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An Evaluation of Market Efficiency

A study of listing and index population changes on the Swedish stock exchange

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Abstract

This paper evaluates market efficiency for the Swedish stock exchange by analysing listing changes on the OMX Stockholm Stock Exchange and index constituent changes in the OMXS30. We find presence of persistent large abnormal returns when a company changes its listing from, and to, a smaller Swedish stock exchange onto the OMX Stockholm Stock Exchange. We find indications of that these abnormal returns do not violate the semi-strong form of the EMH, as they represent signals about underlying firm quality. Further, we find short-term abnormal returns when a company is included into the OMXS30. These excess returns are related to price pressure from index funds, representing a violation of the semi-strong form of the EMH. Firms excluded from OMXS30 experience negative persistent abnormal returns after this event, however we cannot determine whether this represents market inefficiency or not.

Keywords: Market efficiency, abnormal returns, OMX Stockholm Stock Exchange, OMXS30 Index, Event study

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1. Introduction

This study evaluates market efficiency for two settings in the Swedish stock market. The first being listing changes where a company moves from a smaller Swedish exchange, such as First North, Aktietorget, or Nordic Growth Market (NGM), onto the OMX Stockholm Stock Exchange (OMX main list), or vice versa. The second being index constituent changes in the OMXS30. We provide a Swedish perspective of a phenomenon that has gathered strong academic interest in the past, with studies dating back to the mid 1980's when the efficient market hypothesis (EMH) was extensively debated. Interestingly, researchers find clear evidence of abnormal share price movements in relation to changes in the S&P 500 and a number of other indices around the world. Further, the main debate has been centered on whether those observations represent violations of the semi-strong form of the EMH, in this paper referred to as the information hypothesis, or not. Two important hypotheses were presented in the mid 1980's, arguing of violations of the EMH. These two are the imperfect substitutes hypothesis (DS hypothesis) relating to long-term demand presented by Shleifer (1986), and the price pressure hypothesis (PPH) related to short-term demand introduced by Harris and Gurel (1986). The EMH relies on the foundation that both long- and short-term demand is near fully elastic, and therefore that only news about changes in company fundamentals will affect share prices. Shleifer (1986) presents findings that long-term demand is not fully elastic (DS hypothesis) for companies included into the S&P 500. Harris and Gurel (1986) find that long-term demand is near fully elastic, while short-term demand is not (PPH). We elaborate on past and present research that has followed these two papers, and outline why we think the Swedish stock market represent a good fit to this discussion.

This paper investigates whether there are any abnormal returns present at listing and delisting decisions from the OMX main list, and at inclusion into or exclusion from the OMXS30. Further, we analyse if these represent violation of the EMH or not. With listing and delisting we refer to the event when a company moves from, or to, a smaller list such as First North, Aktietorget, or NGM, onto the OMX main list. We distinguish these listings from any activities related to IPOs, which this paper does not analyse. We use an event study methodology to investigate the aforementioned research questions, and also support with analysis of abnormal trading volume around the event dates. To conduct the study, we gathered two datasets, consisting of 88 listings onto and 11 delistings from the OMX main list from 1997-2016, and 14 inclusions into and 12 exclusions from the OMXS30 from 2000-2017. Two main shortcomings apply to our datasets. First, delistings from the OMX main list related to other reasons than bankruptcy, mergers or similar, are uncommon, leaving us with a small sample size. Similarly, the turnover of companies in the OMXS30 is low, again resulting in a small sample size, affecting the robustness of our results. Furthermore, there are two specific dates to keep in mind in this study. First, the announcement date is when the news of listing or delisting, inclusion or exclusion, first reaches the market. Second, the effective date is when actual listing or delisting, inclusion or exclusion, occur. In general, there are 8 trading days between announcement and effective date in our sample of listings and delistings. Similarly, there are 20 trading days between announcement and effective date on average in our sample of inclusions and exclusions.

This paper presents two main findings. First, we find support for market efficiency when companies are being listed onto the OMX main list from a smaller exchange. Share prices increase abnormally with 3.3% on average in our sample at the announcement of upward listing, and then continue to increase by an average abnormal return of 2.5% for the 10-days following this in our sample. No reversal of those increases seems present in our sample, indicating that upward listing is a signal of firm quality. Further, we find a -4.0% abnormal return on average in our sample at announcement of delisting from the OMX main list onto a smaller Swedish exchange. Again, the share prices continue to trade down abnormally with about 6.9% on average in our sample the 10-days following this. No reversal of these negative returns seems present in our sample, indicating that downward listing is a signal of low firm quality. Second, we find that being included into the OMXS30 give rise to a violation of the semi-strong form of the EMH. There are indications that share prices increase prior to and decrease post the effective inclusion date on average in our sample. Further, we find a large spike in abnormal trading volume one day prior to effective inclusion, which is related to heavy trading from index funds. Short-term demand curves for included companies are therefore found to be less than perfectly elastic from price pressure when index funds acquire holdings in the underlying companies. However, we do not find the same for companies being excluded from the OMXS30. Excluded companies trade down abnormally with -6.7% during the 10 days prior to effective exclusion. There is no full short-term reversal of this following the effective date, indicating that short-term demand is very elastic, as opposed to companies being included into the OMXS30. We cannot determine whether this effect is representing a signal of low quality, supporting the EMH, or if it represents an effect due to long-term demand being less than fully elastic when index funds let go off their holdings, a violation of the EMH.

This paper is organized as follows. Section 2 presents the findings and implications of previous research from a US and non-US context. Section 3 establishes our theoretical framework, with details on our research questions and the methodology used to evaluate those. Section 4 presents our data and its sources. Section 5 outlines our results and their implications. Section 6 concludes the study.

2. Literature Review

Index inclusion and exclusion events have a rich history in financial research, as it has been a tool to investigate the efficient market hypothesis and limits to arbitrage. The key theme is that those events offer a setting where it is possible to evaluate returns when there is no news about company fundamentals, implying that any abnormal movements should be explained by market irrationalities. This section is divided into three sub-parts. First, we separate the existing literature concerning the S&P 500. Second, we elaborate on papers providing a non-US context. In both of these sub-sections, we discuss excess share price movements and the theories developed to support this, as well as observations of abnormal trading volume in relation to these events. Finally, we discuss our fit into the existing sphere of research on the topic.

2.1 S&P 500 papers

This sub-section will delve into the large existing literature on inclusions into and exclusions from the S&P 500. The S&P 500 is a closed-end index, where composition changes occur when one company is removed. A company can be removed for several reasons, for example due to takeovers, mergers, or repeated violation of addition criteria. The eligibility criteria stem from the goal of minimizing composition changes, and includes different measures of size, liquidity and corporate information. These factors make it difficult for risk arbitrageurs to predict beforehand which companies might get included or excluded from the index. During 1976-1988 it was S&P's policy to announce additions or deletions to the index simultaneously as they were implemented. However, in October 1989, S&P revised their policy to announce changes in the index one week prior to the actual implementation. Therefore, it is relevant to separate early studies from those with samples post-1989.

Two important papers emerged in the pre-1989 period, providing different demand-side explanations of abnormal returns in connection to index inclusions. Shleifer (1986) introduced the imperfect substitutes hypothesis (or the DS hypothesis). As firms are included into the S&P 500, index funds take a substantial fraction of the public float. If stocks have close substitutes, the underlying firm value is not dependent on supply, and therefore demand curves should be horizontal. If demand curves are horizontal, no permanent price effect should occur as index funds acquire a fraction of the public float. Shleifer (1986) forms an event study on inclusions to the S&P 500 to investigate this, and found a 2.8% statistically significant abnormal return in connection with announcement of inclusion into the S&P 500 in a post-1976 sub sample. Furthermore, he found a lasting component in abnormal returns, as cumulative excess returns remained over a ten to twenty trading days time period. He argued that this provide evidence that demand curves for stocks are not horizontal, but rather downward-sloping, and prices adjust to the new long-term equilibrium. This contradicts the EMH, which assumes that long-term demand is near perfectly elastic, and that large share transactions should not have any impact on prices. However, he also acknowledges that there might be different explanations in play for the lasting component of abnormal returns, one being that returns of inclusion announcements could be certification of firm quality, driven by S&P's ability to pick better companies. The announcement of S&P 500 inclusion could therefore be a signal of firm quality, referred to as the information hypothesis (IH), which would not contradict the EMH as there will be new publicly available information at the event. The argument goes that S&P would like to avoid excessive turnover in its index to minimize cost and inconvenience for index funds, and make it an attractive representation of the market. Therefore, S&P would like the index to hold only qualitative companies. Shleifer (1986) made an attempt to test this by regressing announcement day returns to bond ratings, but could not find any meaningful results. Similarly to Shleifer's (1986) findings, Harris and Gurel (1986) conclude a statistically significant abnormal return of on average 3.1% after announcement of inclusion into the S&P 500 for 1977-1983. Further, in contrast to Shleifer (1986), the authors found that the announcement return is reversed over a 30 trading days period. Harris and Gurel (1986) argue that the pattern of large immediate price rise, and subsequent reversals, can be explained by the price-pressure hypothesis (PPH). The PPH details that investors providing liquidity in non-informational demand shifts, such as from heavy trading by index funds, should be compensated for any transaction cost or portfolio risk they bear. Similar to the EMH, the PPH assumes that long-term demand is still very elastic, but in contrast, the short-term demand is less than fully elastic. Harris and Gurel (1986) also discusses the IH, but argues qualitatively that there should be no additional information in S&P's decisions, and therefore that their results should provide evidence contradicting the EMH. The authors also evaluate the PPH from S&P 500 deletions for 1978-1983. The price effect of an announcement was on average negative 1.4%, and statistically significant. However, their sample includes only 13 deletions that were not caused by a merger, bankruptcy, or tender offer, whereof six was due to the breakup of AT&T. Therefore, no meaningful insights could be drawn on longer cumulative returns.

In total, the two authors introduced and discussed three important explanations. Two being demand-driven that contradicts the EMH in different ways, the DS hypothesis and the PPH, and one being the IH that implies market efficiency. A number of studies followed Shleifer (1986) and Harris and Gurel (1986), all showing statistically significant positive announcement day abnormal returns. Jain (1987) found a statistically significant excess return of 3.1% on average after announcement of inclusion into the S&P 500 for 1977-1983. The author also investigates about 40 firms included into other S&P indexes than the S&P 500, which by then had not attracted interest from the larger institutional investors. He found that this control group experienced an average announcement-day excess return of 2.9%, and therefore argues that the IH should be in play rather than the DS or the PPH, contradicting the conclusions of Shleifer (1986) and Harris and Gurel (1986). Dhillon and Johnson (1991) found a 3.3% average excess return after being included into the S&P 500 for 1984-1988. Similar to Jain (1987), the authors argue that their results are consistent with the information hypothesis, but inconsistent with the DS and the PPH, therefore not violating the EMH.

Several studies followed the post-1989 period when S&P began announcing additions and deletions with five trading days notice. Beneish and Whaley (1996) found a 4.4% one-day average abnormal return for 1986-1989, and a 5.6% excess return for 1989-1994, following the announcement of inclusion into the S&P 500. In common to Shleifer (1986), the authors also found a permanent effect in prices, but do not elaborate on whether this supports the DS hypothesis or the IH. Furthermore, Lynch and Mendenhall (1997) also found positive announcement day abnormal returns on the S&P 500, detailing 3.2% on average for 1990-1995. The authors also found a permanent positive effect for inclusions into the index. They argue that the announcement day return could be attributed to any of the three aforementioned hypotheses, but the permanent effect could only be due to the DS hypothesis. Lynch and Mendenhall (1997) also investigate deletions from the S&P 500, and found that the average announcement-day abnormal return is negative 6.3% on average, and statistically significant. However, their sample of deletions not caused by mergers or spin-offs was only 15 companies between 1990-1995. More recent studies show similar pattern. Petajisto (2011) investigates cumulative abnormal returns for additions and deletions from the S&P 500. He found statistically significant 10-day cumulative abnormal returns starting five days prior to announcement of 8.8% and negative 15.1% for additions and deletions respectively for 1990-2005. He argues that the result is consistent with the DS hypothesis and the IH, but qualitatively discusses that there should not be any informational value in the S&P decision.

