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The effect of index inclusion

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Abstract

Many empirical studies reveal that there is an index inclusion effect: a stock's inclusion to an index is associated with significant abnormal returns. The effect of the index reviews in the Dutch market has been studied to a limited extent, in particular the differences in index inclusion effect between the large cap, mid cap and small cap indices of the Netherlands have never been studied before. This thesis investigates the index inclusion effect in the Dutch stock market. I found that, for the AEX inclusions an upward price movement of 5.64% is observed during the 50 days before the inclusion. This is followed by a full price reversal: the return on the inclusion day was -0.99% and during the 50 days after the event a cumulative abnormal return of -7.13% was found. The results of the AMX inclusions are in particular interesting, because in contrary to the findings for the AEX inclusions, the observed price changes lead to permanently higher stock prices. When examining the pre-inclusion period of 50 trading days, a strong positive excess return of 9.54% is observed. No reversal is observed during the 50 days after the event. Significant price patterns for index exclusions and AScX reviews were not found. The results are consistent with the trading behaviour of index funds and the anticipation of investors, but can also be linked to other several hypotheses.

JEL Classification: G14

Key words: Event study, index review, AEX, AMX, AScX, cumulative abnormal returns, behavioural finance.

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Chapter 1: Introduction

On the 5th of March 2015, Euronext announced its annual review of the AEX, AMX and AScX, publishing the inclusions and exclusions of stocks for these indices. The following day, the stocks that were going to be included in the AEX showed a positive return during the opening hours of the stock exchange. Media explained this positive return by the fact that those stocks will be included in the AEX soon, but no new information regarding the companies' future prospects was released and thus the fundamental value of these companies did not change. This raises some important questions. Do stock prices show positive (negative) abnormal returns when included in (excluded from) an index? And if they do, what explains this price response?

In this paper, the effect of index inclusion and exclusion on stock return is examined in the Dutch stock market. The effect on the price of the stock that will be included in a (higher) index is studied around the review cut-off date, the announcement date and the inclusion date. A similar approach is applied to the exclusion of a stock from an index.

A large number of papers have investigated index inclusions and exclusions, mainly focusing on the S&P 500. The effect of the index reviews in the European market, and in particular the Dutch market, has been studied to a limited extent. The Dutch market is in particular interesting because it has three major stock indices: the AEX, AMX and AScX, which are respectively the large cap, mid cap and small cap stock indices of the Netherlands. This usually implies that inclusion of a company in one of these indices means that the firm is excluded from another index. A stock that gets 'promoted' to the AEX was thus, in most cases, already part of another index; the AMX. This makes it possible to study the index inclusion effect across the different capitalization indices. The differences in index inclusion effects between the large cap, mid cap and small cap indices of the Netherlands have never been studied before.

This research also tests the Efficient Market Hypothesis. According to Fama (1970), a market in which prices always fully reflect available information is called efficient. If there is indeed a positive price response after a stock is included to an index, this strongly suggests an inconsistency with the Efficient Market Hypothesis, since no new information regarding the companies' future prospects was released. If the Efficient Market Hypothesis of Fama (1970) does not hold, and thus asset prices do not fully reflect all available information, we can speak of an anomaly. A market anomaly is a price deviation of an asset that contradicts the Efficient Market Hypothesis in the semi-strong form. In this paper we speak of an index inclusion effect if prices respond around the review of an index, even if the price response is temporary.

The aim of this paper is to examine whether index inclusion and exclusion of stocks for the Dutch indices, the AEX, AMX and AScX yield abnormal returns. In order to answer this, (cumulative) abnormal returns of stocks around the index inclusion or exclusion will be computed. The results will be linked to conceptual points and hypothesis, which are described below, to find explanations for a potential index inclusion effect.

Research question: *What is the effect of index inclusion and exclusion on stock return in the Netherlands?*

The remainder of this thesis is organized as follows: The next chapter offers an overview of the empirical results of other authors and a literature review covering the conceptual points. Chapter 3 provides a description of the methodology and is followed by the 4th chapter in which the data is described. The results of this research can be found in chapter 5. Finally, chapter 6 provides the conclusion and some recommendations for further research.

Chapter 2: Literature Review and Hypotheses

2.1 Previous findings on the index inclusion effect

Research on the effects of index inclusion on stock prices dates back to the late 1980s. Over the past decades, empirical studies yielded several findings which are not all consistent. Nevertheless, we can find common ground in these studies, as authors mainly find that inclusion in a major market index is typically associated with both a positive price response and increased comovement between newly-added companies and the rest of the index. An overview of the major studies and key findings in this field is elaborated below.

Shleifer (1986) was one of the first who studied newly included stocks into the S&P 500 index. He found that these stocks earned a significant positive abnormal return of 2.8% at the inclusion announcement. This abnormal return did not disappear in the ten days after the inclusion. A positive price effect lasted for at least a month and no evidence was found for a price reversal during the 60 days after the announcement.

Jain (1987) also examined the stock price effects of S&P index inclusion and exclusion announcements. His findings strongly support a price effect in line with the S&P announcement. Stock prices showed a 3.1% excess return on the first trading day after the announcement when added to the S&P 500. Since no reversion of the excess returns was found in the 60 days after the announcement, the effect was not temporary. No significant abnormal returns were found during the 120 days before the event, which indicates that the inclusion or exclusion was not dependant on the firms prior performance.

Beneish and Whaley (1996) analyzed the index inclusion effect for the S&P 500 index in a period in which S&P began its preannouncing of the changes five days beforehand. They found that stock prices show an abnormal return response of 7.2%, starting at the announcement day and ending at the close on the effective day. The return response which they found was greater than under the old announcement policy. Only a small part of the return response reversed after the inclusion itself; a 2.2% reversal was found in the two weeks after the effective day.

Kasch and Sarkar (2011) demonstrate that an inclusion to the S&P 500 index has no permanent effect on the market capitalization and return comovement of the index-included firms. Comovement can be described as the tendency of two variables to move in parallel, in this case the correlation of the firms with the S&P 500 index. The authors show that the firms included in the S&P 500 index show increases in earnings, appreciation in market value, and positive price momentum in the period before their index inclusion. The strong pre-inclusion performance predicts both a permanent increase of market value and a change in return comovement. But in contrast to other findings in the literature, their results indicate that index inclusion has no permanent effect on value and comovement. A steady increase in the firms' market capitalization is observed in the period prior to

the index inclusion. This is followed by a stronger increase in the period following the inclusion, but a price reversal is observed in the subsequent period.

The difference in the outcome of this paper compared to other findings in the literature can be explained by the fact that Kasch and Sarkar (2011) controlled for pre-event performance of the index-included firms. These control stocks were traded on the same exchange, had a similar size and the same growth in performance and earnings per share as the event stock, but were not added to the S&P 500 index in the period in which the event stock was added to the index. Firms that were not included in the S&P experienced similar changes in value and comovement as the event firms.

Barberis et al. (2005) investigated the comovement of newly added stocks to its index. They found that after inclusion a stock's correlation coefficient (beta) with the S&P increases. In multivariate regressions, which control for the return of non-S&P stocks, the increase in S&P beta is even more pronounced. The authors found that the results are generally stronger in more recent data.

In Europe, similar research is done by Brealey (2000). He examined the price adjustments that occur when a stock is included or excluded from both the FTSE All-Share and the FTSE 100 indices, which are the biggest stock market indices traded on the London Stock Exchange. The result of the paper contradicts other findings in the literature. For both the FTSE All-Share and FTSE 100 indices, no significant price adjustment was found for stock inclusions. Stock exclusions, however, were associated with an eleven-day cumulative abnormal return of -4.5% for the FTSE All-Share index and -2.0% for the FTSE 100 index.

The first study of index inclusion in emerging markets was done by Hacibedel and Bommel (2006). In their paper, the effects of stock inclusions in the region of Central and Eastern Europe are examined. The authors did this by studying the returns of emerging market stocks that are included in the MSCI Emerging Markets Index. They find convincing evidence of positive (negative) price impacts upon index inclusions (exclusions). The abnormal return was 2-3% after index inclusion.

Bankovica and Pranevics (2007) did similar research in the Cental and Eastern Europe (CEE) region. Their results show that significant abnormal returns are present on the announcement day. An investment strategy based on these findings would earn on average 5.1% over the following 20 days. However, no significant abnormal returns were observed on the inclusion day. On both the announcement day and the inclusion day there is a significant increase in volatilities of the stocks. The results of Bankovica and Pranevics (2007) show that volatility increases a few days around both the announcement day and inclusion day and that it is possible to earn abnormal returns in the region of Central and Eastern Europe when a stock is included to an index.

Zitman (2006) studied the stock price and trading volume effects for AEX inclusions and exclusions. The results indicate that stock prices increase temporarily in case of an index inclusion, and decrease temporarily in case of an index exclusion. These price changes are observed around the announcement day. Zitman (2006) found a very strong pre-announcement price reaction of 6.55% over the 40 days prior to the inclusion announcement. The excess return is 8.63% for the 61 day interval, starting 40 days before the announcement and ending 20 days after the announcement. However, the positive stock price effects fully diminished after the 80th trading day following the announcement. Furthermore, evidence was found for a temporarily increased trading volume for both additions and removals, which are observed around the implementation day.

Doeswijk (2005) examined the annual review of the Dutch AEX index with a slightly different approach. He did not just focus on the inclusions and exclusions, but on all the stocks that are expected to benefit from the index review, for example those who benefit from an increase in weight. Besides this, instead of the announcement date, he used the revision date as the event date. Doeswijk focused on the period 1994-2001. In this period the new composition of the AEX was calculated 34 trading days before the review. He constructed portfolios with all the stocks that are expected to benefit from the annual review, starting at day -33 up to day 34. A change-weighted buy-and-hold portfolio containing all the stocks that are expected to benefit from the index revision showed an excess return of up to 7% in 33 days up to and including the inclusion day.

