tag{12}$$

The *CAAR*s are computed in order to analyze whether the returns are abnormal during specified periods.

5.2.6 Measuring abnormal trading volumes

The main difference between an abnormal volume event study and an abnormal return event study is that instead of returns, the log-transformed relative volume per firm is used (Campbell & Wasley, 1996). This relative volume is simply the percentage of shares traded in relation to the total number of shares outstanding at time *t*. In the formula, a constant of 0.000255 is added to avoid taking the logarithm of zero, in case if there are days with zero trading. The formula for the daily trading volume is therefore (Campbell & Wesley, 1996):

$$V_{it} = log\,(\frac{n_{it} + 0.000255}{S_{it}} \cdot 100) \tag{13}$$

where S_{it} is the number of shares outstanding at time *t* for stock *i*, and n_{it} is the observed trading volume for the stock at time *t*. Furthermore, in this thesis the mean-adjusted abnormal trading volume method is the chosen approach to estimate abnormal trading volumes (Campbell & Wesley, 1996):

$$AV_{it} = V_{it} - \bar{V}_i \tag{14}$$

where $\bar{V}_i$ is the average trading volume for stock *i* and is given by the following formula:

$$\bar{V}_i = \frac{1}{T} \sum_{t=f(l)}^{t=1} V_{it} \tag{15}$$

where T is the number of days in the estimation period, and f(l) is the first (last) day of the estimation period. To obtain similar conditions with the abnormal return calculations, the estimation period starts 180 days prior the events and ends 60 days prior the events, to avoid overlapping with the event windows. Like the average abnormal return formula, the average abnormal volume (AAV) is given by:

$$AAV_t = \frac{1}{N}\sum_{i=1}^{N} AV_{i,t} \quad (16)$$

where $AV_{i,t}$'s are obtained from formula 14 for each event period and N represent the number of events. Furthermore, like cumulative abnormal returns, the cumulative abnormal volume can be defined for an asset *i* during event window t_1 to t_2 as:

$$CAV_i(t_1, t_2) = \sum_{t=t_1}^{t_2} AV_{i,t} \quad (17)$$

Average abnormal volumes (AAVs) can be further accumulated over the event window t_1 to t_2 with the formula of:

$$CAAV(t_1, t_2) = \sum_{t=t_1}^{t_2} AAV_t \quad (18)$$

5.2.7 Measuring the statistical significance

It is important to test whether the estimated abnormal returns and volumes are statistically different from zero or not. To make conclusions about the statistical significance, the null hypothesis for testing the significance of abnormality is set. The null hypothesis states that the event has no impact on returns or trading volumes. Therefore, the null hypothesis assumes that the abnormal returns and abnormal average returns for stocks around the events are zero. Similarly, for the volume event study, the null hypothesis assumes the abnormal volumes and abnormal average volumes for stocks to be zero around the events. There are several test statistics that can be used to measure the statistical significance of the results, and whether the null hypothesis is rejected or not. Generally, these significance tests can be grouped into parametric and nonparametric tests. Parametric tests assume that an individual firm's abnormal returns or volumes are normally distributed, whereas nonparametric tests do not make such assumptions. Parametric tests are grounded on the widely known method called the t-test. Later on, scholars have developed variations from the t-test to correct for the t-test's prediction error.

Boehmer, Musumeci and Poulsen (1991) state that there are problems related to the commonly applied methods for measuring the statistical significance (e.g. t-tests, Chi-Square, sign test). They argue that the problems are caused by the variance occurred due to the event and therefore the common methods tend to reject the null hypothesis too frequently and incorrectly. Hence, Boehmer et al. (1991) propose a modified standardized cross-sectional method, called BMP-test. The BMP-test is robust to the variance induced by the event. Subsequently, Kolari and Pynnönen (2010) found that the BMP-test ignores cross-sectional correlation of the returns and thus over-rejects the null hypothesis. That is why they propose a modification to the BMP-test to account for the cross-sectional correlation. The modification is called adjusted BMP-test and is robust to both issues related to the standard t-test: variance changes and cross-correlation. In this thesis, the adjusted BMP-test proposed by Kolari and Pynnönen (2010) is applied to evaluate the significance of the abnormal returns while the t-test is used for the abnormal volumes.

5.2.8 Possible challenges in event studies

There are challenges associated with event studies. The most probable ones are considered when conducting the event study in this thesis. First, one possible challenge is other major events that might have occurred on the event windows and influenced the stock prices or trading volumes. However, this challenge was considered and observations where the deletion events occurred due to mergers, acquisitions, spin-offs, or other similar reasons were removed from the sample. Nevertheless, it is possible that all events that might have had an effect on the stocks are not completely left out. For instance, earnings reports or profit warnings are not considered.

Second, most of the events in the full sample occurred in two of the indices (mainly in the OMXC20 and OMXC25), while other two indices (OMXS30 and OMXH25) had relatively few events. Hence, it is possible that some of the indices where most of the events occurred would govern the full sample. Thus, it is possible that the full sample would not give a comprehensive picture of the index effect in the Nordics. To avoid this, the event study is conducted and evaluated also separately for all the indices. Moreover, the event study that is performed separately for the four indices might induce a challenge regarding the OMXS30 and OMXH25, caused by the relatively small sample sizes in the two indices. Due to this, the samples might have outliers that affect considerably the results of the specific indices.

Third, different results might have been observed if the proxy indices for estimating the model parameters would have been different. For example, if some major index such as STOXX 600 would have been chosen, the betas might have been different altering the market model returns and then the abnormal returns of the study. One could argue that applying one index as a proxy for the sample could be preferable to using each country's all-share indices. However, stocks that are part of the OMXH25, OMXS30, OMXC25, and OMXC20 indices are also part of the respective countries' all-share indices. Yet, most of these stocks are not part of for instance, the STOXX 600 index. Therefore, one could argue that it is reasonable to choose the respective countries all share indices as a proxy.

