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The Index Effect
OMXS30 vs EURO STOXX 50

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Abstract

This paper examines the index effect, the phenomenon of abnormal returns and abnormal trading volumes that stocks may experience when included in or excluded from an index. Many theories have been presented to explain this phenomenon, relating it to factors such as demand shocks, increased attention and lower trading costs. At present, there is no consensus how the index effect is developing since it should be diminishing as markets become more effective, but should be increasing with the growth of index funds. It is obvious that index funds must reweight their portfolios along with index revisions which lead to changes in demand. However, it is not certain whether changes in demand should affect prices. This study examines the existence of index effects on the EURO STOXX 50 and the OMXS30 and relates the difference in findings to the underlying characteristics of the two indices. We find signs of abnormal returns and abnormal trading volumes for both indices short term but can conclude that a permanent effect only exists for the OMXS30. These findings are reasonable since the EURO STOXX 50 has more perfect substitutes and is more scrutinized which leaves less room for long term anomalies. Inclusions should not have a significant long term effect as demand curves are fairly elastic. However, inclusions to the OMXS30 introduce the stocks to a larger base of potential investors. Also, since stocks in this smaller market have less close substitutes, demand curves are more inelastic and increased demand drives prices.

Key words: Index effect, price pressure hypothesis, imperfect substitutes hypothesis, attention hypothesis, EURO STOXX 50, OMXS30

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1. Introduction

Fama (1970) has together with several other researchers within the field of finance proposed that financial markets are efficient, meaning that demand curves for stocks are completely elastic and that prices reflect all available information in the market. This theory is called the efficient market hypothesis (EMH) and implies that market participants should be able to trade any amount of stocks at the prevailing market price without affecting the price. According to the EMH, revisions of indices based purely on prices and trading volume should not impact the stock returns since it does not reveal any new information. The return one can expect from an investment stands in proportion to its risk and any asset offering abnormal returns would experience a direct price correction since arbitrageurs would instantly take advantage of such mispricing.

The total risk of an investment consists of both systematic and firm specific risk. The idiosyncratic (firm specific) risk can be diversified away, and for that reason an investor should not be compensated for bearing it. However, the systematic risk is non-diversifiable and must be fairly compensated for. Ultimately, one should hold the market portfolio to perfectly diversify away the idiosyncratic risk, but since this is not feasible, a substitute for the market portfolio can be a broad market index. An index fund is a mutual fund or a Unit Investment Trust with the aim to closely track the return of an index (U.S. Securities Exchange Commission (2007)). These funds are passively managed which results in lower fees due to reduced transaction costs and favorable tax treatment. In line with the EMH, research show that actively managed funds cannot outperform the market over time. Consequently, the net result offered by index funds is often more attractive than that of actively managed funds and naturally index funds have grown in popularity (Elton, Gruber & Blake (1996)).

The increased popularity of using indices as benchmarks has given rise to a phenomenon called the index effect. It is a market inefficiency of the form that stocks experience abnormal returns and abnormal trading volumes when included in or excluded from an index. The index effect can be positive as well as negative and there are several suggested explanations for this anomaly. One of them is that index funds will buy newly included stocks to replicate a change in the index. This increase in demand leads to a price appreciation. Another explanation is that index inclusions lead to increased attention from potential investors, increased availability of information and increased liquidity in the stock which reduces the trading cost and leads to higher prices. The effect can be short term (temporary) meaning that it has vanished within weeks after the event, but it can also be long term (permanent) meaning that it remains even after this period.

A recent study made by Standard & Poor (2008) showed that the index effect is diminishing and the explanation they provide is that arbitrageurs have become aware of this market anomaly and use every opportunity to profit from. However, other recent studies provide evidence for that this effect still exists and show that abnormal returns can still be captured. The number of index funds has grown which makes it is reasonable to believe that the index effect even could have increased.

In a previous study on the Swedish market, Andelius & Skrutkowski (2008) concluded that the index effect was the inverse on the Swedish market. This contradicts most other studies on the phenomenon which we feel is intriguing. The authors used an event window which excluded eventual effects ahead of announcement of changes from index revisions. Changes in the composition of OMXS30 can be predicted in advance and for that reason we want to examine the OMXS30 with an event window starting long before announcement date. The purpose of our thesis is hence to examine the existence of an index effect on the Swedish market using another event window to see if it actually is different in some way or if it can be explained with the general theories applied to this phenomenon. Another purpose with this study is to see what implications the size and popularity of an index has on the index effect. This will be done by investigating the observed effects on a major European blue-chip index, the EURO STOXX 50, and compare the findings with those of the OMXS30. The reason why EURO STOXX 50 and OMXS30 are suitable for comparison is that they have similar transparent selection criteria and only differ materially in size and popularity.

2. Academic Framework

The efficient market hypothesis

Fama (1970) evaluated the theoretical and empirical literature on the EMH. The theory of an efficient market deals with the question if security prices fully reflect the available information in the market. There are three different forms of the EMH: the weak-form which includes historical prices and returns, the semi-strong-form which also embraces publicly available information and lastly the strong-form which also incorporate insider information. The author states that there is evidence supporting the EMH but he also points out that the strong-form of market efficiency should only be seen as a benchmark from which inefficiencies can be observed.

The price pressure hypothesis

The price-pressure hypothesis discussed by Schleifer (1986), Harris & Gurel (1986) and Pruitt & Wei (1989) violates the EMH and is based on the notion that stock prices and trading volumes are affected by the quantity of shares demanded. According to the price-pressure hypothesis there should be a price increase (decrease) associated with increased purchasing (selling) of a stock. Assume that buying and selling large blocks of shares comes with the cost of rebalancing portfolios, then the buyers initiating trades must cover the sellers' costs as compensation for providing liquidity. Trades initiated by buyers should come with a premium and trades initiated by the sellers should be at discount. This change in prices is temporary and an immediate correction will follow. Applying this to the index effect, one could expect a temporary price increase (decrease) in the share price following an index inclusion (exclusion) as index funds and other market participants mimicking the index must reweight their portfolios. Trading volumes can be expected to increase around the announcement date or effective date as stocks change hands to a greater extent than what would happen if there was no reweighting of the index (table I).

The imperfect substitutes hypothesis

This hypothesis, presented by Scholes (1972), Kraus & Stoll (1972), Hess & Frost (1982) and Kaul, Mehrotra & Morck (2000) does also violate the EMH but says that effects are permanent. When securities have close substitutes, their value will not significantly depend on changes in supply and demand which implies an (almost) horizontal demand curve. The imperfect substitutes hypothesis assumes that investors do not regard different stocks as close substitutes. Under this condition, the long run demand curve slopes downward, i.e. it is not perfectly elastic. When there are shocks of increasing (decreasing) demand for a specific stock, then the price must adjust upward (downward) to a new equilibrium. When relating this to the index effect, one could expect a permanent price increase (decrease) following an index inclusion (exclusion) as investors react to the index changes and reweight their portfolios. The increased demand can be further supported by increased popularity among foreign investors who tend to invest in the main indices to gain exposure to different markets.

A change in trading volume according to this theory is ambiguous, depending on the behavior of investors. If they simply buy and hold the shares, the effect on trading volume is consistent with that of the price-pressure hypothesis. Investors will buy a stock included in the index and sell a stock excluded from the index upon announcement, otherwise volumes will on average be normal or even slightly lower than normal. However, if an index inclusion leads to increased popularity in general (as with international exposure), the change in trading volume will remain as long as the stock remains in the index (table I).

The information cost/liquidity hypothesis

The information cost/liquidity hypothesis presented by Barry & Brown (1985) and Beneish & Gardner (1995) states that investors demand higher returns for investing in stocks with less available information and low liquidity. Acquiring information before investing in stocks is a costly process. Also, securities with less available information are usually associated with a higher systematic risk. Further, stocks with low liquidity have higher bid-ask spreads which increases transaction costs. When a stock is included into an index, it will get increased coverage by analysts and new investors which naturally leads to better liquidity. More available information and the increased trading volume will decrease direct transactions costs (bid-ask spread) and indirect trading costs (information cost), hence total trading costs. Accordingly, an index inclusion should lead to a permanent increase in both price and trading volume and the opposite for an index exclusion (table I).

The attention hypothesis

The attention hypothesis discussed by Merton (1987) and Polonchek & Krehbiel (1994) states that news which attracts market attention can lead to a permanent stock price appreciation since it draws new potential investors to the firm by increasing awareness of it. This applies to the index effect since index revisions most often get media attention. As stocks are added to an index, they enter the scope for new potential investor groups which leads to a permanent positive price effect. The opposite, a permanent negative price effect is not valid for stock exclusions since investors are still familiar with these stocks (table I). The attention hypothesis also implies that inclusions of stocks that have previously been excluded from certain indices should not trigger the same price increase as should inclusions of completely new stocks. The attention hypothesis as modeled by Merton does not make any predictions about changes in trading volumes.

The information signaling hypothesis

The information signaling hypothesis presented by Mikkelson (1981), Harris & Raviv (1985) and Smith (1986) deals with stock price reactions to what is signaled to the market. It assumes that the stock price effect from signaling is permanent, however, it is hard to conclude something about the trading volume. An inclusion of a stock into an index is perceived as something positive and an exclusion is considered negative. Thus, an index inclusion (exclusion) of a stock will lead to a positive price increase (decrease) (see table I). There are many factors and events that send signals to the market. One positive signal can be that the index composition is decided by a committee that bases their decision on private information. This is the case with the S&P 500. For other indices that mainly is constructed after market capitalization, positive signals can be that the stock is considered as a blue chip security and thereby results in increased awareness among investors and can lead to take-over premiums.

The selection criteria hypothesis

The selection criteria hypothesis described by Bechmann (2002) states that changes in stock prices and volumes can be explained partly by the criteria upon which the sample of stocks is selected. For the index effect, it means that abnormal returns and abnormal trading volumes can be associated with the criteria of an inclusion in an index (table I). If stocks are selected on the basis that they have generated abnormal returns in the previous period, they are more likely to do so in the subsequent period as well when included in the index. Also, anticipated changes in an index may generate an index effect several days or even weeks before the actual announcement of an inclusion/exclusion.

Table I

Inclusions		Temporary	Permanent	Exclusions		Temporary	Permanent
Price pressure hypothesis	Price	+	0	**Price pressure hypothesis**	Price	-	0
	Volume	+	0		Volume	+	0
Imperfect substitutes hypothesis	Price	0	+	**Imperfect substitutes hypothesis**	Price	0	-
	Volume	+	(+) / (-)		Volume	+	(+) / (-)
Information cost / liquidity hypothesis	Price	0	+	**Information cost / liquidity hypothesis**	Price	0	-
	Volume	0	+		Volume	0	-
Attention hypothesis	Price	0	+	**Attention hypothesis**	Price	0	0
	Volume				Volume		
Information signaling hypothesis	Price	0	+	**Information signaling hypothesis**	Price	0	-
	Volume	0	+		Volume	+	-
Selection criteria hypothesis	Price	0	+	**Selection criteria hypothesis**	Price	0	-
	Volume	0	+		Volume	0	-

The table shows expected price and volume effects under the different hypotheses
+ a positive effect, - a negative effect, ( ) theory is ambiguous, 0 no expected effect
the theory gives no indication about the expected effect

3. Related Literature

Schleifer (1986) was one of the first to investigate the index effect and focused on the slope of demand curves. He looked at inclusions on the S&P 500 index where he found significant abnormal returns associated with the announcement of inclusions in the index. These observed abnormal returns seemed to grow with the increasing popularity of index funds. However, results for abnormal volumes were not as clear as for abnormal returns but he found increasing trading activity on the announcement day and throughout the announcement week, implying slow rebalancing by index funds. By regressing results, he found support for a significant relationship between index funds buying and a price effect, consistent with the price pressure hypothesis and downward sloping demand curves in the short term.

Harris & *Gurel (1986)* found in their study that both stock prices and trading volumes were affected by announcements of index inclusion for a particular stock, i.e. a price pressure effect. Announcement of changes did not reveal any new information as specified explicitly by the S&P 500. Hence, there must have been something else driving prices and trading volume and it was most likely a shift in demand. In the fist time period no evidence of increased prices and trading volumes could be found. The authors related this to the lack of index funds during the period. However, as the number of index funds increased and the money invested in funds grew, they could see a growing pattern. They concluded that the effect was not caused by the announcement itself but by the increased demand from the replicating index funds.

Polonchek & *Krehbiel (1994)* investigated what effect media attention had on stock returns. They compared the returns and trading volumes from securities included in the Dow Jones Industrial Average (DJIA) - which receives much media attention - to securities registered on the Dow Jones Transportation Average (DJTA) which receive modest media attention. They found that stocks gaining more media coverage had greater positive abnormal return and abnormal trading volume from index revisions, in line with the attention hypothesis.

Beneish & *Gardner (1995)* examined the index effect on two different indices, The S&P 500 which is a popular index for index replication, and the DJIA which is replicated sparsely. The authors presented evidence for an index effect for the S&P 500 but not for the DJIA. Their conclusion was that the extensive difference in index replication was the explanation. When a security was included in the index S&P 500, it had a major impact on the demand for the stock which caused prices to change. The same result was also found by Jain (1987) and Dhillon & Johnson (1991). However, they all offered different explanations for the phenomenon. Worth noticing was that an exclusion from the index resulted in both negative abnormal returns and significant reductions in trading volume during a 3-day period. As the trading volume decreases, the bid-ask spread on the stock increase, leading to higher trading costs and decrease analyst coverage. This is much in line with the information cost/liquidity hypothesis.

Bechmann (2002) investigated the index effect on the Danish blue-chip index KFX. An interesting distinction from the S&P 500 is that the KFX index has transparent selection criteria based purely on stocks' liquidity and market value which makes changes in index composition easier to predict. Bechmann (2002) observed only modest changes in stock prices around the announcement date and effective date. Stocks added to the index experienced abnormal returns in the month foregoing the announcement whereas stocks deleted from the index experienced negative abnormal returns in the 6 months foregoing exclusion. He also found that trading volumes were higher and price pressure more significant around the announcement date and that the effect post inclusions was permanent while the effect post exclusions reverted. It was also shown that stocks included in the KFX index experienced higher demand, more attention and lower cost of trading than stocks outside the index.

Doeswijk (2005) performed another study on a European index, namely the AEX index in the Netherlands. He studied price and volume effects from inclusions and exclusions but added a test for changes in weights where he measures performance of a 'winners' portfolio of stocks with anticipated increasing weights versus a 'losers' portfolio of stocks with anticipated decreasing weights ahead of revision. Just as for the KFX index, the outcomes of revisions of the AEX index are easy to predict before announcement. Consistent with the idea of anticipated index revisions, he found that 'winners' of index revisions showed abnormal returns of 7.4% on average in the five weeks prior to revision. For losers, abnormal returns and trading volumes were unaffected long term. The findings were ambiguous compared to previous research but gave support to the attention hypothesis and price pressure hypothesis.

Mase (2007) examined both the short- and long term impact of inclusions and exclusions on the FTSE 100. He found that there remained abnormal returns for included securities when measured 21 days after the effective date, indicating a permanent price effect explained by the imperfect substitutes hypothesis. Significant negative abnormal returns could also be seen when a security was deleted. Since the index is based on market capitalization, stocks included (excluded) have most likely performed better (worse) than expected before the revision. Mase accounted for this problem by using the market model, estimating coefficients post event, and concluded that there existed cumulative abnormal returns with a subsequent price reversal. The results for deletions followed the same pattern, the only difference being that price reversals were more limited. Evidence for an increased trading volume was also found before the effective date. The stock liquidity fell back to normal levels when returns reversed. Noticeably, the trading volume started to rise before the actual announcement date for additions indicating speculation.

