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Timing of the announcement and execution of open-market share repurchases for AEX-listed firms

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PREFACE AND ACKNOWLEDGEMENTS

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Abstract

This study uses daily handpicked repurchase execution data from AEX-listed firms. It tests various motives and market-reactions for 'timing' the announcement and execution for share repurchase programs. The study uses 51 announcements and 2,077 daily repurchase executions of AEX-listed firms, in the period 2007-2015. AEX-listed firms use prior (relative) underperformance to time both announcements and executions of share repurchase programs. Firms time their announcements and executions to signal undervaluation and to support their share prices. These motives are in line with the predictions of *the overreaction* and the *contrarian-trading* hypotheses. Furthermore, there is a short-term cumulative abnormal return (CAR) after announcement of 1.20%. This is in line with economic expectations. While, there is no (longer a) long-term CAR anomaly after announcement. Overall, the results are in agreement with the findings in comparable markets and recent studies on both the announcement and execution section.

Keywords: Share Repurchases; Announcement Effect; Timing of the execution of share buybacks; AEX-listed firms; The Netherlands; AFM; overreaction hypothesis; inside-information hypothesis; risk-change hypothesis; market-timing hypothesis; contrarian-trading hypothesis

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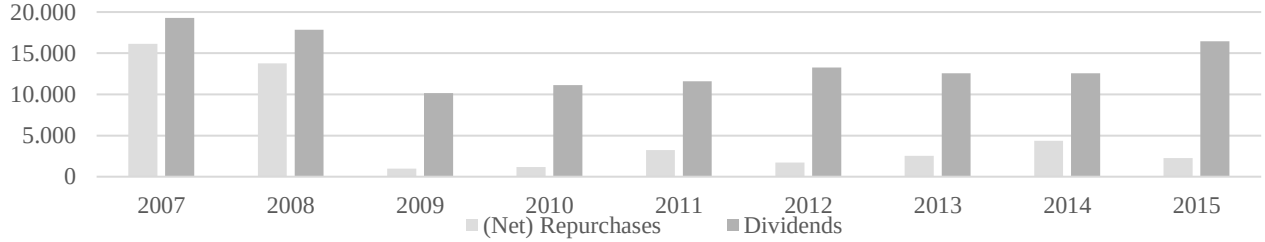
1. Introduction

In the period 1998-2008 the total value of share repurchases greatly increased worldwide (Manconi, Peyer and Vermaelen, 2014). In this period, the total value of share repurchases in the S&P 500 increased with more than 300%, to 400 billion dollars in 2008 (Yardeni, Abbott and Quintanta, 2016). In that year, the total value of share repurhcase exceeded that of dividends by 100 billion dollars in the S&P 500. After a decrease due to the financial ciris, share repurhcases again exceeded the total value of dividends in 2013 (Invesco, 2015). Making it the largest current payout policy in the US (Yardeni, Abbott and Quintanta, 2016).

In the Netherlands, firms repurchased a total value of more than 46 billion euro in the period 2007-2015. Equal to 10% of the total current value of stocks listed in the AEX, and 7% of the Dutch GDP in 2015 (CBS, 2015).[1] In the years 2007 and 2008 the total value of share repurchases almost equaled the total value of dividends, as illustrated in figure 1. However, after the financial crisis the total value of repurchases plunged.[2]

The worldwide increase of the total value of share repurchases over the past decades increased the interest in how firms approach this payout policy In the US, Canada, and other countries with large economies, share repurchases have been researched extensively. However, in the Netherlands there is very little research on this subject, especially regarding the execution. This study contributes to existing literature by researching the timing and motivation to announce and execute Open Market share Repurchases (OMR) for AEX-listed firms.[3]

Figure 1: The yearly amount of net repurchases and dividend for firms listed in the Netherlands, in mln euro. Retrieved from CBS Statline



[1] CBS uses a different measure to record the total amount of repurchases than used in this paper. Therefore, the total amount of repurchases are not the same. For example, CBS excludes share repurchases by firms which are executed in other countries

[2] This decrease is mainly caused by financial uncertainty after the financial and European sovereign debt crisis (Huang, 2016).The decrease in the total value of share repurchase announcements compared to dividends is not part of the scope of this study. Please see the study of Miller (2015) for an analysis of the stickiness of dividends compared to share repurchases before and after the crisis

[3]I use open-market share repurchases since 95% of the share repurchases are through this channel and the data is more widely available (Weston & Siu, 2003).

The dataset contains 51 announcements from the period 2007-2015, and 2,077 daily handpicked repurchase executions from 2010-2015. To my knowledge, this is the first study that uses daily repurchase executions for AEX-listed firms to test different motivations for timing repurchase actions. If firms listed in the AEX time their repurchase actions based on asymmetric information. It could indicate that firms (management) obtain rents from their information advantage. According to economic theory, this will have a negative impact on stock market participation. As it leads to distrust between the principal (shareholder) and agent (management) (Jensen and Meckling, 1976; Healy and Palepu, 2001). Eventually, this will push investors out of the market towards investments that are more transparent.

AEX-listed firms experience a short-term positive Abnormal Performance (AP) after a share repurchase announcement. While, there is no (longer) a long-term AP after announcement. Furthermore, there is strong evidence that AEX-listed firm's use prior relative (under)performance to time the announcements and executions of their share repurchases. This indicates that the motivation to conduct a repurchase action is undervaluation and supporting the share price.[4] The results are in line with previous written literature and survey studies conducted under C-level management.[5]

The study first examines market reactions on the announcement of share repurchase programs. Previous literature finds a consistent short-term Cumulative Abnormal Return (CAR) after announcement. While, prior evidence for a long-term CAR is rather weak. Especially, in studies using recent datasets and datasets from French civil law countries (Li & McNally, 2007; Fu, Huang, & Lin, 2012; Obernberger, 2014). Therefore, I only expect a significant short-term CAR after announcement. This positive short-term CAR is line with economic expectations, since a repurchase announcement releases information to the market.

AEX-listed firms indeed experience a short-term CAR of 1.20% in the three-day event-window [-1;+1] surrounding a repurchase announcement. This result is in line with previous recorded short-term CAR's in the Netherlands (Fierkens, 2010; Erken, 2010; Cremers, 2012). Furthermore, I find no long-term CAR after announcement for AEX-listed firms.

[4] Assuming that management only repurchases shares when they believe that they are undervalued, repurchasing could also point towards over-optimism of management. This is not part of the scope of this study but might supplement the findings and would be an interesting follow-up study.

[5] See, for example the results: (Baker, Powell, and Veit, 2003; Zhang, 2005; Brav, et al., 2005; Ginglinger and L'Her, 2006; Ginglinger and Hamon, 2007; Peyer & Vermaelen, 2009 and Obernberger, 2014).

Second, the study investigates the timing and motivation of the announcement of share repurchase programs.[6] It tests the *inside-information, the overreaction,* and *the risk-change hypothesis.* Which respectively predict that firms either use, inside-information, prior (relative) performance, or changes in company riskiness, to time the announcement of share repurchase programs (Ikenberry and Vermaelen, 1996; Grullon and Michaely, 2004; Peyer and Vermaelen, 2009). Management argues that one of the main motivations to repurchase is to support the share price and benefit from a relative low share price (Brav, et al., 2005). Therefore, I expect that firm's use prior underperformance to time the announcement of share repurchases. In line with the predictions of *the overreaction hypothesis*.

The results are in favor of *the overreaction hypothesis*: Firms that were the most 'beaten up' by analysts or markets, experienced the strongest CAR after announcement. There is a significant negative correlation between the subsequent CAR after announcement and both the prior raw stock performance and the change in the prior 6-month Buy-Hold-Sell (BHS)-rating.[7] This result indicates that the motivation to announce a share repurchase program is undervaluation and supporting the falling share price. Furthermore, there is insignificant evidence that management uses inside-information to time the announcement of share repurchases. Nor is there evidence that firms signal a decrease in future riskiness. This result excludes *the inside-information* and *the risk-change hypothesis.*

Finally, the study tests *the market-timing* and *contrarian-trading hypothesis.* Which, respectively predict that firms time the execution based on inside-information, or on prior (relative) underperformance (Zhang, 2005; Ben-Rephael, Oded , & Wohl, 2014; Obernberger, 2014). *The overreaction hypothesis* and *the contrarian-trading hypothesis* are related, both predict a share repurchase action after relative underperformance - I expect results in favor of the *contrarian-trading hypothesis*.

There is significant evidence for *the contrarian-trading hypothesis:* Firms undertake actual share repurchases against significantly lower-than-average prices and proxies for undervaluation drive firms' execution decision and intensity. Furthermore, there is no relationship between proxies

[6] The study neglects the *optimal capital structure hypothesis,* as it is not part of the scope of this study. This hypothesis could however supplement the results, since firms frequently state this as a motivation for a share repurchase program. It is not part of the thesis as the hypothesis is not mutually exclusive for the other hypotheses, and due to time and simplicity reasons.

[7] Peyer and Vermaelen (2009) calculate an Undervaluation-index (U-index) based on several proxies such as past performance, Book-to-Market (BM), size and repurchase motivation, and find that past performance is the best predictor. Therefore they use raw prior performance as a measure of undervaluation.

for inside-information and the propensity and intensity to execute. Nor is there a positive covariance with subsequent abnormal performance and the ability to execute against lower-than-the-average share price.[8] AEX-listed firms time the execution based on prior relative underperformance and undervaluation. This result is in line with the predictions of *the contrarian-trading hypothesis.*

Overall, the contribution to the existing literature is the use of the unique dataset. The results indicate that AEX-listed firms time the announcement and execution as a reaction to recent underperformance. This result indicates that the motive for firms to announce or execute, is to signal undervaluation and to support the share prices. The relatively low number of events used in the dataset leaves room for discussion on the interpretation of the results. A potential follow-up study could research the motivation of management from AEX-listed firms for announcing and executing share repurchases. This could increase the robustness of the result. Furthermore, this might supplement the conclusion with possible findings of managerial over-optimism and find suggestions in favor of other not researched hypotheses such as the *optimal capital structure hypothesis*.

Section 2 summarizes the existing literature on repurchase announcements and repurchase executions. Section 3 describes the methodology used. Section 4 describes the dataset. Section 5 covers the results of the conducted tests. In section 6, the robustness of the results from this research is discussed. A conclusion will be drawn in section 7. Appendix A, consists of non-essential supportive tables that summarize important takeaways from each section. Appendix B includes the econometric specifications for all formulas and models used in this study. Finally, appendix C contains a short explanation of share repurchases and their most important difference with dividends, to get the unexperienced reader up-to-date with the subject.

[8] This is an important prediction for the market-timing hypothesis from among others, Ginglinger & Hamon (2007), Obernberger (2014) and Dittmar (2015). This is because the release of positive inside-information will in part be directly incorporated by the market, resulting in a short-term CAR. While the rest would slowly leak to the market, resulting in a medium/long-term CAR. Therefore, the market-timing hypothesis predicts a positive correlation between the ability to repurchase against lower-than-average prices and subsequent abnormal performance.

2. Literature Review

This section starts with an overview of firms' repurchase announcements; thereafter literature about the execution of share repurchase programs will be covered. Finally, different hypotheses will be stated based on the existing literature.

2.1. Announcement of share repurchase programs

Ikenberry, Lakonishok, and Vermaelen (1995) were among the first researchers to conduct a data-driven research on the effect of announcing open-market share repurchases (OMR). They found a long-term CAR of 12.1% using a 4-year buy-and-hold strategy after initial announcement. The anomaly of the long-term CAR after the announcement is underpinned by several studies. Besides the long-term CAR, all previous literature also find a significant smaller short-term CAR after announcement ranging between 1% and 5%, depending on the timeframe (Dann, 1981; Vermaelen, 1981; Lakonishok & Vermaelen, 1990; Comment & Jarrell, 1991; Ikenberry & Vermaelen, 1996). While, a short-term CAR is expected since a repurchase announcement releases new information into the market, a long-term CAR is expected to disappear since investors will anticipate the returns when the anomaly becomes public.

Later studies also suggested that an announcement still leads to long-term CAR in the US. Therefore, against economic predicts, the anomaly seems to be persistent over time (Guay & Harford, 2000; Jagannathan, Clifford, & Weisbach, 2000; Weston & Siu, 2003; Maxwell & Stephens, 2003; Chan, Ikenberry, & Lee, 2004; Grullon & Michaely, 2004; Peyer & Vermaelen, 2008). Ikenberry, Lakonishok, and Vermaelen (2000) also reported a long-term CAR in Canada. They used the Ibbotson's Returns Across Time and Securities (IRATS) method combined with a Fama-French 3-factor model to calculate the long-term CAR. This approach has become standard in most recent conducted studies, as it corrects for changings risk factor over the long horizon.

Peyer and Vermaelen (2005) use private repurchase announcements to show that the premium paid in private share repurchases is insignificant. However, they still find a long-term CAR, suggesting the CAR is generated by the initial information in the repurchase announcement rather than just an increased demand on the open market. Grullon and Michaely (2004) showed that a repurchase announcement is not followed by an increase in operating performance. Rather, the long-term CAR is caused by a decrease in systematic risks and cost of capital. A repurchase announcement signals a decrease in future cash flows, making the company less volatile and therefore less risky. Investors underestimate this decrease and thus underestimate the decrease in

capital cost. *The risk-change hypothesis,* argues that a repurchase announcement and the subsequent long-term CAR are driven the decrease in the firm's risk profile. This hypothesis is closely related to the *free-cash-flow hypothesis,* which argues that when managers have less free cash, they will 'waste' less cash and generate higher Returns on the Invested Capital (ROIC).

Peyer and Vermaelen (2008) argue that the announcements and long-term positive CAR's are driven by overreaction of investors to prior bad news. They show that the long-term CAR is particularly high when stocks have experienced severe price declines half-a-year prior to the announcement (*the overreaction hypothesis*). This hypothesis is deducted from De Bondt and Thaler's (1985) economic concept that *"Extreme movements in stock prices will be followed by subsequent price movements in the opposite direction".* In *the overreaction hypothesis,* management signals to the market that it has overreacted, while De Bondt and Thaler's 'normal' overreaction hypothesis assumes no action from management. Peyer and Vermaelen (2008) reject *the risk-change hypothesis*, as they still find a long-term CAR using the IRATS method, this method corrects for changing risk-factors.

Both studies, however, disagree with *inside information hypothesis* (Grullon & Michaely, 2004; Peyer & Vermaelen, 2008), which states that the management uses positive inside information to time repurchase activities. Grullon and Michaely (2004) find no improvements in long-term company earnings, while Peyer and Vermaelen (2008) find a strong negative correlation between prior returns and future abnormal returns. This is inconsistent with the interpretation of the *inside-information hypothesis*. Finally, Pastor and Stambaugh (2003) argue that *the liquidity hypothesis* causes long-term CAR by increasing stock liquidity after the announcement. This hypothesis is rejected by almost all later studies as being the main reason for the announcement and the long-term CAR.(Manconi, Peyer and Vermaelen, 2014; Peyer and Vermaelen, 2008; and Grullon and Michaely, 2004). Fu, Huang, and Lin (2012) show that the long-term anomaly has disappeared in the US since 2002. Obernberger (2014) underpins this results by showing showing that the long-term CAR anomly has disappeared since 2004. In Canada, Li and McNally (2007) also show that the long-term CAR has disappeared.

All of the above-discussed literature conducted their research in the U.S. or Canada, countries with an English common law system. Which is characterized by relative high ownership dispersion, resulting in higher information asymmetries. Therefore, markets should react more intensely to new information release. It is expected that the announcement of share repurchase program have a higher effect in these countries (Lasfer, 2000; Matos, 2014).

This study focuses on firms listed in the Netherlands, a country with a French legal origin. French legal systems are known for their low shareholder protection, resulting in relatively high ownership concentration. Leading to relatively low information asymmetry between shareholders and management, making it more difficult for management to take advantage of any information asymmetries. Matos (2014) does not find any concluding evidence for this hypothesis; however, he finds limited support that firms in English legal origin countries show a stronger reaction to repurchase announcements. Manconi, Peyer, and Vermaelen (2014) show that countries with an English common law system have the highest short and long-term CARs after announcement. They also find that countries with the French civil law have insignificant long- and short-term CARs after announcement. Although they do find a significant short-term CAR after announcement in the Netherlands. Depending on the model used, the researchers also find a long-term CAR for Europe and the Netherlands. Overall, the results for a long-term CAR are less convincing in Europe than in the US or Canada (Manconi, Peyer, & Vermaelen, 2014)

Besides Manconi, Peyer and Vermaelen (2014), there lacks recent studies that find a significant long-term CAR in Europe. There are, however, many studies that find a short-term CAR after announcement in Europe. For example, Ginglinger and L'Her (2002) found a CAR of 0.7% in France; Rees (1996) found a CAR of 2.81% while Oswald and Young (2002) found a CAR of 1.31% in the UK. In Germany Seifer and Stehle (2003) found a 5.9% CAR, while Gerke, Fleischer, and Langer (2002) find a CAR of 7.1%. Lastly, in the Netherlands, Fierkens (2010) finds a CAR of 1.7%, while Erken (2012) finds CAR of 1% for the Benelux and a CAR of 1.1% for AEX listed firms. (Cremers, 2012). In the appendix A table 1A and table 2A, I provide an overview of the long- and short-term CAR results after announcement found in previous literature. I excluded the results of Manconi, Peyer and Vermaelen (2014) since they cover multiple markets and already have a very good overview.

In table 1, there is an overview of the predictions from the discussed hypotheses. These hypotheses either predict that the firm will perform above their expected market return as suggested by *the inside information* or *risk change hypothesis,* or it signals undervaluation due to recent underperformance as suggested by *the overreaction hypothesis*. Overall, the latter finds the most backing from the prior studies, as repurchasing firms have a significant negative correlation between prior returns and subsequent returns. This is somewhat contradicted by Grullon and Michaely (2004), who argue for the *risk change hypothesis.* The *inside information hypothesis* finds no backing, as repurchasing companies do not show an increase in company performance (Ikenberry, Lakonishok,

& Vermaelen, 1995; Ikenberry & Vermaelen, 1996; Grullon & Michaely, 2004; Peyer & Vermaelen, 2009).

Table 1: Prediction from the Announcement Hypotheses

Hypotheses	Prediction 1	Prediction 2	Prediction 3
The Inside-information	Firms show an unexpected increase in company earnings after announcement.	Firms show an increase in future operating performance after announcement.	There is no significant negative correlation between prior returns and future abnormal returns.
The Overreaction	Stocks that have experienced a relative decline in the recent months show the strongest CAR after announcement.	Companies that were relatively 'beaten up' by analyst in the prior months show the strongest CAR after announcement.	**Firms who have relative high insider ownership show the highest CAR after announcement.*
The Risk-Change	Firms that repurchase their shares should experience a decline in their systematic risk.	Firms that repurchase should experience a decrease significant decline in profitability.	Firms should have a long-term CAR after announcement when using the CTP and BHAR methods but not with the IRATS method.

* This prediction is a self-constructed prediction to underpin the results for the announcement hypotheses. In line with significant results from the other predictions will supports the argument that firms signal undervaluation with a repurchase announcement. This prediction is explained in the methodology section.

2.2 Share repurchase execution

Stephens and Weisbach (1998), using voluntarily disclosed monthly repurchase execution information from U.S. listed firms, find that the timing of the execution is negatively related to prior share performance. They also conclude that firms increase their repurchasing depending on the perceived degree of undervaluation. Cook, Krigman, and Leach (2004), who also use voluntarily disclosed monthly repurchase data from 64 U.S. firms, show no clear evidence that repurchase executions are timed preceding or following information release. However, they find evidence that NYSE-listed firms repurchase against a lower-than-average market price, suggesting that managers have some timing ability when repurchasing their stocks. This is underpinned by Brockman and Chung (2001) who use daily repurchase data from the Hong Kong Stock Exchange. They bootstrap the repurchasing firms to comparable firms within the index and find that firms repurchase against lower prices than the simulated prices derived from the bootstrapped firms. De Cesari et al. (2012) and Ben-Rephael, Oded, and Wohl, (2014) also find that firms repurchase against lower than average

market prices. However, De Cesari et al. (2012) suggest that this ability is due to abnormal price declines before announcement, while Ben-Rephael, Oded, and Wohl (2014) suggest the lower than average price is as a result of a CAR after execution.[9]

De Cesari et al. (2012) finds that a company's ownership structure is a crucial determinant for the ability to repurchase against a discount. A high insider-ownership increases the firm's ability to repurchase against lower prices while a high level of institutional-ownership decreases the firm's ability to repurchase against a discount. These are very interesting results since firstly, firms in the Netherlands tend to have a relatively high level of institutional ownership. The second reason is because repurchasing under the 'real' value will result in wealth-transfer from selling to non-selling shareholders (Barclay & Smith Jr., 1988). Since institutional shareholders are more aware of the true value of the shares, and they will not sell below that value, they will most likely profit from repurchasing against a discount. Therefore the opposite is expected.