6 EMPIRICAL RESULTS

This chapter introduces and discusses the findings of this thesis. An evaluation is made based on the share price and trading volume responses to index inclusions and exclusions of companies listed in the Nordic indices OMXH25, OMXS30, OMXC25, and OMXC20. Moreover, the reactions are examined through average abnormal returns and cumulative average abnormal returns of the stocks on index change announcements, and later, the changes becoming effective. To attain a comprehensive view of the index effect in the Nordics, the average abnormal volumes and cumulative average abnormal volumes are also evaluated around the events. The short-term findings are presented first, after which the long-term findings are introduced. The findings are shortly discussed and compared to previous evidence.

6.1 Full sample results

Table 3 presents the average abnormal returns (AARs) and cumulative average abnormal returns (CAARs) around the short-term event windows and the relative adjusted BMP-test statistics. The results of Table 3 display the full sample consisting of all events that occurred in the four Nordic indices between January 2009 and January 2020. AD and ED refers to announcement and effective date, respectively.

Results presented in Table 3 indicate no distinct patterns of abnormal returns occurring around any of the four events. On most event days, the abnormal returns are generally small and statistically insignificant. Despite of no clear return patterns, occasional days with statistically significant abnormal returns are observed, suggesting temporary price shocks around the events. However, the observed abnormal returns are rather conflicting between each other and no straightforward conclusion about the effect can be made.

Table 3. Abnormal returns around the short-term event windows

	Additions				Deletions		
	Event days	AAR	Adjusted BMP		Event days	AAR	Adjusted BMP
AD	-5	0.08%	0.209	AD	-5	0.01%	-0.443
	-4	-0.01%	-0.475		-4	0.46%	2.538**
	-3	0.50%	2.101**		-3	0.08%	-1.404
	-2	0.18%	0.570		-2	-0.34%	-0.461
	-1	0.24%	0.981		-1	0.13%	0.869
	0	0.04%	-0.146		0	0.21%	-0.274
	+1	-0.38%	-1.156		+1	-0.66%	-3.067***
	+2	0.14%	0.081		+2	-0.28%	-0.061
	+3	-0.59%	-2.090**		+3	-0.23%	0.953
	+4	-0.35%	-0.409		+4	0.51%	0.943
	+5	-0.28%	-0.903		+5	0.55%	1.761*
		CAAR				CAAR	
	-1 ; +1	-0.10%	-0.748		-1 ; +1	-0.32%	-1.214
	-5 ; +5	-0.43%	-0.460		-5 ; +5	0.45%	-0.059
	Event days	AAR	Adjusted BMP		Event days	AAR	Adjusted BMP
ED	-5	-0.36%	-1.546	ED	-5	0.46%	-0.164
	-4	0.13%	0.253		-4	0.21%	0.512
	-3	-0.03%	-1.105		-3	-0.19%	-0.292
	-2	0.04%	0.010		-2	-0.51%	-1.609
	-1	0.09%	0.735		-1	0.91%	2.334**
	0	0.16%	1.492		0	0.37%	1.055
	+1	0.25%	1.054		+1	-0.24%	-0.548
	+2	0.33%	0.998		+2	0.25%	1.098
	+3	-0.85%	-1.287		+3	-0.16%	-1.625
	+4	0.01%	0.792		+4	-0.04%	-0.154
	+5	0.04%	-0.107		+5	-0.20%	-0.332
		CAAR				CAAR	
	-1 ; +1	0.50%	2.284**		-1 ; +1	1.04%	1.835*
	-5 ; +5	-0.19%	0.307		-5 ; +5	0.85%	0.100

-1; +1 =Cumulative Average Abnormal Return (CAAR) of 3-day event window around the event date.
-5; +5 = Cumulative Average Abnormal Return (CAAR) of 11-day event window around the event date.
* = significance at the 10% level, ** = significance at the 5% level and *** = significance at the 1% level.

More specifically, Table 3 shows that around index deletions the announcement of exclusion results in a significantly negative share price response on the day after the announcement. This suggests that the announcement of index deletion is likely taken as negative news. On the contrary, after the announcement of index addition no positive returns are observed. Moreover, on the announcement day of additions there occurs nearly zero abnormal return indicating no surprise or new information being published on that day. Therefore, it is possible that the information about the addition is already incorporated into the stock price before the announcement day, or that the announcement of the information does not simply affect the stock price. Moreover, prior to the announcements of index deletions and additions, significant positive abnormal returns occur on days -4 and -3, respectively. This one-day positive pre-announcement return effect prior both announcements could suggest some anticipatory trading. Therefore, next the long-term effects are observed before the announcement day to make further conclusions whether observable anticipatory trading occurs or not. Overall, straightforward conclusions about the announcement effects cannot be made. This is due to the return effects being rather conflicting. For instance, announcement of index deletion leads to negative returns, but announcement of additions has no return effects. Additionally, positive returns occur before both events. Furthermore, no multi-day price drifts are found around the announcements. For these reasons, we conclude that the price effects around index change announcements are rather negligible.

For effective dates, Table 3 shows no distinct return patterns. When index additions become effective, only the cumulative average abnormal return during the three day event window (-1;+1) implies significantly positive abnormal returns around the effective date. This indicates that some abnormal trading around the effective date potentially occurs that results in positive stock price drift during the three-day event window. Symmetrically for index deletions, positive cumulative average abnormal return occurs during the three day event window (-1;+1) as well as positive AAR on day -1. However, the one-day return effects around effective dates are mainly small and statistically insignificant, and thus no return patterns can be discovered. Therefore, no straightforward conclusions should be drawn on the effective date effects either.

In contrast to the results of this thesis, for example Lynch and Mendenhall (1997) find significant positive (negative) price effects on the announcement day in the S&P 500. However, findings of Kappou et al. (2010) suggest that all abnormal returns are generated right after the announcement of index changes. Whereas, Bechmann (2004) claims that his results do not imply clear overall stock price effects around the announcement date, but instead around the effective date. The results of this thesis around the short-term event windows show index deletions generating negative one-day abnormal returns right after the announcement, which is in line with the findings of Kappou et al. (2010). Additions face positive one-day AAR before the announcement that tends to revert and turns into one-day negative AAR after the announcement, which is in line with the findings of Mase (2007) but contradicts the suggestions of Kappou et al. (2010). Furthermore, somewhat similarly to Bechmann's (2004) findings, both index additions and deletions generate positive cumulative average abnormal returns around the effective date. Overall, the short-term findings indicate no distinct return patterns around the events despite a few days with abnormal price movement. Next, it seems relevant to assess whether the few observed daily price movements around the events are temporary shocks or does the price drift for a longer time period. This can be done by analyzing the long-term return effects around index changes.