The goal of this paper is to extent to the findings in the literature by examining the Dutch market with a broader range of indices and by using a more recent dataset. In terms of price response there are three potential effects that could occur around the index inclusion or exclusion: a temporary stock price effect, either positive or negative; a permanent stock price effect, either positive or negative; or no significant stock price effect.

2.2 Price Pressure Hypothesis versus Downward Sloping Demand Curve Hypothesis

A large part of the financial literature concludes that there is an index inclusion effect. Although some literature describes an index effect of a temporary nature and others a permanent effect, almost all research which was focused on index inclusion found a change in the stock price around the announcement of the inclusion or exclusion. The first hypothesis which can describe the price effect is the Price Pressure Hypothesis (PPH), which is initially developed by Harris and Gurel (1986). It implies that long term demand curves for securities are perfectly elastic. According to the Price Pressure Hypothesis, price and volume changes are temporary. That means that this hypothesis predicts a full price reversal afterwards; stock prices go back to their normal levels during the days after the event.

The Price Pressure Hypothesis is consistent with the Efficient Market Hypothesis in that the buying or selling of a large number of shares does not influence the price. It differs in that it recognizes that immediate information about demand shifts that are not driven by information are costly, and thus that short-term demand curves can be less than perfectly elastic (Harris and Gurel, 1986). If a stock's index inclusion leads to an increase in the stock price which is reversed in the days after the announcement, this is in line with the Price Pressure Hypothesis.

However, a potential price increase itself is not sufficient evidence for a price pressure effect. To test directly for a price pressure effect, a control group is needed. Jain (1987) used a supplementary index, published by the S&P, which covered 40 stocks that are not included in the S&P 500. The inclusion of a stock in a supplementary index should have no impact on the share price, since fund managers do not include these stocks in their portfolios. Unfortunately, using such a control group is not possible in a research for AEX stocks, since Euronext does not publish those. Kasch and Sarkar (2011) controlled for pre-event performance of the index-included firms. Firms that were not included in the S&P that had the same pre-event performance as the event firms experienced similar changes in value and comovement as the event firms. Unfortunately for the Dutch market it would be impossible to use such a control group, since there are only around 100 stocks noted at the Euronext Amsterdam, of which 75 stocks are either in the AEX, AMX or AScX. Although within most other similar papers also no control group was used, it is important to note that the absence of such

a control group implies that a more cautious way of interpreting the results of this research is needed.

A substantial part of the financial literature assumes that investors can buy and sell stocks without significantly affecting the price permanently, consistent with the assumption of horizontal demand curves. When the demand curve for stocks is perfectly elastic, the inclusion of a stock into an index should thus not lead to a share price increase. Shleifer (1986) proposed the hypothesis of downward sloped demand curves, which assumes that demand curves for stocks are less than perfectly elastic. When investors do influence the price of the stock when they buy or sell, this provides evidence for the hypothesis that demand curves for stocks slope down. The return response represents an outward shift of the demand curve of the firm's stocks which is not caused by new positive information. When demand curves shift, equilibrium prices change which eliminates the excess demand. According to the Downward Sloped Demand Curve Hypothesis, the new price is a new equilibrium and thus price reversals are not expected. The positive price response on the announcement day which was found by Shleifer is consistent with the hypothesis that demand curves for stocks slope down. The Downward Sloping Demand Curve hypothesis was also described by Harris and Gurel (1986) as the Imperfect Substitutes Hypothesis or Distribution Effect Hypothesis.

The Downward Sloping Demand Curve Hypothesis differs from both the Price Pressure Hypothesis and the Efficient Market Hypothesis because it assumes that securities are imperfect substitutes and that the long term demand curves for securities are less than perfectly elastic. If a stock's index inclusion leads to a permanently higher stock price, it is consistent with the Downward Sloping Demand Curve Hypothesis of Shleifer (1986).

2.3 Block Trades

Like described above, a potential index inclusion effect can be either consistent with the price Pressure Hypothesis or with the Downward Sloping Demand Curve Hypothesis. These hypotheses can form an explanation of how the stock prices move, but they fail to explain why the stock prices move in the first place. Since there can be multiple reasons or hypotheses for a potential index effect, a closer look at these explanations is needed, which can be found below.

The first potential explanation could be the seller-initiated block trading by index funds. Block trades were described by Kraus and Stoll (1972) as transactions involving a larger number of shares that can readily be handed in the normal course of the auction market. In recent years, many investors have given up the quest for superior performance and simply chose to match the returns on some broad market index (Brealey, 2000). The demand for Exchange Traded Funds, which often follow an index, also increased since many institutional investors have found that ETFs are a convenient product for hedging against broad movements in the stock market. This leads to an increasing demand for index funds, which replicate indices.

The growth in demand of index funds is reflected in the growth of the exchange traded product's market, which are typically benchmarked to an index. According to Blackrock (2015), the total net assets of exchange traded products - securities that are derivatively priced, like ETF's - was 2959 billion dollars in December of 2015, while it was 428 billion dollars in 2005. When just focusing on the European market, an even bigger relative growth can be observed. The total net assets in the

European ETP market was 56 billion dollars in December 2005 and has been growing to 511 billion in 2015.

The providers of index funds have to adjust their portfolios after a new stock is included in an index, leading to an increasing demand for that stock. In case of a deletion, selling pressure from index funds can cause the stock price to decrease. The question is to what extent these large transactions of index funds have an effect on stock prices, if there is even an effect at all. When the potential block trades following an index inclusion lead to a temporary higher share price, this provides evidence for the Price Pressure Hypothesis. But when the block trades result in a new permanent equilibrium for the stock price, this would be in line with the Downward Sloping Demand Curve Hypothesis.

Index funds try to follow the return of a specific index as accurate as possible, therefore they will need to buy the included stock before the actual inclusion takes place. To find the exact moment on which index funds buy the included stocks and sell the excluded stock, Think ETF´s, a Dutch ETF provider was interviewed about their trading procedure in case of an annual review (2016). Martijn Rozemuller, founder and managing director, and Aaron Renkers, fund manager, confirmed that Think ETF´s ideally buys the included stocks at the market close of the day before the actual review takes place. Index fund providers need to make sure that that they have the included stocks before the inclusion day in order to prevent the risk of not completely following the index. Therefore index funds buy in the period before the inclusion date and at the latest at the market close of the last day before the index inclusion. Therefore one would expect an upward price pattern in the days before the inclusion, and vice versa for exclusions.

Shleifer (1986) explained his results by the block trades of index funds, since these funds mainly attempt to mimic the return on the S&P 500 index and thus need to buy the included stock. A similar explanation is provided by Barberis et al. (2005). However, Jain (1987) describes that the buying of index funds does not explain the excess returns, since his findings indicate that stocks included in supplementary indices showed similar returns as the stock's included in the S&P 500.

2.4 Information Signalling Hypothesis

Jain (1987) was one of the first who found evidence that the S&P index including decisions contain information content. He states that the inclusion or exclusion announcement may contain information that changed the perception of the investing public about the stock's investment appeal. Jain explains his observed positive price response by the buying of investors who might perceive a stock's inclusion as an indication of a lower risk. This is the basis for the Information Signalling Hypothesis, which is described by Zitman (2006). This hypothesis assumes that a stock's inclusion to an index is no information free event, and thus that it contains information. A similar hypotheses is described by Bankovica and Pranevics (2007), although their null hypothesis states that index inclusion is not an information free event. The Information Signalling Hypothesis states that the change to the index has informative value to investors about the stock being added to the index. If the hypothesis is rejected, the event does not contain information that is new to the market.

Chen et al. (2004) give multiple reasons for changes in expectations about the included stock, which are in line with the Information Signalling Hypothesis. Firstly, the Certification Hypothesis says, that inclusion in an index contains positive information about the particular firm, which is not known to

the general public beforehand. Since it is Standard and Poor's objective to minimize the index changes and select stable firms that represent the economy (S&P 500 Dow Jones Indices, 2016), their inclusion of a stock might suggest longevity and that the company is healthy. Given the specific nature of the AEX index revision process with publicly available index revision rules, the Certification Hypothesis can be ruled out.

Furthermore, increased investor awareness results in more positive expected future cash flows as well as better monitoring and more successful investment decisions. This is also described by Denis et al. (2014), who explained abnormal returns of included stocks by information that was previously unknown to the market. Companies that were newly added to the S&P 500 showed significant increases in earnings per share forecasts and improvements in realized earnings, which indicates that index inclusion is not an information-free event. Denis et al. (2014) explained this by a greater scrutiny of management after index inclusion. Since the costs in managerial reputation when a company is doing bad are higher for a manager of a firm which is included in the S&P 500, the manager has an extra incentive to deliver a higher effort, resulting in a higher stock price. In this case there is a reversed causality, since the inclusion itself generates information. The inclusion of a firm to an index increases its future expected performance, not because S&P is revealing new information about the company, but because index inclusion itself indirectly leads to an improved performance. This could possibly also explain an index inclusion effect in the Dutch market. When stocks permanently increase after being added to an index, which is also in line with the Downward Sloping Demand Curve Hypothesis, this is consistent with and can be explained by the Information Signalling Hypothesis.

