The Impact of OMXS30 Index Revisions Announcements on Stock Returns and Volume

Analyzing Index Revisions Effects Around the Announcement Day

Andreas Frantzich & Albin Nilson

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Supervisor: Jian Hua Zhang

Department of Economics

School of Business, Economics and Law

University of Gothenburg

Abstract:

This thesis examines the impact of revision announcements of the OMXS30 index, analyzing firm specific deviations in returns and volume during an event window surrounding revision announcements. By using event study methodology, announcement data of *Joiners and Leavers* of the index from 1995 through 2024 analyzes Abnormal Returns and volume to examine the semi-strong form of the *Efficient Market Hypothesis*. The results find significant Abnormal Volume of stock inclusions and exclusions, particularly during days close to and after announcements, with inclusions slightly more significant. Results of Abnormal Volume are partly consistent with the *Investor recognition Hypothesis*. Abnormal Returns are largely insignificant and challenge the *Efficient Market Hypothesis*, instead suggesting that the market does not reevaluate affected stocks on the event day, or much at all in the period following the announcement. These results deviate from previous literature by finding no significant Abnormal Returns during index revision announcements, emphasizing the OMXS30's unique selection criteria and its implications of mitigating stock reactions of inclusion and exclusion.

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1 Introduction

1.1 Background

The rising popularity of passive index fund investing, aiming to track the performance of a certain stock market index, doubled during the last fifteen years according to Dagens Industri (2019). Index funds adjust their portfolios whenever the index composite changes in order to minimize tracking error, potentially driving volume towards stocks that are included and excluded during the revision period as funds rebalance their stock holdings. With the increased index fund investing, institutional investments decisions impact on the market may increase due to their great trading volume.

This study focuses on the revision announcement of the OMXS30 index, a composite of the 30 most traded stocks on the Stockholm Stock Exchange. The OMXS30 selects stocks based on a publicly defined criteria which ranks 30 stocks with the highest trading turnover during the past six month period, ending one month before the revision. Index revisions announcements occur semi-annually, once in the beginning of January and once in July. Nasdaq, which manages the index, publishes the revision announcement at least five days and up to one month prior to the revision taking place. The revision announcement lists the stocks which will be added and (or) removed during the revision event. Prior research on other indices suggest affected stocks experience significant Abnormal Returns and Volume in the period leading up to and following the announcement. This challenges the semi-strong form of the *Efficient Market Hypothesis*, which expects stocks to instantly and fully reflect all publicly available information (Fama, 1970). The discussion whether index revision announcements should affect share prices is explained by the *Information Hypothesis* (Jain, 1987), as being a part of an index is not necessarily changing the fundamentals of affected firms. However, alternative explanations of abnormal returns in connection to index revision announcements exist.

Previous literature argues the change in demand from index fund portfolio rebalancing is so great it causes share prices to deviate from their intrinsic value, with positive and negative effects for inclusions and exclusions respectively. This is the foundation of the *Price Pressure Hypothesis* (Scholes, 1972) and *Imperfect Substitutes Hypothesis* (Shlifer, 1986). Contrary to what the semi strong form *Efficient Market Hypothesis* asserts, both the *Price Pressure* and

Imperfect Substitutes Hypothesis imply stocks do not just reflect all public information, during periods such as index revision announcements, demand influences share prices.

Others attribute abnormal returns to the cost of information investors are subject to. The *Investor Recognition Hypothesis* (Merton, 1987) suggests stocks included in well-known indices attract more attention from financial analysts, leading to sustained positive Abnormal Returns for stock inclusions as information becomes more readily accessible. Conversely, stock exclusions are expected to generate negative Abnormal Returns following revision announcements, as investors anticipate available information about these stocks will decrease in the future.

1.2 Research Problem

Modern financial markets and theory are based on the notion of efficient markets. The semi strong form of the *Efficient Market Hypothesis* assumes market prices reflect all available information and is symmetric to all investors (Fama, 1970). However, previous studies show significant evidence of Abnormal Return during index revision announcements and revision events (Jain, 1987; Shleifer, 1986), thus, violating the semi strong form of the *Efficient Market Hypothesis* (Fama, 1970). These studies assign Abnormal Returns to several hypotheses, such as *Information Hypothesis* (Jain, 1987) *Price Pressure Hypothesis* (Harris and Gurel, 1986), *Imperfect Substitutes Hypothesis* (Shleifer, 1986) and *Investor Recognition Hypothesis* (Merton, 1987). The Selection criteria effect often influences the testing as stock selection of indices can depend on multiple factors such as market capitalization, trading volume and sector balance (Edmister, Graham and Pirie, 1994). This causes selection bias due to the eligibility criteria which favours stocks with major increase in market value and excludes poorly performing firms with falling market value (Edmister et. al, 1994). Furthermore, selection bias is observed in S&P 500 studies as removals come as a result of corporate events, such as delistings and mergers, leaving few clean observations available for dataset samples (Harris and Gurel, 1986; Bechmann, 2004). Other index studies find exclusions experience significant abnormal negative performance following the revision announcement (Bechmann, 2004). Publicly available selection criteria based on trading turnover months prior to the event should not reveal any new public or private information about the stock, since it is not indicative about firm fundamentals and is accessible to market participants (Bechmann, 2004).

1.3 Research Purpose

The thesis's primary purpose is examining the semi-strong form market efficiency of the Stockholm Stock Exchange by conducting an event study of the index revision announcement of the OMXS30 index. Information of index changes are known further in advance due to the OMXS30 announcement unlike indices such as the S&P 500, where revision announcements are made public a few days in advance. Measuring the effect from the official semi-annual revision announcement from the Nasdaq enables analysis of whether the announcement of inclusion or exclusion causes volume and (or) returns to exhibit abnormal deviations during an event window (day -5 to day 5). The transparency of the OMXS30 methodology and criteria based solely on trading volume, allow for a straightforward testing of multiple hypotheses compared to other indices. Potentially minimizing bias from criteria effects which influences other similar index studies (Bechmann, 2004). This helps explain index revision announcements impact on Abnormal Return and Volume, while contributing to a broader understanding of how transparent index selection criteria affects *Index Effect* event studies. By analyzing the Stockholm Stock Exchange, this thesis provides insights into the relationship between Abnormal Returns and Volume from index revision announcements.

1.4 Research Question

The paper will discuss and answer the following research question;

> How do announcements of OMXS30 revisions impact Abnormal Returns and Volume of affected stocks, and what does this reveal about the efficiency of the Stockholm Stock Exchange?

1.5 Hypothesis

Building on the research question and to further investigate the *Index Effect*, this thesis aims to address the following hypothesis regarding potential Abnormal Returns and Trading Volumes, constructed similar to Ishigami and Takeda (2018):

Hypothesis 1a. Stock inclusions in the OMXS30 experience positive Abnormal Returns during the event window of the announcement.

Hypothesis 1b. Stock inclusions in the OMXS30 experience positive Abnormal Volume during the event window of the announcement.

Hypothesis 2a. Stock exclusions from the OMXS30 experience negative Abnormal Returns during the event window of the announcement.

Hypothesis 2b. Stock exclusions from the OMXS30 experience positive Abnormal Volumes during the event window of the announcement.

1.6 Thesis Layout

Section 2 lays out the theoretical background of the semi-strong form *Efficient Market Hypothesis*, which is the foundation of this thesis. Section 3 conducts a literature review examining and summarizing existing research on index revision announcements. Litterature which is the source of the discussion and comparison with the study's empirical results.

Section 4 explains the methodology the thesis uses, including the formulas for calculating Average Abnormal Return (Volume), as well as Cumulative Average Abnormal Return and Volume. It also details the t-test formula and includes criticism of the methodology. Section 5 focuses on the data collection process, describing data gathering, sample sizes, and other relevant details.

The results and analysis appear in Section 6, with tables summarizing the findings for Average Abnormal Return (Volume), Cumulative Average Abnormal Return (Volume), along with their respective t-values and the number of observations. Section 7 concludes the thesis by evaluating whether the empirical findings align with the research question and suggestions for future research.

2 Theory

The theory section details the strengths and limitations of the semi strong form of the *Efficient Market Hypothesis*. Providing a description of its basic principles, assumptions, and implications in relation to the research.