Overall, there is conclusive evidence of abnormal returns in relation to index inclusions and exclusions both when S&P preannounced changes and when they did not. However, there seem to be no coherent explanation of this pattern. To summarize, the three main hypotheses discussed in the financial literature are the DS hypothesis, the PPH, and the IH. A summary of the three could be found in the appendix.

As two of the aforementioned hypotheses are demand-driven, it is interesting to briefly elaborate on findings of abnormal trading volume. Beneish and Whaley (1996), Lynch and Mendenhall (1997), and Petajisto (2011) all discuss that there is large abnormal trading one day before the effective date. This is argued to be because index funds are designed to minimize tracking error, and therefore fund managers are inclined to reposition as close to the effective date as possible. Even though previous research seems to agree that this behaviour is true, researchers have different opinions whether this is desired or not. For example, Chen et al. (2006) argue for making index changes as unpredictable as possible to avoid the associated inefficiency that mechanical indexers experience at effective date. In contrast, Petajisto (2011) argue that this is exactly what passive indexers want, as risk arbitrageurs act as market makers by anticipating the index change and then supplying for or buying from those index funds for inclusions and exclusions respectively.

2.2 Non-US papers

While a majority of studies have focused on the S&P 500, there are a few interesting papers to mention outside of the US. Chung and Kryzanowski (1998) examined effects of changes in the composition of the Toronto Stock Exchange (TSE) 300 index for 1990-1994. The inclusion rationale in the TSE 300 index is based on a float-adjusted market capitalization, and composition changes occur annually, or if a firm gets delisted throughout the year. The authors found a statistically significant announcement-day abnormal return of 1.7% and 2.5% for annual and non-annual additions. However, this return reverses, arguing support for the PPH. Furthermore, they also found statistically significant 60-days cumulative abnormal returns prior to announcement, which they argue indicate that additions are drawn from stocks that have performed better than the market prior to the selection. No significance is found looking at exclusions from the TSE 300. Furthermore, Chan and Howard (2002) examined the effect of inclusion and exclusion from the Australian All Ordinaries Share Price Index (AOI). In contrast to the S&P 500, the AOI index is an open-ended index where the number of constituents can vary over time, and composition changes are determined by the market capitalization of the company and liquidity of the underlying share. The authors found statistically significant 2.6% average abnormal return one day before the effective date. Further they find negative 3.3%-, and negative 2.4% average abnormal return the day before effective exclusion based on the size criteria, and exclusion based on the liquidity criteria respectively for 1995-1998. The abnormal returns are reversed in the short-term following the effective date, supporting the PPH. Furthermore, the authors argue that the inclusion decision is biased towards companies that have outperformed the market in the months prior to inclusion. In an attempt to adjust for this selection bias, they conduct another test with an outperformance control group. The results were still sizable, with a statistically significant four months cumulative abnormal return of about 25% prior to inclusion. Mase (2007) examined the effect of being included, or excluded, from the FTSE 100 index. The composition of the index depends purely on the relative market capitalization of the companies, contrasting the decision criteria in the S&P 500. The author argue that this is beneficial to the analysis, as there is no informational content in the inclusion or exclusion, as these can be predicted based on ranking firms on their market capitalization. He found that the announcement-day abnormal return is close to zero for both inclusions and exclusions, while the 10-days cumulative excess return prior to announcement is 2.9% for inclusions and negative 4.8% for exclusions. Mase (2007) argues that this evidences anticipatory trading before announcement date, as there is predictability in which firms would be included and excluded. These abnormal returns are reversed in the short-term following effective inclusion or exclusion, providing support for the PPH.

For trading activity, non-US papers find similar results as those based on the S&P 500. Chen & Howard (2003) found that the average trading volume is over 5x larger the day before effective date as compared to a pre-test period for the AOI index. The authors found that the abnormal trading starts well before effective inclusion, and argue that this is due to risk arbitrageurs predicting which companies will enter the index. Similarly, Mase (2007) found large abnormal trading three days before the effective date for FTSE 100 additions and deletions, with a peak at one day before. Additionally, for additions he found large abnormal trading before the announcement date as well, again attributing this to the predictability of constituent changes of the FTSE 100.

Overall, the findings on abnormal returns in non-US papers are mixed. The story seems to rely on indices having different inclusion and exclusion rules, where predictability becomes an important factor. Further, in contrast to the studies on the S&P 500, the PPH is well supported in studies outside the US.

2.3 Our fit into existing literature

As detailed above, inclusions into and exclusions from common indices have thoroughly been studied in attempts to evaluate deviations from the EMH. We would like to add to this discussion by providing a Swedish context, which we think is interesting from two broad perspectives. The first one is that similarly to the non-US studies, the OMXS30 index has clear composition rules based on liquidity. Therefore we think that results should be comparable to the findings of Chung and Kryzanowski (1998), Chan and Howard (2002), and Mase (2007). The second perspective is that the Swedish stock market is in our opinion unique in the sense of having several different stock exchanges, for example the Stockholm Stock Exchange, First North, and Aktietorget. As shares sometimes move between these lists we can add another view of an arguably non-informational event that can be studied to evaluate market irrationalities.

3. Theoretical framework

The literature review established that abnormal returns historically have been identified around announcement of inclusion into and exclusion from common indices. Three main hypotheses have been discussed to explain the observed movements. In this section, we will first outline our research questions and hypotheses, and then thoroughly motivate our selected methodology to evaluate these hypotheses and questions.

3.1 Research questions and hypotheses

Our study is divided into two sections. The first one evaluating listing changes in the OMX main list, and the second one population changes in the OMXS30 index. Therefore, we will split our research hypotheses in two sub groups.

3.1.1 OMX main list research questions

Overall, we have two broad and one specific research questions we would like to evaluate in this paper relating to listing changes in the OMX main list.

1. *Are there abnormal returns before, at, and after the* <u>*announcement date*</u> *of listing onto or delisting from the OMX main list?*
2. *Are there abnormal returns before, at, and after the* <u>*effective date*</u> *of listing onto or delisting from the OMX main list?*
3. *Does these abnormal returns represent market irrationalities or not?*

In general, financial theory suggests that only announcements of changes in company fundamentals should give rise to abnormal returns. Therefore, our research questions are interesting as any abnormal returns found either could be attributed to changes in perception about company fundamentals (IH) or to market inefficiencies and demand price pressure (DS, PPH). The following section will detail why we think the OMX main list provides an strong platform to analyse the above.

3.1.1.1 OMX main list listing regulations

For inclusion into the OMX main list, the listing procedure entails the underlying company first applying and then a committee at Nasdaq takes the final decision. The decision is based on five key criteria. First, the company should have been active in the past three years. Second, it has to prove proof of profitability for the past twelve months, or provide clear indication of profitability the following twelve months. This criterion only applies as listing eligibility, i.e. after listing a company cannot be excluded based on this criterion. Third, there needs to be sufficient liquidity. At least 500 shareholders should hold shares of value above 500 EUR, and there also needs to be at least 25% public float. Fourth, the total market capitalization needs to surpass 1 MEUR. Fifth, the company needs to meet the increased reporting standards compared to smaller exchanges. Overall, those five criteria are very general, and we believe that it should not be possible to predict if and when a company will be moved to a larger list purely on sorting on those variables. Further, there is no particular rule governing that a company is too large for a smaller list, and therefore has to apply for listing at the main list. The delisting process is somewhat different. The company can still apply for delisting, and the committee at Nasdaq takes the final decision. Other means of delisting includes bankruptcy, acquisitions, or that the company no longer fulfils the reporting and governance criteria.

In total, we believe that the OMX main list is unique in the sense that the decision process is difficult to replicate, much similar to the S&P 500, and that the eligibility criteria do not per se detail that the listing is informative of company fundamentals. Furthermore, if the above is true, it is arguably difficult to motivate why a company would move between a smaller list to the OMX main list. After revision of press releases from companies announcing listing changes, we find that common motivations include the medial attention, more diversified investor clientele, and stronger governing rules.

3.1.1.2 OMX main list hypotheses

We expect to find no abnormal return prior to announcement of listing changes as the event should be unpredictable. Further, we do not think that there is any informational value in an upward listing decision. A delisting might indicate low firm quality as the companies either are forced to delist because of violation of governance rules, or that they actively apply for it themselves. Therefore, our main hypothesis is to find no abnormal return at announcement for listing and a negative excess return for delisting. Further, we do not expect to find any abnormal return at the effective date as no news is released at this date.

This would contradict findings in previous literature that details abnormal returns for inclusion and exclusions from various indices. We think that the OMX main list is different from the S&P 500, and other non-US indices presented in section 2.2, for two reasons. First, we believe that Nasdaq OMX does not have as clear incentive to list only qualitative firms as for example S&P, where the latter wants to minimize turnover of companies in the index. Therefore, there is arguably less informational value in Nasdaq

OMX's decision than S&P's. Second, listing decisions should have less effect on long- and short-term demand as compared to for example the S&P 500 as there are comparably less index tracking funds investing in the OMX main list. Overall, we think that those two reasons would differentiate results found on the OMX main list from studies presented in section 2.

3.1.2 OMXS30 research questions

Similar to the OMX main list part of this study, we have two broad and one specific research question in this section.

1. *Are there abnormal returns before, at, and after the <u>announcement date</u> of inclusion into or exclusion from the OMXS30?*
2. *Are there abnormal returns before, at, and after the <u>effective date</u> of inclusion into or exclusion from the OMXS30?*
3. *Does these abnormal returns represent market irrationalities or not?*

The OMXS30 is a closed-end index, consisting of the 30 most traded companies on the OMX main list. We think that this section is an interesting contrast to the OMX main list as the selection process for inclusion and exclusion is different, and in effect similar to the non-US indices evaluated by Chung and Kryzanowski (1998), Chan and Howard (2002), and Mase (2007).

3.1.2.1 OMXS30 selection process

Every six months, in December and June, Nasdaq ranks each OMX main list company in terms of trading volume in SEK through a control period between end of June to end of November, and end of December to end of May respectively. A company could be included into the OMXS30 in two ways. Either the company is among the 15 most traded companies during the control period, or the company is ranked number 31 simultaneously as one index constituent drops below the 45 most traded in the same period. Similarly, a company is excluded if it is ranked number 31 as one new company boosts up to top 15, or if it drops below the 45 most traded firms in the control period. As the selection process purely focuses on liquidity, it differs to some extent from those evaluated in previous research. Many indices do have a liquidity component of selection, but also includes some market capitalization measure (Chung and Kryzanowski 1998, Chan and Howard 2002, and Mase 2007). We believe that purely focusing on liquidity is favourable as it arguably reduces the selection bias of using market capitalization as criteria, which will cause inclusions to be past winners and exclusions to be past losers. Further, some indices such as the S&P 500 have a separate committee that decides on inclusion or exclusion (e.g. Shleifer 1986, Harris and Gurel 1986). Overall, it is clear that the OMXS30 selection process is fully transparent, it should therefore be possible for funds and traders to replicate the decision process and predict which companies will get included or excluded, but this analysis is out of scope for this study.

3.1.2.2 OMXS30 hypotheses

As detailed in the previous section, the OMXS30 selection process is transparent. That makes analysing the index a good complement to the not so transparent process of listing onto the OMX main list. Furthermore, we expect index fund activity to be significantly larger for the OMXS30 changes as compared to overall main list listing or delisting, since the OMXS30 is a popular benchmark index. Therefore, in contrast to the OMX main list analysis, for the OMXS30 we expect to find results more in line with previous research presented in section 2. More specifically, we expect that share prices will increase around the effective date when index funds start trading, and be reversed in the following days, similar to the results of Chung and Kryzanowski (1998), Chan and Howard (2002), and Mase (2007). Therefore, we hypothesize that the PPH will be in play, and that the short-term demand curves of the stocks included and excluded from the OMXS30 is less than perfectly elastic – contradicting the EMH.

3.2 Methodology

The research questions and hypotheses presented in section 3.1 will be tested through an event study. The nature of the study is the same for both the OMX main list and the OMXS30, and will be divided into two sub-sections around the announcement and the effective date. In this section, we will present the methodology of measuring abnormal returns in the event window, the cumulative abnormal returns in the days prior to and following the event, and the evaluation of abnormal trading volume. We finish with a discussion of potential limitations of the presented methodology in relation to our research questions.