Ben-Rephael, Oded, and Wohl (2014) find that smaller S&P 500 companies repurchase against significantly lower average market prices. Their repurchase activity was followed by a positive CAR lasting up to 3 months. They concluded that especially smaller firms repurchase strategically whereas larger firms are more focused at redistributing free cash. In France, Ginglinger and Hamon (2007), using daily repurchase data, found no evidence for repurchase execution based on positive inside information. They argue that firms time their repurchase activities for price supporting reasons which are in line with a contrarian-trading strategy. This result is underpinned by Zhang (2005) who, using a daily Hong Kong Stock Exchange dataset, found that firms repurchase after a 20-day period of relative negative share performance.

In the literatrue there are two main hypotheses regarding the execution of share repurchases. The hypotheses, based on findings in prior written literature, are able to explain timing, the difference between market and repurchase price, and subsequent returns of actual share repurchases. *The market timing hypothesis* predicts that the management has private information regarding the true value of the stock. This information advantage gives managers the opportunity to time the repurchases, resulting in a lower repurchasing price compared to the increased average market price.The second hypothesis is *the contrarian trading hypothesis,* which predicts that firms time the

[9] Both studies use the monthly data disclosed by U.S. companies as a result of the new SEC-rule. As of the beginning of 2004, US firms are required to report detailed information about their repurchase activity in their quarterly reports. SEC rule 10b-18, which was adopted on 1982, provides a voluntary "safe harbor" from liability for manipulation, when an issuer or its affiliated purchases bids for or purchases shares of the issuer's common stock, if they follow the rule's timing, price, and volume restrictions (Ben-Rephael, Oded , & Wohl, 2014).

repurchase execution after a share price decrease, and stop their repurchasing activity once the share price increases. As a result, repurchase prices are below the average market price. Obernberger (2014), using monthly US data, finds strong evidence for *the contrarian trading hypothesis*. He finds no evidence for *the market-timing hypothesis* as there are no subsequent AR after a execution. This is result is contradicted by Dittmar and Field (2015) who us a similar dataset and report a signifiant CAR after execution, and conclude that firms are able to time the market in a repurchase execution based on inside information.

Managers repurchase against lower-than-average share prices for, at least, two reasons. First, their performance evaluation or compensation may be related to repurchase program performance. Second, large shareholders could pressure managers to repurchase at low prices since they benefit the most from the wealth transfer (Barclay & Smith, 1988; Obernberger, 2014;). The second 'reason' is somewhat contradicted by De Cesari et al. (2012).

Overall, previous literature finds that firms repurchase against a discount compared to the average share price. The literature, however, disagrees whether the discount is a result of a contrarian trading strategy (Cook, Krigman, and Leach 2004; Zhang, 2005; inglinger and Hamon ,2007; De Cesari et al., 2012; Obernberger, 2014). Or whether it is due to inside information or managerial strategic timing ability as suggested by *market-timing hypothesis* (Brockman and Chung, 2001; Ben-Rephael, Oded, and Wohl, 2014; Dittmar and Field, 2015). In table 2, there is an overview of the main emperical predictions of the *contrarian-trading* and the *market-timing hypothesis* using daily data, based on predictions of prior literature.

Table 2: Main predictions of the execution hypotheses.

Hypotheses	**Prediction 1**	**Prediction 2**	**Prediction 3**
Market-Timing	A repurchase execution leads to a CAR after execution, as a result the release of inside information.	Repurchase decision and repurchase intensities are drive by positive inside information.	Firms repurchase against lower than average prices as result of timing the execution based on inside information.
Contrarian-Trading	Execution is timed after (relative) underperformance compared to the market before execution.	Repurchase decision and repurchase intensities are driven by undervaluation.	Firms repurchase against lower than average prices as a result of a recent price drop.

2.3. Hypotheses

A short-term CAR after a repurchase announcement is expected, as the announcement release positive information into the market. In line with this expectation prior literature indeed find consistent evidence that the announcement of a share repurchase program, leads to a short-term CAR. Please see appendix A table 2A, for a summary overview of the short-term CAR found in previous literature. In contrast, a long-term CAR is not expected, as it is assumed that efficient markets directly incorporate news into the share price. Furthermore, it is expected that once such anomaly has been discovered it will disappear, as investors anticipate on the anomaly. In line with this expectation recent literature indeed suggests that the long-term CAR has disappeared. The long-term CAR, was mainly found in US or Canada studies, while evidence in Europe has been relative little. Especially the difference between the legal systems in the continents, creates significant differences in asymmetric information between shareholder and management. The lower asymmetric information in the Netherlands will decrease the probability of finding a long-term CAR. This is also underpinned by Manconi, Peyer and Vermaelen (2014) who find no significant long-term CAR in countries with a French civil law system. Therefore, I expect not to find a long-term CAR after announcement. I do however expect to find a significant short-term CAR, therefore my first hypothesis is:

H1: There is a significant short-term CAR after announcement**.**

The announcement hypotheses argue different motivations for firms to announce a repurchase program. *The inside-information hypothesis* argues that firms time repurchase announcements based on positive inside-information. *The overreaction hypothesis* argues that firms time announcements as a reaction to recent relative underperformance, which has left the company undervalued. Finally, *the risk-change hypothesis* argues that firms use repurchase announcement to signal a systematic decrease in risk, as a result of a lack of new positive NPV investments. The different hypotheses are accompanied by empirical predictions that help to explain the motivation and decision to repurchase. Please see table 2 for an overview of the empirical predictions per hypothesis.

I expect that the relative low information asymmetry in the Netherlands increases the difficulty for firms to use inside-information to time announcements. I also believe that Dutch corporate culture is very transparent. With a strong focus on company performance and less engaged by share price performance compared to US firms. This cultural characteristic decreases the

likelihood of firms using asymmetric information to boost financial share price performance. Furthermore, in survey studies conducted under C-level management. Managers argue that among the main motivations to conduct a share repurchase are undervaluation and supporting the share price. This result is in line with most of the motivations found in the announcements in this dataset. Finally, studies conducted in comparable countries find backing for *the overreaction hypothesis* (Ginglinger and L'Her, 2006). Therefore, I expect that management use price supporting motives to time the announcement of share repurchase programs. Therefore my second hypothesis is:

H2: AEX-listed firms time the announcement according to *the overreaction hypothesis*.

In the execution section, there are two main hypotheses that explain the motivation and timing of companies to execute share repurchases. *The contrarian-trading hypothesi*s argues that firm's use relative underperformance to time the execution of their share repurchases. This ability ensures that firms are able to repurchase against lower than average share prices and is in line with price supporting theories. *The market-timing hypothesis* argues that firms time the execution based on inside information, firms will then benefit from the relative low price paid for the shares. This hypothesis predicts that a repurchase action release positive inside information into the market thereby resulting in a medium-term CAR. For the main empirical predictions of both hypotheses, please see table 2. In line with my expectations that firms use repurchase announcements to signal undervaluation and to support the share price. I expect similar motivations to time the execution of share repurchases. Furthermore, I expect that executions in the Netherlands will have a relative low magnitude, as the asymmetric information is low. Therefore my third hypothesis is:

H3: AEX-listed firms time the execution of share repurchases according to *the contrarian-trading hypothesis.*

3. Methodology

This thesis is divided into three sections, with each section testing a specific hypothesis. The first section discusses the method used to test both short and long-term CAR after share repurchase announcements. The second section discusses the method used to test the hypotheses that explain the timing and motivation of companies to announce a share repurchase program. Finally, I test the two hypotheses that explain the timing and motivation of companies for repurchase executions. In appendix B, there is an overview of the econometric specifications used. Appendix A (Tables 6A, 7A, and 8A) show a summary overview of the methodology per section.

3.1 Abnormal performance

3.1.1 Short-Term Abnormal Performance

The most common method used in previous studies to test for a short-term CAR is the CAR-method.[10] This method tests whether the stock performed above their *'expected performance'* within an event period by cumulatively adding the daily abnormal returns over the event period. The event period only consists out of trading-days. Abnormal returns are calculated by subtracting the predicted returns from the 'real' returns. Finally, a two-sided t-test is used to test whether the CAR is significantly larger than zero. Previous literature uses two models to calculate the predicted returns: the market model and the Fama and French three-factor model. They find no significant differences in the short-term CAR results for either models. To increase the robustness of the results, this study used both methods to calculate the predicted returns. A sign test on the CAR was also used to test whether the median is significantly different from zero.

The econometric specifications of the models used in this study are available in Appendix B (Formula 1 and 2). The study uses a prior 500-trading day estimation window to predict the returns for each company. This is in line with previously written literature and represents a 2-year period in a calendar time. The study uses Fama and French's (1993) risk-free rate, SMB and HML factors. An overview of the CAR-method and the econometric specifications of the two models used in this study can be found in appendix A table 6A, and appendix B (Formula 1 and 2) respectively.

[10] See for example Fama, Fisher, Jensen, and Roll, (1969), Dann (1981), Ikenberry, Lakonishok, and Vermaelen, (1995), Ginglinger and L'Her, (2006), Peyer and Vermaelen, (2009), and Manconi, Peyer, and Vermaelen, (2014),. For an in-depth discussion of the different methods that are used to calculate abnormal return after announcement, please see Mitchell and Stafford (2000), and Loughran and Ritter (2000).

In the second test, I exclude firms who announce a repurchase in the same week as an earnings announcement. This is to tests whether Nguyen et al.'s (2015) argument that a CAR after announcement is actually an earnings announcement drift in disguise is true.

3.1.2. Long-Term Abnormal Performance

Three methods are used to calculate long-term CAR after announcement. These are the buy-and-hold abnormal return (BHAR), the Calendar-Time Portfolio (CTP), and the IRATS-method. The BHAR-method is comparable to the CAR-method. Both methods only use trading days to calculate the CAR. However, the BHAR-method uses geometric returns, allowing it to control for compounding returns. This better reflects the investors' 'real' long-term experience. The BHAR-method can be used by bootstrapping to comparable firms or calculating predicted returns based on prior relative performance. The low number of firms in the AEX makes it hard to bootstrap firms. Therefore, this study uses a prior 500-trading day combined with a market model to predict returns.

Both CTP and IRATS methods use calendar-time to calculate the long-term CAR. They difference between the two methods is that the IRATS-method incorporates changing coefficients throughout the event period while the CTP method uses 'fixed' coefficients throughout time. The IRATS-method is advantageous in that it corrects changes in the firm's riskiness. The CTP and IRATS methods are combined with a Fama and French's (1993) 3-factor model. These econometric specifications are also used by Peyer and Vermaelen (2009) and Manconi, Peyer, and Vermaelen (2014). The latter also tests a market model and Fama and French's 4-factor model for both methods but do not find any significant differences.

To increase the robustness of the results, all three methods are used.[11] An overview of the calculation steps conducted in each method is shown in Appendix a table 7A. The econometric specifications for BHAR, CTP, and IRATS methods are presented in Appendix B (formula 3, 4 and 5 respectively). In order to test for potential exogenous effect on the long-term CAR, the events announced before the start of the 2008 financial crisis have been excluded, leaving 43 events. The sample has also been subdivided into a group that completed their program and those that did not.

[11] For an in-depth discussion of the different methods that are used to calculate the abnormal return after announcement, please see Mitchell and Stafford (2000) and Loughran and Ritter (2000). Furthermore, I did not robust-check the BHAR results as suggested by Loughran and Ritter (1991) as I already use two other methods.

3.2 Announcement hypotheses

The following sub-sections describe the model and tests used to test the prediction of each hypothesis. An overview of the predictions for each hypothesis is shown in table 1. The hypotheses tested are also able to explain the existence of a long-term CAR. Since, this study does not expect to find a long-term CAR. I only test for the timing and the motivation to announce a share repurchase program, using short and medium term market reactions. The *takeover hypothesis* and *the liquidity hypothesis* are not tested because there are insignificant results for testing (Pastor and Stambaugh, 2003; Peyer and Vermaelen, 2009; Grullon and Michaely, 2004).

3.2.1 Inside-information hypothesis

To test the first prediction, the percentage of Analyst Surprise (AS) in the quarters after announcement was compared against the average AS found in the dataset.[12] An independent two-sample t-test was used to compare the means. I robust check the results using an two-sample sign test to compare the medians. For an in-depth discussion of the AS variable, please see the data section. Peyer and Vermaelen (2009) and Manconi, Peyer and Vermaelen (2014) used the absolute long-term EPS forecast as a measure of inside-information. The inconsistent EPS forecast found in my dataset did not allow me to robust-check my results using this method.

To test for changes in future operational performance, I used the change in BHS-rating from the quarter before announcements and the quarters after announcement. The BHS-rating best reflects an increase in future operational performance (Peyer and Vermaelen, 2009). Please see the data section on the discussion of the BHS-rating. I used a paired two-sided t-test to compare whether the BHS rating significantly increases in the quarters after announcement. I robust checked the results using a paired sign test to test for difference in the medians. The period used was significantly shorter than the 4-years used by Grullon and Michealy (2004). The dataset used was very recent—less than 4 years old—so a 1-year period was used. The third prediction is a mutually exclusive prediction for the *inside-information* and *overreaction hypothesis*.[13] To test this prediction, I categorized firms that announced share repurchases into three groups based on prior relative performance. For each group,

[12] This variable measures the percentage of surprise of the analyst forecasted consensus compared to the company's announced earnings. Please see the data section to see how I constructed the CAS. The AS is publicly available and therefore reflects the level of inside information management possess. Since analyst earnings were too pessimistic, the AS was compared with the average AS found in the dataset (Dreman and Berry, 1995). Indeed, a significantly larger than zero AS was reported in the dataset.

[13] Peyer and Vermaelen (2009) argue that "*the strong negative correlation between prior returns and future abnormal returns are inconsistent with the interpretation that the inside-information hypothesis is the predominant explanation of the open market long-term CAR buyback anomaly."* The CAR after announcement should thus be independent of prior returns.

I calculated the short and medium-term CAR using a CAR-method combined with a market model returns. Please see appendix B formula 1, for the econometric specifications. I tested whether the CAR was significantly different from zero using a two-sided t-test. To increase the robustness of the result, I also used a sign test to test whether the median is different from zero. This was used in all short and medium-term CAR calculations in the announcement hypotheses section. Peyer and Vermaelen (2009) used a long-term CAR to test this prediction. Since I did not expect to find a long-term CAR after announcement, I used short and medium-term CARs. Furthermore, Peyer and Vermaelen used a larger dataset and sub-divided it into five quintiles. Since my dataset was smaller than theirs, I could not use five quintiles. The prediction was expected to be in favor of *the inside-information hypothesis* if there was no clear indication that companies that experienced the strongest prior share price decline generated a higher CAR after announcement.

3.2.2. Overreaction hypothesis

The first prediction of *the overreaction hypothesis* uses the same test as the third prediction of the *inside-information hypothesis* (Peyer and Vermaelen, 2009).[14] Therefore, I used the same results and method. For the second prediction, I tested whether the group with the highest decrease in BHS-rating prior to announcement showed the strongest CAR after announcement. The decrease in BHS-rating reflects the level of 'beeing beaten up' by analysts prior to announcement (Manconi, Peyer, and Vermaelen ,2014). To calculate the decrease, I deducted the BHS-rating 6-months before announcement from the BHS-rating 5-days before announcement. For each group, I calculated the short and medium-term CAR. The first and second prediction are the most frequent used methods to test for *the overreaction hypothesis* in previous literature.

I believe that there should be a third prediction that argues that the management signals undervaluation. As all three hypotheses argue that the firm is undervalued at announcement, the prediction is not mutually exclusive for different hypotheses. However, it increases the robustness of the argument that repurchase announcements signal undervaluation. The prediction is based on the wealth-transfer concept from De Bondt and Thaler (1985) and on the concept of Jensen and Meckling (1976) that management acts in their own interest. This leads to the third prediction that firms with the highest insider ownership will yield the strongest reaction after announcement.

[14] This prediction is in line with the economic theory of De Bondt and Thaler (1985), of which *the overreaction hypothesis* is an derivative. Peyer and Vermaelen (2009) show that prior six month share performance is the best measure for relative undervaluation. Therefore, they predict that the firms with the worst prior stock performance should yield the highest CAR after announcement. This prediction is the exact opposite of the third prediction of *the inside-information hypothesis*

The market perceives the signal as more credible when managements has more 'balls' in the game. Furthermore, management is more likely to time the announcement when the firm is most undervalued as they proportionally gain the most as non-selling shareholders. I tested this prediction by subdividing the dataset into three quintiles based on insider ownership on the day of announcement. I tested whether the group with the highest insider ownership generates a relatively higher CAR in the short-term and medium-term compared to the group with the lowest insider-ownership.

3.2.3. Risk-change hypothesis

This hypothesis assumes that a repurchase announcement signals a decrease in future growth opportunities (Grullon & Michaely, 2004).[15] To test the first prediction, I tested whether the market specific risk factor (beta) significantly decreases after announcement (Dann, Masulis, and Mayers, 1991; Manconi, Peyer, and Vermaelen, 2014). This is different from the method of Grullon and Michealy (2004),[16] Which I could not use due to dataset restrictions. To calculate the beta, I used a market model and 500 prior trading days. Appendix B formula 6, shows the econometric specifications of the model used. I subtracted the beta from the quarters after announcement from the beta 5 days before announcement. I tested whether the mean of the difference between the betas was significantly different from zero using a two-sided t-test. To increase the robustness, I also used a sign test to test whether the median is different from zero.

The second prediction argues that firms will show a significant decrease in profits after announcement as a result of lack of new positive NPV projects. I tested this prediction by comparing the percentage of change in profit with zero. The percentage of change in profit was calculated by comparing the profit from the quarters after announcement with profit of the quarter before announcement. I used a two-sided t-test to test if the change in profit was significantly different from zero. I robust checked this result with a sign test on the median of the percentage change.

Finally, Peyer and Vermaelen (2009) argue that if the market fails to correctly incorporate the change in risk after announcement, there should be a significant difference between the long-

[15] These growth opportunities are more risky than the current assets in place and therefore, the future 'risk' of the company decreases. The hypothesis is a derivative of the *the free-cash-flow hypothesis,* which states that if management has less free-cash, the firm will waist less cash on risky or negative Net Present Value (NPV) projects. This will increase the ROIC from the current assets in place.

[16] Grullon and Michaely (2004) use a one-and-three factor market model to capture the company's relative riskiness towards the market and other firms-specific factors. They then bootstrap the firms to comparable companies to see if the risk-factors significantly decrease after announcement. Grullon and Michaely (2004) use a 4-year period to test this prediction. As the AEX-index is a relative small index, I could not bootstrap to comparable firms. Therefore, I tested wheter the market specific risk-factor significicatly decreased after announcement.

term CAR results. According to them, the BHAR and CTP methods should report higher CAR results compared to the IRATS method as the latter method corrects for changing risk factors. For this prediction, I used the results from the long-term abnormal performance.

3.3 Repurchase Execution

The two hypotheses tested in this section explain companies timing and motivation to repurchase. Table 2, shows an overview of the empirical predictions from the two hypotheses. To test the different predictions from each hypothesis, this section is sub-divided into three parts. The first part tests whether firms time the execution after (relative) underperformance, or whether they use positive inside information. The second part tests whether proxies for undervaluation or proxies for inside information, influence repurchase decisions and intensities. The third section tests whether firms repurchase against lower-than-average market prices And whether this ability is a result of prior underperformance as a result of the release of inside information. Appendix A table 7A, shows a summary of the methodology for the execution section.