4. Data

The OMXS30 is a value-weighted index which comprises the 30 most traded stocks on the Stockholm Stock Exchange. It is the oldest, largest and most liquid index on the exchange, hence also the most popular choice for index funds to replicate. It is calculated and published by NASDAQ OMX AB which reviews the index on a semi-annual basis. The announcement dates for index changes are in the end of June and December and with implementation dates in the beginning of July and January. An index-stock which does not qualify among the 45 stocks with highest trading volume in the control period is replaced by the non-index stock with the highest trading volume. Likewise a non-index stock that is among the 15 stocks with highest trading volume in the control period replaces the index stock with the lowest trading volume. Since the rules of inclusion and exclusion are publicly known and based on trading volumes, all changes in the index composition can be anticipated and reveal no new information to the public. Hence, an inclusion or exclusion should not affect the stock price as explained by the efficient market hypothesis.

The EURO STOXX 50 is a leading European blue-chip index published by STOXX Ltd. It includes 50 securities from 12 different countries - Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal and Spain – and captures approximately 55-60% of the free float in these markets. The index is reviewed annually in August and changes are implemented the third Friday of September. The constituents are selected based on free float market capitalization, thus the events of inclusions/exclusions should not be based on new information and can be anticipated. The stock selection works as follows: A list from the 19 EURO STOXX Supersector indices are created based on their free float capitalization. Stocks with the largest market capitalization in these countries are added to the selection list until they together cover nearly, but still less than 60% of the free float market capitalization of the EURO STOXX Total Market Index (TMI) Supersector index. If there are any current index stocks which do not fit the description above, they will also be included on the list. The 40 largest securities are selected as components of the index. Any current index stocks ranked between 41 and 60 on the list will remain included. If the number of components after this selection process is still below 50, the stocks with the highest free float market capitalization are added until 50 securities are included.

As mentioned above, both indices have straightforward selection criteria which make the changes in index composition easier to predict. However, they differ when it comes to international recognition and average size of constituents which makes them suitable instruments for investigating how the index effect differ between a heavily tracked multinational index and a national index, less popular to replicate.

To test for index effects, we study the index revisions for OMXS30 and EURO STOOX 50 between January 1996 and December 2009. We define every inclusion or exclusion as an event and look at daily returns and trading volumes of the securities added or deleted. This data is supplied by DataStream and adjusted for stock splits and dividends. For the selected methodology we also require returns of the market indices OMX Allshare, MSCI Europe and MSCI World as benchmarks for the same period, which is supplied by the same source. There are two dates of interest for every inclusion and exclusion, the announcement date and the effective date. Both these dates, as well as a period before and after, are interesting for our study since revisions can be anticipated and the different hypothesis differ as to where eventual index effects will be observed. The relevant data strings range from 130 days before to 120 days after the effective date. We control for currency effects by converting prices to SEK for the OMXS30 study and EUR for the EURO STOXX 50 study. Trading volume is measured in units of stocks.

There are 110 events (i.e. inclusions or exclusions) observed for the EURO STOXX 50 and 69 events observed for the OMXS30 during the given period (table XII, table XIII, table XV & table XVI in appendix). For practical and theoretical reasons, all these observations cannot be included in our study. Selected event observations must come from the regular anticipated index reviews. The composition of indices can also change due to corporate events such as name changes, mergers, acquisitions or divestures. Such events can trigger abnormal returns and trading volumes for other reasons than solely being included in or excluded from the index. Hence, including such event observations in our study would give misleading results and we exclude them to be able to isolate the effects related to the index change itself and to explain the observed effects from the same theoretical perspective. This adjustment method is similar to previous research, e.g. Chen, Noronha & Singal (2004), Denis, McConnell, Ovtchinnikov & Yu (2003) and Lynch & Mendenhall (1997).

We end up having 45 observed events for EURO STOXX 50 and 36 observed events for OMXS30 with relevant return and volume data (table XII & table XV). We split these two samples into subsamples by separating inclusions from exclusions as eventual index effects may have different characteristic for the two event types. The sample size has been reduced and it has negative implications for the statistical significance of our findings. Our intention was not to exclude observations from our initial dataset but to find interesting and interpretable results we had to exclude these disturbing factors and align out data under given criteria. One would need to extend the observation period a couple of years to increase the number of observations but 1996 is how far back in time data was available from STOXX Ltd. It is worth noting that, despite our adjustments, there may still be some bias due to spin-offs or merger activities around the times for announcement dates which we have not detected. An indication for such activities can be seen in the sample volatility in trading volumes for OMXS30 exclusions where shocks of individual securities are more obvious (table XVII in appendix). The set of exclusions for the OMXS30 is very small (14 observations) and for that reason we view this sample only as indicative.

5. Methodology

Estimation windows & model selection

To examine stock price and trading volume effects of index inclusions and exclusions, we use a standard event-study methodology as described by MacKinlay (1997). We define an event as an index inclusion or index exclusion. The event window, the period over which we will observe eventual abnormal returns and trading volumes, is set around the announcement date (AD) and effective date (ED). For both indices, announcement is on average 7-8 trading days before the effective date depending on how the holidays are located.

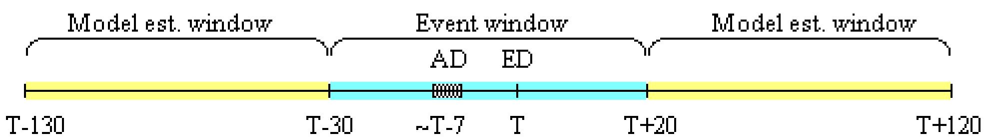
Given the high predictability of changes in the EURO STOXX 50 and the OMXS30, we expect index effects to be visible before the announcement and for that reason we set our event window to start 30 trading days before the effective date which is about 23 days before the announcement date (figure 1). This is consistent with Mase (2007) and Bechmann (2002) who investigated the FTSE100 and the KFX index, two indices with similar degree of predictability in composition changes. Previous research suggests that temporary price effects are fully reversed within a few weeks after the effective date and for that reason we set our event window to end 20 trading days after the event which is also in line with Mase (2007), Bechmann (2002) and Beneish & Gardner (1995).

We define daily stock return as the lognormal change in price from the closing price one day before. The abnormal returns and abnormal trading volumes we want to observe can be defined as the deviations from the expected returns and volumes. The expected return is calculated with *the constant mean return model* or *the market* model. The expected volume is calculated with *the constant mean return model* and since abnormal trading volume is measured in unit of stocks, it must be set as percentage of the mean volume to be comparable across the panel.

Both models mentioned above calculate estimates on the basis of actual returns measured over a certain time period, we call it the model estimation window. There is no unanimous theory for which model estimation window to use, except that the actual event window should be excluded to avoid biased estimates (Scholes (1972)). MacKinlay (1997) suggested that when using daily data, one could have an estimation window of 120 days prior to the event period. However, using only observations before the event would give biased estimates of abnormal returns (Bechmann (2002)). Intuitively, exclusions must have performed worse in the period prior to the event and vice versa. Also, one must remember that abnormal returns may come from increased risk associated with the firm which is adjusted for with the market model estimated over the applied model estimation window.

Using a model estimation window before and after the event window solves the problem of biased estimates and rules out the selection criterion hypothesis as a potential explanation to our findings. It is also consistent with many previous studies, e.g. Scholes (1972), Harris & Gurel (1986), Beneish & Gardner (1995) and Bechmann (2002). The constant mean return model does not impose restrictions for how many days to use specifically but to maximize the predictive power of the market model we found the most appropriate model estimation window to be 100 days before the event window and 100 days after the event window (figure 1).

Figure 1



Quantities with subscript τ are calculated on the event window period whereas quantities with subscript t are calculated on the model estimation window. T is defined as the date when index changes become effective.

$\tau \in [\mathrm{T}-30; \mathrm{T}+20]$

$t \in [\mathrm{T}-130; \mathrm{T}-31] \cup [\mathrm{T}+21; \mathrm{T}+120]$

The constant mean model

The constant mean model states that returns and volumes over the event window can be expected to equal the mean return and volume calculated over the model estimation window (eq.1).

$$E(X_{i,\tau}) = \mu_i = \frac{1}{n} * \sum_{t=1}^{n} X_{i,t} \qquad \text{(eq.1)}$$

Where

$E(X_{i,\tau})$ = expected return/volume for security i in the event window

μ_i = mean return/volume for security i

$X_{i,t}$ = Actual return/volume for security i at time t

n = number of days in the model estimation window

The model is simple and can be applied on examinations of both the price and volume effects. Schleifer (1996) performed a study using both this model and the market model whereby he found that results were robust to changes in methodology. However, one must bear in mind that the constant mean model does not account for changes in the market and for that reason results may be biased. Since revisions of the EURO STOXX 50 and the OMXS30 take place around the same dates every year, we may obtain results influenced by seasonality (such as the January effect) when using non-market adjusted results.

The market model

The market model as proposed by Sharpe describes the return of any security as a linear relationship with the market portfolio (eq.3). It accounts for changes in returns that are attributable to changes in the market, thus reduces the variance of abnormal returns.

$$R_{i,t} = \alpha_i + \beta_i R_{m,t} + \epsilon_{i,t} \qquad \text{(eq.2)}$$

$E(\epsilon_{i,t}) = 0$ and $Var(\epsilon_{i,t}) = \sigma^2$

Where

$R_{i,t}$ = return of security i at time t

$R_{m,t}$ = return of the market portfolio at time t

α_i = intercept for security i

β_i = slope coefficient for security i

$\epsilon_{i,t}$ = residual for security i at time t

A common way when using this model is to choose a wide market index as proxy for the market portfolio and there we have chosen to use the MSCI World index. However, due to market segmentation, there are trends in local markets that are not captured by a broad world market index. Such movements can still not be seen as company specific and for that reason we have extended the model to include two market indices for our regression, one world index and one index representing the specific market. By this we can capture more systematic risk than would the simple market model described above (eq.2). For the OMXS30 study we use the OMX AllShare index and for the EURO STOXX 50 study we use the MSCI Europe index. For each individual security (i) we run the following OLS regressions over the model estimation window, adjusting for heteroskedasticity.

OMXS30:

$$R_{i,t} = \alpha_i + \beta_{i;OMX\ AllShare} R_{OMX\ AllShare,t} + \beta_{i;MSCI\ World} R_{MSCI\ World,t} + \epsilon_{i,t}$$

EURO STOXX 50:

$$R_{i,t} = \alpha_i + \beta_{i;MSCI\ Europe} R_{MSCI\ Europe,t} + \beta_{i;MSCI\ World} R_{MSCI\ World,t} + \epsilon_{i,t}$$

The intercept $\hat{\alpha}_i$ and the OLS estimators $\hat{\beta}_{i;OMX\ AllShare}$, $\hat{\beta}_{i;MSCI\ Europe}$ and $\hat{\beta}_{i;MSCI\ World}$ can then be used to calculate the expected return in the event window (eq.3a) (eq.3b).

OMXS30:

$$E(R_{i,\tau}) = \hat{\alpha}_i + \hat{\beta}_{i;OMX\ AllShare} R_{OMX\ AllShare,\tau} + \hat{\beta}_{i;MSCI\ World} R_{MSCI\ World,\tau} \qquad \text{(eq.3a)}$$

EURO STOXX 50:

$$E(R_{i,\tau}) = \hat{\alpha}_i + \hat{\beta}_{i;MSCI\ Europe} R_{MSCI\ Europe,\tau} + \hat{\beta}_{i;MSCI\ World} R_{MSCI\ World,\tau} \qquad \text{(eq.3b)}$$

One must note that for several OLS regressions, intercepts and/or one of the slope coefficients were not significantly different from zero and for that reason they were set to zero in eq.3a and eq.3b.

Despite the increased complexity in calculations, the market model presents results that are more robust. The period we have chosen for our study (1996-2009) includes two rather dramatic market breakdowns, the IT-bubble and the credit crunch, which both lead to unusual market movements. Using market adjusted returns as given by the market model helps us minimizing the impact of these breakdowns. Unfortunately the market model is not applicable for the volume aspect of our study. One could use market adjusted volume figures but then it takes a good proxy for market volumes which we do not have.

Abnormal values calculations

Using the models above gives us estimates for expected daily returns and trading volumes. The calculation of abnormal returns/volumes is defined as the difference between actual returns/volumes and expected returns/volumes. Since we have two different models for calculating expected returns, we will calculate two figures for abnormal returns whereas we will only obtain one figure for abnormal trading volume each day (eq.4).

$$AX_{i,\tau} = X_{i,\tau} - E(X_{i,\tau}) \qquad \text{(eq.4)}$$

Where

$AX_{i,\tau}$ = Abnormal return/volume for security i at time τ

$X_{i,\tau}$ = Actual return/volume for security i at time τ

$E(X_{i,\tau})$ = Expected return/volume for security i at time τ

To study whether there is a general price/volume effect associated with index changes, we must look at the average abnormal returns/volumes that securities experience when included or excluded from an index. For this we use the arithmetic mean of the abnormal returns/volumes for all securities on the same day in their respective event window. However, we investigate additions separately from deletions for each index (eq.5).

$$\overline{AX}_{\tau} = \frac{1}{N}\sum_{i=1}^{N} AX_{i,\tau} \qquad \text{(eq.5)}$$

where

$\overline{AX}_{\tau}$ = Arithmetic mean abnormal return/volume at time τ

N = Amount of securities in the observed sample (inclusions/exclusions separate for the index)

We will obtain daily numbers for market adjusted average abnormal returns (expected returns given by the market model), unadjusted average abnormal returns (expected returns given by the constant mean model) and average abnormal trading volumes (expected volumes given by the constant mean model) on securities included in and excluded from both indices over the event window [T-30;T+20] where T is the effective date.

Since changes in index constituents can be predicted from the selection criteria for both indices, we expect to observe index effects over a period ranging from day τ_1 (most likely before the announcement) to day τ_2 (after the announcement). To show the cumulative average total effect on prices caused by index changes, we will calculate cumulative abnormal returns (CAR) for each event type over different periods, showing the total return one would obtain by taking a long position on one day and then closing it out another day (eq.6).

$$\overline{CAR}_{(\tau_1;\tau_2)} = \sum_{\tau=\tau_1}^{\tau_2} \overline{AR}_{\tau} \qquad \text{(eq.6)}$$

where

$\overline{CAR}_{(\tau_1;\tau_2)}$ = the cumulative arithmetic mean abnormal return for all N securities between day τ_1 and day τ_2

If an index inclusion has a positive effect on the stock price and trading volume we should be able to observe average increased returns and volumes, i.e. positive $\overline{AX}_{\tau}$ on the announcement date. The predictability of changes in index constituents makes us believe that the effects may be spread out over a period of time around the announcement date and the effective date, giving us positive $\overline{CAR}_{(\tau_1;\tau_2)}$ and $\overline{AV}_{\tau}$ for several days. Testing for different τ_1 and τ_2 we will find the periods where the index effect is most evident (Pape & Schmidt-Tank (2004)).