3.2.1 Measuring abnormal returns in the event window

We have used the event study approach presented by MacKinlay (1997) and Brown and Warner (1980). We use two separate event dates for the analysis of announcement and effective date respectively. For announcement, we have defined our events as the day when the list change or change in index population is announced for the first time. For the effective date, we use the first day of trading as the event date. The event window (t_0) is set to one day to only capture the effect from the announcement or effective date on close-to-close prices.

In a next step, we estimate the abnormal returns for the security in the event window calculated as the ex post actual return less the expected return for that security given by:

$$AR_{it} = R_{it} - E(R_{it}|X_t)$$

Where AR_{it} is the abnormal return for firm *i* at time *t*, R_{it} is the actual return for firm *i* in time *t*, $E(R_{it}|X_t)$ is the expected return for firm *i* at time *t*, and X_t is an explanatory variable determining expected returns at time *t*.

Actual returns are calculated as the natural logarithm return based on daily close-to-close prices for each firm as follows:

$$R_{it} = \ln\left(\frac{p_t}{p_{t-1}}\right)$$

According to Brown and Warner (1980), expected return, $E(R_{it}|X_t)$, for a security can be measured in three ways. The first method, mean adjusted returns, assumes that the expected return in the event window is equal to a constant K_i, which is specific for each firm and can be measured as an average return during an estimation window prior to the actual event. The second method is calculating market adjusted returns. This model assumes that the expected return is equal to the return of the market portfolio, $E(R_{it}|X_t) = E(R_{mt})$, thus being equal for all firms but not equal over time, as is assumed according to the mean adjusted returns model. The third and final approach is a market and risk adjusted model. This approach takes into account both the return of the market and each firm's exposure to one or more risk factors. This implies that the expected return is specific for each firm and varies over time. In this study, we will use the third model to estimate expected returns. Adding risk adjusted factors to the market-adjusted model will capture additional information of actual returns and decrease variance of the abnormal component of returns. This will better enable us to isolate that the abnormal return in the event window is due to the listing or delisting, or inclusion or exclusion, from OMX Stockholm or the OMXS30 index, rather than due to a firm's exposure to a certain risk factor.

The market and risk adjusted model used in this study is Carhart's (1997) four factor model, an extension of Fama and Franch's (1993) three factor model.

$$E(R_{it}|X_t) = a_i + R_{Ft} + \beta_{RMRF,i}RMRF_t + \beta_{SMB,i}SMB_t + \beta_{HML,i}HML_t + \beta_{MOM,i}MOM_t + e_{it}$$

Where R_{Ft} is the risk-free rate, $RMRF_t$ is the market risk premium at time t, SMB_t is the return spread of small minus large stocks at time t, HML_t is the return spread of high minus low value stocks at time t, and MOM_t is the return spread of past winners and past losers at time t. The alpha and betas of the model is estimated using an ordinary least squares (OLS) regression for each firm during an estimation window of 40 trading days prior to the event date to prevent the event date from influencing the estimation of normal performance. MacKinlay (1997) suggests using an estimation window of 120 trading days. However, 40 trading days should be sufficient to estimate short-term normal returns and prevent the estimated parameters to be influenced by data from different regimes.

Combining the abnormal return formula with the market and risk adjusted model above, we get the following estimation of abnormal returns:

$$\widehat{AR}_{it} = R_{it} - E(R_{it}|X_t) = R_{it} - (\hat{a}_i + R_{Ft} + \hat{\beta}_{RMRF,i}RMRF_t$$

$$+\hat{\beta}_{SMB,i}SMB_t + \hat{\beta}_{HML,i}HML_t + \hat{\beta}_{MOM,i}MOM_t)$$

3.2.2 Cumulative abnormal return around the event window

To study movements pre- and post our t_0 event window, we calculate the cumulative abnormal returns (CARs) for four different windows. The CARs are calculated as follows:

$$\widehat{CAR}(t_t, t_{t+n}) = \sum_{t}^{t_n} \widehat{AR}_{i,t}$$

We do this for the following pre- and post event windows:

- Pre-event window 1: t_{-10} → t_{-1}
- Pre-event window 2: t_{-5} → t_{-1}
- Post event window 1: t_1 → t_{10}
- Post event window 2: t_1 → t_5

We decided to keep the maximum number of trading days to 10 in the pre and post event windows for the regressions, and illustrate longer windows graphically.

3.2.3 Regressions

We perform two separate types of regressions in this study. To find the effect of being listed onto the OMX main list or included into the OMXS30, we perform the following regression:

$$\widehat{AR}_i = a_i + \beta_{Listing/Inclusion} * Listing/Inclusion\ dummy_i + \varepsilon_i$$

The $\beta_{Listing/Inclusion}$ will show the effect of being listed onto the OMX main list or included into the OMXS30. We perform the same type of regression to find the delisting and exclusion effect.

Furthermore, to find the effect of operation and valuation variables on being listed onto the OMX main list, we perform the following regression for each variable with an if-statement if the company is listed:

$$\widehat{AR}_{i,t} = a_i + \beta_{Operational\ growth\ dummy,i} * Low\ median\ op.growth\ dummy_{i,t} + \varepsilon_i$$

or:

$$\widehat{AR}_{i,t} = a_i + \beta_{Valaution\ growth\ dummy,i} * Low\ median\ valuation\ growth\ dummy_{i,t} + \varepsilon_i$$

Where the operation and valuation growth dummies are indicating whether a company is in the low median in the sample. Further details on the variables are presented in section 4. Since we perform this regression with an if-statement, the effect of being in the high category will be detailed in the a_i for each regression.

3.2.4 Measuring abnormal trading volume

To examine how trading volumes are changing around the effective date of listing onto or delisting from the OMX main list, and inclusion or exclusion from the OMXS30 index, we are calculating Mean Volume Ratios (MVRs) similar to Beneish and Whaley (1996) and Chan and Howard (2002). MVR is calculated in the following way:

$$MVR_{i,t} = \frac{V_{i,t}}{1/_N * \sum_{t=t_1}^{t_n} V_i}$$

Where $V_{i,t}$ is the number of shares traded of security *i* at time *t*, and the denominator is the average number of shares traded for security *i* during an estimation window. MVR is calculated for t_{-10} to t_{10} for each firm around the announcement and effective date. Researchers use different estimation periods in their MVRs, we chose to follow Harris and

Gurel's (1986) normalized trading volume estimation window, and use 8 trading weeks from t_{-50} to t_{-11}. The period ends at t_{-11} to not interfere with the first event window starting at t_{-10}. The same estimation window is used for both announcement and effective date to avoid abnormal trading volume during the announcement from affecting mean adjusted trading volume prior to the effective date.

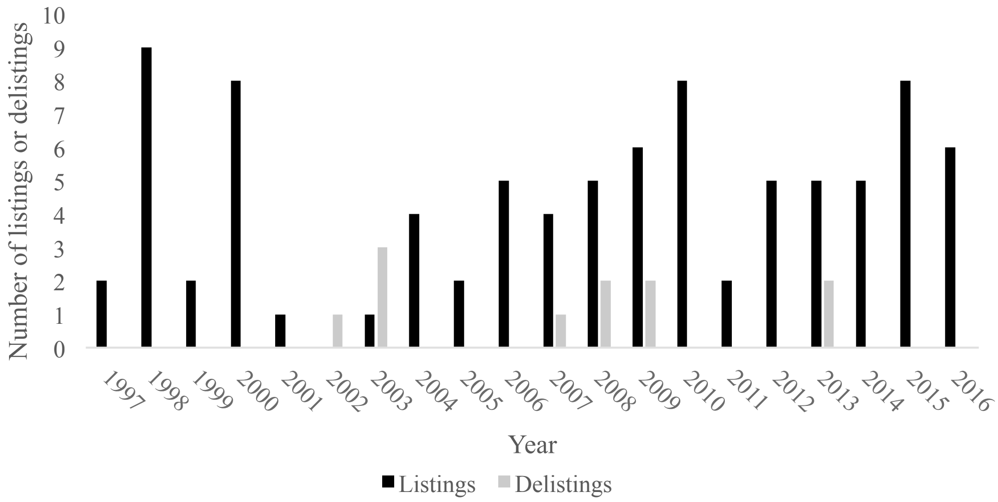
4. Data

We have used multiple sources to build datasets on OMX listing and delisting, and OMXS30 inclusions and exclusions. This section is divided as follows. First, we present the process and sources to gather data on announcement and effective dates for listings and delistings on the OMX main list. Second, we outline the same procedure for the OMXS30 dataset. Third, we describe our sources of share prices, trading volumes, and the operation and growth variables. Fourth, we present an overview and distribution of the variables used to analyse our research questions. Fifth, we discuss the two main shortcomings of our datasets.

4.1 Listing and delisting observations OMX main list

The first set of events includes stocks that are included into or excluded from OMX Stockholm main list, i.e. companies that move to or from a smaller Swedish stock exchange such as Nasdaq First North, Aktietorget or NGM. Up to 2005 this set of events also includes changes between the A-list and the O-list, which were later merged together into the OMX Stockholm main list. The first day of trading on the new exchange for each of these events are available year by year on Nasdaq OMX's website. We continued to select companies that change list due to other reasons than IPOs, spin-offs, mergers, acquisitions, buy-outs or companies that are delisted because of bankruptcy or other reasons. We have also manually screened the dataset to exclude list changes due to companies changing names, and those where an informative event occurred within two weeks of our event date. After excluding these events, we have a data set of 99 list changes on the Swedish stock exchange from 1997 to 2016, of which 88 are listings and 11 are delistings. Figure I & II in appendix 8.2 show the sources and destinations for listings and delistings respectively. Figure I shows that a large majority of the 88 listings come from First North. Figure II shows that the most common destination for delisted companies is also First North. The data available on Nasdaq OMX website only registers the first day of trading for each event. To obtain the announcement date for each event, we have found the press release by the concerning company announcing that the list change is approved and the first day of trading on the new list. On average, the announcement date is 8 trading days ahead of effective listing or delisting in our sample. An overview of yearly distribution of the listings and delistings in our sample is presented in Figure 1.

Figure 1: Yearly distribution

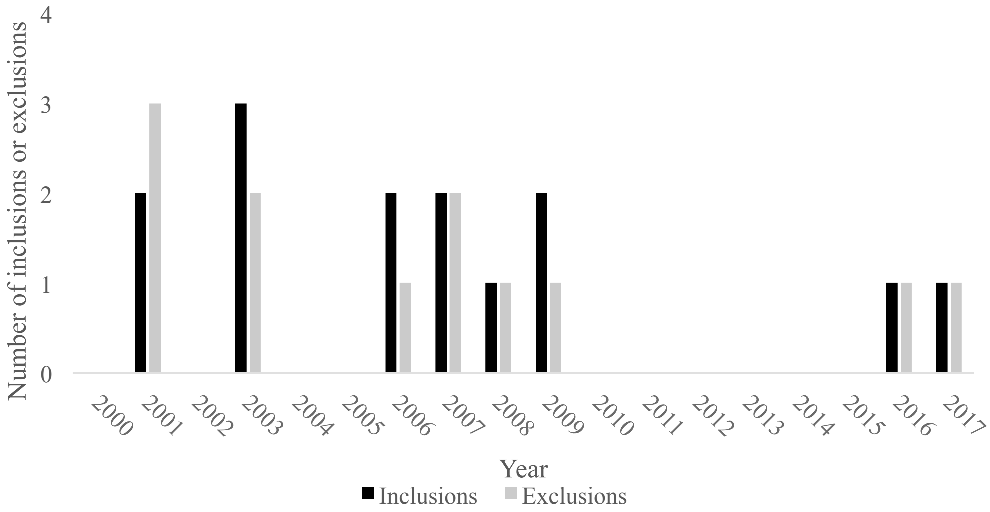


Note: Yearly distribution of listings onto or delistings from OMX main list by effective date from 1997-2016.

