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Master's Thesis in Finance

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Study on the effect of stock inclusion/exclusion in the Euro STOXX 50 Index – is the effect permanent and can it be explained by expectations for improved corporate performance?

(1998-2015)

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Statement of Originality

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I declare that the text and the work presented in this document is original and that no sources other than those mentioned in the text and its references have been used in creating it.

Abstract

This paper studies the abnormal stock performance around inclusion/exclusion from the Euro STOXX 50 index for the period 1998-2015 in order to extend the abundant evidence on the index effect which shows conflicting results for different indices and time periods studied. The study on abnormal stock returns for deletions and additions shows only temporary effect among European blue chip stocks and supports the Price pressure hypothesis. Further investigation of companies' operating performance does not produce any convincing evidence that the inclusion in the Euro STOXX 50 index has any significant effect on companies' profitability.

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1. Introduction

Trading strategies that focus on stocks' inclusion/exclusion in the composition of a major stock exchange index have always been an interesting topic for academic research with high practical application. The highest amount of papers on the subject is focused on the American stock market, and mainly on stock performance in relation to changes in the S&P 500 index constituents. As financial markets become more and more global, however, arbitrageurs and high-frequency traders try to exploit profitable trading strategies on various markets and stock exchanges, diverting their attention to other major indices as well.

In this paper I conduct a study on the effects of changes in the constituents of the Euro Stoxx 50 index, which is a reflection of the broad-based performance of the European economy, since it consists of the 19 EURO STOXX regional Supersector indices and represents the largest super-sector leaders in the Eurozone in terms of free-float market capitalization. There are several research areas that I have focused my analysis on, based on previous findings in the scientific literature.

Firstly, due to the wide index coverage (it's classified as "Mega Cap" and is comprised by the leading European companies from all sectors) it should be widely tracked by index funds (Mutual Funds and Exchange-Traded Funds), which are trying to replicate the exact composition of the index and therefore will be constantly rebalancing their portfolios on announcements of stock inclusions and deletions. Index funds are becoming more and more popular as investors are trying to diversify the idiosyncratic risk of holding stock in a single company by buying proxies to the broad market portfolio, namely ETFs and mutual fund shares. These portfolio adjustments are able to explain large part of the abnormal returns during an event study around the announcement date and effective date of change in the index composition.

Another possible explanation, given by Chen et al.(2004) is that arbitrageurs readily enter into the market on the announcement date of a change in index constituents, since

they are already aware of the benefits of the strategy, using long-short portfolio with the intention to realize abnormal returns until the effective date and then flip the stocks over. The results of this study confirm these hypotheses and are in line with the price pressure theory, since the significant abnormal returns between the announcement and effective date revert I, although not entirely, in the20 day period after the effective change in constituents.

The second set of hypotheses consist of studying the mean abnormal trading volume for both additions and deletions, since the change in the constituents of the Euro STOXX 50 index should be associated with significant portfolio rebalancing of index funds and Exchange Traded Funds. The results show large positive abnormal volume for both inclusions and deletions around the effective date and insignificant changes in the long run.

Thirdly, I conduct a study of changes in operating performance for companies that experience inclusion or exclusion using their Return on Assets and changes in analysts' forecasts as a gauge for profitability. This idea is in line with the hypothesis proposed by Denis et al. (2003) and Dahia (2009), who believe that inclusion in the S&P 500 (respectively IBEX 35) leads to improved corporate performance, exhibited in increased earnings expectations by analysts' consensus forecasts, relative to benchmark companies. While there have been previous studies on inclusion/deletion from the Euro Stoxx 50 index they have been mostly of practical, rather than of academic character and they haven't focused on the relationship that such an event may bring in earnings expectations or profitability.

The finding of Denis et al. contradicts general theory, according to which the inclusion in a stock index is considered an information free event and therefore should not affect the performance of a stock. "Information free" can be regarded in a sense that the committee announces the change in the constituents according to a pre-determined schedule and the determinant is market capitalization, which represents public information. Therefore the decision for inclusion should not possess an opinion about the investment prospects in a company.

However, a broad amount of literature has documented the so called "index effect", characterized on average by positive abnormal returns for stocks that have been

added to a major stock index and more ambiguous effect, but usually negative for stocks deleted from an index.

A more detailed review of the findings will be described in the literature review section.

2. Literature review

Generally, the criteria for stock inclusion in an index differ among the stock exchanges, but they are all based on public information, and therefore, based on the Efficient Market Hypothesis should not be predictors of future stock performance. The analysis of stock market index constituents has been dominated by two main contradicting financial theories. The price pressure hypothesis, which was first introduced by Scholes (1972), suggests that share prices can deviate from long-run equilibrium and a short-term price increase occurs when there is a positive shift in demand, caused by rebalancing of investors' portfolios. Among the papers that provide evidence for this theory is a study on the changes in constituents of the S&P 500 index conducted by Harris and Gurel (1986) in the 1973-1983 period, which found an immediate price increase after an announcement for stock inclusion, followed by a reversal in the following 3 weeks, while at the same time the events were marked by above average trading volume. The above arguments showed support for the Price pressure hypothesis, but the results did not discover any anticipatory abnormal returns or volume prior to the announcement.

Some studies on the constituents of European indices have also found evidence supporting only short-term price pressure for additions and deletions. In a paper on the index effect of the British top index FTSE 100 Bryan Mase (2007) studies the changes in the composition which occur based on quarterly revisions for the period 1992 – 2005. The analysis documents short-term price pressure for both inclusions and deletions from an index before

the actual announcement. However the observed price effects are reversed within 20 days after the event, thereby do not providing evidence for permanently downward sloping demand curves which result from a permanent price effect.
Another study that adds evidence to the price pressure hypothesis is conducted by Dash(2002) on behalf of the Standard & Poors agency. He studies the deletions from the S&P 500 for the period 1998-2002 and finds that the significant negative returns generated around the announcements for stock deletions revert almost entirely until 6 days after the changes in the composition.

The temporary effect of this hypothesis is contrasted by the imperfect substitutes hypothesis, devised by Shleifer(1986). It predicts a permanent price effect, caused by inclusion in a stock index, since investors cannot find a perfectly equivalent stock. In his study Shleifer finds that since September 1976 the inclusion of a stock in the S&P 500 index earned investors an additional 3% return on the date of the announcement and that the effects persists at least 10 to 20 days after the event. He also established a higher trading volume around the announcement.
Blouin et al.(2000) also investigate the abnormal returns around stocks inclusion in to the S&P 500 but their model explains it with capital gains taxes. The evidence provided in their paper shows that individual investors' capital gains on taxes lead to significant positive abnormal returns for stocks when their announcement for inclusion in the S&P benchmark takes place. The effect, however, reverts in the weeks following the announcement

Since 1989 changes to the S&P 500 have been announced five days before the effective date of stock exclusion/inclusion in order to overcome previously documented buying pressure from index funds. Beneish and Whaley (1996) report that stocks added to the S&P 500 between 1989 and 1994 exhibit positive abnormal returns between the announcement and effective dates which are afterwards reversed only partially, pointing at the permanent effect of changes in constituents of the S&P 500.

More recent researches in the area include Wurgler and Zhuravskaya (2002) who find support for downward sloping demand curves for stocks included in the S&P 500, since the

absence of perfect stock substitutes deters risk-averse arbitrageurs from flattening the demand curve. Chen, Noronha, and Singal (2004) conduct a study on a longer time frame (1961 to 2000) and their most important finding is that the price effect for stock inclusion in the S&P 500 is permanent, whereas the decline for stocks that were removed from an index is only temporary. They explain the fact by arguing that investor awareness for a stock is easily increased by the publicity surrounding inclusion in a major index, but once a stock has already become salient, it is more difficult that it loses market participants' attention once it is deleted from an index. Elliot and Warr(2003) examine the price reactions of additions the S&P 500 and Nasdaq indices and find greater positive abnormal effect for the latter. The explanation they provide for the effect is with the difference of the stock exchanges where the indices are traded. In their view NYSE is more centralized and is able to better absorb the unexpected demand shocks for stocks around inclusion.

Another hypothesis, than be attributed to index inclusion, since it attracts investors' awareness is the attention hypothesis, first proposed by Merton (1987) and later further developed by scientific literature. In his study the author analyzes market equilibrium in a setting where investors are aware only about part of the existing market securities. News (in our case announcement for inclusion in an index) brings additional attention to the security and therefore more investors are buying it, leading to a permanent positive price effect.

Merton's arguments were confirmed by another study conducted by Polonchek & Krehbiel (1994). It focused on studying the effect of stock additions and deletions from the Dow Jones Industrial Average index, which receives a lot of media attention on average, comparing in to the Transportation Average index. It found significant positive abnormal returns for stocks included in the DJIA, but no obvious effect for stocks that entered the less popular Transportation index. Besides media attention, authors also explain the fact with the smaller capitalization and daily turnover of stocks included in the Transportation index.