2.5 Liquidity Hypothesis

The third type of hypotheses is the Liquidity Hypothesis, which is described by Woolridge and Ghosh, (1986). This hypothesis claims that a stock's inclusion in an index results in an increase of the public information available and a reduced information asymmetry, which leads to an increased trading volume. The improved liquidity results in a lower bid-ask spread. The reduced information asymmetry and the lower bid-ask spread lead to less uncertainty on the performance of a stock and thus a lower required return, which makes the stock price rise.

Merton (1987) adds that more visible stocks attract more investors because of an increasing media attention, which is commonly referred to as the Merton Attention Model. This model predicts that stocks that receive more attention should have higher valuations and thus a lower rate of return. When there are many alternatives, stocks that attract attention are more likely to be considered, hence more likely to be chosen, while stocks that do not attract attention are often ignored. Stocks that are part of a blue chip index often receive more media attention. Next to this, the inclusion itself is often also subject to media coverage. Index inclusions can lead to a positive price effect of a permanent nature because these stocks are new to a certain group of investors. Exclusions however, are stocks that are already known and thus are unaffected. According to Hirshleifer and Teoh (2003), due to limited investor attention, information that is presented in a salient, easily processed form is assumed to be absorbed more easily than information that is less salient. Inattention seems foolish, as inattentive investors lose money by ignoring aspects. However, since time and attention are costly, such behaviour may be reasonable.

Gilbert et al. (2011) showed the existence of investor inattention by examining the market impact of summary statistics. They showed that investors respond to the release of the Leading Economic Indicators, which is a monthly released summary statistic of previously released inputs. A front-running strategy that trades S&P500 futures in the direction of the announcement one day before its release and then trades in opposite direction of the announcement after the release, generates an average annual return of almost 8%. This indicates the inattention of investors, overreacting to the stale component of the information releases, failing to see that the LEI announcement is just a summary of old news. When a stock is included to an index, no new information regarding the companies' future prospects was released. The fundamental value of the included company does not change, but still there is a lot of evidence that the market does respond. Within behavioural finance, such a price reaction is described as overreaction. This market hypothesis states that investors and traders react disproportionately to new information. This results in a significant change in the price of the asset, so that the price of the asset will not fully reflect the true or fundamental value. This price reaction is not permanent, since the stock prices reaction reverses and returns back to its fundamental value. The Overreaction Hypothesis is not consistent with the Efficient Market Hypothesis.

Next to Merton (1987), there is a lot of literature that suggests that higher media attention for a stock leads to more buys. Engelberg and Parsons (2011) find that local media coverage strongly predicts local trading. Barber and Odean (2008) provide evidence for the fact that individual investors are net buyers of attention grabbing stocks. Fang, Peress and Zhang (2014) found that mutual funds tend to buy more of those stocks that receive heavy media coverage and that this is negatively related to their future performance. Overall, empirical findings suggest that both individual and professional investors are subject to limited attention, which leads to more buying of stocks that receive more media attention. When stocks permanently increase after being added to an index, this is consistent with the Liquidity Hypothesis.

Hacidebel and Bommel (2006) concluded that inclusion in the index is not an information free event, which explains the price response they found. In the first place because it rises investor' expectations about increased liquidity of the stock, making it less risky to invest in it. Secondly, stocks that are part of an index receive greater investor interest and increased monitoring, raising the stock price. These explanations are in line with both the Information Signalling Hypothesis and the Liquidity Hypothesis.

2.6 Anticipating Investors

Both Zitman (2006) and Doeswijk (2005) found a very strong positive pre announcement price response in the days before the announcement and the effective day, which can be called a pre inclusion effect. A possible explanation for this is the anticipating of asset managers and investors on the expected price response of the potential included stocks. Since a substantial part of the financial literature suggests a positive price response when a stock is included in to an index, it can be very rewarding for asset managers and investors to anticipate on this. A possible strategy is to predict the outcome of the index review and buying the stocks that have a high possibility to profit from the index inclusion. Such investment behaviour will lead to a positive abnormal price response in the pre-review cut-off period. However, it can also be the case that investors start anticipating in a later stage, for example around the announcement date, because they expect the price of the stock to rise

and want to profit from this. If the buying of anticipating investors lead to an increased stock price, one would expect a reversal after the event, since this anticipating is a short-term investment.

2.7 Selection Bias

In the case of anticipating investors, the reasoning is that the inclusion of a stock in an index leads to a positive price reaction, outperforming the market. However, since stocks with a higher market capitalization have a higher chance to get selected for the index, there might be a selection bias. Heckman (1979) describes the selection bias as a bias that results from using non randomly selected samples to estimate behavioural relations. A selection bias can occur when the individuals or data units, in this case stocks, select themselves. For example, when a firm of the AMX index has a very good year and thus an increasing stock price which outperforms the market, this results in a higher market capitalization. Since stocks are not randomly selected, but selected based upon market capitalization, the good performance of this stock leads to a higher chance to get selected for the AEX index. In case of a selection effect, a potential upward price movement prior to the review cut-off date is not irrational. In that case there is a reversed causality; it's not that the anticipating on the index inclusion leads to an increasing stock price, but the increased stock price leads to the index inclusion.

2.8 Limits to Arbitrage

The hypotheses and explanations above describe why stock prices could possibly move in the case of index inclusion. This potential price reaction could be overreaction, leading to mispricing. In most cases, arbitrage will correct for this mispricing. Arbitrage can be described as the simultaneous buying and selling of the same security for two different prices, and hereby correcting for its mispricing.

However, arbitrage does not always correct prices. Although it is usually stated that arbitrage requires no capital and entails no risk, Shleifer and Vishny (1997) state that it does require capital and that it is risky. This is consistent with the findings of Wurgler and Zhuravskaya (2002), who suggest that arbitrage strategies are far from riskless. Furthermore, they state that in theory, demand curves for stocks are kept flat by riskless arbitrage between perfect substitutes, but in reality, individual stocks do not have perfect substitutes.

Lamont and Thaler (2003) found violations of the law of one price, which states that the same asset cannot trade simultaneously at different prices. However, this does not always lead to exploitable arbitrage opportunities because of the limits to arbitrage. For example, transaction costs and short sale constraints can lead to mispricing. Next to this, there can also be cases in which arbitrageurs are unable/unwilling to arbitrage relative mispricing because of fundamental risk or noise trader risk.

Shleifer and Vishny (1997) describe noise trader risk. According to them, professional arbitrage is conducted by a small number of specialized investors using other people's capital. These, specialized, professional arbitrageurs may avoid extremely volatile arbitrage positions. Although such positions offer attractive average returns, the volatility also exposes arbitrageurs to risk of losses and the need to liquidate the portfolio under pressure from the investors in the fund. This implies that specialized performance-based arbitrage may not be fully effective in bringing security prices to fundamental values, especially in extreme circumstances.

The findings of this authors can be applied to the index inclusion effect. There are three possible limits of arbitrage that can prevent arbitrageurs to correct for the overreaction of investors and thus the mispricing in case of index inclusions of stocks. Firstly, there is fundamental risk. This means that arbitrageurs cannot fully take away the risk when correcting for mispricing, either because there is a risk that the asset hold loses value, or because finding a perfect hedge or substitute is impossible. Secondly, noise trader risk is also a possible limit to arbitrage. When the mispricing worsens due to investor sentiment, arbitrageurs are forced to liquidate their positions prematurely. Since arbitrageurs will prevent situations like these, it can be a rational explanation for them to not correct for mispricing. Thirdly, implementation costs, like transaction costs and short-sale constraints, make it less attractive to exploit mispricing.

Chapter 3: Methodology

3.1 Event Study

A standard event study methodology will be used for this research. According to MacKinlay (1997), an event study measures the impact of a specific event on a stock's return using historical return data. The impact of a particular event could be reflected in stock prices. Event studies are widely used for measuring return behaviour for a sample of firms experiencing a common type of event (Khotari and Warner, 2006). The Event study has many applications. In accounting and finance research, event studies have been applied to a variety of firm specific and economy wide events, including mergers, earnings announcements, announcements of macroeconomic variables, etc. (MacKinlay, 1997). However, event studies can also be used to measure the impact of index inclusions and exclusions.

Normal returns can be calculated in a number of ways. These approaches can be grouped into two categories: statistical and economic models. Models of the first category follow from statistical assumptions and do not depend on economic arguments. Examples of these models are the constant mean return model, the return model and the market model. Models of the second category are not based solely on statistical assumptions, but also on economic arguments like investor behaviour. Those models give the opportunity to calculate the normal returns more precisely using economic restrictions. Examples of economic models are the Capital Asset Pricing Model and the Fama and French Three Factor Model.

3.2 Market model

For this study the market model is used. The market model is a statistical model which can be used to compare the return of a stock to the 'normal' return: the return on the market portfolio. The market model is in this case the most preferred statistical model, since it has a higher power compared to the mean adjusted model in case of event clustering (Brown and Warner, 1985). Within this research there is also event clustering, because index inclusions and exclusions of multiple stocks are announced on the same day. Another advantage of the market model is that the return which is related to the variation in the market's return is removed. This leads to a reduced variance of the abnormal return, which leads to an increased ability to detect event effects.

The market model assumes a stable linear relation between the market return and the return on the specific stock (MacKinlay, 1997). A broad stock index is usually chosen as a market portfolio. In this

case the AEX index is used as the market portfolio. The market model also assumes normally and independently distributed returns and a linear relationship between the market return and the return of a particular stock.

The abnormal return is the actual ex post return of the security over the event window minus the normal return of the firm over the event window. The normal return is defined as the expected return without conditioning on the event taking place (MacKinlay, 1997). In this study the market model is used to model the normal return. This implies that abnormal returns are calculated by adjusting the actual return of a company for its normal return, which is based on the market model.