4.2 Inclusion and exclusion observations OMXS30

Our second dataset consists of stocks that are included or excluded from OMXS30 index. The population at each given semi-annual constituents' review are available through the Trust terminal from SIX Financials Information. To obtain which companies are moving in or out of the index, we have identified population changes in the index around the time when the changes are made. After that, we manually searched for press releases from Nasdaq OMX and other sources to find the announcement date, which on average occur 20 trading days ahead of the effective change in our sample. We have excluded those events where the announcement date cannot be confirmed with certainty. During the period 2000 to 2017, we end up with 26 changes to the index, 14 inclusions and 12 exclusions. The observations of inclusion and exclusion differs as some exclusions were removed due to merger activity. An overview of yearly distribution of the inclusions and exclusions in our sample is presented in Figure 2.

Figure 2: Yearly distribution



Note: Yearly distribution of inclusions into or exclusions from OMXS30 index by effective date from 2000-2017.

4.3 Share prices, volumes, and controlling variables

To be able to measure abnormal returns for the events included in our two data sets, we have matched the events with daily shares prices for each firm during the period t_{-250} to t_{+250} for events in the OMX main list data list, and t_{-125} to t_{+125} for each event in the OMXS30 data list. This data is obtained from the FinBas database, covering all Swedish stock exchanges. The price data is used to calculate daily returns for each company. We also download trading volumes from the FinBas database. To obtain normalized returns we use the Carhart (1997) four-factor model. The factors are published by the Swedish House of Finance and calculated over every Swedish stock from 1983 to 2016, aggregated by day. Finally, our controlling operating and valuation variables are obtained from S&P Capital IQ and Bloomberg.

4.4 Event and variable distributions

Our final dataset consists of 99 OMX main list changes from 1997-2016, 26 OMXS30 population changes from 2000-2017, and a subset of operational and valuation variables. An overview and explanation of these variables are presented in Table 1.

Table 1 – Variable descriptions
Descriptions of variables used in this paper. All variables are dummy variables. Operational and valuation variables represent LTM, L3Y, and L5Y company characteristics of listed and delisted firms at the announcement date.

Variable	# observations (Main list / OMXS30)	Dummy variable description
Listing / inclusion	88 / 14	1 = Upward listing change onto the OMX main list or inclusion into the OMXS30
Delisting / exclusion	11 / 12	1 = Downward listing change from the OMX main list or exclusion from the OMXS30
Operational variables (main list only)		
EBIT_1Y_low	22	1 = Company is in the low 50th percentile in EBIT growth last year
EBIT_5Y_low	9	1 = Company is in the low 50th percentile in EBIT CAGR last five years
Rev_1Y_low	35	1 = Company is in the low 50th percentile in revenue growth last year
Rev_5Y_low	22	1 = Company is in the low 50th percentile in revenue CAGR last five years
Valuation variables (main list only)		
Div/share_1Y_low	8	1 = Company is in the low 50th percentile in dividend per share growth last year
Div/share_5Y_low	4	1 = Company is in the low 50th percentile in dividend per share CAGR last five years
P/B_1Y_low	32	1 = Company is in the low 50th percentile in price-to-book ratio growth last year
P/B_5Y_low	15	1 = Company is in the low 50th percentile in price-to-book ratio CAGR last five years

Sources: S&P Capital IQ, Bloomberg, Nasdaq OMX, SIX Trust

4.5 Limitations of the data and sources

One main issue relates to the number of observations in our data sets. To be able to draw robust conclusions and answer our research questions, our findings need to be based on a sufficient number of observations. While companies are listed on OMX Stockholm main list from one of the smaller stock exchanges quite regularly, delisting is seldom requested by companies, but rather because of bankruptcy or mergers. Therefore, many delisting observations are excluded. Similarly, changes in the OMXS30 index is quite rare, resulting in a small sample size, which affects the robustness of our findings.

A second limitation concerns when news about an event is first available to the market. Nasdaq OMX releases news about index changes on its platform Global Index Watch. To get access to these releases, a subscription is needed. Since it was not possible for us to get this access, we have researched the announcement of inclusions and exclusions from mix of press releases from those found on the general Nasdaq OMX website and from the involved companies. In the cases when Nasdaq OMX releases the news, we can say with most certainty that this is the first time the information reaches the market. However, when the company releases the news, there is a possibility that some actors with subscriptions have accessed it prior to the announcement date in our data set. The situation is the same for listings and delistings from the main list, as these news are almost exclusively released by the companies. However, double-checking those event dates that could be found from both Nasdaq and the underlying company, it matches. Therefore we can be reasonably comfortable with the announcement dates in our dataset.

5. Results and discussion

This section presents our results in answering the stated research questions. It will be divided into two sub-sections. First, we will present the results in relation to the OMX main list analysis. Second, we will present the results of the OMXS30 analysis. Each sub-section will start with descriptive statistics of the samples, and then be followed by regression output and graphs.

5.1 OMX main list results

5.1.1 Announcement listing and delisting effect

5.1.1.1 Descriptive statistics

Table 2 presents descriptive statistics of the OMX main list analysis. The table is divided into two panels, each describing listing and delisting abnormal returns at announcement.

Panel 1 describes announcement listing abnormal returns in our sample. Overall, there seem to be positive abnormal share price increases at the announcement date, as both the average and the median excess return is positive, at 3.3% and 2.7% respectively over the 88 observations. As expected, it seems to be about zero abnormal return before announcement. Interestingly, over the short term following announcement, share prices continue to rise on average. However, the standard deviations of the post event windows are larger than the pre- and event day windows. Aggregated over the full window, from 10 days pre event to 10 days post event, there seem to be a potentially large CAR. So far, there is no indication that the share prices reverse after announcement.

Panel 2 describes the same variables at delisting announcements in our sample. At the event day, there seem to be negative abnormal returns. However, there are some outliers with large negative returns, which pushes the average excess return to -4.0%, while the median is -0.9% in the sample of 11 delistings. Before announcement, the sample firms seem to increase, which is puzzling, as these events both should be unpredictable and are expected to be negative for the company. However, aggregating the abnormal returns over the full window from 10 days pre to 10 days post event, the CAR seems negative.

Table 2 – Descriptive statistics of abnormal return at announcement of listing onto and delisting from the OMX main list Descriptive statistics of abnormal return around announcement of listing or delisting. Data from 1997-2016.					
Panel 1 – Announcement of listing onto the OMX main list					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	88	88	88	88	88
Max	20.6%	25.2%	26.5%	21.2%	32.1%
Average	3.3%	0.6%	0.4%	2.0%	2.5%
Median	2.7%	-0.3%	-0.4%	1.8%	1.4%
Min	-9.8%	-11.4%	-19.2%	-16.7%	-24.3%
Standard deviation	5.1%	5.5%	6.7%	6.7%	10.5%
Panel 2 – Announcement of delisting from the OMX main list					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	11	11	11	11	11
Max	2.5%	9.2%	12.2%	16.3%	24.1%
Average	-4.0%	3.7%	1.9%	-4.3%	-6.9%
Median	-0.9%	2.7%	2.0%	-4.1%	-6.4%
Min	-18.7%	-2.0%	-9.0%	-15.0%	-31.6%
Standard deviation	6.6%	3.7%	6.1%	8.3%	13.8%

5.1.1.2 OLS regression results and implications

Table 3 presents the overall result. Interestingly, there are large abnormal returns associated with listing and delisting in the sample. A company that is listed exhibits a positive 3.3% excess share price increase on average, which is significant at the 1%-level, shown in regression 1. There seem to be no excess returns leading up to listing onto the main list, shown in regression 3 and 5. Following announcement of inclusion, share prices continue to experience cumulative positive excess returns of 2.0% on average in the 5-days window, and 2.5% on average in the 10-days window. These coefficients are statistically significant at the 1%- and 5%-level respectively.

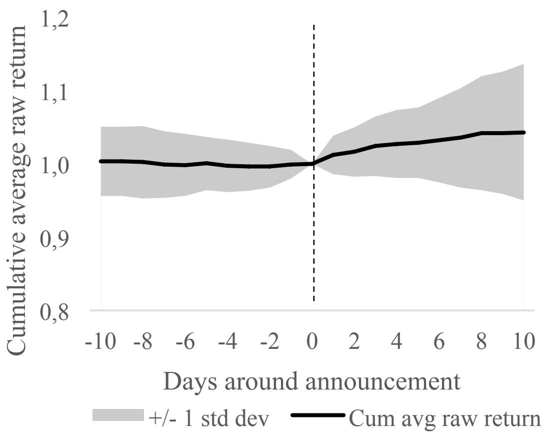
Further, the share price of a company that is delisted is punished and experiences a -4.0% excess return on average in the sample, shown in regression 2, which is statistically significant at the 5% level. For delisting, we see an increase in share price 5 days ahead of announcement, which is puzzling. The 5-days CAR in regression 4 is 3.68% on average in the sample, and significant at the 1%-level. Delisting announcements are followed by a -4.3% cumulative excess return in the 5-days window, and -6.9% cumulative excess return in the 10-days window. Both are statistically significant at the 10%-level. In total, it is clear that listing and delisting announcement do have large effect on share prices on average.

Table 3 – Abnormal return around announcement of listing onto and delisting from the OMX main list
OLS regression results. Event windows: 1 = Announcement day, 2 = 5-days pre announcement day, 3 = 10-days pre announcement day, 4 = 5-days post announcement day, 5 = 10-days post announcement day. Numbers in percentage points. 5- and 10-days windows are cumulative abnormal returns. Listing and delisting are dummy variables. Robust standard errors in parentheses. * = 10% significance, ** = 5% significance, and *** = 1% significance.

Event window	1	1	2	2	3	3	4	4	5	5
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Listing	3.33***		0.58		0.44		2.00***		2.52**	
	(0.54)		(0.59)		(0.71)		(0.71)		(1.11)	
Delisting		-4.02**		3.68***		1.89		-4.31*		-6.92*
		(1.91)		(1.06)		(1.74)		(2.39)		(3.97)
Constant	0.00*	0.00***	0.00**	0.00	0.00	0.00	0.00	0.00***	0.00	0.00**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	88	11	88	11	88	11	88	11	88	11
R-Squared	25.1%	4.6%	1.0%	5.0%	0.4%	0.0%	6.7%	3.9%	4.4%	0.5%

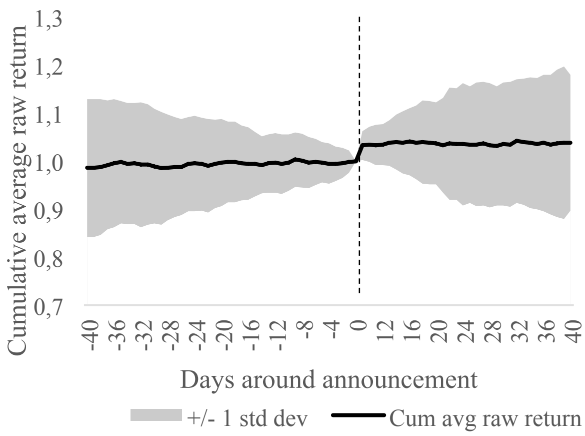
The regression results are supported by Figure 3 that plots cumulative average raw returns ten days prior to ten days after the announcement day for the full sample of listings, indexed to the announcement day. The figure clearly illustrates that the announcement effect is large, and not predicted by the market as the share price on average is steady prior to the event. Together with the regression results presented in Table 3, there is clear indication that no reversal happens in the short term after the listing announcement. Figure 3 is further supported by Figure 4, which presents cumulative raw returns for the 40 days prior and post announcement. In this graph, the average 8 trading days between the announcement and effective date is removed to clearly illustrate the share price jump that occurs at listing onto the OMX main list. Further, we have removed the companies in the top 20th percentile of daily raw return standard deviation as there were large outliers affecting the days farther away from the announcement date. Since we are mostly interested in the shorter term leading up to and after the event date, we cleaned the sample of those observations. For comparability, we did so for all graphs in this study.

Figure 3: 20 trading days cumulative average raw return listed firms



Note: Cumulative average raw return, firms listed onto the OMX main list, 10 days prior to 10 days after the announcement, indexed to the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded.