A theory that tries to explain the index effect in the context of the Dow Jones Industrial Average is the Information cost/ Liquidity Hypothesis. Beneish & Gardner (1996) find asymmetric stock price response for changes in its constituents – negative for deletions but lack of significant effect for inclusions. The failure to explain such observations by the price

pressure or imperfect substitutes hypothesis leads the authors to turn to the information cost arguments. They argue that a stock entering the DJIA index has little effect since it is already actively traded and considered prominent among investors. The exclusion, however, might affect the ability of the firm to borrow capital and will also decrease the coverage it enjoys by investors. Therefore, its liquidity will decrease, trading costs will rise and hence the stock price is likely to experience negative returns.

The study which applied an innovative approach in its attempt to explain permanent effects of stock inclusion in the S&P 500 is by Denis, McConnell, Ovtchinnikov and Yu (2003). Their hypothesis is based on the fact that index inclusion might lead to better operating performance of newly added firms, because the event brings increased scrutiny of management, which in turn leads to higher profits. Based on their finding for the S&P index, I intend to broaden the research in terms of the new constituents of the Euro STOXX 50 index since its inception in 1998 and to provide support or refutation of the hypothesis.

A similar study by Dahia (2006) has been conducted on earnings improvement for stocks added to the British FTSE 100 index. It finds that stock included to the British Flagman index lead to improved earnings, higher media coverage and improved investor awareness and therefore challenges the assumptions that inclusion in an index is an information-free event and long-run demand curves for stocks slope downward.

Shankar & Miller (2006) examine stock price response around change in the constituents list of the small cap S&P 600 index, while also focusing on the change of another variable – institutional ownership. They find significant positive abnormal returns, high abnormal volume and increase in institutional ownership for additions to the S&P 600 index, with the effect being more pronounced for stocks that are new entrants for the whole S&P index family.

The index effect study has been conducted for Spanish stocks as well in a research by Dahia & Garcia (2012). In a study of changes in composition of the IBEX 35 index (where the criteria for inclusion are based only on stock liquidity and are therefore public) for the

period between 1992 and 2007 they find significant positive effect for additions and negative for deletions in the short run, but conflicting results in the long run, showing positive abnormal returns for deletions. In order to provide explanation of the fact, the authors scrutinize the forecasted and realized earnings and find a positive revision of both indicators for stock deletions. Their results also show that the increased expectations coincide with a turnover in the senior managerial ranks of the respective companies.

A research on the effect of changes in the composition of the Dutch index AEX 25 has been conducted by Doeswijk (2005). Due to the heavy weights of some stocks included in the index the author implements a methodology dividing stocks into two portfolios – winners and losers. Winners are stocks whose weight is expected to increase due to the revisions, while losers are stocks where weight is expected to decrease, which is consistent with the idea that index changes are anticipated by the market. The results point at stronger price effect for additions than for deletions but the effect is only temporary, supporting the price pressure hypothesis. Volume also seems to be unaffected, with the exception of the announcement day.

The only academic research that I was able to find on the Euro STOXX 50 index was conducted by Blomstrand & Safstrand (2010) which compare the abnormal returns around changes in its constituents to those exhibited by the Scandinavian benchmark index OMXS 30. Their findings support temporary effect for the Euro STOXX 50 index and permanent effect for the Swedish OMXS 30 and the authors explain the differences by the specific characteristics of the two indices – the Euro STOXX 50 is more broadly recognized by investors since it is a mega-cap, while the OMXS 30 is a local index scrutinized mostly by local traders.

The Standard & Poor's agency (2008) conducted a more practical research on the evidence of diminishing index effect by studying 5 of the biggest equity indices in the world (S&P 500, TSX 60 Canada, the German DAX, the British FTSE 100 and the Japanese NIKKEI 225. The study separates the abnormal returns for the indices for the period of 1998-2008 in two sub-groups and shows that the excess returns for the most recent sub-period are diminishing for all indices except the FTSE 100. The findings are explained by increasing popularity of the trading strategy and more proprietary trading companies and hedge funds

trying to take advantage of the opportunity. Another possible explanation is a change in the trading pattern of index funds, who try to rebalance their portfolios beforehand by trading around the close price in an attempt to partially transfer the risk to other trading desks.

A recent study from Petajisto (2010) aims to update the evidence on index premiums for stock inclusions in the S&P 500 and the Russell 2000 indices. It shows that index premiums have significantly grown since the 1980s due to increasing popularity of index tracking, reaching a peak in 2000, and have since been declining, which they attribute to increased anticipation of the events. For the period from 1990 to 2005 the positive abnormal return has been +8.8% and +4.7% for the S&P 500 and Russell 2000 respectively, while for deletions the returns have been averaging -15.1% and -4.6%.

A study that focuses on small-cap stocks performance on their inclusion in the Russel 2000 index is performed by Biktimirov, Cowan and Jordan (2004). The criteria for entering the Russel 2000 are based solely on market cap, and the research finds a significant change in price, volume and institutional ownership for stocks entering or leaving the Russel 2000, however the effect depends on whether the stock is a pure addition or deletion, or simply shifts to the larger cap index Russel 1000.

Generally small-cap indexes have not been subject to very extensive research since they are less scrutinized by investors, however Biktimirov & Li (2013) find an interesting reaction to changes in the British FTSE Small cap index. Their research shows permanent increase in stock price and liquidity for stocks promoted from the FTSE Small Cap to the Midcap FTSE 250 and permanent negative effect for the reverse process. In contrast, new additions, which have previously not been parts of the FTSE Small Cap experience only transitory effect in price and negative effect on liquidity. The negative liquidity effect is explained by a decline in the free floating shares of the respective pure additions.

3. Data and subsamples

The data for stock inclusion and exclusion from the Euro STOXX 50 index is gathered from Compustat Global and double checked with the official press releases, published on the website of the revision committee at http://www.stoxx.com/news/announcements.html. The period covered starts at the inception of the index in 1998 until 2015.

The total amount of changes in the index composition for the whole period is 116, but in order to isolate the pure effect of index addition/deletion, I have removed from the sample changes in constituents which have occurred due to a merger, name change, acquisitions or spin-offs since these events can trigger additional abnormal returns and volume, which will interfere with the rationale of the research. Thus, the remaining sample consists of 60 events eligible for analysis, of which 31 inclusions and 29 deletions. Table 1 features the isolated event dates and company names:

Table 1: List of eligible additions and deletions for analysis

Company name	Announcement Date	Effective date	Addition/Deletion
Banco Santander SA	19/08/1999	20/09/1999	*Addition*
Akzo Nobel	19/08/1999	20/09/1999	*Deletion*
BASF SE	19/08/1999	20/09/1999	*Addition*
Allied Irish Banks	18/08/1999	20/09/1999	*Deletion*
Bayerische Hypo- und Vereinsbank	19/08/1999	20/09/1999	*Addition*
Deutsche Lufthansa AG	19/08/1999	20/09/1999	*Deletion*
Dresdner Bank AG	19/08/1999	20/09/1999	*Addition*

Fiat Chrysler Auto NV	19/08/1999	20/09/1999	*Deletion*
Munich Re Company	19/08/1999	20/09/1999	*Addition*
Portugal Telecom SGPS SA	19/08/1999	20/09/1999	*Deletion*
Sanofi	19/08/1999	20/09/1999	*Addition*
Reed Elsevier NV	19/08/1999	20/09/1999	*Deletion*
Suez	19/08/1999	20/09/1999	*Addition*
Schneider Electric SA	19/08/1999	20/09/1999	*Deletion*
Enel Spa	17/02/2000	20/03/2000	*Addition*
Saint Gobain	17/02/2000	20/03/2000	*Deletion*
Danone SA	15/08/2000	15/09/2000	*Addition*
Electrabel SA	15/08/2000	15/09/2000	*Deletion*
San Paolo-IMI SPA	15/08/2000	15/09/2000	*Addition*
Metro AG	15/08/2000	15/09/2000	*Deletion*
Saint-Gobain	03/09/2001	24/09/2001	*Addition*
Koninklijke KPN	03/09/2001	21/09/2001	*Deletion*
Lafarge SA	02/09/2002	23/09/2002	*Addition*
Kering	02/09/2002	20/09/2002	*Deletion*
Iberdrola SA	01/09/2003	22/09/2003	*Addition*
Bayerische Hypo- und Vereinsbank	01/09/2003	19/09/2003	*Deletion*
Credit Agricole SA	01/09/2004	20/09/2004	*Addition*
Volkswagen AG	01/09/2004	19/09/2004	*Deletion*
Arcelormittal SA	03/09/2007	24/09/2007	*Addition*
Allied Irish Banks	03/09/2007	21/09/2007	*Deletion*
Schneider Electric	03/09/2007	24/09/2007	*Addition*
Koninklijke Ahold NV	03/09/2007	21/09/2007	*Deletion*
Vinci SA	03/09/2007	24/09/2007	*Addition*
Lafarge SA	03/09/2007	21/09/2007	*Deletion*
Volkswagen AG	05/10/2007	10/10/2007	*Addition*
Deutsche Boerse AG	10/10/2007	15/10/2007	*Addition*
Alstom SA	01/09/2008	22/09/2008	*Addition*
Alcatel Lucent	01/09/2008	19/09/2008	*Deletion*
CRH Plc	31/08/2009	21/09/2009	*Addition*
Ageas SA/NV	31/08/2009	18/09/2009	*Deletion*
Anheuser-Busch InBev	31/08/2009	21/09/2009	*Addition*