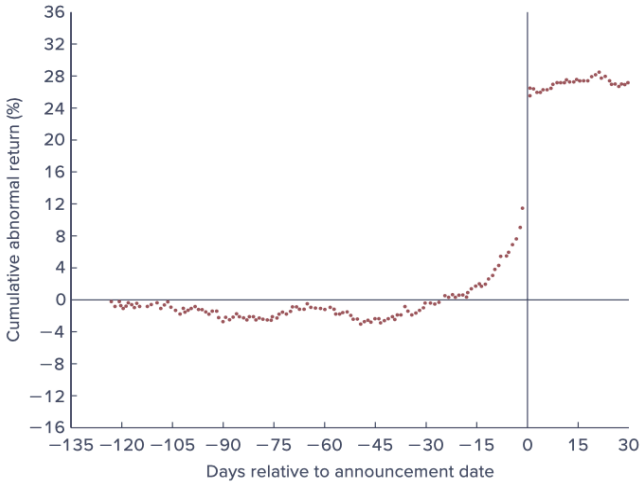
2.1 Efficient Market Hypothesis

The semi strong form *Efficient Market Hypothesis* posits that financial markets are highly efficient and that asset prices fully reflect all public available and relevant information (Fama, 1970). This hypothesis assumes investors, both institutional and private, act rationally, process new information instantly. This results in almost instantaneous price adjustments when new information is available to market participants. According to the semi strong *Efficient Market Hypothesis*, this mechanism makes it virtually impossible for investors to consistently achieve positive Abnormal Returns, as prices already incorporate all public information. In an efficient market, the expected value of Abnormal Returns over time is zero, since there is no room to gain an informational advantage (Fama, 1970).

The *Efficient Market Hypothesis* is generally classified into three forms: weak-, semi-strong-, and strong efficiency (Fama, 1970). In the weak form, asset prices reflect all historical price information, suggesting that technical analysis cannot provide a systematic edge. The semi-strong form asserts that stock prices adjust to all public information, implying that fundamental analysis of companies cannot consistently yield Abnormal Returns. Most markets today are semi-strong efficient and it is what the thesis examines. In semi-strong form, announcements of new information should only yield Abnormal Returns on the event day, since an efficient market reacts instantly to release of new publicly available information (Bodie et. al, 2018). Event studies on index revisions announcements test semi-strong form by analyzing this before, during and after the announcement (see graph 1). If there are Abnormal Returns before the event day, the test detects information leakage or insider trading of affected stocks. Abnormal Returns days following the announcement indicate stocks do not reflect all the new information instantly. Abnormal Returns before or following the announcement contradicts the semi-strong form of market efficiency, suggesting markets do not reflect publicly available information immediately (Bodie et. al, 2018).

While the semi strong form of the *Efficient Market Hypothesis* is fundamental in finance theory, empirical research documents several instances where it does not fully hold and leads to market inefficiency. Market inefficiency leads to mispriced securities, which may allow investors to generate returns above the market average. Market anomalies, such as the *Index Effect*, illustrate cases when the release of information is an opportunity to generate Abnormal Returns. Several studies find different market reactions of revision announcements events, therefore the possibility of yielding Abnormal Returns exists. Behavioral finance theories also propose that cognitive biases and irrational behaviors, such as herding and overconfidence cause price deviations from a stock's intrinsic value, challenging the semi strong form of the *Efficient Market Hypothesis* assumption of fully rational investor behavior (Fama, 1970; Shleifer, 1986).

Graph 1 is from Bodie et. al (2018) and shows the Cumulative Abnormal Return relative to the announcement date of new information, according to the semi strong form of the *Efficient Market Hypothesis*. It describes the information leakage before the event day (0).



3 Literature Review

The literature review examines hypotheses and empirical studies relevant to the thesis, providing a foundation for understanding the topic from previous academic research.

3.1 Information Hypothesis

Jain's (1987) study find evidence for price effects for both inclusion and exclusion from the S&P 500 index, suggesting listing and removal from the index signals relevant information about affected firms. To test the *Price Pressure Hypothesis* and *Information Hypothesis*, Jain (1987) chose to examine additional supplementary S&P indices that do not require them to adjust their portfolio to mirror the index following a revision. Both S&P 500 and supplementary indices after revisions have significant effect on inclusions as well as exclusion share prices. The price effect for securities after a revision is not entirely due to increased trading volume by large institutions, but rather a shift in sentiment accredited to the event. Effects are lasting and independent of firm size in contrast to the *Price Pressure Hypothesis*, which suggests greater impact on smaller firms in the short run, due to liquidity constraints (Jain, 1987). *Information Hypothesis* is presented as the main contributor of price effects (Jain, 1987). The sentiment change is attributed to the perceived information content gathered from the S&P's selection criteria, a potential signal of shift in the firm's fundamentals in the future. As a result, prices drop in anticipation of information becoming less easily accessible in months following the revision (Goetzmann and Garry, 1986). Similarly, a study of the Russell 2000 index shows significant positive (negative) Abnormal Returns of additions and removals, suggesting an index membership leads to long term increase in either information flow and liquidity, or both (Madhavan, 2003).

Dhillon and Johnson (1991) analyze index revision post-announcement and Abnormal Returns by observing the price of a newly listed firm's stock, bond and options returns. The study finds stock, bonds and call options of stock inclusions generally all experience lasting price increases, while the put options decline. This is indicative of investors interpreting listing into a large index as a signal of either reduced risk or higher quality of the firm (Dhillion and Johnson, 1991). The results also show an elevation of trading volume following the announcement, which peaks around the revision event but does not revert back to preannouncement levels. This suggests investors view the inclusion as positive information

about stock inclusions (Dhillion and Johnson, 1991). The findings seem to align with *Imperfect-substitutes Hypothesis*, but Dhillion and Johnson (1991) argue different asset classes (stock, bonds, options) are not close substitutes in real world scenarios.

3.2 Price Pressure versus Substitution Hypothesis

The *Price Pressure Hypothesis* asserts Abnormal Returns in the short run derive from large transactions of securities, which cause imbalance between supply and demand (Scholes, 1972). This indicates market demand influences price in the short run, as large transactions drive volatile price movements, but reverting back to equilibrium in the mid and long term after the initial reaction (Scholes, 1972). Proponents of the *Price Pressure Hypothesis* argue the increase in money flow from institutions and index funds drive demand since they are obligated to track the performance of the market composite (Pruitt and Wei, 1989). Index funds manage substantial amounts and are usual investment vehicles for local and overseas investors that want a passive exposure to other countries' equity markets (Bechmann, 2004). Institutions and index funds are shown to increase (decrease) their holdings of stock following index revisions announcements which contribute to increases in demand in connection to revisions (Pruitt and Wei, 1989). Studies find significant evidence showing increase in volume (liquidity proxy) to be permanent for inclusions into the S&P 500, with volume peaking around the event window to later revert back to a new higher equilibrium state (Dhillion and Johnson, 1991; Harris and Gurel 1986; Edmister et. al, 1994). Removals from the S&P 500 show significant positive volume and negative Abnormal Returns. Volume reverts back to equilibrium when liquidity normalizes while returns do not (Goetzmann and Garry, 1986). With other studies suggesting exclusions after the initial trading volume increase, stock exclusions experience a decrease in volume in the months following the revision itself (Chan and Howard, 2002). The temporary liquidity increase of stocks included (or excluded) following index revision announcements come as a result of institutional investors reconstructing their portfolios to minimize tracking error, which lead to lower transaction costs, lowering bid-ask spreads (Madhavan, 2003; Edmister et. al, 1995). Exclusions appear more prone to pronounced price effects in relation to announcement and revision relative to inclusions (Papachristou et al., 2018; Bechmann, 2004). This implies removals from the index are less liquid as a result of the exclusion and thus more sensitive to supply increases (Bechmann, 2004). In the case of open ended indices, an increase in volume and Abnormal Returns is seen prior and in some cases peak at the announcement date. This

indicates speculation on the upcoming revision changes, as the public methodology allows investors to calculate the outcome with greater certainty as the announcement day approaches (Howard and Chan, 2002; Papachristou et. al, 2018; Bechmann, 2004; Chung and Kryzanowski, 1998). This creates a longer time frame for the announcement effect compared to close end indices such as the S&P 500, where the revision result is difficult to calculate prior to the announcement.

In contrast, the *Substitution Hypothesis* argues stocks are largely interchangeable to investors, which indicates large trade blocks of shares should not have lasting effects on share prices. Since investors consider stocks as close substitutes, they are able to adjust their holdings of securities at current market prices (Scholes, 1972). Prediction errors define the Abnormal Return for each stock not attributed to market movements. The prediction errors are analyzed around the secondary distributions period to test the effect from large transactions and test the hypotheses. Scholes (1972) finds support for the *Substitution Hypothesis* with no persistent price declines after secondary distributions, which is attributed to investors' view that companies in the same sector are often seen as substitutes to each other. Suggesting markets adjust quickly and efficiently to secondary distributions, absorbing the large quantity of stock with no price changes. This implies stocks are close substitutes, as the share price effect from secondary distributions are insignificant and similar to the S&P 500 (Scholes, 1972).