We will primarily look at CAR for 5 different periods for the different event types on both indices. These intervals are chosen to show the maximum CAR, the size of an eventual price pressure pattern, an eventual permanent price effect and a price effect from announcement date onwards. This we feel will give sufficient data to be able to apply the different theories behind the phenomenon. We will number the intervals as following:

1. The interval giving highest CAR
2. The interval showing CAR for the price increase (decrease) in an eventual price pressure pattern
3. The interval showing CAR for the price reversal in an eventual price pressure pattern
4. The interval showing CAR from announcement to the end of the event window
5. The interval showing CAR over the whole event window

Test of abnormal returns as depending on abnormal trading volumes

To gain deeper understanding in the phenomenon and investigate the explanatory power of the price pressure hypothesis, we investigate whether abnormal trading volumes can be used to explain abnormal returns over a certain period in the event window. For this we run a panel regression adjusting for heteroskedasticity with daily abnormal returns as the dependent variable and daily abnormal trading volumes as the independent variable (eq.7a). To adjust for time fixed effects, we run the same regression adding a dummy for each day in the event window (eq.7b).

$$AR_{i,\tau} = \alpha + \pi AV_{i,\tau} + \epsilon_{i,\tau} \qquad \text{(eq.7a)}$$

$$AR_{i,\tau} = a_{\tau} + \pi AV_{i,\tau} + \epsilon_{i,\tau} \qquad \text{(eq.7b)}$$

where

$AR_{i,\tau}$ = abnormal return for security i on day τ

$AV_{i,\tau}$ = abnormal trading volume for security i on day τ

α = intercept for the linear relationship between abnormal returns and abnormal trading volumes

π = slope coefficient

a_{τ} = time fixed effect for day τ

$\epsilon_{i,\tau}$= residual for security i on day τ

Testing for different intervals over the event window, we find the slope coefficients π with different significance. A significant positive (negative) estimate for π would support a linear relationship between abnormal trading volumes and positive (negative) abnormal returns. If abnormal trading volumes represent buying (selling) by investors mimicking the index, we can apply or reject the imperfect substitutes hypothesis with downward sloping demand curves. Since the price-volume relationship is foremost interesting when it comes to proving price pressure, we will run the above regression (eq.7b) over a few days around the effective date where we may find indications of price pressure as well as for a more narrow interval around the effective date. Since volumes may affect prices differently in price appreciation/depreciation, we split the period to get a coefficient estimate for each side of the price pressure pattern.

Testing for significance

We test the cumulative abnormal returns and abnormal trading volumes separately by calculating the sample variances (eq.8) and performing the student's t-test at a 5% significance level (eq.9) (MacKinlay (1997) and Pape & Schmidt-Tank (2004)). Previous research that has presented evidence for the index effects is consistent as to whether abnormal returns and abnormal trading volumes are positive or negative in the various cases. For that reason we are confident on the direction of eventual findings and use one-sided tests.

$$var(\bar{z}) = \frac{1}{N}\sum_{i=1}^{N}(z_i - \bar{z})^2 \qquad \text{(eq.8)}$$

$$t = \frac{\bar{z}-\mu_0}{\sqrt{var(\bar{z})}/\sqrt{N}} \qquad \text{(eq.9)}$$

where

$\bar{z}$ = the sample mean

μ_0 = the expected value under the null-hypothesis, i.e. the value which we want to test if the population mean deviates from

$var(\bar{z})$ = the variance in the sample mean

N = the sample size

Setting μ_0 equal to zero gives us the t-statistics from which we can draw conclusions about the statistical significance of our findings.

6. Expected findings

Testable theories

With the given index characteristics and the described method described above, we conclude that some theories can or should not be tested. *The price-pressure hypothesis* can be tested simply by looking at prices and volumes before and after the event. *The Imperfect substitutes hypothesis* can be tested in the same way as it only differs from the price pressure hypothesis in duration of price effects and the pattern of abnormal trading volumes. Price effects explained by *the attention hypothesis* and *the information cost/liquidity hypothesis* can be tested for by looking at price developments from the announcement date onwards. Ultimately we should look at bid-ask spreads to find support for the information cost/liquidity hypothesis but we use trading volume as a proxy for liquidity effects. *The information signaling hypothesis* needs not to be tested for since revisions for the two indices do not reveal any new information. We do not have to test for *the selection criteria hypothesis* either since our estimation models allow us to observe eventual index effects absent selection bias.

Hypotheses

The existence of index effects has been proven by most studies on several different indices, among them the EURO STOXX 50, the KFX index, the AEX index and the FTSE100, which makes it plausible to assume that OMXS30 should be no different. As the attention around indices has grown with the number of index funds, the events of inclusions and exclusions should present statistically significant index effects. However, they may not be consistent over time and large enough for investors to speculate on. In contradiction, the improved flow of information and the increased presence of arbitrageurs have made the market more efficient and arbitrage opportunities should be limited. Hence, the following hypotheses are reasonable to test:

Hypothesis 1.

In the short term, inclusions will lead to positive effects on prices and volumes while exclusions will lead to negative effects on prices and positive effects on volumes for the EURO STOXX 50.

Hypothesis 2.

In the long term, inclusions will lead to positive price and volume effects while exclusions will lead to negative price and volume effects on EURO STOXX 50.

Hypothesis 3.

In the short term, inclusions will lead to positive effects on prices and volumes while exclusions will lead to negative effects on prices and positive effects on volumes for the OMXS30.

Hypothesis 4.

In the long term, inclusions will lead to positive price and volume effects while exclusions will lead to negative price and volume effects on OMXS30.

It is suggested that stocks in popular and heavily replicated indices such as the EURO STOXX 50 should experience larger abnormal returns and larger abnormal trading volumes. However, it is also proposed that effects may be greater in markets with greater information asymmetries and where inclusions lead to more potential investors. The EURO STOXX 50 contains larger stocks, hence constituents should have more close substitutes than constituents on the OMXS30 index (Wurgler & Zhuravskaya (2002)). This makes arbitrage opportunities on the EURO STOXX 50 easier to exploit and the long term demand curve should be more elastic (Pruitt & Wei (1989)). Prices in the European market should shift less by changes in demand and should more quickly experience price correction. Thus, the following hypothesis will be tested:

Hypothesis 5.

The price and volume effects are more evident for the OMXS30 index than for the EURO STOXX 50 index.

7. Empirical findings

For our study on price effects, we have calculated market adjusted as well as unadjusted figures. We regard the market adjusted figures as more accurate since they account for changes in the surrounding economy, hence it isolates eventual effects caused by our events more precisely. However, similar to the findings of Schleifer (1996), the unadjusted figures do not differ substantially from the market adjusted figures which is why we only present them in the appendix (table XIV, table XVII, graph 6 & graph 9 in appendix). In our study on volume effects, figures are not adjusted for market changes, thus seasonality and increased variance dilutes the results. As described above, significance is tested at 5% level.

EURO STOXX 50

For the EURO STOXX 50 we observe significant and positive average cumulative abnormal return (CAR) for inclusions which is most evident for the long period T-25 to T-1 but also for the short period T-9 to T-1. The CAR is 4.86% and 4.09% for the respective periods. For exclusions there is an opposite pattern with the most evident negative CAR of -5.47% for the period T-28 to T+2 and -3.15% for the period T-6 to T+2 (table II & table III). This suggests that the most significant CAR for inclusions exist between the announcement date and the effective date but there are price effects appearing already before the announcement date. For exclusions we cannot see the same concentration around the effective date.

The duration of price effects becomes clearer when looking at the abnormal returns from the effective date onwards. Between day T and T+9 for inclusions, we see a negative CAR of -4.09% which implies that there is a partial price reversal of prices after an inclusion. For exclusions, CAR in the period T+3 to T+14 is 2.84%, hence a reversal also here. Since the reversals are about as large as the abnormal returns a few days before, there are no statistically significant permanent price effects from changes in EURO STOXX 50 constituents, neither for the whole period nor from the announcement date onwards (table II & table III).

Table II

	EURO STOXX 50			
	Inclusions			
	Period	**Avg CAR**	**Std.Dev**	**t-stat**
1	**T-25 to T-1**	**4.86%**	**6.60%**	**3.53**
2	**T-9 to T-1**	**4.09%**	**4.85%**	**4.05**
3	**T to T+9**	**-4.09%**	**7.32%**	**-2.68**
4	*T-9 to T+20*	*1.26%*	*7.06%*	*0.85*
5	*T-25 to T+20*	*2.02%*	*8.68%*	*1.12*

Table III

	EURO STOXX 50			
	Exclusions			
	Period	**Avg CAR**	**Std.Dev**	**t-stat**
1	**T-28 to T+2**	**-5.47%**	**8.70%**	**-3.08**
2	**T-6 to T+2**	**-3.15%**	**5.67%**	**-2.72**
3	**T+3 to T+14**	**2.84%**	**6.71%**	**2.07**
4	*T-9 to T+20*	*0.66%*	*12.12%*	*0.27*
5	*T-28 to T+20*	*-2.64%*	*13.17%*	*-0.98*

CAR and t-statistics for the different intervals described in chp 5. Bold figures are statistically significant

The interesting volume pattern is the jump in abnormal trading volumes for the period surrounding the effective date. Both event types show the highest abnormal trading volumes on the day before effective date (T-1) with 307% average AV for inclusions and 239% average AV for exclusions (statistically significant). This implies that it is the day on which most investors reweight their portfolios. See table XXII & table XXIII in appendix for abnormal volumes, standard deviations and t-statistics around the effective date.

The regression of abnormal returns as dependent on abnormal trading volumes (adjusted for time fixed effects) can be seen in the tables below (table IV & table V). R-squared is not displayed since it equals 1 for all these regressions. Testing for different intervals, we can only find statistically significant relationships for the reversals. The Standard deviation in trading volumes for inclusions on day T is 73% (table XXII in appendix) and the slope coefficient is -0.0063 for the period T to T+9 (table IV). Hence, if trading volumes on day T deviates by one standard deviation, this means that the stock price will change by 0.46%. When not controlling for time fixed effects, we find significant coefficients for all the four periods for inclusions but this includes a bias of eventual weekday effects (table XXX in appendix).

Table IV

EURO STOXX 50		
Inclusions		
Interval	**Coefficient**	**Z-statistic**
T-9 to T-1	*0.0014*	*1.56*
T to T+9	**-0.0063**	**-2.30**
T-3 to T-1	*0.0013*	*1.39*
T to T+2	*-0.0066*	*-1.61*

Table V

EURO STOXX 50		
Exclusions		
Interval	**Coefficient**	**Z-statistic**
T-9 to T+2	*-0.0014*	*-0.85*
T+3 to T+14	**0.0102**	**3.80**
T-3 to T+2	*-0.0019*	*-1.04*
T+3 to T+6	**0.0073**	**2.15**

AR-AV Regression coefficients and Z-statistics for the price pressure interval and a narrower interval. Bold figures are statistically significant

OMXS30

For inclusions on the OMXS30 we observe that the CAR is most significant for the period T-30 to T, 7.92%. For T-6 to T CAR is 5.31%. For exclusions, we find negative CAR for the period T-27 to T-1 and T-14 to T-1 of -12.57% and -5.61% respectively, however the later is statistically insignificant (table VI & table VII). This suggests, just as for inclusions to the EURO STOXX 50, that abnormal returns can be observed several days ahead of the announcement but that a majority of the CAR is located between announcement and effective date. The pattern of price effects is more evenly distributed for exclusions and deviates somewhat from that of exclusions from the European index. However, one must bear in mind that the sample size for OMXS30 exclusions is small and the variance of cumulative abnormal returns/volumes is large which makes meaningful inference hard.

The duration of price effects from inclusion to the OMXS30 is similar to that of the European index, showing a price reversal during the 11 days following the effective date. CAR is -2.70% for the period which in relation to the pre-inclusion price hike is smaller, implying a positive price effect in the long run. The CAR for inclusions over the entire event window is 5.48%, and measured from announcement date to the end of the event window CAR is 2.86%. For exclusions the total CAR is -14.68% from T-27 onwards. However, worth noticing is that there is no significant price reversal after the announcement date for OMXS30 exclusions. On the contrary, the price level remains relatively flat from announcement date onwards (table VI & table VII).

Table VI

	OMXS30			
	Inclusions			
	Period	Avg CAR	Std.Dev	t-stat
1	**T-30 to T**	**7.92%**	**14.41%**	**2.61**
2	**T-6 to T**	**5.31%**	**6.17%**	**3.91**
3	**T+1 to T+11**	**-2.70%**	**6.61%**	**-1.96**
4	**T-6 to T+20**	**2.86%**	**7.14%**	**1.85**
5	**T-30 to T+20**	**5.48%**	**14.01%**	**1.85**

Table VII

	OMXS30			
	Exclusions			
	Period	Avg CAR	Std.Dev	t-stat
1	**T-27 to T-1**	**-12.57%**	**23.81%**	**-2.04**
2	*T-14 to T-1*	*-5.61%*	*18.78%*	*-1.15*
3	*T to T+11*	*-0.21%*	*6.80%*	*-0.12*
4	*T-6 to T+20*	*-0.48%*	*10.27%*	*-0.18*
5	**T-27 to T+20**	**-14.68%**	**28.59%**	**-1.99**

CAR and t-statistics for the different intervals described in chp 5.Bold figures are statistically significant

Abnormal volumes for OMXS30 observations fluctuate over the event window, especially for exclusions since the volume sample is quite small and individual trades can influence the averages significantly. We can observe an increased trading activity around the effective date, but the only statistically significant abnormal volumes are observed on the day before effective date. Average AV on day T-1 is 63% for inclusions and 94% for exclusions. See table XXIV & XXV in appendix for abnormal volumes, standard deviations and t-statistics around the effective date.

The regression of abnormal returns as dependent on abnormal trading volumes adjusted for time fixed effects can be seen below (table VIII & table IX). R-squared is not displayed since it equals 1 for all these regressions. Insignificant coefficients were expected for exclusions due to poor data set. For inclusions we can only find a significant relationship for the period T-2 to T. The Standard deviation in trading volumes for inclusions on day T-1 is 88% (table XXIV) and the slope coefficient for the period T-2 to T is -0.0133 (table VIII). Hence, if trading volumes on day T-1 deviates by one standard deviation, this means that the stock price will change by 1.17%. Findings are similar even if we do not control for time fixed effects (table XXXII & XXXIII in appendix).