Renault SA	31/08/2009	18/09/2009	*Deletion*
Unibail Rodamco	01/02/2010	08/02/2010	*Addition*
Volkswagen AG	01/02/2010	07/02/2010	*Deletion*
BMW AG	31/08/2010	20/09/2010	*Addition*
Aegon NV	31/08/2010	18/09/2010	*Deletion*
Volkswagen AG	31/08/2011	19/09/2011	*Addition*
Alstom SA	31/08/2011	16/09/2011	*Deletion*
Inditex SA	31/08/2011	19/09/2011	*Addition*
Credit Agricole SA	31/08/2011	16/09/2011	*Deletion*
ASML Holding NV	01/06/2012	18/06/2012	*Addition*
Deutsche Boerse	01/06/2012	15/06/2012	*Deletion*
Essilor International	01/06/2012	18/06/2012	*Addition*
Telecom Italia Spa	01/06/2012	15/06/2012	*Deletion*
Airbus Group NV	01/03/2013	18/03/2013	*Addition*
Nokia Corp	01/03/2013	15/03/2013	*Deletion*
Deutsche Post AG	30/08/2013	23/09/2013	*Addition*
Arcelormittal SA	30/08/2013	20/09/2013	*Deletion*
Nokia Corp	29/08/2014	22/09/2014	*Addition*
CRH Plc	29/08/2014	19/09/2014	*Deletion*
Total	60	60	60

Source: Compustat Global

The criteria for inclusion into the pan-European index are the following: The 50 constituents are selected on basis of their free float market capitalization out of 19 Euro Stoxx Supersector indices. These indices contain stocks from countries in the Euro Area and are arranged in terms of market capitalization. Stocks are included in the Euro STOXX 50 index until they cover almost, but not completely 60% of the market cap of the Euro STOXX Total Market Index. 40 of these stocks that rank highest in market cap are directly included in the index. In the remaining buffer of stocks ranging from 40 to 60 stocks that have been previously included in the index are not excluded. If the remaining number of stocks is still below 50, stocks are included from the buffer until the number

50 is reached. The index constituents are reviewed once a year and the review cut-off date is last trading date in August. The changes come into effect in September.

In addition, the committee has also introduced the fast entry and fast exit rules, which can cause changes in the constituents of the index on a quarterly basis. A stock qualifies for fast entry rule if it ranks within the lower buffer (1-25) on the selection list of the blue-chip stocks during the quarterly reviews held in February, May, August or November. However, stocks that enter due to this rule are most often ones that have experienced an IPO or another corporate event which has triggered large abnormal returns. Similarly, the fast exit rule applies for stocks that rank 75^{th} or below on the selection list at the time of the quarterly revision and have been at such a low position for the previous month as well.

The sample includes additions which are replacing companies subject of a merger, since the event itself can lead to increased scrutiny by investors and index funds. For example in October 2007 ABN AMRO is excluded from the Euro STOXX 50 due to a takeover by Royal Bank of Scotland, Fortis and Santander. I have excluded this from the sample as an eligible deletion. The company that replaces it, however, Volkswagen AG is included and subject to analysis of the event study. That explains the uneven amount in the two sub-samples (31 additions to 29 deletions).

As announced on the website of STOXX Limited, a special ETF, replicating the movement of the Euro STOXX 50 index has been introduced in October 2008 due to the constant increase in popularity of the blue chip European benchmark index. The newly traded ETF is managed by Credit Agricole Structured Asset Management. In order to test whether the index effect has increased after the introduction of this ETF I drop all observations before the date of its introduction and present the results after October 2008 in a separate table.

4. Methodology

4.1 Description of the event study model

The data for stock prices and returns around inclusion/exclusion in the Euro Stoxx 50 are gathered from Compustat Global and adjusted for stock splits and dividends. The event study estimates abnormal returns as the difference between actual and predicted returns. Predicted returns are obtained by regressing each individual security i for both subgroups (additions and deletions) on the relevant market benchmark index, in this case the MSCI Europe excluding UK index, supplied by Datastream database. Since the MSCI index covers almost 85% of the free float-adjusted market capitalization of European developed markets, it is considered as a reliable proxy for the blue-chip Euro Stoxx 50 index, consisting of the top 50 EU stocks by market cap. I have excluded UK stocks, since the Euro Stoxx 50 index is comprised only by stocks within the euro area sharing together the single currency.

The following OLS regression is run for each individual security within the estimation window starting from 31 days after the effective date until 200 days after that (as suggested by Cowan, Nayar and Singh(1990)):

$$R_{i,t} = \alpha_i + \beta_{iMSCI\ Europe\ ex.UK}\ R_{MSCI\ Europe\ ex.UK,t} + \epsilon_{i,t}$$

All the performed regressions within the individual securities are giving significant results for MSCI market return estimator. Then the OLS estimator $\beta_{\text{iMSCI Europe ex.UK}}$ and the intercept α_i are used to calculate the predicted (expected) return.

$$E(R_{i,t}) = \widehat{\alpha_i} + \beta_{iMSCI\ \widehat{Europe\ ex.UK}}$$

The abnormal returns are calculated as the simple difference between the actual realized return for stock *i* on day *t* (defined as the percentage change measured by dividing the stock closing price on day *t* divided by the price for day *t-1*) minus the expected return from the OLS regressions:

$$AR_{i,t} = R_{i,t} - \widehat{R_{i,t}} = R_{i,t} - \left(\widehat{\alpha_i} + \widehat{\beta_i} R_{MSCI\ Europe\ ex.UK,t}\right)$$

The calculated abnormal returns are aggregated over time within the specified event window, in order to calculate the average CAR for a total of n securities experiencing inclusion/deletion, which shows the total return that an investor can achieve, using the long-short portfolio strategy during the specified event windows:

$$\overline{CAR(\tau_1, \tau_2)} = \overline{\sum_{t=\tau_1}^{\tau_2} AR_{i,t}}$$

The CARs are then tested for significance, using the student t-test, which is defined as:

$$t = \frac{\bar{x} - \mu_0}{\sqrt{var(\bar{x})/\sqrt{N}}},$$

where $\bar{x}$ is the sample mean, μ_0 is the expected value under the null hypothesis, $var(\bar{x})$ is the variance of the sample mean and N is the number of observations in the sample under analysis.

In order to measure the abnormal volume around the effective date I am using the Mean-adjusted abnormal trading volume model as suggested by Campbell et al.(1996), which is calculated as:

$$v_{it} = V_{it} - \bar{V}_i,$$

Where $\bar{V}_i = \frac{1}{T}\sum_{t=f}^{t=l} V_{it}$, with T being the number of trading days in the estimation period, f is the first trading day in the period and l is the last. The volume $V_{it} = \frac{n_{it}\times 100}{S_{it}}$ is measured in percentage terms, where $n_{it}$is the number of shares traded and S_{it} is total number of shares outstanding for security *i*.

4.2 Estimation and event windows of the event study

The analysis follows the event study methodology as described by MacKinlay (1997) in his comprehensive paper on the method in question. I define the events eligible for analysis as inclusions and exclusions and study the price dynamics around the date announcement and the effective date. The difference between the two dates for each separate event differs, since some have not occurred on the regular annual revision, but the average number of days between the events for both subsets is 16 trading days.

The estimation window used to obtain the predicted returns generally should not include the event window under scrutiny in order to avoid biased results. In addition, including the days immediately prior to the event might also produce flawed results since the index revision depends only on the market capitalization of the leading European blue chips, hence they are quite likely to have experienced superior performance prior to the inclusion (or underperformed before deletion). That is why I am using an estimation window period between 31 and 200 trading days after the Effective date (+31, +200), an approach used by Cowan, Nayar and Singh(1990) and also implemented by Mase (2007) in his study of the FTSE 100 index. In the Robustness check section I provide other estimation window which produces similar results, thereby confirming the validity of the results.

When measuring the mean-adjusted abnormal trading volume the event window I use starts from 10 trading days before the announcement date and finishes 30 days after the effective date. The estimation window, over which the calculations are

performed, includes pre-event and post event window, starting 200 days before the announcement and ending 10 days before it and the second part starting 10 days after the effective date until 200 days after that. The methodology is in line with Campbel et al.(1996) and Cready and Ramanan (1991).

