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What is the effect of stocks added or deleted from a stock market index?

The price response to AEX and AMX inclusions and exclusions

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Abstract

While the Efficient Market Hypothesis infers that the inclusion of a company to a stock index or exclusion from it should not affect the company's share price, significant effects have been discovered on various markets. Several hypotheses have been developed to explain this phenomenon. This thesis examines the price and volume effects related to the revisions of two of the Dutch stock markets, the AEX and AMX index during the period 1983-2015. By using event study methodology, I find a significant positive temporary price response for stocks added to the AEX supporting the price pressure hypothesis. Interestingly, contrary to the AEX, the observed inclusion effect on returns for the AMX is permanent which is consistent with various hypotheses such as the downward sloping demand curve hypothesis. The results for stocks deleted from the AEX and AMX index do not show highly significant effects around the revision date. Regarding the volume effects, this study finds significant evidence for an increase in trading volume around the index revisions for both inclusions and exclusions for both indices. The permanent effect for stocks added to the AEX supports the liquidity, attention and operating performance hypotheses. While the temporary inclusion effect on trading volume for the AMX is consistent with the downward sloping demand curve hypothesis. This thesis concludes that the annual revision to the AEX and AMX index by Euronext has been a party for those investors aware of the opportunity it presents.

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1. Introduction

It is a big deal for firms to join the stock market index of a country. Many consider it a cheerful event, and evidence shows that for example S&P 500 stocks prices tend to rise after being included (Chen et al., 2004). In the Netherlands, all firms that have been listed on the AEX index in 2015 showed a positive stock performance during their first day of trading (Dobber, 2015). At the same time, recently included stocks start to co-move more with the market as evidenced by an increase in beta (Barberis et al., 2005). This means that the cost of capital in fact rises, and projects become more expensive to finance. Hence, the increase in stock price ("inclusion effect") seems an easy and quick albeit temporarily, profit opportunity for investors, but at the same appears unwarranted by fundamentals.

In this study, the inclusion and exclusion effects of the annual revision to the AEX and AMX index are examined. The AEX index is a capped market capitalization weighted index, including the largest and most traded stocks of the Dutch stock market, and the leading index of the Dutch stock market. The AMX includes the twenty funds that trade on the exchange and that rank from 26-50 in size of all Dutch stocks. The benefit of analyzing changes in these Dutch indexes is that they are determined by a ranking by market capitalization at annual reviews. Changes in the composition of the index should therefore have no direct information content. The annual revision is based on publicly available rules, which makes it interesting as it enables investors to anticipate for changes to the stock index before the announcement date (Doeswijk, 2005). The majority of previous research uses US data related to the S&P 500 index to explain the effects on the stock markets around index revisions. Looking at other markets that differ in their revision rules and market structures may reveal additional information to the proposed explanations. This thesis compares the in- and exclusion effects for the Dutch indices with literature related to other indices in order to answer the research question: what is the effect of stocks added or removed from a stock market index?

This paper will proceed with these topics as follows. Section 2 reviews the literature on the effects on stock prices of changes to the composition of a stock index, to give a better understanding of factors that drive the price response. In the third part of the paper, the research methodology is discussed. Subsequently, based on the theory and insights provided by the literature, the hypotheses of this study are motivated. Section 4 describes the data and is followed by section 5 in which the statistical tests and empirical results are discussed. These results are linked back to the original hypotheses to explain the abnormal returns following Dutch index revisions. Finally, section 6 concludes this study and provides recommendations for further research.

2. Theoretical background

To analyze the price response to AEX and AMX inclusions and exclusions, this study starts with a review of previous research regarding index revisions and the fundamental drivers that lead to the effect on stock prices. Since there is no obvious reason to believe that changes to an index contain new information; it can be used to test whether stocks have horizontal demand curves. However, prior research, that mostly focuses on stocks that enter an index, suggests that index composition changes have a substantial impact on stock prices. For example, the price pressure hypothesis developed by Scholes (1972) expects that this effect is temporary, driven by a short-run demand increase around the revision date from investors rebalancing their portfolios moves the stock price above long-run equilibrium. The most prominent hypotheses that have been developed to explain the price and volume patterns observed in the periods around index revisions are the downward sloping demand curve hypothesis, the price pressure hypothesis, liquidity hypothesis, attention hypothesis, investor recognition hypothesis and the operating performance hypothesis. These hypotheses are discussed separately below.

2.1 Downward sloping demand curve hypothesis

Scholes (1972) performed one of the earliest studies related to stock price reactions, by examining stock price reactions to buyer and seller-initiated large block trades called secondary distributions. He finds positive stock price reactions to large block purchases and negative reactions for large block sales. He argues that this is due to funds attempting to imitate the index and therefore will buy (sell) the stock as it is added (deleted) resulting in the price response. However, Shleifer (1986) argues that this conclusion may be flawed because a block trade entails an information effect. A bid to purchase (sell) a large block may signal good (bad) news about the stock, thus resulting in a price increase (decrease). Since block trade studies are considered not to be sufficient to provide comprehensive evidence on the hypothesis that demand curves for stocks slope down, Shleifer (1986) extends the literature by specifically focusing on a context where information effects are considered to play no role. He tests the downward sloping demand curve developed by Scholes (1972) on stocks added to the S&P 500 Index between 1966 and 1983. According to Scholes (1972) the downward sloping demand curve hypothesis predicts that when a stock is added to an index, the additional demand from index-related investors to hold the stock will result in short-term upward price pressure. The demand curve is expected to be downward sloping both in the short as well as in the long run (Scholes, 1972 and Shleifer, 1986). Shleifer (1986) finds that

returns are positively related to measures of buying by index funds, which is consistent with the hypothesis that demand curves for stocks slope down. He explains this finding by investors who cannot agree over the value of a share that is not resolved through the observation of the share price. Because of this implication found by Shleifer, several important propositions in corporate finance, among which the assumptions the Modigliani and Miller Theorem (1958) relies on, needed reexamination. The theory for the irrelevance of capital structure developed by Modigliani and Miller (1958) assumes that demand curves for a firm's equity are horizontal, which is rejected for the S&P500 as these demand curves are sloping downward.

Various studies provide evidence for the downward sloping demand curve hypothesis for the S&P 500 index (Mase, 2007) as well as various other indices such as the Toronto Stock Exchange (Kaul et al., 2000) and the FTSE index (Mase, 2008). On the other hand, Chen et al. (2004) does not find consistent evidence with this hypothesis. Since they do not find significantly negative abnormal returns, they argue that the downward sloping demand curve hypothesis is an inconclusive explanation for the price effect of index changes. They extend the literature by introducing the attention hypothesis (see 2.4), to better explain the asymmetric price response to index inclusions and exclusions. Chan et al. (2013) also find results contrary to the downward sloping demand curve hypothesis. They find abnormal returns in the long run for both inclusions and exclusions from the S&P 500 index, which cannot be explained by this hypothesis. Rather, they suggest the abnormal returns could be explained by the influence of changes to company fundamentals and therefore develop the operating performance hypothesis. This hypothesis contributes part of the positive inclusion effect to good prospects of the firm to be included, it is further discussed in section 2.6.