The return R_{it} of share i at time t can be modelled as follows:

$$R_{it} = \alpha_i + \beta_i \mathrm{R_{mt}} + \varepsilon$$

R_{it} is the normal return on share i during period t.
α_i is the stock specific return component.
β_i is the sensitivity to the market index.
$\mathrm{R_{mt}}$ the return of the market index.
ε is the error term, assumed to be normal through time with mean zero and constant variance.

In order to model the normal return of a stock, the error term from the model above will be omitted, leading to the following equation:

$$R_{nit} = \alpha_i + \beta_i \, R_{mt}$$

The normal return is thus the predicted return based on the correlation between the market index and the stock.

In order to get unbiased estimates of alpha and beta, autocorrelation and heteroskedasticity should not play a role. When there is autocorrelation, the error terms are not independently distributed, leading to a correlation between the observations at different times. Heteroskedasticity means that the variance of the error terms is not constant. It is really likely that there is both autocorrelation and heteroskedasticity within the used data. However, this will only effect the standard errors, the estimates of alpha and beta remain unbiased. Thus these estimates can be used to provide predictions of the normal return.

3.3 Estimation- and Event Window

In order to calculate the abnormal return, a normal return should be calculated first. Therefore, an estimation window is needed, which calculates the average return of a stock in a given period. The most common choice, when feasible, is using the period prior to the event window for the estimation window (MacKinlay, 1997).

This study uses an estimation window of -250 to -51. This means that the calculation of the average market return of a stock is based on the 250 days before to 51 days before the event. This is an estimation window of approximately one year when purely considering trading days. This should be sufficient to capture any effect of inclusion or exclusion on stock prices. The review cut-off day is first taken as the event day. After testing for abnormal returns around these dates, the same tests will also be performed for the announcement and actual inclusion and exclusion dates.

The period of interest is often expanded to multiple days, including at least the day of the event and the day after the event (MacKinlay, 1997). This period, called the event window, is the period in which the impact of the event might be incorporated into the stock prices. The event window in this study consists of 101 days; 50 days before the event (-50 to -1), the event day (0) and the 50 days after the event (1 to 50). The 50 days before the event are of interest because the market may acquire information about the inclusion or exclusion in an earlier stage. This information could be incorporated into stock prices in the days before the event day. The 50 days after the event capture the return response after the close of the market on the event day (MacKinlay, 1997). Zitman (2006) found a strong pre and post announcement price response during the 40 days before and after the announcement, which is a strong motivation to have a pre and post announcement interval of at least 40 days.

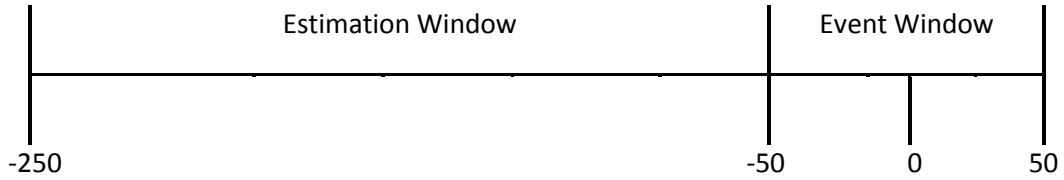

Figure 1: Event Study

When the normal return of a stock is calculated with the help of the estimation window, and the realized total return of a stock is calculated with the help of the event window, the abnormal return can be calculated. The market model takes the stock's return on the event dates and corrects for the normal return by subtracting the intercept and the slope times the index return.

The abnormal return AR_{it} for stock i at time t is calculated as follows:

$$AR_{it} = R_{tit} - \ R_{nit}$$

$\mathrm{R_{tit}}$ is the realized total return of stock i during period t.
R_{nit} is the normal return on share i during period t, calculated by the formula:

$$R_{nit} = \alpha_i + \beta_i \mathrm{R_{mt}}$$

If the market responds to an index inclusion or exclusion of a stock, abnormal returns will be observable. These abnormal returns should be significantly different from zero.

3.4 Datastream Event Study Tool

For this study the Datastream Event Study Tool is used. This tool makes it possible to do an event study with the help of data obtained from Datastream. This tool calculates the mean adjusted returns and the market model adjusted returns. These returns are corrected for the average return and the market return. For this study, the market model adjusted returns are used. This return is automatically calculated by the Datastream Event Study Tool.

3.5 One Sample T-Test

After obtaining the market model adjusted returns from Datastream and the Datastream Event Study Tool, Eviews is used for statistical calculations. With the 'simple hypothesis test', Eviews calculates whether the obtained excess returns significantly differ from zero. This one-sample t-test can be used to test whether a sample comes from a particular population with a known mean or that it comes from a different population. In this case we compare the mean of the (cumulative) abnormal returns with the known predicted mean, which is zero.

The t-test is a parametric test that needs a few assumptions to be met in order to properly test the hypotheses. First of all, the population should be normally distributed. Secondly, the observations should be independent and thus randomly selected from the population it represents. Thirdly, an interval or ratio scale of measurement should be used (Sheskin, 2011). A description of the t-test can be found in Appendix 1.

3.6 Wilcoxon One Sample Signed Rank Test

When examining the data for this research, one notices that the sample size is not very big. This increases the vulnerability to assumption violations. It is likely that the (cumulative) abnormal returns are not always normally distributed. Next to this, outliers are present, which have a big impact on the calculations of the t-test, because this test is based on the sample mean. A nonparametric test can in this case lead to more reliable results.

Nonparametric tests need less assumptions than parametric tests, like the t-test described above. A nonparametric test can also be applied when the sample is not normally distributed. Other advantages of nonparametric tests are that a very small sample is needed and that outliers have less impact. However, it should be taken into account that these tests in general have less power. The power of a statistical test is the probability that it will reject the null hypothesis when the alternative is true, measuring its ability to detect deviations from the null hypothesis (Moore et al., 2011).

To increase the statistical strength and robustness of this research, next to the t-test also a nonparametric test is used. A sign test is a nonparametric primitive test which can be used when the conditions for the one sample t-test are not met. A Wilcoxon signed rank test can give more reliable results since not just the signs but also the ranking of the data is taken into account. Working with ranks allows us to dispense the assumptions about the shape of the distribution, making normality not necessary (Moore et al., 2011), but symmetry is still assumed.

The Wilcoxon one sample signed rank test is the most commonly used nonparametric alternative to the one-sample t-test. The test is used more often within psychology, but not much within finance literature since there are often many data points. The test is based on the idea that the sum of the ranks for the samples above and below the median should be similar. Although the Wilcoxon signed rank test is mostly applied for two sample studies, the test can also be used to test hypotheses about a population median by applying it to a single sample (Moore et al., 2011).

The Wilcoxon signed rank test can be used to test whether a sample of n subjects comes from a population in which the median equals a specified value (Sheskin, 2011), in this case zero. The test is based on the following assumptions: a) the sample has been randomly selected from the population; b)the original scores obtained for each of the subjects are in the format of interval/ratio scale; C) the

underlying population distribution is symmetrical. A description of the Wilcoxon one sample signed rank test can be found in Appendix 2.

Chapter 4: Data

4.1 The Amsterdam Exchange Index

The main goal of this paper is to examine the effect of index inclusion and exclusion on the Dutch market. The Dutch stock exchange has three indices: the AEX, the AMX and the AScX, where the AEX is the largest capitalization index and the AScX the smallest. This has the implication that, for example, a stock that gets excluded from the AEX will normally be included in the AMX, although there are exceptions. This has to be taken into account within this research.

The AEX index, or Amsterdam Exchange index, is a Dutch stock market index of companies that trade on the Euronext Amsterdam. The index is founded in 1983, and represents the 25 highest capitalization-weighted listed stocks in Amsterdam. There is a full annual review since the foundation in 1983. But since 2011, the composition of the AEX is also quarterly reviewed. Further changes in the index, due to takeovers, mergers and other corporate events, can also take place during the rest of the year.

The AMX index, or Amsterdam Midkap index, is a Dutch mid cap stock market index of companies that trade on Euronext Amsterdam. This index is founded in 1995 and is composed of the 26^{th} to 50^{th} size ranked stocks. The AScX, or Amsterdam Small Cap index, is a Dutch small cap stock market index of companies that trade on Euronext Amsterdam. This index is founded in 2005 and is composed of the 51th to 75^{th} size ranked stocks.

In the first place, this paper aims to examine the return reactions of stocks that are included to the AEX and the stocks that are excluded from the AEX. Furthermore, the return reaction of stocks that are included to the AMX are examined. However, in that case we only look at the stocks that come from the AScX, so the stocks that are 'promoted'. Next to this, the return reaction of stocks that are excluded from the AMX can also be examined. In that case we only look at stocks that are degraded to the AScX, so not the stocks that are promoted to the AEX. When examining the AScX, the return reaction of the included stocks will be examined, but only those who are promoted to this index. Finally, the return reaction of the excluded stocks of the AScX will be studied.

4.2 Selection Procedure

The aim of the index reviews of Euronext is to ensure that the selection and weighting reflects the underlying market. The Dutch indices are made up of shares issued by the highest ranking companies in terms of free float market capitalization. In order to be able to get selected for the AEX, the shares of a company must have a trading velocity of at least 10%. This means that their trading volume should represent at least 10% of the total number of shares issued, calculated over the course of the previous calendar year. Furthermore, a firm must have a free float percentage of 25%. This means that at least 25% of the stocks listed by the company should be freely available for trading. The free float is rounded up to the next multiple of 5%. The maximum weight of a company in the index is 15%.