4.3 Testable hypotheses as part of the research

The hypotheses that will be tested for the abnormal returns are the following:

H_{1a}: The CARs in the short term will be positive for additions, negative for deletions and statistically significantly different from 0, supporting the price pressure hypothesis

H_{1b}: The CARs in the long run will be positive for additions and negative for deletions and significantly different from 0, supporting the imperfect substitutes hypothesis

H_2: The CAR between the announcement date and effective date should be the highest within the three event windows due to portfolio rebalancing of index tracking funds. Testing the above hypothesis is relevant in terms of establishing trading strategies based on abnormal returns around changes in the constituents of the Euro STOXX 50 index. I suspect it should be the highest, since arbitrageurs and index fund managers are expected to be immediately aware of the new information and therefore to rebalance their portfolios as quickly as possible during this event window

H_{3a}: A positive abnormal trading volume should be observed for both inclusions and deletions in the short term and especially around the effective date

H_{3b}: In the long run event window abnormal volume should revert back to average values since the changes in the index constituents are reflected immediately by index funds and arbitrage traders.

H_4: The CARs for the period after the introduction of the special ETF following the price movement of the Euro STOXX 50 index should be more pronounced (respectively higher positive effect for additions and higher negative effect for deletions).

H_5: If inclusion in the Euro STOXX 50 index is an information free event then inclusion or exclusion from the index should not lead to any significant change in companies' operating performance as exhibited by their Return on Assets

5. Analysis of results

5.1 Summary Statistics

Table 2 provides several accounting and stock market measures for the two sub-samples of additions and deletions under analysis. Conclusions that can be drawn from the mean and median values are that the stocks experiencing inclusion are, on average, stocks with higher market capitalization and higher profitability, as exhibited by Return on Assets. The traded volume for the two groups is similar, but the company specific risk is a fraction smaller for the additions, as shown by the lower beta. The average number of employees for stocks experiencing inclusion in the Euro STOXX 50 index is also about 20% higher than those being deleted from the blue-chip benchmark.

In the next section I report the results obtained from computing abnormal returns and cumulative abnormal returns through several event windows as well as the mean adjusted trading volume around the effective date of change in the constituents.

Table 2 Summary Statistics for Euro Stoxx 50 Constituents **Mean and median (in parenthesis) values for the two sub-samples of Euro STOXX 50 Additions and Deletions. Data for the listed variables is supplied by Datastream**

	Euro STOXX 50 Additions	Euro STOXX 50 Deletions
Number of observations	**31**	**29**
Market capitalization (mil. Euro)	**39 543 (30 580)**	**19 872 (14 042)**
Total Assets (mil. Euro)	**186 889 (72 301)**	**137 836 (33 512)**
Return on Assets (5 Year Average)	**5.33% (4.2%)**	**4.09% (2.46%)**
Company Beta	**1.12 (1.26)**	**1.23 (1.22)**
Number of Employees	**122 878 (99 680)**	**101 807 (85 180)**
Daily Volume (mil)	**8.03 (5.14)**	**9.4 (4.3)**
Total Liabilities (mil. Euro)	**158 220 (39 609)**	**129 037 (39609)**

5.2 Additions to the Euro STOXX 50 index

5.2.2 Abnormal returns and Cumulative abnormal returns for the specified event windows

Since the change in constituents depends solely on their market capitalization and could be anticipated by index tracking funds, ETFs and other arbitrageurs (as suggested by Chen et al. (2004), the first event window which I use to calculate the abnormal and cumulative abnormal returns is a pre-announcement event window starting 10 trading days before the announcement date. The Cumulative average abnormal return of 2.55% is significant and positive and implies that index arbitrageurs and index-tracking funds are speculating on the probability of a stock being included in the Euro STOXX 50 index before the actual announcement, since the inclusion is based on publicly known criteria (market capitalization).

The second pre-event window calculates the CARs between the announcement date and the effective date of a change in the constituent. The period is not fixed, since the

dates for the inclusion vary between 5 and 18 trading days. The Average CAR of 3.69%, the largest positive return among the event windows and indicates short-term price pressure for the additions. The total CAR for the entire event window (Announcement Date to 20 trading days after the Effective Date), however is 0.0065 and insignificant, therefore not providing evidence of any long-term price effect.

The two post-event windows (0,+10), (0,+20) have negative and significant CARS of -3.45% and -3.14% respectively, which implies that prices revert back, although not entirely, to 0 and again support the Price Pressure hypothesis.

The abnormal return on the announcement date of 1.05% is significant at the 1% and provides evidence for the short term price pressure that future additions stocks start to experience. There is no significant price effect occurring on the Effective Date itself, which implies that the index funds and arbitrage traders have already fully adjusted their portfolios before the changes in the constituents of the Euro STOXX 50 index take place.

The fact that the abnormal returns do not fully revert to 0 until 20 days after the announcement (the abnormal return including the pre-announcement anticipatory effect is still 2.7%) might provide any support for the imperfect substitutes hypothesis, therefore in the next section I also provide long-term stock performance (up to 180 days) in order to check for any long term effect of the change in constituents. Hypothesis 2 from the testable predictions is also confirmed since the CAR in the event window from announcement date until effective date is the highest among the periods covered in the analysis.

Table 3- Average Cumulative Abnormal Returns for Additions to the Euro STOXX 50 index 1998-2015

Event Window Period	CAAR	St. Deviation	P-value
Anndats-10 to Anndats	0.02551***	0.046303	0.004
Anndats to Effdats (-20-0)	0.0369***	0.0536	0.001
Effdats, Effdats+10	-0.0345***	0.0574	0.002
Effdats, Effdats+20	-0.0314**	0.0669	0.015

Anndats to Effdats +20	0.0065	0.0808	0.66
Effdats-2, Effdats+2	0.011*	0.031	0.05
Announcement Date	0.0105***	0.014	0.000
Effective Date	-0.00388	0.0195	0.277

The Cumulative Average abnormal return provided in Figure 1 starts from 26 trading days before the effective date (around 10 days before announcement date) and the Mean-adjusted volume is calculated as specified in section 3.

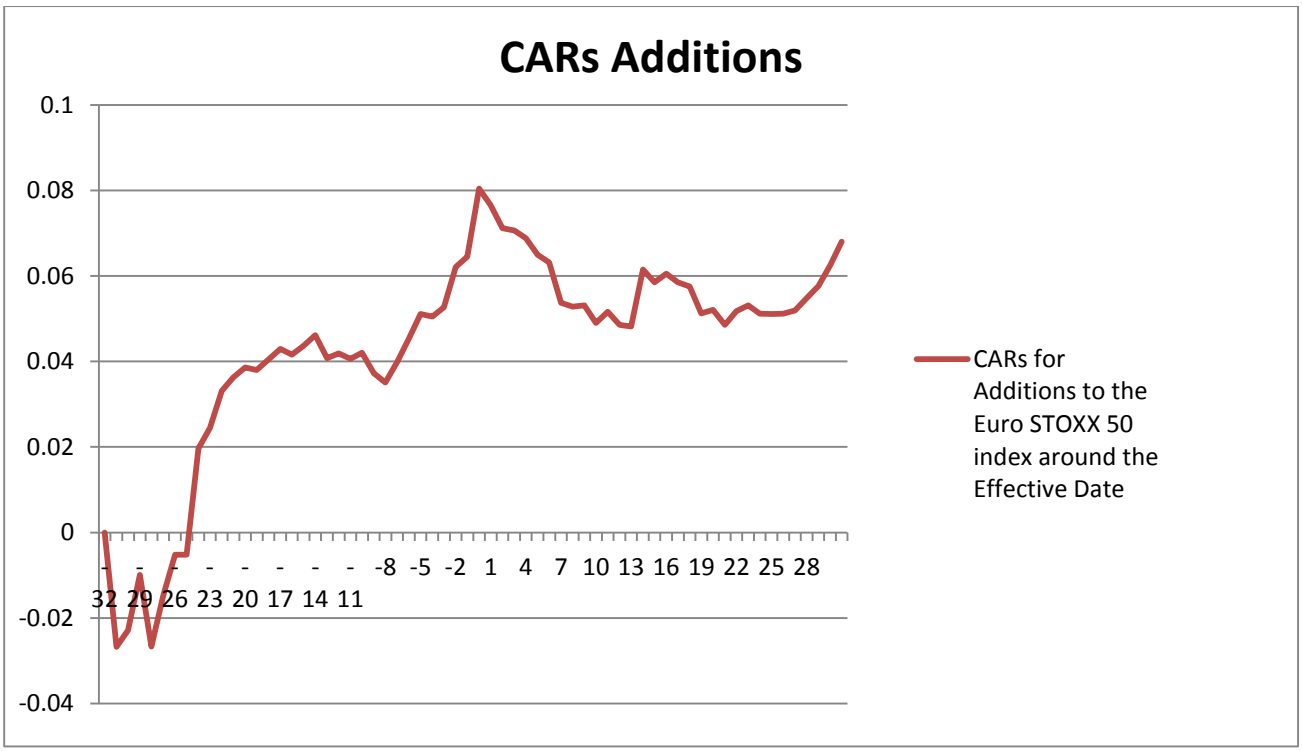

Figure 1 Cumulative Average Abnormal Returns for additions to the Euro STOXX 50 index, 1998-2015