Figure 3 illustrates cumulative average abnormal returns from 30 days prior to the announcement day until 10 days after the announcement. For deletions, the CAAR increases well before the announcement. However, on the announcement date (day 0), the CAAR experience a negative drop that lasts for the next three days, supporting the finding of the short-term negative price shock after the AD for deletions. For additions, the CAAR is relatively stable throughout the event window. Furthermore, the returns are not increasing before the announcement of additions, suggesting that no anticipatory trading occurs beforehand. Additionally, the findings shown in the figure are against the selection criteria hypothesis. This is because the hypothesis claims that decreasing market value is often a reason for index deletions (as it is one of the two selection criteria in the OMXC indices) but instead, the figure shows that the market values have increased before the announcement for deletions. However, it is possible that the market value has decreased before the 30 days that are observed in the event window, which have led to index deletion or that the trading volumes (being the other selection criterion) have been decreasing.

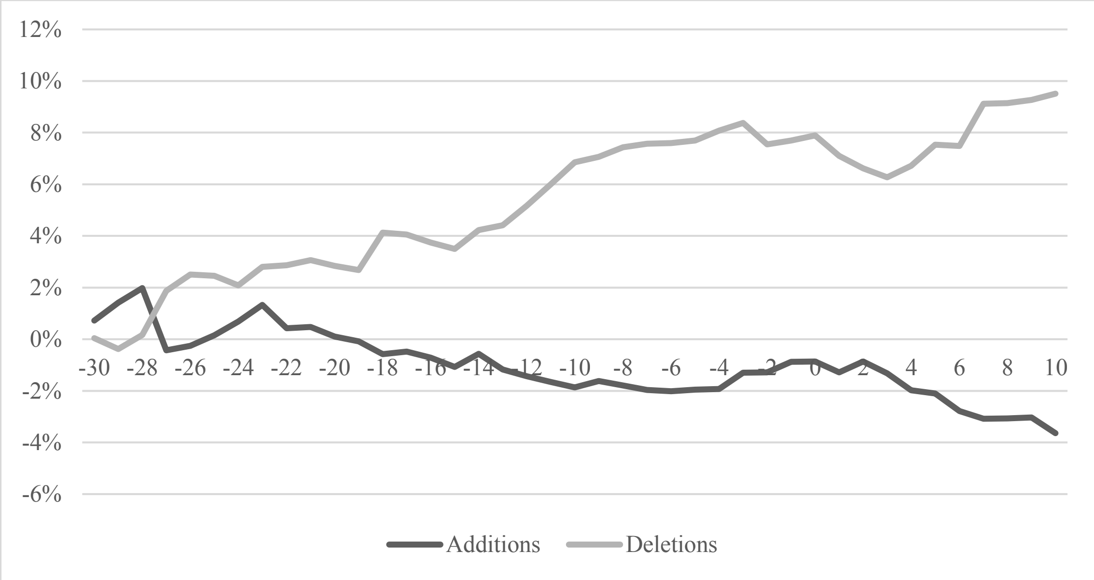

Figure 3. CAAR around the announcement date -30 to 10

Figure 4 shows CAARs around the effective date (from 10 days prior until 30 days after). For both additions and deletions, a slightly positive price pressure around the effective date can be observed which was also found in Table 3. After the effective date the CAAR of additions seem to have a downward multiday price drift and vice versa.

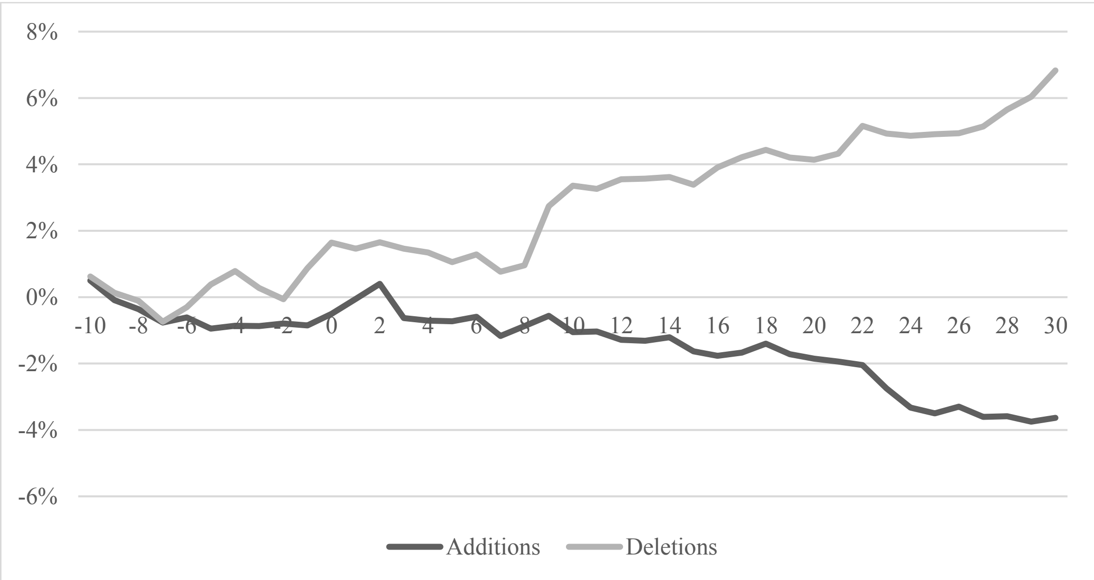

Figure 4. CAAR around the effective date -10 to 30

To give a more detailed description of the results, Table 4 shows the long-term cumulative average abnormal returns and relative adjusted BMP statistics for the sample both before and after the events during five different event windows. More specifically, the table illustrates the long-term effects by assessing the cumulative average abnormal returns from 50 days before the announcement day until 50 days after the events become effective. This allows us to capture both long-term pre-announcement effects and post-effective date effects. The event window of 10 days before the effective date until the ED allows us to capture the price effects between the announcement and effective dates.