Table VIII

OMXS30		
Inclusions		
Interval	Coefficient	Z-statistic
T-6 to T	*0.0056*	*0.96*
T+1 to T+11	*-0.0073*	*-1.84*
T-2 to T	**0.0133**	**2.04**
T+1 to T+4	*-0.0021*	*-0.91*

Table IX

OMXS30		
Exclusions		
Interval	Coefficient	Z-statistic
T-6 to T	*-0.0008*	*-0.11*
T+1 to T+11	*0.0004*	*0.19*
T-2 to T	*-0.0012*	*-0.13*
T+1 to T+4	*0.0017*	*0.73*

AR-AV Regression coefficients and Z-statistics for the price pressure interval and a narrower interval. Bold figures are statistically significant

8. Analysis

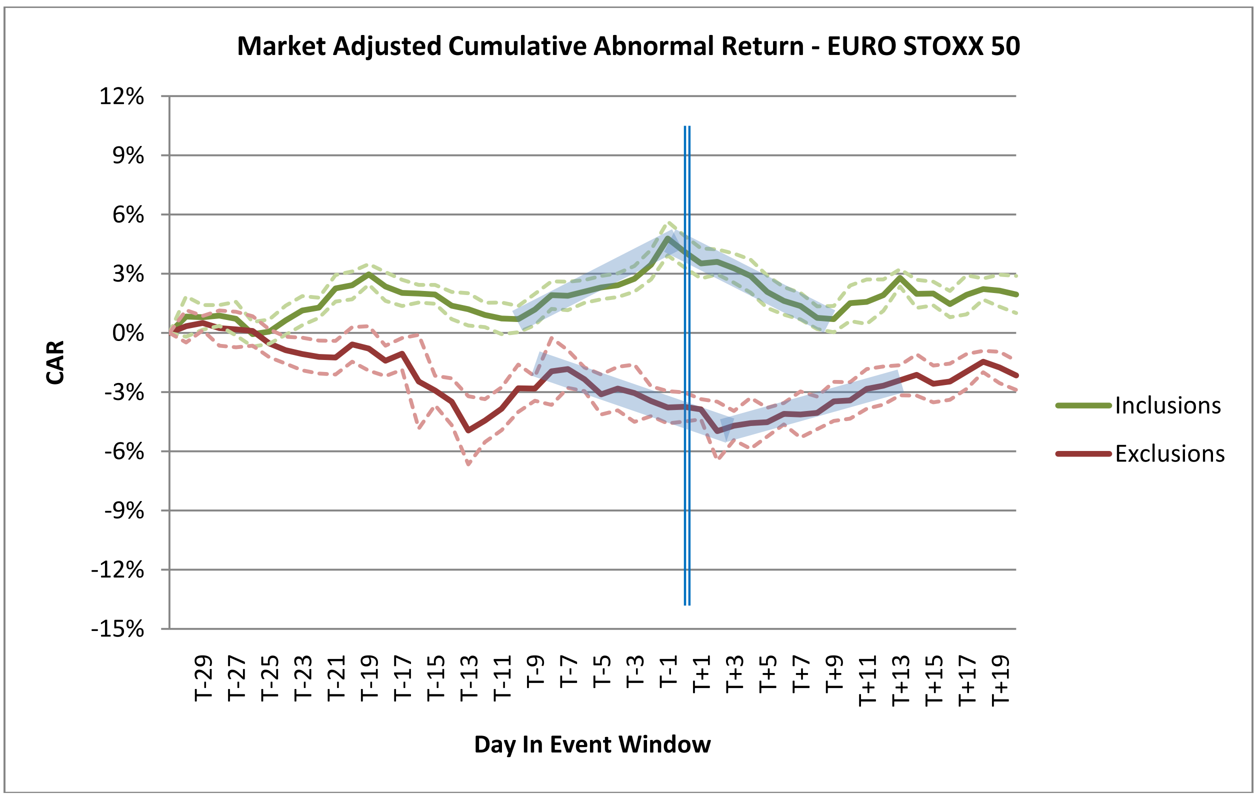
EURO STOXX 50

The findings when observing the price and volume effects from the EURO STOXX 50 revisions confirm that there are significant abnormal effects. These effects can be summarized as follows:

1. Stocks included in the index experience positive abnormal returns from announcement date to the day before effective date with a subsequent reversal of the same amplitude over the next 10 days. Stocks excluded from the index experience the similar reversed effect with negative abnormal returns from announcement date to the day after effective date with subsequent reversal (graph 1).

2. Stocks included in the index also experience abnormal returns ahead of the announcement but the overall CAR for the event window is insignificant. The similar pattern is valid for stocks excluded from the index, showing negative CAR for the period up until effective date but statistically insignificant for the whole event window (graph 2).

Graph 1

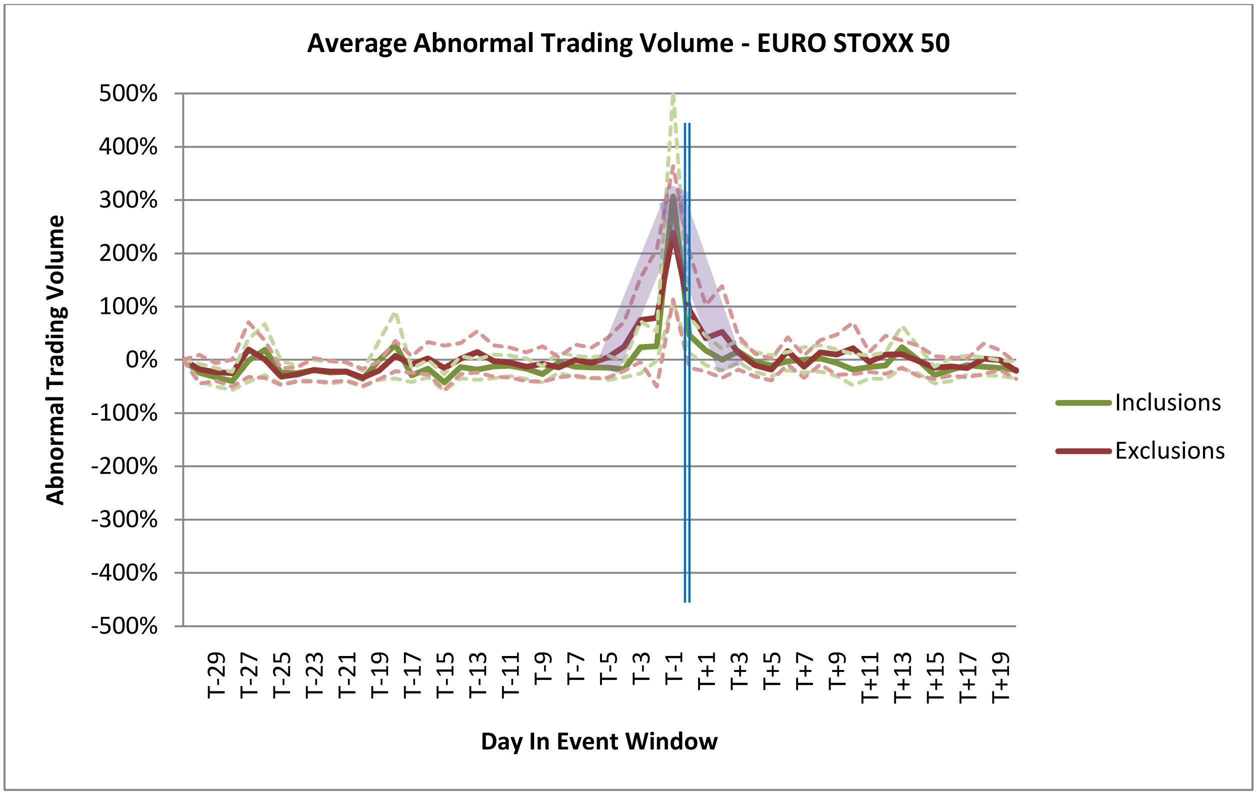


Shaded areas illustrate the indicated price pressure pattern

3. Trading volumes for stocks included in or excluded from the index experience a sudden shock around the effective date. Apart from this shock, abnormal trading volumes are modest and fluctuate around zero before and after the effective date (graph 2).

4. Abnormal trading volumes have explanatory power for the abnormal returns in a period after the effective date when controlling for time fixed effects (table IV & table V).

Graph 2



Shaded area illustrates the shock in trading volumes

The patterns described in point 1 and 3 are both typical indications of price pressure. The fact that abnormal trading volumes coincides with the period around the effective date can reasonably be explained by investors reweighting their portfolios along with an index event. However, findings described in point 4 are ambiguous to price pressure since it supports the price reversal whereas we cannot find a significant relationship for the price appreciation before the effective date. If abnormal trading volumes affect prices, it is a clear indication that demand curves are downward sloping. The lack of significant results for the price appreciation can eventually be explained by the fact that speculation drives prices over a longer time period ahead of the effective date, as described in point 2. It can also depend on the limited data sample we have. However, it can also be seen as evidence for elasticity in demand curves which is reasonable for a market where stocks have close substitutes.

If we ignore time fixed effects, we are able to support the price-volume relationship up until the effective date. However, omitting time fixed effects would ignore that announcement and effective date for revisions of the EURO STOXX 50 always occur on the same weekdays. It is proven that weekday effects exist in some markets and for that reason we do not want reject the idea that such effect could also exist in the observed market (Apolinario, Santana, Sales & Caro, (2006)).

We can observe price and volume patterns in line with the price pressure hypothesis although we cannot prove that the full abnormal price pattern around the effective date is caused by the abnormal trading activity. We view the price effect described in point 2 as temporary since there is no significant price effect lasting until the end of our event window, neglecting theories suggesting permanent price and volume effects from index revisions.

Table X

Inclusions		Temporary	Permanent	Exclusions		Temporary	Permanent
Price pressure hypothesis	Price	**+**	**0**	**Price pressure hypothesis**	Price	**-**	**0**
	Volume	**+**	**0**		Volume	**+**	**0**
Imperfect substitutes hypothesis	Price	0	+	**Imperfect substitutes hypothesis**	Price	0	-
	Volume	+	(+) / (-)		Volume	+	(+) / (-)
Information cost / liquidity hypothesis	Price	0	+	**Information cost / liquidity hypothesis**	Price	0	-
	Volume	0	+		Volume	0	+
Attention hypothesis	Price	0	+	**Attention hypothesis**	Price	0	0
	Volume				Volume		

Bold symbols show where we find support whereas shaded areas show theories that are rejected by our findings

To summarize our analysis of the EURO STOXX 50 index, we find support for hypothesis 1, although we cannot with certainty apply the price pressure hypothesis to our findings. Further, we do not find significant long term effects and for that reason we reject hypothesis 2 (table X).

OMXS30

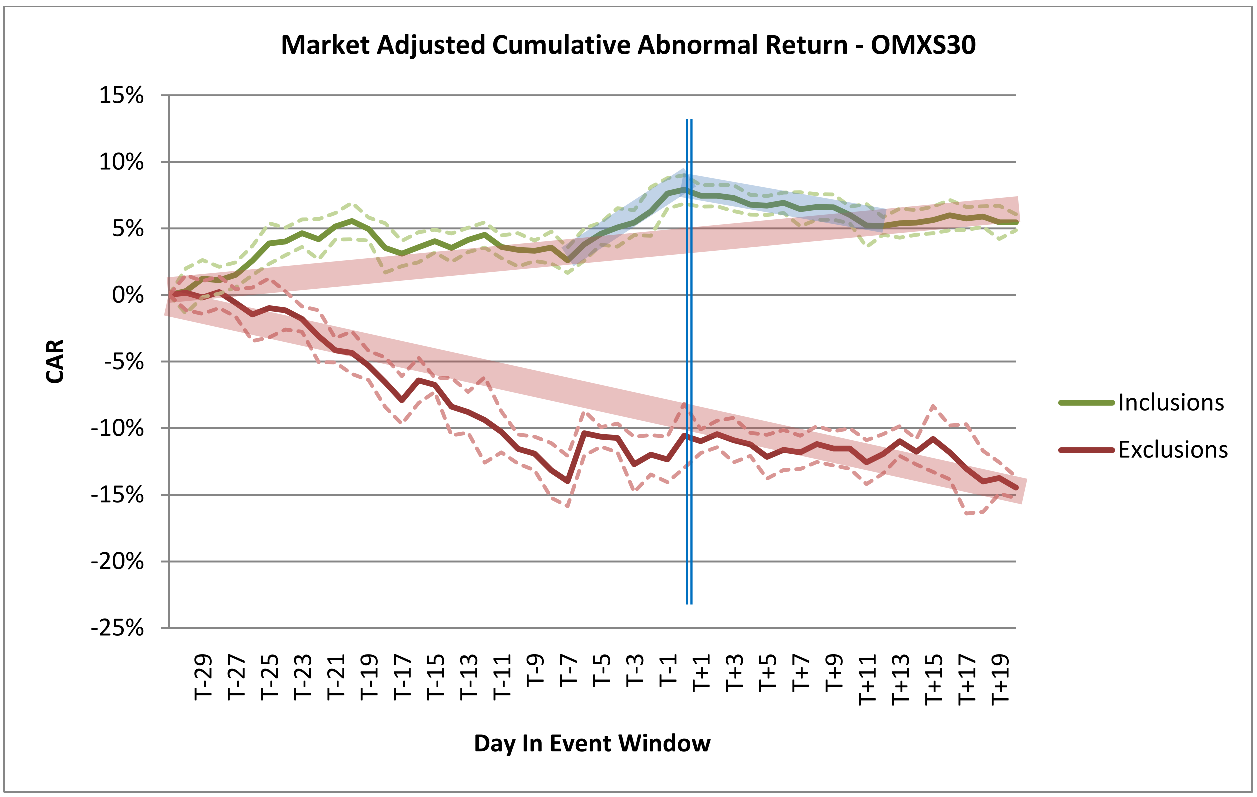
For the OMXS30 index we can also observe price and volume effects coinciding with revisions, even though the patterns look slightly different. Due to a smaller sample size for exclusions and the large variance of abnormal returns, it is hard to make meaningful inferences from these observations over the event window. Nevertheless, the observed effects can be summarized as the following:

1. Stocks added to the index experience a positive abnormal return from the announcement date up until the day before the effective date. From the effective date onwards there is a ten day price reversal not as great as the previous price appreciation resulting in a statistically significant

upside effect. Stocks deleted from the index experience no decline, hence no subsequent reversal from the announcement date onwards (graph 3).

2. Stocks included in the index experience an abnormal return previous to the announcement date and the total CAR over the event window is positive. A similar pattern is applicable for exclusions, demonstrating negative CAR from the start of the event window up until announcement (graph 3).

Graph 3

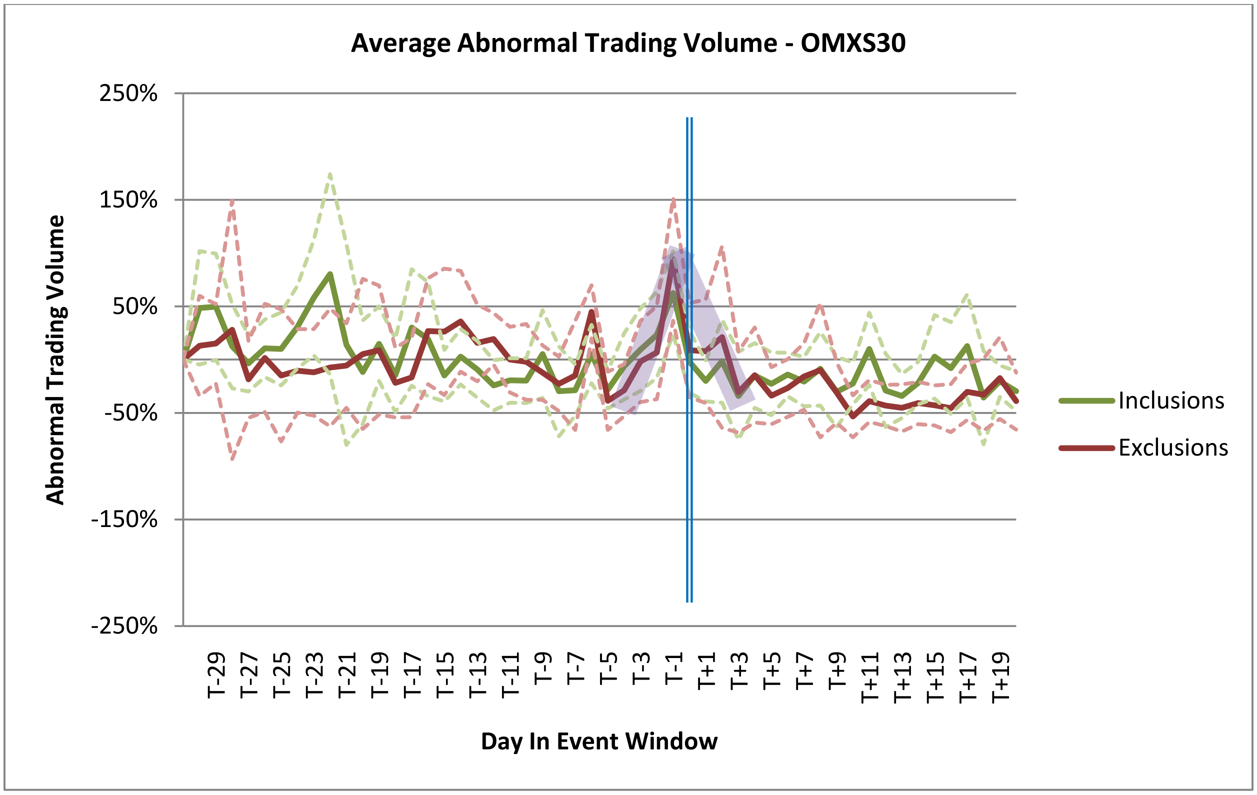


Shaded areas illustrate the indicated price pressure pattern for inclusions and the permanent price effects

3. Trading volumes for stocks included in or excluded from the index are higher around the effective date. We can also see large fluctuations caused by a few extreme observations (graph 4).