Graham and Pirie (1994) test the *Price Pressure* and *Imperfect Substitution Hypothesis* on a particular index revision. The S&P 500 removed one stock and did not include another, which forced index funds to increase their holdings of all S&P 500 stocks by 0.9% without an inclusion event. This event is interesting since there is no change in investor recognition or additional information about the remaining stocks already in the index, allowing for testing of purely demand changes. Following the announcement, the study finds significant positive increase in trading volume of the remaining S&P 500 stocks, normalizing days later. The price did not show any Abnormal Returns, suggesting the market absorb the demand increase without price deviations (Graham and Pirie, 1994). This suggests results of Abnormal Returns in other index revision studies is due to the *Information* or *Investor Recognition Hypothesis*, while the market is liquid and stocks are substitutes when there is no present information disclosure or change in attention (Graham and Pirie, 1994).

3.3 Imperfect Substitutes Hypothesis

Earlier studies show index revision announcements yield Abnormal Return for both inclusions and exclusions following the release of the announcement. Shleifer (1986) explains Abnormal Returns of stocks during index revisions announcements and introduces the *Imperfect Substitutes Hypothesis*. This suggests stocks demand curves slopes downward, in contrast to earlier theories such as CAPM and APT that posit stock demand curves are horizontal. If demand affects stock prices, the market is inefficient due to illiquidity or inelastic demand (Graham and Pirie, 1994). Shleifer (1986) investigates index revision of the S&P 500 and stock price effects following the announcement and introduction into the index. Horizontal demand curves implies demand changes do not affect stock prices even if the volume increase is substantial, because stock prices only reflect all publicly available information and not liquidity, as the semi strong form *Efficient Market Hypothesis* suggests (Fama, 1970).

Shleifer (1986) finds stock inclusions of the S&P 500 sustains positive effective returns up to ten days following the index revision, which aligns with buying pressure from index funds purchasing shares to reflect the new market index. Index funds have grown in significance and manage substantial portions of ordinary investors' capital (Shleifer, 1986). Institutions' holdings of stocks before and after S&P 500 revision show positive correlation with Abnormal Returns and trading volume (Pruitt and Wei, 1989). In the case of a downward sloping demand curve, it challenges the notion that stock's fundamental value derives solely from publicly available information, but also is sensitive to demand changes.

Shleifer (1986) tests whether inclusion into the S&P 500 contains information about the firm and is the reason for the excess returns, by comparing the performance of securities with high and low grade S&P bond ratings to measure their impact on share price. The data indicates there is no significant difference in Abnormal Return after revision based on the stocks’ bond ratings (Shleifer, 1986). This challenges whether index inclusion should be regarded as positive information about a firm's quality and the S&P and similar index fund providers have special information about included stocks, since there is no correlation between S&P bond rating and inclusion performance (Shleifer, 1986). *Index Effect* studies in the European markets have come to similar conclusions, arguing public selection criteria and methodology restrict speculation about the information an index inclusion brings (Bechmann, 2004).

3.4 Investor Recognition Hypothesis

Merton's (1987) model of capital market equilibrium under incomplete information, contrasts conventional models such as the CAPM, which assumes investors act under complete information about the market. The cost of information contributes to prices not fully reflecting all publicly available information, as information or important tools to analyze data might not be available at zero cost (Merton, 1987). Hence, it is possible to expect the markets to be inefficient (Beaver, 1981). Being a part of large indices such as the S&P 500 (or OMXS30) will attract greater attention, lowering research costs of stock inclusions and broadening their investor base. The research costs investors are subject to and the size of the stocks investor base is a reason behind market segmentation (Merton, 1987). When size requirements are not part of the index revisions selection criteria, fewer changes in the index are expected. However, the effect of inclusions is stronger on smaller firms, as they are more likely to benefit from increased visibility, are included and less likely to be removed later on (Bechmann, 2004).

Merton's (1987) model takes the cost constraints of investors into consideration by adjusting for stocks with limited visibility and information. The model introduces a risk premium to compensate for restricted investor knowledge and demand. As a result, firms with less recognition tend to generate higher expected returns in the model (Merton, 1987). This challenges the traditional CAPM model, which asserts an asset's expected return is determined by its sensitivity to market risk (Sharpe, 1964). Merton (1987) attributes the difference in expected return to the existence of asymmetric information among investors, causing investors to neglect certain sections of the market. This restricts diversification and creates a *small-firm effect* which investors could exploit (Merton, 1987). Other studies suggest the long term increase in trading volume of stock inclusions leads to lower transaction costs, causing the price to increase in both short and long term (Edmister et. al, 1995). When considering the effects of exclusion from an index, there is not a direct loss of information, but investors anticipate analysts to neglect the excluded firm which will increase the information cost in the future, leading to lower share prices today (Goetzmann and Garry, 1986).

3.5 Effect of Selection Criteria

Indices in different parts of the world employ different selection criteria, and some are not public to investors. Danish KFX index publicly uses a similar selection criterion to the OMXS30 since 2001, which is solely based on the trading turnover during the reference period (Bechmann, 2004). The S&P 500 index uses closed methodology with multiple factors such as market capitalization, industry and trading turnover (Shleifer, 1986), while the smaller Russell 2000 index selects inclusions solely on market capitalization (Madhavan, 2003). The Australian index uses both market capitalization and liquidity requirements for eligibility (Chan and Howard, 2002). The TSE300 also uses liquidity and market capitalization criteria (Chung and Kryzanowski, 1998). All these indices publish their methodology. The transparency of methodological selection criteria indices use can lead to empirically different results (Edmister et. al, 1994).

As mentioned, the S&P 500 index does not explicitly disclose their criterion. Stock selections into the S&P 500 are firms with superior stock returns relative to the market index during the previous two year period. Rising stock prices cause a selection criteria effect when market capitalization is a requirement (Edmister et. al, 1994). Several studies note the importance of controlling for performance and size requirements in event study methodology, in order to avoid estimation bias (Chung and Kryzanowski, 1998; Chan and Howard, 2002; Bechmann, 2004). After controlling for selection criteria effect, Edmister et. al (1994) find excess returns do not revert back following the announcement, which they did before. The results thus went from suggesting price pressure to being consistent with *Information Hypothesis*.

Exclusions experience similar levels or even greater temporary volume increases relative to inclusions in connection to the announcement (Chan and Howard, 2002; Bechmann,2004). In the KFX index, more than half of exclusions were due to falling market cap and the rest due to falling trading volume (Bechmann, 2004). In other indices, the diminishing trading volume following the announcement is attributed to selection bias, as the exclusion reinforces investors' perceptions of weaker fundamentals (Goetzmann and Garry, 1986). The public selection criteria provide market participants with the opportunity to calculate revision outcomes with increasing accuracy as the reference period approaches the end (Chung and Kryzanowski, 1998; Chan and Howard, 2002). Consequently, it is not impossible that some of the *Index Effects* occur prior to the official announcement (Bechmann, 2004).

4 Methodology

This section provides a description of the event study, formulas, sample and the framework the study uses for data and result analysis.

4.1 Event Study Methodologies

The main objective of an event study is to observe how stock price reacts to the release of an announcement. It measures how well the efficient market processes information. In relation to the semi strong form of the *Efficient Market Hypothesis*, it measures how stock prices react to events with respect to public information (Fama, 1970; Ullah et. al, 2021). The data can be split into two groups to test the effect of positive and negative news in order to control for high variance in the event study (Brown and Warner, 1985).

Brown and Warner (1985) examine event study methodologies associated with using daily return data to measure the influence of non-systematic firm specific events on share prices. Brown and Warner (1980) previously assessed similar observations in event study methodologies with monthly return data with the market model. By applying numerous models such as the ordinary least squares market model and parametric test, the paper investigates the behaviour of abnormal returns on daily return data (Brown and Warner, 1985).

Non-synchronized is a problem in which trading occurs when stock returns and the market benchmark are measured during different trading intervals, potentially leading to biased and inconsistent Beta (β) estimations in the ordinary least squares market model (Scholes and Williams, 1977). Scholes and Williams (1977) and Dimson (1979) propose alternative models which appear to slightly reduce the beta bias that daily data can exacerbate in the ordinary least square market model, particularly in stocks with low frequency trading (Scholes and Williams, 1977; Dimson, 1979). There is an upward bias estimation of stocks with low volume between 10- and 20%, while actively traded stocks observe small and unimportant bias estimations (MacKinlay, 1997). Brown and Warner (1985) further find the ordinary least squares market model adequately powerful to the alternative models while using daily data even in low frequency trading environments.