Table 4. Cumulative average abnormal returns around the long-term event windows

		Additions	Deletions
CAAR [AD: -50 ; 0]		-2.40%	9.90%
	Adjusted BMP	-1.549	1.515
CAAR [AD: -20 ; 0]		-0.47%	4.20%
	Adjusted BMP	-0.573	1.346
CAAR [ED: -10 ; 0]		-0.63%	1.22%
	Adjusted BMP	-0.535	0.196
CAAR [ED: 0 ; +20]		-1.34%	3.12%
	Adjusted BMP	1.380	0.715
CAAR [ED: 0 ; +50]		-4.72%	8.77%
	Adjusted BMP	-1.346	1.955*

*** Statistically significant at the 1% level

** Statistically significant at the 5% level

* Statistically significant at the 10% level

The long-term cumulative average abnormal returns are mainly insignificant as only the event window starting from the effective date to 50 days ahead has significantly positive CAAR. Therefore, we argue that index inclusions as well as exclusions do not have permanent price effects. The long-term results do not to support the findings of many studies arguing that inclusions (exclusions) are followed by price increases (decreases) that are persistent over time (see e.g. Shleifer, 1986; Bechmann, 2004). In fact, the long-term results indicate that the occasional price movements that occurred in the short-term tend to revert quickly and not last over a longer period. These long-term results are mostly in line with the findings of Harris and Gurel (1986), because the occasional short-term abnormal returns seem not to last over a longer-period. Results of Beneish and Whaley (1996) as well as Lynch and Mendenhall (1997) suggest that in the S&P 500 the prices seem to take the form of a multiday positive (negative) drift from the announcement date of index additions (deletions) till the effective date. This finding is contradictory to the results of this thesis as the CAARs observed in the event window starting from day -10 to ED are insignificant for both additions and deletions, suggesting no price drift between the announcement day and effective day in the Nordic indices. Kappou (2018) finds similar results suggesting that for the first time there exist no abnormal return opportunities between announcement and effective date in the S&P 500 in data obtained after October 2008.

In general, the occasional short-term price effects observed are mostly consistent with the price-pressure hypothesis, because the price effects are temporary shocks possibly caused by abnormal trading volumes. For example, Harris and Gurel (1986), and Lynch and Mendenhall (1997), conclude similarly in the S&P 500 index and claim that prices revert after the index change events. Moreover, Harris and Gurel (1986) argue that index changes do not imply any new information to the public because the price effects are only short-term shocks and revert in the long-term – which appears to be the case in this thesis as well. The temporary price shocks observed in the thesis are best explained by temporary excess demand and supply occurring around the events (price pressure). However, in order to make further implications whether there actually occurs excess demand and supply, the abnormal volumes around the events are examined in section 6.3.

In contrast to earlier evidence, Kappou et al. (2010) and Kim et al. (2017) suggest that in recent years, stock prices have found their equilibrium prices faster after an index change events. This implication is partly consistent with this research because only occasional price movements are observed. The overall results of this thesis are conflicted with the majority of earlier studies, as most of the earlier evidence suggests that the index effect evidently exists in the S&P 500 index and measurable short- and long-term abnormal returns are found. The price reactions observed in this research are relatively small and indicate that the index effect has only a minor effect on prices of stocks listed in the Nordic indices. Moreover, the index changes seem not to provide any new information to market participants in the Nordics, and it can be therefore concluded that the findings are not contradictory to the efficient market hypothesis.

Petajisto (2008) claims that higher transparency of index selection criteria is related to a lesser extent of the index effect, because the index composition changes could be predicted by market participants. This higher transparency in the Nordic indices could be one explanation for the relatively small price reactions. It is also possible that the effect has been more remarkable before January 2009 and has been diminishing during recent years, which is suggested to be happening in the S&P 500 index (e.g. Kappou et al., 2010; Kappou, 2018; Kim et al., 2017).

6.2 Results of separate indices

To further analyze the return effects, the sample is separated into individual indices, and event study is performed. This allows us to detect whether the effects are similar through all the Nordic indices and further analyze if some of the four indices govern the overall sample results (if the overall sample returns are strongly affected by one or two of the four indices). Table 5 shows the long-term and short-term return effects of the composition changes in the four indices.

In Table 5, addition and deletion events are separated, and cumulative average abnormal returns of the four Nordic indices are reported. The CAARs are evaluated from 30 days before the index change announcements until the announcement to capture potential pre-event effects. The immediate stock price reactions are captured with three-day event windows around the announcement day and effective day. To evaluate whether the effects are temporary or permanent, the CAARs are also evaluated on an event window starting from the effective date and ending 30 days later.

Table 5. Cumulative average abnormal returns on different Nordic indices

		OMXH25	OMXS30	OMXC25	OMXC20
Additions					
CAAR [AD: -30 ; 0]		-0.89%	17.29%	-1.72%	-4.28%
	Adjusted BMP	-0.079	2.634***	-0.548	-2.007**
CAAR [AD: -1 ; +1]		-0.25%	-1.50 %	-0.07%	0.44%
	Adjusted BMP	-0.504	-0.078	-0.798	0.042
CAAR [ED: -1 ; +1]		0.68%	0.32%	1.30%	0.22%
	Adjusted BMP	0.788	1.303	2.047**	0.672
CAAR [ED: 0 ; +30]		-0.82%	-8.86%	0.47%	-4.29%
	Adjusted BMP	0.543	-0.442	-0.188	-1.632
Deletions					
		OMXH25	OMXS30	OMXC25	OMXC20
CAAR [AD: -30 ; 0]		3.53%	12.81%	1.06%	4.46%
	Adjusted BMP	-0.879	1.037	0.706	1.486
CAAR [AD: -1 ; +1]		-0.33%	-0.55%	0.08%	-0.45%
	Adjusted BMP	-1.584	-1.237	-0.120	-0.787
CAAR [ED: -1 ; +1]		0.50%	2.79%	0.71%	0.97%
	Adjusted BMP	0.181	1.720*	0.636	1.108
CAAR [ED: 0 ; +30]		5.06%	13.09%	-0.73%	4.64%
	Adjusted BMP	0.926	1.494	0.172	0.672

*** Statistically significant at the 1% level

** Statistically significant at the 5% level

* Statistically significant at the 10% level

The immediate effects around AD and ED illustrated in Table 5 are mainly similar between the different indices and generally insignificant. Significantly positive CAARs are observed only for OMXC25 additions and OMXS30 deletions in short-term event windows around the ED. In the long-term, returns of OMXS30 seem to differentiate from the other indices, as significantly positive CAAR occurs prior to the addition announcement. However, it must be noted that the sample size is extremely small in the OMXS30 (5 observations), which undermines the internal and external validity of the results regarding the OMXS30. Furthermore, OMXC20 exhibits a significantly negative abnormal return on the event window prior the announcement of index addition.