2.2 Price pressure hypothesis

Harris and Gurel (1986) argue that the evidence of the effect on price of large stock sales found by Scholes (1972) as described above, cannot be used as conclusive evidence as the examined events, such as block sales and new issues, are in most cases associated with negative information about future prospects of the related stock. To get around this flawed evidence, they examine changes in the composition of the S&P 500 index, an event that is considered to be unlikely to prevail new information to the market. Their critique regarding the information effect is similar to Shleifer (1986) but they take a slightly different approach. In order to better determine of whether price pressure exist, they study the effect on prices and trading volume following the shifts in demand, primarily from index funds, from the index

revision. The price pressure hypothesis states that investors who enable demand shifts need to be compensated for the transaction costs and portfolio risks that they carry when they accept to purchase or sell shares which they otherwise would not trade (Harris, 1986). According to this hypothesis, investors, who supply liquidity, are attracted by price declines that are associated with large sales. This reasoning can be used vice versa, as liquidity suppliers are attracted by rises in price associated with large purchases. These suppliers obtain compensation for this when prices rise or drop to their full-information levels. Contrary to the efficient market hypothesis, this hypothesis does not predict that short-term demand curves are completely elastic. It acknowledges that information about non-information-motivated demand shifts may come at a cost. To examine the inclusion effect to the S&P 500 index on trading activity, trading volumes, adjusted for market volume, are analyzed around the event period. Using event-study methodology they find that immediately after the announcement of an inclusion, prices increase significantly. This effect is reversed after two weeks, which is consistent with the price pressure hypothesis. The results are not consistent with the efficient market hypothesis, as it rejects the no-information assumption. Rather, the price change that occurs after announcement is evidence of price pressures among stocks as new investors buy the added stocks. Therefore, Harris and Gurel (1986) call this effect the price pressure hypothesis.

Blouin et al. (2000) extends the understanding of the price pressure hypothesis by examining price responses to stocks included into the S&P 500 index. They find that share prices of appreciated (depreciated) firms temporarily increase (decrease) to compensate individual shareholders for any unanticipated capital gains (losses) taxes triggered when they sell to index funds. The greatest part of the price response diminishes in the week following the event, which is consistent with the temporary price pressure. Mitchell et al. (2004) also finds evidence of price pressure on stocks, by examining the trading behavior of investors around mergers. Since this effect is relatively short, they argue that the assumption of horizontal demand curves for stocks is still appropriate.

Lynch and Mendenhall (1997) also examine deletions and find that prices reverse for both stocks added as well as deleted from the S&P 500 index. The returns for deletions are stronger than those for stocks included. This hypothesis is also supported by studies related to other markets such as the FTSE index (Mase, 2008).

2.3 Liquidity hypothesis

The liquidity hypothesis proposed by Amihud (1986) is another hypothesis, like the downward sloping demand curve hypothesis (see 2.1) that predicts a permanent increase in value for stocks added to a stock index. Instead of focusing on block trades, they examine the effect of the spread between the bid and ask prices on asset pricing. An investor who wants to trade faces a tradeoff as he can either wait to buy or sell at a beneficial price or he or she can choose to immediately execute the transaction at the current bid or ask price. In the latter case, this means the bid price includes a premium while the ask price would reflect a concession for an investor that wants to sell immediately. They develop the liquidity hypothesis which predicts that liquidity will improve (decline) following a stock's inclusion (exclusion) to an index, since the lower present value of all expected trading costs results to an increase (decrease) in share price. The amount of information on a stock increases upon its addition to an index due to greater attention form investors and greater coverage from analysts, the media, and other financial intermediaries. As a result, the information asymmetry declines and more liquidity becomes available. The resulting decline in the liquidity premium causes a positive price movement. Furthermore, the presence of more investors trading the stock reduces the inventory cost component of liquidity, which results in a further positive price adjustment. Amihud and Mendelson (1986) find a negative correlation between the bid-ask spread on stocks and liquidity, which is consistent with their liquidity hypothesis. They use liquidity characteristics such as the number of shareholders and the change in trading volume to show that expected asset returns increase in the bid-ask spread, this means that higher bid-ask stocks result in higher expected returns. Vice versa reasoning holds for the effect on stocks removed from an index.

The liquidity hypothesis is extended by Biktimirov and Li (2013), who study the effect on stock prices of changes in the FTSE SmallCap index membership, that tracks the performance of small stocks listed on the London Stock Exchange. They find asymmetric price and liquidity reactions between firms that are shifted between FTSE indexes and firms that are new to FTSE indexes. Firms that moved from a smaller-cap to a larger-cap FTSE index show both a permanent increase in stock price and improved liquidity. They find contrary results for firms moving downwards; these experience negative effects on stock price and liquidity. Consistent with the liquidity hypothesis, newly added firms to the FTSE experience a transitory increase in price and decrease in liquidity. Various other studies also provide empirical support for the liquidity effect hypothesis for the S&P 500 index (Green, 2011 and Cai, 2007).

Other studies also find significant evidence for improved stock liquidity for companies added to smaller indexes such as Russell 2000 (Madhavan, 2003) and S&P 600 (Paul, 2010). On the other hand, Hegde and McDermott (2003), who examine excess returns around S&P 500 additions and deletions, argue that changes in liquidity can only partially explain the excess returns around additions.

2.4 Attention hypothesis

Another explanation for the positive abnormal returns after inclusion, resulting from the increase in trading volume, is proposed by Odean (1999). He suggests that investors base their decision on stocks that have recently caught their attention and do not consider other stocks in their investment decision since they simply do not have the time and/or ability to evaluate all available stocks they could potentially invest in during their investment decision process. They do not buy each stock that catches their attention; however, for the greatest part, they buy stocks that do so. Among the stocks that caught the attention of an investor, the decision on which to buy is based on personal preferences. Compared to the other hypotheses discussed in this section, this study differs fundamentally in how they treat the buy and sell decision of a security. Odean (1999) argues that other hypotheses consider investor's decisions to buy and sell differ only by a minus sign, while he argues that this is not the case because of investor's characteristics. Because of two main reasons, this hypothesis is mostly applicable on buyer-related considerations. First, since most investors sell only stocks that they already own, they usually do not use the option to sell short. As most of them do not spend attention on stocks they could potentially sell short, this hypothesis is less applicable to these investors. Secondly, because the greatest part of individual investors holds relatively few common stocks in their portfolio. However, there is one exception. According to Odean (1999) this does not apply for institutions because they often face a significant search problem when they want to sell stocks as they often sell short (e.g. hedge funds). Another factor that contributes to the selling issue with institutions is that institutional investors spend more time on searching for stocks to buy and sell than most individuals. As it is impossible to measure the daily attention of investors paid to stocks directly, it is measured indirectly. The factors used to proof the correlation between attention and price response are: whether the firm appeared in that day's news, a stock's abnormal daily trading volume, and the stock's one-day return. Unusual high abnormal trading volume could be flawed by the liquidity or information-based trades of a few large investors.

Barber and Odean (2008) confirm the attention hypothesis for individual investors, by analyzing investor trading data the evidence shows that they are more likely to buy rather than sell stocks that caught their attention. They use news, unusual trading volume and extreme returns as proxies for attention.

Chen et al. (2014) take a similar approach for examining the S&P 500. According to them, the attention hypothesis explains the increase in stock price for additions to index, by the attention the index revision attracts form both the media as well as analysts. The increase in attention enlarges the investor base that keeps track of the company. Because additions are new stocks for some investors whereas with deletions the investor base is unchanged, the increase in stock price only in case of additions. Doesbeek (2005), like this study, focuses on the Dutch AEX index and takes a slightly different approach. He argues that if a firm experiences strong organic growth that leads to an increase in index weight of a firm's stock, it gets more attention in the 'league tables' published around the index revision which enlarges the potential investor base of that firm. He uses the number of analysts that follow a stock as a proxy for attention. He finds significant evidence for the attention hypothesis, as an explanatory variable for the observed asymmetric price effect. Added stocks are 'new' for some investors, enlarging the potential investor base aware of the company, while for deleted stocks there is no effect on the number of potential investors. Cai (2007) finds that the inclusion of a stock to the S&P 500 index conveys favorable information about the company or industry.

Contrary to these studies related to the S&P 500, Mase (2007) does not find significant evidence for investor awareness and monitoring for stocks added and deleted from the FTSE 100. This might be due to the fact that for stocks in the S&P 500, the market is not aware of which stocks are potential candidates for inclusion while for the FTSE 100 the market is aware of this. However, following this reasoning the same should hold for the Dutch stock market but Doesbeek (2005) does find results for the AEX supporting the attention hypothesis.