4. Abnormal trading volumes have explanatory power for the abnormal returns that stocks experience in period T-2 to T for inclusions when controlling for time fixed effects. No such interpretation can be done for exclusions (table XIII & table XIV).

Graph 4



Shaded area illustrates the shock in trading volumes around the effective date

Point 1 and point 3 are both indications of price pressure and could be an effect from investors reweighting their portfolios. Point 4 offers a further indication of price pressure since it supports the idea that abnormal trading volumes drives prices and that demand curves are downward sloping. However, no significant relationship can be found for the subsequent reversal which should be the case according to the price pressure hypothesis. Prices do not revert completely which may explain why the full price pressure relationship cannot be supported by our results. However, the statistical insignificance may also depend on the limited data sample. The absence of a clear price pressure pattern for exclusions does not aid to reject the price pressure hypothesis since we have few observations and high variance.

The findings described in point 2 shows that there are permanent price effects from the observed events which could be explained by the imperfect substitutes hypothesis. The abnormal price reaction ahead of announcement is not surprising since the outcome of OMXS30 revisions can be anticipated. There is a small downward trend in trading volumes over the event window but this can also be due to seasonality since volumes are benchmarked versus an average (i.e. a constant) and the weeks after OMXS30 revisions (January and July) are known to be months with low trading volumes.

The attention hypothesis can also explain the permanent price effect since CAR for inclusions is positive from announcement to the end of the event window. The effect should only be visible after the actual announcement date as this is the time when media actually highlights that a firm will be included in the index. The attention from an inclusion will permanently increase demand due to awareness and a wider base of potential investors. Since the price pattern for exclusions is flat from announcement date onwards, the attention hypothesis provides a reasonable explanation for some of the observed price effects.

A third potential explanation for the permanent price effects is the information cost/liquidity hypothesis. However, for exclusions the hypothesis suggests that prices will decline after announcement but this is not the case for OMXS30. Even though liquidity may fall after an exclusion it seems unreasonable to believe that the availability of information declines rapidly already before announcement, and for that reason we find this hypothesis to be a less reasonable explanation. The long term change in coverage could lead to increased (decreased) liquidity for inclusions (exclusions) but to find such effect one would have to look at a long period after day T+20. We observe a small decrease in the liquidity for both inclusions and exclusions over the event window but, as mentioned above, this can be due to the seasonality bias.

Table XI

Inclusions		Temporary	Permanent	Exclusions		Temporary	Permanent
Price pressure hypothesis	Price	**+**	0	**Price pressure hypothesis**	Price	**-**	0
	Volume	**+**	0		Volume	+	0
Imperfect substitutes hypothesis	Price	0	**+**	**Imperfect substitutes hypothesis**	Price	0	**-**
	Volume	+	(+) / (-)		Volume	+	(+) / (-)
Information cost / liquidity hypothesis	Price	0	+	**Information cost / liquidity hypothesis**	Price	0	-
	Volume	0	+		Volume	0	-
Attention hypothesis	Price	**0**	**+**	**Attention hypothesis**	Price	**0**	**0**
	Volume				Volume		

Bold symbols show where we find support whereas shaded areas show theories that are rejected by our findings

To summarize our analysis of the OMXS30 index, we find support for hypothesis 3 given that inference cannot be made from our price sample on exclusions. However, we cannot with certainty apply the price pressure hypothesis to these findings. The observed long term price effects partly confirms hypothesis 4 and can be explained by the imperfect substitutes hypothesis and the attention hypothesis (table XI).

Comparison of the indices

We have been able to confirm hypothesis 1, 3 and partly 4 but have rejected hypothesis 2.These results indicate that there is some difference in the observed indices. To shed more light on these differences, we compare our findings and relate them to the underlying characteristics of the two indices.

The abnormal return pattern around the effective date for the EURO STOXX 50 is a typical pattern for price pressure since the reversal is as great as the foregoing price appreciation. However, for the OMXS30 we must consider that the permanent price effect explained by the imperfect substitutes hypothesis and the attention hypothesis should prevent a full reversal even if the price pressure hypothesis would be applicable. The temporary volume effects are more evident for the EURO STOXX 50. A plausible explanation for this can be that the Swedish index is not as heavily tracked as its European counterpart. When fewer index funds are reweighting their portfolios, a lower AV follows. As described by Andelius & Skrutkowski (2008), Swedish fund managers are well aware of the risk of moving prices around OMXS30 revisions and for that reason most of them spread out their trades over several days ahead of index changes. It is reasonable to believe that it is harder for individual fund managers to move prices on larger European stocks and therefore their trades should not affect the market to the same extent. Unfortunately we do not have information about the behavior of fund managers tracking the EURO STOXX 50 why this interpretation must be read carefully.

A permanent abnormal return can only be found for changes in the composition of the OMXS30. It is argued that there are fewer substitutes on smaller markets such as the Swedish one (Wurgler & Zhuravskaya (2002)) and this would imply that the Swedish demand curve is more inelastic. Therefore, stock prices in Sweden should be more affected by changes in demand and supply. Another explanation for the observed permanent price increase is the attention hypothesis, and our findings suggest that the attention around OMXS30 revisions offer greater abnormal return than the corresponding for EURO STOXX 50 revisions. Companies on the OMXS30 are relatively small compared to the European blue-chip companies which are well known, highly scrutinized and probably listed on several other indices. As mentioned above, inclusion on the OMXS30 should also increase potential new investors and coverage by analysts, making the long term effect more evident. This implies that increased attention should have larger impact on the companies in OMXS30 and hence be an explanatory factor for the permanent price increase. Given the explanation above it is quite intuitive that we found no statistically significant results for a permanent price increase on the EURO STOXX 50. Another difference, which considers the EMH, is that the EURO STOXX 50 is observed more carefully by institutional investors, and for this reason market anomalies such as the index effect should be less apparent since arbitrageurs would quickly correct these mispricings.

To conclude, we can observe temporary price and volume effects for both indices which follow the same pattern suggested by the price pressure hypothesis. However, we cannot prove a relationship between prices and volumes for any of the indices over the full period where we see this pattern, and for that reason we are unable to apply the price pressure hypothesis with certainty. A permanent index effect can only be observed for the OMXS30 index where we can apply the imperfect substitutes hypothesis and the attention hypothesis. Considering the difference between the two indices explained above, these findings are expected and we can confirm hypothesis 5.

9. Conclusion

This paper examines the index effect for revisions of the OMXS30 and the EURO STOXX 50, and it is clear that price and volume effects are apparent for both inclusions and exclusions on the indices. However, we see a difference in duration which we can relate to the underlying characteristics of the two indices. The EURO STOXX 50 and OMXS30 both show price and volume patterns similar to those of typical price pressure with abnormal trading activity and abnormal returns around the effective dates. However, we cannot with certainty say that the abnormal volumes are causing the abnormal return which is why we remain ambiguous as to whether the price pressure hypothesis can explain the phenomenon. A greater dataset could be one way to improve accuracy in regressions and could lead to full support or rejection of the hypothesis.

A long term price effect can only be shown on the OMXS30 which can be explained by the imperfect substitutes hypothesis. It is suggested that there are fewer substitutes on the Swedish market, implying less elastic demand curves which makes prices more responsive to changes in demand. Less perfect substitutes also makes arbitrage attempts on the OMXS30 more risky and mispricing should not be corrected as quickly. The long term abnormal returns may also be explained by the increased attention stocks get from new potential investors when included in the index, implying that this attention offer greater abnormal returns around OMXS30 revisions than the corresponding around EURO STOXX 50 revisions.

The above mentioned results allow us to accept hypotheses 1, 3 and partly number 4. Also, as hypothesis 5 propose, we can confirm that the long run index effect is more evident for the OMXS30 index, consisting of smaller companies on a smaller market, than for the EURO STOXX 50, consisting of European blue-chip stocks on a global market.

10. Implications & Further areas of study

Implications

Our findings indicate that it should be possible to gain abnormal returns by predicting changes in index constituents on both the OMXS30 and the EURO STOXX 50. However, on the OMXS30 one should be more certain to gain an abnormal return since there is a long term price effect whereas on the EURO STOXX 50 one can only gamble on a temporary price effect where timing would be crucial. The best way to make these types of bets would be to take a long (short) position in the stock expected to be included (excluded), and hedge with a short (long) position in the broad market index or, even better, in a group of close substitutes. The arbitrage risk should be smaller for revisions of the EURO STOXX 50 with more perfect substitutes, but so should the potential abnormal returns as shown in our figures (table II, table III, table VI & table VII) (Wurgler & Zhuravskaya (2002).

Limitations

A limitation in our study is the size of our data sample since we had to exclude many observations from the original sample. The same problem has been experienced in many previous studies but we could not improve the analysis since more data for index revisions could not be retrieved. This influenced the statistical significance negatively in our studies and for OMXS30 deletions we were unable to make strong interpretations.

Another limitation is that we did not use market adjusted figures for trading volumes. Potentially we could have used a proxy for the daily free float in the market to isolate the clean index effect on trading volumes but unfortunately we had no such data available.

Setting our model estimation window over a period before and after the event window removes a potential selection bias but imposes another limitation. A survivorship bias is imposed as stocks must survive for 120 trading days after the effective date to have the necessary data for our study. However, we do not regard this as a major problem since stocks defaulting closely after an event can be expected to show abnormal return and volume patterns not related to the event itself which would create noise in our study.

Further research

In this paper we have discussed different possible reasons to why the index effect exists and have tried to provide some evidence for which the strongest explanations are. With this in mind, we suggest 4 areas of further research which would shed more light on the phenomenon:

1. One appealing study would be to see how bid ask spreads on the OMXS30 and the EURO STOXX 50 change around additions and deletions. This would examine the magnitude of the information cost/liquidity hypothesis.

2. Previous studies have come to different conclusions whether this anomaly is diminishing as capital markets become more effective or if it actually increases with the growing fund market. A study that investigates if the development of the index effect change with the fund industry in Sweden and Europe, including a study on changes in institutional ownership, would provide more insight in the phenomenon.

3. A major problem we experienced in this study was the lack of data due to exclusions. A study that prolongs the event study with a greater data sample for exclusions would be interesting so that one with greater certainty can say what the index effect of a deletion is.

4. An interesting study would be to dig deeper into the relationship between prices and volumes around the effective date. A greater data sample in general would increase significance of a price-volume regression and may support or reject the price pressure hypothesis fully. However, there could also be another explanation for the observed findings, not covered by the theories we apply.

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Appendix

EURO STOXX 50 observations

Table XII

EURO STOXX 50 observations included in study		
Effective Date	**Company Name**	**Action**
1996-09-23	Solvay et Cie S.A.	Deletion
1996-09-23	Peugeot SA	Deletion
1996-09-23	Schneider SA (EX SPIE Batignolles)	Addition
1996-09-23	Thyssen AG	Addition
1997-09-22	Sanofi	Deletion
1997-09-22	Schering AG	Deletion
1997-09-22	Thyssen AG	Deletion
1997-09-22	Paribas (Compagnie Financiere de)	Addition
1997-09-22	L'Oreal (Ordinary)	Addition
1997-09-22	PORTUGAL TELECOM S.A.	Addition
1999-09-20	LUFTHANSA AG -B-	Deletion
1999-09-20	SCHNEIDER ELECTRIC	Deletion
1999-09-20	ALLIED IRISH BANKS PLC	Deletion
1999-09-20	FIAT SPA	Deletion
1999-09-20	AKZO NOBEL	Deletion
1999-09-20	ELSEVIER	Deletion
1999-09-20	PORTUGAL TELECOM SA -R-	Deletion
1999-09-20	BASF AG	Addition
1999-09-20	BAYERISCHE HYPO-&VEREINSBANK	Addition
1999-09-20	DRESDNER BANK AG	Addition
1999-09-20	MUENCHENER RUECKVER AG-REG	Addition
1999-09-20	BANCO SANTANDER CEN	Addition
1999-09-20	SANOFI-SYNTHELABO	Addition
2000-09-18	ELECTRABEL SA	Deletion
2000-09-18	METRO AG	Deletion
2000-09-18	SAN PAOLO-IMI	Addition
2001-09-24	KPN	Deletion
2001-09-24	SAINT GOBAIN	Addition
2002-09-23	LAFARGE	Addition
2003-09-22	BAYERISCHE HYPO & VEREINSBANK	Deletion
2003-09-22	IBERDROLA	Addition
2004-09-20	VOLKSWAGEN	Deletion
2004-09-20	CREDIT AGRICOLE	Addition
2007-09-24	LAFARGE	Deletion
2007-09-24	AHOLD	Deletion
2007-09-24	ALLIED IRISH BANKS	Deletion
2007-09-24	ARCELOR MITTAL	Addition
2007-09-24	VINCI	Addition
2007-09-24	SCHNEIDER ELECTRIC	Addition
2008-09-22	ALCATEL LUCENT	Deletion
2008-09-22	ALSTOM	Addition
2009-09-21	RENAULT	Deletion
2009-09-21	FORTIS	Deletion
2009-09-21	CRH	Addition
2009-09-21	ANHEUSER-BUSCH INBEV	Addition