Nevertheless, the return effects for separate indices are mainly insignificant. Furthermore, the price reactions are mainly similar between the four indices. This finding verifies that there is no single index governing the overall sample results, which would make the full sample results distorted.

6.3 Abnormal volume results

To provide further insight into the index effect in the Nordics, the average abnormal volumes around the events are measured and examined. First, abnormal volumes are observed in the short-term around the events and then in the long-term. The short-term average abnormal volumes (AAVs) are illustrated in Table 6 for all of the four events. The table also shows the long-term cumulative average abnormal volumes (CAAVs) within two different event windows of 30 days before the announcement date until 10 days after, as well as 10 days prior to the effective date until 30 days after.

Table 6. Average abnormal volumes around the events

	Additions				Deletions		
	Event days	AAV	t-test		Event days	AAV	t-test
	-5	18.41%	0.336		-5	1.48%	0.032
	-4	11.50%	0.216		-4	2.92%	0.036
	-3	-5.28%	-0.082		-3	19.92%	0.383
	-2	-0.62%	0.043		-2	8.76%	0.198
	-1	11.73%	0.236		-1	7.94%	0.198
AD	0	12.70%	0.259	**AD**	0	7.34%	0.184
	+1	-8.29%	-0.085		+1	3.46%	0.076
	+2	2.23%	0.041		+2	15.47%	0.312
	+3	-2.16%	-0.031		+3	1.00%	0.033
	+4	-8.37%	-0.093		+4	8.84%	0.156
	+5	8.44%	0.195		+5	3.16%	0.065
		CAAV	t-test			CAAV	t-test
	-30 ; +10	809.88%	2.322**		-30 ; +10	-139.12%	-0.071
	Event days	AAV	t-test		Event days	AAV	t-test
	-5	-15.56%	-0.266		-5	4.93%	0.123
	-4	-4.38%	-0.049		-4	13.50%	0.305
	-3	-0.57%	0.020		-3	24.84%	0.559
	-2	72.31%	1.354*		-2	74.00%	1.525*
	-1	17.31%	0.300		-1	8.09%	0.170
ED	0	-0.09%	0.000	**ED**	0	-2.85%	-0.024
	+1	-0.58%	0.016		+1	-15.58%	-0.250
	+2	4.56%	0.069		+2	-14.32%	-0.235
	+3	-10.09%	-0.188		+3	-20.70%	-0.380
	+4	-22.79%	-0.399		+4	-37.79%	-0.690
	+5	-22.64%	-0.347		+5	-30.24%	-0.530
		CAAV	t-test			CAAV	t-test
	-10 ; +30	289.87%	1.643*		-10 ; +30	-600.91%	-1.901**

* = significance at the 10% level,
** = significance at the 5% level
*** = significance at the 1% level.

Table 6 shows that no significant average abnormal volumes are found around the announcement days in the short-term. Therefore, in the short-term it seems that no anticipatory trading is made before the announcement day, as well as that index change announcements do not lead to any abnormal trading. However, around the effective days, a significant peak in trading volumes occurs two days before the index changes become effective in both additions and deletions.

The result of significant trading volume before the effective date is similar to the findings of Bechmann (2004), who reports that the majority of the abnormal volume in the KFX index occurs one day prior to the effective date. Bechmann (2004) further concludes that this abnormal volume before the effective date provides evidence indicating that some investors are adjusting their portfolios in accordance with the index changes. Similarly, Lynch and Mendenhall (1997) report that the largest abnormal volumes take place on the day before the index additions become effective and claim that to be caused by index funds buying the added stocks to minimize their tracking error. Therefore, it seems reasonable to conclude that the significant trading volumes occurring two days prior to the effective dates for additions and deletions in the Nordic indices are likely caused by investors and index funds aiming to adjust their portfolios in accordance with the index changes.

To draw further conclusions of the trading volume changes, the long-term volume effects are observed. Therefore, the cumulative average abnormal volumes (CAAVs) are calculated for two event periods: 30 days prior to the announcement of index changes to 10 days after, and 10 days before the effective day to 30 days after. The results of these event window CAAVs are illustrated in Figures 5 and 6 and more specifically in Table 6.