Figure 4: 80 trading days cumulative average raw return listed firms

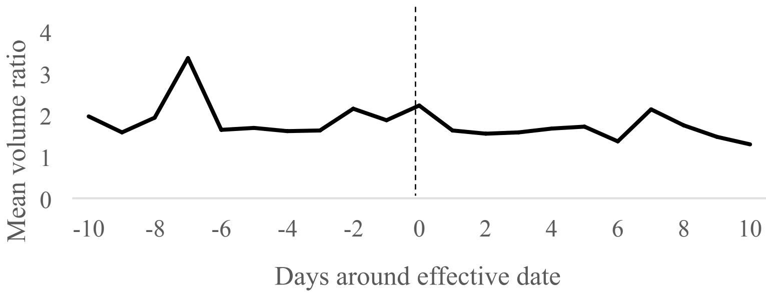


Note: Cumulative average raw return firms, listed onto the OMX main list, 40 days prior to 40 days after the announcement, indexed to the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 8 trading days between announcement and effective date excluded.

Clearly, the share price is not reversed after the event on average in our sample. This would be in line with either the IH or the DS hypothesis. If the DS hypothesis is true, the argument would be that being listed attracts a different investor clientele that absorbs a large part of the public float. To evaluate this, we analyse abnormal trading activity around the effective inclusion date to identify if there are any main list tracking funds acquiring the listed companies. If so, they would be inclined to acquire shares in the listed companies as close to the effective listing date as possible to minimize tracking error.

Figure 5 shows that there is no spike in abnormal trading close to the effective listing. Therefore, there seem to be no particular effect of tracking funds investing in the listed companies, which argues for the IH and market efficiency rather than the DS hypothesis. However, there may still be an effect of active funds trading in the listed companies. Therefore, it might be the case that the persistent effect in share prices from being listed is indeed related to the DS hypothesis, however this discussion is difficult to analyse with public data, as we do not know whom the investors trading in the listed companies are. While the DS hypothesis might not be possible to rule out completely, the results still strongly suggests of listing being an informative event, supporting the IH.

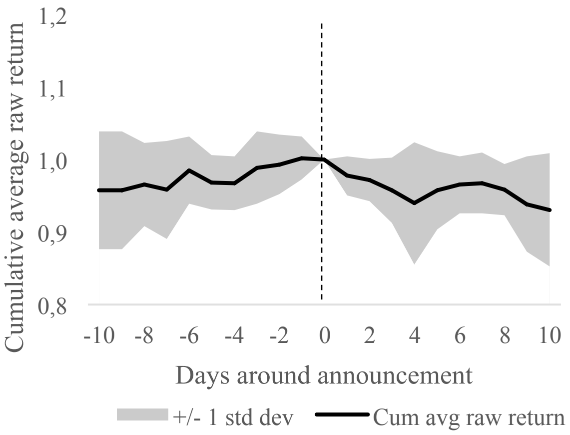
Figure 5: Average mean volume ratio



Note: Average mean volume ratio firms listed onto the OMX main list, 10 days prior to 10 days after effective date. MVR of 1 is equal to normalized trading.

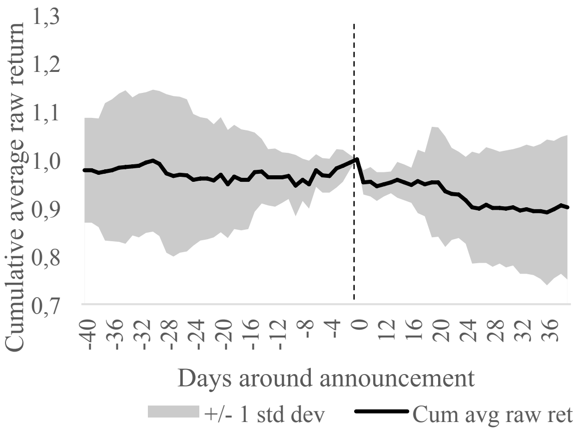
Similarly, Figure 6 and Figure 7 illustrate the delisting effect in Table 3. The announcement day is indexed to one. The negative effect is apparent, in the short-term Figure 6 shows that the stocks on average start to trade down immediately after announcement. In Figure 7, the average 8 trading days between announcement and effective date is removed, and it is clear that the share price has decreased significantly. The share price seem to settle at a lower level, but the full effect does not materialize until 25 trading days after delisting announcement, which differs from the listing effect, which realized almost in full between announcement and effective date on average in our sample.

Figure 6: 20 trading days cumulative average raw return delisted firms



Note: Cumulative average raw return, firms delisted from the OMX main list, 10 days prior to 10 days after the announcement, indexed to the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded.

Figure 7: 80 trading days cumulative average raw return delisted firms



Note: Cumulative average raw return, firms delisted from the OMX main list, 40 days prior to 40 days after the announcement, indexed to the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 8 trading days between announcement and effective date excluded.

The observations in the delisting sample are low; therefore longer-term analysis than the one presented in Figure 7 might be difficult to perform. The rest of the analysis on the announcement effect on the OMX main list will therefore center on the listing observations.

Table 3 indicates a large announcement effect at the event date. Therefore going forward we will dig deeper and include a selection of operation and valuation variables to evaluate any difference between performance of quality and non-quality companies. Table 4 presents regression results on this matter. Each operation and valuation variable is a dummy variable indicating if a company is in the lower 50th percentile of the total observations. Indeed, the results indicate that there is a quality effect at announcement. Regression 2 show that those companies that are listed and are in the lower median in terms of one year EBIT growth experience a 2.9 p.p. lower abnormal return on average than those companies in the upper median. This result is significant at the 1%-level. Similarly, regression 5 show that companies that are listed and are in the lower 50th percentile in terms of five year revenue CAGR experience a 2.2 p.p. lower abnormal return on average, compared to those in the high median. We cannot find any significant result for the valuation variables, indicating that the effect is mostly determined by the growth in operations of the company included. The results for the one year EBIT growth variable is robust controlling for the valuation variables as well, shown in regression 10, 11 and 14. The five year revenue CAGR variable loses significance controlling for the valuation variables, however it is still economically significant with a close to 2 p.p. lower abnormal return on average for the low median as compared to those in the high. We extended the analysis by combining different variables and over different time periods, but due to multicollinearity the results are difficult to interpret, which is why we keep the regressions as simple as possible in Table 4.

Table 4 is supported by Figure III and Figure IV found in the appendix. The figures plot average cumulative raw returns 40 trading days prior and post the announcement date of listing change, separated by high and low median one year EBIT growth and five year revenue CAGR companies. Figure III indicates that the short-term EBIT growth identified in Table 4 does not seem to persist in the longer run, as the high and low median companies seem to trade close to each other post event date on average in our sample. However, there seem to be a larger effect for long-term revenue growth. High median companies trade significantly higher than the low in the 40 trading days following the announcement, indicating that the market rewards high growth firms being listed on the OMX main list.

Arguably, this is well in line with the IH. Past high growth companies being listed onto the OMX main list get a quality confirmation, and the market revalue the firms accordingly.

To summarize, we find support for the IH. There are large and persistent increases during and after announcement, arguing for a listing decision being a qualitative signal, while the opposite is indicated for a delisting. This is further supported in the short term by separating quality companies based on past operating performance. Overall, this indicates that the market is efficient in responding to listing changes on the OMX main list. The results presented in this section are in line with those found by Jain (1987) and Dhillon and Johnson (1991) on the S&P 500.

Table 4 – Abnormal returns around announcement of listing onto the OMX main list
OLS regression results. Each column represents our event windows: 1 = Announcement day, 2 = 5-days pre announcement day, 3 = 10-days pre announcement day, 4 = 5-days post announcement day, 5 = 10-days post announcement day. All variables are dummy variables. Operational and valuation growth variables represent dummies if the companies are in the low median of the specific variable. 1Y represent one year historical growth, 5Y represent five year historical CAGR. Numbers in percentage points. Robust standard errors in parentheses. * = 10% significance, ** = 5% significance, and *** = 1% significance.

Event window	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
(Regression)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Listing	3.33***														
	(0.54)														
Operational growth variables															
EBIT_1Y_low		-2.88***								-2.73***	-2.77***			-2.63***	
		(0.80)								(0.89)	(0.98)			(0.99)	
EBIT_5Y_low			-0.82												
			(2.34)												
Rev_1Y_low				-0.27											
				(1.03)											
Rev_5Y_low					-2.15*							-1.90	-1.94		-1.70
					(1.16)							(1.26)	(1.18)		(1.27)
Valuation growth variables															
P/B_1Y_low						-1.27				-0.95		-0.96		-0.95	-0.94
						(1.09)				(1.08)		(1.16)		(1.04)	(1.16)
P/B_5Y_low							-0.02								
							(1.18)								
Div/sh_1Y_low								-1.97			-0.43		-1.43	-0.40	-1.38
								(1.41)			(1.41)		(1.32)	(1.42)	(1.31)
Div/sh_5Y_low									-0.89						
									(2.26)						
Constant	0.00*	3.92***	3.39***	3.41***	3.69***	3.73***	3.32***	3.48***	3.35***	4.19***	3.93***	3.95***	3.77***	4.20***	4.02***
	(0.00)	(0.65)	(0.56)	(0.72)	(0.62)	(0.69)	(0.61)	(0.94)	(0.56)	(0.76)	(0.66)	(0.71)	(0.64)	(0.76)	(0.73)
Observations	88	88	88	88	88	88	88	88	88	88	88	88	88	88	88
R-Squared	25.1%	5.2%	0.2%	1.0%	2.5%	1.4%	0.0%	1.1%	0.1%	6.0%	5.3%	3.3%	3.1%	6.0%	3.8%

5.1.2 Effective date listing and delisting

5.1.2.1 Descriptive statistics

Table 5 presents descriptive statistics for the OMX main list effective date event windows. Panel 1 describes effective day abnormal returns. As expected, the average and median return is closer to zero. The pre event windows will in some cases overlap with the announcement of listing, which might explain why there are indications of abnormal returns before the effective listing. The average and median abnormal return in the post event windows indicates a short-term reversal after the effective date. However, aggregating the full window, the abnormal returns at effective date is close to zero.

Panel 2 describes the same variables at effective delisting. Again, the abnormal return at event day is closer to zero than for the announcement date. The pre- and post windows indicate that share prices continue to decrease before and after the effective delisting. There seem to be outliers driving the average abnormal return much lower in the post event windows, while the medians are higher at -1.4% and -0.6% for the 5- and 10-days windows respectively.

Table 5 – Descriptive statistics of effective date abnormal return at listing and delisting from the OMX main list

Descriptive statistics of abnormal return around the effective date of listing or delisting. Data from 1997-2016.

Panel 1 – Effective date of listing onto the OMX main list					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	88	88	88	88	88
Max	13.7%	17.8%	30.6%	29.2%	37.2%
Average	0.4%	3.5%	3.5%	-2.3%	-3.3%
Median	0.1%	2.2%	2.6%	-1.5%	-2.4%
Min	-10.2%	-13.6%	-10.0%	-36.7%	-39.4%
Standard deviation	3.8%	6.2%	7.2%	9.0%	11.8%
Panel 2 – Effective date of delisting from the OMX main list					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	11	11	11	11	11
Max	2.3%	9.0%	12.3%	3.0%	9.5%
Average	-0.9%	-0.2%	-2.1%	-5.6%	-3.1%
Median	-0.1%	-0.9%	-0.2%	-1.4%	-0.6%
Min	-8.3%	-6.3%	-18.6%	-46.8%	-31.9%
Standard deviation	3.1%	4.4%	9.1%	14.0%	10.6%

5.1.2.2 OLS regression results and implications

The regression results for the effective listing and delisting analysis is presented in Table 6. The main takeaway is presented in regression 1 and 2, showing that there is no effect on share prices at the effective date, which is expected as the news of listing or delisting already is available to the market. Further, regression 3-6 with the 5- and 10-days pre effective date windows are positive for listing and negative for delisting, which is in part due to some of the announcement effect discussed in section 5.1.1 being present. Regression 7 and 9 indicate a correction of -2.3% and -3.3% for the 5- and 10-days post effective date window respectively for listed companies. However, aggregating the pre- and post effective date windows, the abnormal return is still positive for listings. Regression 8 and 10 show that delisted companies continue to trade down following the effective date. However, these results are not statistically significant. Overall, Table 6 show that for the OMX main list, there is foremost an announcement date story rather than one for the effective date. This is in line with the findings of for example Lynch and Mendenhall (1997) on the S&P 500. Therefore we will not further pursue analysis for this sub-section.