In general, the 25 highest ranked companies are included in the AEX, the following 25 are included in the AMX and the remainder is included in the AScX. When there is a review, the 23 highest ranking companies are instantly selected for the AEX. There is a small buffer zone in the ranking for the places 24 until 27; currently included companies are preferred over companies that are not part of the index at that moment.

Euronext changed the procedure for the indices a few times since the start of the AEX in 1983. From 1994 onwards, the weight of a stock is based on market capitalization, which is determined based on the stock price, the number of stocks issued by the company, and the free float rate. The rules of the procedure are publicly available, and so is the data which is needed to calculate the market capitalization. This makes the outcome of the review predictable. The number of stocks and the free float rate of a firm do not deviate that much. However, stock prices change every day, which means that the market capitalization also changes. An investor is able to predict which stocks would get selected for the AEX at the annual review, however, the larger the period between the prediction and the announcement, the higher the uncertainty. The closer you get to the announcement date, the stronger becomes the prediction.

4.3 Event Dates

This paper distinguishes between three particular event dates; the review cut-off date, the announcement date and the review effective date. The review cut-off date is the date on which the new composition of the index is calculated. Currently, the review cut-off date is after the market close of the last Friday of February. Since the market can predict the outcome of the review, which is announced later, you might expect a price reaction around the review cut-off date. The announcement date is in the first week of March and the review effective date is after the market close of the third Friday of March. Since it's the objective of an index fund to follow the return of a specific index as accurate as possible, index funds ideally buy the included stocks and sell the excluded stocks at closing of the trading day before the actual review takes place (Think ETF's, 2016). This would be a potential explanation for a possible price reaction during the days before the review effective day.

Like stated above, Euronext changed the procedure of the review quite some times, including some changes in the timing of the review cut-off, announcement and the actual review. The review cut-off dates do not seem to get much media attention, but they are published in the index rulebook of Euronext, which is publicly available. From 1994 until 2001, the review cut-off date was 34 trading days before the effective date. From 2001 until 2010, it was on the 31st of December and from 2011 until 2015 it was on the last trading day of January.

Stock inclusions and exclusions data is provided by Euronext and Zitman (2006). Announcement data is obtained from both the online databases of Euronext and newspapers such as Trouw and Het Financieel Dagblad, and the paper of Zitman (2006). Review cut-off data is constructed based on the Euronext index rulebook and is confirmed by Euronext. Furthermore, return data is obtained using Datastream at the Erasmus University Rotterdam. When examining the lists of announcement days and effective days of inclusions and exclusions, one could notice that there is a difference between the data provided by the above mentioned sources and the data in the list. This is due to the fact that review cut-off's, announcements and the index additions and deletions itself take place after the

market close. This implicates that the market can only respond the day after. Therefore, the day after the review cut-off, announcement or actual inclusion or exclusion is taken as the event day (day 0).

There are a lot of inclusions and exclusions associated with mergers, takeovers, spin-offs and bankruptcy or other corporate events. These were eliminated from the sample, because events like these are often associated with abnormal return responses, which might disturb the results of this research. In most of these cases it was not even possible to include those within the sample, because no data can be obtained for the whole estimation or event window. Finally, a few companies were excluded from the sample because their identifier codes, like ISIN or SEDOL, were not working in the Datastream Event Study Tool.

When examining index inclusions and effects inclusions for the Dutch stock market, there is naturally some overlap between the included stocks for one index and the excluded stocks from another index. Important to note is that within this research, index inclusion is seen as a promotion to a higher index and exclusion is seen as a degradation to a lower index. This implies that promoted stocks that are excluded from an index because they will be included in a higher index do not count as exclusions. Vice versa, stocks which are excluded from an index and therefore have to be included in a lower index do not count as inclusions.

This leads to a final sample of 40 AEX inclusions and 30 AEX exclusions, which all either come from or go to the AMX during the index review. For the AMX, a sample of 65 inclusions and 40 exclusions is used. The sample of AMX inclusions consists only of observations of stocks which were 'promoted' from the AScX to the AMX. The AMX exclusions are only the ones which are degraded from the AMX to the AScX. For the AScX a sample of 52 inclusions and 26 exclusions is used. Obviously, AMX exclusions are no part of the AScX inclusions sample and AScX exclusions are no longer part of any index.

When examining the data, one could notice that the amount of observations for the AEX inclusions and exclusions is not always equal for both the review cut-off day, announcement day and inclusion day. Firstly, for the review cut-off dates data from 1994 onwards is used, since this is the year in which the review procedure is based on free float market capitalization. Therefore, firms that were included to the AEX between 1983 and 1994 were not used for the calculations around the review cut-off date. Secondly, since the review cut-off dates and announcement dates are a few weeks earlier than the inclusion/exclusion date, it was sometimes the case that a firm was listed long enough in order to be able to get all the return data during the estimation window for the inclusion/exclusion date, but that the firm was not listed long enough to get data for the estimation window around the review cut-off date or announcement date.

Chapter 5: Results

5.1 AEX Inclusions

Figure 2 shows both the daily and cumulative market adjusted abnormal return responses for AEX index inclusions around the review cut-off day (RCD), the announcement day (AD) and the inclusion day (ID). The day after the actual review cut-off, announcement or actual inclusion or exclusion, is taken as the event day, which is day 0, since all the available information is available for the market after the market close, and thus investors can at the earliest respond at the following day. With a

daily abnormal return of almost zero and a very high p-value, the results do not show any market response on this day. More interesting is the upward price movement of 1.49% in the 5 days before the review cut-off date, which significantly differs from zero according to both the the t-test and the Wilcoxon signed rank test. When examining the cumulative abnormal returns around the announcement day, the most interesting is the pre announcement intervals of five days. The results show an upward price movement of 1.11% during the five days before the announcement day.

The strongest statistical returns for the AEX index inclusions can be found when examining the period around the actual inclusion day. The market adjusted return on the effective day was -0.99%, which is significant at all levels according to the t-test. When examining a pre announcement period of 50 trading days, a strong positive excess return of 5.64% is observed. This is significant at the 5% significance level. The post inclusion period shows a strong return response, but in opposite direction. During the 50 days after the effective day, a cumulative abnormal return of –7.13% was found, which is also significant at the 5% significance level.

Abnormal returns for AEX inclusions							
		T-test			**Wilcoxon Signed Rank Test**		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	32	2.59	0.82		2.14	0.93	
(-10,-1)	32	-0.09	-0.14		-0.65	0.35	
(-5,-1)	32	1.49	2.87	***	1.13	2.52	**
RCD	32	0.03	0.09		0.03	0.31	
(+1,+5)	32	-1.42	-0.95		-1.02	0.98	
(+1,+10)	32	-1.33	-0.63		-0.34	0.57	
(+1,+50)	32	1.78	0.56		2.58	0.78	
(-50,-1)	39	1.09	0.38		0.35	0.06	
(-10,-1)	39	1.26	1.59		0.09	1.39	
(-5,-1)	39	1.11	2.11	**	1.11	1.95	*
AD	39	0.61	1.16		0.68	1.95	*
(+1,+5)	39	-0.03	-0.05		0.21	0.01	
(+1,+10)	39	0.51	0.58		0.71	0.54	
(+1,+50)	39	-1.74	-0.65		0.40	0.33	
(-50,-1)	40	5.64	2.33	**	4.43	2.35	**
(-10,-1)	40	1.30	1.18		1.26	1.42	
(-5,-1)	40	0.39	0.53		-0.05	0.28	
ID	40	-0.99	-2.91	***	-0.66	2.36	**
(+1,+5)	40	-0.34	-0.69		-0.36	0.92	
(+1,+10)	40	-1.05	-1.03		-0.58	0.54	
(+1,+50)	40	-7.13	-2.20	**	-7.13	2.20	**

Figure 2 presents (cumulative) abnormal returns for AEX inclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

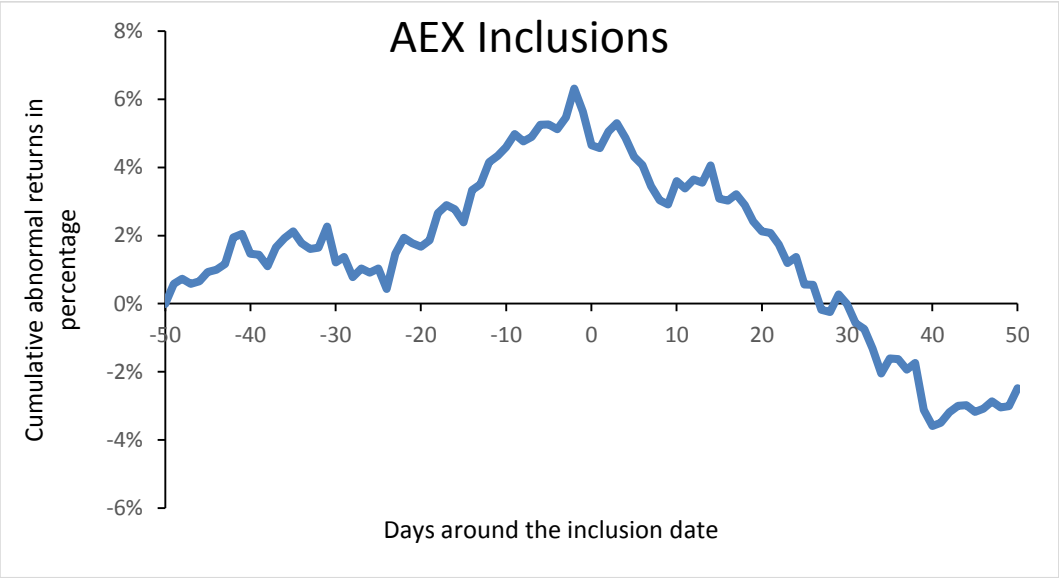

Figure 3: Cumulative market adjusted abnormal return responses in percentages for AEX index inclusions during the 100 days around the inclusion day.