3.3.1. Abnormal returns surrounding executions

I tested for CAR before and after executions using various event-windows. I calculated the CAR using the CAR-method combined with a market model to predict the returns. The specifications for this method and results are the same as those used in the short-term CAR section. I corrected for frequent repurchases and overlapping events by creating an event sample without overlapping events within the event windows used. Please see the data section on how I constructed my event sample. Due to the low number of events, I could only use short-term event windows for the analysis in this section. I tested the CAR for the windows [-4;-1] and [0;+1]. The [-4;-1] window controls for a short-term prior relative underperformance compared to the market. The 4-day window incorporates the possible lag that firms experience when repurchasing their shares As firms are not allowed to trade in their own stocks. The [0;+1] time window captures the direct impact on the execution. To increase the robustness of the results, I conducted the same test on the entire execution sample. Furthermore, I tested for a medium-term CAR using a sample group with no overlapping executions within a 20-tradingday period.[17] The low number of events in the non-overlapping group imposes serious difficulties in interpreting the results. Unfortunately, this is a data

[17] I also reported the medium-term CAR for the entire execution sample and the created event sample. However, since these groups had overlapping events in the medium-term, I could not correctly interpret the results.

problem that I could not solve. Therefore, I do not draw any conclusion for medium-term performance.

The contrarian-trading hypothesis predicts that firms repurchase after a (relative) underperformance. This would imply a negative CAR, a negative raw-return or a significant lower raw performance before execution. Therefore, I did not only use the CAR before and after execution but also test for the absolute average raw return. If these results are both in favor of the prediction, the robustness of the results increases. *The market-timing hypothesis* predicts that a firm experiences a significant abnormal performance subsequent to the execution. The abnormal performance is a result of the release of inside information to the market. The abnormal performance should last up to the medium-term as the hypothesis assumes that the information will slowly leak to the market. As I could not interpret the medium-term CAR, I tested whether the short-term CAR is economically and significantly different from zero.

3.3.2. Repurchase decision and intensity

This sections tests which factors influence the decision and intensity to repurchase.[18] To test this I run an OLS regression on the repurchase dummy and intensity. These models and variables were based on previous literature.[19] For both models, I first created a basic model that only uses daily changing variables and the AS. The econometric specifications of these models are reported in formula 8 and 9 in appendix B. In the basic model, besides the AS and the relative bid-ask-spread all variables control for undervaluation. I later added firm- and program-specific variables and lagged dependent variables to control for the influence on the dependent variables. Besides the AS, all variables used were also used in similar models in prior literature and merit little discussion. The variables used have very intuitive explanations. For example, a higher decrease in the BHS-rating, or a large difference between the target and share price, both implicate stronger undervaluation. Appendix A table 13A, shows an overview of each variable used and the effect the variable should capture and why. I could not use announcement related control variables, as it is not always clear to which programs certain repurchases belong. In both models, I included firm- and time-fixed effects

[18] *The contrarian-trading hypothesis* predicts that proxies for undervaluation increase the propensity and intensity to repurchase. While, *the market-timing hypothesis* predicts that proxies for inside-information drive the decision and intensity. I use the AS to measure inside-information. The AS is updated once per quarter while, the propensity and intensity are daily variables. This decrease the ability to capture inside-information at a daily level. Therefore, I assume that a significant influence of prior undervaluation and the propensity and intensity to repurchase. Will be inconsistent with the assumption that inside-information is the main for timing executions.

[19] See for example: (Stephens & Weisbach, 1998), (Dittmar & Field, 2015), (Dittmar, 2000), (De Cesari et al., 2012), (Ginglinger & Hamon, 2007) and (Obernberger, 2014)

to control for across-firm and across-time variation. To increase the robustness, I also ran a logit model on the repurchase dummy. The results of these are shown in the appendix.

3.3.3. Bargain Analysis

In this section, I test whether firms are able to repurchase against significantly lower-than-average share price, and which factors influence the ability to repurchase against a 'bargain'.[20] I calculated the 'bargain' by comparing the average price paid at execution with the average end-of-day share price for the [-3;+1] event period surrounding each execution. Appendix B formula 8, shows how to calculate the bargain. The bargain captures prior short-term performance and the first reaction on the repurchase execution.

To test the third prediction of *the contrarian trading hypothesis*, I used a two-sided t-test to test whether the mean of the bargain significant larger than zero.[21] To increase the robustness of the results, I also used a sign test to test whether the median is different from zero. To test for the third prediction of *the market-timing hypothesis,* I regressed the subsequent CAR on the bargain.[22] In this analysis, I also added other variables that control for various market-, firm- and program-specific influences. The factors used could further explain the ability of firms to repurchase against a bargain. Similar to the approach of the previous section, I first created a basic model that only used frequently changing variables. I then added firm-specific variables to see whether they increased the explanatory value of the model. Appendix B formula 9, shows an overview of the econometric specification of the multivariate regressions on the bargain. All variables used are also used in previous literature and do not merit much discussion. To increase the robustness of the results. I also conducted the bargain analysis on the bargain of the entire sample group. I included firm-fixed and time-fixed effects to control for across-firm and across-time variation.

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[20] This method is also used by Ginglinger and Hamon (2007), Obernberger (2014) and Dittmar (2015). The bargain I constructed was slightly different than those used in previous literature as the daily dataset allowed me to use more detailed information.

[21] According to this hypothesis, firms will time the execution based on undervaluation as result of (relative) underperformance. This implies that firms will experience a negative performance before announcement. This should result in a significant lower than average price paid compared to the prior share price.

[22] *The market-timing hypothesis* predicts that the bargain is significantly positively correlated with the subsequent medium-term CAR. This should be a result of firms experiencing a positive price reaction after the execution due to the release of inside-information. The hypothesis assumes that the information will gradually 'leak' to the market. This implies that better positive information generates a higher first reaction, resulting in a higher bargain and ultimately in higher subsequent returns (Ginglinger and Hamon, 2007; Obernberger, 2014; Dittmar, 2015).

4. Data

I first discuss the company and market specific data, and then I discuss the repurchase data. Finally, I discuss some specific variables used. The dataset used consists from data from the period 2005 until the end of March 2016. It uses repurchase announcement data from the period 2007-2015 and execution data from the period 2010-2015. The two extra years in the dataset are used to calculate normalized performances. During the sample period 2007-2015, six firms left the AEX and six firms where introduced. I include only the companies that were listed during the entire period. Since the information of the new firms is only available after introduction and not all old firms fully disclose all necessary information.

4.1 Company and Market Specific Information

To conduct this research company specific and overall market data is needed. In appendix A, table 7A, there is a summary of the variables I collected for each company and the overall market. I used Bloomberg as my data source. The information is extracted using the Bloomberg excel plug-in. I constructed an automatic updatable file, which retrieves all the variables needed. There are no abnormal gaps within the dataset. However, the BHS-rating, analyst target price and forecasted earnings consensus did not report data for each separate day. I assumed that if there no data, it was the same as the trading day before. This assumption seems reasonable, as analysts forecast do not change on a daily basis often. Furthermore, I matched the AS to the corresponding quarter. The variable is normally only available on the same day of the earnings or company announcement.

During the sample period, there are no stock splits and only three reversed stock splits.[23] Of those only two-reversed stock splits, possibly effect the results of three repurchase announcements. However, correcting for the reversed stock split does not change the overall result. I correct the share price for stock splits, reversed stock splits and dividends. This is a standard option in the Bloomberg excel plug-in. Correcting for these types of events is necessary since they could influence the relative performance of the stock.

To predicted normalized returns, I compare prior firm performance to the performance of the equal weighted AEX-index. It is important to use an equally weighted index because, small firm's returns are underrepresented by a normal weighted index. Loughran and Ritter (2000) also note that especially small firms could be misvalued and along side their underrepresentation in the indexes

[23] Ahold announced a reverse stock split on 21 January 2014 and on 23 may 2007, which influenced three share repurchase programs of Ahold. ASML announced a reversed stock split on 31 may 2007, which influenced no share repurchase programs.

the right approach should be to use an equally weighted index. I robustcheck the predicted performance by also using the equal weighted STOXX-50 index. I find no different results. This is somewhat expected since the indexes have a significant correlation of 0.98.

4.2. Repurchase Announcement and Execution data

The European Union has a relative strict regulation regarding share repurchase programs and executions. This regulation sets restrictions on both the announcement and execution. For example, European firms need approval of their shareholders for a share repurchase program, while US firms only need approval of their board of directors. Furthermore, firms have a set bandwidth for the volume traded per day and a set, relative price range, which they have to publish at announcement. This legislation makes it more difficult to abuse inside-information and market conditions. The AFM even has some additional rules in for firms who repurchase in the Netherlands.[24]

The AFM states that firms should report any price-sensitive information and needs to publish this information when it is above a certain threshold. Usually, this threshold is when it effects more than 3% of the total outstanding capital but it could depend on the situation. If it falls below the threshold, the AFM and the firms are not obligated to report the corporate action publicly. Trading in your own shares is always seen as price sensitive information therefore companies always need to report this to the AFM. For trading in your own shares the minimum threshold for reporting price sensitive information publicly is Euro 5.000. Furthermore, companies are obligated to report price sensitive information directly to the market, or when reasonably possible. Firms listed in the Netherlands must report it to the AFM and post it on Bloomberg, Reuters or another known public sources, or release a company statement, according to "*artikel 5:25i, tweede lid, Wft*". (AFM, 2016) For a repurchase execution, this legislation implies that firms should report it on the same day or at latest the day after. This is indeed correct when checking the data, all reports in Bloomberg are at the same day of repurchase or on the first day of a subsequent repurchase. The AFM than stores this information in an online archive, which unfortunately is not downloadable, not sortable and shows a maximum of 50 publication, per screen. Bloomberg collects and archives, all the repurchase announcements and executions. However, they archive each statement release separate, thereby obligating the user to handpick the data. To my knowledge, this is the first study which completes

[24] (EU) No 596/2014 of the European Parliament and of the Council of 16 April 2014 on market abuse (market abuse regulation), and repealing Directive 2003/6/EC of the European Parliament and of the Council and Commission Directives 2003/124/EC, 2003/125/EC and 2004/72/EC, and in particular the third subparagraph of Article 5(6).

this detailed repurchase information for AEX listed firms. Not all repurchase executions were available. The companies that have no repurchase execution data are: Shell, Gemalto (repurchased in another country), Wolters Kluwer (not available) Randstad and Vopak (execution and announcement fall on the same day). I also miss the execution data for the first Heineken repurchase program, the investor relations from Heineken were unwilling to supplement me with their information. I did however receive the first program of ASML of their investor relations as I could not find this online either. The missing data could indicate suggestions of a sample bias. However as the information is not available, I cannot control for this potential bias. A potential way to exclude this bias for future research is to include all repurchase executions for all European countries. As the countries are subjected to the same legislation, it should be possible to retrieve the information for at least all the European Union countries.

In appendix table 11A, there is a summary overview of the firms that announced and executed during the sample period. Table 12A reports all announcements made during the sample period. Table 13A shows a summary overview of the executions per firm for the sample. The total value of announcement and executions are not the equal, as I miss some executions. In total there were 55 announcements in the sample period, I neglect the announcements that consisted of less than 0.1% of the total outstanding capital. Resulting in 51 announcements, which lasted an average of 16 months. Of which Vopak had the smallest, 11 million Euro (0.28% of total outstanding Capital) and Shell had the largest, 30 billion euro (9.09% of outstanding capital).

4.3 Constructing the execution event

An important data assumption I make is: If firms state that the repurchase activity took several days, I equally divide the activity over the days it reportedly lasted. Consequently, this leads to a somewhat inaccurate measure of the bargain and repurchase intensities. Furthermore, it could potentially decrease the number of ‘true’ events found in the event sample, since I exclude subsequent executions. However, the repurchase executions still closely reflects reality and the assumption should not strongly influence the result (Zhang, 2005). There are 63-repurchase execution that reportedly lasted multiple days. The multiple-day executions equaled a total of 306-repurchase execution days. Equal to 15% of the total execution found in the data sample. The longest multiple-day execution consisted of 14 subsequent trading days.

I create a separate event variable to correct for firm who frequently repurchase and to exclude overlapping event windows. Zhang (2005) also uses this method, he only accounts for the first

repurchase in the month. Using this method would exclude too many execution in this dataset. Therefore, I us events that did not execute within the prior 6-trading days, leaving 355 events. A longer period would not be possible, as I would lose too many events. For example, using only events that did not repurchase in the last 20-trading days leaves 22 events. As I assume that, the effect subsequent to the execution will last 2- trading days. I can only use a maximum event-window of 4-trading days prior to the execution. The relative low number of events increases the difficulty of correctly interpreting the results found. To increase the robustness of the results, I replicate each test conducted on the entire execution sample. Ditto results on both groups will increase the robustness of my results.

4.4 Variables Description

4.4.1 Analyst Surprise (AS)

AS is the percentage surprise of the analyst consensus on the quarterly earnings announcements of the company. Bloomberg uses the analyst consensus of the 5-trading days before announcement. The 5-trading days corrects for a potential leak of information before an earnings announcement. If there are no surprise figures for the quarterly earnings, the surprise of the half-year reports are used. In the dataset Boskalis, Gemalto, Randstad and Vopak do not consistently report quarterly forecasts. Using an unpaired two-sided t-test, I find no significant differences between the half-year and quarterly forecasts. Furthermore, excluding the companies from the results does not change the conclusions.

AEX-listed firms are relatively good covered by analysts. The minimum in the dataset is eight covering analysts. Firms with fewer covering analyst tend to have higher dispersion between the consensus and the real figures (Brown, 1997). I assumue that is not a problem since the minimum is already quite high.[25] Because analyst constantly cover the company and market, they incorporate any changes in the market or within the industry. For example, if the industry forecast becomes more pessimistic, analyst directly incorporate this into their expectations. I assume that analyst consensus directly incorporate any information release.[26] As the consensus also incorporates changes in the

[25] Almost all analysts report at least one of the used measure to calculate the consensus. The consensus used are the normalized EPS, normalized net income and comparable sales. The consensus are compared with normalized earnings from companies, excluding one-offs.

[26] Fired and Givoly (1982) show that analyst forecasts are better proxies for future performance than forecasts generated by time-series models.

market and industry. It is a better measure for unexpected performance compared to company specific measures (Peyer and Vermaelen, 2009).

I assume management knows the company earnings for the current and future periods. For longer horizons this assumption is not as reliable. As exogenous factors, of which manager are not aware yet, could influence future earnings of the firm. Since the forecast consensus is public, I assume that management knows the AS. Therefore, the AS captures inside-information.

The average AS reported is significantly larger than zero. To correct for this bias I compared the AS reported with the average AS of the entire sample.[27] The larger than zero AS is in line with the reported pessimistic measure of analysts' forecasts and the earnings management to beat analysts' consensus (Dreman & Berry, 1995; Abarbanell & Lehavy, 2003; Burgstahler & Eames, 2006). The consistent finding of forecasts biases in analyst consensus decreases the reliability of the measure. Overall, the use of AS, as a measure of inside information might not be fully reliable. Since the analysts' consensus are pessimistically biased and management use earnings management to beat forecasts. However, the AS is still a close measure for inside-information. Furthermore, previous literature also use analysts' forecasts to calculate inside-information. (Gullon and Michealy, 2004; Peyer and Vermaelen, 2009; Manconi, Peyer and Vermaelen, 2014)

4.4.2. BHS

Covering analysts give companies a rating on the scale from 1 to 5. 1 being a 'strong sale' and 5 a 'strong buy' advice. This advice reflect the expected future performance for a company compared to their direct peers and market. Usually, a decrease of this measure is more reliable than an increase. As a decrease worsens the relationship between the analysts bank/broker and the company. Therefore, finding a significant decrease in the BHS rating increases the reliability of the results. Peyer and Vermaelen (2009), argue that the BHS-rating is a better measure for future operational performance than absolute earnings or ratio's. They argue that ratios and absolute earnings are influenced by changes in the capital structure and do not reflect relative performance. An increased rating would reflect an increase of future expected operating performance, compared to their peers and market.

[27] This correction is not necessary for the AS used in the multivariate analyses. Since a higher AS still implies 'more' inside-information.

5. Results

This section is divided into the three sub-sections introduced in the methodology. To increase the robustness of the results, I also use a non-parametric test on the results from the abnormal performance and the announcement hypotheses. This will correct for the relative low number of events used. I report the significance of these tests in the same result tables as the normal results. The significance levels at the t-statistics indicate the normal, t-statistic significance. While, the significance levels at the results (CAR, mean etc.) indicate the significance level of the non-parametric test used.

5.1. Abnormal Performance

5.1.1. Short-Term Abnormal Performance

I find a significant short-term CAR after announcement using various event windows. For the most commonly used event-window [-1; +1], I report a CAR of 1.20% using the market model and 1.18% CAR using the Fama and French 3 factor model. In Table 3, there is an overview of the results. The minor differences between the two models used increases the overall robustness of the result. There also is a short-term CAR for firms who do not announce earnings on the same day as a repurchase announcement. I report a CAR of 1.33% using the market model and a CAR of 1.25% using the Fama and French 3 factor model. This result contradicts the suggestion that the CAR after announcement is actually an earnings announcement drift in disguise (Nguyen et al., 2015). Between the two groups, I report similar magnitudes for the CAR's in the [-1;+1] and [0:+1] event-windows. This result increase the robusteness of the conclusion that markets react positively to a repurhcase announcement. However, the effect for a repurchase announcement does seem to have a shorter period, compared to the earnings announcement drift.

Overall, the results reported are in line with previous literature and economic expectations. The short-term CAR for firms listed in the AEX is around 1.20 % for a [-1;+1] event window. This magnitude is in line with the short-term CAR's reported in previous studies using historic Benelux and Netherlands datasets. (Fierkens, 2010) I conclude that there is a positive abnormal market reaction after a repurchase program announcement. As expected over short windows, the BHAR-method produced similar results so I do not report these results.

Table 3: Short-Term Cumulative Abnormal Performance (CAR) after Announcement

Time period (Days)	Full sample, n=51				Without earnings announcement, n=31			
	Market model		Fama and French 3 Factor model		Market model		Fama and French 3 Factor model	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
CAR[-6:+6]	1.87%**	(2.53) **	2.23%***	(3.38)***	1.29%	(1.76)*	1.58%	(2.59)
CAR[-3:+3]	1.05%**	(1.71) *	1.10%**	(2.14)***	0.60%	(0.80)	0.63%	(1.13)
CAR[-1:+1]	1.20%***	(2.97)***	1.18%***	(3.38)***	1.33%***	(3.81)***	1.25%***	(3.53)
CAR[0:+1]	1.26%***	(3.10)***	1.15%***	(3.21)***	1.27%***	(3.73)***	1.15%***	(3.41)

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively. The significance levels at the t-statistics indicate the significance level for the two-sided t-test. While, the significance levels at the CAR, indicate the significance of the sign test. For the full econometric specifications of both models please see Appendix B, formula 1 and 2. The predicted coefficients are calculated using 500 days of return data from 530 to 30 days before the start of the event period.

5.1.2 Long-term Abnormal Performance

There is no long-term CAR after announcement for firms listed in the AEX. Therefore, I conclude that the long-term anomaly has indeed disappeared.[28] For the overall sample group I report a 1-year CAR of -3.90% using the BHAR-method. While, the CTP and IRATS-method respectively report a 1-year CAR of -4.62% and -1.17%. The insignificant difference between the results of the three methods increases the overall robustness of the conclusion. In table 4, there is an overview of the results from the different methods employed. Due to the relative recent dataset, not all announcements have two subsequent years of data available. For periods longer than 1-year, I only report 40 events in the overall sample. Longer periods would results in even less events. Therefore, 2-years is longest period tested.

The low number of events in the dataset increases the difficulty to correctly interpret the results. As they might be influenced by outliers. This indeed seems to be the case. In the dataset, four events report a 2-year BHAR-method CAR below -50%. While, two events report a 2-year CAR above 90% using the same method. All other companies report 2-year BHAR-method CAR's between the -35% and 45% range. Leaving out these six outliers, results in insignificant long-term CAR's. Therefore, I conclude that there is no long-term abnormal performance after a share repurchase announcement for AEX-listed firms.

[28] Although there has never been any truly robust significant result that the long-term CAR anomaly was present. For example, Manconi, Peyer and Vermaelen (2014) find a significant long-term CAR using the IRATS method but do not find any significant long-term CAR results using the Calendar-Time portfolio method.

Correcting for programs announced before the crisis, shows no significant different result. The 1-year CAR of -9.60% found in *no-crisis* group using the BHAR-method. Is lower than the CAR report in the entire sample. This effect is also reported using the CTP and IRATS-method. The negative outliers in the dataset cause this difference, since they all reside in the *no-crisis* group.