When testing variance estimation of mean excess return, positive cross-sectional dependence can severely underestimate the variance estimation if no adjustments are made (Brown and Warner, 1980). Corporate events have been shown to significantly increase variance of stock returns around the event day, which can induce bias in the estimation (Patell and Wolfson, 1979). Bias reduces the precision of the statistical test and can cause false positives or negative conclusions about the event, making it more difficult to determine the announcement's effect on price movement and attribute the observed results solely to the event or other factors (McWilliams and Siegel, 1997; Brown and Warner, 1985). Therefore, sample collection should ensure no other firm-specific events fall within the event window to avoid return estimation errors (Lubaktin and Shrieves, 1986). While this might reduce the amount of observations in the sample, research facing the challenge of insufficient data could make use of daily data instead of monthly to increase the dataset (Brown and Warner, 1985; Ullah et. al, 2021). Daily data is more fat-tailed due to higher non-normality than monthly data because of greater volatility in daily data observations, the deviation from normality converges towards a normal distribution as the number of observations increases (Fama, 1976). Brown and Warner (1985) find daily data to be sufficient in simple event study methodologies such as parametric tests. Using daily data detects positive Abnormal Returns more accurately than monthly data while retaining test power.

4.2 Event Study Design

This section presents the formulas and model for calculation of returns and volumes, accompanied by explanation of their application and relevance to the research. The model is designed in similarity with Brown and Warner (1980; 1985). The section also presents the formulas of Average Abnormal Return (Volume) and Cumulative Average Abnormal Return (Volume), in accordance with Ullah et. al (2021).

4.2.1 Expected return & Market Model

The expected return for each stock is calculated with the *Market Model*, the same used by Warner and Brown (1985) which assumes a linear relationship between the stock's return and the market return. The formula is expressed as:

$$E\left[R_{i,t}\right] = \alpha_i + \beta_i * R_m \quad (1)$$

where $E\left[R_{i,t}\right]$ is the Expected Return of stock *i* at time *t*. Alpha and Beta are the ordinary least square values from the regressions of estimation window, and R_m is the Average Return of OMXS30 (market return) during the estimation window. The estimation window, typically set before the event window, is used to establish the relationship between individual stock returns and market returns under normal market conditions. These variables (α and β) are used to predict what the stock's return would have been in the absence of any event that could possibly produce Abnormal Returns (Brown and Warner, 1985).

4.2.2 Abnormal Return

The Abnormal Return for each individual stocks is calculated by comparing its actual return to the expected return;

$$AR_{i,t} = R_{i,t} - E\left[R_{i,t}\right], \quad (2)$$

where $AR_{i,t}$ is the Abnormal Return of stock *i* at time *t*, $R_{i,t}$ is the actual return of stock *i* at time *t*. The Abnormal Return is any possible return that can not be explained by a general movement in the market, this highlights the index revision announcements impact on returns .

4.2.3 Average Abnormal Return

To analyze the event's broader impact across multiple stocks the Average Abnormal Return is obtained by Averaging Abnormal Returns across multiple events;

$$AAR_t = \frac{1}{n}\sum_{t=1}^{n} AR_t, \quad (3)$$

where AAR_t is the Average Abnormal Return, *t* refers to each day of the event window and $\frac{1}{n}$ is used to get the Average Abnormal Return.

4.2.4 Cumulative Average Abnormal Return

To measure the overall impact of Abnormal Returns over a period, the Cumulative Average Abnormal Return (CAAR) is calculated as follows;

$$CAAR_t = \frac{1}{n}\sum_{t=1}^{n} AAR_t, \quad (4)$$

where $CAAR_t$ is the Cumulative Average Abnormal Return during time period *t*. The CAAR helps to quantify the event's overall effect on the securities performance, capturing both immediate and possible delayed reactions within the event window.

4.2.5 Expected Volume

The expected volume for each stock during the event window is calculated as the average trading volume observed in the estimation window, representing trading volume under normal market conditions. The Expected Volume is measured according to the formula;

$$E[V]_i = AvgV_i, \tag{5}$$

where $E[V]_i$ is the Expected Volume of stock *i*, $AvgV_i$ is the Average Volume during the estimation window of stock *i*.

4.2.6 Abnormal Volume

The Abnormal Volume captures the deviation of the observed trading volume from the Expected Volume. To measure the Abnormal Volume of stock *i*, the following formula is used:

$$AV_i = V_{i,t} - E[V]_i, \tag{6}$$

where $V_{i,t}$ is the volume of stock *i* during each day of the event window, time *t*.

4.2.7 Average Abnormal Volume

The Average Abnormal Volume is obtained measuring the mean of the Abnormal Volume across multiple stocks:

$$AAV_t = \frac{1}{n}\sum_{t=1}^{n} AV_t, \tag{7}$$

where AAV_t is the Average Abnormal Volume, *t* refers to each day of the event window and $\frac{1}{n}$ is used to calculate the mean.

4.2.8 Cumulative Average Abnormal Volume

To measure the overall impact of Abnormal Volumes over a period, the cumulative average Abnormal Volume (CAAV) formula as follows:

$$CAAV_t = \frac{1}{n}\sum_{t=1}^{n} AAV_t, \quad (8)$$

where $CAAV_t$ is the Cumulative Average Abnormal Volume during time period *t*.

4.3 Test Statistics

This study uses a parametric t-test, which is a widely recognized method in event studies. It allows for straightforward testing of the statistical significance of Abnormal Returns and Volume, evaluating the significance of the observed variables (eg. Average Abnormal Return, Average Abnormal Volume, Cumulative Average Abnormal Return and Cumulative Average Abnormal Volume) and the deviation from their respective expected values.

Studies such as Brown and Warner (1985) and MacKinlay (1997) find the parametric tests be well specified and exhibit approximate normality under the null hypothesis of no Abnormal Returns, appearing robust and powerful at detecting Abnormal Returns and deviations when using daily data. Brown and Warner (1985) emphasize the advantage of using daily prices over monthly data, highlighting the significant increase in sample size and the enhanced validity of the assumption of normality as the sample size increases. As the number of observations increase, t-test quickly converges to an asymptotic distribution, effective in relation to event study methodology (Brown and Warner, 1985). Therefore, this thesis reasonably assumes the dataset follows an approximate normal distribution.

The following formula calculates the t-value of the t-test (Warner and Brown, 1985; Ullah et. al, 2021);

$$t = \frac{\bar{x}}{\frac{s}{\sqrt{n_i}}}, \quad (9)$$

where t is the t-value, $\bar{x}$ is the sample of x (Average Abnormal Return, Average Abnormal Volume, Cumulative Average Abnormal Return or Cumulative Average Abnormal Volume), s is the standard deviation of variable $\bar{x}$ and n_i is the number of observations used in the sample. The standard deviation(s) is calculated by the formula;

$$s = \sqrt{\frac{\sum_{t=1}^{n} (x - \bar{x})^2}{n-1}}, \quad (10)$$

The t-value is compared to the associated critical value for the significance levels 10%, 5%, and 1%, which are the values this study uses to determine statistical significance. The number of observations, *n,* decide the critical value since smaller sample sizes follow a t-distribution rather than the normal distribution. If the absolute t-value exceeds the critical value, the observed variable is considered statistically significant and rejects the null hypothesis, in similarity with Warner and Brown (1985) and Ullah et. al, (2021).

4.4 Methodology Critique

While the methodology of this study follows established papers, there are inherent limitations that might influence the results of the event study. The data of announcement pre 2008 in Dagens Industri introduces potential inaccuracies due to manual collection and incomplete records. Nasdaq does not possess any records of earlier revision announcement press releases prior to 2008. Additionally, some initial sample inclusions and exclusions have been removed from the sample due to incomplete or missing data. The limitations of the number of revisions available for the study decreases the sample size, this may reduce the testing power (Brown and Warner, 1985) Furthermore, the use of t-tests assumes normality and independence of residuals, which could be improved upon by using alternative models and robustness checks with non-parametric tests to enhance the reliability of the findings (MacKinlay, 1997; Brown and Warner, 1985).

5 Data

The data section describes the OMXS30 index methodology, the construction of the thesis dataset and selection of estimation and event windows.

5.1 OMXS30

The OMXS30 index was introduced on 30th september 1986 and serves as a benchmark for the Stockholm Stock Exchange. The index tracks the performance of a composition of the 30 stocks with the highest traded turnover listed on the Stockholm Stock Exchange. The weighting of the index is determined by market capitalization of a single firm in relation to the total market capitalization of all firms in the index (Nasdaq, 2024).