In general, the results clearly indicate that the market responds to the inclusion of stocks to the AEX. Figure 3 shows the total return response in the 50 days before until the 50 days after the inclusion. Please note that the difference in days between the review cut/off date, announcement and the inclusion itself are not the same for the whole sample, since Euronext changed the review procedure a few times. An upward price movement of 5.64% is observed in the 50 days before the inclusion. A full price reversal is observed in the 50 days after the inclusion. These findings are similar to the results found by Zitman (2006), who found a 6.55% upward price movement during the 40 days before the announcement, followed by a reverse which more than fully diminished the effect.

These results are consistent with the Price Pressure Hypothesis, which states that price changes are temporary. However, a small side note should be made here about the fact that a price effect should occur simultaneously with a volume effect (Zitman, 2006), which was not tested for in this research. Zitman (2006) found that volume effects were not pronounced around the announcement day and concluded that the results from additions were not completely in accordance with the price pressure hypothesis.

Secondly, the Information Signalling Hypothesis is rejected. Like described earlier, no new information is released about the included stocks. The reversal of the price effect provides additional evidence for a rejection of this hypothesis. This reversal leads also to a rejection of the Liquidity Hypothesis.

The Selection Effect Hypothesis is not rejected. An upward price movement prior to the review cut-off date is observed, which might be caused by the effect that well-performing firms are more likely to be included to the AEX than bad performing firms. However, the positive stock price effect of 1.49% is only significant over the five days before the review cut-off date and it is unlikely that the selection effect is the only explanation. A more likely explanation is the anticipation of investors on

the upcoming index inclusion, which can be predicted with a pretty high certainty when there is such a low amount of days until the review cut-off date. The strong positive return response during the 50 days before the inclusion can also be explained by the buying pressure of investors, anticipating on the upcoming index inclusion. Finally, the upward price movement can also be explained by the block trades of index funds, who need to buy the included stocks in the period before the inclusion.

After the strong pre-inclusion performance the reversal starts. The negative post-inclusion return suggests that the price pressure decreases, making stock prices decrease back to their normal values, or even slightly lower. A potential explanation for this is that on the one hand index funds already have the stock and have stopped buying, on the other hand investors stop buying or even start selling because they either close their positions that were based on anticipating on the inclusion or because the included stocks trade above their fundamental value (Think ETF's, 2016).

5.2 AEX Exclusions

Figure 4 shows the results for the AEX exclusions. In contrast to the price responses for the AEX inclusions, no significant price reactions can be observed around all the event dates for the exclusions. This implies that investors do not seem to react to changes in the AEX concerning exclusions. The asymmetrical impact of index reviews, whereby winners profit but losers show no reaction, is consistent with the findings of Doeswijk (2005). However, the results differ from those found by Zitman (2006). During the 40 days before the announcement he found a price response of -7.59%, which was significant at the 10% level. This negative price reaction became even more pronounced during the 100 days after the announcement. Stock prices decreased more than 17% during the 140 days around the announcement, indicating that the price effect was permanent.

When examining the dataset, the difference in results can be explained by the observations that were added in the sample of this research. Zitman (2006) used data until 2006, while in this paper data until 2015 is used, leading to 12 extra observations. When quickly examining the returns of these extra observations, a positive price response can be found in the period 2007-2015 during the 50 days before the announcement of the exclusion. This leads to the fact that the obtained returns for the AEX exclusions insignificantly differ from zero. Besides that, in general the dataset for exclusions is small, which makes finding significant results more difficult.

Since no significant findings were found for the AEX exclusions, the results are inconsistent with all hypotheses. Firstly, in this case there is no support for the Block Trading Hypothesis, since according to this hypothesis one would expect a negative price response in the days before the exclusion day. Secondly, the absence of a negative price reaction are in line with a rejection of both the Information Signalling Hypothesis and Liquidity Hypothesis.

A possible explanation for the absence of significant abnormal returns is that investors are less able to trade in line with the index exclusions, since this requires short positions. Institutional investors like mutual funds are not allowed to go short, but also for individual investors there are several short sale constraints, making it harder or even impossible to anticipate on the index inclusion.

Abnormal returns for AEX exclusions							
		T-test			Wilcoxon Signed Rank Test		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	28	-7.05	-0.89		-2.11	0.22	
(-10,-1)	28	0.51	0.33		-0.57	0.01	
(-5,-1)	28	0.45	0.48		0.43	0.49	
RCD	28	0.37	0.70		-0.36	0.10	
(+1,+5)	28	-0.05	-0.05		-0.01	0.35	
(+1,+10)	28	-1.31	-0.77		0.28	0.35	
(+1,+50)	28	-1.07	-0.18		2.98	0.95	
(-50,-1)	30	-4.64	-0.65		-2.31	0.08	
(-10,-1)	30	-0.07	-0.05		0.84	0.00	
(-5,-1)	30	-0.66	-0.43		-0.98	0.95	
AD	30	-0.35	-0.77		-0.21	1.13	
(+1,+5)	30	1.07	1.04		0.22	0.70	
(+1,+10)	30	0.90	0.73		1.92	0.68	
(+1,+50)	30	-1.23	-0.24		3.30	0.70	
(-50,-1)	30	1.74	0.36		4.92	1.38	
(-10,-1)	30	-0.87	-0.56		0.98	0.33	
(-5,-1)	30	-1.34	-1.13		-0.43	1.17	
ED	30	0.42	0.70		0.28	1.07	
(+1,+5)	30	-0.35	-0.33		0.13	0.12	
(+1,+10)	30	-0.96	-0.48		0.64	0.25	
(+1,+50)	30	-5.63	-0.83		0.73	0.29	

Figure 4 presents (cumulative) abnormal returns for AEX exclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

5.3 AMX Inclusions

Figure 5 shows the daily and cumulative market adjusted abnormal return responses for AMX index inclusions around the review cut-off day, announcement day and inclusion day. The observed patterns are similar to the ones observed for the AEX inclusions. In the 5 days before the review cut-off date, a small positive price response is observed. A positive price reaction can also be found on the announcement day; the stock prices of included stocks go up with approximately 1 percent, although no new information is released on this day. Most interesting is the price pattern during the 100 days around the inclusion day. When examining the pre-inclusion period of 50 trading days, a strong positive excess return of 9.54% is observed, which is significant at all significance levels according to both tests. But in contrary to the AEX inclusions, no reversal is observed during the 50 days after the event. Unfortunately, no comparison with results of other authors can be made here, since this is the first time that the AMX and AScX are examined. Figure 6 shows the total return response in the 50 days before until the 50 days after the inclusion.

Abnormal returns for AMX inclusions							
		T-test			Wilcoxon Signed Rank Test		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	65	-0.35	-0.15		-1.39	0.67	
(-10,-1)	65	0.89	1.26		1.29	1.75	*
(-5,-1)	65	0.08	1.74	*	0.91	1.82	*
RCD	65	0.42	1.52		0.37	1.41	
(+1,+5)	65	0.50	0.58		1.01	0.88	
(+1,+10)	65	1.78	1.47		0.91	1.41	
(+1,+50)	65	4.39	1.63		1.91	1.81	*
(-50,-1)	65	8.23	3.25	***	4.67	3.03	***
(-10,-1)	65	4.34	4.18	***	2.71	3.98	***
(-5,-1)	65	1.01	1.80	*	0.57	1.47	
AD	65	1.07	3.42	***	0.62	2.81	***
(+1,+5)	65	-0.16	-0.19		0.14	0.23	
(+1,+10)	65	-1.21	-0.91		-0.21	0.08	
(+1,+50)	65	4.29	1.65		3.38	1.55	
(-50,-1)	65	9.54	4.37	***	7.89	4.59	***
(-10,-1)	65	2.30	2.32	**	1.47	2.37	**
(-5,-1)	65	1.12	1.02		0.96	1.22	
ID	65	-0.08	-0.25		-0.15	0.86	
(+1,+5)	65	-0.79	-1.18		-0.53	1.12	
(+1,+10)	65	0.01	0.01		-0.76	0.52	
(+1,+50)	65	1.35	0.42		-0.31	0.14	

Figure 5 presents (cumulative) abnormal returns for AMX inclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

The results of the AMX inclusions are in particular interesting, because in contrary to the findings for the AEX inclusions, these results are consistent with the Downward Sloping Demand Curve Hypothesis of Shleifer (1986), which states that price changes lead to permanently higher stock price. Secondly, the upward price movement can be explained by the block trades of index funds. Thirdly, the results are consistent with the Information Signalling Hypothesis, which would imply that AMX index inclusions are not an information free event and thus that they contain information which is new for the market. The reasoning behind this is that index inclusion might lead to a greater scrutiny of the management and an improved performance of the firm (Denis et al., 2014). However, one should note that when this is the case for the mid cap index, a similar situation would be expected for the large cap index, but no permanent price response was found there.

For the same reasoning as for the AEX inclusions, the Selection Effect Hypothesis is not rejected. An upward price movement of 0.08% during the five days prior to the review cut-off date is observed. According to the Wilcoxon Signed Rank Test, the return is 1.29% in the 10 days before the review cut-off date. However, this was only significant at the 10% level.