Table XIII

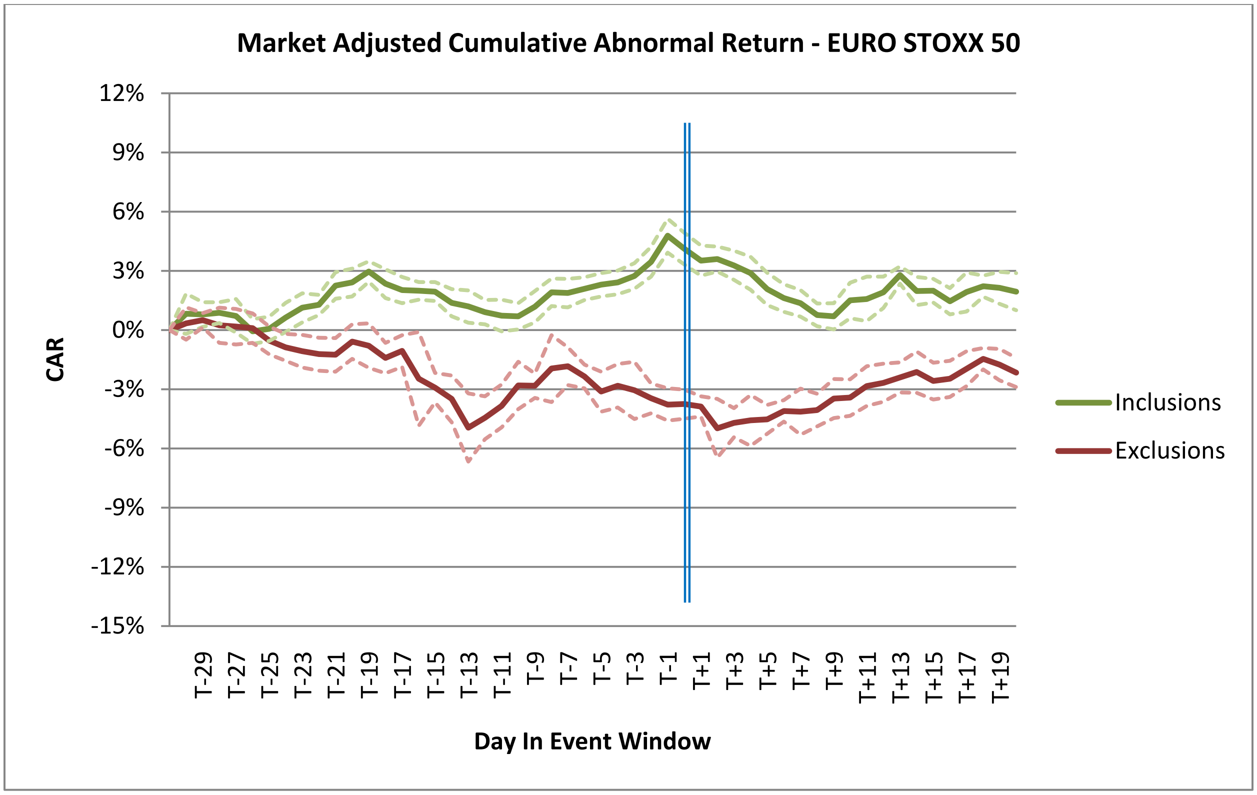
EURO STOXX 50 observations excluded from study			
Effective Date	Company Name	Action	
1996-04-23	Generale De Banque VVPR	Addition	
1996-04-23	Generale Banque S.A.		Deletion
1996-08-15	Electrabel	Addition	
1996-09-04	ENI	Addition	
1996-09-23	Generale De Banque S.A.		Deletion
1996-09-23	Cie de Suez		Deletion
1996-09-23	Rhone Poulenc SA	Addition	
1996-09-23	Viag AG		Deletion
1996-09-23	Metro AG	Addition	
1996-09-23	Credito Italiano S.p.A Ord	Addition	
1996-12-23	Banco de Santander		Deletion
1997-02-13	Deutsche Telecom AG	Addition	
1997-07-21	Telecom Italia Ord	Addition	
1997-07-21	Telecom Italia Ord		Deletion
1997-12-22	Pinault-Printemps-La Redoute		Deletion
1997-12-22	France Telecom	Addition	
1998-05-26	Paribas	Addition	
1998-05-26	Paribas		Deletion
1998-06-29	Koninklijke KPN	Addition	
1998-06-29	Koninklijke PTT KPN		Deletion
1998-10-26	UniCredito	Addition	
1998-10-26	Credito Italiano		Deletion
1998-10-26	Daimler Benz UMA	Addition	
1998-10-26	Daimler Benz		Deletion
1998-11-17	DaimlerChrysler	Addition	
1998-11-17	Daimler Benz UMA		Deletion
1999-06-16	TOTALFINA	Addition	
1999-06-16	PETROFINA SA		Deletion
1999-09-20	SUEZ LYONNAISE DES EAUX	Addition	
1999-11-01	PINAULT-PRINTEMPS-REDOUTE	Addition	
1999-11-01	BNP	Addition	
1999-11-01	PARIBAS		Deletion
1999-11-01	ELF AQUITAINE		Deletion
1999-12-20	AVENTIS	Addition	
1999-12-20	RHONE-POULENC		Deletion
2000-02-14	CANAL +	Addition	
2000-02-14	MANNESMANN AG -R-		Deletion
2000-03-20	SAINT GOBAIN		Deletion
2000-03-20	ENEL	Addition	
2000-06-19	E.ON	Addition	
2000-06-19	VEBA		Deletion
2000-09-18	GROUPE DANONE	Addition	
2000-12-11	VOLKSWAGEN AG	Addition	
2000-12-11	CANAL +		Deletion
2001-07-23	TIM	Addition	
2001-07-23	DRESDNER BANK		Deletion
2001-12-17	FORTIS	Addition	
2001-12-17	FORTIS B		Deletion
2002-09-23	PINAULT PRINTEMPS REDOUTE		Deletion
2003-08-04	TELECOM ITALIA	Addition	
2003-08-04	TELECOM ITALIA		Deletion
2004-07-28	SAP	Addition	
2004-07-28	AVENTIS		Deletion
2005-06-30	ALLIED IRISH BANKS	Addition	
2005-06-30	TIM		Deletion
2005-07-20	RENAULT	Addition	
2005-07-20	ROYAL DUTCH PETROLEUM		Deletion
2007-01-02	INTESA SANPAOLO S.P.A.	Addition	
2007-01-02	SAN PAOLO IMI		Deletion
2007-10-10	VOLKSWAGEN	Addition	
2007-10-10	ENDESA		Deletion
2007-10-15	DEUTSCHE BOERSE	Addition	
2007-10-15	ABN AMRO		Deletion
2008-07-22	GDF SUEZ	Addition	
2008-07-22	SUEZ		Deletion

EURO STOXX 50 output

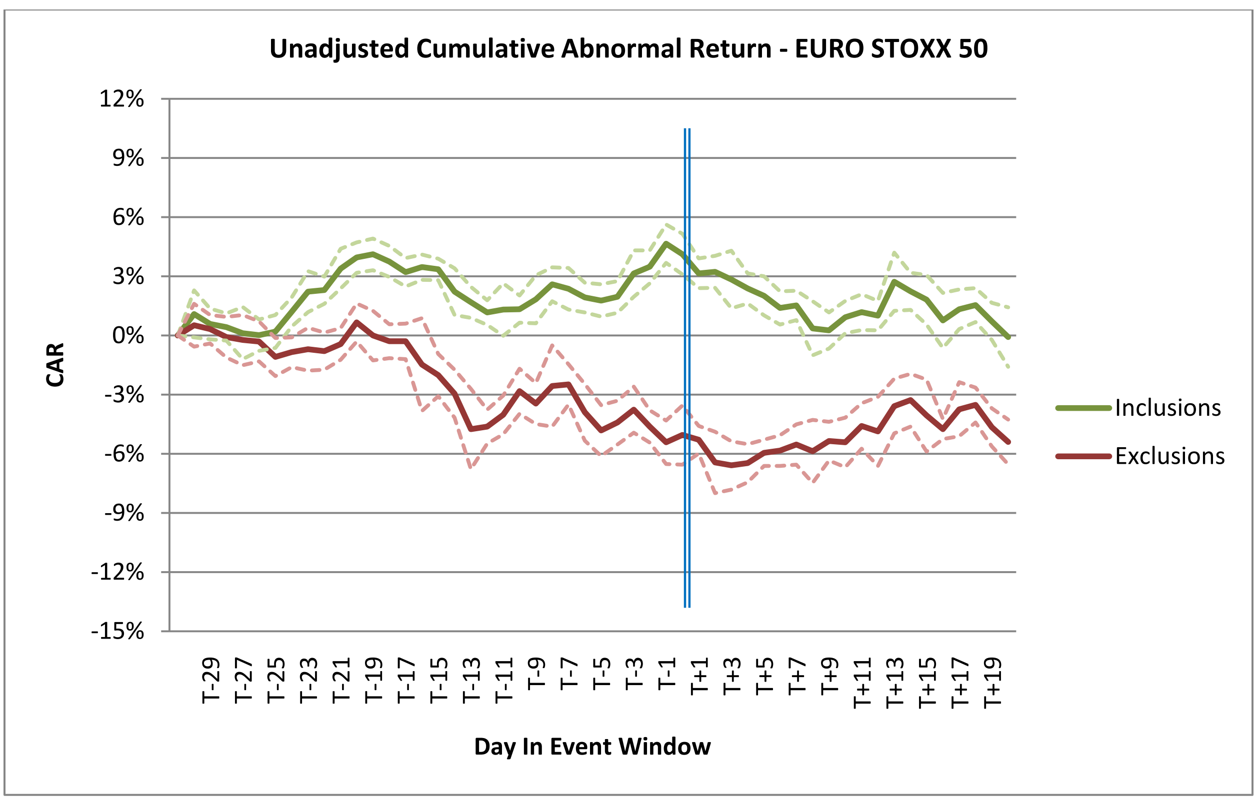
Table XIV

EURO STOXX 50												
	Inclusions						Exclusions					
Date	Adj Avg AR	σ	Unadj Avg AR	σ	Avg AV	σ	Adj Avg AR	σ	Unadj Avg AR	σ	Avg AV	σ
T-30	0.83%	0.023	1.10%	0.027	-24%	0.363	0.33%	0.019	0.52%	0.025	-18%	0.594
T-29	-0.04%	0.014	-0.51%	0.017	-33%	0.383	0.16%	0.009	-0.20%	0.017	-23%	0.362
T-28	0.09%	0.012	-0.16%	0.016	-40%	0.375	-0.25%	0.021	-0.41%	0.024	-25%	0.555
T-27	-0.16%	0.019	-0.31%	0.030	-1%	0.881	-0.07%	0.021	-0.15%	0.030	19%	1.133
T-26	-0.79%	0.014	-0.10%	0.018	19%	1.055	-0.07%	0.017	-0.07%	0.024	1%	0.776
T-25	0.14%	0.014	0.18%	0.019	-24%	0.484	-0.63%	0.016	-0.79%	0.022	-31%	0.342
T-24	0.58%	0.017	0.99%	0.017	-25%	0.298	-0.35%	0.016	0.25%	0.017	-27%	0.289
T-23	0.49%	0.017	1.03%	0.024	-20%	0.434	-0.20%	0.019	0.15%	0.025	-19%	0.481
T-22	0.14%	0.012	0.07%	0.015	-24%	0.466	-0.15%	0.019	-0.10%	0.022	-22%	0.431
T-21	0.99%	0.015	1.10%	0.023	-22%	0.383	-0.04%	0.020	0.36%	0.019	-22%	0.381
T-20	0.15%	0.016	0.56%	0.017	-36%	0.327	0.68%	0.020	1.09%	0.022	-33%	0.351
T-19	0.56%	0.012	0.16%	0.018	-6%	0.799	-0.21%	0.026	-0.66%	0.029	-20%	0.363
T-18	-0.62%	0.017	-0.36%	0.018	28%	1.395	-0.63%	0.018	-0.28%	0.020	7%	0.627
T-17	-0.33%	0.015	-0.55%	0.016	-29%	0.285	0.35%	0.019	-0.01%	0.021	-9%	0.342
T-16	-0.03%	0.010	0.26%	0.015	-17%	0.352	-1.41%	0.055	-1.19%	0.054	3%	0.670
T-15	-0.04%	0.011	-0.12%	0.012	-45%	0.362	-0.45%	0.017	-0.53%	0.025	-15%	0.921
T-14	-0.57%	0.016	-1.13%	0.027	-14%	0.455	-0.56%	0.028	-0.95%	0.028	2%	0.636
T-13	-0.19%	0.019	-0.54%	0.018	-18%	0.422	-1.45%	0.040	-1.79%	0.047	15%	0.854
T-12	-0.28%	0.014	-0.52%	0.014	-12%	0.486	0.49%	0.025	0.13%	0.020	-2%	0.647
T-11	-0.17%	0.018	0.15%	0.030	-11%	0.426	0.60%	0.025	0.59%	0.023	-5%	0.623
T-10	-0.04%	0.015	0.03%	0.016	-21%	0.453	1.03%	0.028	1.20%	0.027	-13%	0.598
T-9	0.49%	0.018	0.49%	0.027	-27%	0.338	-0.01%	0.014	-0.63%	0.024	-8%	0.735
T-8	0.73%	0.016	0.76%	0.020	-5%	0.430	0.87%	0.039	0.90%	0.048	-14%	0.415
T-7	-0.04%	0.016	-0.23%	0.024	-13%	0.440	0.12%	0.022	0.08%	0.024	-1%	0.643
T-6	0.22%	0.013	-0.44%	0.017	-14%	0.424	-0.52%	0.014	-1.42%	0.033	-6%	0.631
T-5	0.20%	0.013	-0.15%	0.018	-19%	0.520	-0.77%	0.024	-0.93%	0.030	4%	0.832
T-4	0.11%	0.014	0.18%	0.018	-18%	0.325	0.29%	0.026	0.40%	0.026	25%	1.011
T-3	0.33%	0.015	1.18%	0.027	24%	1.078	-0.23%	0.033	0.65%	0.027	75%	1.745
T-2	0.72%	0.017	0.35%	0.019	26%	0.604	-0.40%	0.017	-0.85%	0.019	79%	2.839
T-1	1.33%	0.020	1.17%	0.022	307%	4.354	-0.32%	0.019	-0.80%	0.026	239%	2.756
T	-0.66%	0.018	-0.53%	0.023	46%	0.726	0.03%	0.017	0.37%	0.035	93%	2.385
T+1	-0.61%	0.017	-0.97%	0.017	18%	0.609	-0.12%	0.012	-0.24%	0.016	40%	1.372
T+2	0.08%	0.014	0.07%	0.018	0%	0.451	-1.10%	0.035	-1.15%	0.036	52%	1.903
T+3	-0.32%	0.017	-0.38%	0.033	16%	0.457	0.28%	0.017	-0.15%	0.028	13%	0.696
T+4	-0.40%	0.019	-0.46%	0.017	-4%	0.413	0.12%	0.030	0.12%	0.022	-10%	0.475
T+5	-0.80%	0.018	-0.38%	0.022	-11%	0.429	0.05%	0.017	0.52%	0.015	-18%	0.451
T+6	-0.47%	0.016	-0.62%	0.019	-2%	0.380	0.43%	0.013	0.12%	0.018	17%	0.563
T+7	-0.26%	0.015	0.14%	0.017	0%	0.523	-0.04%	0.027	0.30%	0.024	-13%	0.464
T+8	-0.59%	0.013	-1.16%	0.031	-2%	0.575	0.09%	0.019	-0.34%	0.037	14%	0.500
T+9	-0.07%	0.015	-0.10%	0.021	-5%	0.547	0.58%	0.023	0.52%	0.023	-1%	0.854
T+10	0.80%	0.020	0.67%	0.018	-18%	0.652	0.05%	0.021	-0.07%	0.029	22%	1.070
T+11	0.08%	0.026	0.25%	0.020	-14%	0.478	0.59%	0.023	0.84%	0.027	-4%	0.413
T+12	0.34%	0.018	-0.18%	0.017	-11%	0.552	0.17%	0.022	-0.28%	0.041	10%	0.785
T+13	0.88%	0.010	1.72%	0.033	24%	0.890	0.27%	0.018	1.29%	0.032	11%	0.563
T+14	-0.81%	0.016	-0.48%	0.021	0%	0.556	0.27%	0.024	0.30%	0.031	-2%	0.626
T+15	0.01%	0.014	-0.43%	0.029	-28%	0.348	-0.45%	0.022	-0.78%	0.042	-14%	0.472
T+16	-0.54%	0.015	-1.05%	0.032	-19%	0.471	0.11%	0.021	-0.69%	0.012	-12%	0.380
T+17	0.47%	0.023	0.57%	0.023	-10%	0.389	0.51%	0.021	1.01%	0.032	-15%	0.382
T+18	0.30%	0.012	0.21%	0.020	-13%	0.375	0.51%	0.013	0.22%	0.021	2%	0.624
T+19	-0.08%	0.018	-0.82%	0.021	-15%	0.316	-0.31%	0.018	-1.14%	0.022	0%	0.410
T+20	-0.19%	0.021	-0.80%	0.034	-19%	0.353	-0.39%	0.017	-0.74%	0.026	-21%	0.329