Table 6 – Abnormal return around effective listing onto and delisting from the OMX main list
OLS regression results. Event windows: 1 = Effective day, 2 = 5-days pre effective day, 3 = 10-days pre effective day, 4 = 5-days post effective day, 5 = 10-days post effective day. Numbers in percentage points. Listing and delisting dummy variables. Robust standard errors in parentheses. * = 10% significance, ** = 5% significance, and *** = 1% significance.

Event window Regression	1 (1)	1 (2)	2 (3)	2 (4)	3 (5)	3 (6)	4 (7)	4 (8)	5 (9)	5 (10)
Listing	0.36 (0.40)		3.51*** (0.65)		3.54*** (0.76)		-2.31** (0.96)		-3.30*** (1.25)	
Delisting		-0.86 (0.88)		-0.22 (1.27)		-2.09 (2.62)		-5.63 (4.01)		-3.10 (3.04)
Constant	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00*** (0.00)	0.00 (0.00)	0.00*** (0.00)	0.00 (0.00)	0.00** (0.00)	0.00 (0.00)	0.00** (0.00)
Observations	88	11	88	11	88	11	88	11	88	11
R-Squared	0.8%	0.6%	23.7%	0.0%	17.1%	0.7%	4.7%	3.5%	6.7%	0.7%

5.2 OMXS30 index results

5.2.1 Announcement effect inclusion and exclusion

5.2.1.1 Descriptive statistics

Table 7 presents descriptive statistics of the OMXS30 index analysis. The table is divided into two panels, each describing inclusion or exclusion abnormal returns at announcement.

Panel 1 describes announcement inclusion abnormal returns. Overall, the abnormal return on the event day seem to be positive as both the average and median abnormal returns are positive, 1.2% and 1.1% respectively over the 14 observations. There seem to be positive abnormal returns in the days prior to the event, both on average and median. This is indicating that there are some investors that predict that the inclusion will take place in the following days. The positive abnormal returns prior to and during the event day is partly reversed in the days after the event as average abnormal return for the 5- and 10-days windows are -2.2% and -1.8% respectively.

Panel 2 describes announcement exclusion abnormal returns. The data shows that not much is happening on average in the days prior to the event and the standard deviation for the 5-days period before the event is quite large. The event day seem to exhibit negative abnormal returns. Abnormal return during the 10-days window after the event is also negative on average at -3.1%, but there seem to be some outliers driving the results, as the median is higher at 1.6%.

Table 7 – Descriptive statistics of abnormal return at announcement of inclusion into and exclusion from the OMXS30 index
Descriptive statistics of abnormal return around announcement of inclusion or exclusion. Data from 2000-2017.

Panel 1 – Announcement of inclusion into the OMXS30 index					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	14	14	14	14	14
Max	5.7%	14.7%	24.5%	10.6%	18.6%
Average	1.2%	0.4%	1.7%	-2.2%	-1.8%
Median	1.1%	0.1%	0.2%	-0.2%	0.9%
Min	-2.8%	-8.3%	-11.8%	-19.1%	-19.6%
Standard deviation	2.4%	5.5%	10.1%	7.5%	10.0%
Panel 2 – Announcement of exclusion from the OMXS30 index					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	12	12	12	12	12
Max	0.2%	16.3%	16.8%	3.7%	4.9%
Average	-1.6%	-0.3%	0.6%	-2.1%	-3.1%
Median	-1.5%	0.8%	0.8%	-0.5%	1.6%
Min	-3.9%	-21.4%	-10.4%	-15.2%	-23.7%
Standard deviation	1.2%	8.5%	7.6%	5.1%	9.9%

5.2.1.2 OLS regression results and implications

Table 8 present the overall regression results of the OMXS30 index analysis around the announcement. The results are presented for our five different event windows for both inclusion and exclusion. Looking at inclusion to the index, there are positive abnormal returns during the event day of 1.23% on average in our sample, significant at the 10% level, shown in regression 1. The results from regression 3 and 5 indicate that there seem to be a positive reaction in the days leading up to the event, but the results are not significant, making it difficult to draw any firm conclusions. Following the announcement, share prices are falling down again, reversing the positive abnormal returns prior to and during the event day, shown in regression 7 and 9. As with the pre event windows, no significance is found after inclusion.

Excluded companies are experiencing negative abnormal returns on the event day of -1.62% on average in our sample, significant at the 1% level shown in regression 2. Abnormal returns in the pre-event window, shown in regression 4 and 6, are small and not significant, implying that not much is happening prior to the event. Regression 8 and 10 indicates that the sell-off during the event day continues after the event, with cumulative abnormal returns of -2.10% and -3.07% for the 5-days and 10-days event windows respectively. While the results are not statistically significant, they are large and economically significant, indicating that exclusion announcement from the OMXS30 index have a large effect on share prices.

Table 8 – Abnormal return around announcement of inclusion into and exclusion from the OMXS30 index

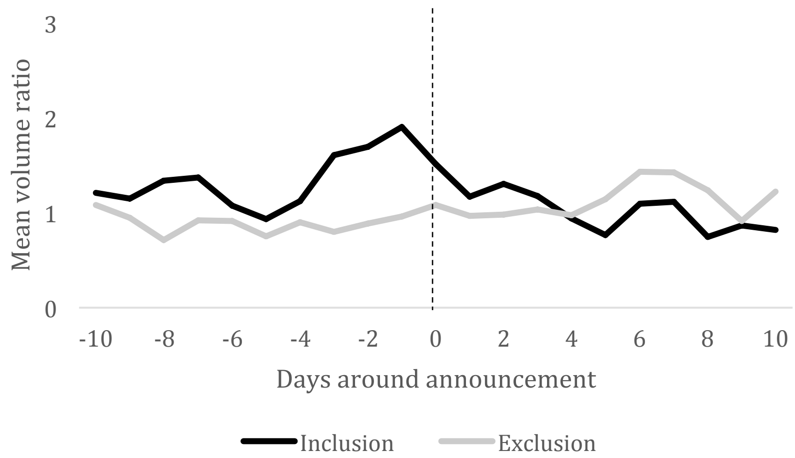
OLS regression results. Event windows: 1 = Announcement day, 2 = 5-days pre announcement day, 3 = 10-days pre announcement day, 4 = 5-days post announcement day, 5 = 10-days post announcement day. Numbers in percentage points. Inclusion and exclusion dummy variables. Robust standard errors in parentheses. * = 10% significance,
** = 5% significance, and *** = 1% significance.

Event window Regression	1 (1)	1 (2)	2 (3)	2 (4)	3 (5)	3 (6)	4 (7)	4 (8)	5 (9)	5 (10)
Inclusion	1.23* (0.63)		0.43 (1.40)		1.69 (2.59)		-2.15 (1.93)		-1.82 (2.57)	
Exclusion		-1.62*** (0.34)		-0.31 (2.34)		0.60 (2.11)		-2.10 (1.42)		-3.07 (2.74)
Constant	0.00*** (0.00)	0.00* (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	0.00 (0.00)	0.00 (0.00)	0.01 (0.01)	0.00 (0.01)
Observations	14	12	14	12	14	12	14	12	14	12
R-Squared	14.3%	21.5%	0.2%	0.1%	2.0%	0.2%	5.7%	4.7%	1.8%	4.4%

The conclusion from Table 8 is that there is a positive effect for included companies and a negative effect on excluded companies on the event day, both economically and statistically significant. Interestingly, we find that the coefficient is much smaller for OMXS30 inclusions as compared to those found e.g. Shleifer (1986) or Harris and Gurel (1986), which detailed above 3% on average. However, this is expected since constituent changes should be more predictable compared to the S&P 500, as argued in section 3.1.2.1. This is supported for inclusions in Figure 8, which details that there is large abnormal trading prior to the announcement of inclusion into the OMXS30. Furthermore, based on the sign of the coefficients for the pre and post inclusion windows, there seem to be a weak short-term reversal after announcement. This would be supportive of the PPH presented by Harris and

Gurel (1986). However, no significance is found and we cannot conclude whether this holds. For exclusions, the share price seem to abnormally continue to trade down after announcement, supported by what is indicated to be a sell-off in Figure 8. Overall, we do find abnormal returns around announcement of inclusion into or exclusion from the OMXS30. There seems to be a short-term reversal after this date. Further, for inclusions, there is a spike in abnormal trading the day prior to announcement, similar to the findings of Mase (2007), and therefore our results might indicate support for the PPH. However, we expect index funds to represent the largest short-term demand changes. We know that these are most inclined to trade closer to the effective date, and therefore this date should represent a better analysis of whether the PPH is supported in our sample or not. Therefore, we will not do further analysis in this section, but rather focus on the effective date in the next section.

Figure 8: Average mean volume ratio



Note: Average mean volume ratio for firms included into or excluded from the OMXS30 index, 10 days prior to 10 days after the announcement. MVR of 1 is equal to normalized trading.

5.2.2 Effective date inclusion and exclusion

5.2.2.1 Descriptive statistics

Table 9 presents descriptive statistics of the OMXS30 effective date analysis. The table is divided into two panels, each describing inclusion or exclusion abnormal returns at effective date.

Panel 1 describes effective day inclusion abnormal returns. Abnormal return is negative on average during the event day at -0.6% and quite different from the reaction on the inclusion announcement that detailed 1.2% on average. There seem to be a positive reaction on average in the days prior to the effective event at 1.9% and 2.8% for the 5- and 10-days windows respectively. The average number of trading days between announcement and effective date is 20, thus we do not expect that any pre event abnormal returns will be biased by the announcement effect. However, this reaction is reversed in the days after as average abnormal returns are -3.5% and -5.6% for the 5- and 10-days windows respectively.

Panel 2 describes effective date exclusion abnormal returns. There is a positive reaction on the event day of 2.5% on average, following large negative abnormal returns prior to the event. Standard deviation during the pre-event window is quite large, making it difficult to confirm any clear pattern. Returns continue to be negative in the post event window but the effects are not that large.

Table 9 – Descriptive statistics of abnormal return at effective date of inclusion into and exclusion from the OMXS30 index

Descriptive statistics of abnormal return around effective date of inclusion or exclusion. Data from 2000-2017.

Panel 1 – Effective date of inclusion into the OMXS30 index					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	14	14	14	14	14
Max	8.3%	14.7%	23.7%	5.1%	9.0%
Average	-0.6%	1.9%	2.8%	-3.5%	-5.6%
Median	-0.7%	2.3%	-0.2%	-3.8%	-3.5%
Min	-8.7%	-7.1%	-8.2%	-16.4%	-21.0%
Standard deviation	3.9%	5.9%	9.5%	6.3%	8.9%
Panel 2 – Effective date of exclusion from the OMXS30 index					
Event window	**Event day**	**5 days pre event**	**10 days pre event**	**5 days post event**	**10 days post event**
# observations	12	12	12	12	12
Max	13.7%	15.6%	8.3%	14.4%	10.8%
Average	2.5%	-4.5%	-6.7%	-1.1%	-0.3%
Median	1.5%	-3.8%	-3.4%	-0.7%	-2.1%
Min	-6.0%	-22.7%	-27.7%	-10.9%	-11.7%
Standard deviation	5.0%	10.3%	11.9%	7.8%	6.9%

5.2.2.2 OLS regression results and implications

Table 10 present the regression results of inclusion and exclusion from the OMXS30 index around the effective date. The results from regression 1 show that there seem to be no particular effect on the event day. Further, there seem to be abnormal returns leading up to the effective inclusion date on average, however these results are not statistically significant. In the days after the event date, included companies experience negative abnormal returns on average of -3.49% and -5.56% for the 5-days and 10-days event windows respectively, both significant on the 5% level. Economically, there seems to be clear indication of that the PPH presented by Harris and Gurel (1986) is supported for the effective date. The coefficients for the pre and post windows are large, however we cannot find any significance for the pre event windows. This is probably related to the low sample size.