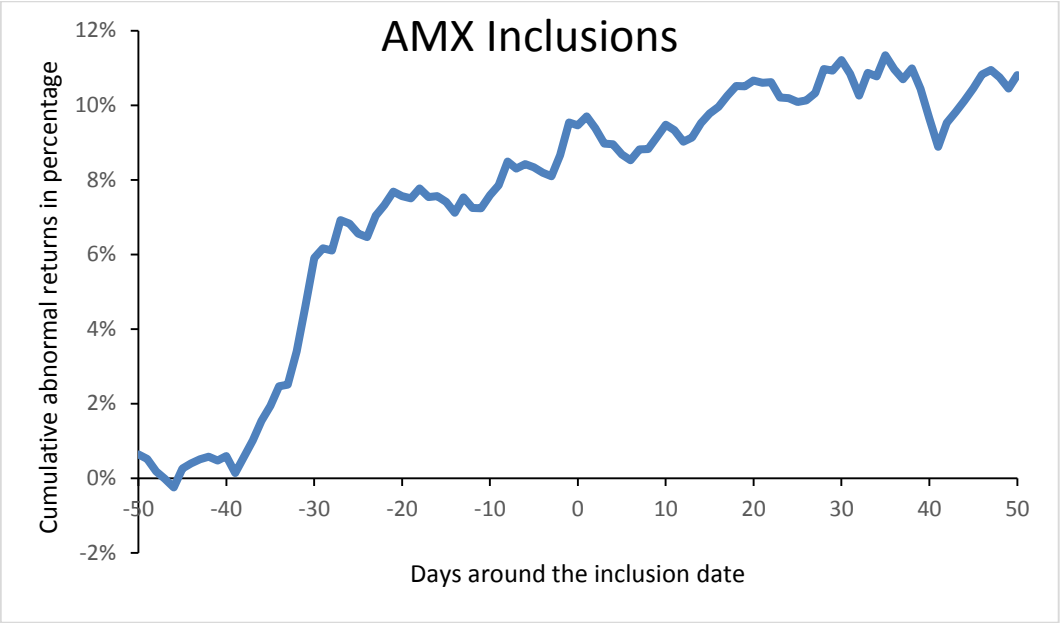

Figure 6: Cumulative market adjusted abnormal return responses in percentages for AMX index inclusions during the 100 days around the inclusion day.

The results are also consistent with the Liquidity Hypothesis, which states that stock inclusions result in an increase of publicly available information because of a higher media attention. This leads to an increased trading volume and lower bid-ask spread, resulting in a decreased uncertainty about the performance of the stock and a lower required return. A permanently higher stock price after index inclusion can be explained with this hypothesis, although this is certainly not waterproof. It should be taken into account that the included stocks were already part of an index: the AScX. The inclusion to the AMX is not the first time that the stock gets included to an index, it only gets 'promoted' to a higher index. This can still explain the price reaction, since a higher index receives more media attention. But then arises the question why the price effect is not permanent for the AEX inclusions. A potential explanation for this is that AEX and AMX stocks receive a lot more media attention than AScX stocks. The AEX and AMX index and the stocks of which it is composed are covered more often on Dutch financial news sources, like RTLZ, IEX and Beleggers Belangen, than the AScX stocks. AMX stocks are also more known by the public because most of the stocks have been part of the large cap index before. A promotion of an AScX stock to the AMX index leads in that case to a higher media attention and investor awareness, raising the stock price.

It is not likely that the buying of these investors is based upon the idea of a short term anticipating on the inclusion. If they decide to trade the stock, it is more likely that they buy it to hold it for a longer period in their portfolio. AMX stocks are much less liquid than AEX stocks, making it less likely that investors want to anticipate on an AMX index inclusion compared to AEX inclusions (Think, 2016). When stocks are not frequently traded, an investor who buys the stock takes the risk that he cannot find a buyer in case he wants to sell. This can lead to less speculation and anticipating of investors on the AMX inclusions. Therefore only market players that want to hold the stock for a longer period, like index funds, will buy, and since the volume of these stocks is low, they need to buy the stocks earlier to make sure that they have them in their portfolio before the actual inclusion takes place.

5.4 AMX Exclusions

Figure 7 shows the excess returns in association with exclusions. In contrast to the inclusions, not many significant results can be found here. The only interesting cumulative abnormal return is observed during the 5 days before the exclusion day; excluded stocks show a negative excess return of -2.18%.

The observed returns for the AMX inclusions and exclusions are to a certain extent similar to the ones observed for the AEX inclusions and exclusions. In both cases strong statistical evidence is found for stock price reactions around the inclusion event days, but not many statistical evidence is found for stock price reactions in the period around the exclusions.

Abnormal returns for AMX exclusions							
		T-test			**Wilcoxon Signed Rank Test**		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	40	3.83	1.16		2.10	0.83	
(-10,-1)	40	1.42	1.47		-0.43	0.77	
(-5,-1)	40	1.10	1.23		0.27	1.59	
RCD	40	0.26	0.58		-0.13	0.19	
(+1,+5)	40	1.40	1.74	*	0.72	1.16	
(+1,+10)	40	1.45	1.21		0.48	0.88	
(+1,+50)	40	-3.71	-0.96		-1.67	0.25	
(-50,-1)	40	1.12	0.43		3.26	0.79	
(-10,-1)	40	-2.00	-1.22		-1.96	1.58	
(-5,-1)	40	-0.09	-0.08		-0.53	0.73	
AD	40	-0.14	-0.38		-0.11	0.37	
(+1,+5)	40	0.81	1.11		0.35	0.46	
(+1,+10)	40	-1.21	-0.91		0.19	0.24	
(+1,+50)	40	-0.50	-0.07		-1.88	0.77	
(-50,-1)	40	-2.75	-0.92		-0.33	0.49	
(-10,-1)	40	-2.03	-1.14		-1.96	2.41	**
(-5,-1)	40	-2.18	-1.73	*	-2.70	2,78	***
ED	40	-0.14	-0.28		-0.32	0.81	
(+1,+5)	40	-0.44	-0.22		0.73	0.36	
(+1,+10)	40	1.42	1.35		0.05	0.69	
(+1,+50)	40	2.22	0.19		0.68	0.42	

Figure 7 presents (cumulative) abnormal returns for AMX exclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

Since again no significant findings were found for the exclusions, this is inconsistent with the described hypotheses. If the Information Signalling Hypothesis form the cause of the permanently increased stock prices after an AMX inclusion, one would expect the opposite effect for exclusions, which was not found. The absence of significant negative returns form an additional reason to point

the Liquidity Hypothesis as the cause of the observed price pattern for inclusions, since according to this hypothesis, excluded stocks should not be affected. The index review leads to a higher attention from both the media and investors. Included stocks are mostly new for investors and thus increases the awareness about the stock, while deleted stocks are still known by the investors after exclusion. A second potential explanation for the absence of significant results are short sale constraints, like described earlier.

5.5 AScX Inclusions

Figure 8 shows the excess returns for stocks that were included to the AScX. A one percent increase in stock price is observed on the announcement day, which is significant at the 5% level. In contrast to the AEX and AMX, not many significant price reactions are observed for the AScX inclusions around the event days and time intervals and thus no hypotheses can be confirmed.

The absence for any return reaction for AScX stocks can be explained by the fact that the volume of these stocks is much lower than the volume of the other indices (Think ETF's, 2016). This is also the reason why there is no single ETF provider which offers an AScX etf.

Abnormal returns for AScX inclusions							
		T-test			**Wilcoxon Signed Rank Test**		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	52	-4.42	-1.56		-3.47	1.79	*
(-10,-1)	52	-2.12	-1.41		-0.59	1.17	
(-5,-1)	52	-0.44	-0.73		-0.54	0.98	
RCD	52	0.40	0.97		0.00	0.10	
(+1,+5)	52	-0.07	-0.08		-0.41	0.67	
(+1,+10)	52	-0.15	-0.16		0.20	0.08	
(+1,+50)	52	3.49	1.42		3.03	1.46	
(-50,-1)	52	-2.35	-0.71		0.70	0.16	
(-10,-1)	52	1.13	0.77		0.06	0.63	
(-5,-1)	52	-1.33	-1.16		-1.19	1.71	*
AD	52	1.05	2.06	**	0.34	1.84	*
(+1,+5)	52	-0.32	-0.64		0.03	0.45	
(+1,+10)	52	-0.27	-0.27		0.41	0.08	
(+1,+50)	52	-0.83	-0.28		-2.62	0.82	
(-50,-1)	52	0.74	0.21		0.87	0.66	
(-10,-1)	52	-0.17	-0.12		1.08	0.66	
(-5,-1)	52	-1.45	-1.42		-0.73	1.33	
ED	52	-0.67	-1.47		-0.23	1.67	*
(+1,+5)	52	1.59	0.83		-0.42	0.31	
(+1,+10)	52	1.90	0.90		-0.01	0.05	
(+1,+50)	52	1.07	0.28		-1.19	0.71	

Figure 8 presents (cumulative) abnormal returns for AScX inclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

5.6 AScX Exclusions

Figure 9 shows the excess returns for stocks that were included to the AScX. Similar to the returns obtained for the AEX and AMX exclusions, no significant results are found here and no hypotheses can be confirmed.