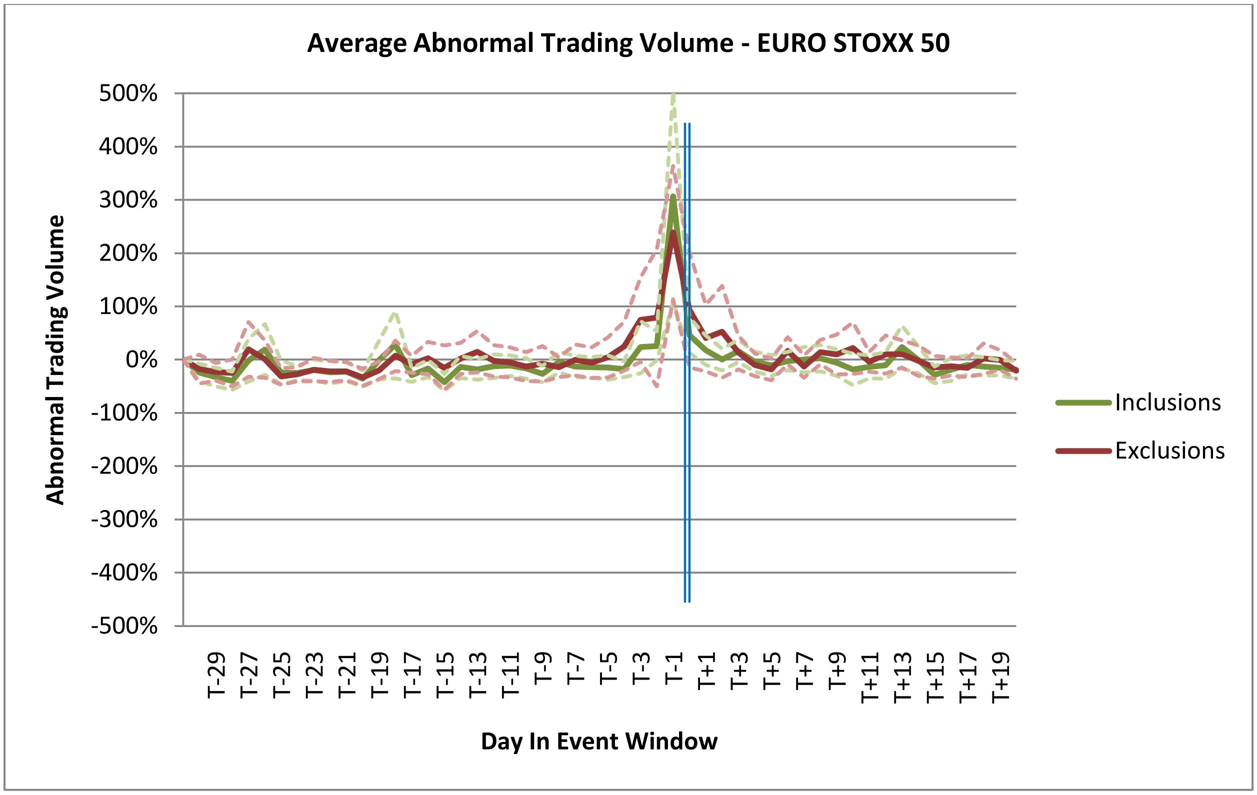
Graph 5



Graph 6



Graph 7


Average Abnormal Trading Volume - EURO STOXX 50
500%
400%
300%
200%
100%
0%
-100%
-200%
-300%
-400%
-500%
Abnormal Trading Volume
T-29
T-27
T-25
T-23
T-21
T-19
T-17
T-15
T-13
T-11
T-9
T-7
T-5
T-3
T-1
T+1
T+3
T+5
T+7
T+9
T+11
T+13
T+15
T+17
T+19
Day In Event Window
Inclusions
Exclusions

OMXS30 observations

Table XV

OMXS30 observations included in study		
Effective Date	**Company Name**	**Action**
1996-01-02	SPARBANKEN A	Addition
1996-01-02	KINNEVIK B	Addition
1996-07-01	PHARMACIA UPJOHN	Addition
1996-07-01	CELSIUS B	Deletion
1997-07-01	NOKIA-SDB	Addition
1997-07-01	SCANIA B	Addition
1997-07-01	INVESTOR A	Deletion
1998-01-02	AUTOLIV	Addition
1998-01-02	STORA B	Deletion
1998-07-01	NBH	Addition
1998-07-01	AVESTA	Deletion
2000-01-03	SECU-B	Addition
2000-01-03	WM-B	Addition
2000-01-03	ICON-B	Addition
2000-01-03	STE-A	Deletion
2000-01-03	SCV-B	Deletion
2001-01-02	ASSA-B	Addition
2001-01-02	KINV-B	Deletion
2001-01-02	TREL-B	Deletion
2001-07-02	ENRO	Addition
2001-07-02	EURO	Addition
2001-07-02	ICON	Deletion
2003-01-02	ALFA	Addition
2003-01-02	SWMA	Addition
2003-01-02	WM-B	Deletion
2006-07-03	BOL	Addition
2006-07-03	VOST SDB	Addition
2006-07-03	FABG B	Deletion
2007-01-02	SCV B	Addition
2007-01-02	HOLM B	Deletion
2007-07-02	SSAB A	Addition
2008-01-02	LUPE	Addition
2008-01-02	ALIV SDB	Deletion
2009-07-01	GETI B	Addition
2009-07-01	MTG B	Addition
2009-07-01	ENRO	Deletion

Table XVI

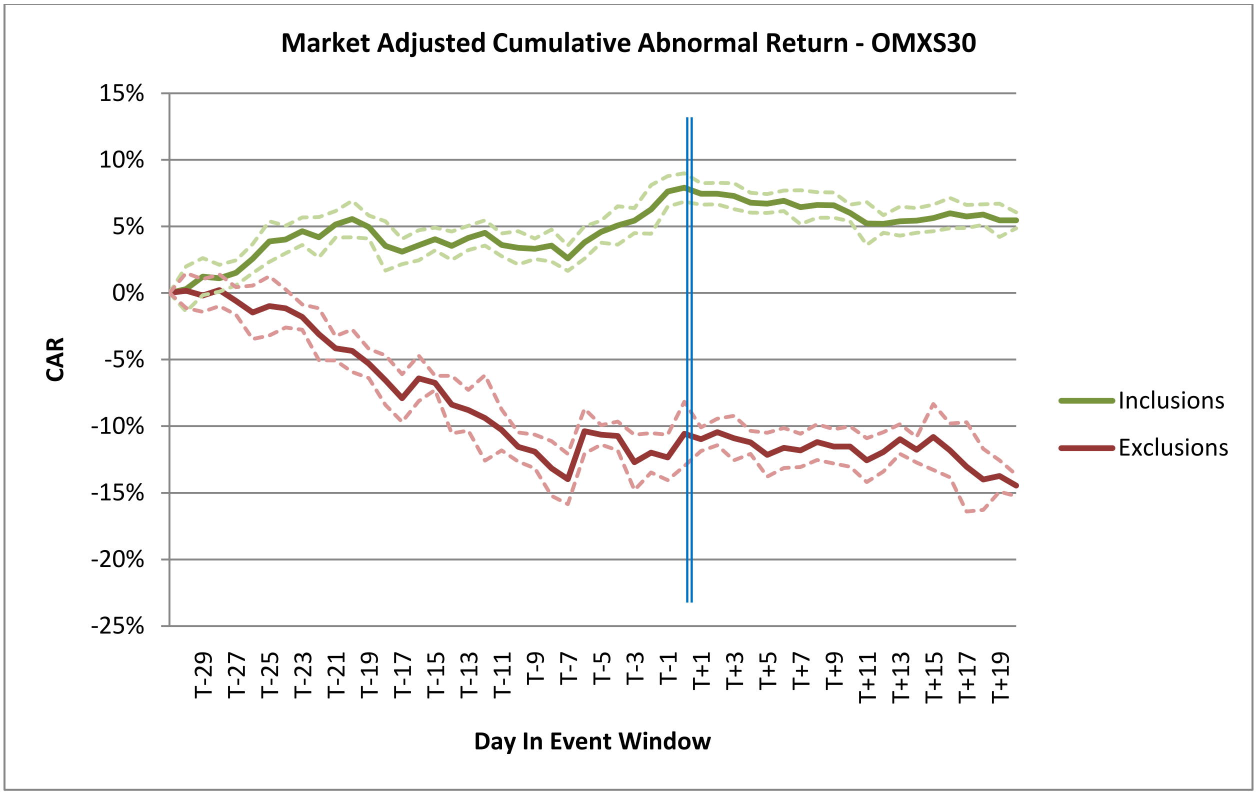
OMXS30 observations excluded from study		
Effective Date	**Company Name**	**Action**
1996-01-02	AUTOLIV	Addition
1996-01-02	INCENTIVE B	Deletion
1997-05-12	AUTOLIV	Deletion
1999-04-07	ASTR-A	Deletion
1999-04-07	ASTR-B	Deletion
1999-04-07	AZN	Addition
1999-06-16	ABB-TDBA	Addition
1999-06-16	ABB-TDBB	Addition
1999-06-16	ABB-A	Deletion
1999-06-16	ABB-B	Deletion
1999-06-23	ABB	Addition
1999-06-23	ABB-TDBA	Deletion
1999-06-23	ABB-TDBB	Deletion
1999-07-01	NETCOM	Addition
1999-10-18	AGA-B	Deletion
2000-04-03	PHU-SDB	Deletion
2000-04-04	PHA	Addition
2000-05-11	SAND	Addition
2000-05-11	SAND-A	Deletion
2000-05-11	SAND-B	Deletion
2000-06-14	TLIA	Addition
2000-07-03	FTID	Addition
2001-07-02	FTID	Deletion
2003-01-02	PHA	Deletion
2003-03-05	EURO	Deletion
2003-07-01	DROT-B	Addition
2006-03-15	OLDM	Addition
2006-03-15	SDIA	Deletion
2006-07-03	OLDM	Deletion
2007-07-02	STE R	Deletion
2009-01-02	VGAS SDB	Deletion
14-oct-04	WIHL	Addition
14-oct-04	FABG B	Deletion