5.1.1 Index Selection Criteria & Process

Index revision announcements of the OMXS30 occur semi-annually on the first trading day in January and July each year. The criteria for selection is publicly defined and based on the trading volume during the previous six month period, ending on the last trading day of November and May. The continuous revision process selects stocks with the highest trading turnover. The top 15 traded stocks are automatically included into the index, while stocks within the index that are still ranked in the top 30 of trading turnover remain. Stocks ranked outside the top 45 in turnover currently in the index, are excluded. If there are fewer than 30 stocks that meet this criteria, the remaining spot(s) is filled by the next highest trading turnover in the top 45 until the 30 spots are filled. There are no market capitalization requirements for eligibility, but the index weighting is determined by each firm's relative market cap. Before the index revision, Nasdaq publishes the revision changes at least five days prior to it taking effect and up to one month in advance (Nasdaq, 2024).

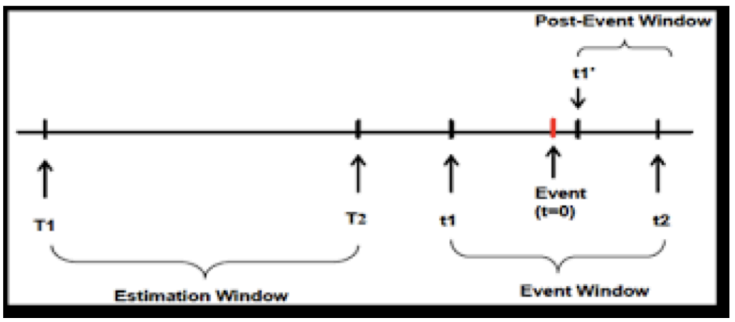
The criteria for index exclusion applies to stocks subject to substantial corporate events such as bankruptcy, delisting and mergers, thus not eligible for selection. In the event of such change in firm fundamentals which deem the stock ineligible for selection, it is immediately excluded from the index. The vacant spot typically remains open until the next revision event. This study will not include these types of exclusions in the dataset. Changes in the index are not mandatory every revision event if no stocks reach the selection criteria (Nasdaq, 2024).

5.1.2 Event Period

The event day (day of the announcement) for each observation is determined when the Nasdaq (previously OMX) or (pre 2007) Dagens Industri issues a press release of the announcement. In order to measure the announcement's impact on share price and volume, the event day is defined as day '*0*' ($t = 0$), see figure 1. For each stock, we collect a sample of 286 daily return and trading volume observations to estimate an event and estimation window. The estimation window (day -280 to day –30 before the event day) is used to estimate the expected returns and expected volumes before the event to ensure the estimations reflect returns and volume under ordinary conditions, see figure 1. This calculates systemic risk of stocks which is needed in regression analysis (Ullah et. al, 2021; (Brown and Warner, 1985).

The event window is defined as the 11 day period around the semi-annual index revision announcement ($t = 0$). The period includes five days before and after (-5 to 5) the event day. The event windows' purpose is to capture the announcement's immediate impact on the sample stock's performance relative to its expected return and expected volume, while also detecting information leakage before announcements and recognition delays following the release as investors react to the announcement (Ullah et. al, 2021). The length of the event window is designed to avoid overlap with the revision event itself. Since OMXS30 methodology allows the announcement to be released up to five days before the revision, extending the period would interfere with the revision event which is unrelated to the study and distorts return estimations (McWilliams and Siegel, 1997; Lubatkin and Shrieves, 1986). The public selection criteria of the OMXS30 revisions provide investors the opportunity to calculate the revision outcome before announcement. Shortening the event window potentially misses some leakage from market participants that calculate the result in advance.

Figure 1 (Ullah et. al, 2021):



5.1.3 Sample Collection

The sample data is collected from Thomson Reuters financial database, Refinitive Eikon (2024). The database has a list of OMXS30 *Leavers and Joiners*, containing every revision inclusion and exclusion between 1995 to 2024 (Refinitive Eikon). Each firm's historical price data is downloaded as daily numerical price, November 28, 2024 (Refinitive Eikon). For a stock to be part of the dataset sample, it requires at least 30 daily return data and no missing data in the last 30 days. However, no observation has less than 100 daily return data points (Brown and Warner, 1985). There are 37 inclusions and 29 exclusions that are eligible to analyze, of these 37 inclusions only 36 observations have available volume eligible to analyze. The volume data for the inclusion of Nordbanken Holding AB is not available, which is the reason for the missing value. The initial list sample includes observations which have corporate events close to the announcement day and during the event window, which could add noise to the sample (Brown and Warner, 1985). Corporate events such as earnings releases significantly increase variance of stock returns around the event day, which induce bias in Abnormal Returns estimations (Patell and Wolfson, 1979; McWilliams and Siegel, 1997). Bias reduces the precision of the statistical test and can cause false positives or negative conclusions about the event. This makes it more difficult to determine the announcement's effect on price movement and attribute the observed results solely to the announcement or other factors (Brown and Warner, 1985). Hence, such observations are removed from the dataset, consistent with procedures from similar studies (Bechmann, 2004; Chan and Howard, 2002; Doukas and Travlos, 1988).

5.1.4 Data Collection

The announcement date of joiners and leavers between 2008 and 2024 is available from official Nasdaq press releases (Nasdaq, 2024). Records date back to 2008, following Nasdaq's acquisition of OMX. 1995 through 2008. Gathering the remaining observations between 1995 and 2008 by scouring through Dagens Industri in the historical archives of the Library of Handelshögskolans computer (DN, 2024). The numerical prices and volumes of the historical data from the sample is compiled in Microsoft Excel, allowing for statistical analysis. In excel, the price and volume data were converted into the daily yielded return and volume.

6 Results & Analysis

This section presents the results in six tables which examines the outcomes of the t-tests conducted to assess the statistical significance of Abnormal Returns and Volumes during index revision announcements by comparing them to the volume and return estimations from the estimation window. The volume data for the inclusion of Nordbanken Holding AB is not available, which is the reason for the missing value.

6.1 Results

Table 1

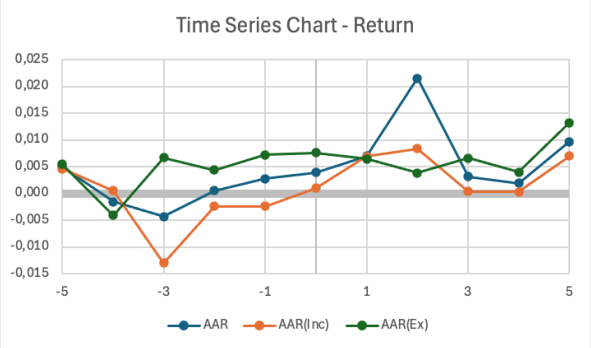
Day	AAR_{Inc}	t-value	n	AAR_{Ex}	t-value	n
(1)	(2)	(3)	(4)	(5)	(6)	(7)
-5	0.005	0.762	37	0.005	0.564	29
-4	0.001	0.075	37	-0.004	-0.827	29
-3	-0.013 **	-2.439	37	0.007	1.419	29
-2	-0.002	-0.483	37	0.004	0.723	29
-1	-0.002	-0.159	37	0.007	1.625	29
0	0.001	0.145	37	0.008	0.940	29
1	0.007	1.229	37	0.006	1.444	29
2	0.008	1.293	37	0.004	0.689	29
3	0.000	0.076	37	0.007	0.769	29
4	0.000	0.042	37	0.004	0.648	29
5	0.007	0.908	37	0.013	1.057	29

Table 1. Average Abnormal Returns (AAR) for stocks included (2) and excluded (5) from the OMXS30 index, across the event window spanning from day -5 to day 5. Values are in terms of growth (%). T-values to assess statistical significance and the sample size *n*. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

The Average Abnormal Return for inclusions (2) are statistically insignificant for all days except day -3, showing significant negative -1,3% return. There are insignificant negative

returns for days -2 and -1. The negative Average Abnormal Return on day -3 corresponds with significant volume increase as seen in Table 1, which suggests selling pressure ahead of the announcement. The exclusion columns are all but one positive, but none are statistically significant. Overall, the return values are close to zero.

Chart 1. Time series chart containing the Average Abnormal Return (AAR) for all stocks in percentage (%), as well as for stocks included (Inc) and excluded (Ex) from the OMXS30 index, across the event window (day -5 to day 5).



AAR is the *Average Abnormal Return*, AAR(Inc) is the AAR of inclusions and AAR(Ex) is the AAV of exclusions.