2.5 Investor awareness hypothesis

Another hypothesis that focuses on the attention of investors, is developed by Merton (1987). According to the investor awareness hypothesis, investors hold incompletely diversified portfolios in segmented markets and invest only in stocks of which they are aware. Merton, using a static mean-variance model, develops a model in which markets are segmented and investors are divided into two categories: they are either informed or not informed about a

stock. He argues that when investors become aware of a stock, for example in case of the event that it is added to a stock index, it should lead to an increase in the stock price. These segmented markets lead to investors with not fully diversified portfolios. Therefore, there will be a difference between the equilibrium return demanded by not fully diversified investors and that demanded by fully informed and diversified investors according to the capital asset pricing model. This excess return demanded by less than fully diversified investors is called Merton's shadow cost. Once a stock is added to an index, both investor's awareness as well as their demand to hold it for its diversification potential increases. This leads to a decrease of the stock's shadow cost, which subsequently lead to the stock price to rise. For deleted stocks, Merton's model does not predict an equal but negative abnormal return. As investors do not become unaware of stocks that are deleted, there is no reason to expect that these stocks will experience negative returns as they leave the index.

Shapiro (2002) further develops Merton's model into a general equilibrium framework. He adds a class of investors, or so-called 'agents' in the paper, who can execute only a particular trading strategy. This enables him to show differences relative to Merton's investor recognition hypothesis, due to intertemporal considerations. Contrary to Merton's static mean-variance model, Shapiro's model states that the risk premium on a stock that is less visible does not need to be higher compared to a stock that is more visible with a lower volatility. The investor recognition hypothesis is a significant contribution to the consumption-based capital asset pricing model, since it more realistically explains the cross-sectional variation in unconditional expected equity returns.

This hypothesis is further developed by Chen et al. (2004), who examine the effects of S&P 500 index revisions on stock prices and find an asymmetric price response: a permanent increase in the price of inclusions but no permanent decline for deletions. These results are not consistent with the explanations of the effects of index revisions like the downward sloping demand curve and liquidity hypothesis as described above, that both expect symmetric price responses. They find that the changes in awareness of investors are asymmetric as there is an increased awareness for additions as investors get to know them, but a relatively smaller decrease in awareness for deleted stocks. Several factors contribute to the increased awareness such as the increased monitoring by investors and a reduction in information asymmetry component of the bid-ask spread.

With respect to investor awareness in the Netherlands, Doeswijk (2006) examines the proportion of index-linked investing to the AEX index and finds that ~2 to 4~% of the total market capitalization is managed by mutual funds. He argues that the Dutch major stock

market has some level of importance for both institutional and particular investors. Therefore, index-related trading could be an explanatory factor for abnormal return and/or trading volume patterns around index revisions.

On the other hand, the negative effect for deleted stocks appears to be much smaller or even nonexistent. Fang et al. (2009) examine the relation between media coverage and stock returns and provides evidence for the investor recognition hypothesis. They find that stocks without media coverage offer a significant return premium. This premium appears to be relatively large for small stocks and with high individual ownership. Chan et al. (2013) also analyze the effects of S&P 500 index additions and deletions, but focuses on the long term, and find a significant long-term price increase for both added and deleted stocks. They find that the long-term price increase for added stocks can be attributed to increases in institutional ownership, liquidity, and analyst coverage.

2.6 Operating performance hypothesis

Denis et al. (2003) examines the earnings forecasts and realized earnings per share of stocks added to the S&P 500 index and find that these achieve better operating performance relative to expectations than do firms that have been in the index for more than one year. This finding leads them to the operating performance hypothesis which predicts that stocks included to an index are more likely to have better prospects and to improve operating performance subsequently. The hypothesis is based on two factors. First, firms added to the index are likely to have good prospects. Secondly, once these firms are added to the index investors will start to closely track them and put pressure on them to improve operating performance (Denis et al., 2003). Denis et al. (2003) note that their findings do not allow them to reject alternative explanations other than operating performance. The selection of stocks added to the S&P 500 index, may for example be influenced, by inside knowledge of the S&P 500, by future prospects of the potential companies to be added to the index. If investors are aware of this, both investors and analysts might rationally update their earnings forecasts when the S&P 500 decided to add a company to the Index. If that would be the case, the excess return found by Denis et al. (2003) would be considered a rational response.

Chan et al. (2013) extends the operating performance hypothesis, by also analyzing operating performance for stocks excluded from the S&P 500 index. At least, the research by Denis et al. (2003) indicates that the announcement of a stock to be added to the SYP 500 is not information free. Instead of analyzing the earnings per share like Denis et al. (2003), Chan et al. (2013) focus on several operating measures such as Profit Margin and Return On Assets.

Interestingly, they find that deletions significantly outperform included stocks. While operating performance declines for stocks added to the index, it increases for stocks deleted the year following the year of addition or deletion. This might indicate that firms that are included to the S&P 500 index are at their peak in terms of operating performance, while deleted firms are at low performance and eventually manage to improve the operating performance in the years following deletion. A firm might for example be deleted from the index because of relatively poor prospects, but it could still be able to restructure their operations internally so their operating performance does not have to decrease in the long run. It might be even required to make sure they sustain their business model.

The operating performance hypothesis is supported by several studies for various indexes; Cai (2007) finds evidence consistent with the operating performance hypothesis for the S&P 500 and Fernandes and Mergulhão (2016) for the FTSE 100.

2.7 Conclusion literature review

In conclusion, the review of the literature indicates that there are several fundamental reasons to expect a permanent, long-term price effect from the addition of a stock to an index. The research by Scholes (1972) and other previous studies with a focus on the inclusions of stocks to an index have one conclusion in common: stocks promoted to an index relatively outperform the market. However, they do not agree what causes this effect and whether it is permanent or temporary, as well as offer competing explanations. The most prominent hypotheses come from Harris and Gurel (1986) and Shleifer (1986) who both find abnormal returns for inclusions to the S&P 500 index. They both argue that these additions do not prevail new information about future return distributions, but cause outward shifts in excess demand by investment strategies, primarily by index funds, who follow the S&P 500 index. Harris and Gurel (1986) find evidence that is consistent with the price pressure hypothesis because they find that stock prices reverse in two weeks. If, on the other hand, stocks have a long-term downward sloping demand curve, prices will not reverse and the abnormal returns should be permanent (Shleifer, 1986). Chen et al. (2004) doubt the validity of both the downward sloping demand curve hypothesis and the liquidity hypothesis, as he finds asymmetric instead of symmetric responses around additions to and deletions from the S&P 500. Rather, he explains the price response based on changes in investor awareness. Prior research also disagrees about the effects of stocks leaving an index.

It seems that several effects play a role in the in- and exclusion effects on both stock prices and trading volume. The most prominent explanations for these effects are the price pressure hypothesis, downward sloping demand curves, and liquidity, while the effects are different depending on the characteristics of the specific index involved. Although results with respect to the effects of a deletion from an index vary more widely, the driving factors for added stocks should work in the opposite direction for deleted stocks. Table 1 below provides an overview of the effects of index revisions on price and trading volume activity, according to the hypotheses discussed in this section. In an attempt to discriminate among these competing hypotheses, this study examines market reactions to revisions in the AEX index, which tracks the performance of the large stocks listed on the Amsterdam Stock Exchange.

Table 1. Summary of competing explanations to index revision effects on price and volume

Hypothesis	**Revision**	**Stock price**	**Duration**	**Trading volume**	**Duration**
Downward sloping	Inclusion	Increase	Permanent	Increase	Temporary
	Exclusion	Decrease	Permanent	Increase	Temporary
Price pressure	Inclusion	Increase	Temporary	Increase	Temporary
	Exclusion	Decrease	Temporary	Increase	Temporary
Liquidity	Inclusion	Increase	Permanent	Increase	Permanent
	Exclusion	Decrease	Permanent	Decrease	Permanent
Attention	Inclusion	Increase	Permanent	Increase	Permanent
	Exclusion	No effect	No effect	No effect	No effect
Investor recognition	Inclusion	Increase	Permanent	Increase	Temporary
	Exclusion	Decrease	Permanent	Increase	Temporary
Operating performance	Inclusion	Increase	Permanent	Increase	Permanent
	Exclusion	Increase	Permanent	Increase	Permanent

Source: compiled by authors based on previous research, discussed in section 2.