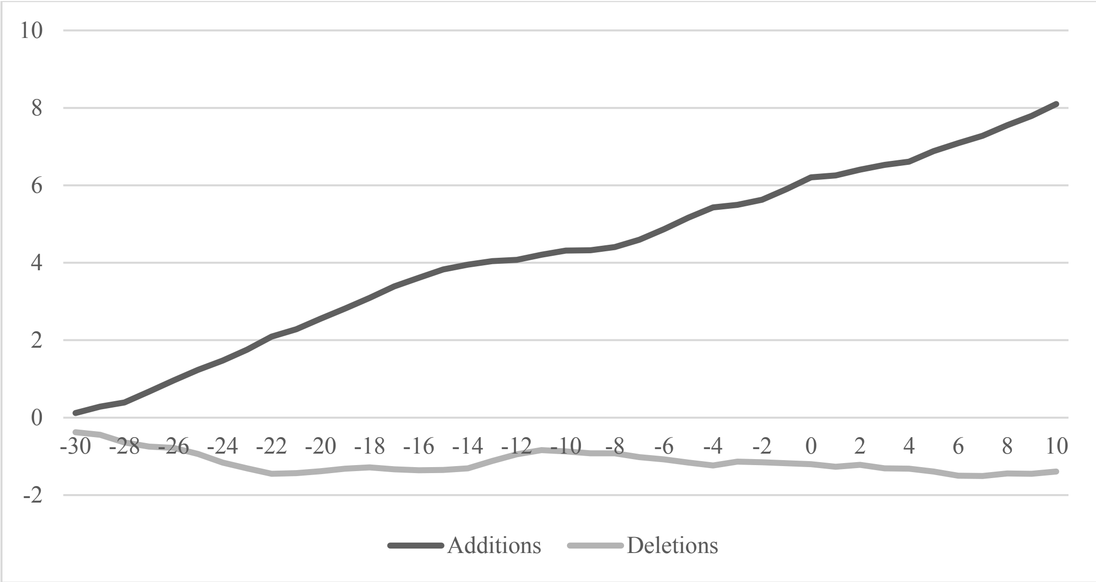

Figure 5. CAAV around the announcement date -30 to 10

Figure 5 shows the CAAVs around the announcement day for both additions and deletions. CAAV of index additions increase linearly throughout the whole event period indicating that investors are trading highly with the included stocks prior to and right after the announcement of index inclusion. This long-term pre-announcement CAAV is also statistically significant for additions as can be seen in Table 6. However, the CAAV of deletions remains relatively stable, and no significant changes in trading volumes are observed during this event period. This result of index additions being more heavily traded before the effective date than index deletions is consistent with the findings of Bechmann (2004). Additionally, this high pre-announcement CAAV of index additions indicates that some anticipatory trading occurs starting from 30 days before the announcement. Furthermore, this pre-announcement trading volume increase might have something to do with the selection criteria of the Nordic indices, as trading volume is one of the factors used for deciding new index constituents. Therefore, it is possible that the high trading volume that takes place have actually caused the inclusion, and not vice versa. Thus, the selection criteria hypothesis potentially explains a part of the results.

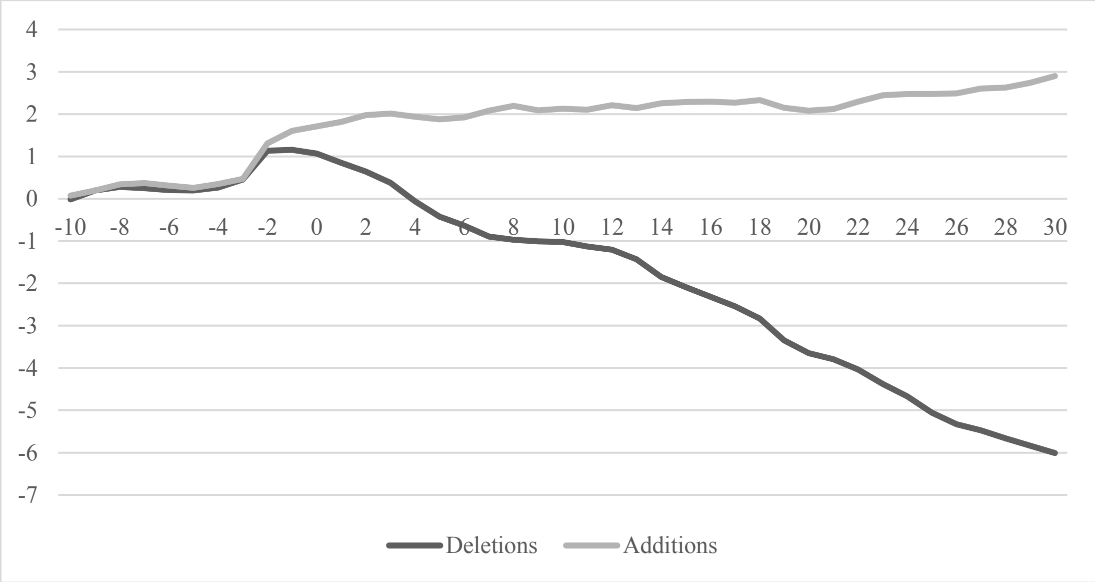

Figure 6. CAAV around the effective date -10 to 30

Figure 6 illustrates the long-term volume effects of the additions and deletions around the effective date. Around both events an increase in cumulative average abnormal volume occurs two days prior to the effective date, which was also identified earlier in Table 6. Moreover, for additions, the volume stays relatively high for the whole event period, suggesting that a somewhat permanent increase in trading volume occurs. This is supported by the fact that the CAAV during the event window is significantly positive as shown in Table 6. On the contrary, for deletions the volume decreases after the effective day and the event window CAAV is significantly negative (Table 6).

Similar results regarding the abnormal volumes have been observed in earlier studies. For instance, Hegde and McDermott (2003) find in-line behavior in trading volumes around the effective date for index additions. They report that the trading volume starts to increase four days prior to the effective date, reaching its peak on the effective date. Furthermore, they say that the abnormal volume remains high after the effective date for index additions, suggesting that increased liquidity could potentially be the explanation for such effects. Additionally, Kappou et al. (2008) find permanent volume increases, supporting the liquidity hypothesis. In addition, Harris and Gurel (1986) suggest that inclusion to the S&P 500 index increases the stocks' volume permanently and further claim that this is due to funds (not limited to index funds) being more willing to trade with the stocks when they are a part of the index.

The results shown in Figure 6 and Table 6 provide evidence for potentially improved (reduced) liquidity for stocks added (deleted) to (from) the Nordic indices, as the results show signs of a somewhat permanent trading volume increase for additions and decrease for deletions. This finding supports the liquidity hypothesis. To draw further conclusions about the role of the liquidity hypothesis in the Nordics, the market microstructure[4] of the Nordic indices should be studied. The market microstructure in terms of the index effect is studied on the S&P 500 index, for example by Chen et al. (2004), but there is no such research made on the Nordic indices. Therefore, future research regarding the market microstructure in the Nordic indices could provide interesting findings.

In addition, the significant short-term abnormal volumes observed prior to the effective dates in Table 6 support the price pressure hypothesis. As the price pressure hypothesis was also the most appropriate explanation for the occasional price movements observed, it seems to best explain the overall findings of this paper. However, especially the price movements do not imply distinct return patterns around index changes and thus, it must be concluded that the role of the index effect in the Nordic indices is rather negligible but observable.

[4] Market microstructure is a branch of finance that focuses on the details of how exchange occurs in stock markets.