OMXS30 output

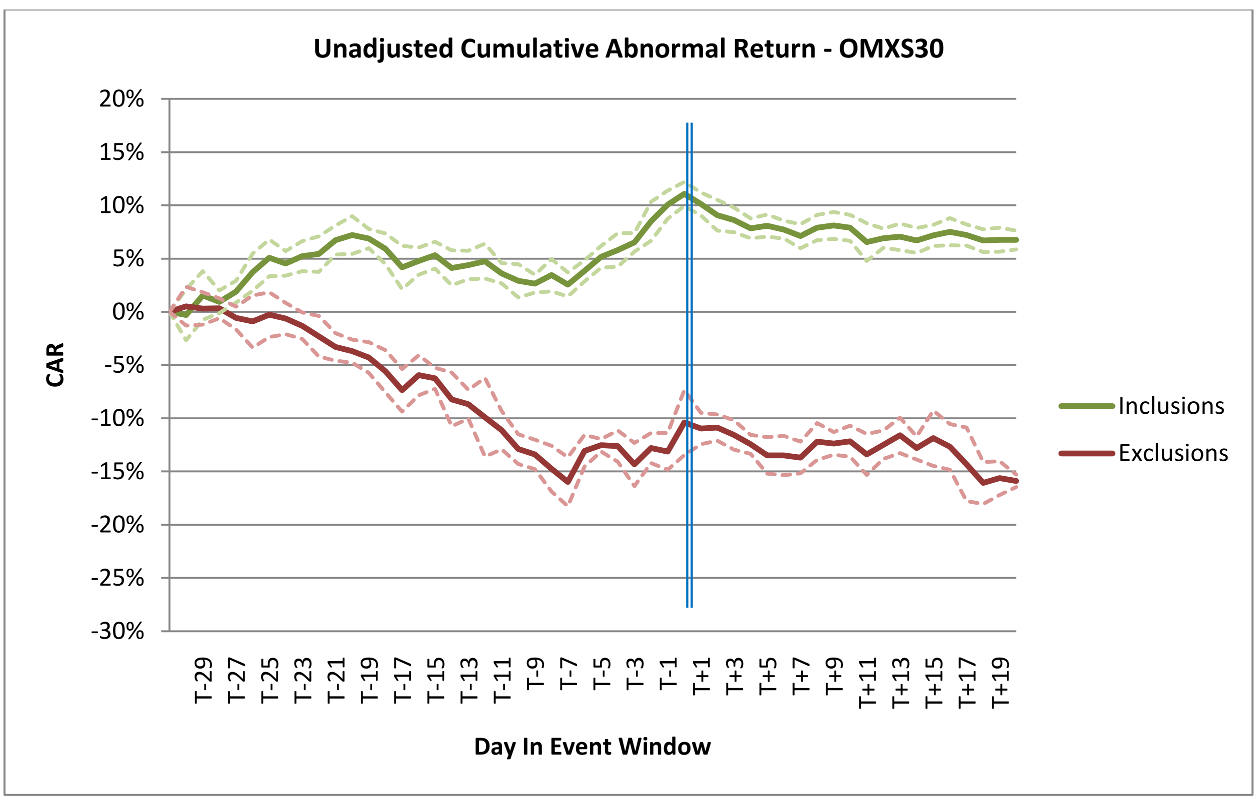
Table XVII

	OMXS30											
	Inclusions						Exclusions					
Date	Adj Avg AR	σ	Unadj Avg AR	σ	Avg AV	σ	Adj Avg AR	σ	Unadj Avg AR	σ	Avg AV	σ
T-30	0.31%	0.038	-0.29%	0.054	49%	1.204	0.19%	0.023	0.52%	0.032	13%	0.822
T-29	0.93%	0.031	1.82%	0.052	50%	1.128	-0.36%	0.021	-0.22%	0.026	15%	0.648
T-28	-0.12%	0.023	-0.58%	0.024	13%	0.893	0.40%	0.021	0.03%	0.016	28%	2.118
T-27	0.41%	0.021	0.94%	0.023	-3%	0.598	-0.81%	0.018	-0.92%	0.018	-19%	0.627
T-26	1.07%	0.025	1.84%	0.039	11%	0.613	-0.85%	0.035	-0.33%	0.043	2%	0.886
T-25	1.28%	0.035	1.34%	0.039	10%	0.775	0.47%	0.039	0.64%	0.037	-15%	1.081
T-24	0.15%	0.023	-0.51%	0.026	31%	0.880	-0.18%	0.025	-0.36%	0.026	-10%	0.684
T-23	0.61%	0.023	0.68%	0.032	58%	1.222	-0.64%	0.017	-0.68%	0.022	-12%	0.707
T-22	-0.45%	0.034	0.20%	0.038	80%	2.124	-1.29%	0.034	-1.00%	0.033	-7%	0.965
T-21	0.97%	0.023	1.31%	0.031	14%	2.131	-1.05%	0.016	-0.99%	0.023	-6%	0.691
T-20	0.41%	0.031	0.47%	0.040	-12%	1.097	-0.19%	0.028	-0.40%	0.019	5%	1.228
T-19	-0.61%	0.019	-0.32%	0.020	15%	0.792	-0.96%	0.019	-0.60%	0.025	9%	1.055
T-18	-1.42%	0.042	-0.98%	0.033	-15%	0.775	-1.24%	0.032	-1.29%	0.035	-22%	0.570
T-17	-0.43%	0.022	-1.74%	0.046	30%	1.237	-1.36%	0.031	-1.78%	0.035	-17%	0.650
T-16	0.47%	0.026	0.59%	0.029	19%	1.214	1.49%	0.030	1.41%	0.033	27%	0.867
T-15	0.47%	0.019	0.55%	0.029	-15%	0.546	-0.33%	0.009	-0.29%	0.017	26%	1.036
T-14	-0.51%	0.024	-1.18%	0.037	3%	0.590	-1.63%	0.038	-1.99%	0.044	36%	0.826
T-13	0.59%	0.021	0.27%	0.030	-9%	0.600	-0.42%	0.027	-0.45%	0.023	16%	0.629
T-12	0.38%	0.022	0.36%	0.037	-24%	0.533	-0.59%	0.056	-1.22%	0.064	19%	0.420
T-11	-0.89%	0.019	-1.14%	0.021	-20%	0.472	-0.90%	0.027	-1.21%	0.031	0%	0.537
T-10	-0.22%	0.028	-0.70%	0.035	-20%	0.475	-1.29%	0.019	-1.78%	0.025	-2%	0.622
T-9	-0.08%	0.017	-0.27%	0.019	5%	0.931	-0.34%	0.022	-0.49%	0.024	-12%	0.444
T-8	0.25%	0.027	0.80%	0.034	-30%	0.957	-1.26%	0.036	-1.34%	0.038	-23%	0.444
T-7	-0.96%	0.022	-0.88%	0.026	-29%	0.539	-0.80%	0.033	-1.24%	0.040	-15%	0.895
T-6	1.19%	0.027	1.27%	0.022	5%	0.620	3.60%	0.029	2.91%	0.026	45%	0.435
T-5	0.80%	0.019	1.34%	0.023	-28%	0.400	-0.27%	0.013	0.53%	0.010	-39%	0.475
T-4	0.47%	0.033	0.63%	0.036	-6%	0.702	-0.09%	0.019	-0.07%	0.026	-29%	0.423
T-3	0.37%	0.021	0.72%	0.020	9%	0.876	-1.99%	0.036	-1.74%	0.035	-2%	0.666
T-2	0.84%	0.041	1.99%	0.042	23%	0.912	0.72%	0.026	1.56%	0.025	7%	0.764
T-1	1.36%	0.026	1.57%	0.030	63%	0.879	-0.35%	0.030	-0.33%	0.030	94%	1.007
T	0.28%	0.024	1.00%	0.025	-2%	0.654	1.77%	0.042	2.71%	0.053	9%	0.771
T+1	-0.47%	0.018	-0.95%	0.024	-20%	0.431	-0.40%	0.016	-0.56%	0.026	8%	0.849
T+2	0.02%	0.018	-1.06%	0.032	-1%	0.880	0.54%	0.017	0.10%	0.021	21%	1.489
T+3	-0.18%	0.022	-0.43%	0.026	-34%	0.934	-0.46%	0.029	-0.70%	0.024	-30%	0.664
T+4	-0.51%	0.017	-0.79%	0.021	-15%	0.686	-0.31%	0.015	-0.88%	0.015	-14%	0.778
T+5	-0.06%	0.016	0.25%	0.024	-23%	0.667	-0.94%	0.029	-1.04%	0.030	-34%	0.465
T+6	0.21%	0.017	-0.37%	0.019	-14%	0.465	0.52%	0.026	-0.01%	0.032	-27%	0.473
T+7	-0.48%	0.029	-0.61%	0.025	-21%	0.525	-0.19%	0.022	-0.19%	0.026	-16%	0.546
T+8	0.16%	0.022	0.79%	0.027	-9%	0.782	0.62%	0.023	1.51%	0.030	-10%	1.102
T+9	-0.01%	0.021	0.20%	0.028	-30%	0.746	-0.33%	0.022	-0.18%	0.019	-31%	0.495
T+10	-0.58%	0.014	-0.22%	0.028	-22%	0.443	-0.01%	0.026	0.21%	0.025	-53%	0.344
T+11	-0.80%	0.037	-1.35%	0.040	10%	0.765	-1.03%	0.029	-1.24%	0.034	-39%	0.344
T+12	-0.03%	0.015	0.38%	0.020	-29%	0.776	0.63%	0.026	0.91%	0.023	-43%	0.337
T+13	0.21%	0.025	0.13%	0.028	-34%	0.468	0.96%	0.020	0.87%	0.029	-45%	0.385
T+14	0.05%	0.021	-0.34%	0.027	-22%	0.453	-0.79%	0.017	-1.19%	0.019	-41%	0.347
T+15	0.19%	0.023	0.48%	0.022	3%	0.888	0.96%	0.043	0.92%	0.045	-43%	0.328
T+16	0.36%	0.026	0.34%	0.029	-8%	0.976	-1.02%	0.035	-0.81%	0.037	-46%	0.395
T+17	-0.25%	0.019	-0.30%	0.022	13%	1.099	-1.22%	0.058	-1.65%	0.060	-30%	0.461
T+18	0.14%	0.017	-0.52%	0.024	-36%	0.993	-0.95%	0.040	-1.75%	0.034	-33%	0.588
T+19	-0.43%	0.028	0.07%	0.025	-20%	0.334	0.25%	0.020	0.45%	0.028	-17%	0.670
T+20	0.01%	0.014	-0.02%	0.020	-30%	0.424	-0.71%	0.014	-0.25%	0.010	-39%	0.468

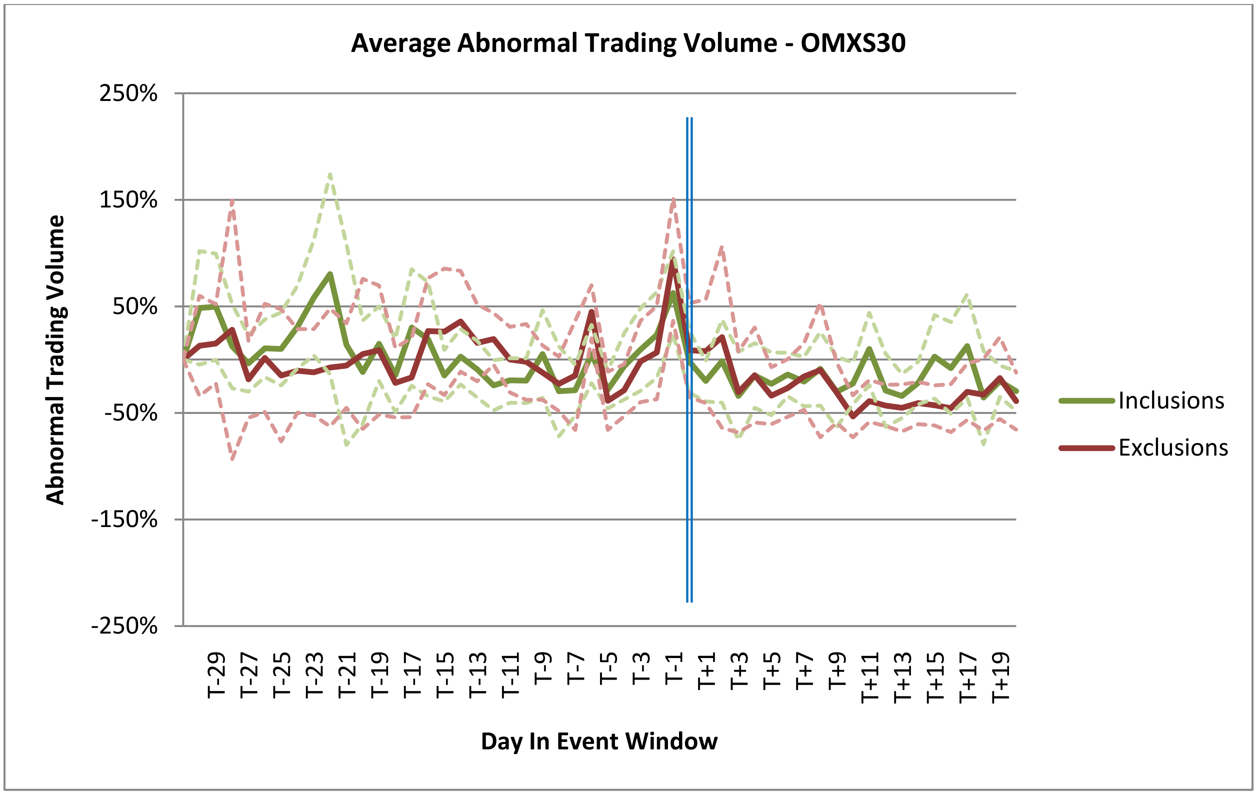
Graph 8



Graph 9



Graph 10



CAR tables

Table XVIII

EURO STOXX 50			
Inclusions			
Period	**Avg CAR**	**Std.Dev**	**t-stat**
T-25 to T-1	**4.86%**	**6.60%**	**3.53**
T-9 to T-1	**4.09%**	**4.85%**	**4.05**
T to T+9	**-4.09%**	**7.32%**	**-2.68**
T-9 to T+20	*1.26%*	*7.06%*	*0.85*
T-25 to T+20	*2.02%*	*8.68%*	*1.12*

Table XIX

EURO STOXX 50			
Exclusions			
Period	**Avg CAR**	**Std.Dev**	**t-stat**
T-28 to T+2	**-5.47%**	**8.70%**	**-3.08**
T-6 to T+2	**-3.15%**	**5.67%**	**-2.72**
T+3 to T+14	**2.84%**	**6.71%**	**2.07**
T-9 to T+20	*0.66%*	*12.12%*	*0.27*
T-28 to T+20	*-2.64%*	*13.17%*	*-0.98*

Table XX

OMXS30			
Inclusions			
Period	**Avg CAR**	**Std.Dev**	**t-stat**
T-30 to T	**7.92%**	**14.41%**	**2.61**
T-6 to T	**5.31%**	**6.17%**	**3.91**
T+1 to T+11	**-2.70%**	**6.61%**	**-1.96**
T-6 to T+20	**2.86%**	**7.14%**	**1.85**
T-30 to T+20	**5.48%**	**14.01%**	**1.85**

Table XXI

OMXS30			
Exclusions			
Period	**Avg CAR**	**Std.Dev**	**t-stat**
T-27 to T-1	**-12.57%**	**23.81%**	**-2.04**
T-14 to T-1	*-5.61%*	*18.78%*	*-1.15*
T to T+11	*-0.21%*	*6.80%*	*-0.12*
T-6 to T+20	*-0.48%*	*10.27%*	*-0.18*
T-27 to T+20	**-14.68%**	**28.59%**	**-1.99**

AV Tables

Table XXII

EURO STOXX 50			
Inclusions			
Day	Avg AV	Std.Dev	t-stat
T-3	*23.64%*	*107.79%*	*1.01*
T-2	*25.81%*	*60.41%*	*1.96*
T-1	**306.73%**	**435.43%**	**3.23**
T	**45.91%**	**72.63%**	**2.90**
T+ 1	*17.65%*	*60.94%*	*1.33*

Table XXIII

EURO STOXX 50			
Exclusions			
Day	Avg AV	Std.Dev	t-stat
T-3	*75.07%*	*174.54%*	*1.97*
T-2	*78.82%*	*283.87%*	*1.27*
T-1	**238.58%**	**275.62%**	**3.97**
T	*93.43%*	*238.51%*	*1.80*
T+ 1	*40.50%*	*137.21%*	*1.35*

Table XXIV

OMXS30			
Inclusions			
Day	Avg AV	Std.Dev	t-stat
T-3	*9.35%*	*87.61%*	*0.50*
T-2	*23.22%*	*91.24%*	*1.08*
T-1	**62.76%**	**87.90%**	**2.37**
T	*-2.07%*	*65.44%*	*-0.15*
T+ 1	*-20.08%*	*43.06%*	*-2.19*

Table XXV

OMXS30			
Exclusions			
Day	Avg AV	Std.Dev	t-stat
T-3	*-1.59%*	*66.61%*	*-0.09*
T-2	*6.64%*	*76.37%*	*0.29*
T-1	**94.13%**	**100.71%**	**2.47**
T	*8.90%*	*77.05%*	*0.42*
T+ 1	*7.85%*	*84.87%*	*0.33*

AR-AV regression coefficients

Controlling for time fixed effects

Table XXVI

EURO STOXX 50		
Inclusions		
Interval	Coefficient	Z-statistic
T-9 to T-1	*0.0014*	*1.56*
T to T+9	**-0.0063**	**-2.30**
T-3 to T-1	*0.0013*	*1.39*
T to T+2	*-0.0066*	*-1.61*

Table XXVII

EURO STOXX 50		
Exclusions		
Interval	Coefficient	Z-statistic
T-9 to T+2	*-0.0014*	*-0.85*
T+3 to T+14	**0.0102**	**3.80**
T-3 to T+2	*-0.0019*	*-1.04*
T+3 to T+6	**0.0073**	**2.15**

Table XXVIII

OMXS30		
Inclusions		
Interval	Coefficient	Z-statistic
T-6 to T	*0.0056*	*0.96*
T+1 to T+11	*-0.0073*	*-1.84*
T-2 to T	**0.0133**	**2.04**
T+1 to T+4	*-0.0021*	*-0.91*

Table XXIX

OMXS30		
Exclusions		
Interval	Coefficient	Z-statistic
T-6 to T	*-0.0008*	*-0.11*
T+1 to T+11	*0.0004*	*0.19*
T-2 to T	*-0.0012*	*-0.13*
T+1 to T+4	*0.0017*	*0.73*

Ignoring time fixed effects

Table XXX

EURO STOXX 50			
Inclusions			
Interval	**Coefficient**	**Z-statistic**	**R-squared**
T-9 to T-1	**0.0020**	**2.58**	**0.3929**
T to T+9	**-0.0067**	**-2.46**	**0.3929**
T-3 to T-1	**0.0022**	**3.11**	**0.8687**
T to T+2	**-0.0093**	**-2.21**	**0.8687**

Table XXXI

EURO STOXX 50			
Exclusions			
Interval	**Coefficient**	**Z-statistic**	**R-squared**
T-9 to T+2	*-0.0016*	*-1.08*	*0.1181*
T+3 to T+14	**0.0101**	**3.77**	**0.1181**
T-3 to T+2	*-0.0018*	*-1.12*	*0.1588*
T+3 to T+6	**0.0078**	**2.34**	**0.1588**

Table XXXII

OMXS30			
Inclusions			
Interval	**Coefficient**	**Z-statistic**	**R-squared**
T-6 to T	*0.0066*	*1.23*	*0.0056*
T+1 to T+11	*-0.0061*	*-1.49*	*0.0056*
T-2 to T	**0.0155**	**2.42**	*0.73***00**
T+1 to T+4	*-0.0008*	*-0.33*	*0.7300*

Table XXXIII

OMXS30			
Exclusions			
Interval	**Coefficient**	**Z-statistic**	**R-squared**
T-6 to T	*0.0006*	*0.1*	*0.1423*
T+1 to T+11	*0.0009*	*0.45*	*0.1423*
T-2 to T	*-0.0017*	*-0.21*	*0.1495*
T+1 to T+4	*0.0023*	*0.96*	*0.1495*