3 Research methodology

This section discusses the research design of this study. In order to empirically test whether there are abnormal returns around the index revisions of the AEX and AMX index, an event study is used of which is discussed in the first part of this section. Following the returns methodology, the volumes methodology is discussed in the second part. Subsequently, the regression model that is tested and the link between this model and the hypotheses are discussed. In the third part of this section, Merton's model of shadow cost is discussed to explain whether there is evidence for his investor awareness hypothesis. Lastly, this section concludes with an overview of the various hypotheses based on the literature review discussed in section 2 and the characteristics of the Dutch stock market.

3.1 Returns

The event study methodology developed by Fama et al. (1969) is the most frequently used method to examine the price effects and volume changes around the announcement dates and implementation dates of index revisions. This method first requires to first estimate the normal returns based on the market model and then calculates the abnormal returns being the difference between the former normal return of the reference market and the observed returns and the respective t-statistics. The market model is used in this study as it provides a higher power compared to the mean adjusted model in case of event clustering (Brown and Warner, 1985). Subsequently, the abnormal returns are aggregated over the chosen event windows into cumulative abnormal returns measure. Results are reported based on abnormal and cumulative abnormal returns measured relative to the market portfolio, in this case the AEX index. The post-event estimation window is chosen similarly to Chen et al. (2013) and set at 120 days; from 60 days before the event until 60 days after the event. The cumulative abnormal return is estimated with the regression stated in equation 1.

$$AR_{i,t} = R_{i,t} - (\alpha_i + \beta_i * R_{m,t}) \qquad (1)$$

Where:

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

α_i = intercept

β_i = slope of the systematic risk

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

The abnormal return on a particular day within the event window represents the difference between the actual stock return $R_{i,t}$ on that day and the normal return, which is predicted based the typical relationship between the firm's stock and its reference index being either the AEX or AMX, indicated by the α and β parameters. The event day is tested for the review cut-off date, the announcement date and actual revision date.

I run the regression separately for the inclusions and exclusions with the data on stock returns and the market for the estimation window and event window. If abnormal returns are present, I analyze if they are temporary, consistent with the price pressure hypothesis as discussed in section 2, or permanent predicted by other hypotheses. Next, I calculate cumulative returns relative to the AEX and AMX index. I will use unadjusted abnormal returns because these generally present less difficulties in case of event studies (Brown & Warner, 1985). The return on the relevant index (e.g. AEX or AMX) is used as a proxy for the return on the market portfolio. By means of a standard t-test, I test for the significance of the mean.

3.2 Volumes

For the volume indices, changes in trading volume are measured in terms of volume turnover instead of trading volume, to prevent that extreme values of a few large stocks disproportionately influence the trading volume of the market. Volume turnover can be calculated by trading volume dividing by shares outstanding. The turnover ratio is calculated by equation 2. Due to highly skewed distribution of the volume data, caused by some extreme observations unrelated to the events under investigation I use logarithmic adjustment for the trading volumes in the analyses.

$$Turnover\ ratio = \frac{\sum_{t=1}^{n} \frac{Tit}{Tmt}}{\sum_{t=-60}^{AD-1} \frac{Tit}{Tmt}} \qquad (2)$$

In equation 2, T_{it} indicates the turnover of a firm i at time t and m indicates which stock market (AEX or AMX), and AD refers to the day of the announcement of the revision by Euronext, which is the first trading day following announcement as the announcement is after market close. When examining the changes in turnover, the market is limited to only AEX and AMX stocks. According to the method used by Chen et al. (2013), the post-change turnover ratio is calculated as follows: 61 days after the revision, I take the average of the

trading turnover for at least 30 days. Therefore, there should be a minimum of 90 days of trading post change to be included in the sample.

Since investors can anticipate on the announcement by Euronext of which stocks are included and excluded, I also focus on the event period around the announcement date and the period prior to the actual change (20 days before and after). According to the attention hypothesis, there should be a gradual change in share prices around each date as the stocks to be included and excluded get more attention by media and analysts. The efficient market hypothesis argues that arbitrageurs will undo this effect as they provide the stock market with sufficient shares, which should lead to regular price levels again.

3.3 Merton's shadow cost

Whether there is evidence for the investor recognition hypothesis (see section 2.5), is tested by Merton's measure of shadow cost (2004), as given in equation 3. The return required by less than fully diversified investors is higher than that required in a full-information setting, with the difference between the two returns being defined as the Shadow Cost.

$$ShadowCost = \frac{ResidualStandardDev}{AEX\ MarketCap} x \frac{Firm\ Size}{Number\ of\ Shareholders} \qquad (3)$$

The residual standard deviation in equation 3 refers to the standard deviation of the firm's return minus the total return of the relevant index (AEX or AMX). The return is calculated over the 252 days before the revision announcement day and the 252 days after the effective day. The index market capitalization and firm size, defined as market value of equity, refer to the value on the date of the revision announcement. The method to measure the number of shareholders prior and post the event are as described in chapter 4.

If Merton's shadow cost model is at least partly responsible for the potential excess return around AEX and AMX index changes, there should be a correlation between changes in the shadow cost and abnormal returns. This relationship is tested by equation 4.

$$AR = \alpha + \beta(dShadow) + \varepsilon \qquad (4)$$
$$dShadow = ShadowPost - ShadowPre$$

Besides the change in shadow cost, other related factors may affect abnormal returns (Chen et al., 2004). One of the factors that might influence the change in share price is the years of incorporation. One may argue that younger firms are probably less known than old firms and are therefore considered by a smaller group of investors. As I do not have the year of incorporation for all the firms in the sample, I use the number of months of listing on the AEX as an approximation. Next to age, size might also affect the popularity of a stock as bigger firms are in general better known than smaller ones. To test whether this affects the abnormal return, firm size is divided by the market capitalization of the relevant index (relative to the AEX or AMX index) on the announcement date. Also, the literature review that firms in the largest index of a country are usually better known than firms listed on smaller indices. An exchange dummy (AEXdum) is used to indicate whether this differs and is set to 0 AEX stocks, and 1 otherwise. Thus, in addition to equation 3, I also estimate equation 5, which includes several control variables.

$$AR = \alpha + \beta 1\, Log(RelSize) + \beta 2 Log(Age) + \beta 3 AEXdum + \beta 4 dShadow + \varepsilon \quad (5)$$

According to the investor recognition hypothesis, the abnormal return (AR in equation 5) is predicted to be permanent (Merton et al., 1987). AR in equation 5 tests whether this effect is indeed permanent for the Dutch stock market. The abnormal return is measured from the period beginning from the day of announcement to 60 days post the effective day.

3.4 Robustness check

In order to check the robustness for the return analysis results, I run the analysis of the returns using the pre-event estimation instead of the post-event estimation for computing the normal returns over the event window. Besides that, I conduct the analysis using the standard event study methodology. This shows if any anomalies appear in the patterns found in the results section. Also the trading volume analysis results are checked for robustness regarding the trading volumes.

3.5 Hypotheses

Based on the previous literature discussed in section 2, I have established several hypotheses regarding the effects of the Dutch stock market revisions on both stock prices and trading volume. The first part of this paragraph discusses the three hypotheses related to the duration of the effects on stock prices. Subsequently, the hypotheses regarding to the effects on trading

volume are discussed.