7 CONCLUSIONS

Stock market indices are occasionally revised in accordance with the methodology that the index applies. These revisions lead to occasional deletions of one or more participant companies from the index and consequently to inclusions of a new company or companies to the index. Contradictory with the efficient market hypothesis, scholars have discovered that these index inclusions and exclusions tend to affect the stock prices resulting in inclusions exhibiting positive abnormal returns while deletions leading to negative abnormal returns. This stock market anomaly is called the index effect. The purpose of this thesis was to examine whether the index effect exists in the Nordic indices and to what extent. This was accomplished by analyzing the abnormal return and volume effects around the index composition change events. In order to draw conclusions of the possible hypotheses that could explain the results, the longevity of the return and volume effects as well as the symmetry in the effects between deletions and additions was to be measured.

The findings of the thesis suggest that the index effect is evident in the Nordic indices. However, the effect is rather negligible since no distinct abnormal return patterns are discovered around the index revision events. Instead, abnormal returns on individual days around the events are observed. However, these returns are rather conflicting between each other and thus, straightforward conclusions based on these are not drew. More specifically, around the effective date of index additions and deletions, positive cumulative average abnormal returns are observed as well as significant abnormal trading volume two days prior to the effective date for both additions and deletions. This short-term finding suggests heavy trading by index funds and investors before the changes come into effect. Furthermore, the volume effects are found to be somewhat permanent and symmetric between included and excluded stocks, indicating improved (impaired) liquidity for stocks that are included (excluded) to (from) the Nordic indices. Moreover, abnormal trading volume increases from one month prior to the announcement of index additions. This pre-announcement trading volume increase for index additions can be explained by anticipatory trading or selection criteria hypothesis[5]. Despite the long-term abnormal trading volume occurrence, no long-term return effects are found. This gives support to the efficient market hypothesis since stock prices are relatively unaffected by the significant abnormal trading volumes. To generalize the findings, we conclude that the index effect has a relatively small impact on the returns but distinct impacts on the trading volumes of the stocks in the Nordic indices.

The findings of the thesis are best explained by the price pressure and liquidity hypotheses, because temporary price movements and somewhat permanent abnormal trading volume increases, and decreases are observed. Moreover, the findings do not reject the selection criteria hypothesis which likely explains the results to some degree. Additionally, the relatively small price reactions might be attributed to the Nordic indices having explicit selection criterion transparency. The findings of the thesis are contradictory to most of the research that shows evidence of both long-term and short-term positive (negative) abnormal returns on index addition (deletion) events. However, findings regarding the abnormal volumes in this thesis are similar to the majority of earlier studies. Overall, the results of this thesis mostly agree with the implications of the more recently conducted studies, claiming that the index effect might have changed or diminished over the years. Moreover, the index changes seem not to provide new information to market participants in the Nordics, and thus, the findings are not contradictory to the efficient market hypothesis.

While most of the literature regarding the index effect is conducted on the S&P 500 or other major indices, the results of this thesis provided new insights into the phenomenon by studying the effects in the Nordic indices. Moreover, the Nordic indices provide an information free setting to study the index effect. This information free setting results from the selection criteria that are used in the Nordic indices, as the selection criterion is publicly specified and accessible for everyone, containing only market capitalization and trading volume. Because the index change decisions are

[5] The trading volume is part of the selection criteria in the Nordic indices and, therefore, it is possible that the trading volume has been increasing for some other reason prior the announcement day, that have actually caused the inclusion, and not vice versa. Thus, the selection criteria hypothesis could explain the finding.

conducted based on these publicly available criteria, index inclusions and exclusions in the Nordic indices should not provide any new information to the market participants. For many other indices, including the S&P 500 index, the criterion is nonspecific and not completely based on public information. Additionally, in the S&P 500 index, most of the deletions are caused by company events (e.g. M&A activities, spin-offs, or bankruptcies) leaving only a few pure deletions. This makes it difficult to compare deletion events to addition events. In turn, in the Nordic indices, most of the deletions are put into practice based on the selection criteria methodology, much like the additions. Therefore, addition and deletion events are comparable in the Nordics.

The thesis considers most of the potential biases. Thus, the results are reliable. The findings provide valuable information for all investors but especially for index funds and index trackers. For the Nasdaq Nordics, the results show evidence that the index revision methodology is effective, as no indications of an anomaly regarding the index changes are observed. For investors, the results imply that no notable abnormal return opportunities exist in the Nordic indices around the index change events. For the index effect's field of research, the thesis exhibits evidence that the index effect is relatively small in the Nordic indices where the index changes are information free events.

It would be essential to find out why the index effect is relatively small in the Nordics and whether it has diminished over time or not. Therefore, reasons behind the relatively small effects in the Nordic indices could be one subsequent question for the future research to solve. In addition, analyzing the market microstructure of the Nordic indices would be interesting from the index effect's point of view. It would likely tell whether the liquidity hypothesis plays a more crucial role in explaining the index effect in the Nordics.

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Appendix 1. List of inclusions and exclusions of OMXH 25

	INCLUSIONS		EXCLUSIONS	
Dates	Announcement	Effective	Announcement	Effective
2009-07-20			Metsä Board Corporation B	
2009-08-03				Metsä Board Corporation B
2010-01-14	Kemira Oyj			
2010-02-01		Kemira Oyj		
2011-07-13			Tieto Oyj (TIE1V)	
2011-08-01				Tieto Oyj (TIE1V)
2013-01-10	Huhtamäki Oyj (HUH1V)		Sanoma Oyj (SAA1V)	
2013-02-01		Huhtamäki Oyj (HUH1V)		Sanoma Oyj (SAA1V)
2014-07-08	Valmet Corporation			
2014-08-01		Valmet Corporation		
2015-01-09	Tieto Corporation			
2015-02-02		Tieto Corporation		
2016-07-07	Metsä Board Corporation B		Kemira Oyj	
2016-08-01		Metsä Board Corporation B		Kemira Oyj
2018-07-05	DNA Plc (DNA)		Tieto Corporation (TIETO)	
2018-08-01		DNA Plc (DNA)		Tieto Corporation (TIETO)
2019-07-08	Tieto Corporation (TIETO)		YIT Corporation (YIT)	
2019-07-08	Kemira Oyj (KEMIRA)			
2019-08-01		Tieto Corporation (TIETO)		YIT Corporation (YIT)
2019-08-01		Kemira Oyj (KEMIRA)		
2020-01-10	Kojamo Plc (KOJAMO)			
2020-02-03		Kojamo Plc (KOJAMO)		