Table 2

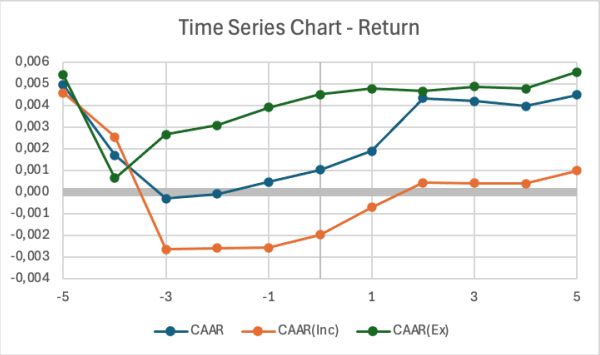
Day's (1)	$CAAR_{Inc}$ (2)	t-value (3)	n (4)	$CAAR_{Ex}$ (5)	t-value (6)	n (7)
-5, 5	0.001	0.192	37	0.006	0.777	29
-5, -1	-0.002	-0.296	37	0.004	0.629	29
0, 5	0.004	0.643	37	0.007	0.888	29
-2, 2	0.003	0.447	37	0.006	1.017	29

Table 2. Cumulative Average Abnormal Returns (CAAR) stocks included (2) and excluded (5) from the OMXS30 index, across aggregated event windows. Values are in terms of growth (%). T-values to assess statistical significance and the sample size *n*. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

Neither inclusions (2) or exclusions (5) exhibit statistically significant Cumulative Average Abnormal Return during the event window presented in Table 2. The insignificant Cumulative Average Abnormal Return values are marginally positive with replacement stocks showing insignificant Abnormal Returns of 0.1% during the event window (-5 to 5). Day -5 to event day -1 show insignificant negative Cumulative Average Abnormal Return of

-0.2%. The insignificance of Cumulative Average Abnormal Returns across test periods shows daily short-term fluctuations from Table 1 and 2 does accumulate to consistent Abnormal Returns of either stock inclusions or exclusions.

Chart 2. Time series chart containing the Cumulative Average Abnormal Return (CAAR) for all stocks in percentage (%), as well as for stocks included (Inc) and excluded (Ex) from the OMXS30 index, across the event window (-5 to 5).



CAAR is the *Cumulative Average Abnormal Return*, CAAR(Inc) is the CAAR of inclusions and CAAR(Ex) is the CAAR of exclusions.

Table 3

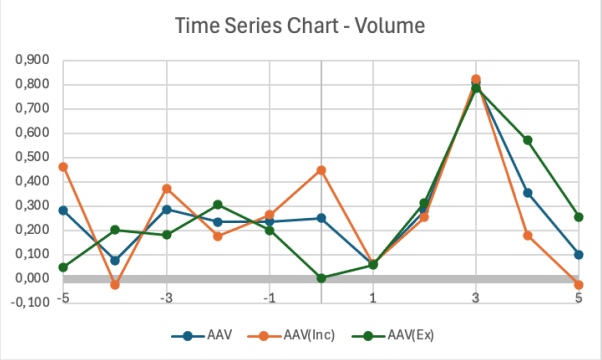
Day	AAV_{Inc}	t-value	n	AAV_{Ex}	t-value	n
(1)	(2)	(3)	(4)	(5)	(6)	(7)
-5	0.464 **	2.271	36	0.050	0.366	29
-4	-0.024	-0.183	36	0.204 *	1.948	29
-3	0.373 *	1.923	36	0.182	1.051	29
-2	0.178	1.596	36	0.307 **	2.267	29
-1	0.265 **	2.283	36	0.202	1.642	29
0	0.450 **	2.249	36	0.006	0.068	29
1	0.064	0.551	36	0.059	0.422	29
2	0.256 *	2.015	36	0.316 *	2.016	29
3	0.826 ***	3.219	36	0.788 *	1.876	29
4	0.182	1.342	36	0.573 **	2.161	29

5	-0.023	-0.187	36	0.256	1.280	29

Table 3. Average Abnormal Volumes (AAV) for stocks included (2) and excluded (5) from the OMXS30 index across the event window, spanning from day -5 to day 5. Values are in terms of growth (%). T-values to assess statistical significance and the sample size *n*. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

Table 3, like in Table 1, divides the Average Abnormal Volume into securities being included (2) or excluded (5) from the OMXS30. Significant Average Abnormal Volume values are observed on several days. Significant Average Abnormal Volume values for inclusions appear on days -5, -3, -1, 0, 2 and 3, with positive returns for all significant days. Showing inclusions react significantly to the announcement with 45% Abnormal Volume on the event day (0). Day 3 is most statistically significant of the inclusions, and also has the highest Abnormal Volume of 82.6%. Average Abnormal Volume for exclusions are significant on day -4, -2, 2, 3 and 4, all positive values in Abnormal Volume. Day 3 is also the day with the highest excess trading volume for exclusions at 78.8%. Day 3 is the peak in both inclusions and exclusions, with falling Average Abnormal Volume in the days following (Chart 2). Table 1 only statistically significantly Average Abnormal Return, which simultaneously corresponds with inclusions day 3 Average Abnormal Volume in Table 3.

Chart 3. Time series chart containing the Average Abnormal Volumes (AAV) for all stocks in percentage (%), as well as included (Inc) and excluded (Ex) stocks from the OMXS30 index, across the event window (-5 to 5).



AAV is the *Average Abnormal Volume*, AAV(Inc) is the AAV for inclusions and AAV(Ex) is the AAV for exclusions.

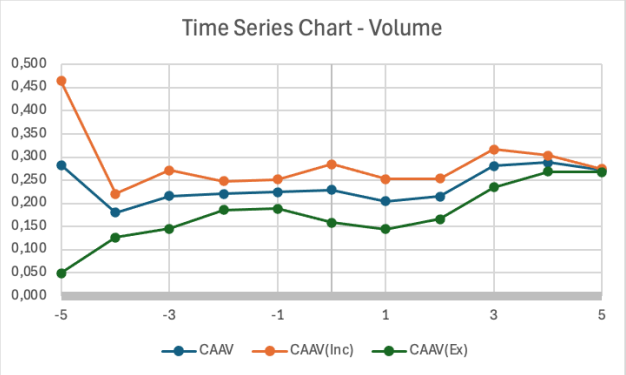
Table 4

Day's (1)	$CAAV_{Inc}$ (2)	t-value (3)	n (4)	$CAAV_{Ex}$ (5)	t-value (6)	n (7)
-5, 5	0.274	1.655	36	0.268	1.346	29
-5, -1	0.251	1.598	36	0.189	1.401	29
0, 5	0.292	1.001	36	0.333	1.389	29
-2, 2	0.243 *	1.754	36	0.178	1.359	29

Table 4. Cumulative Average Abnormal Volumes (CAAV) for stocks included (2) and excluded (5) from the OMXS30 index across aggregated event windows; −5 to 5, -5 to -1, 0 to 5, and -2 to 2. Values are in terms of growth (%). T-values to assess statistical significance and the sample size *n*. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

Table 4 presents significant results for the Cumulative Average Abnormal Volume during the time period from -2 to 2 at 10% significance, showing positive Abnormal Volume of 24.3% for stock inclusions. The other windows show insignificant positive Cumulative Average Abnormal Volume, with similar levels of change in Abnormal Volume for both inclusions and exclusions. The event windows (-5 to 5) are insignificant for both inclusions and exclusions, with 27.4% and 26.8% Abnormal Volume respectively.

Chart 4. Time series chart containing the Cumulative Average Abnormal Return (CAAR) of all stocks in percentage (%), as well as included (Inc) and excluded (Ex) stocks from the OMXS30 index, across the event windows (-5 to 5, -5 to -1, 0 to 5, and -2 to 2).



CAAV is the *Cumulative Average Abnormal Volume*, CAAV(Inc) is the CAAV for inclusions and CAAV(Ex) is the CAAV for exclusions.

Table 5

Day (1)	AAR (2)	t-value (3)	n (4)	AAV (5)	t-value (6)	n (7)
-5	0.005	0.924	66	0.283 **	2.158	65
-4	-0.002	-0.356	66	0.078	0.894	65
-3	-0.00	-1.135	66	0.288 **	2.182	65
-2	0.001	0.141	66	0.236 ***	2.736	65
-1	0.003	0.776	66	0.237 ***	2.821	65
0	0.004	0.756	66	0.252 **	2.097	65
1	0.007 *	1.818	66	0.062	0.695	65
2	0.022	1.465	66	0.283 ***	2.871	65
3	0.003	0.668	66	0.810 ***	3.470	65
4	0.002	0.438	66	0.356 **	2.528	65
5	0.010	1.402	66	0.102	0.906	65

Table 5. Average Abnormal Return (AAR) and Average Abnormal Volume (AAV)for the stocks across the event window (day -5 to day 5), inclusions and excursions grouped together. Values are in terms of growth (%). T-values to assess the statistical significance of these measures and the sample size *n* for each day. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

Average Abnormal Return is statistically significant on day 1, suggesting a marginal positive market reaction after the event day. On day 1, volume is insignificant which does not explain the price increase with corresponding increase in volume. Average Abnormal Returns are otherwise insignificant for the remaining observations. The Average Abnormal Volume is consistently significant, on days -5, -3, -2, 0, 2, 3 and 4. The highest levels of Abnormal Volume is following the event, peaking day 3 with 81% and falling days after. Combining inclusions and exclusions together adds insights by increasing the sample size and finding a general pattern for volumes. Abnormal Returns combining of inclusions and exclusions, if Abnormal Returns is zero, possibly should be more significant.