3.5.1 Returns

H1: Stocks added to the index experience significant positive abnormal returns around the event date

The review of the literature indicates that there are several fundamental reasons to expect a permanent, long-term price effect from the addition of a stock to an index. The research by Scholes (1972) and other previous studies with a focus on the inclusions of stocks to an index have one conclusion in common: stocks entering an index show an outperformance relative to the market. This means that the coefficient on the change of the shadow cost (*dShadow*) in equation 4 should be negative, as the decrease in shadow cost should result in an increase in abnormal return (Chen et al., 2013). Therefore, this study predicts that stocks included to the AEX and AMX experience significant abnormal returns. All six hypotheses discussed in section 2 use different variables to explain the positive abnormal return, such as the impact on required return via risk reduction from greater attention. These proxies are regressed on the return to test whether there is evidence consistent with the relevant hypothesis.

H2: There is an asymmetric price response, stocks deleted from the index do not experience significant negative abnormal returns around the event date

Although results with respect to the effects of a deletion from an index vary more widely, the driving factors for added stocks, according to the majority of the previous research, should work in the opposite direction for deleted stocks. Although most hypotheses find that the price response is smaller for exclusions compared to inclusions. Only the operating performance hypothesis expects a positive abnormal return after deletion, but several other studies find evidence contrary to this (as discussed in section 2). As Doeswijk (2005) finds no significant price effects for stocks leaving the AEX, apart from some price pressure around the revision date. This might be explained by the attention hypothesis, that argues that the attention of investors for deleted stocks does not decrease as they do not 'forget' stocks but it will only increase when a stock is promoted to an index. I believe this study by Doeswijk is most relevant and comparable to this study. Therefore, this hypothesis predicts that stocks deleted from the AEX or AMX index do not experience significant negative abnormal returns.

H3: For stocks included into the index, the positive abnormal returns are temporary

All six hypotheses discussed in the literature review expect a significant positive abnormal return after inclusion. However, they disagree whether it is permanent or temporary. The price pressure hypothesis is the only hypothesis that predicts, due to excess demand/supply from index trackers, that this positive abnormal return is temporary and reverses after the event. Doeswijk (2005) finds evidence for the AEX consistent with the price pressure hypothesis, a prices reverse within 10 days after the event. Therefore, I expect that the positive abnormal returns for stocks added to the index are temporary and reverse in the longer term.

3.5.2 Volumes

H4: The trading volume increases around the event for both stocks added and deleted from the index

Several hypotheses, including the downward sloping demand curve hypothesis and the investor awareness hypothesis, predict that trading volume increases around the index revision for both stocks included and excluded from the index. As the most prominent part of the previous literature finds evidence consistent with these hypotheses, this research expects that the trading volume increases for both stocks included and excluded around Dutch stock market revisions. On the other hand, both the operating performance and liquidity hypothesis expect that trading volume for stocks deleted from the index decreases. If the results for deleted stocks are not consistent with this hypothesis, but instead show that trading volume decreases for stocks deleted from the index, this provides evidence for the operating performance and liquidity hypothesis.

H5: For stocks added to the index the increase in trading volume is permanent

The downward sloping demand curve and price pressure hypothesis expect that the increase in trading volume is temporarily caused by index funds and will reverse after the event. On the other hand, the liquidity, attention and operating performance hypotheses predict that stocks included to the index will be traded more frequently. Doeswijk (2005) does not find any significant effect on trading volumes, but he finds an asymmetric price response of the AEX revision which points to the attention hypothesis. As the change in the index composition attracts attention from the media, it enlarges the investor base while for stocks excluded from the index the potential number of investors remains unchanged. As this change in investor base is permanent, this study predicts that for stocks added to the index trading volume will increase permanently.

H6: For stocks deleted from the index the decrease in trading volume is temporary

As discussed above in H5, the investor base for stocks deleted from the index remains unchanged (Doeswijk, 2005). Only the liquidity and operating performance hypothesis state that trading volume of stocks excluded will increase permanently, as the change in trading frequency influences the trading and information costs only around the event. The operating performance hypothesis even expects a permanent increase in trading volume as exclusions are more incentivized to improve their operating performance (Chan et al., 2013). Based on the majority of the literature and the paper by Doeswijk (2005) and Chen et al. (2004) in particular, I expect that trading volumes decreases in stocks deleted from the AEX and AMX.

4 Data

Before describing the initial data samples, this section starts with a description of the methodology followed by Euronext for making changes to the AEX and AMX index. After a description of the initial data samples, part 3 and 4 of this section discuss what adjustments are made in order to get to the final data samples for returns and volumes respectively.

4.1 Changes to and membership in the Dutch stock index

The Dutch stock market consists of shares issued by companies ranked in terms of free float market capitalization with the AEX reflecting the performance of the 25 largest and most actively traded shares listed on Euronext Amsterdam and the following 25 are included in the AMX (Euronext, 2016). Euronext Amsterdam annually reviews, based on a set of publicly available rules and conditions, in March what stocks will be added (deleted) to (from) the index, to make sure that the selection and weight of the stocks reflect the underlying market of market segment it represents. Among the restrictions included in the rules and conditions used by Euronext, an important one is related to the weighting factors of the component stocks. The maximum weight of a component stock is limited to 15%. In case there is a specified part of outstanding shares not freely available for trading, the so-called free float, the market capitalization gets adjusted. The weighting factor then depends on the free-float-adjusted market capitalization (Euronext, 2016). This study considers a stock promoted from the AMX to the AEX as an index inclusion and a stock degraded from the AEX to the AMX as an index exclusion. This means that the latter does not count as an inclusion for the AMX. Vice versa, stocks promoted from a lower index (AMX) to the higher index (AEX) are not part of the deletions sample for the lower index.

Next to the annual revision, there is a quarterly review to enable fast entry for recently listed companies or replacement to the index during the year. The review cut-off date is after the market close of the last Friday of month prior to the month the revision actually takes place. For the annual review this is the last Friday of February, for the quarterly reviews the last Friday of May, August, and November. As discussed in the literature review (section 2), as investors can predict the result of the review one might hypothesize a price response around the review cut-off date. The actual announcement date is in the first week of March. The review effective date is after the market close of the third Friday of March. For the quarterly reviews, the review effective date is after the market close of the third Fridays of June, September, and December. As index funds aim to mimic the index, they are expected to buy (sell) the inclusions (exclusions) the trading day at closing before the actual review takes place (Doesbeek, 2006).

The revision rules, and the review cut-off date in particular, used by Euronext have changed several times over the years. Currently, the review cut-off date is after the market close of the last Friday of February (for the annual review). However, the cut-off date from 1994 until 2001 was 34 trading days before the effective date and subsequently, until 2010, the cut-off took place on 31st of December. From the beginning of 2011 the procedure is at is currently.

4.2 Data description

The sample for both the analyses on returns and volumes, consists of all stocks added to and deleted from the AEX and AMX index from January 1983, from when the AEX was reviewed annually, to August 2016. This sample of all index revisions is obtained from Euronext. The initial sample consists of 56 inclusions and 54 exclusions for the AEX. For the AMX, the initial data includes 84 additions and 81 deleted stocks. Stocks added to or deleted from the index due to mergers, takeover, spin-offs or delisting are removed from the initial sample. As delisting and takeovers are primarily the case for exclusions, the final sample of exclusions consists of a smaller number of events. The number of events in different parts of the analyses below may differ due to the restriction that there must be at least 60 trading days before the date of announcement of return data available and for at least 90 trading days after the effective day, in order to estimate the abnormal returns. After these adjustments, the final sample entails 43 additions and 32 deletions for the AEX and 66 additions and 43 deletions for the AMX. Trading volumes are obtained from Thomson Reuters Datastream. Table 2 shows that the stocks in the final sample seem to be highly correlated with the AEX All Share

index (AAX).