In order to test the hypothesis whether the introduction of a special ETF following the Euro STOXX 50 index has contributed to the index effect I drop all the events that occur before 2008 and calculate the abnormal returns once more. The total sample of additions now contains only 12 additions, which might affect the representativeness of the results. Most of the cumulative abnormal returns, however, are still significant and the absolute values are higher. The anticipation window covering 10 trading before the announcement is significant at the 5% level with a 3.11% positive return compared to

2.5% for the whole 1998-2015 period. The abnormal performance between the announcement date and the effective date has also increased, with a 4.46% positive return, which starts to revert back after the effective date with stock prices declining 2.92% in the first 10 days after the actual change in composition and another 0.9% in the next 10 days. The total abnormal return from the announcement date until 20 days after the constituents' change is again insignificant with only 0.6% positive return.

These results provide support in favor of the hypothesis that the introduction of an ETF contract following the movement of the Euro STOXX 50 index has increased the index effect around changes in its constituting stocks.

Table 4 Average Cumulative Abnormal Returns for Additions to the Euro STOXX 50 index 2008-2015

Event Window Period	CAAR	St. Deviation	P-value
Anndats-10 to Anndats	0.0311**	0.05103	0.047
Anndats to Effdats (-20-0)	0.0446***	0.0329	0.000
Effdats, Effdats+10	-0.0292*	0.0522	0.002
Effdats, Effdats+20	-0.0382**	0.0771	0.049
Anndats to Effdats +20	0.00681	0.0603	0.777
Effdats-2, Effdats+2	0.004	0.0627	0.658
Announcement Date	0.0154***	0.0181	0.007
Effective Date	-0.00392	0.0161	0.277

5.2.3 Mean Abnormal Volume for Additions

The traded volume on the day before the effective date is almost 200% higher than the average for the whole period and significant at the 1% level, which confirms the hypothesis

that index funds and Exchange Traded funds are rebalancing heavily their portfolios on the date the actual changes are taking place.

In the attached chart below the spike occurring at the effective date for additions accounts for the increased trading volume caused by the portfolio rebalancing of index-tracking funds and Exchange Traded Funds. The average abnormal returns for each day through the short-term event window, as well as the mean-adjusted trading volume are listed in the Appendix – Table 2 and 3. The other trading days from the event window reveal relatively normal trading volume with average values ranging between 20 and 30%. Therefore hypothesis 3b is also confirmed since no significant abnormal volume is evident, besides the one on the effective date itself.

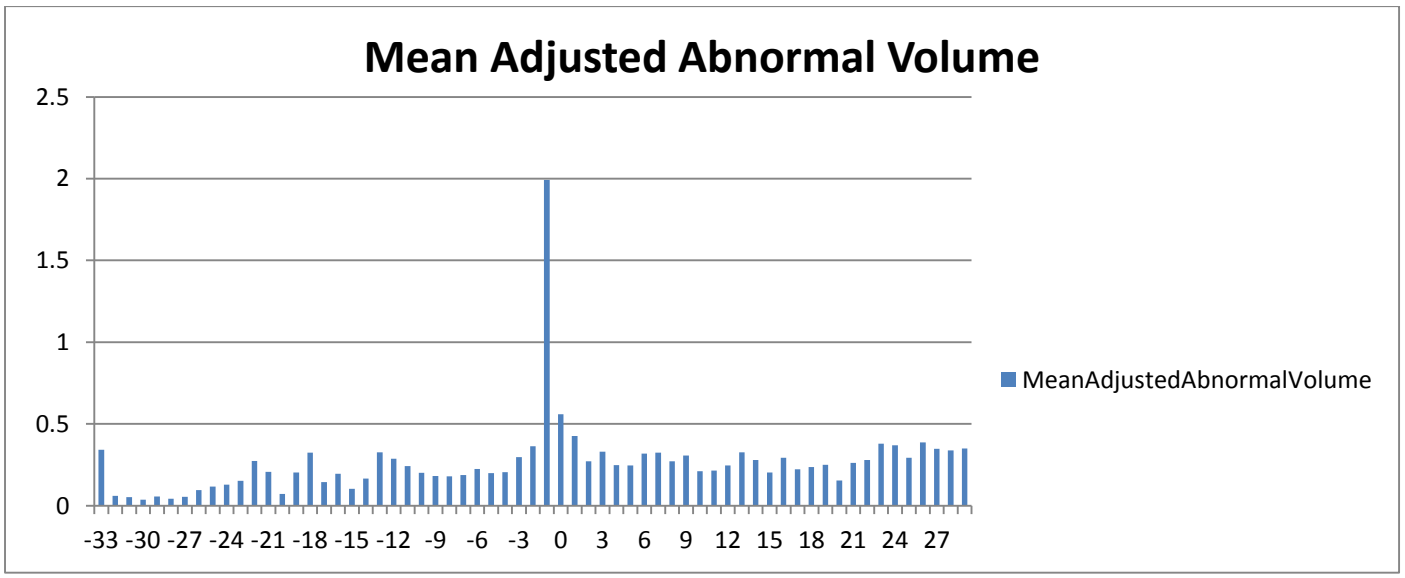

Figure 2 Mean abnormal volume for additions to the Euro STOXX 50 index

5.3 Deletions to the Euro STOXX 50 Index

5.3.2 Abnormal returns and Cumulative abnormal returns for the specified event windows

The pattern exhibited by the deletions is similar to that of additions, but the abnormal returns are smaller in absolute value and less significant. The pre-event window starting from 10 days before the announcement date provides a negative return of 3.51%, statistically significant at the 5% level, which also provides evidence for anticipatory effect among arbitrageurs and index funds. The period between the announcement and effective date adds to the negative price shock for the stocks with another 2.59%, a number which is significant but only at the 10% level. Here, the anticipatory effect is stronger the portfolio adjustment (Announcement to Effective Date), therefore Hypothesis 2 is rejected.

After the effective date, as suggested by the Price Pressure Hypothesis the negative returns start to revert back to 0, although not entirely. The stocks register a 1.6% positive return until 20 days after the effective date. The total abnormal return for the whole event window between the announcement date and 20 days after the effective date is -0.4%, although not statistically significant, which builds support for only transitory effect and only the Price Pressure hypothesis is confirmed among the theories mentioned in the Literature review section.

The announcement date itself does not bring any significant abnormal returns, but there seems to be some portfolio adjustment on the Effective Date with stocks declining on average 1.23%.

Table 5- Average Cumulative Abnormal Returns for Deletions to the Euro STOXX 50 index 1998-2015

Event Window Period	CAAR	St. Deviation	P-value
Anndats-10 to Anndats	-0.0351**	0.0923	0.045
Anndats to Effdats (-20-0)	-0.0259*	0.0954	0.183
Effdats, Effdats+10	-0.0044	0.0574	0.739
Effdats, Effdats+20	0.016	0.0669	0.263

Anndats to Effdats +20	-0.0057	0.0808	0.66
Effdats-2, Effdats+2	-0.0275**	0.0559	0.014
Announcement Date	-0.0032	0.0317	0.496
Effective Date	-0.0123**	0.0250	0.046

The CARs starting from 33 days before effective date (average 10 days before announcement date) start to revert back to neutrality after 20 days after the deletion. In order to test the long run stock performance I also study abnormal returns up to 180 days after effective date in the next section.