Companies, who do not finish the repurchase program, report a significant negative CAR. Using a 1-year period, these companies respectively report a CAR of -13.99%, -8.47% and -3.94% for the BHAR, CTP and IRATS-method. However, there seems to be a reversed causality. It is more likely that firms who severely underperform stop their program to support their financial positions. Looking at the reasons why firms stop their programs, this indeed seems to be true.[29] This finding indicates there are either external or firm specific influences on which management did not anticipate. These influences cannot be predicted or controlled for as they are market, or industry-specific and most of the time are not influenced by decisions of the repurchasing firm.

Furthermore, I find weak evidence that firms who finish the program, have a positive CAR in the long-term (2 years). This result indicates that firms are only rewarded once they fully commit to the repurchase action. This seems reasonable, since one of the benefits of a share repurchase action is an increased EPS. This would only be effective once the execution has really happened.

The conclusion that there is no long-term CAR after announcement is in line with results from recent studies, and studies covering countries with a French Civil law. Therefore, I conclude that the results are in line with previous literature and economic expectations. Overall, there is no long-term CAR anomaly in the Netherlands, or at least it has disappeared over time. The weak evidence that firms who finish their repurchase program generate a long-term CAR. Suggests that there is some very weak long-term signaling power in the announcement of a share repurchase program.

[29] For example: KPN and Philips stopped to support cash positions, Shell stopped due to the steep decreasing oil prices, Heineken and ASML stopped because of the merger of competitors, Ahold stopped because of their own merger, and Gemalto, DSM and RELX, stopped because of the increase future uncertainty in the markets.

Table 4: Long-term CAR using daily BHAR and weekly Calendar Time Portfolio (CTP) and IRATS method.

Time period (Trading Days)	BHAR, *full sample*		BHAR, *no crisis*		BHAR, not-completed program		BHAR, *completed* program	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
CAR[-60:-20]	0.13%	(0.72)	0.13%%	(0.64)	-0.13%	(-0.64)	0.23%	(1.00)
CAR[-1;+125]	-3.37%**	(-2.32)	-3.86%**	(-2.32)	-5.22%	(-1.70)	-0.26%	(-1.61)
CAR[-1;+250]	-5.36%*	(-1.71)	-9.60%**	(-2.73)	-13.99%**	(-2.52)	-0.15%	(-0.42)
CAR[-1;+500]	-3.90%	(-0.63)	-8.23%	(-1.03)	-21.05%**	(-2.36)	1.28%	(0.17)
Events	51(40)		37 (23)		15(12)		36(28)	

Time period (Months)	CTP, *full sample*		CTP, *no crisis*		CTP, not-completed program		CTP, *completed program*	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
CAR [-6:-1]	2.22%	(1.16)	4.05%	(1.56)	-1.55%	(-0.37)	3.51%*	(1.88)
CAR [1;+6]	-1.70%	(-1.06)	-1.05%	(-0.56)	-3.22%*	(-1.80)	-0.45%	(-0.20)
CAR [1;+12]	-1.21%	(-0.86)	-3.63%	(-1.45)	-8.47%	(-1.19)	2.22%	(0.86)
CAR[1;+24]	-4.62%	(-1.30)	-10.81%**	(-2.96)	-11.28%	(-1.37)	4.76%	(1.62)
Events	51(40)		36 (23)		15(12)		36(28)	

Time period (Months)	IRATS, *full sample*		IRATS, *no crisis*		IRATS, not-completed program		IRATS, completed program	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
CAR [-6:-1]	1.25%	(0.21)	1.35%	(0.43)	-0.75%	(-0.63)	-0.08%	(-0.09)
CAR [1;+6]	-1.37%	(-0.96)	-2.48%	(1.47)	0.59%	(0.22)	2.65%	(1.35)
CAR [1;+12]	-2.54%	(-1.16)	-3.86%	(-1.51)	-3.94%	(-0.79)	3.83%	(1.33)
CAR[1;+24]	-1.17%	(-0.30)	-8.63%*	(-1.99)	-15.02%*	(-1.87)	6.70%*	(1.99)
Events	51(40)		36 (23)		15(12)		36(28)	

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively, using a two-sided test. The number of events used are reported under each model. The number of events between the parentheses reflects the number of events using the two year event window. Please see Appendix B, formula 3, 4 and 5, for the full econometric specifications of the BHAR-method, the CTP-method and the IRATS-method, respectively. The CTP method requires a minimum of 5 events per month to calculate the alpha (CAR). The coefficients for the BHAR-method are calculated measuring 500 days of return data from 530 to 30 days.

5.2. Announcement Hypotheses

AEX-listed firms time the repurchase announcement according to the empirical predictions of *the overreactions hypothesis*. This result suggests that firms time the announcement after they have relatively underperformed and/or have been 'beaten up' by analysts. Firms react, by signaling (announcing) that the market is wrong and they are undervalued. The hypothesis suggests that the motivation for firms to announce is supporting falling share prices and to benefit from relative undervaluation. Both motivations are in line with survey results from CFO and CEO's motivation to announce repurchase programs (Baker et al., 2003; Brav et al., 2005). In table 1, there is an

overview of the empirical predictions from the different hypotheses. In appendix A 4A, there is an overview of the methods used to test each prediction of the hypotheses.

5.2.1. The inside information hypothesis

There is insignificant evidence for *the inside-information hypothesis*. Therefore, I conclude that repurchase announcement are not timed based on inside information. In table 5, there is an overview of the results used to test the predictions. I reject all three predictions, including the prediction that there is no negative correlation between prior negative returns and subsequent CAR, which is the main reason why Peyer and Vermaelen (2009) reject this hypothesis.

Firms do not significantly surprise the market in the short and long term. Although, the AS in the quarter of announcement is 4.28%. This is not significantly larger than the average AS of the entire sample. Furthermore, the negative average AS of -4.70% found in the fourth quarter indicates that firms do not show a positive long-term earnings surprise after announcement. Therefore, I conclude that firms show no unexpected abnormal earnings after announcement. Based on this conclusion, I reject the first prediction of *the inside-information hypothesis.*

There is a significant negative change in the BHS-rating of -0.12% in the fourth quarter after announcement. This result indicates that firms do not show an increase in future expected operational performance, compared to their peers. The significant decrease strongly increase the robustness of the result. As a decrease is more creditable than an increase. I reject the second prediction of *the inside-information hypothesis*.

Finally, there is significant difference between the CAR for the groups with the highest and lowest CAR. The group with the lowest return yields a significant short-term CAR of 1.93%. While the group with the highest prior return, has an insignificant negative CAR of -0.01% in the same event window. This result indicates that firms that experienced the lowest prior return to announcement show a stronger CAR after announcement. I reject the third prediction of *the inside-information hypothesis.* Therefore, I reject *the inside-information hypothesis* as motivation for firms to time the announcement of share repurchase programs. Overall, the results are in line with prior literature (Peyer and Vermaelen, 2009; Grullon & Michaely, 2004).

Table 5: Panel A: Prediction 1 & 2 of the Inside information hypothesis

Prediction 1: unexpected positive earnings				Prediction 2: Improve of future operating performance			
AS	Mean	*t*-statistic	n	BHS	Mean	*t*-statistic	N
AS_t	4.28%	(1.34)	51	ΔBHS_{t+1}	0.01	(0.23)	50
AS_{t+1}	3.72%	(1.16)	51	ΔBHS_{t+2}	0.01	(0.11)	50
AS_{t+2}	1.51%	(0.40)	49	ΔBHS_{t+3}	-0.05*	(-1.08)	49
AS_{t+4}	-4.70%	(-1.00)	46	ΔBHS_{t+4}	-0.12**	(-2.13)**	46

Panel B: Prediction 4 of inside-information hypothesis & prediction 1 of the overreaction hypothesis

Time period (Trading Days)	Lowest *prior* return, n=17		Prior return group 2, *n=17*		Highest prior return, *n=17*	
	CAR	*t*-statistic	CAR	*t*-statistic	CAR	*t*-statistic
CAR[-1:1]	1.93%***	(2.69)**	2.18%***	(3.51)***	-0.01%	(-0.01)
CAR[-1+5]	2.07%***	(2.11)**	1.62%***	(1.74)**	0.02%	(0.25)
CAR[-1:+20]	1.06%**	(0.88)	2.02%***	(1.37)	0.62%	(0.57)

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively. The significance levels at the t-statistics indicate the significance level for the two-sided t-tests. While, the significance levels from the mean and the CAR, indicate the significance of the non-parametric tests used. The AS_{t+i} is the AS in the *i* quarter after announcement, corrected for the average AS of the entire sample. The ΔBHS_{t+i} is the change in the BHS rating in the *i* quarter after announcement. The change in the BHS-rating is calculated by subtracting the BHS-rating 5 days prior to announcement from the BHS-rating *i* quarters after announcement. The CAR is calculated using a CAR-method combined with a market model to predict returns. The beta coefficient for each firm is calculated measuring 500 days of return data from 530 to 30 days before each event.

5.2.2. The overreaction hypothesis

There is significant evidence in favor of the two empirical predictions of *the overreaction hypothesis*. Furthermore, I find minor significant evidence for the third, self-added prediction. This results increases the robustness of the argument that undervaluation is among the main motives for management to announce a share repurchase program. The motivation for management to announce a repurchase programs is to signal undervaluation and to support the falling share prices. This conclusion is in line with the predictions of *the overreaction hypothesis.* In table 6, there is an overview of the results from the second and third prediction.

There is significant evidence that firms who underperformed in the months prior to announcement, experience a higher CAR after announcement. Especially, the short-term CAR is significantly larger. The results of the first prediction can be found in table 5 panel B. The lower CAR found in the medium term compared to the short term, 1.93% and 1.06%. Is in line with the expectations of the economic theory of de Bondt and Thaler (1985). The results are in line with the first prediction of *the overreaction hypothesis* and with the results from Peyer and Vermaelen (2009), who use the same method. Therefore, I accept the first prediction of *the overreaction hypothesis*.

Firms with a more negative change in the BHS-rating before announcement, report a higher CAR. The significant difference of 2.22% in the CAR for the event period [-1; +5] between the high and low group. Shows that firms who were more beaten up by analysts show a stronger reaction

after announcement. This is underpinned by the consistent positive difference between the groups for both the short and medium-term CAR. There is a insignificant difference between the high and medium group. This somewhat decreases the robustness of the result. This low difference could be a result of the relative low number of groups constructed. Previous literature also report no significant difference between the two highest groups (Manoni, Peyer and Vermaelen, 2014). Therefore, I accept the second prediction of *the overreaction hypothesis.*

There is a consistent higher CAR after announcement for firms with a higher level of insider ownership. Especially the significant difference between the high and low group of 1.27% in the CAR for the [-1;+1]. Shows that markets react more strongly to announcement of firms with a higher level of insider ownership. This result indicates that markets indeed realize that management signals undervaluation. The market realizes that the signal is more creditable when management has a higher stake in the company. Since, management proportionally gains the most as non-selling shareholder. Therefore, I accept the self-proposed third prediction.

Overall, there is significant evidence that firms who underperformed before announcement, generate a higher CAR after announcement. Therefore, I conclude that management uses an announcement to signal that the firm is undervalued due to an overreaction from the market. This conclusion is in line with the conclusion from survey studies under C-level management, and studies using comparable datasets.[30]

Table 6: Overreaction predictions test, prediction 2 and 3

Time period (Trading Days)	Prediction 2: *Prior Δ6m decrease in analyst rating*				Prediction 3: *Insider-ownership at announcement*			
	Low	Medium	High	*High-Low*	Low	Medium	High	*High-Low*
CAR[-1:1]	0.45%	1.58%**	2.23%***	1.78%**	1.12%*	0.42%	2.39%***	1.27%
	(0.48)	(2.10)**	(2.70)**	(1.42)	(1.73)	(0.61)	(3.08)***	(1.42)
CAR[-1+5]	-0.07%	1.94%***	2.15%***	2.22%***	1.31%	0.86%	1.91%***	0.60%
	(-0.07)	(1.82)**	(2.08)**	(1.74)*	(1.25)	(0.91)	(1.84)*	(0.83)
CAR[-1:+20]	0.77%	2.34%**	1.17%**	0.38%	0.37%	2.25%**	0.93%	0.56%
	(0.31)	(2.06)**	(1.08)	(0.19)	(0.32)	(1.74)*	(0.71)	(0.47)
Events	17	17	17	n.a.	17	18	16	n.a.

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively. The significance levels at the t-statistics indicate the significance level for the two-sided t-test. While, the significance levels at the CAR, indicate the significance of the sign test. The CAR is calculated using a CAR-method combined with market model to predict returns. The beta coefficient for each firm is calculated measuring 500 days of return data from 530 to 30 days before each event. The change in prior 6 months BHS rating, is calculated by subtracting the 6 months BHS-rating before announcement from the BHS-rating 5 days before announcement. The events with the largest decrease are in the high quintile group. I the firms with the highest insider ownership on the day of announcement are in the high category.

[30] See for example: See for example the results of (Baker, Powell, & Veit, 2003), (Chan, Ikenberry, & Lee, 2004), (Brav, et al., 2005), (Ginglinger & L'Her, 2006), (Peyer & Vermaelen, 2009) and (Manconi, Peyer and Vermaelen, 2014)

5.2.3. The risk-change hypothesis

I reject *the risk-change hypothesis* and conclude that there is no significant decrease in systematic risk after announcement. The results are in agreement with the results of several previous studies who also reject *the risk-change hypothesis* (Ginglinger & L'Her, 2006; Peyer & Vermaelen, 2009; Manconi, Peyer, & Vermaelen, 2014).

In table 7, there is an overview of the changes in the company beta between the 5 days before announcement and the subsequent quarters after announcement. There is a significant positive increase in the beta of 0.05 in the fourth quarter after nnouncement. This is in constrast with the predicted decrease in the riskiness and thus in the beta. This rejects the prediction that firms become significant less risky after announcement. The result is in line with the result found by Dann, Masulis, and Mayers (1991) and Manconi, Peyer and Vermaelen (2014) who both conclude that the beta's do not significantly change after announcement.

Furthermore, the consistent positive increase in proft after announcement contradicts the second prediciton. Correcting the profit for changes in capital structure produces similar results so I dot not report these results. Therefore, I reject the second prediction. Finally, I report no significant difference between the long-term CAR using the IRATS and BHAR and CTP methods. The IRATS method should incoprorate changes in riskiness and thus report lower long-term CAR. All three predictions of the risk-change hypothesis are rejected. Therefore, I conclude that firms do not signal a decrease in future risk with a share repurchase announcement.[31]

Table 7: Prediction 1 and prediction 2 form the risk-change hypothesis.

Prediction 1: Change in company Beta				Prediction 2: Decrease in Company Profit			
$\Delta\beta$	*Abs. diff*	*t*-statistic	n	% $\Delta\pi$	*% diff*	*t*-statistic	n
$\Delta\beta_{t,t+1}$	0.01	(1.64)	51	$\%\Delta\pi_{t,t+1}$	0.23%*	(0.69)	37
$\Delta\beta_{t,t+2}$	0.02	(1.92)*	51	$\%\Delta\pi_{t,t+2}$	0.18%	(1.46)	37
$\Delta\beta_{t,t+3}$	0.05*	(2.87)**	50	$\%\Delta\pi_{t,t+3}$	0.03%	(0.38)	36
$\Delta\beta_{t,t+4}$	0.05*	(2.08)*	47	$\%\Delta\pi_{t,t+4}$	0.03%	(0.19)	33

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively. The significance levels at the t-statistics indicate the significance level for the two-sided t-tests. While, the significance levels at the mean, indicate the significance of the non-parametric tests used. The company Beta is calculated per month using the preceding 500 trading days and a market model. In appendix B, formula 8 there is an econometric specification of the model used. The $\Delta\beta_{t,t+1}$ is calculated by subtracting the market specific risk beta of t quarters before announcement from five days before announcement Beta. The percentage change in profit is calculated by dividing the change in comparable net income of the *i* quarter after announcement with the comparable net income the quarter before announcement, by the comparable net income the quarter before announcement. I excluded companies who announced before the crisis.

[31] I do however use a significant shorter period than Grullon and Michaely (2004), so I cannot account for potential risk-changes in the 'very' long-term.

5.3. Repurchase Execution

There is significant evidence in favor of the empirical predictions of *the contrarian-trading hypothesis*. Therefore, I conclude that firms' motivation to execute a repurchase: Is to support falling share prices and to benefit from the relative low share price. Although, the economic significance of the results are low, I find that firms repurchase after relative underperformance. Furthermore, undervalued firms repurchase more often and more intensely. Companies execute against a significant bargain and there is a positive covariance between the relative intensity of an execution and the bargain. All of which are in line with the expectations of *the contrarian-trading hypothesis*. First, I discuss the results of the (relative) abnormal performance before and after a repurchase. Second, I discuss the results of the analysis on the propensity and intensity to repurchase. Finally, I test for a bargain at execution and test which factors influence the bargain.

5.3.1. Abnormal Performance

There is minor significant evidence that firms time the execution after they relatively under-perform. In table 8 panel A, I report a significant negative CAR of -0.25% before execution [-4;-1] for the event sample. There is no evidence that firm's time the execution based on positive inside-information. As there is no medium-term abnormal performance after execution. The results found are in line with the conclusion of studies conducted in comparable markets with comparable datasets (Zhang, 2005; Ginglinger and Hamon, 2007). However, the economic significance of the CAR-results are low. The CAR before and after announcement is not significantly larger than the average relative bid-ask-spread found in this dataset. This problem is also reported by Zhang (2005). The relative low CAR is however expected. As executions release relative little information, especially compared to the announcement of share repurchase programs.

I also test for the absolute raw performance in the days surrounding repurchase executions. I find insignificant results for a negative average raw performance prior to execution. However, using an unpaired t-test to compare the average [-4;-1] raw return with the average raw return throughout the sample. I report that it is significantly smaller. Other raw returns show no significant difference compared to the overall average raw return. This result indicates that firms use prior underperformance to time the executions. This increase the robustness of the significant negative short-term CAR before execution. Furthermore, the negative CAR before execution is also reported in the average CAR per firm. These averages are calculated using only the 'event' CAR's per firm. The results are in line with the first prediction of *the contrarian-trading hypothesis* and previous

survey studies that report that firms use repurchase executions to support share prices (Brav, et al., 2005; Zhang,2005; Ginglinger and Hamon, 2007).

In panel B, I show the [-4;-1] and [0; +1] CAR for firms subdivided per quintile on firm or program specific factors. I find insignificant evidence that market-to-book, repurchase frequency or repurchase size have an influence on the timing of executions based on relative prior and subsequent abnormal performance. However, firms with a low market-to-book show stronger reactions to repurchases executions. Indicated by the 0.33% difference between the high and low group. This is in line with the argument that executions signal undervaluation, as these companies are expected to be the most undervalued (Ikenberry and Vermaelen, 1996). Furthermore, I report that that events in which the relative intensity is higher, show a stronger negative CAR before execution. The significant negative CAR of -0.45% in the [-4;-1] event window, indicates that firms increase the intensity when they relative underperformed. The results that the CAR subsequent to execution is smaller for events in which the relative intensity is high, is not in line with expectation and seems puzzling. Overall, the lack of significant results is not in-line with economic expectations and prior literature. The lack of significant results could indicate that several relative large and frequent repurchases or outliers influence the overall dataset. This possible influence decreases the overall robustness of the result. Therefore, I cannot draw any conclusions on the sub-division between program or firms specific factors.

Overall, the results are in favor of the first prediction of *the contrarian-trading hypothesis*. While, there is no evidence for the first prediction of the market-timing hypothesis. As there is no medium-term CAR after execution, and the short-term CAR after executions is economically insignificant. Furthermore, there also is no significant medium-term CAR even when including overlapping events. This should inflate the medium–term CAR due to the positive influence of the short-term CAR per execution. Therefore, I conclude that the minor subsequent CAR is not generated by a release of positive inside-information, but is a result of a signal of undervaluation due to relative underperformance before the execution. Therefore, I accept the first prediction of *the contrarian-trading hypothesis*. Although the conclusion is in line with earlier findings in comparable studies and markets, the economic significance of the results is far less convincing (Zhang, 2005; Ginglinger and Hamon, 2007).

Table 8: CAR for Netherlands based firms in the surrounding days of a repurchase execution.