Table 2. Beta of stocks included in final data sample with AEX All Share Index (AAX)

	Beta prior to revision	
	AEX	**AMX**
Additions	0.94	1.08
Deletions	0.85	0.93
	Beta after revision	
Additions	1.01	0.96
Deletions	0.93	0.94

Appendix 1 shows the industry overview of the final sample. Especially for the AMX, the addition sample consists primarily out of firms of two industries (e.g. 'Industrials' and 'Real Estate'). Although Euronext aims to mimic the performance of the largest companies per industry, the results might be affected by investors with a preference for a specific industry. This study does not examine whether the return and volume results differ per industry, this may be interesting for future research.

4.3 Volumes

The normal turnover for a stock and the market is taken as the average turnover sixty days before the announcement date. The post-change turnover is the average of the 60 days trading turnover beginning sixty-one trading days after the effective date (Chen et al., 2013). For the turnover ratios, the medians and proportions greater than for each index are reported. By means of binomial distribution, the significance of these proportions is tested.

5 Results

This section discusses the results of this study. It starts with a description of the robustness tests. As discussed in section 4, this study focuses on two different event dates surrounding index revisions: the announcement date (AD) and the revision effective date (ED). The second part of this section discusses the inclusion effects on the Dutch stock market indices around these different dates on both the share price as well as the trading volume. Subsequently, also the exclusion effects on these variables found by this research are described. This section concludes with a reconciliation of the findings of this research with the hypotheses discussed in section 3 based on the previous literature.

5.1 Robustness

As described in the research methodology section, robustness checks are used to examine to how the regression estimates used in the Return and Volume analyses behave when the regression specified in equation 3 is modified. If the coefficients are plausible and robust, we can interpret the results described in this section as evidence of structural validity (Lu, 2014).

To check the impact of the choice of the event window on returns, I run the same analyses for various pre- and post-event periods. In general, the graphical chart seems to be similar. Although I do notice some differences, these are not significantly different from the results described in this section.

Since the results might be affected by the choice of the estimation period, I check whether any significant differences appear when I run the same analyses for different estimation windows. Obviously, the choice of event period does affect the statistical significance but this is not considered an issue.

5.2 Inclusion effects

5.2.1 Returns

Table 3 shows the abnormal returns and volume turnover around revisions in the AEX and AMX index. First, we focus on the abnormal returns around stocks added to the AEX. Chart 1 graphically shows the cumulative abnormal return over the event period around the effective date. Five days before the announcement date we find a statistically significant positive abnormal return of 1.15%. This indicates that investors anticipate for the revision by Euronext and buy the stocks they predict to be promoted to the AEX prior to the announcement by Euronext. The results do not show a significant abnormal return on the actual announcement day, which can be explained by a similar logic as investors could already calculate the revision based on the publicly available rules (Euronext, 2016) and thereby anticipate for the stocks to be included.

Next, we look at the revision effective date. If we look at the post-inclusion results, we notice a significant abnormal return of -1.02% at the day the revision takes place. This negative price response continues to increase post inclusion with a negative return of -1.11% and 6.81% after 10 days and 60 days respectively. This shows that the inclusion effect of stocks added to the AEX appears to be temporary and is fully reversed within 50 days.

Table 3. Abnormal returns and volume turnover around changes in the AEX and AMX index

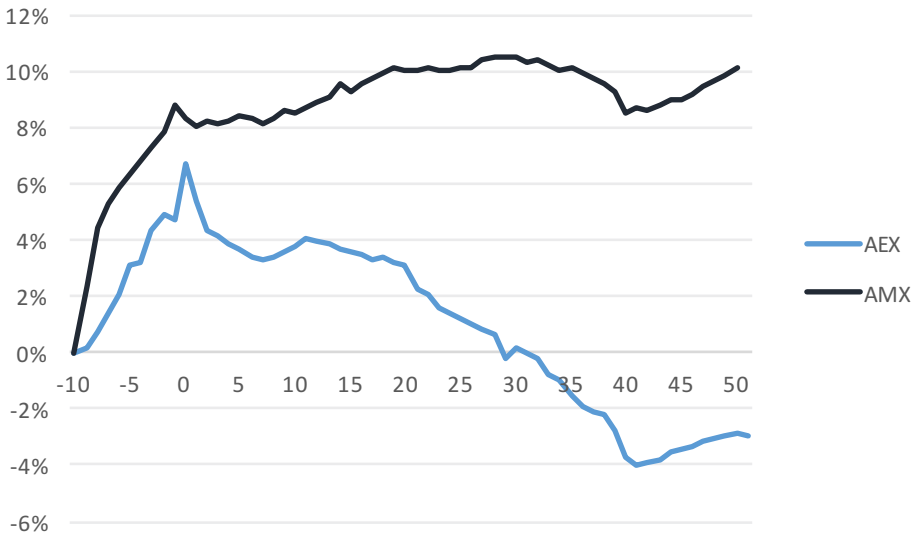
	Panel A. Inclusions			
	AEX	% positive	AMX	% positive
Initial sample	56		84	
Final sample	43		66	
Cumulative Abnormal Returns				
AD-5 to AD-1	1.15**	93%	2.03**	
AD to AD+1	0.59		1.14***	
ED-5 to ED-1	1.09		2.11**	
ED to ED+1	-1.02***		-0.04	
AD to ED +10 (CAR10)	-1.11		-0.01	
AD to ED +60 (CAR60)	-6.81**		1.13	
Turnover Ratios		%(N>1)		%(N>1)
AD/Pre	2.87***	93%	2.37***	88%
ED/Pre	9.47**	92%	6.68***	88%
	Panel B. Exclusions			
	AEX	% positive	AMX	% positive
Initial sample	54		81	
Final sample	32		43	
Cumulative Abnormal Returns				
AD-5 to AD-1	-0.78		-0.31	
AD to AD+1	-0.25		-0.02	
Ed-5 to ED-1	-3.80***		-2.22*	
ED to ED+1	-1.06		0.02	
AD to ED + 10 (CAR10)	1.21		1.32	
AD to ED +60 (CAR60)	2.38		1.98	
Turnover Ratios		%(N>1)		%(N>1)
AD/Pre	2.61**	88%	1.91*	88%
ED/Pre	6.54**	85%	5.12*	69%
Post/Pre	0.987	49%	0.93	36%

*, **, and *** indicate significance at the 10%, 5%, or 1% level, respectively

The table shows the cumulative abnormal returns and trading volume for specific event windows around changes to the AEX and AMX index from January 1983 to July 2016. AD refers to the Announcement Day, as the announcement is after market close AD indicates the abnormal return for the first trading day after the announcement. ED refers to the Effective Day, on which the revision actually takes place. For the cumulative abnormal returns, the first number shows the mean (%) and is accompanied on the right by the percentage how many of the observations in the sub-sample are positive. The significance of the mean of returns is tested with a standard t-test. CAR10 measures the cumulative abnormal return from the first trading day after the announcement to 10 days after the effective day. CAR60 refers to the abnormal return from the announcement

day to 60 days after the effective day. As explained in the research methodology, the normal turnover for the firm is calculated as the average turnover 60 days before the date of announcement. These turnover ratios are adjusted for are corrected for the relevant stock market, being either the AEX or AMX. For the turnover ratios, the first column reports medians and the second column reports the percentage of medians greater than one. The significance of the median of turnovers is tested using the binomial distribution.

Chart 1. Cumulative Abnormal Returns around the effective date of the revision for stocks included



For the AMX we see similar results for the pre inclusion effects for abnormal returns. Within the event period of 5 days prior to the revision announcement date, there is a statistically significant abnormal return of 2.03%, which is a larger effect compared to the AEX. The same logic of investors anticipating for the outcome of the review can be applied to explain this result. Next, we find an interesting difference between the two effects on the indices. Interestingly, the positive excess return does not reverse within the event period. Contrary to the AEX results, we do not find a negative return post inclusion for stocks included to the AMX. Instead, there is no significant result after inclusion at all and the positive excess price response appears to be permanent. Table 3 shows that around prior to the actual revision day the to be added stocks experience a significant positive abnormal return of 2.11%. On the revision day itself and the 10 days after the effect is very close to zero and therefore not significant. In the longer term post inclusion, the newly included stocks to the AMX show an insignificant positive return of 1.13%. Potential explanations for the temporary price effect for the AEX and the permanent price response for the AMX are discussed in section 5.3.