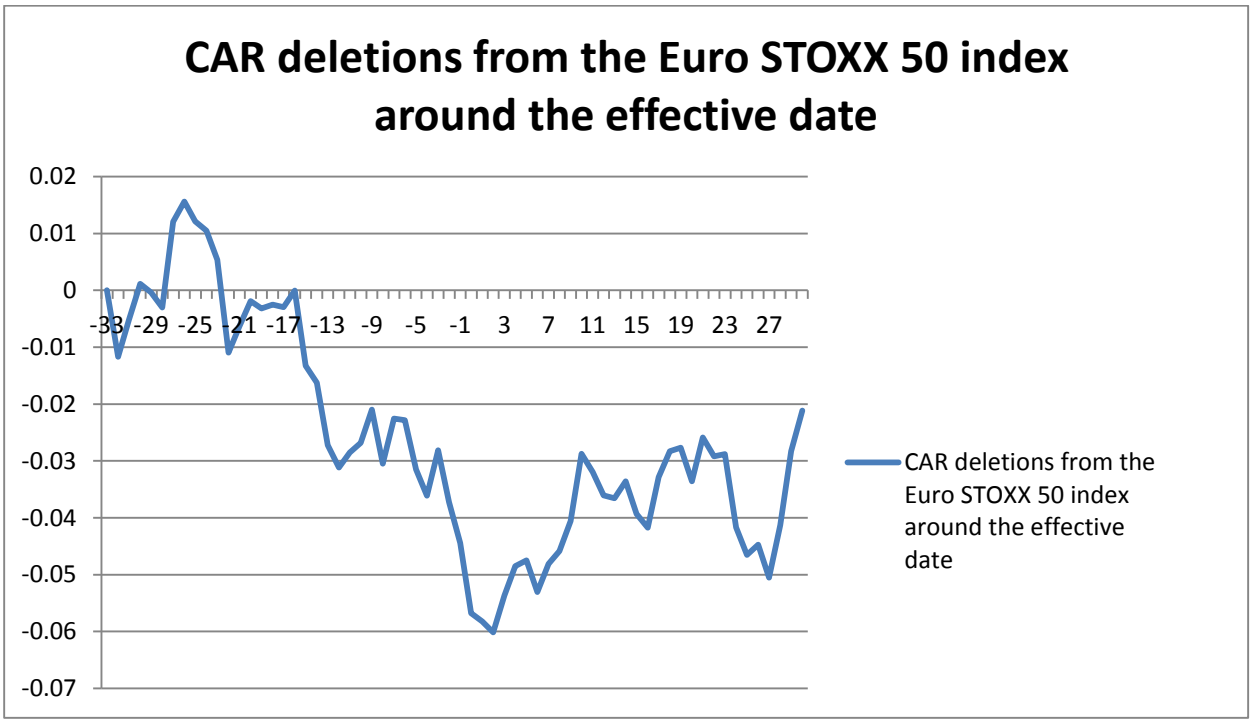

Figure 3 Cumulative Average Abnormal Returns for deletions to the Euro STOXX 50 index, 1998-2015

Again, I perform the test on the abnormal returns after dropping observations occurring before 2008 in order to test whether the introduction of the ETF managed by Credit Agricole Asset Management has increased the abnormal trading and returns around dates when stocks experience deletion from the Euro STOXX 50 index. The sample is again left with only 12 observations and, as with deletions, the abnormal returns appear to be higher.

The anticipation effect has increased to a significant -4.71%, indicating that index funds and arbitrageurs are selling stocks in advance before their deletion is announced by simply observing their market capitalization and speculating on a possible deletion. The period between the announcement date and the effective date also produces a significant negative return of 4.33% which confirms the price pressure hypothesis and portfolio adjustment among index-tracking funds before the actual change in composition.

The prices start to revert after the effective date with 2.29% in the 10 trading days following the deletion, however the return is not statistically significant. The total event window from the announcement until 20 trading days after the effective date produces -4.84% negative return, which provides some evidence for a permanent effect among the deleted stocks, although the return is not significant.

Table 6- Average Cumulative Abnormal Returns for Deletions to the Euro STOXX 50 index 2008-2015

Event Window Period	CAAR	St. Deviation	P-value
Anndats-10 to Anndats	-0.0471***	0.0353	0.001
Anndats to Effdats (-20-0)	-0.0433**	0.0711	0.049
Effdats, Effdats+10	0.0229	0.0759	0.336
Effdats, Effdats+20	-0.0050	0.0726	0.822
Anndats to Effdats +20	-0.0484	0.0523	0.226
Effdats-2, Effdats+2	-0.0341**	0.0451	0.037
Announcement Date	0.00156	0.0316	0.867
Effective Date	-0.0301***	0.0362	0.009

5.3.3 Mean Abnormal Volume for Deletions

The volume for deletions is highest on the effective date itself with 157% higher than average, but the day before also enjoys heavy trading with 73% higher abnormal volume. It Unlike the additions, here the heavy portfolio adjustments take place on 2 trading days, with the prevailing deals occurring on the actual day of the constituents change.

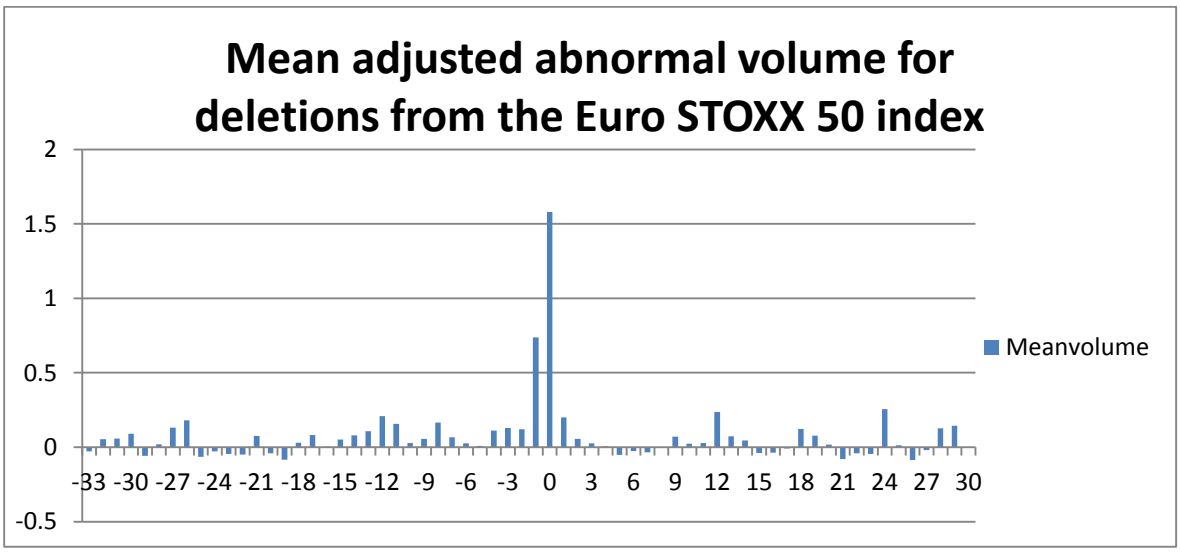

Figure 4 Mean abnormal volume for deletions to the Euro STOXX 50 index

5.4 Changes in operating performance after inclusion/deletion

So far the price and volume effects for both inclusions and deletions from the Euro STOXX 50 index appear only temporary that is why I extend the research by focusing on some operating performance measures for the stocks in question. In order to develop the idea of explaining positive abnormal performance around index inclusions I try to dig deeper by scrutinizing EPS forecasts,and Return on Assets for the companies that experienced inclusion/exclusion. Higher earnings forecasts for the period following the index inclusion is

a finding that appears in Denis et al. (2003) , while Dahia (2009) also studies whether the Return on Assets for the companies in question exhibit any significant change. In order to test this hypothesis for stock additions to the Euro Stoxx 50 index I have obtained annual analysts' forecasts for the stocks in question from I/B/E/S database.

For each analyst, covering the stock, I take the annual forecast for the current fiscal year and one year ahead forecast that is made before but closest to the announcement of inclusion, provided that it was made no earlier than 4 months before the announcement. The median of all analysts covering the stock is taken. For the period after the announcement the methodology will be the same – the forecasts of analysts continuing to cover stock and made after, but closest to the month of the announcement shall be taken, provided that they are not older than 4 months after the announcement. (*The methodology is used in Denis et. al.(2003), however it is based on quarterly revisions for the S&P 500, whereas in the case of Euro Stoxx 50 the revision month is always September*)

The data in IBES, however, offers low coverage of European stocks and I am able to obtain forecast for only 10 out of the 31 addition events. Among those two events experience no change in forecast, 5 realize improvement in both current and 1 year ahead forecasts, 1 is improvement only in 1 year ahead forecast and 2 companies have lower forecasts than before the inclusion.