Panel A: CAR and average raw-return per event split

		Window, (days)			
	N	**[-20;-5]**	**[-4;-1]**	**[0;+1]**	**[2;+20]**
Entire Sample					
CAR		*0.49%***	-0.07%	0.10%**	*0.11%*
p-value	*2,077*	*(5.33)*	(-0.62)	(2.13)	*(1.02)*
Avg. raw Return		*0.07%****	0.06%*	0.03%*	*0.05%**
p-value		*(9.40)*	(4.06)	(1.75)	*(6.17)*
Event sample					
CAR		*0.37**	-0.25%**	0.25%**	*0.15%*
p-value	*355*	*(1.69)*	(-1.93)	(2.15)	*(0.59)*
Avg. raw Return		*0.05%***	-0.16%	0.05%	*0.05%**
p-value		*(2.25)*	(-0.44)	(1.45)	*(2.04)*
No-overlapping event within 20-trading day period					
CAR		0.39%	0.06%	0.34%	-1.11%
p-value	*22*	(0.50)	(0.46)	(1.00)	(-1.15)
Avg. raw Return		-0.64%	0.05%	0.18%	-0.01
p-value		(-1.00)	(0.43)	(1.57)	(-1.29)
Robustness check per firm					
CAR	*9*	*-0.32%*	-0.48%*	0.10%	*-0.12%*
p-value		*(-0.51)*	(-1.22)	(0.10)	*(-0.19)*

Panel B: Split on firm,- and program-specific factors, using the event sample

	High	**Medium**	**Low**	**High-Low**
By Market-to-Book ratio				
CAR[-4;-1]	-0.06%	-0.29%	-0.40%*	0.33%
p-value	(-0.26)	(-1.32)	(-1.86)	(1.05)
CAR[0;+1]	-0.03%	0.39%*	0.38%**	-0.40%
p-value	(-0.13)	(1.89)	(1.97)	(-1.47)
N	*118*	*118*	*119*	
By number of actual repurchases				
CAR[-4;-1]	-0.23%	-0.28%	-0.24%	-0.01%
p-value	(-1.04)	(-1.21)	(-1.09)	(-0.01)
CAR[0;+1]	0.45%**	0.16%	0.13%	-0.32%
p-value	(2.27)	(0.79)	(0.65)	(-1.18)
N	*120*	*121*	*114*	
By relative repurchased Intensity				
CAR[-4;-1]	-0.45%*	-0.15%	-0.15%	-0.29%
p-value	(-1.88)	(-0.72)	(-0.70)	(-0.88)
CAR[0;+1]	0.05%	0.33%	0.35%*	-0.31%
p-value	(0.28)	(1.59)	(1.73)	(-1.15)
N	*118*	*118*	*119*	

The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively, using a two-sided t-test. The CAR is calculated using a CAR-method combined with a market model. Beta coefficients for each firm are calculated measuring 500 days of return data from 530 to 30 days before the start of each event. The average raw returns is the average compounded return for the event period. The Market-to-book quintile is determined relative to the market-to-book ratios for all firms on the AEX, who execute a repurchase in this dataset. The quintile for the number of actual repurchase corresponds to the number of repurchases executed during the last three months. Relative repurchased size measures the executed total value of shares as a percentage of total value of shares outstanding. The high-low is tested by comparing the means of both groups using an unpaired two-sample t-test. The numbers in the main entries are the CAR's for the various event windows and the numbers in brackets, are the corresponding t-test values. The robustness check per firm uses the average CAR per firm for the event period.

5.3.2. Repurchase Intensity and Repurchase Dummy

Using an OLS on the repurchase dummy and repurchase intensity, I find that proxies for undervaluation have the correct coefficient sign towards repurchase propensity and intensity. There is no evidence that inside-information influences the propensity and intensity to repurchase. Therefore, I reject the second prediction of the market-timing hypothesis and accept the second prediction of the contrarian-trading hypothesis. Furthermore, I find that control variables for the *excess capital hypothesis* and *the optimal leverage hypothesis* also significantly influences the propensity and intensity of executions. The results are in line with findings of previous literature. In table 10, there is an overview of the results for the repurchase dummy analysis. In table 11, there is an overview of the results on the repurchase intensity analysis. In table 9 there is an overview of the statistical descriptive of the variables used and in table 13A there is an overview of the variables used and which effect they capture.

For each analysis, I use a base model which only consists of daily changing variables and the AS. After which I separately add several firm and program specific control, and lagged-dependent variables, respectively. Overall, the explanatory power of the models is low, the model to explain the variation in the linear probability model (repurchase dummy), explains only 20% to 22%. In appendix A table 8A, I report a logit model on the repurchase dummy, which shows no significant different results. The models that should explain the variation in the repurchase intensity, and do not use a lagged dependent variable, only explain 5% to 7% of the variation. These relative low explanatory powers are also recorded in previous studies. Adding a lagged dependent variable greatly increase the explanatory power. However, it also arise serious spurious relationship questions. This endogeneity problem falsely increase the R^2 of the model and creates a model which is not BLUE and inconsistent.

The models experience multicollinearity problems between the firm fixed effects and the variables company size and market-to-book. Which seem to be very intuitive, as company size and market-to-book variables are relatively fixed per firm over time. The multicollinearity problem inflates the standard errors of the coefficients. However, the OLS is still BLUE. In appendix A table 9A, I show the models used without firm and time fixed effect which solves the multicollinearity problem. The results found in these models do not show significantly differ from the results reported without correcting for the issue. I correct for homoscedasticity and serial correlation using a HAC-Newey-West correction in each model. The models experience no stationarity or further endogeneity

problems. The minor significant differences between the results of the models increases the robustness of the overall result.

The significant negative coefficients for the CAR [-4;-1] in the repurchase dummy model, indeed confirms that firms time the execution based on relative underperformance before execution. Furthermore, the negative coefficient for the average raw returns, which according to Peyer and Vermaelen (2009) is the best indicator for undervaluation, suggest that firms time the repurchase execution based on undervaluation. This conclusion is underpinned by the significant positive coefficient for the target price deviation. Indicating, that the further a stock relatively trades from its target price, the more likely they are to repurchase. The result that undervaluation influences executions actions, is also found in the repurchase intensity model. Both the BHS-rating and the Target Price variables have the correct expected significant coefficients. Furthermore, the positive significant coefficient for the prior relative volatility before execution, show that events with a higher repurchase intensity, experienced a relative higher volatility prior to execution. High volatility is an indication for mispricing and this increasing the chance of being undervalued. These results are in line with the *contrarian-trading hypothesis* and *undervaluation hypothesis* (Ginglinger & Hamon, 2007). There is insignificant evidence that companies time the repurchase decision or intensity based on inside information. As there is no positive covariance between the AS and the propensity and intensity to repurchase. This result rejects the empirical predictions of *the market-timing hypothesis*.

Overall, the coefficients from the independent variables in the basic model are in line with previous literature and economic expectations. However, I do not find a negative covariance between liquidity (relative bid-ask spread) and repurchase decision or intensity, in contrast to Hillert et al. (2012). This difference probably arises from the difference of the datasets. As the monthly liquidity is influenced by the actual repurchase, while the previous day liquidity levels are not influenced by a repurchase execution. Furthermore, most of the added firm-specific variables have the expected signs for their coefficients. However, the negative coefficient for company size in the repurchase intensity model is not in line with prior literature. This could be a results of the relative low number of firms used in this dataset, which makes it difficult to interpret the firm specific effects correctly.

In line with Obernberger (2014), I find that institutional-ownership has a positive covariance with the repurchase decision and intensity. He predicts that one the motivation for management to execute a repurchase is that institutional-owners push companies to execute, as they relatively

benefit as a non-selling shareholder. Furthermore, I find that firms with higher insider-ownership also repurchase more and more intense (Barclay & Smith, 1988). Combined with the finding of a larger than zero bargain, it could implicate that management uses personal incentive to execute a repurchase. Finally, I report that cash-to-assets and leverage both have the expected coefficients. These results indicate that the *excess capital hypothesis* and *the optimal leverage hypothesis* also influence the execution propensity and intensity.[32]

Overall, the results mostly agree to the empirical predictions of *the contrarian-trading hypothesis*. As I find a significant negative covariance between repurchases propensity/intensity, and prior CAR/average raw returns. Furthermore, I find that most other proxies for undervaluation all increase the propensity and intensity to repurchase. However, most of the time-series variation still remains unexplained which is also recorded in previous literature. This confirms the suggestion that there are other undiscovered influences on the repurchase action.

Table 9: Descriptive statistics of the Repurchase Dummy and Intensity analysis

Variable	Observations	Mean	Median	Std. error	Min.	Max.
Repurchase Intensity, *%*	2,077	0.34%	0.11%	0.01%	0.01%	4.44%
Repurchase Event, *%*	13,886	0.05	0.00	0.00	0.00	1.00
Avg. Raw Return [-4;-1], *%*	13,886	0.15%	0.30%	0.03%	-45.85%	20.64%
Relative Bid-Ask Spread, *%*	13,886	0.08%	0.07%	0.00%	-0.71%	2.58%
Volatility, %	13,843	0.62%	0.52%	0.01%	0.03%	11.22%
Company Size, *%*	13,886	554.74	146.20	9.35	28.04	4,822.40
Market-to-book, *ratio*	13,886	2.97	2.11	0.02	0.27	14.41
Cash-to-assets, *%*	13,886	9.66%	6.71%	0.07%	1.09%	48.35%
Leverage, *ratio*	13,886	90.31	42.74	1.05	4.43	964.07
Δ3M-BHS rating, *abs*	13,780	0.00	0.00	0.00	-0.77	0.81
Target Price Deviation, *%*	13,857	5.14%	7.27%	0.16%	-40.40%	107.97%
Analyst Surprise, *%*	13,884	15.33%	4.00%	0.50%	-350.00%	392.00%
Insider ownership, %	13,839	0.58%	0.35%	0.01%	0.00%	5.30%
Institutional ownership, %	13,838	44.03%	41.55%	0.14%	6.94%	84.39%

Repurchase intensity is calculated by the total value of shares repurchases divided by the total value of outstanding shares Repurchase Event is a dummy variable which is 1 on a repurchase day and 0 on a non-repurchase day. AVG raw return is the average raw return for the event period. . The relative average Bid-Ask spread is g the average bid-ask spread for the preceding 2-days divided by the average share price over those days. The volatility is based on the previous 4-day stock volatility, divided by the average share price of the event period. Company Size is the total assets at the time of repurchase; I excluded Financial Institutions (FI). The market to book ratio is the market value divided by the book of the equity value at the day of the execution, I excluded FI's. The Institutional ownership is the percentage of shares outstanding held by institutions, based on holdings data collected by Bloomberg. Insider ownership is the percentage of shares outstanding held by insiders, based on holdings data collected by Bloomberg.

[32] Furthermore, this underpins that management uses repurchases as a way to influence their capital structure. Survey results indicate that these are among the 'less important' reasons to execute and announce a repurchase program (Brav et al. , 2005).

Table 10: Repruchase dummy analysis-probit model

	(1) Repurchase Dummy	(2) Repurchase Dummy	(3) Repurchase Dummy	(4) Repurchase Dummy	(5) Repurchase Dummy	(6) Repurchase Dummy	(7) Repurchase Dummy
Avg. Raw Return	-0.387**	-0.412**	-0.452**	-0.439**	-0.417**	-0.480**	-0.441**
[-4;-1], %	(-2.16)	(-2.24)	(-2.45)	-(2.38)	-(2.24)	(-2.18)	(-2.12)
Relative Bid-Ask	0.468	0.614	0.517	0.460	0.409	0.283	0.183
Spread, %	(0.45)	(0.63)	(0.49)	(0.43)	(0.38)	(0.24)	(0.24)
Volatility, %	-0.004	0.039	0.010	0.016	0.036	0.129	0.112
	(-0.03)	(0.30)	(0.08)	(0.12)	(0.26)	(0.89)	(0.75)
CAR[-4;-1], %	-0.049*	-0.050*	-0.054*	-0.055*	-0.053*	-0.062**	-0.059*
	(-1.66)	(-1.71)	(-1.83)	(-1.86)	(-1.80)	(-1.99)	(-1.90)
Δ3M-BHS	0.002	0.113	0.183	0.166	0.126	0.412	0.409
rating, abs	(0.01)	(0.37)	(0.60)	(0.54)	(0.41)	(1.31)	(1.31)
Target Price	0.030***	0.035***	0.043***	0.042***	0.041***	0.035***	0.031**
Deviation %	(3.57)	(3.92)	(4.08)	(4.02)	(3.99)	(2.94)	(2.58)
AS, %	-0.002	-0.003*	-0.003*	-0.003	-0.003	-0.003*	-0.003*
	(-1.40)	(-1.70)	(-1.63)	(-1.54)	(-1.32)	-(1.84)	-(1.83)
Company Size		0.872***	0.595	0.685	0.374	0.266**	0.195**
(ln)		(2.15)	(1.34)	(1.51)	(0.78)	(4.04)	(3.85)
Market-to-book			-0.849*	-0.713	-0.888*	1.124*	0.964
(ln)			(-1.77)	-(1.55)	(-1.90)	(1.88)	(1.62)
Insider				0.130	0.136	0.203**	0.166*
Ownership, %				(1.52)	(1.60)	(2.36)	(1.88)
Institutional					0.014*	0.034**	0.026**
Ownership, %					(1.85)	(3.82)	(2.68)
Cash-to-assets, %						0.092***	0.078***
						(5.10)	(4.10)
Leverage, %						-0.011**	-0.010***
						(-3.48)	(-3.15)
Days since last repo							-0.107***
							(-3.20)
Constant	-2.125***	-10.236**	-6.210	-7.364	-5.139	-27.676***	-25.238***
	(-10.23)	(-2.72)	(-1.38)	(-1.62)	(-1.10)	(-4.86)	(-4.45)
Adj. R2	0.2006	0.2019	0.2019	0.2033	0.2041	0.2175	0.2198
Observations	12,337	12,337	12,337	12,337	12,337	12,337	12,337
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

The dependent variable is the dummy for a repurchase at the selected event sample, which is 1 at an execution and 0 when there is no execution. The avg. raw return is the average compounded raw return for the trading days during the event period. The relative bid-ask spread is the average bid-ask spread for the preceding 5-days divided by the share price over those days. The volatility is based on the relative previous 5-day stock volatility. The CAR is calculated using a CAR-method combined with a market model. Beta coefficients for each firm are calculated measuring 500 days of return data from 530 to 30 days before the start of each event. Company size is the natural logarithm of the total assets at the repurchase day, I exclude FI's from the regression. Market to book ratio is natural logarithm of the market value divided by the book value of the equity at the day of the execution. Cash-to-Asset is cash divided by total assets. Leverage is calculated as the average total assets divided by average total common equity. The Δ3M BHS rating is the 3-months change in the BHS-rating. The target price deviation is the percentage of the difference between the current share price and the analyst target price. The AS is the percentage of surprise for analyst expected figures compared to the figures of the current quarter. Insider and institutional ownership is the percentage of shares outstanding owned by insiders of institutions, respectively.

Table 11: Repurchase Intensity analysis

	(1) Repurchase intensity	(2) Repurchase intensity	(3) Repurchase intensity	(4) Repurchase intensity	(5) Repurchase intensity	(6) Repurchase intensity	(7) Repurchase intensity
Avg. Raw Return	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006	-0.006
[-4;-1], %	(-1.10)	(-1.15)	(-1.19)	(-1.20)	-(1.15)	-(1.15)	(-1.15)
Relative Bid-Ask	0.014	0.011	0.013	0.013	0.012	0.016	0.018
Spread, %	(0.68)	(0.54)	(0.58)	(0.58)	(0.55)	(0.74)	(0.83)
Volatility, %	0.14**	0.012**	0.011*	0.010*	0.011**	0.011**	0.011*
	(2.40)	(2.16)	(1.91)	(1.86)	(2.02)	(1.95)	(1.86)
CAR[-4;-1], %	0.000	0.000	-0.000	-0.000	0.000	-0.001	-0.001
	(0.06)	(0.01)	(-0.24)	(-0.26)	-(0.18)	(-0.48)	(-0.49)
Δ3M-BHS	-0.003**	-0.004**	-0.003**	-0.003**	-0.003**	-0.003**	-0.003**
rating, abs	(-2.29)	(-2.39)	(-2.10)	(-1.97)	(-1.99)	(-2.12)	(-2.22)
Target Price	0.006***	0.006**	0.012***	0.001***	0.001***	0.001***	0.001***
Deviation %	(2.47)	(2.65)	(4.41)	(4.53)	(3.98)	(3.68)	(3.50)
AS, %	-0.004*	-0.000	-0.000	0.000	0.000	-0.000	0.000
	(-1.78)	(-1.49)	(-0.06)	(-0.06)	(0.04)	(-1.64)	(-1.28)
Company Size		-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
(ln)		(-4.75)	(-6.01)	(-5.99)	(-6.63)	(-4.77)	(-3.98)
Market-to-book			-0.001***	-0.001***	-0.001***	-0.001**	-0.001**
(ln)			(-5.59)	(-5.46)	(-5.96)	(-1.92)	(-1.90)
Insider				0.002	0.002	0.005*	0.005*
Ownership, %				(0.71)	(0.73)	(1.86)	(1.66)
Institutional					0.001**	0.001***	0.001***
Ownership, %					(2.85)	(5.25)	(5.11)
Cash-to-assets, %						0.005***	0.005***
						(6.19)	(5.95)
Leverage, %						-0.000	-0.000
						-(0.59)	-(0.63)
RI, i-1							0.798***
							(24.61)
Constant	0.001***	0.006***	0.007***	0.008***	0.008***	0.003***	0.005***
	(7.90)	(5.26)	(5.83)	(6.38)	(6.68)	(2.92)	(2.71)
Adj. R2	0.0510	0.0518	0.0528	0.0528	0.0533	0.0573	0.6554
Observations	12,337	12,337	12,337	12,337	12,337	12,337	12,337
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

The dependent variable is repurchase intensity at the event sample. The repurchase intensity is calculated by dividing the total value of stock executed by the total value of stocks outstanding. The avg. raw return is the average compounded raw return for the trading days during the event period. The relative bid-ask spread is the average bid-ask spread for the preceding 5-days divided by the share price over those days. The volatility is based on the relative previous 5-day stock volatility. The CAR is calculated using a CAR-method combined with a market model. Beta coefficients for each firm are calculated measuring 500 days of return data from 530 to 30 days before the start of each event. Company size is the natural logarithm of the total assets at the repurchase day, I exclude FI's from the OLS. Market to book ratio is natural logarithm of the market value divided by the book value of the equity at the day of the execution. Cash-to-Asset is cash divided by total assets. Leverage is calculated as the average total assets divided by average total common equity. The Δ3M BHS rating is the 3-months change in the BHS-rating. The target price deviation is the percentage of the difference between the current share price and the analyst target price. The AS is the percentage of surprise for analyst expected figures compared to the figures of the current quarter. Insider and institutional ownership is the percentage of shares outstanding owned by insiders of institutions, respectively. RI, i-1 is the repurchase intensity of the previous event for the same company.

5.3.3. Bargain Analysis

I find a significant positive bargain when comparing the average price paid, with the average end-of-day share price of the prior 3 days and subsequent day to execution [-3;+1]. This indicates that firms repurchase against a lower than average market price, and supports one of the empirical predictions of *the contrarian-trading hypothesis*. The result is underpinned by the positive covariance between the bargain and the repurchase intensity. Combined with the earlier results, this indicates that firms repurchase relative more when they are able to strike a bargain. Furthermore, the significant negative covariance between the prior change in BHS-rating and the bargain indicates that undervalued firms are able to strike a better bargain. Which is in line with the expectations of *the contrarian-trading hypothesis*. If find no positive covariance between the bargain and the subsequent CAR [+2;+20], as the market-timing hypothesis would predict.[33] Therefore, I reject the third prediction for t*he market-timing hypothesis,* and accept the third prediction of *the contrarian-trading hypothesis*.