Appendix 2. List of inclusions and exclusions of OMXS 30

	INCLUSIONS		EXCLUSIONS	
Dates	Announcement	Effective	Announcement	Effective
2009-06-03	Modern Times Group MTG AB		Eniro AB	
2009-06-03	Getinge AB			
2009-07-01		Getinge AB		Eniro AB
2009-07-01		Modern Times Group MTG AB		
2014-06-05	Kinnevik, Investment AB ser. B			
2014-07-01		Kinnevik, Investment AB ser. B		
2015-12-04	Fingerprint Cards AB ser. B (FING B)		Modern Times Group MTG AB ser. B	
2016-01-04		Fingerprint Cards AB ser. B (FING B)		Modern Times Group MTG AB ser. B
2016-12-07	Autoliv Inc. SDB (ALIV SDB)		Nokia Corporation (NOKIA SEK)	
2017-01-02		Autoliv Inc. SDB (ALIV SDB)		Nokia Corporation (NOKIA SEK)
2017-12-07			Lundin Petroleum AB (LUPE)	
2018-01-02				Lundin Petroleum AB (LUPE)
2018-06-07	Hexagon AB ser. B (HEXA B)		Fingerprint Cards AB ser. B (FING B)	
2018-07-02		Hexagon AB ser. B (HEXA B)		Fingerprint Cards AB ser. B (FING B)

Appendix 3. List of inclusions and exclusions of OMXC 25

	INCLUSIONS		EXCLUSIONS	
Dates	Announcement	Effective	Announcement	Effective
2017-06-09	Bavarian Nordic A/S (BAVA)		NKT A/S (NKT)	
2017-06-09	Sydbank A/S (SYDB)		Topdanmark A/S (TOP)	
2017-06-19		Bavarian Nordic A/S (BAVA)		NKT A/S (NKT)
2017-06-19		Sydbank A/S (SYDB)		Topdanmark A/S (TOP)
2017-12-05	NKT (NKT)		Sydbank (SYDB)	
2017-12-18		NKT (NKT)		Sydbank (SYDB)
2018-06-07	Ambu B (AMBU B)		NKT (NKT)	
2018-06-07	Royal Unibrew (RBREW)			
2018-06-07	SimCorp (SIM)			
2018-06-18		Ambu B (AMBU B)		NKT (NKT)
2018-06-18		Royal Unibrew (RBREW)		
2018-06-18		SimCorp (SIM)		
2018-12-07	Rockwool International B (ROCK B)		Nordea Bank Abp (NDA DK)	
2018-12-07	Sydbank (SYDB)		Bavarian Nordic (BAVA)	
2018-12-27		Rockwool International B (ROCK B)		Nordea Bank Abp (NDA DK)
2018-12-27		Sydbank (SYDB)		Bavarian Nordic (BAVA)
2019-06-11	The Drilling Company of 1972 A (DRLCO)		Sydbank (SYDB)	
2019-06-24		The Drilling Company of 1972 A (DRLCO)		Sydbank (SYDB)
2019-12-10	Topdanmark A/S (TOP)		The Drilling Company of 1972 A	
2019-12-23		Topdanmark A/S (TOP)		The Drilling Company of 1972 A

Appendix 4. List of inclusions and exclusions of OMXC 20

	INCLUSIONS		EXCLUSIONS	
Dates	Announcement	Effective	Announcement	Effective
2009-12-02	Jyske Bank A/S		Coloplast B	
2009-12-21		Jyske Bank A/S		Coloplast B
2010-06-03	Coloplast B		Genmab	
2010-06-21		Coloplast B		Genmab
2010-12-02	Pandora A/S		Lundbeck	
2010-12-02	GN Store Nord		Jyske Bank A/S	
2010-12-02	Chr. Hansen Holding A/S		D/S Norden	
2010-12-20		Pandora A/S		Lundbeck
2010-12-20		GN Store Nord		Jyske Bank A/S
2010-12-20		Chr. Hansen Holding A/S		D/S Norden
2011-06-06			A.P. Møller Maersk A	
2011-06-06	D/S Norden		Nordea Bank AB	
2011-06-06	Lundbeck			
2011-06-20				A.P. Møller Maersk A
2011-06-20		D/S Norden		Nordea Bank AB
2011-06-20		Lundbeck		
2011-12-05	Nordea Bank AB		D/S Norden	
2011-12-05	A.P. Møller - Mærsk A		Pandora A/S	
2011-12-19		A.P. Møller - Mærsk A		D/S Norden
2011-12-19		Nordea Bank AB		Pandora A/S
2012-06-04	Pandora A/S		Sydbank	
2012-06-18		Pandora A/S		Sydbank
2012-12-06	Jyske Bank A/S		NKT Holding	
2012-12-27		Jyske Bank A/S		NKT Holding
2013-12-05	Genmab A/S (GEN)		H. Lundbeck A/S (LUN)	
2013-12-23		Genmab A/S (GEN)		H. Lundbeck A/S (LUN)
2014-06-04	ISS A/S (ISS)		Topdanmark A/S (TOP)	
2014-06-23		ISS A/S (ISS)		Topdanmark A/S (TOP)
2016-06-10	H. Lundbeck A/S (LUN		Tryg A/S (TRYG)	
2016-06-20		H. Lundbeck A/S (LUN		Tryg A/S (TRYG)
2016-12-07	Nets A/S (NETS)		FLSmidth & Co. (FLS)	
2016-12-07	DONG Energy A/S (DENERG)		Nordea Bank AB (NDA DKK)	
2016-12-19		Nets A/S (NETS)		FLSmidth & Co. (FLS)
2016-12-19		DONG Energy A/S (DENERG)		Nordea Bank AB (NDA DKK)

2017-06-09	FLSmidth & Co. (FLS)		Nets A/S (NETS)	
2017-06-09	Nordea Bank AB (NDA DKK)		William Demant Holding (WDH)	
2017-06-19		FLSmidth & Co. (FLS)		Nets A/S (NETS)
2017-06-19		Nordea Bank AB (NDA DKK)		William Demant Holding (WDH)