Table 6

Days (1)	CAAR (2)	t-value (3)	n (4)	CAAV (5)	t-value (6)	n (7)
-5, 5	0.003	0.668	66	0.271 **	2.127	65
-5, -1	0.001	0.113	66	0.224 **	2.119	65
0, 5	0.008	1.601	66	0.310 **	2.170	65
-2, 2	0.004	0.978	66	0.214 **	2.221	65

Table 6. Cumulative Average Abnormal Returns (CAAR) and Cumulative Average Abnormal Volumes (CAAV) of stocks across aggregated event periods, with inclusion and exclusion grouped together. Values are in terms of growth (%). T-values to assess statistical significance and the sample size *n* for each event window. * Significant at the 0,10 level, ** Significant at the 0,05 level and *** Significant at the 0,01 level or better.

Cumulative Average Abnormal Return is not statistically significant in any period, and shows varying positive returns with highs of 0.8% during the days following announcements (day 0 to day 5). This could be because of the expectation of included and excluded stock share prices to go in the opposite direction, however this is insignificant in Table 1. The Cumulative Average Abnormal Volume is statistically significant with positive volume ranging from 21.4% to 32.2% relative to the estimation period. As volume is expected to be positive for both inclusions and exclusions, it is perhaps more relevant to combine them than Returns.

6.2 Analysis

Table 7 presents the previous literature and the study's results, comparing the theoretical predictions and the empirical results. This shows whether the hypothesis aligns with the study's empirical evidence.

Hypothesis	**Prediction Abnormal Return**	**Prediction Abnormal Volume**	**Explanation**	**Our Results Abnormal Return**	**Our Results Abnormal Volume**	**Support or Reject the Hypothesis**
Efficient Market Hypothesis (Semi Strong). (Fama, 1970).	Positive Abnormal Return on event day for inclusion. Negative Abnormal Return on event day for exclusions. No Abnormal Returns before or after event day.		The semi strong form of the EMH asserts markets react instantly to new information, prices adjust accordingly. Leakage indicates inefficiency.	Insignificant Abnormal Return on the event day and on other days.		Reject.
Information Hypothesis (Jain, 1987)	Positive Abnormal Return for inclusion and negative Abnormal Return for exclusions.	Positive Abnormal Volume for both inclusions and exclusions.	Index revisions announcements signal new information about firm fundamentals.	Insignificant Abnormal Returns.	Some significant Abnormal Volume during the event window for inclusions.	Reject Abnormal Returns; Supportive Abnormal Volume.
Price Pressure Hypothesis (Scholes, 1972)	Positive Abnormal Return for inclusion and negative Abnormal Return for exclusions.	Positive Abnormal Volume for either inclusions or exclusions.	Short term price and volume effects are driven by temporary supply and demand imbalance.	Insignificant Abnormal Returns for both inclusions and exclusions.	Some significant Abnormal Volume during the event window for both inclusions and exclusions.	Reject Abnormal Returns; Supportive Abnormal Volume.
Substitution Hypothesis (Scholes, 1972)	No Abnormal Return for either inclusions or exclusions.	Positive Abnormal Volume for both inclusions and exclusions.	Stocks are interchangeable, meaning large transactions do not cause price effects.	Insignificant Abnormal Returns.	Some significant Abnormal Volume during the event window for both inclusions and exclusions.	Support.
Imperfect Substitutes Hypothesis (Shleifer, 1986)	Positive Abnormal Return.	Positive Abnormal Volume for both inclusions and exclusions.	Demand for unique stocks, which can not be easily replaced by others.	Insignificant Abnormal Returns.	Some significant Abnormal Volume observed the event window for both inclusions and exclusions.	Reject Abnormal Returns; Supportive Abnormal Volume.
Investor Recognition Hypothesis (Merton, 1987)	Positive Abnormal Return for inclusions. Negative Abnormal Return for exclusions.	Positive Abnormal Volume for both inclusions and exclusions.	Increased visibility from index revisions announcements reduces information costs, broadens the investor base.	Insignificant Abnormal Returns.	Some significant Abnormal Volume during the event window for both inclusions and exclusions.	Reject Abnormal Returns; Supportive Abnormal Volume.

In Table 1, the insignificant Average Abnormal Return from day -5 to day -1 and day 1 to day 5 align with the semi-strong form of the *Efficient Market Hypothesis*, as it suggests the market efficiently incorporates information without notable price adjustments. However, the insignificant Average Abnormal Return on day "0" contradicts the semi-strong form of the *Efficient Market Hypothesis*, which predicts that new information should immediately affect stock prices (Fama, 1970). Similarly, Jain's (1987) *Information Hypothesis* argues that

revision announcements convey new information and should lead to price adjustments and increase in short term volume stock inclusions and exclusions. Results are insignificant in Tables 1 and 2 but with Abnormal Volume (Table 3, 5). This suggests that the market may not perceive index revisions provide fundamental new positive (negative) information about included (excluded) stocks value, therefore no Abnormal Returns are observed.

Empirical findings from Tables 1, 2, 5 and 6 align with Bechmann's (2004) concept that indices which display methodology publicly, such as the OMXS30, do not introduce firm-specific information, therefore affected stocks do not experience Abnormal Returns. The absence of significant Average Abnormal Return of both inclusions and exclusions contradicts the *Imperfect Substitutes Hypothesis*, which predicts sustained Abnormal Returns due to change in demand (Shleifer, 1986). Instead, the evidence supports the *Substitution Hypothesis* (Scholes, 1972), which argues that stocks are interchangeable and markets absorb the Abnormal trading volume without significant Abnormal Returns. The significant positive Average Abnormal Volumes across multiple days demonstrate this as increase in trading activity suggest possible portfolio rebalancing from index funds and institutions.

The insignificant Abnormal Returns do not align with the *Price Pressure Hypothesis*. It expects prices of stock inclusions (exclusions) to be pressured higher (lower) as trading volume increases because of demand changes as index funds rebalance their portfolios to mirror the new index, leading to short term increase in both Abnormal Returns and Volume in the short term (Scholes, 1972 ; Harris and Gurel, 1986). However, the results only show Abnormal Volume of inclusion and exclusions, which does not have the effect on Returns as the *Price Pressure Hypothesis* anticipates.

Insignificant Cumulative Average Abnormal Return values in Table 2 further support the concept that OMXS30 revision announcements do not result in price deviations, possibly due to the selection criteria weakening effects. Cumulative Average Abnormal Return from day -5 to day -1 shows a marginally negative value of -0.2%, while the event window (-5 to 5) reports a minor positive Cumulative Average Abnormal Return of 0.1%, both are statistically insignificant. This lack of sustained abnormal returns suggests that the market perceives OMXS30 revisions as informationally neutral events. The predictability of the OMXS30 revision changes could potentially mitigate the impact of revisions on firm valuations, distinguishing it from indices with close-end methodology and selection criteria.

The significant Cumulative Average Abnormal Volume values in Table 6, ranging from 21.4% to 32.2% during the event period indicate trading activity increase around revision announcements. However, when Cumulative Average Abnormal Volume is divided into inclusions and exclusions (Table 4), the significance diminishes. This indicates the aggregated results better capture overall volume effects, possibly because of the larger sample size. These results align with similar studies finding comparable positive trading volume increases for both inclusions and exclusions during index revisions announcements (Bechmann, 2004; Chan and Howard, 2002; Chung and Kryzanowski, 1998; Goetzmann and Garry, 1986).

The consistently positive Average Abnormal Volume shows an increase in Volume in anticipation of and following revision announcements. Significant Abnormal Volume in Table 5 is particularly concentrated before and after the event day, with significance on days -5, -3, -2 and -1. In Table 3 inclusions have significant positive Average Abnormal Volume on day -5, -3 and -1 and exclusions have significant Average Abnormal Volume on day -4 and -2. The rise in trading activity suggests speculators and (or) trading firms rebalance their portfolios in anticipation of index reconstruction and after the announcement. The liquidity increase in anticipation of index announcements is similar to other *Index Effect* studies with public methodology, which find increases in trading volume in anticipation of the announcement as markets find out index changes (Madhavan, 2003; Chan and Howard, 2002).