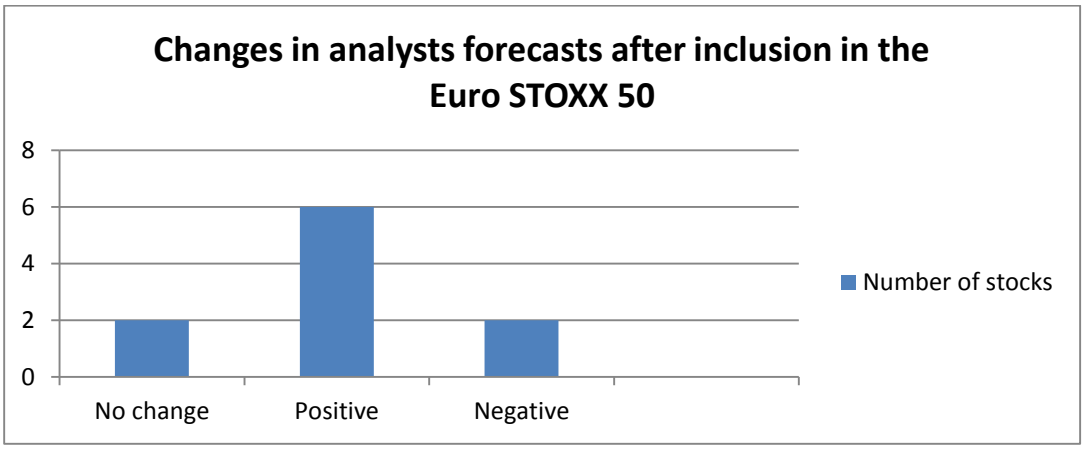

Figure 5 Changes in analysts' forecasts after stock inclusion

Due to the scarce data found on I/B/E/S I resort to Datastream and calculate Return on Assets for both additions and deletions, defined as $\frac{Net\ Income}{Total\ Assets}$ and I take the measure from two years before inclusion to two years after inclusion using the average for each sample, as reported in Table 7.The table also includes long-term stock performance by calculating the returns from a period starting from 180 days before the event until 180 days after the event. The abnormal returns realized before the announcement date entirely revert in the long term, which confirms that only the price pressure hypothesis can explain the index effect exhibited by the Euro STOXX 50 index due to its wide popularity and selection criteria based only on market capitalization.

The changes in Return on Assets for additions exhibit a positive trend in the years before becoming part of the index until inclusion, but then start to decrease from 4.77 to 4.44 and 4.70 respectively in the years following the addition. This trend is more pronounced for the deletions sample, where I have excluded 3 stocks from the sample due to significant deterioration in profitability during the financial crisis of 2008-2009. Their Return on Assets exhibit a downward trend starting from two years before deletion until 1 year after they have been removed from the Euro STOXX 50 index and there is an increase from 0.84% to 2.17% only in the second year after leaving the blue chip index. The results, however, are not significant, and do not provide any clear evidence of stock inclusion/deletion having any actual effect on company profitability.

Table 7 Long-run Stock Performance and change in Return on Assets (Data on Net Income and Total Assets for companies supplied by Datastream)

Panel A: Euro STOXX 50 Additions (1998-2015)			
Number of observations	31	31	31
Long-run Stock Performance			
ANN-180 through ANN-1(Pre-event)	0.0557		
ANN-120 through ANN-1	0.0348		
ANN-60 through ANN-1	0.0238		
EFF+1 through EFF+60	-0.0549**		
EFF+1 through EFF+120	-0.0618		
EFF+1 through EFF+180	-0.0921*		
Long-run Operating Performance	ROA	ΔROA_{y-1}	ΔROA_{y}
ROA y-2 /two years before inclusion/	3.95		
ROA y-1 /one year before inclusion/	3.87		
ROA y /in year of inclusion/	4.77	0.9	
ROA y+1 /one year after inclusion/	4.44	0.57	-0.33
ROA y+2 /two years after inclusion/	4.70	0.83	-0.07

Panel B: Euro STOXX 50 Deletions (1998-2015)			
Number of observations	26	26	26
Long-run Stock Performance			
ANN-180 through ANN-1(Pre-event)	-0.0484		
ANN-120 through ANN-1	-0.0355		
ANN-60 through ANN-1	-0.0397		
EFF+1 through EFF+60	0.0413		
EFF+1 through EFF+120	0.0687		
EFF+1 through EFF+180	0.0564		
Long-run Operating Performance	ROA	ΔROA_{y-1}	ΔROA_{y}
ROAy-2 /two years before inclusion/	2.08		
ROAy-1 /one year before inclusion/	1.54		
ROAy /in year of inclusion/	1.26	-0.28	
ROAy+1 /one year after inclusion/	0.84	-0.70	-0.42
ROAy+2 /two years after inclusion/	2.17	0.63	0.91

6. Robustness checks

The OLS regressions were performed using different estimation windows and also using the MSCI World Index as a market benchmark. However, it did not produce any significant

difference in the reported abnormal returns and cumulative abnormal returns, therefore I consider the reported results reliable. However, the small size of the two subsamples (31 and 29) might produce some bias on the abnormal returns.

7. Conclusion

This study documents the index effect, as exhibited by a blue-chip pan-European index as the Euro STOXX 50, whose selection criteria are based solely on market capitalization. As the changes in the index composition are considered to be an information-free event, stocks experiencing inclusion/deletion do not exhibit any long-term abnormal returns, which supports the price pressure hypothesis as a main explanation for the presented results among the academic theories focusing on the index effect. The study on changes in operating performance respectively for additions and deletions does not produce any significant results and cannot confirm a theory about higher profitability after index inclusion, as documented by Denis et al. (2003) for the S&P 500 index.

Further analysis that can be done in the researching the Euro STOXX 50 index might include grouping the additions and deletions sub-samples in terms of new additions/deletions and stocks that have already been part of the index in order to try to establish evidence on whether new entrants benefit any increase in investors' attention.

Changes in the bid-ask spread around the effective date might also produce any additional evidence on the index effect as index funds and arbitrageurs are trading the stocks more heavily. However, since the Euro STOXX index is still a relatively new instrument and changes in its constituents occur mostly on an annual basis, the number of observations will grow only slowly in time.

References:

Beneish, Messod D., and John C. Gardner, 1995, Information Costs and Liquidity Effects from Changes in the Dow Jones Industrial Average List, The Journal of Financial and Quantitative Analysis, Vol. 30, No 1

Beneish, M. D., and R. E. Whaley, 1996, An anatomy of the `S&P game': The effects of changing the rules, Journal of Finance 51, 1909-1930.

Biktimirov E., Cowan A., Jordan B., 2004, Do demand curves for small stocks slope down?, Journal of Financial Research 27, 161-178.

Biktimirov E., Li B., 2013, Market Reactions to Changes in the S&P/TSX SmallCap Index, The Journal of Index Investing 08/2014, 57-64

Blomstrand, Josef, Safstrand, Tomas, 2010, The Index Effect, Stockholm School of Economics

Blouin, Jennifer, Jana Raedy, and Douglas Shackelford, 2000, The impact of capital gains taxes on stock price reactions to S&P 500 inclusion, National Bureau of Economic Research, Working Paper #8011.

Campbell, Cynthia, 1996, Measuring Abnormal Daily Trading Volumes for Samples of NYSE/ASE and NASDAQ Securities Using Parametric and Nonparametric Test Statistics" *Review of Quantitative Finance and Accounting* 6.3 (1996): 309-326.

Chen, Honghui, Gregory Noronha, and Vijay Singal, 2004, The asymmetric price response to S&P 500 index additions and deletions: Evidence and explanation, Journal of Finance 59, 1901-1940.

Dahia, Jay, 2006, Playing Footsie with the FTSE 100 Index, SSRN Electronic Journal, DOI 10.2139/ssrn.687465

Dahia, Jay & Garcia, Laura, 2009, IBEX 35 Inclusiones and Exclusiones

Dash, Srikant, 2002, Price changes associated with S&P 500 deletions: Time variation and effect of size and share prices, Standard & Poor‟s.

Denis, Diane K., John T. McConnell, Alexei V. Ovtchinnikov and Yun Yu, 2003, S&P 500 index Additions and Earnings Expectations, The Journal of Finance, Vol. 58, No. 5, pp. 1821-1840

Doeswijk, Ronald C., 2005, The index revision party, The International Review of Financial Analysis, Vol. 14, pp. 93-112

Elliott, William B., and Richard S. Warr, 2003, Price pressure on the NYSE and NASDAQ: Evidence from the S&P 500 changes, Financial Management, 32, 85-99.

Harris, L. E., and E. Gurel, 1986, Price and volume effects associated with changes in the S&P 500 list: New evidence for the existence of price pressures, Journal of Finance 41, 815-829.

MacKinlay, Craig A., 1997, Event Studies in Economics and Finance, The Journal of Economic Literature, Vol. 35, No. 1, pp. 13-39

Mase, Bryan, 2007, The Impact of Changes in the FTSE 100 Index, The Financial Review, Vol. 42, No. 3, pp. 461-484

Merton, Robert C., 1987, A Simple Model of Capital Market Equilibrium with Incomplete Information, The Journal of Finance, Vol. 42, No. 3, pp. 483-510

Petajisto, A., 2010, The Index Premium and its hidden cost for index funds, Journal of Empirical Finance, p. 271-288

Polonchek, John and Tim Krehbiel, 1994, Price and Volume Effects Associated with Changes in the Dow Jones Averages, The Quarterly Review of Economics and Finance, Vol. 34, No. 4, pp. 305-316

Shankar, S. Gowri, and James M. Miller, 2006, Market reaction to changes in the S&P Small-cap 600 Index, Financial Review, 41(3), 339-360.