To examine the inclusion effects in further detail, I divide the sample per industry. As discussed in the research methodology, the sample is divided into three parts: Financial Services, Tech (including telecommunication and technology), and other firms (including the other stocks). An overview of the stocks per industry can be found in appendix 1. As the betas of the various industry vary, the difference in sensitivity to news may affect the results. Especially for the attention hypothesis, one industry may have greater attention compared to another, which may affect the results. Unfortunately, due to the sample size none of the results specified per industry is significant.

5.2.2 Trading volumes

First, we discuss the effects on trading volume of stocks promoted to the AEX index. Around the announcement date there is a significant increase in trading volume for stocks announced to be added to the AEX. Table 3 shows that the median announcement day turnover is 187% higher compared to the turnover normally measured for the firm. 88% Of all stocks added to the index experience an increase in turnover. On the effective day the effect is even larger, with 92% of all included stocks experiencing an increase in trading volume and the frequency of volume turnover exceeding the normal turnover by 8 times. The Post/Pre result shows that the effect on volume turnover gradually decreases post inclusion but is still significant. This implies that there is evidence for a permanent effect in trading volume for stocks added to the AEX index.

For the AMX the effects on trading volume are weaker and less significant. Around both the announcement and the effective day, we observe a significant increase in trading volume of about 2 and 6 times the normal turnover respectively. Interestingly, the post inclusion effect for the AMX, contrary to the AEX, is not significant.

5.3 Exclusion effects

5.3.1 Returns

The bottom part of table 3 shows the cumulative abnormal returns and changes in trading volume for stocks excludes from the index. Compared to the inclusion effects, the abnormal returns on stocks excluded from both indices are much less significant. Around the announcement date we do not find any statistically significant abnormal return. During the five days prior to the effective date the to be deleted stocks from the AEX experience a statistically significant abnormal return of -3.8%, while for the AMX this is -2.2%.

This indicates that investors sell the to be excluded stocks before the revision takes place. After the stocks have been degraded, the price response reverses soon to negligible abnormal returns.

To further investigate this pattern, we examine the negligible abnormal returns by using Merton's model of shadow cost. We focus on CAR60, which refers to the cumulative abnormal return measured from the announcement day to 60 days after the effective day. For both stocks excluded from the AEX and the AMX, the coefficient on *dShadow* is insignificant. This is most probably explained by the small sample, due to the limited data availability for number of shareholders which is required to calculate the *dShadow* (as discussed in section 3). Similar to the inclusions, also for the stocks removed from the Dutch indices the results per industry are insignificant. Like Merton's shadow cost this is most probably due to the small sample size per industry.

5.3.2 Trading volumes

Compared to the inclusion effects, the exclusion effects on trading volumes around both the announcement date and the revision effective date are weaker. Around the announcement date we observe an increase in the median turnover of 161% and 91% for the AEX and AMX respectively. For the AEX, the strongest effect is visible around the review effective date. The stocks of firms that have been deleted after market close, are traded about 6 times more than normally the day after the revision. For the AMX, this effect is slightly smaller with about 5 times. When observing the post deletion event period, there are no significant returns for both indices. Therefore, we conclude that the deletion effect on trading volume is temporary for both the AEX and the AMX index.

When comparing the inclusion and exclusion effects on trading volume for the AEX and AMX indices, two observations are interesting in particular. Firstly, contrary to the post inclusion effects on trading volume, this effect reverses soon after the changes to the index when trading volumes get back to historical levels. This temporary effect can be explained by various hypotheses, discussed in the section below. Secondly, the exclusion effects on trading volume are larger for stocks deleted from the AEX compared to stocks excluded from the AMX. This suggests that the AEX is considered by investors, probably primarily institutional funds, somewhat more important and preferred to the index containing smaller stocks.

5.4 Reconciliation with previous hypotheses

5.4.1 Inclusion effects

We start with the reconciliation of the results of this study with the previous hypotheses regarding the inclusion effects on the returns. The results discussed in section 5.1.1 confirm H1, as predicted there is a positive abnormal return around the announcement and actual inclusion day. The positive abnormal return prior announcement is consistent with the findings by Chen et al. (2013) as well, who find that stocks increase 3.17% prior the announcement date. He explains this might be due to investors who expect a flip at the effective date and are aiming to sell at that date. H3 is partially confirmed as well. H3 predicts that the positive abnormal return fully reverses during the 60 days after the event, which is only the case for the AEX. The temporary price response is evidence for the price pressure hypothesis. This is consistent with the findings of Doeswijk (2005), who finds that stocks added to the AEX outperform the market by 7.4% prior to the actual revision day. He also finds evidence consistent with the price pressure hypothesis, that predicts that prices fully reverse after the inclusion date.

These results are contrary to the study by Chen et al. (2013) who finds that the increase in price for added stocks is permanent explained by the downward sloping demand curve hypothesis. Therefore, the AMX does support this hypothesis. Another explanation for the permanent increase in stock price is provided by the liquidity hypothesis. This hypothesis predicts that once a stock is added to in this case the AMX index, the attention of investors and financial analysts related to this stock will increase. As the financial analysts will publish more public information, the asymmetric information will decrease. Consequently, the frequency of trading volume increases leading to the stock liquidity improve and thereby reducing the bid-ask spread. The permanent increase in share price can be attributed to the discount rate of return required by investors due to the value of liquidity. There are two limitations to the results of this study related to the hypothesis.

Firstly, it must be noted that stocks promoted to the AMX were already part of an index (AScX). Therefore, their information was already public and financial analysts were able to follow them. However, as Doeswijk (2005) argues, the stocks included in the largest indices, AEX and AMX, are followed more intensively by a greater public. Therefore, this study argues that the increase in attention of investors and financial analysts might be a suitable explanation. Secondly, if this hypothesis would hold for the Dutch stock market one would expect that the price response for stocks added to the AEX would also be permanent

which is not the case.

Secondly, I examine the reconciliation of the previous hypotheses regarding the inclusion effects on the trading volumes. Based on the majority of the previous research this study predicted an increase in trading volume for both inclusions as well as exclusions. The permanent increase in trading volume after inclusion is consistent with H5 for both indices and H6 only for the AEX, discussed in the previous section. The results show, as predicted by H5, an increase in trading volume around both the announcement and effective date for both indices. It must be noted that the effect on the AMX is weaker and less significant compared to the AEX. H6 is only partially supported, as the increase in trading volume appears to be temporary instead of permanent for the AMX. All hypotheses discussed in the literature review predict, either temporary or permanent, an increase in trading volume for stocks added to an index. Interestingly, Doeswijk (2005) found little evidence for evidence for effects of the AEX index revision on trading volume by examining the period from 1994 to 2001. He only found a small increase in trading volume on the revision day, but did not find significant effects for the other event dates. His findings are therefore inconsistent with the liquidity hypothesis, but do align with the price pressure hypothesis.

The permanent effect found by this study for the AEX can be explained by the liquidity, attention and operating performance hypotheses as these hypotheses predict that the increase in trading volume is permanent. Since the attention by the media and financial analysts have increased post inclusion, demand for the shares by investors will increase and therefore we observe a permanent increase in trading volume. The results related to volumes found in this study are similar to these previous studies. For example, Chen et al. (2013) found that 92% of the stocks included to the S&P500 experience an increase in turnover and the median announcement day turnover is more than two times higher than a normal day's trading volume turnover. On the effective day the effect is even larger, with 11 times the normal turnover.