Although the bargain of the event sample group is higher, this difference is expected. As the bargain for especially longer subsequent events, would be more and more, close to zero due to the short-term CAR's after execution. I compare the means of both bargains with zero using a two-sided t-test and compared the medians with zero using a rank-sum test. I furthermore, find no significant differences between the means of the bargains using an independent two-sample t-test. This insignificant difference between the averages of the bargains increases the robustness of the overall result. The bargain values are significantly smaller than those found in US studies, but are similar to the results of Ginglinger and Hamon (2007) who use a French dataset. This could very well be the result of the difference in informed investors. France and the Netherlands have a relative high level of institutional ownership compared to the US. These investors tend to be more aware of the true value making it more difficult to strike a bargain. The value of the bargain on a given event day is on average around the €90.0000. For the event sample, this is a total of €32mln. For the entire event sample, this is a total of €72mln. In table 12, there is an overview of the statistical descriptive used in the bargain analysis.

To analyze which program, market and/or firm specific factors influence the bargain, I run an OLS on the bargain of the event group and the entire sample. Each analysis starts with a basic model, in which I only use frequently changing program and market specific factors. The models

[33] As the bargain would increase when the information of the execution is released (end of the day price of the event day), then information release will last a somewhat longer period resulting in a CAR after execution.

differ by adding firms specific factors. The models again experience multicollinearity problems between the firm fixed effects and the variables company size and market-to-book. I correct for this problem by leaving out the firm fixed effect in final model. Correcting for this does not change the conclusion. However, it does decrease the explanatory power of the model. Furthermore, I correct for homoscedasticity and serial correlation using a HAC-Newey-West correction. The models experience no stationarity or endogeneity problems. The minor significant differences between the results of the models for the bargain of the event group and the bargain for all executions, increases the robustness of the overall result. In table 13 and 14, there is an overview of the OLS regression on the bargain for the event group and the entire execution sample, respectively. The models explain between 8% and 13% of the bargain variation, these R^2 are somewhat higher than the R^2 reported by Ben-Rephael, Oded, and Wohl (2014) and Obernberger (2014) but are around the same as that of De Cesari et al. (2012) who also includes institutional,- and insider-ownership.

The negative coefficient for the relative bid-ask-spread is economically expected and in line with results of previous written literature (Hillert et al., 2012). The consistent negative coefficient for the volatility in the OLS for the event bargain is, although insignificant, not in line with expectations. The volatility coefficient changes to significant positive in the bargain analysis for the entire sample, which is as economically expected. This difference is puzzling and could be a result of the relative small event group, but overall does decrease the robustness of the analysis.

The lack of a positive (significant) coefficient for the subsequent CAR [+2;+20], rejects the third empirical predictions of the market-timing hypothesis. This suggests that firms do not use inside information to time the execution. This is in line with the earlier result that firm's experience no economic significant short and medium-term CAR after execution, and that repurchase decisions and repurchase intensities are not driven by inside-information.

The significant positive coefficients for the repurchase intensity and the consistent positive coefficient for repurchase to trading volume, suggests there is a positive covariance between the relative intensity of the execution and bargain. This implicates, that firms increase their repurchase intensity when they are able to get a better bargain. This result is in line with the empirical predictions of *the contrarian-trading hypothesis*. The coefficients for company size and market-to-book and are in line with economic expectations and therefore do not merit much discussion.[34]

[34] Smaller and more undervalued firms are more able to strike a better bargain, as is suggested by Ikenberry and Vermaelen (1996)

The positive coefficient for insider-ownership is somewhat in line with the findings of De Cesari et al. (2012). They find a non-linear relation between the bargain and insider-ownership.[35] De Cesari et al. (2012) also report a negative influence of institutional-ownership and the bargain. This is in contrast, with the suggestion of Obernberger (2014) that management is pushed by institutional investors to repurchase against lower than average prices, as they will benefit as a non-selling shareholder. I find insignificant results that institutional-ownership influences the ability to strike a bargain. As I only have 10 firms in this data sample, the results might be strongly influenced by frequent repurchases. Due to the lack of data I cannot further test these relationships, but combined with the significant evidence that firms with higher institutional, and higher insider-ownership repurchase more and more intense. I conclude that results are weakly in line with that of De Cesari et al. (2012) and therefore I suggest that there is some evidence that "*OMR's are timed to benefit non-selling shareholders"* (De Cesari et al., 2012; Obernberger, 2014).

The results of the bargain analysis are in line with the empirical predictions of *the contrarian-trading hypothesis* and with the results of previous literature. Therefore, I conclude that firms use a contrarian-trading strategy when timing the execution. They repurchase below significant lower prices, and seem to repurchase more intensely when they are able to get a good bargain. This conclusion is in line with the other results found, and therefore I overall conclude that firms time the execution, to signal undervaluation and to support the price, because of recent relative underperformance.

[35] Low levels of insider-ownership result in a higher ability to strike a bargain, as management will time to the benefit as a non-selling shareholders. While, high insider-ownership, reduces the ability, since the informed level of the owners reduces the firm's chance of repurchasing undervalued stock.

Table 12: Descriptive statistics bargain analysis

	Observations	Mean	Median	Std. error	Min.	Max.
Bargain %	355	0.27%***	0.19%***	0.12%	-8.14%	10.41%
Bargain, entire sample, %	2,077	0.17%***	0.01%**	0.04%	-8.14%	20.03%
Bargain, in € mln.	355	0.92	0.10	0.26	-1.44	4.05
Company Size, in mln	2,077	16,963	14,138	302	5,532	35,939
Market to Book, ratio	2,077	4.03	2.80	0.12	0.94	14.16
Relative Bid-Ask spread t-1;t-5, %	2,077	0.07%	0.06%	0.01%	-0.01%	3.51%
Volatility, t-1;t-5, %	2,077	0.57%	0.45%	0.01%	0.01%	2.82%
CAR[2;+20], %	2,077	0.11%	0.12%	0.10%	-16.93%	16.33%
Repurchase Intensity, %	2,077	0.34%	0.11%	0.01%	0.00%	7.21%
Rep. to trading volume, %	2,077	2.58%	0.93%	0.11%	0.01%	71.12%
Institutional ownership, %	2,077	47.23%	40.67%	0.33%	23.57%	82.09
Insider ownership, %	2,077	0.63%	0.64%	0.01%	0.00%	5.30%

For the bargain, and the bargain of the entire sample I use a two-sided t-test to test whether it is significant different from zero, for the medians I use a Wilcoxon signed-rank test to determine if the median is significantly different from zero. The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively. Company Size is the total assets at the time of repurchase. The market to book ratio is the market value divided by the book of the equity value at the day of the execution. The relative average Bid-Ask spread is the average bid-ask spread for the preceding 5-days divided by the average share price over those days. The volatility is based on the previous 4-day stock volatility, divided by the average share price of the event period. The CAR is calculated using a market model to predict returns. The beta coefficient for each firm is calculated measuring 500 days of return data from 530 to 30 days before an event. Repurchase intensity is calculated by the total value of shares repurchases divided by the total value of outstanding shares. Rep. to trading volume is the total value of repurchased shares divided by the total volume of shares traded on the execution day. Institutional ownership is the percentage of shares outstanding held by institutions, based on holdings data collected by Bloomberg. Insider ownership is the percentage of shares outstanding held by insiders, based on holdings data collected by Bloomberg.

Table 13: 'Event' Bargain Analysis

	Model (1)	Model(2)	Model (3)	Model (4)	Model (5)	Model (6)
Relative Bid-Ask Spread	-0.011	-0.006	-0.011	-0.014	-0.014	0.001
	(-0.30)	(-0.16)	(-0.27)	(-0.37)	(-0.38)	(0.03)
Volatility	-0.003	-0.004	-0.004	-0.003	-0.003	-0.002
	(-0.80)	-(1.01)	-(0.87)	-(0.79)	-(0.79)	(-0.46)
CAR[2;+20], %	-0.037	-0.039	-0.035	-0.034	-0.034	-0.054*
	-(1.27)	-(1.35)	-(1.21)	-(1.18)	-(1.18)	(-1.88)
Repurchase Intensity, %	0.430**	0.374**	0.400*	0.393*	0.400*	0.312*
	(2.01)	(1.72)	(1.86)	(1.81)	(1.76)	(1.83)
Rep. to trading volume, %	0.026	0.037	0.036	0.038	0.037	0.031
	(0.90)	(1.20)	(1.18)	(1.20)	(1.15)	(1.16)
Δ3M-BHS rating, abs	-0.009	-0.013*	-0.014**	-0.014**	-0.014**	-0.006
	(-1.28)	(-1.81)	(-2.00)	(-1.96)	(-1.95)	(-0.88)
Company Size t (ln)		-0.033**	-0.026*	-0.020	-0.019	-0.020
		(-2.55)	(-1.84)	(-1.26)	(-1.17)	(-0.52)
Market to Book (ln)			-0.016	-0.022	-0.023	-0.004
			(-1.29)	(-1.61)	(-1.62)	(-1.28)
Insider ownership, %				0.002	0.002	0.001
				(0.89)	(0.87)	(0.12)
Institutional ownership, %					-0.000	-0.001
					-(0.18)	(-0.45)
Constant	-0.002	0.295**	0.213	0.142	0.135	-0.027
	(-0.32)	(2.54)	(1.53)	(0.93)	(0.86)	(-0.62)
Adj. R2	0.0976	0.1161	0.1201	0.1224	0.1225	0.0629
Observations	335	335	335	335	335	335
Firm FE	Y	Y	Y	Y	Y	N
Year FE	Y	Y	Y	Y	Y	Y

The dependent variable is the bargain of the event sample. The bargain is the percentage difference between the average price paid and the average end-of-day share price for the 3 day prior and the day subsequent to execution[-3;+1]. In appendix B formula 8 I give the econometric specification of the model used. Company size is the natural logarithm of the total assets at the repurchase day. The market to book ratio is the market value divided by the book value of the equity at the day of the execution. The relative average Bid-Ask spread is relative average bid-ask spread of the preceding 5-days. Volatility is based on the previous 5-day stock volatility, divided by the average share price of the preceding 5 days. The CAR is calculated using a CAR-method combined with a market model to predict returns. The beta coefficient for each firm is calculated measuring 500 days of return data from 530 to 30 days before an event. Repurchase intensity is calculated by the total value of shares repurchased divided by the total value of outstanding shares. Rep. to trading volume is the total value of repurchased shares divided by the total volume of shares traded on the execution day. Coefficients are stated in the table with the corresponding t-statistics in the brackets underneath. The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively.

Table 14: 'Entire Sample' Bargain Analysis

	Model (1)	Model(2)	Model (3)	Model (4)	Model (5)	Model (6)
Relative Bid-Ask Spread	-0.003	-0.003	-0.004	-0.004	-0.004	-0.005*
	(-1.19)	(-1.22)	(-1.38)	(-1.37)	(-1.35)	(-1.74)
Volatility	0.003	0.003	0.001*	0.001*	0.001*	0.004**
	(1.48)	(1.48)	(1.71)	(1.72)	(1.72)	(2.25)
CAR[2;+20], %	-0.011	-0.011	-0.015**	-0.015**	-0.015**	-0.013*
	-(1.52)	-(1.51)	(-2.11)	(-2.08)	(-2.08)	(-1.70)
Repurchase Intensity, %	0.674***	0.685***	0.681***	0.685***	0.685***	0.255**
	(4.40)	(4.39)	(4.32)	(4.34)	(4.32)	(1.99)
Rep. to trading volume, %	0.018	0.016	0.014	0.014	0.014	0.017
	(0.89)	(0.80)	(0.72)	(0.71)	(0.72)	(0.97)
Δ3M-BHS rating, abs	-0.005*	-0.004*	-0.000	-0.000	-0.000	-0.006**
	(-1.74)	(-1.67)	(-0.14)	(-0.15)	(-0.10)	(2.17)
Company Size t (ln)		0.004	-0.012*	-0.011	-0.012	0.001
		(0.59)	(-1.71)	-(1.61)	-(1.60)	(0.45)
Market to Book (ln)			-0.020***	-0.020***	-0.020***	0.007
			(-5.24)	(-5.14)	(-4.67)	(0.58)
Insider ownership, %				0.001	0.001	0.014
				(0.47)	(0.47)	(1.09)
Institutional ownership, %					0.000	0.001
					(0.25)	(0.36)
Constant	0.006	-0.030	0.144**	0.136**	0.142**	-0.005
	(1.41)	-(0.49)	(2.21)	(2.10)	(2.07)	(-0.23)
Adj. R2	0.0756	0.0758	0.0895	0.0896	0.0897	0.0525
Observations	2,011	2,011	2,011	2,011	2,011	2,011
Firm FE	Y	Y	Y	Y	Y	N
Year FE	Y	Y	Y	Y	Y	Y

The dependent variable is the bargain of the all executions in the sample. The bargain is the percentage difference between the average price paid and the average end-of-day share price for the 3 day prior and the day subsequent to execution[-3;+1]. In appendix B formula 8 I give the econometric specification of the model used. Company size is the natural logarithm of the total assets at the repurchase day. The market to book ratio is the market value divided by the book value of the equity at the day of the execution. The relative average Bid-Ask spread is relative average bid-ask spread of the preceding 5-days. Volatility is based on the previous 5-day stock volatility, divided by the average share price of the preceding 5 days. The CAR is calculated using a CAR-method combined with a market model to predict returns. The beta coefficient for each firm is calculated measuring 500 days of return data from 530 to 30 days before an event. Repurchase intensity is calculated by the total value of shares repurchased divided by the total value of outstanding shares. Rep. to trading volume is the total value of repurchased shares divided by the total volume of shares traded on the execution day. Coefficients are stated in the table with the corresponding t-statistics in the brackets underneath. The significance levels are indicated by *, ** and ***, and correspond to a significance level of 10%, 5% and 1%, respectively.

6. Discussion

The added value of this study is that it researches a relative unexplored market, by using an unique dataset. This unique dataset gives new empirical insight on how AEX-listed firms time the announcement and execution of their share repurchase programs. The thesis uses methods introduced by prior literature to test existing hypotheses that are explain the timing and motivations of firms and the reaction of markets on share repurchase actions. The results indicate that AEX-listed firms use similar motivations found in comparable countries, to pursue repurchase activities. The empirical evidence reported shows that firms see repurchase announcement and executions, as a method to signal undervaluation due to (relative) underperformance, and to support the falling share prices. These motivations of management are also recorded in markets in the US and Hong-Kong, although they showed less consistent evidence. The difference between these countries and the Netherlands and France is a results of the difference in legal systems, which have effected shareholder-concertation and information asymmetry.

Overall, the results found in are in line with prior literature and the results found per section amplify each other; both increase the robustness of the results. However, compared to other repurchase studies, this study uses a relative small dataset. The low number of firms listed in the AEX causes this drawback. The relative low number of events makes it difficult to interpret the results and decrease the robustness of the overall conclusion. Furthermore, it increases the change of a potential sample bias. Unfortunately, there is just no more data in the AEX to correct for this potential bias. Therefore, it is essential for a new research to use a larger dataset. To increase the number of events a new research should for example add France, Belgium and Luxemburg to the dataset. These countries have very similar legal systems which influence the repurchase environment. A larger dataset would allow further specification of firm-specific influences on the motivation of corporate repurchase actions.

Another potential follow-up research could conduct a survey study under C-level management of Netherlands listed firms. This survey study should test for potential over-optimism of management and other motivations for pursuing a repurchasing or other payout policy. Over-optimism could perhaps increase the likelihood of repurchasing as it increase the change that management perceives the firm as undervalued. Especially, when over-optimism is found in combination with undervaluation motives to conduct a repurchase action. Furthermore, the survey study could test for motivation in favor of the *excess capital hypothesis* and *the optimal leverage*

hypothesis. To my knowledge, there at this moment no such survey study conducted in the Netherlands.

This study uses the Analyst Surprise (AS) as a measure of inside-information. Historically analyst consensus forecasts are associated with some forecasting errors. Especially long-term analysts forecast experience serious forecasting errors. However, the analyst consensus forecast are found to be better predictors for actual earnings other simple prediction models (Burgstahler & Eames, 2006). Previous literature researching repurchase announcement often use analysts forecast as a measure of inside-information (Peyer and Vermaelen, 2009; Manconi, Peyer and Vermaelen, 2014). As they use relative larger dataset their forecasts used are less vulnerable to the forecasts errors and potential outliers. A potential drawback for the AS is use is the possibility of analyst not incorporating news releases correctly. As the dataset is relatively small, this have a significant effect. I indeed find relative high outliers, which could indicate that analysts failed to incorporate new information. Unfortunately, this is a data problem for which I cannot control and can only be improved by using more data. Another potential problem for the use of AS is that these might be mean reverting. I find no concluding evidence for this potential bias, neither do I find prior literature reporting serious problems with this. Furthermore, as I find evidence in favor of the mean-reverting theory of de Bondt & Thaler (1985) and previous written literature finds that analyst consensus is a relative good predictor for performance. I expect that the AS is overall somewhat mean-reverting but this should not decrease the reliability of the overall result.

The result that AEX-listed firms use repurchase actions as a way of signaling for undervaluation, and to support falling prices, instead of timing the market based on inside information, is in line with the Dutch corporate culture. Netherlands listed CEO's often say they are here to manage the company performance, and not to manage the company stock. Thereby, they incline that their first focus is, and always will be, operational and overall company performance. Timing the market, based on inside-information implies that management deliberately intervenes in the company stock. While, using repurchases as a tool to signal undervaluation due to market overreaction on prior market or company news, shows that management has more emphasis on operational performance.

7. Conclusion

I present evidence that firms listed in the AEX use repurchase announcements and executions, as a way to signal undervaluation and to support the share price. The undervaluation is a result of recent (relative) underperformance. The significant short-term CAR after announcement, suggests that markets indeed see repurchase announcements as a signal of undervaluation. The higher short-term CAR for firms with a higher level of insider-ownership. Underpins the conclusion that markets recognize a signal of undervaluation in a repurchase announcement. Although, the short-term CAR found is smaller than the historic CAR's in prior literature. It is in line with my expectations and previous recorded short-term CAR's in the Netherlands. Furthermore, there is no (longer a) long-term CAR after announcement.

The significant evidence in favor of *the overreaction hypothesis* shows that firms who announce a share repurchase program are undervalued due to an overreaction of the market. The firms then use the repurchase announcement as a method to signal this unjust undervaluation and to support the falling share price. These motivations are in line with the main findings in survey studies using management's motivation to commence a share repurchase program (Brav et al., 2005). Furthermore, in line with comparable literature I report insignificant evidence that management's use share repurchase announcements to signal a decrease in company risk, or an increase in future operational performance (Ginglinger & L'Her, 2006; Ginglinger & Hamon, 2007; Peyer & Vermaelen, 2009).

The significant evidence that firms time executions after relative underperformance and when they are more undervalued, supports *the contrarian-trading hypothesis*. This result is further emphasized by the significant positive bargain and the positive covariance between the bargain and the relative intensity. Suggesting that firms repurchase against lower than average prices and increase the relative intensity when they are able to strike a better bargain. The significant results and similarities between *the overreaction hypothesis* and *the contrarian trading hypothesis* further increase the robustness of both results. I therefore conclude that AEX-listed firms, use repurchase actions not just to distribute excess cash, but also as a method of signaling undervaluation and to support falling share prices.

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Appendix A

Table A 1: Long Term CAR of OMR with significant results (at least 10%) , sorted per country and sample period.

Authors (Year)	**Sample Period**	**Country**	**Number of Observations**	**Event Window Years**	**CAR (%)**
Ikenberry, Lakonishok & Vermaelen (1995)	1980-1990	U.S.	1,239	[0;+4]	12.1%
Chan, Ikenberry, & Lee (2004)	1980-1996	U.S.	4,774	[0;+4]	23.56%
Lakonishok & Vermaelen (1990)	1992-1986	U.S.	342	[0;+2]	23.11%
Peyer & Vermaelen (2009)	1991-2001	U.S.	3,481	[0;+2]	24.25%
Ikenberry, Lakonishok, & Vermaelen (2000)	1898-1997	Canada	1,060	[0;+3]	21.40%
Ikenberry & Vermaelen (1996)	1980-1990	U.S.	892	[0;+1]	4.73%
McNally and Smith (2007)	1987-2000	Canada	1,473	[0;+3]	5.01%

Table A 2: Short-Term CAR of OMR with significant results (at least 10%), sorted per country and sample period.