Shleifer, A., 1986, Do demand curves for stocks slope downward?, Journal of Finance 41, 579-590.

Scholes, M., 1972, The market for securities: Substitution versus price pressure and the effects of information on share prices, Journal of Business 45, 179-211.

Standard & Poor's, 2008, The Shrinking Index Effect – A Global Perspective

Wurgler, J., and E. Zhuravskaya, 2002, Does arbitrage flatten demand curves for stocks?, Journal of Business 75, 583-608.

Criteria for inclusion/exclusion into the Euro Stoxx 50 index:
http://www.stoxx.com/download/indices/rulebooks/stoxx_indexguide.pdf

Appendix:

Table 8 Changes in the constituents of the Euro STOXX 50 index excluded from analysis

Company name	Effective date	Addition/Deletion
Koninklijke KPN	**29/06/1998**	Addition
Koninklijke PTT KPN	**29/06/1998**	Deletion
UniCredito	**26/10/1998**	Addition
Credito Italiano	**26/10/1998**	Deletion
Daimler Benz UMA	**26/10/1998**	Addition
Daimler Benz	**26/10/1998**	Deletion
DaimlerChrysler	**17/11/1998**	Addition
Daimler Benz UMA	**17/11/1998**	Deletion
TOTALFINA	**16/06/1999**	Addition
PETROFINA SA	**16/06/1999**	Deletion
SUEZ LYONNAISE DES EAUX	**20/09/1999**	Addition
PPR	**01/11/1999**	Addition
BNP	**01/11/1999**	Addition
PARIBAS	**01/11/1999**	Deletion
ELF AQUITAINE	**01/11/1999**	Deletion
AVENTIS	**20/12/1999**	Addition
RHONE-POULENC	**20/12/1999**	Deletion
CANAL +	**14/02/2000**	Addition
MANNESMANN AG	**14/02/2000**	Deletion
SAINT GOBAIN	**20/03/2000**	Deletion
ENEL	**20/03/2000**	Addition
E.ON	**19/06/2000**	Addition
VEBA	**19/06/2000**	Deletion
GROUPE DANONE	**18/09/2000**	Addition
VOLKSWAGEN AG	**11/12/2000**	Addition
CANAL +	**11/12/2000**	Deletion
TIM	**23/07/2001**	Addition
DRESDNER Bank	**23/07/2001**	Deletion
FORTIS	**17/12/2001**	Addition
FORTIS B	**17/12/2001**	Deletion
PPR	**23/09/2002**	Deletion
SAP	**28/07/2004**	Addition
AVENTIS	**27/07/2004**	Deletion
ALLIED IRISH BANKS	**30/06/2005**	Addition
TIM	**29/06/2005**	Deletion
RENAULT	**20/07/2005**	Addition

ROYAL DUTCH PETROLEUM	**19/07/2005**	Deletion
INTESA SANPAOLO SPA	**02/01/2007**	Addition
SAN PAOLO IMI	**02/01/2007**	Deletion
VOLKSWAGEN	**10/10/2007**	Addition
ENDESA	**09/10/2007**	Deletion
DEUTSCHE BOERSE	**15/10/2007**	Addition
ABN AMRO	**15/10/2007**	Deletion
GDF SUEZ	**22/07/2008**	Addition
SUEZ	**21/07/2008**	Deletion
AGEAS SA	**14/01/2009**	Addition
AGEAS SA	**13/01/2009**	Deletion
ARCELORMITTAL SA	**15/01/2009**	Addition
ARCELORMITTAL SA Subsidiary	**14/01/2009**	Deletion
APERAM SA	**26/01/2011**	Addition
APERAM SA	**31/01/2011**	Deletion
DEUTSCHE BOERSE AG	**20/07/2011**	*Addition*
DEUTSCHE BOERSE AG	**19/07/2011**	*Deletion*
DEUTSCHE POST AG	**01/02/2012**	*Addition*
DEUTSCHE BOERSE AG	**08/02/2012**	*Addition*
		Addition
DEUTSCHE BOERSE AG	**07/02/2012**	*Deletion*
Total	56	56

Table 9 Average Abnormal Returns and volume per Trading day for Additions to the Euro STOXX 50 index 1998-2015

Event Day	Average AR	CAR	Mean-adjusted Trading Volume (in %)
-26	0.000032	-0.00519	9.54
-25	0.02486	0.01967	11.65
-24	0.00475	0.024433	12.92
-23	0.00872	0.03315	15.27
-22	0.00309	0.03625	27.32
-21	0.00237	0.03862	20.78
-20	-0.00063	0.037982	7.27
-19	0.00249	0.04048	20.29
-18	0.00246	0.042947	32.37
-17	-0.00132	0.04162	14.41
-16	0.00205	0.04367	19.61
-15	0.00250	0.04618	10.40
-14	-0.002504	0.04076	16.60
-13	0.00116	0.04193	32.64
-12	-0.00130	0.04062	28.75

-11	0.00140	0.04202	24.33
-10	-0.00473	0.03729	20.22
-9	-0.00218	0.03510	18.13
-8	0.00475	0.03986	18.02
-7	0.00558	0.04544	18.83
-6	0.00569	0.05114	22.54
-5	-0.00061	0.05053	19.92
-4	0.00213	0.05266	20.61
-3	0.00948	0.06215	29.63
-2	0.00239	0.06454	36.40
-1	**0.0159**	**0.08045**	**199.21**
0	-0.00388	0.07656	56.01
1	-0.00539	0.07116	42.61
2	-0.00053	0.07063	27.19
3	-0.00174	0.06888	33.13
4	-0.00392	0.06496	24.80
5	-0.00179	0.06316	24.62
6	-0.00943	0.05372	31.91
7	-0.00086	0.05286	32.38
8	0.00024	0.05310	27.15
9	-0.00412	0.04898	30.71
10	0.00267	0.05165	21.03
11	-0.00308	0.04857	21.56
12	-0.00040	0.04816	24.62
13	0.01332	0.06149	32.69
14	-0.00295	0.05853	27.91
15	0.00198	0.06052	20.41
16	-0.00196	0.05856	29.42
17	-0.00099	0.05756	22.36
18	-0.00628	0.05127	23.72
19	0.00077	0.05205	24.95
20	-0.00346	0.04859	15.44

Table 10 Average Abnormal Returns and volume per Trading day for Deletions to the Euro STOXX 50 index 1998-2015

Event Day	Average AR	CAR	Mean-adjusted Trading Volume (in %)
-26	0.015617	0.18031	18.031
-25	0.012116	-0.0652711	-6.52711
-24	0.010484	-0.0268441	-2.68441
-23	0.005391	-0.0440804	-4.40804
-22	-0.01097	-0.0497728	-4.97728

-21	-0.00636	0.0744736	7.44736
-20	-0.0019	-0.0411694	-4.11694
-19	-0.00317	-0.0848407	-8.48407
-18	-0.00249	0.029931	2.9931
-17	-0.00295	0.082226	8.2226
-16	-5.9E-05	0.0051923	0.51923
-15	-0.01325	0.0509045	5.09045
-14	-0.01627	0.0797262	7.97262
-13	-0.02721	0.1068764	10.68764
-12	-0.03118	0.208302	20.8302
-11	-0.02853	0.1572268	15.72268
-10	-0.02681	0.0282076	2.82076
-9	-0.02095	0.0566052	5.66052
-8	-0.03046	0.1652339	16.52339
-7	-0.02254	0.0673233	6.73233
-6	-0.02281	0.0263581	2.63581
-5	-0.03151	0.0095711	0.95711
-4	-0.03611	0.1109682	11.09682
-3	-0.02812	0.1285945	12.85945
-2	-0.03725	0.1202471	12.02471
-1	-0.04445	0.7382071	73.82071
0	**-0.05676**	**1.579771**	**157.9771**
1	-0.05822	0.1998447	19.98447
2	-0.06017	0.0549172	5.49172
3	-0.05366	0.0260693	2.60693
4	-0.04851	0.0054526	0.54526
5	-0.04749	-0.0506309	-5.06309
6	-0.05307	-0.0256076	-2.56076
7	-0.04813	-0.0352941	-3.52941
8	-0.04583	-0.0009556	-0.09556
9	-0.04056	0.0712771	7.12771
10	-0.02876	0.0227531	2.27531
11	-0.03193	0.0270914	2.70914
12	-0.03607	0.2371032	23.71032
13	-0.03659	0.0742402	7.42402
14	-0.03358	0.0457067	4.57067
15	-0.03934	-0.0396935	-3.96935
16	-0.04176	-0.0374286	-3.74286
17	-0.03283	-0.0091527	-0.91527
18	-0.02827	0.1228845	12.28845
19	-0.02766	0.0784711	7.84711
20	-0.03357	0.0170039	1.70039