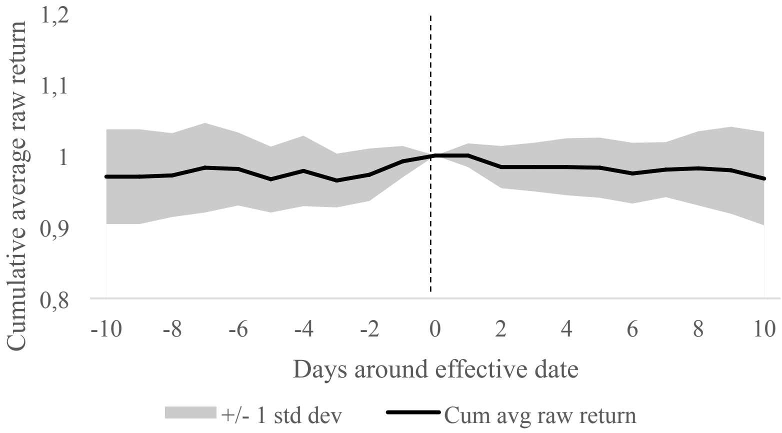
Overall, excluded firms are experiencing a sell-off pre effective date. Regression 6 shows 10-days pre event abnormal return of -6.71%, significant at the 5% level. Regression 1 is indicating positive abnormal return of 2.45% during the event day. This result is significant at the 10%-level and quite puzzling, but could potentially be a correction in the share price following the rapid sell-off both in the 5-days and 10-days event windows prior to the event day. Despite this result, the main take-away if looking at the whole period, from 10 days prior to and 10 days after the event, is that excluded companies are trading down on average in our sample.

Table 10 – Abnormal return around effective inclusion into and exclusion from the OMXS30 index
OLS regression results. Event windows: 1 = Effective day, 2 = 5-days pre effective day, 3 = 10-days pre effective day, 4 = 5-days post effective day, 5 = 10-days post effective day. Numbers in percentage points. Inclusion and exclusion dummy variables. Robust standard errors in parentheses. * = 10% significance, ** = 5% significance,
and *** = 1% significance.

Event window	1	1	2	2	3	3	4	4	5	5
Regression	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Inclusion	-0.56		1.93		2.79		-3.49**		-5.56**	
	(0.99)		(1.51)		(2.44)		(1.68)		(2.37)	
Exclusion		2.45*		-4.45		-6.71**		-1.13		-0.27
		(1.37)		(2.86)		(3.30)		(2.24)		(1.98)
Constant	0.00	0.00	0.00	0.00	0.00*	0.00	0.00	0.00	0.00	0.01**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Observations	14	12	14	12	14	12	14	12	14	12
R-Squared	0.8%	13.3%	2.7%	12.5%	3.2%	15.9%	12.6%	1.1%	22.0%	0.0%

The price reaction for companies included in the OMXS30 index is further illustrated in Figure 9, showing the short term effect on prices 10 days prior to and 10 day after the effective date, indexed to the effective date. The figure outlines the pattern shown in Table 10, indicating support for the PPH.

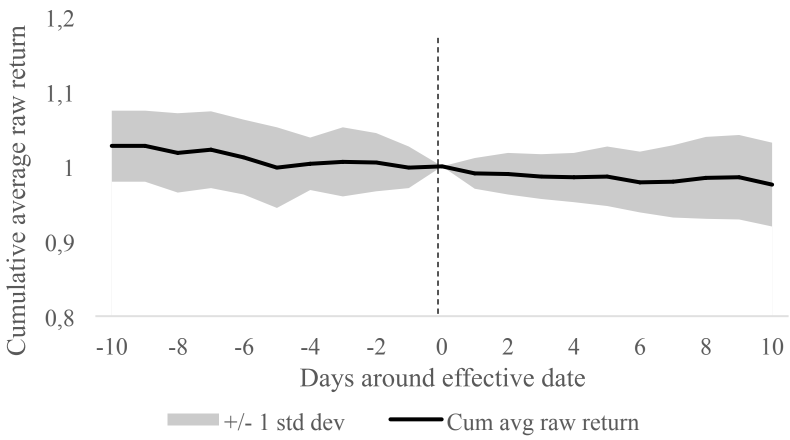
Figure 9: 20 days cumulative average raw return included firms



Note: Cumulative average raw return, firms included into the OMXS30, 10 days prior to 10 days after the effective date, indexed to the effective date. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded.

Figure 10 shows the short term effect on companies being excluded from OMXS30, indexed at the effective date. There seem to be a different story than for included companies. There is no short term price effect and reversion around the effective date, but rather a continuos decrease in returns during the 20-days period on average. Overall, the share price seem to decrease and settle at a lower level in the shorter term. We cannot conclude whether the effect observed for excluded companies is in line with reduced long-term demand (DS hypothesis) or because of a sign of low quality (IH).

Figure 10: 20 days cumulative average raw return excluded firms

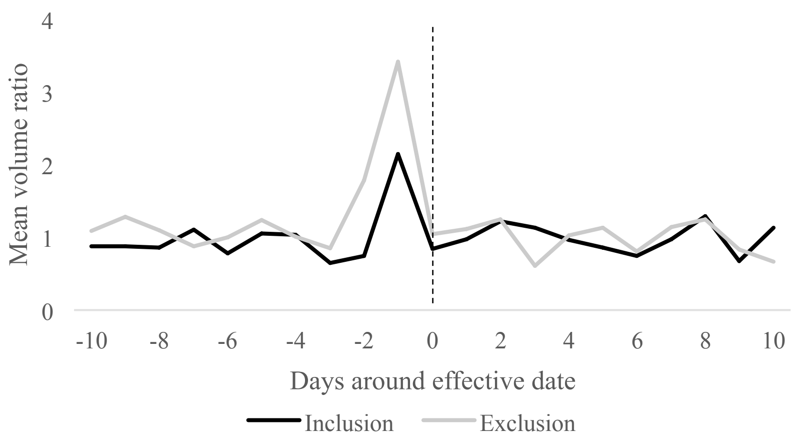


Note: Cumulative average raw return, firms excluded from the OMXS30, 10 days prior to 10 days after the effective date, indexed to the effective date. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded.

To further examine how the price movements above relates to trading volumes, the mean volume ratio for included and excluded companies around the effective date is calculated, shown in Figure 11. It is clear that there is abnormal trading activity one day prior to the effective date, which is in line with the discussions by Beneish and Whaley (1996), Lynch and Mendenhall (1997), and Petajisto (2011) on S&P 500. Index funds are constructed to mimimize tracking error, and fund managers are therefore inclined to trade shares as close to the effective date as possible, generating the spike in Figure 11. Together with Table 10 and Figure 9, it seems more clear that the PPH is in play for inclusions into the OMXS30.

There is a similar pattern in trading volumes for companies being excluded from the index. Similar to included companies, this pattern is also most likely due to index funds letting go of their holdings close to the effective date to aviod tracking error. It seems as the market is able to absorb the excess supply driven by the index funds as there is no corresponding effect in share prices in Figure 10 close to the effective date. This indicates that the short-term demand curve is very elastic for excluded companies. Note that normalized trading volume for excluded companies are about one tenth of the trading volume for included companies, i.e. the absolute trading volume is much lower for excluded than included companies. This might explain why there is no indication of price pressure for excluded firms. Further, as the excess supply is removed at effective date for excluded companies, the share prices seem to bounce back with an abnormal return of 2.45% on average as detailed for the event day window in Table 10.

Figure 11: Average mean volume ratio



Note: Average mean volume ratio for firms included into or excluded from the OMXS30 index, 10 days prior to 10 days after the effective date. MVR of 1 is equal to normalized trading.

To summarize, for included companies we can see a short term increase in abnormal returns around the effective date, supported by high trading volumes. This would support the hump shaped increase in share prices illustrated in Figure 9, which is in line with the PPH. Therefore, we find indication that short-term demand curves are less than fully elastic, violating the EMH. Our results are in line to the findings of Harris and Gurel (1986) on the S&P 500, Chung and Kryzanowski (1998) on the TSE 300, Chan and Howard (2002) on the AOI, and Mase (2007) on the FTSE 100. Excluded companies, on the other hand, experience a lasting price drop in the short term, indicating support for either the DS hypothesis or the IH.

5.2.2.3 A note on long term analysis

We extended the analysis by plotting average raw returns over a 200 trading days period centered on the effective date. The graphs could be found in the appendix. We decided to keep this discussion to a qualitative level since it is difficult to find any meaningful insights in the long term using only 14 observations for inclusion and 12 for exclusion. Figure V plots the 100 trading days prior and post effective inclusion, indexed to the effective date. The average 20 trading days between announcement and effective inclusion have been removed to more clearly illustrate the inclusion effect. The figure shows an increase in prices on average for included firms in the months prior to the announcement. One explaination could be that it is high quality companies that are being included in the index due to high performance prior to the announcement, similar to the selection bias presented by for example Chan and Howard (2002) on the AOI index. However, the selection criteria on that index is mostly based on market capitalization, while the OMXS30 inclusion criteria is purely based on trading volume. Therefore, the argument that included companies are drawn from the best performers is not as clear for the OMXS30. A second potential explanation could be that being included is a sign of high quality. The build up in prices from 45 trading days prior to the announcement could be that investors starts to predict the inclusion and revalue the stocks accordingly. After the effective date, prices remain at a higher level on average. This would support the IH, and indicate that the market is indeed efficient in revaluing firms included in the OMXS30. However, we cannot draw any firm conclusions regarding which of the potential explanations would be true as previously outlined.

The 100 trading days pre and post effective exclusion is presented in Figure VI. The figure shows a steep negative price effect between the announcement and effective date, which seems persistent in the following period. This would either support the DS hypothesis or the IH, as argued for the short term period before. If demand curves are downward sloping as outlined by Shleifer (1986), it could be the case that the excluded companies' demand curves are shifted inwards when index funds no longer holds their shares and therefore prices are settling at a lower level. However, it could also be that being excluded is a sign of low quality, indicating that prices would settle lower. Overall, we cannot specify whether the market is efficient or not in the longer term following exclusion. Figure VI seem to indicate that prices increase on average after day 70. It should be noted that this effect is driven by a few outliers and one should not draw too many conclusions based on that.

6. Conclusion

This study presents two main takeaways. First, in our sample of listings onto and delistings from the OMX main list we find support for the IH, similarly to Jain (1987) and Dhillon and Johnson (1991) on the S&P 500. We find strong presence of abnormal return at and shortly after announcement of list changes. For listing, we find a cross-sectional abnormal return of 3.3% on average at the announcement date, which is followed by a 10-day CAR of an additional 2.5% on average. We find no indication of these returns being reversed, similar to Shleifer (1986), Jain (1987), and Dhillon and Johnson (1991). Furthermore, we find no indication for presence of OMX main list tracking funds entering listed firms close to the effective listing date. Therefore, we cannot find support for the shift in the long-term demand curve for companies being listed on the OMX main list as found by Shleifer (1986) on S&P 500 constituent changes. Further, we find that companies with higher past five-year revenue and one-year EBIT growth get a larger announcement period effect. Overall, the results support the IH that the listing is a confirmatory signal of firm quality, and therefore also the results of Jain (1987) and Dhillon and Johnson (1991) investigating the S&P 500. Therefore, we find indication that the market is efficient in handling listing changes in the OMX main list.

Second, in the OMXS30 sample we find support for the PPH around effective date for inclusions, similar to the findings of Harris and Gurel (1986) on the S&P 500, Chung and Kryzanowski (1998) on the TSE 300, Chan and Howard (2002) on the AOI, and Mase (2007) on the FTSE 100. We find indication of positive abnormal returns leading up to the effective inclusion, and statistically significant negative abnormal returns of 5.6% in the 10-days following the effective inclusion. Further, the abnormal trading is very high one day prior to the effective date, indicating that index funds reposition at this day, giving rise to an excessive short-term demand spike. While the abnormal share price reversal indicates that the long-term demand curve is highly elastic, similar to what is predicted by the EMH, our findings violates market efficiency, as short-term demand curves are less than perfectly elastic in our sample.