On the other hand, the volume effects on the AMX are consistent with the downward sloping demand curve, price pressure and investor recognition hypothesis, since these all hypothesize a temporary effect on trading volume around revisions.

5.4.2 Exclusion effects

First, we focus on the reconciliation of the results of this study with the previous hypotheses regarding the exclusion effects on the returns. Contrary to the majority of previous literature, the results for the AEX and AMX index do not show highly significant effects around

revisions for stocks deleted from the indices. This asymmetric price response provides evidence for H2, that predicted no significant price response for stocks deleted from either the AEX or AMX. It is also consistent with both the research by Doeswijk (2005) and the investor recognition hypothesis. The absence of the price effect for deletions is explained by the investor base. While for stocks added to an index the investor base usually increases, it will leave unchanged for stocks that leave the index. The investor recognition hypothesis developed by Merton argues therefore that excluded stocks should not be affected. Chen et al. (2013) find that a significant negative coefficient for the change in the so-called shadow cost for deletions, which supports Merton's investor recognition hypothesis. It implies that an increase in shadow cost, adversely affects returns. Unfortunately, due to data availability I was not able to get significant results on the change in shadow cost. Also due to the small size sample, the results per industry for both inclusions and exclusions are not significant. Another research on trading volume performed by Doeswijk (2005), also does not find any significant effect for stocks deleted from the AEX. He only finds a weak effect around the revision day, indicating temporary price pressure. Another explanation for the asymmetric price response is related to short sale constraints. All other hypotheses discussed in the literature review are rejected, since they all predict a price increase or decrease after deletion.

When reconciling the volumes with previous hypotheses, the results support H4, similar as for the inclusion effects, for stocks excluded from both the AEX and the AMX index as well. H4 predicted that trading volume would increase around the event date for stocks excluded from the index. Around both the announcement date and the effective revision date the results support this hypothesis. The results are also consistent with another hypothesis discussed in section 4, H6. H6 related to the duration of the effect and expected that the volume effect for stocks deleted would me temporarily. For both indices we noticed a reverse in trading volume shortly after the revision event. The inclusion effects on trading volume appear to be stronger for the AEX than the AMX. This peak at the day of the index revision indicates that the index revision is somewhat more important for investors in the AEX than investors in the AMX. While the positive effect for inclusions on trading volume appears to be permanent, the decrease in trading volume of stocks deleted from the AEX and AMX is temporary.

All hypotheses discussed in the literature review predict an increase in trading volume for stocks deleted from an index, apart from the liquidity hypothesis (permanent effect), operating performance hypothesis (permanent) and attention hypothesis (no effect).

Therefore, the logic behind these latter theories, explained in the previous section, cannot be used to explain the observed effect. The first potential explanation for the temporary volume effect is provided by the downward sloping demand curve hypothesis. Another explanation might be the price pressure hypothesis. The temporary price pressure observed around the announcement and effective date, reverses within 5 to 10 days for both indices. Thirdly, the investor recognition potentially explains the temporary effect.

6 Summary and Conclusions

This study examines the inclusion and exclusion effects of the annual revision to the AEX and AMX index. By focusing on six hypotheses that have been developed in previous literature to explain the patterns in abnormal return and trading volume around the announcement date and the review effective date, the findings of this thesis contribute to the existing literature in several ways.

The price patterns around the announcement and review effective day show two main findings. First, I find a significant positive temporary price response for stocks added to the AEX. The increase in stock price ("inclusion effect") seems an easy profit opportunity for investors, but at the same appears unwarranted by fundamentals. This temporary effect on the share price is consistent with the price pressure hypothesis, that suggests that the increase in price is a reward for investors providing liquidity to the stock market. The price response is asymmetric as the results do not show significantly negative returns for stocks deleted from the index, which can be explained by the attention hypothesis. Since investor's attention increase because of the increased coverage by media and analysts for stocks added to an index, but they do not 'forget' degraded to a lower index there is only an effect for stocks promoted. Secondly, contrary to the AEX, the observed inclusion effect on returns for the AMX is permanent. This is consistent with various hypotheses such as the downward sloping demand curve hypothesis, that states the return response represents a downward shift of the demand curve of the stocks of the firm which is not caused by new positive information. Another explanation is provided the liquidity hypothesis, that argues that index revisions impact the liquidity of a stock. Inclusions result in increased liquidity with higher trading volumes and lower costs, with a one-time permanent jump in share price as the result.

The effects on volume differ compared to the results found by Doeswijk (2005), who examines the AEX revision effects from 1994 to 2001. Contrary to his findings, this study finds significant evidence for an increase in trading volume around the index revisions for both inclusions and exclusions for both the AEX as well as the AMX. The permanent effect

for stocks added to the AEX supports the liquidity, attention and operating performance hypotheses. While the temporary inclusion effect on trading volume for the AMX is consistent with the downward sloping demand curve hypothesis. For the exclusion effects on trading volume, this study finds a temporary effect for both indices. This provides evidence for the downward sloping demand curve hypothesis and the price pressure hypotheses.

In conclusion, this research adds to the limited existing literature related to the inclusion and exclusion effects on stock returns and trading volume. To the knowledge of the author it is the first study to examine the effects on the AMX. Interestingly, we find two main differences contrary to the study on the AEX by Doeswijk (2005). On the other hand, similar to Doeswijk, we find an increase in stock price for stocks added to the index. Doeswijk concluded asking why the easy profit opportunity still had been available despite growing global attention to index revisions from academics. This study concludes that the annual revision by Euronext has continued to be a party for those investors aware of the opportunity it presents. Limitations and potential interesting topics for future research are discussed in the next section.

7 Limitations and recommendations for future research

The presented results discussed in the previous section, need to be considered within the context of limitations. This section first explains the most important limitations, after which the questions that generate from this research that may be interesting to explore through future research are discussed.

One of the limitations of this study is that the absence of the price effect for deletions cannot be explained based on the investor recognition, as I do not have access to the data required to calculate the change in Merton's shadow cost. If one would have access to the number of shareholders pre and post inclusion, he or she may be able to get significant results and to proof whether there is evidence for the investor recognition hypothesis for the Dutch stock market. The absence of the price effect for exclusions could be potentially further explained by the investor base, if one would have access to the data required to calculate Merton's shadow cost discussed in section 4. Another limitation of this study is the relatively small sample size, which makes it harder to perform significant profound analyses. A larger data set would enable one to further explore results in more detail.

The author considers several areas for further development in both research methodology and scope. First, it may be interesting to focus the results on industry level. As the betas of the various industry vary, the difference in sensitivity to news may affect the

results. Especially for the attention hypothesis, one industry may have greater attention compared to another, which may affect the results. Secondly, another potentially explanatory variable to be further investigated is firm size. Next to adding various variables to the Dutch stock market indices, future research may also examine the results in a broader context. For example, by comparing the results for different countries. So far, as discussed in the literature review, most research has focused on the American stock markets, primarily the S&P500. For this study specifically, it would be interesting to investigate the patterns for other stock markets part of Euronext, such as the Belgian BEL20 and the French CAC40 indices. Another advantage of adding more markets is the increased size of the sample, which is relatively small in this study. Lastly, future research may distinguish between stocks added for the first time and stocks returning a particular index. For example, in the beginning of this year ABN Amro returned after eight years to the AEX while SBM Offshore made their debut.

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Appendix 1. Industry overview of final sample

	Additions		Deletions	
Industry	**AEX**	**AMX**	**AEX**	**AMX**
Basic Resources	2	4	2	4
Chemicals		4	1	5
Construction & Materials		7		4
Financial Services	8	4	7	3
Food & Beverage	2	5	5	4
Industrials	12	9	6	4
Media			1	1
Oil and gas	4	2	0	
Real Estate		11	2	5
Retail	4	8		6
Technology	8	9	7	5
Telecommunications	2			
Travel & Leisure	1	3	1	2
Total	**43**	**66**	**32**	**43**

Source: Euronext