The OMXS30's public methodology enables market participants to speculate on inclusions and exclusions ahead of announcements, since it is possible to find out index changes in advance. Merton's (1987) *Investor Recognition Hypothesis* is partly relevant to this finding, as it suggests the attention increase causes trading volume to increase for these stocks. Short term exclusions also experience positive Abnormal Volume as investors reduce their holdings in anticipation of higher cost of information for the excluded stocks. This aligns with Madhavan's (2003) argument that index membership affects Volume due to changes in future information flow and recognition. The insignificant Average Abnormal Return values (Tables 1, 2, and 5) are inconsistent with the *Investor Recognition Hypothesis*, as it expects both Abnormal Returns and Volume. This suggests the market either absorbs the Abnormal Volume, or investors do not consider inclusion or exclusions relevant to stock valuation.

Hypotheses 1a and 2a, about Abnormal Returns of stock inclusions and exclusions following the revision announcement find inclusions show some significant dates with t-values exceeding critical values, while exclusions do not find any level of significance. It could suggest some level of market activity for stock inclusions but not significant on more than individual dates. The results deviate from previous literature of indices with closed and public selection criteria, which finds Abnormal Returns. Insignificant Abnormal Returns before and after event day is expected, while the insignificant value of the event day (0) for both inclusion and exclusions is inconsistent with the semi-strong market efficiency. Consequently, neither 1a or 2a is rejected as the Average Abnormal Return t-values do not exceed any sufficient critical value on event day.

Hypotheses 1b and 2b, Abnormal Trading Volumes of stock inclusion and exclusion show significant positive results leading up to and following the announcement. The Average Abnormal Volume for inclusions are statistically significant on several days, and Cumulative Average Abnormal Volume showing significance with t-values exceeding their critical value days close around the event (-2 to 2), and peaking on day 3 for both inclusions and exclusions. However, not exceeding the whole event window (-5 to 5). This indicates trading activity is heaviest around the event, with activity normalizing towards the end of the event window. We find positive significant Average Abnormal Volume of stock exclusions on several days, but do not reach any significance in the Cumulative Average Abnormal Volume test. However, when combining inclusions and exclusions, there is significance across all Cumulative Average Abnormal Volume tests, and most days testing Average Abnormal Volume, with positive Abnormal Volume for all significant days with the highest levels of Abnormal Volume after the announcement (Chart 2). Therefore hypothesis 1b and 2b is not rejected for both inclusions and exclusions. The results conclude there is positive Abnormal Volume both during and around the index revision announcement, with more significance for inclusions than exclusions but with similar Abnormal Volume changes.

7 Conclusion

This thesis examines the announcement of an index revision's impact on short term abnormal stock returns and trading volume, of both stock inclusions and exclusions of the OMXS30 index in order to test the semi-strong form market efficiency on the Stockholm Stock Exchange. Previous research identifies significant Abnormal Returns around index revision announcements, attributing these effects to multiple hypotheses, such as *Information, Price Pressure, Imperfect-Substitutes* and *Investor Recognition Hypotheses*. With some attributing Abnormal Returns to index funds or institutional investors rebalancing their portfolios. Our study finds little to almost zero empirical evidence of significant Abnormal Returns around the announcement of either stock inclusion or exclusions, with statistically insignificant Cumulative Average Abnormal Return and Average Abnormal Return not supporting either the *Price Pressure, Information, Investor Recognition* or *Imperfect Substitutes Hypothesis*. Findings neither align with the semi strong form of the *Efficient Market Hypothesis* (Fama, 1970), which posits stock prices reflect all publicly available information in an efficient market. The empirical findings do not show any significant Abnormal Returns on the event day, contrary to what the semi strong form *Efficient Market Hypothesis* expects. This indicates stock prices do not adjust immediately following the announcement of new information and raise the question whether index revision announcements are not important to investors due to the selection criteria, or the public selection criteria diminish the Abnormal Returns. Possibly an interesting topic for future research to investigate further and examine.

The study concludes significant positive Abnormal Volume before and peaking three days after the announcement, wearing off toward the end of the event window. The effect is slightly more pronounced and significantly consistent for inclusions compared to exclusions, but both display positive Abnormal Volume. Earlier studies similarly identify Abnormal Volume during revision announcements, but also with accompanying Abnormal Return. Therefore this study challenges the *Price Pressure*, *Imperfect Substitutes, Investor Recognition* and *Information Hypothesis*, which predict Abnormal Returns due to a change in the demand or information signals following index revision announcements. The insignificance of Abnormal Returns on event days indicate market inefficiency as investors do not seem to interpret index revision announcements as important fundamental information of stock valuations, despite the semi strong form *Efficient Market Hypothesis* assertions.

This suggests investors and portfolio managers attempting to speculate on stock inclusions and exclusions of OMXS30 revision announcements are unlikely to garner any significant returns above market average. There are however implications with regards to effects of trading shares around index revision announcements, as Abnormal Volume does not seem to hinder large transactions of portfolio rebalancing of investors and index funds. This can be valuable for index funds wanting to optimize rebalancing strategies. Future research could improve on the method by using a multifactor model to control for other variables which may influence the results, instead of the market model. Additionally, further research could examine related variables, such as volatility, bid-ask spreads, and transaction costs, to further look into Abnormal Volume role in connection to OMXS30 revision announcements to explain the lack of Abnormal Returns. Investigating which market participants, such as institutional investors, retail, or index funds drive the heavy trading during these events could be of interest.

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Appendix

Appendix 1

This table summarizes all the stocks included in the study. The data is between 1995-2024, column 1 presents the announcement dates of the revisions, while Column 2 lists the names of the stocks added to the OMXS30 index.

Announcement Date (1)	**Included Stocks (2)**
2024-06-20	Saab AB
2022-12-22	Nibe Industrier AB ser. B
2022-06-22	Samhällsbyggnadsbolaget AB ser. B
2021-06-22	Sinch AB
2020-12-10	Evolution Gaming Group AB
2018-06-07	Hexagon AB ser. B
2016-12-07	Autoliv Inc
2015-12-04	Fingerprint Cards AB ser. B
2014-06-05	Kinnevik Investment AB ser. B
2009-06-03	Getinge AB ser. B
2009-06-03	Modern Times Group AB ser. B
2007-12-06	Lundin Petroleum AB
2007-06-26	SSAB AB ser. A
2006-12-26	Scania AB ser. B
2006-06-03	Boliden AB
2006-06-03	Vostok Nafta AB
2003-06-04	Drott AB ser. B

2002-12-05	Alfa Laval AB
2002-12-05	Swedish Match AB
2001-06-07	Eniro
2001-06-07	Europolitan Vodafone AB
2000-12-05	Assa Abloy AB ser. B
2000-06-13	Framtidsfabriken AB
1999-12-03	WM-data AB ser. B
1999-12-03	Icon Medialab International AB
1999-12-03	Securitas AB ser. B
1999-06-09	Tele2 AB
1998-06-18	Nordbanken Holding AB
1997-12-15	Autoliv Inc
1997-06-15	Nokia Corporation
1997-06-15	Scania AB ser. B
1996-06-19	Pharmacia & Upjohn Inc
1995-12-19	Kinnevik Industriförvaltning ser. A
1995-12-19	Autoliv Inc
1995-12-19	Sparbanken AB ser. A
1995-06-21	Pharmacia Corp ser. A
1995-06-21	Mo och Domsjö AB ser. B
1995-06-21	Avesta Sheffield AB

Appendix 2

This table summarizes all the stocks excluded in the study. The data is between 1995-2024, column 1 presents the announcement dates of the revisions, while Column 2 lists the names of the stocks removed to the OMXS30 index.

Announcement Date (1)	**Excluded Stocks (2)**
2024-06-20	Autoliv Inc
2022-06-22	Skanska AB ser. B
2022-06-22	Securitas AB ser. B
2020-12-10	SSAB AB ser. A
2018-06-07	Fingerprint Cards AB ser. B
2017-12-07	Lundin Petroleum AB
2016-12-07	Nokia Corporation
2015-12-04	Modern Times Group AB ser. B
2009-06-03	Eniro AB
2007-12-06	Autoliv Inc
2007-06-26	Stora Enso Oyj ser. A
2006-12-26	Holmen AB ser. B
2006-06-03	Fabege AB
2002-12-05	Pharmacia Corp ser. A
2002-12-05	WM-data AB ser. B
2001-06-07	Icon Medialab International AB
2001-06-07	Framtidsfabriken AB
2000-12-05	Kinnevik Industriförvaltning AB ser. A
2000-12-05	Trelleborg AB ser. B
1999-12-03	Stora Enso Oyj ser. A

1999-12-03	Scania AB ser. B
1998-06-18	Avesta Sheffield AB
1997-12-15	Stora Kopparberg AB ser. B
1997-06-15	Investor AB ser. A
1996-12-19	Incentive AB ser. B
1996-06-19	Celsius AB ser. B
1995-06-21	Trygghansa AB ser. B
1995-06-21	Gambro AB ser. B
1995-06-21	Sydkraft AB ser. C