Abnormal returns for AScX exclusions							
		T-test			Wilcoxon Signed Rank Test		
Event Day	n	Mean	T-statistic	Sign.	Median	T-statistic	Sign.
(-50,-1)	26	-6.46	-1.24		-0.53	0.20	
(-10,-1)	26	-1.47	-1.40		-0.96	1.22	
(-5,-1)	26	0.38	0.65		0.18	0.66	
RCD	26	0.00	-0.01		0.12	0.48	
(+1,+5)	26	0.79	0.60		-0.81	0.84	
(+1,+10)	26	0.36	0.29		0.54	0.30	
(+1,+50)	26	2.12	0.41		3.19	0.63	
(-50,-1)	26	0.29	0.09		3.48	0.94	
(-10,-1)	26	0.58	0.40		1.72	0.46	
(-5,-1)	26	0.14	0.18		-0.04	0.20	
AD	26	0.19	0.45		0.16	0.48	
(+1,+5)	26	0.16	0.15		-0.46	0.74	
(+1,+10)	26	1.15	0.65		-1.48	0.94	
(+1,+50)	26	2.92	0.64		3.01	0.58	
(-50,-1)	26	1.26	0.43		1.56	0.41	
(-10,-1)	26	2.00	0.75		-0.83	0.38	
(-5,-1)	26	2.26	1.64		-0.07	0.79	
ED	26	-0.81	-1.13		-0.11	0.74	
(+1,+5)	26	-0.16	-0.09		-0.46	0.81	
(+1,+10)	26	3.27	1.21		0.39	0.66	
(+1,+50)	26	3.07	0.64		3.70	0.61	

Figure 9 presents (cumulative) abnormal returns for AScX exclusions around the review cut-off day (RCD), announcement day (AD) and inclusion day (ID). The first column shows the event days and the amount of observations (n). The second column shows the mean (%), t-statistic and significance provided by the t-test. The third column shows the median (%), t-statistic and significance provided by the Wilcoxon one sample signed rank test. *** denotes significance at the 1% level , ** denotes significance at the 5% level and * denotes significance at the 10% level.

Chapter 6: Conclusion and recommendations for further research

6.1 Conclusion

When examining the index inclusion effect on the Dutch stock market, various price patterns are observed for the included stocks of the different indices. For the AEX inclusions an upward price movement of 5.64% is observed in the 50 days before the inclusion. This is followed by a full price reversal; the return on the inclusion day was -0.99% and during the 50 days after the event a cumulative abnormal return of -7.13% was found. These results are consistent with the Price Pressure Hypothesis, which states that price changes are temporary. According to the Dutch ETF provider Think ETF's (2016), this upward price movement can be explained by both the block trades of index funds, who need to buy the stock in the period before the inclusion, and by the anticipation of investors on the upcoming index review. Since the price effect is fully reversed in the days after the inclusion, the Information Signalling Hypothesis and Liquidity Hypothesis are rejected. This reversal can be explained by the fact that index funds have stopped buying or because anticipating investors close their positions.

The results of the AMX inclusions are in particular interesting, because in contrary to the findings for the AEX inclusions, the observed price changes lead to permanently higher stock prices, which is consistent with the Downward Sloping Demand Curve Hypothesis. When examining the pre-inclusion period of 50 trading days, a strong positive excess return of 9.54% is observed. No reversal is observed during the 50 days after the event. These findings are consistent with the Liquidity Hypothesis and partly consistent with the Information Signalling Hypothesis. Since the liquidity level of mid cap stocks is lower than for large cap stocks, short term anticipating investment behaviour is riskier and thus less likely to be the case. Only the investors or index funds that want to hold the stock for a longer period will buy the included stocks, and since the volume of these stocks is low, they need to buy the stocks earlier to make sure that they have them in their portfolio before the actual inclusion takes place.

For all the examined index exclusions no significant price patterns were found. A possible explanation for the absence of significant abnormal returns is that investors are less able to trade in line with the index exclusions because of short-sale constraints. Also no abnormal returns were observed for the AScX included stocks, which can be explained by low volumes of these stocks.

Although there is definitely an index inclusion effect in the Netherlands, it depends on the index in whether it is inconsistent with the Semi-strong Efficient Market Hypothesis or not. A price reaction is not irrational according to the Information Signalling and Liquidity Hypothesis, which were not rejected when examining the AMX inclusions. When considering the AEX inclusions, the price reaction looks like an anomaly. Since the included stocks temporarily do not fully reflect all publicly available information this is inconsistent with the Efficient Market Hypothesis in the semi-strong form. Although several reasons can be found for the upward price pattern during the pre-inclusion period, none of these explanations is consistent with the idea of newly released information regarding the companies' future prospects. The full reversal indicates that the included stock was temporarily trading above its fundamental value.

6.2 Limitations and Recommendations

With the knowledge acquired from this study, a few recommendations can be made for further research. Firstly the non-permanent price increase which was found for the AEX inclusions is consistent with the price pressure effect. However, this is no sufficient evidence for this hypothesis, since two small side notes should be made here. In order to support the Price Pressure Hypothesis, a price increase should occur simultaneously with an increased volume (Zitman, 2006), but volume effects were not examined within this research. Furthermore, for the Dutch indices it is not possible to use a control group, like used by Jain (1987) and Kach and Sarkar (2011). Therefore a more cautious way of interpreting the results is needed. Authors of future similar research should take this into account when re-examining this or equivalent studies and are recommended to consider testing for volume and to study the index inclusion effect at markets where it is possible to use a control group.

When examining a relatively small stock market, another limitation is present. Although all inclusion and exclusion data since the start of the indices are used, the sample is still not very big. To solve this, the robustness of this study is increased with a non-parametric test, but results should still be interpreted with care. This forms an additional reason to study a larger stock market or stock index when conducting similar research, since such problems do not occur when examining for example the S&P 500 stock inclusion effect.

The impact of block trades could be further extended by having a closer look at the different index funds that buy the included and sell the excluded stocks. Many empirical studies link the index inclusion effect to the block trades of index funds, but fail to dig deeper in the actual trading behaviour of those funds. Within this paper, the actual moment of buying and selling of the included and excluded stocks of one of those index funds is used to interpret the findings. This can be extended by looking at all the index funds which need to adjust their portfolio to a given index review. It might be the case that different index funds have varying buying and selling strategies, which could have its impact on the interpretation of the results. Furthermore, when knowing the size of the index funds and the amount of stocks they need to buy to sufficiently adjust their portfolio to the index review, one could make an estimate of the portion of cumulative abnormal returns which is caused by the block trades of index funds. Additionally, one would have a better insight in the effect of other potential reasons for the index inclusion effect.

This reasoning can also be turned around. Interviews or questionnaires with investors about short term investment behaviour related to the anticipating of investors on index reviews can be conducted. This can give a better insight in the effect of anticipating investors on the prices of included and excluded stocks.

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Appendix 1: T-Test

The following hypotheses are tested with the single-sample t-test:

Null hypothesis: $\mu = 0$; the average market model adjusted return does not differ significantly from zero.

Alternative hypothesis: $\mu \neq 0$; the average market model adjusted return differs significantly from zero.

This is done by the following one-sample t-test (Moore et al., 2011):

$$T = \frac{\bar{X} - \mu_{\circ}}{S/\sqrt{n}}$$

$\bar{X}$ is the sample mean, calculated by: $\bar{X} = \frac{\sum X}{n}$

$\mu_{\circ}$ is the predicted mean, which is zero.

S is the sample standard deviation, calculated by: $S = \frac{\sqrt{\sum X^2 - (\sum X)^2 / n}}{n-1}$

n is the number of observations.

The t-test is based on the t-distribution. The obtained t-value can be evaluated with a table of the student's t distribution, which lists the critical t-values. Since we test whether or not the mean of the sample does equal zero, which is nondirectional, the obtained t-value is compared with the two-sided critical t-value. In order to reject the null hypothesis, the t-value must be equal or greater than the tabled critical two-sided t-value at the specific level of significance. Apart from the t-value, Eviews directly provides the p-value. The null hypothesis is rejected when this p-value is smaller than 0.05.

Appendix 2: Wilcoxon One Sample Signed Rank Test

The Wilcoxon one sample signed rank test is based on the Wilcoxon signed rank statistic W, which is the sum of the ranks of the positive (or negative) differences when we rank the absolute values of the differences. The following two hypotheses can be tested:

Null hypothesis: θ = 0; the median of the population the sample represents equals 0.

Alternative hypothesis: θ ≠ 0; the median of the population the sample represents does not equal 0.

When the null hypothesis is not rejected, the sum of the ranks of the positive difference scores is equal to the sum of the ranks of the negative difference scores, implying that the median is 0 (Sheskin, 2011). When the null hypothesis is rejected, the opposite holds.

The Wilcoxon signed rank test requires a few steps. Firstly, the assumed population median θ, which is zero, is subtracted from every observation. Observations that are zero are ignored. The second step is taking the absolute value of every data point. Thirdly, the observations are ranked in order from smallest to largest. Each absolute value gets a rank R_i, i =1,2,…., n, according to their magnitude. The fourth step is determining the value W_+:

$$W_+ = \sum_{i=1}^{n} Z_i \, R_i$$

Z_i is an indicator variable which can have only two values: zero or one. In this case, $Z_i = 0$ if X_i - θ is negative and $Z_i = 1$ if X_i - θ is positive. W_+ is the sum of the positive signed ranks.

The same can be done for the value W_-, which is the sum of the negative signed ranks:

$$W_- = \sum_{i=1}^{n} Z_i \, R_i$$

In this case, $Z_i = 0$ if X_i - θ is positive and $Z_i = 1$ if X_i- θ is negative.

To check whether W_+ and W_- are correct, the following formula can be used:

$$W_+ + W_- = \frac{1}{2} n(n+1)$$

Finally, the minimum of (W_+, W_-) is designated as the Wilcoxon t-test statistic. This t-value can be interpreted by comparing it to the two-sided critical t-values for Wilcoxon's signed ranks tests. In order to be significant, the obtained value of t must be equal or less than the critical t-value at the relevant level of significance (Sheskin, 2011). Apart from the Wilcoxon t-value, Eviews provides a p-value which directly can be compared with the significance level.