Authors (Year)	**Sample Period**	**Country**	**Number of Observations**	**Event Window Days**	**CAR (%)**
Dann (1981) (*Fixed tender offer)*	1962-1976	U.S.	143	[-1;+1]	17.01%
Vermaelen (1981)	1970-1978	U.S.	243	[-1;+1]	3.7%
Comment & Jarrell (1991)	1985-1988	U.S.	1,197	[-1;+1]	2.3%
Ikenberry, Lakonishok & Vermaelen (1995)	1980-1990	U.S.	1,239	[-1;+1]	3.54%
Ikenberry & Vermaelen (1996)	1980-1990	U.S.	892	[-2;+2]	3.42%
Grullon & Michaely (2004)	1980-1997	U.S.	4,443	[-1;+1]	2.7%
(Grullon & Michaely, 2004)	1980-1997	U.S.	4,443	[-1;+1]	2.71%
Maxwell & Stephens (2003)	1980-1997	U.S.	945	[-1;+1]	1.49%
Guay & Harford (2000)	1981-1993	U.S.	1,068	[-5;+5]	3.20%
Peyer & Vermaelen (2005)	1990-1997	U.S.	6,470	[-1;+1]	2.40%
Peyer and Vermaelen (2009)	1991-2001	U.S.	3,481	[-1;+1]	2.39%
Kahle (2002)	1993-1996	U.S.	712	[-1;+1]	1.16%
Obernberger (2014)	2004-2010	U.S.	3,740~SDC	[-1;+1]	1.61%
			6,462~SEC	[-1;+1]	0.65%
Ikenberry, Lakonishok, & Vermaelen (2000)	1898-1997	Canada	1,060	[0;+1]	0.93%
Li & McNally (2007)	1987-2000	Canada	2,673	[-1;+2]	2.19%
Matos (2014)	1990-2013	EU	1,638	[-2;+2]	1.20%
Lasfer (2000)	1997-2006	U.K.	513	[-1;+1]	1.68%
		France	263	[-1;+1]	0.80%
		Germany	194	[-1;+1]	2.32%
Ginglinger & L'Her (2006)	1998-1999	France	363	[0;+1]	0.6%
Rees (1996)	1981-1990	U.K.	882	[-2;+2]	0.3%
Oswald & Young (2002)	1995-2000	U.K.	266	[-1;+1]	1.4%
Rau & Vermaelen (2002)	1985-1998	U.K.	126	[-2;+2]	1.10%
Seifer & Stehle (2003)	1998-2003	Germany	192	[-1;+1]	5.90%
Gerke, Fleischer, & Langer (2002)	1998-2002	Germany	120	[0;+1]	6.07%
Hackethal & Zdantchouck (2005)	1998-2003	Germany	224	[-1;+1]	6.00%
Erken (2012)	2006-2011	AEX	58	[-1;+1]	1.1%
Fierkens (2010)	2000-2010	Netherlands	91	[-1;+1]	1.68%
Zhang (2002)	1995-1999	Japan	72	[-1;+5]	5.31%

Table A 3: Specifications for the models used to test the short and long-term abnormal performance

Subject	Hypothesis	Model
Short-Term CAR	1) CAR-method, with Market-model for predicted returns.	$(r_{p,t} - r_{f,t}) = a_j + b_j(r_{m,t} - r_{f,t}) + \epsilon_{i,t}$ $E(r_{m,t}) = (r_{p,t} - r_{f,t})$ $AR_{i,t} = (r_{i,t} - r_{f,t}) - E(r_{m,t})$ $CAR_{i,t} = \sum_{-t}^{+t} AR_{i,t}$
	2) CAR-method with Fama and French 3 factor model for predicted returns	$(r_{p,t} - r_{f,t}) = a_j + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t}$ $E(r_{m,t}, SMB_t, HML_t) = (r_{p,t} - r_{f,t})$ $AR_{i,t} = (r_{i,t} - r_{f,t}) - E(r_{m,t}, SMB_t, HML_t)$ $CAR_{i,t} = \sum_{-t}^{+t} AR_{i,t}$
Long-Term CAR	1) IRATS model with Fama and French 3 Factor Model, monthly and weekly returns	$r_{i,t} - r_{f,t} = \boldsymbol{a_j} + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t}$
	2) Calendar Time Period with Fama and French 3 factor model, monthly and weekly returns	$r_{p,t} - r_{f,t} = \boldsymbol{a_j} + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t}$
	3) BHAR, with daily abnormal returns based on the market model.	$BHAR_{i(\varphi,\omega)} = \prod_{t=\varphi}^{\omega}(1 + r_{i,t}) + \prod_{t=\varphi}^{\omega}(1 + E(r_{i,t}))$ $E(r_{i,t}) = a_j + b_j(r_{m,t} - r_{f,t}) + \epsilon_{i,t}$

Table A 4: Specifications for the models used to test each prediction of the announcement hypotheses

Hypothesis	Prediction	Model
Inside-information	1) Firms show an unexpected increase in results after announcement	$\boldsymbol{CAS_{t+i} > 0}$ in which *t* is quarter of announcement and *i* is the quarter after announcement
	2) Firms show an increase of operating performance after announcement	$\boldsymbol{\Delta BHS_{t+i} > 0}$, in which *t* is quarter of announcement and *i* is the quarter after announcement
	3) There is no significant negative correlation between prior returns and future abnormal returns	3 quintile's based on previous **6 months raw returns.** FF 3-factor model to calculate abnormal returns, using a 1, 5, and 20 trading-day period.
Overreaction	1) Stocks that have experienced a decline in the recent past show the strongest CAR after announcement.	3 quintile's based on previous **6 months raw returns.** FF 3-factor model to calculate abnormal returns, using a 1, 5, and 20 trading-day period.
	2) Analyst drop their EPS forecasts in prior months.	3 quintile's prior 6 months **BHS Rating change**. CAR based a 20 and 60 day time period using CAR-method and market model.
	3) **Firms who have relative high-inside ownership show the strongest CAR after execution*	3 quintile's on insider ownership at execution. CAR based a 20 and 60 day time period using CAR-method and market model.
Risk-Change	1) Firms that repurchases their shares should experience a decline in their systematic risk.	$R_{it} = r_{ft} + \beta_{it}(r_{mt} - r_{ft}) + \boldsymbol{b_{\Delta i} D_t (r_{mt} - r_{ft})} + \epsilon_t$
	2) Firms that repurchase should experience a decrease in profitability.	$\%\Delta\pi_{t,t+i} < 0$ The percentage change is calculated by dividing the change in comparable net income of the *i* quarter after announcement with the comparable net income the quarter before announcement
	3) Firms should have a long-term CAR when using the calendar and BHAR methods but not with the IRATS method.	Already tested in the long-term Abnormal Performance section

* This prediction is a self-constructed prediction to underpin the results for the announcement and in line with significant results from the other predictions will supports the argument that firms signal undervaluation with a repurchase announcement.

Table A 5: Specification for the models used to test each prediction of the hypotheses of the Repurchase Execution

Hypothesis	Prediction	Model
Market-Timing	1) A repurchase execution leads to a CAR after execution, as a result the release of inside information.	**CAR[0;+1] > 0 & CAR[2;+20] > 0** In which CAR is the cumulative abnormal return
	2) Repurchase decision and repurchase intensities are drive by positive inside information.	$\boldsymbol{cov(AS_{i,t,}, RI_{i,t,}) > 0}$ or $\boldsymbol{cov(\gamma_{i,t,}, RI_{i,t}) > 0}$ In which $AS_{i,t,}$is the percentage of analyst surprise at time t for firm *i*, $RI_{i,t}$ is the relative repurchase intensity for firm *i* at time *t* and $\gamma_{i,t,}$ is dummy for the decision to repurchase
	3) Firms repurchase against lower than average prices as result of timing the execution based on inside information.	$\boldsymbol{cov(B_{i,t}, CAR_{+2;+20}) > 0}$ In which $B_{i,t}$ is the bargain for firm *i* at time *t* and CAR is the cumulative abnormal return
Contrarian-Trading	1) Execution is timed after (relative) underperformance compared to the market before execution.	**CAR[-4;-1] < 0 or $\bar{R}$[-4;-1]<0 or $\bar{R}$[-4;-1]< $\bar{R}$** In which CAR is the cumulative abnormal return and $\bar{R}$ is the average daily return. 0 is the event day
	2) Repurchase decision and repurchase intensities are driven by undervaluation.	OLS regression on the repurchase dummy and repurchase intensity, dependent variables that control for undervaluation should have significant positive coefficients
	3) Firms repurchase against lower than average prices as a result of a recent price drop.	$\boldsymbol{B_{i,t}}$**>0** In which $B_{i,t}$ is the bargain for firm *i* at time *t*

Table A 6: Company and Market Specific information needed to conduct this research

Company Specific Variables daily	Company Specific Variables daily	Company Specific Variables quarterly	Market Specific Variables daily
Trading days	Market-to-Book ratio	Sales	AEX Equally Weighted Index (EWI)
End of day Price	Analyst BHS rating ~	Net Income	
Bid-Ask Spread	Change in BHS ~	EPS	STOXX 600 EWI
Volume Traded	Analyst Target Price ~	Analyst % Surprise~	Risk Free rate*
Outstanding Shares	Leverage (LT debt over Total Equity)	Analyst Expected Earnings ~	SMB Factor*
Outstanding Capital			HML Factor*

The factors with * are also used as monthly factors and are extracted from the website of Kenneth French (Fama & French, 1993). The factors with a ~ are consensus factors created by Bloomberg, for an analysis please see Bloomberg user policies.

Table A 7: Summary descriptive per used variable, data range from 1st January 2008 until 31th December 2015.

Variable	Observations	Mean	Median	Min	Max
Price	49,635	29.99	21.64	1.39	260.45
Bid-Ask Spread	46,635	0.04	0.01	-17.65	11.45
Outstanding Capital	49,635	20,227	9,672	330	201,133
Volume Traded(#)	49,635	4,069,457	1,427,951	50	218,000,000
Sales*	49,635	9,208	3,370	-20,054	131,567
Net Income*	49,635	497	158	-7,416	11,556
EPS	49,635	0.81	0.60	-5.53	9.90
Company Size	49,460	96,561	13,765	1,434	1,375,814
Cash	49,460	2,879	875	0	46,587
Leverage	49,450	145.14	49.94	0.00	13,412.56
Market-to-Book ratio	49,364	2.79	1.85	0.19	143.89
Earnings announcement	49,460	0.01	0	0	1
AEX EWI	5,843	987	987	431	1659
STOXX 600 EWI	5,843	1786	1716	1625	264
Analyst Target Price	49,501	31.60	23.19	1.72	256..48
BHS Rating	49,600	3.70	3.72	2	5
Analyst Surprise	49,501	2.44%	4.57%	-350%	338%

** in million euro*

Table A 8: Repurchase Dummy logit model

	(1) Repurchase Dummy	(2) Repurchase Dummy	(3) Repurchase Dummy	(4) Repurchase Dummy	(5) Repurchase Dummy	(6) Repurchase Dummy	(7) Repurchase Dummy
Avg. Raw Return	-0.006	-0.005	-0.006	-0.006	-0.005	-0.009**	-0.008**
[-4;-1], %	(-1.53)	(-1.35)	-(1.53)	(0.99)	(-1.39)	-(2.21)	(-2.07)
Relative Bid-Ask	-0.001	0.000	0.001	0.001	0.000	0.003	0.000
Spread, %	(-0.06)	(0.04)	(0.05)	(0.04)	(0.03)	(0.19)	(0.00)
Volatility, %	0.003	0.004	0.003	0.003	0.004	0.005	0.004
	(0.98)	(1.14)	(1.05)	(0.99)	(1.06)	(1.30)	(1.26)
CAR[-4;-1], %	-0.001***	-0.001***	-0.001***	-0.002***	-0.001***	-0.002***	-0.002***
	(-3.09)	-(2.98)	-(3.10)	-(3.13)	-(3.02)	-(3.54)	-(3.41)
Δ3M-BHS	0.001	0.002	0.003	0.004	0.004	0.004	0.003
rating, abs	(0.14)	(0.24)	(0.37)	(0.58)	(0.56)	(0.55)	(0.43)
Target Price	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***	0.001***
Deviation %	(4.92)	(4.63)	(4.80)	(4.90)	(4.55)	(4.51)	(4.13)
AS, %	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(-0.26)	-(0.43)	-(0.01)	-(0.02)	(0.01)	-(1.01)	-(1.23)
Company Size		0.022**	0.018*	0.015	0.013	0.028**	0.026**
(ln)		(2.12)	(1.69)	(1.31)	(1.13)	(2.66)	(2.49)
Market-to-book			-0.011*	-0.011*	-0.012**	0.009	0.002
(ln)			-(1.74)	-(1.77)	-(2.07)	(1.41)	(0.28)
Insider				0.003	0.003	0.005**	0.004**
Ownership, %				(1.61)	(1.61)	(2.59)	(2.49)
Institutional					0.000	0.001***	0.000**
Ownership, %					(1.42)	(3.37)	(2.56)
Cash-to-assets, %						0.003***	0.002***
						(4.90)	(4.28)
Leverage, %						-0.001**	-0.001**
						-(2.80)	-(2.36)
Days since last repo							-0.004
							-(4.13)
Constant	0.086***	-0.115	-0.079	-0.053	-0.021	-0.282***	-0.225**
	(11.41)	(-1.22)	(-0.78)	(-0.50)	(-0.20)	(-2.96)	(-2.41)
Adj. R2	0.0506	0.0510	0.0511	0.0515	0.0517	0.0551	0.0563
Observations	12,337	12,337	12,337	12,337	12,337	12,337	12,337
Firm FE	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y

The dependent variable is the dummy for a repurchase at the selected event sample, which is 1 at an execution and 0 when there is no execution. The avg. raw return is the average compounded raw return for the trading days during the event period. The relative bid-ask spread is the average bid-ask spread for the preceding 5-days divided by the share price over those days. The volatility is based on the relative previous 5-day stock volatility. The CAR is calculated using a CAR-method combined with a market model. Beta coefficients for each firm are calculated measuring 500 days of return data from 530 to 30 days before the start of each event. Company size is the natural logarithm of the total assets at the repurchase day, I exclude FI's from the regression. Market to book ratio is natural logarithm of the market value divided by the book value of the equity at the day of the execution. Cash-to-Asset is cash divided by total assets. Leverage is calculated as the average total assets divided by average total common equity. The Δ3M BHS rating is the 3-months change in the BHS-rating. The target price deviation is the percentage of the difference between the current share price and the analyst target price. The AS is the percentage of surprise for analyst expected figures compared to the figures of the current quarter. Insider and institutional ownership is the percentage of shares outstanding owned by insiders of institutions, respectively.

Table A 9: Repurchase Dummy and Intensity Model corrected for multicollinearity

	(1) Repurchase Dummy, OLS	(2) Repurchase Dummy, Logit	(3) Repurchase Intensity, OLS
Avg. Raw Return [-4;-1], %	-0.163**	-0.004	-0.005
	(-1.97)	(-1.09)	(-0.93)
Relative Bid-Ask Spread, %	0.024	0.001	0.020
	-(0.04)	(0.09)	(0.87)
Volatility, %	-0.149	-0.005	0.005
	-(0.89)	(-1.38)	(0.80)
CAR[-4;-1], %	-0.063**	-0.002***	-0.001
	-(2.90)	(-3.29)	-(0.49)
Δ3M-BHS rating, abs	-0.043	-0.005	-0.034**
	-(0.16)	(-0.70)	-(2.26)
Target Price Deviation %	0.015**	0.001*	0.001**
	(2.03)	(1.47)	(2.54)
AS, %	-0.004**	-0.001***	-0.001***
	-(3.29)	(-3.84)	-(4.56)
Company Size (ln)	0.916***	0.021***	0.001***
	(6.27)	(7.08)	(11.92)
Market-to-book (ln)	-0.564***	-0.003	-0.001***
	-(3.17)	(-0.91)	-(6.72)
Insider Ownership, %	0.345***	0.007***	0.010**
	(5.18)	(4.37)	(4.02)
Institutional Ownership, %	0.061***	0.001***	0.002***
	(9.27)	(8.21)	(8.85)
Cash-to-assets, %	0.107***	0.004***	0.005***
	(12.73)	(11.00)	(9.77)
Leverage, %	-0.002	-0.001***	-0.001***
	-(1.49)	(-1.36)	-(5.38)
Constant	-16.368***	-0.259***	-0.007***
	(-9.08)	(-7.19)	(-10.82)
Adj. R2	0.1540	0.0422	0.0415
Observations	12,337	12,337	12,337
Firm FE	N	N	N
Year FE	Y	Y	Y

The dependent variable is stated above each model The avg. raw return is the average compounded raw return for the trading days during the event period. The relative bid-ask spread is the average bid-ask spread for the preceding 5-days divided by the share price over those days. The volatility is based on the relative previous 5-day stock volatility. The CAR is calculated using a CAR-method combined with a market model. Beta coefficients for each firm are calculated measuring 500 days of return data from 530 to 30 days before the start of each event. Company size is the natural logarithm of the total assets at the repurchase day, I exclude FI's from the regression. Market to book ratio is natural logarithm of the market value divided by the book value of the equity at the day of the execution. Cash-to-Asset is cash divided by total assets. Leverage is calculated as the average total assets divided by average total common equity. The Δ3M BHS rating is the 3-months change in the BHS-rating. The target price deviation is the percentage of the difference between the current share price and the analyst target price. The AS is the percentage of surprise for analyst expected figures compared to the figures of the current quarter. Insider and institutional ownership is the percentage of shares outstanding owned by insiders of institutions, respectively.

Table A 10: Repurchase announcement and execution per company

Company Name	Number of Announcement	Total value Announced*	Average Value Announced*	Average % of outstanding capital Announced	Total Value Completed*	Repurchase execution	Total value of repurchase execution's*~	Average value repurchase execution*	Average Price Paid
Aegon	4	1,312	328	1.17%	1,448	67	528	4.89	6.09
Akzo Nobel	1	1,600	1,600	9.53%	1,437	n.a	n.a	n.a	n.a
ASML	4	3,320	808	4.31%	3,144	303	2,000	6.56	53.33
Ahold	6	5,000	833	6.28%	4,660	167	3,249	19.10	12.50
Boskalis	1	415	415	8.13%	26	6	25.6	42.74	41.035
DSM	4	1,280	320	4.02%	1,020	50	726	14.20	48.05
Gemalto	5	1,618	324	6.79%	1,050	n.a.	n.a.	n.a.	n.a.
Heineken	3	1,000	333	1.40%	765	79	365	4.62	70.50
ING	1	5,000	5,000	6.81%	4,875	n.a.	n.a.	n.a.	n.a.
KPN	5	4,500	900	4.49%	4,404	29	350	12.1	10.85
Philips	4	10,130	2,533	9.28%	7,361	785	2,679	3.40	20.35
Randstad	3	33	11	0.05%	33	n.a.	n.a.	n.a.	n.a.
RELX	3	211	70	0.21%	211	591	106	1.79	15.92
Shell	4	56,000	14,000	7.87%	46,031	n.a.	n.a.	n.a.	n.a.
Unilever	2	3,000	1,500	2.38%	3,000	n.a.	n.a.	n.a.	n.a.
Vopak	1	11	11	0.28%	9	n.a.	n.a.	n.a.	n.a.
Wolters Kluwer	6	995	165	3.69%	1,001	n.a.	n.a.	n.a.	n.a.
Total/(Average)	57	95,425	1,714	4.51%	80,475	2,077	10,072	8.33	29.70

Table A 11: Descriptive data per announcement, sorted on announcement date, values are in million euros