7. References

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Bloomberg Professional (2017) [Online], subscription service

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Mase, 2007, The Impact of Changes in the FTSE 100 Index

8. Appendix

8.1 Summary of hypotheses in previous literature

8.1.1 The imperfect substitutes hypothesis (DS hypothesis)

The DS hypothesis assumes that stocks are not close substitutes of each other, and therefore that the long-term demand curve is less than fully elastic. This causes prices to move to a new equilibrium when the demand curve moves in or out following large share transactions, such as block trades or index funds' buying of newly included stocks. No reversal of the increases or decreases is expected. The DS hypothesis represent a violation of the EMH, which assumes near fully elastic demand curves, and that only new information on company fundamentals should affect valuations.

8.1.2 The price pressure hypothesis (PPH)

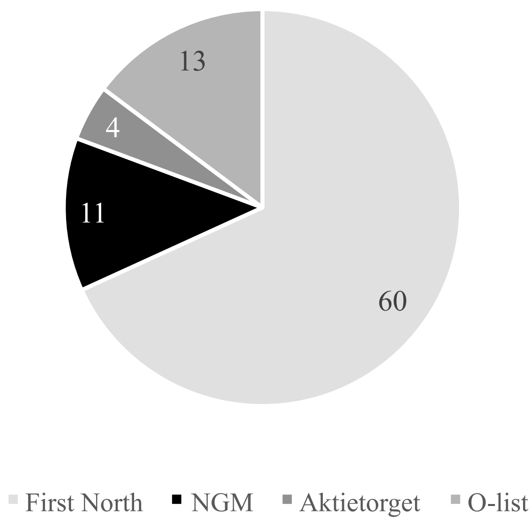
The PPH details that it is the short-term demand curve, rather than the long-term, of stocks that is not fully elastic. This implies price pressure effects of large short-term demand changes; the share prices increase but reverse shortly after when the excess demand disappears. The PPH also represent a violation of the EMH, which assumes that also short-term demand curves should be perfectly elastic.

8.1.3 The information hypothesis (IH)

The IH represents market efficiency. Only news and signals about company fundamentals will have an effect on share prices (semi-strong form of the EMH).

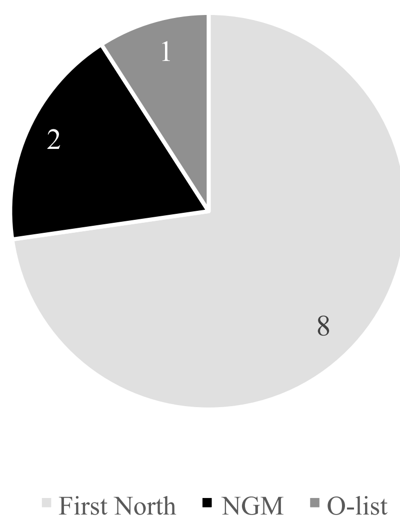
8.2 Distribution of sources and destinations of listings and delistings OMX main list

Figure I: Distribution of sources of listings onto OMX main list



Note: Distribution of previous stock exchange for companies being listed onto OMX main list. Data from 1997-2016.

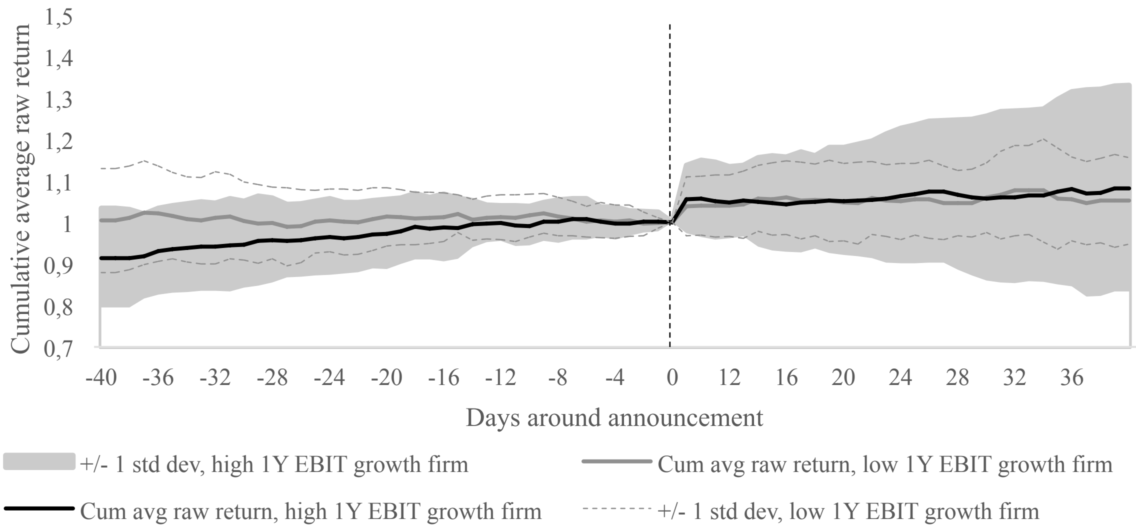
Figure II: Distribution of destinations of delistings from OMX main list



Note: Distribution of new stock exchange for companies being delisted from OMX main list. Data from 1997-2016.

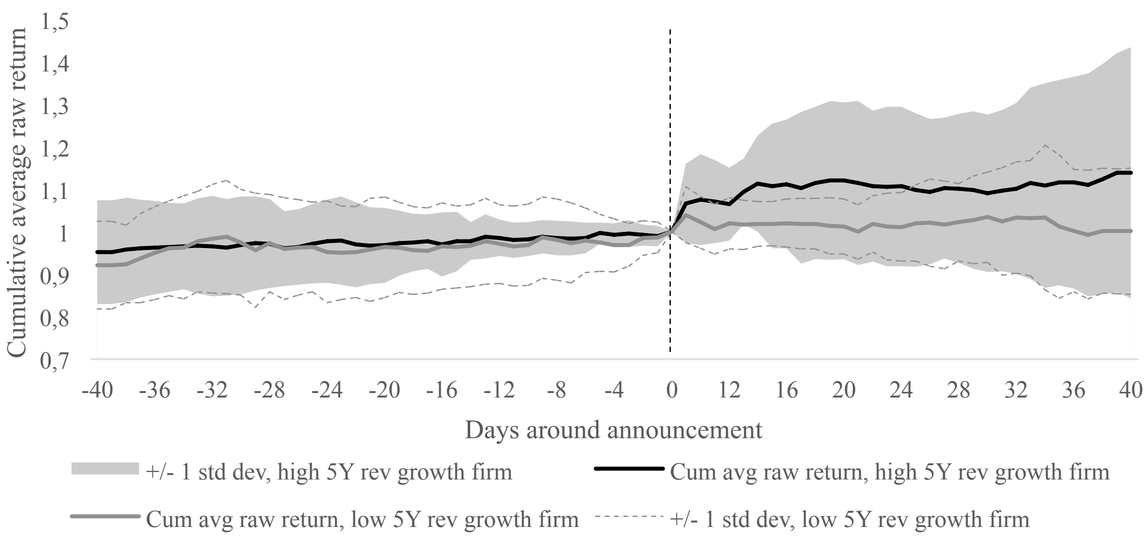
8.3 Cumulative average raw return by firm characteristics OMX main list

Figure III: 80 days cumulative average raw return listed firms, split by high and low 1Y EBIT growth



Note: Cumulative average raw return, firms listed on the OMX main list. Split by high and low 1Y EBIT growth, 40 days prior to 40 days after the announcement, indexed at the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 8 trading days between announcement and effective date excluded.

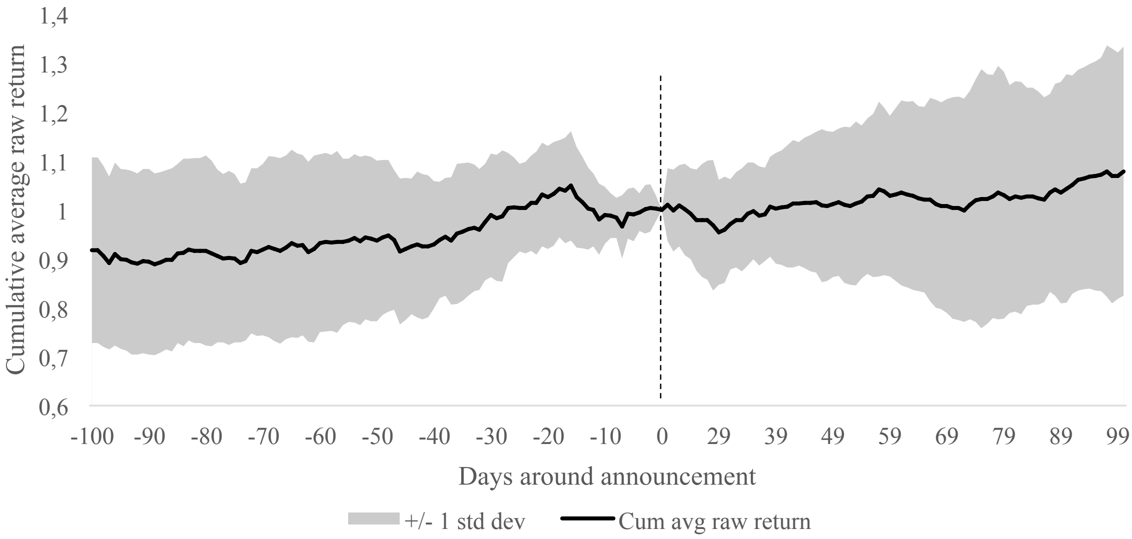
Figure IV: 80 days cumulative average raw return listed firms, split by high and low 5Y revenue growth



Note: Cumulative average raw return, firms listed on the OMX main list. Split by high and low 5Y revenue growth, 40 days prior to 40 days after the announcement, indexed at the announcement day. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 8 trading days between announcement and effective date excluded.

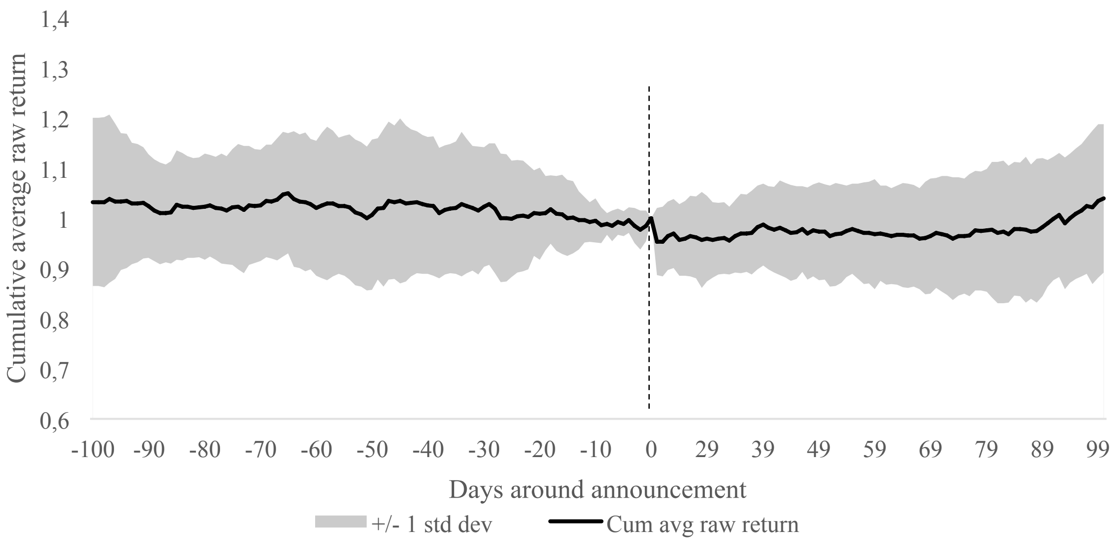
8.4 Long-term cumulative average raw return OMXS30

Figure V: 200 days cumulative average raw return included firms



Note: Cumulative average raw return, firms included into the OMXS30, 100 days prior to 100 days after the effective date, indexed at the effective date. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 20 trading days between announcement and effective date excluded.

Figure VI: Cumulative average raw return excluded firms



Note: Cumulative average raw return, firms excluded from the OMXS30, 100 days prior to 100 days after the effective date, indexed at the effective date. Firms in the high 20% percentile in daily standard deviation of raw returns are excluded. Average of 20 trading days between announcement and effective date excluded.