Company Name	Announce-ment Date	Completion Date	Duration (months)	Announced Value	Completed Value	Percentage Out. Shares Announced	Motive announcement / stop program	CAR[-1;+1]	BHAR 1 year
KPN	6-2-2007	30-8-2007	9	1,000	1,000	4.76%	Return unutilized surplus cash to shareholders and benefit from the relative low share price.	2.83%	11.28%
Unilever	8-2-2007	24-12-2007	14	1,500	1,500	2.42%	Provide a flexible route for returning cash to shareholders	-3.90%	7.59%
Wolters Kluwer	26-3-2007	31-12-2007	12	645	645	9.15%	n.a.	0.73%	-18.45%
Akzo Nobel	6-5-2007	3-9-2007	5	1,600	1,437	9.53%	Benefit from low share price.	-1.10%	7.84%
ING	18-5-2007	23-5-2008	16	5,000	4,875	6.81%	Dedicated capital management.	0.38%	-12.25%
Aegon	9-8-2007	19-11-2007	4	1,000	1,136	4.59%	Benefit from low share price and overall capital management.	1.57%	-9.85%
Ahold	30-8-2007	31-12-2008	21	1,000	999	8.14%	n.a.	5.57%	8.69%
Philips	3-9-2007	18-12-2007	5	1,630	819	4.92%	Accelerated first program and benefit from low share price.	-0.10%	1.00%
KPN	3-9-2007	24-12-2007	5	500	500	2.21%	Accelerated previous program, benefit from the current low share price and self-imposed capital management.	1.57%	3.98%
DSM	26-9-2007	16-1-2009	21	750	500	9.84%	Accelerated previous program and to benefit from the relative low share price	5.84%	27.02%
Gemalto	13-11-2007	n.a.	0	129	100	7.24%	n.a.	0.63%	69.01%
Philips	19-12-2007	19-11-2008	15	5,000	3,229	14.39%	Dedicated capital management and benefit from low share price.	2.82%	1.88%
Unilever	8-2-2008	24-12-2008	14	1,500	1,500	2.34%	Provide a flexible route for returning cash to shareholders.	-1.97%	-16.13%
KPN	22-2-2008	17-9-2008	9	1,000	1,000	4.36%	Return unutilized surplus cash to shareholders.	0.79%	8.41%
KPN	22-10-2008	14-12-2009	18	1,000	999	5.60%	Dedicated capital management.	6.05%	-18.55%
Ahold	4-3-2010	31-12-2011	29	500	500	4.36%	Return unutilized surplus cash and benefit from low share price	3.90%	-8.44%
Heineken	8-3-2010	3-10-2011	25	100	100	0.54%	In connection with the intended acquisition of competitor	0.26%	-11.90%
Vopak	28-4-2010	30-4-2010	1	11	9	0.28%	Neutralize stock dividend	-0.34%	-23.98%
Gemalto	2-11-2010	n.a.	n.a.	125	125	4.34%	n.a.	1.42%	16.44%
Heineken	17-11-2010	3-10-2011	14	150	300	0.72%	Accelerated previous program and to benefit from the low share price.	1.59%	-8.51%
Wolters Kluwer	3-1-2011	31-12-2011	16	100	108	2.00%	n.a.	0.75%	-2.64%

Table 11A: Cont'd

Company Name	Announce-ment Date	Completion Date	Duration (months)	Announced Value	Completed Value	Percentage Out. Shares Announced	Motive announcement / stop program	CAR[-1;+1]	BHAR 1 year
ASML	19-1-2011	22-11-2012	29	1,130	1,130	9.30%	Dedicated capital management and benefit from low share price.	1.88%	26.69%
KPN	26-1-2011	26-9-2011	11	1,000	905	5.53%	Dedicated capital management and benefit from low share price.	-1.51%	-16.66%
Ahold	3-3-2011	31-12-2011	13	1,000	1,000	8.89%	Return unutilized surplus cash and benefit from low share price	-3.60%	12.58%
Philips	18-7-2011	20-6-2013	31	2,000	2,000	11.52%	Dedicated capital management.	-0.40%	4.30%
Shell	11-8-2011	27-7-2012	15	13,500	13,531	9.09%	Shareholder benefit program and return unutilized surplus cash	2.27%	11.06%
DSM	7-9-2011	2-11-2011	2	150	137	2.53%	Neutralize stock dividend	3.60%	-25.86%
Wolters Kluwer	2-1-2012	30-6-2012	8	100	108	2.43%	n.a.	0.15%	4.06%
ASML	18-1-2012	13-12-2012	14	100	105	0.71%	Dedicated capital management and benefit from low share price.	-5.35%	4.27%
Shell	24-9-2012	31-12-2013	20	5,000	5,000	2.95%	Shareholder benefit program and return unutilized surplus cash	0.62%	-34.89%
Gemalto	19-11-2012	n.a.	n.a.	313	250	5.11%	n.a.	-1.99%	-52.42%
Ahold	28-2-2013	12-12-2014	28	500	500	4.38%	n.a.	-0.21%	4.80%
ASML	16-4-2013	31-12-2014	27	1,000	909	4.75%	Dedicated capital management and benefit from low share price.	1.69%	-38.11%
Ahold	4-6-2013	12-12-2014	24	1,500	1,500	11.86%	Return unutilized surplus cash and benefit from low share price	-3.10%	-8.41%
Gemalto	15-7-2013	n.a.	n.a.	563	200	8.84%	n.a.	6.49%	-49.27%
Aegon	17-9-2013	16-10-2013	1	100	100	0.81%	Neutralize stock dividend	-0.60%	-19.94%
Philips	17-9-2013	30-7-2016	46	1,500	1,313	6.29%	Return unutilized surplus cash and benefit from low share price	-0.73%	-24.89%
DSM	26-9-2013	27-4-2014	9	263	263	2.49%	Return unutilized surplus cash and benefit from low share price	4.37%	-25.35%
RELX	16-12-2013	n.a.	n.a.	100	100	0.44%	n.a.	0.48%	3.72%
Shell	19-12-2013	27-4-2014	5	7,500	7,500	4.36%	Shareholder benefit program and return unutilized surplus cash	2.55%	19.03%
Shell	31-7-2014	29-1-2015	8	30,000	20,000	15.08%	Return unutilized surplus cash and benefit from low share price	-0.03%	-19.81%
Boskalis	14-8-2014	10-11-2014	4	415	26	8.13%	Return unutilized surplus cash and benefit from low share price	5.56%	-22.18%

Table 11A: Cont'd

Company Name	Announce-ment Date	Completion Date	Duration (months)	Announced Value	Completed Value	Percentage Out. Shares Announced	Motive announcement / stop program	CAR[-1;+1]	BHAR 1 year
Aegon	17-9-2014	16-10-2014	1	105	105	0.75%	Neutralize stock dividend	0.50%	-37.33%
Gemalto	19-11-2014	n.a.	n.a.	487	375	8.42%	n.a.	0.85%	-16.16%
RELX	4-12-2014	n.a.	n.a.	100	100	0.33%	n.a.	0.70%	-6.39%
ASML	21-1-2015	31-12-2015	15	1,000	1,000	2.49%	Dedicated capital management and benefit from low share price.	2.53%	-34.14%
Heineken	18-2-2015	26-10-2015	11	750	365	1.98%	Takeover defense and benefit from the low share price.	2.35%	16.16%
Wolters Kluwer	18-2-2015	30-6-2015	6	100	140	1.18%	n.a.	9.17%	-10.66%
Ahold	26-2-2015	5-1-2016	14	500	161	3.32%	Return unutilized surplus cash and benefit from low share price	-3.75%	11.55%
DSM	14-5-2015	28-7-2015	3	117	120	1.27%	Neutralize stock dividend	5.16%	n.a.
Aegon	15-9-2015	16-10-2015	1	107	107	0.92%	Neutralize stock dividend	2.27%	n.a.

Table A 12: Descriptive data per company who executes a repurchase in the dataset

Company Name	Number of Executions	Number of Events	Total value executions (mln)	Average RI	Average RTV	Average Bargain	CAR[-4;-1]	CAR[0;+1]
Aegon	67	3	580	0.01%	0.75%	-0.01%	0.10%	0.02%
ASML	303	121	2,000	0.05%	4.90%	0.50%	-0.04%	0.17%
Ahold	167	122	3,249	0.12%	7.43%	0.09%	-0.08%	0.36%
Boskalis	6	6	25.6	0.01%	12.53%	0.32%	-0.31%	0.05%
DSM	50	45	726	0.04%	15.81%	0.24%	0.03%	0.35%
Heineken	79	2	365	0.01%	5.29%	0.53%	-0.14%	0.00%
KPN	29	12	350	0.01%	1.73%	0.82%	0.08%	-0.09%
Philips	785	28	2,670	0.06%	0.94%	0.28%	-0.10%	0.09%
RELX	591	16	106	0.02%	0.85%	-0.17%	0.02%	0.01%
Total/Average	**2,077**	**355**	**10,702**	**0.04%**	**5.58%**	**0.29%**	**-0.05%**	**0.11%**

Table A 13: Descriptive of variables used in the execution analysis.

Variable	Capture	Description
Avg. Raw Return [-4;-1], %	Undervaluation	Is the compounded average raw return for the 3 days before an event (execution). The compounded return is calculated using a geometric average for the days in the event period. This variable is a proxy for undervaluation and underperformance as Peyer and Vermaelen (2009) argue that raw performance is good proxy for undervaluation.
Relative Bid-Ask Spread, %	Liquidity	The Relative Bid-Ask Spread is the average, of the prior 5 daily bid-ask-spread divided by the end-of-day share price per day. This variable measures the liquidity of the stock prior to execution, the lower the percentage the higher the liquidity and vice versa.
Volatility, %	Liquidity /Undervaluation	The volatility is the percentage of the average of the relative volatility for the 5 days prior to execution. The volatility is calculated using the 5 days of stock data and the relative volatility is the volatility of the trading day divided by the end-of-day share price. The higher the percentage the more volatile the stock was over the past days. The measure captures liquidity and undervaluation.
CAR[-4;-1], %	Undervaluation/	The CAR is the cumulative abnormal return for the event period before execution. The CAR is calculated using a CAR-method combined with a market model. The predicted coefficients are calculated using 500 days of return data from 530 to 30 days before the start of the event period. This variable is a proxy for undervaluation and underperformance.
Δ3M-BHS rating, abs	Undervaluation	The Δ3M BHS rating is the 3-months change in the BHS-rating. This is calculated by subtracting the BHS-rating 3 months before execution from the BHS-rating 5 days prior to execution from. This measure captures undervaluation as a result of being 'beaten-up' by analysts in the prior 3 months.
Target Price Deviation %	Undervaluation	The target price deviation is the percentage of the difference between the current share price and the analyst target price. This measure captures undervaluation as the higher this percentage the further the company trades from its 'true value'.
AS, %	Inside-information	This measures the percentage of surprise from the covering analysts on the company earnings. This is done by using the EPS, EBITDA and Sales consensus estimates 5 days before announcement and comparing this with the actual figures. The variable captures inside-information as I assume that management already knows the company performance and the consensus estimates are publicly available.
Company Size (ln)	Firm Specific	Company size is the natural logarithm of the total assets at the repurchase day.
Market-to-book (ln)	Firm Specific / Undervaluation	Market to book ratio is natural logarithm of the market value divided by the book value of the equity at the day of the execution.
Insider Ownership, %	Ownership Structure	Insider ownership is the percentage of outstanding capital owned by insiders.
Institutional Ownership, %	Ownership Structure	Institutional ownership is the percentage of shares outstanding owned by institutions.
Cash-to-assets, %	Free cash hypothesis	Cash-to-Asset is cash divided by total assets, at the event day.
Leverage, %	Optimal Leverage Hypothesis	Leverage is calculated as the average total assets divided by average total common equity. The leverage is a percentage subtracted from Bloomberg.
Days since last repo (ln)	Program variable	Is the natural logarithm from the number of days since the last execution, using all executions in the dataset.
RI, i-1	Lagged dependent variable	Is the repurchase intensity of the previous event.
Repurchase Intensity, %	Program variable	Repurchase intensity is calculated by the total value of shares repurchases divided by the total value of outstanding shares.
Rep. to trading volume, %	Program variable	Rep. to trading volume is the total value of repurchased shares divided by the total volume of shares traded on the execution day.

Appendix B

Formula: $$(r_{i,t} - r_{f,t}) = a_j + b_j(r_{m,t} - r_{f,t}) + \epsilon_{i,t} \quad (1)$$

Where $r_{i,t}$ is the daily return on stock *i* at trading day t, $r_{f,t}$ is the daily risk free rate at day t and r_{mt} is the daily return on the Equally Weighted AEX Index. The coefficientsa_j,b_j are the cross-sectional results for day *j*.

Formula: $$(r_{i,t} - r_{f,t}) = a_j + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t} \quad (2)$$

Where $r_{i,t}$ is the daily return on stock *i* at *t*, $r_{f,t}$ is the daily risk-free rate at *t*, and r_{mt} is the daily return on the Equally Weighted AEX Index. SMB_t is the daily return on the size factor, and HML_t is the daily return on the book-to-market factor on trading day *t*, The coefficients a_j,b_j, c_j and d_j are the cross-sectional results for day *j*.

Formula: $$BHAR_{i(\varphi,\omega)} = \prod_{t=\varphi}^{\omega}(1 + r_{i,t}) - \prod_{t=\varphi}^{\omega}(1 + E(r_{i,t}|\Omega_{i,t}) \quad (3)$$

Where $r_{i,t}$ is the daily return on stock i at trading day t, $r_{f,t}$ is the daily risk free rate at day t and r_{mt} is the daily return on the Equally Weighted AEX Index. $\prod_{t=\varphi}^{\omega}(1 + r_{i,t})$ is the compounded return on the stock and$\prod_{t=\varphi}^{\omega}(1 + E(r_{i,t}|\Omega_{i,t})$ is the compounded predicted return on the stock based on a market model.

Formula: $$r_{p,t} - r_{f,t} = \boldsymbol{a_j} + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t} \quad (4)$$

Where $r_{p,t}$ is the monthly return of all stocks that had an event within the event window, at t, $r_{f,t}$ is the monthly risk-free rate and r_{mt} is the monthly return on the Equally Weighted AEX Index. SMB_t is the monthly return on the size factor, and HML_t is the monthly return on the book-to-market factor in calendar month *t.* The coefficientsa_j,b_j, c_j and d_j are the cross-sectional results for month j. The CAR of the period is the sum of the intercepts $a_j$over the event period

Formula: $$r_{p,t} - r_{f,t} = \boldsymbol{a_j} + b_j(r_{m,t} - r_{f,t}) + c_j SMB_t + d_j HML_t + \epsilon_{i,t} \quad (5)$$

Where $r_{i,t}$ is the monthly return on stock *i* at *t*, $r_{f,t}$ is the monthly risk-free rate and r_{mt} is the monthly return on the Equally Weighted AEX Index. SMB_t is the monthly return on the size factor, and HML_t is the monthly return on the book-to-market factor in calendar month *t*, The coefficients a_j,b_j, c_j and d_j are the cross-sectional results for month j. The CAR of the period is the sum of the intercepts $a_j$over the event period

Formula: $$R_{it} = r_{ft} + \beta_{it}(r_{mt} - r_{ft}) + b_{\Delta i} D_t(r_{mt} - r_{ft}) + \epsilon_t \quad (6)$$

In which $R_{it}$is the cost of capital for firm *i* at t, r_{ft} is the yearly risk-free rate at *t* and r_{mt} is the yearly on the equally weighted AEX index. D_t is a dummy which has the value of 1 if t*≥t, where t* is the month in which the repurchase program is announced.

Formula: $$B_{i,t} = R_t - \left(\frac{\sum_{t_{-3}}^{t_{+1}} = (P_{-3} + P_{-2} + \cdots + P_{t+1})}{\sum_{t_{-3}}^{t_{+1}} t} \right) \quad (7)$$

In which $B_{i,t}$ is the bargain of firm *i* at time *t*, $R_{i,t}$ is the repurchase price of firm *i* at time *t* and $P_{i,t}$ is the end-of-day share price of firm *i* at day *t*. *t* is always a trading day, and *t=0* is the day at which the company executes a repurchase.

Formula: $$Repurchase\ Dummy_{\ i,t} = \alpha_t + \beta_{j,t} Variable_{i,t} + \mu_i + \eta_t + \epsilon_{i,t} \quad (8)$$

$Repurchase\ Dummy_{\ i,t}$refers to the dummy variable which indicates a share repurchase execution of firm *i* in on day *t*. $Variable_{i,t}$is the independent variables used to model the variation of the dependent variable a description of the variables used can be found in table 14A in appendix A. μ_i is a the firm-fixed effect which is constant throughout time, and η_t is the year dummy.

Formula: $$Repurchase\ Intensity_{\ i,t} = \alpha_t + \beta_{j,t} Variable_{i,t} + \mu_i + \eta_t + \epsilon_{i,t} \quad (9)$$

$Repurchase\ Intensity_{\ i,t}$refers to the variable which indicates the relative intensity of the execution of firm *i* in on day *t*. $Variable_{i,t}$is the independent variables used to model the variation of the dependent variable a description of the variables used can be found in table 14A in appendix A. μ_i is a the firm-fixed effect which is constant throughout time, and η_t is the year dummy.

Formula: $$Bargain_{\ i,t} = \alpha_t + \beta_{j,t} Variable_{i,t} + \mu_i + \eta_t + \epsilon_{i,t} \quad (10)$$

$Bargain_{\ i,t}$ refers to the variable which indicates the relative bargain firms 'experience' at execution of firm *i* in on day *t*. $Variable_{i,t}$is the independent variables used to model the variation of the dependent variable a description of the variables used can be found in table 14A in appendix A. μ_i is a the firm-fixed effect which is constant throughout time, and η_t is the year dummy.

Appendix C

What are Share repurchases?

When it comes to investing, it is crucial to know when and how you will receive the returns on your investment. In the case of major companies, investors (shareholders) entrust the management of a firm to take care of this issue. The distribution and the payout of the returns on investments are a major issue of the principal-agent problem between shareholder (principal) and management (agent). When firms have excess cash, it will be optimal to redistribute the cash to the investors, since excess cash generate no/low returns[36]. For firms it is import to be competitive within their market to remain attractive for investors. Keeping competitive does not only mean that the product or marketing strategy is better than its competitors, it also means that the firm's corporate finance policy remains attractive for investors. Meaning, competitive firms should yield the highest possible return on the invested capital (ROIC), especially compared to its peers. This is done through an optimal distribution of the available capital in investments possibilities within the firm. If a firm has more capital to redistribute than investment possibilities with a Net Positive Value (NPV), the firm has access cash. This access cash thus generates no return; expect maybe the interest on a bank account. However, the investors who have provided the capital still demand a return on that capital. Thereby actually demanding more returns from the projects that are generating returns, to compensate for the very low return on the access cash. This makes the firm not competitive in a corporate finance sense and therefore it becomes less attractive for investors.

There are two main ways in which management can decide to redistribute the access cash namely: dividends and share repurchases. Dividends imposes a disadvantage compared to share repurchase when it comes to personal tax preferences. This is explained by the following example:

Example 1: Dividends vs. Share repurchases

Suppose there is a firm, company ABC, which currently has 1,000 shares outstanding for a value of 100 each and the firm has zero debt thereby valuing the company at 100,000. The firms want to distribute 1,000 of excess cash. The firm has two options for the redistribution of the excess cash, through dividends or the repurchases of shares. Assume that there is a taxation of 25% over realized capital gains.

[36] Excess cash usually is a sign of a lack of positive Net Present Value (NPV) investment opportunities. This is often a problem for more mature companies. A lack of positive NPV project is overall seen as a bad sign for future company cash-flows (lack of innovation) but can also indicate an abnormal cash flow generation, which is a good sign.(Extremely good market position etc.) It depends per situation whether it is positive or negative.

If the firm would distribute the cash through a dividend payment, each share would receive 1 in dividends, which is directly taxed, resulting in a net gain of 0.75 per share. Because 1,000 of excess cash the 'left', the firm the value per share drops leading to a share price of 99 (99,000/1,000) thus a decrease of 1 which is exactly equal to the gross dividend pay-out per share.

On the other hand if the firm decides to repurchase the shares it would be able to repurchases 10 shares (1,000/100). Afterwards there are only 990 shares remaining and the firm has a value of 99,000(same as dividend pay-out) thereby keeping the share price at 100 (99,000/1,000). As you can see the difference between the share-price of "after dividend" and "after the share repurchase" differs by 1. In other words, the shareholders are paid by the 'gain' in the share-price. Because this gain is unrealized until it is sold, the investor is not taxed until he decides to sell his stock.

Because the share repurchase option gives the investor more flexibility when it comes to his personal taxes, the investor would value the repurchase option as more valuable[37]. Another reason why investors prefer buybacks are the higher earnings per share (EPS). However, in a rational world, the different share price after dividend vs. after repurchase already incorporates that difference. As can be seen by the higher price of the shares after repurchase compared to dividends.

In Section 2 I summarize the existing literature on the topic of timing of the (execution) of the repurchase programs. In Section 3 I elaborate on the methodology used and in Section 4 I explain the dataset. Section 5 includes all results from the conducted tests and draws preliminary conclusions on the results. Section 6 discusses possible flaws and direct any possible further research. Finally, Section 7 draws a short conclusion of the results.

[37] Under the assumption that investors are perfectly rational this is challenged by behavioral models, than the option value becomes a trade-off with the direct value of cash. Perfect rationality is however assumed in this paper.