Market Reaction on Share Repurchases Announcements

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Abstract

This paper shows that the buyback anomaly prevails, suggesting that investors still do not make use of the arbitrage opportunity associated with the buyback anomaly. The paper tries to identify the firm specific characteristics for which the market reaction to the share repurchases is most abnormal. Thus identifying for which type of firms the repurchase announcement creates the best arbitrage opportunity. With calculating Cumulative Abnormal Returns and Buy-and-Hold Abnormal Returns this reaction is tested using two different models. Doing this, the paper tries to advise investors which characteristics are most attractive on average as portfolio selection characteristics. The results of this paper suggest that small firms and value firms are likely to have the most positive abnormal reaction, on average, after the repurchase announcement. Furthermore, the results of this paper identify for which industries this reaction is most common.

1. Introduction

Stock prices can behave abnormal on average compared to a given model around major events in the life of a firm. This so called abnormal return is an anomaly. Major events can be for example spinoffs, mergers, acquisitions, IPO's, secondary stock issues, or stock repurchases. Many different models are being used to calculate the abnormal returns around a major event and yield different conclusions about anomalies. When anomalies are revealed it can be expected that they disappear. Anomalies behave in such a way due to the fact that investors try to take advantage of them. Schwert (2003) argues that many notorious anomalies have disappeared in recent years, even if the anomalies existed in the sample period in which they were first identified. "This is not the case for the buyback anomaly", so say many researchers (e.g. Vermaelen (1981); Dann (1981); Ikenberry et al. (1995, 2000); Peyer and Vermaelen (2008)). These researchers suggest that after the share repurchase announcement is publicized prices keep adjusting in the long run with respect to the initial repurchase announcement. By suggesting that this anomaly still exist, research indirectly suggest that investors do not take advantage of the arbitrage opportunity that is associated with this anomaly. This makes this particular anomaly interesting for research and for investors. Researchers have attempted to investigate the reasons why investors do not take advantage of the occurring anomaly, and thus tried to clarify why the anomaly does not resolve itself.

This research argues that, up to now, investors do not make use of the arbitrage opportunity that lies within the buyback anomaly, suggesting that the buyback anomaly persists. Moreover, this research creates a basis for investors to make use of the described arbitrary opportunities. This thesis does this by testing the anomaly for different firms within the sample. With use of basic firm characteristics, firms are placed in different groups. By doing this the paper tries to identify the firm specific characteristics for which the market reaction to the share repurchases is most abnormal. Thus identifying for which type of firms the repurchase announcement creates the best arbitrage opportunity. A real life portfolio is not created. However, different characteristics such as, past stock price performance, firm-size, Book-to-Market ratio, timing of the repurchase, and industries, are tested using existing data on share repurchases. This contributes to the research in two ways. Firstly, it helps investors to identify the best performing repurchasing firms and, secondly, it may be of use to clarify the reasoning behind the share repurchase anomaly. With more knowledge on this topic, and further testing through time and in different regions of the world, investors could possibly benefit from the buyback anomaly.

At first, the question "do buyback anomaly still exist?" is discussed. To make an attempt at answering this question one must start by investigating the model that lies behind an anomaly, which is the efficient market hypothesis (EMH) of Fama and Malkiel (1972). The theory states that a firm's stock price incorporates all publicly known information. As mentioned earlier, researchers suggest that on

average prices keep increasing due to the share repurchase announcement, in the long run. This investigation identifies two periods of stock price movement to be able to test market reaction on the buyback anomaly.

The first period is the short-term movement *around* the event. According to the efficient market hypothesis the news should be processed and incorporated in the stock price of the repurchasing firm. This investigation tests the abnormal return around the event in a short period window of 3 days. Research claims that the positive news of repurchasing stock brings out positive abnormal returns. Which means the market processes the news and is efficient regarding the news. The testing model used for the abnormal returns is the event study of Fama (1969). This test is not submissive to measurement errors in the short-term (Barber and Lyon, 1997). This paper provides indicators of evidence for positive abnormal returns in the short-term and assumes that the news is processed and incorporated in the stock price.

The second period is the long-term movement *after* the event. For the long-term, the event study method is not applicable due to measurement errors. Therefore, other models are used to test the long-term abnormal movement of the stock price, to investigate if the buyback anomaly prevails. As mentioned earlier, according to former researchers it is the case that, in the long run, after the share repurchase announcement, prices keep adjusting to the news. Two methods are used to analyse the abnormal returns for the long-term. Calculating Cumulative Abnormal Returns and Buy-and-Hold Abnormal Returns, this paper argues that there are abnormal returns in the long run. By doing this, this research is able to identify the best performing portfolios with respect to the firm specific characteristics. In other words, the abnormal returns of sub-groups of the initial sample are calculated and so the best performing subgroup is identified when compared to others. These two models yield outcomes on subgroups, which are selected using past stock price performance, size, Book-to-Market, timing of the repurchase and for industries.

For the time period of the 1st of January 2007 until the 31st December 2013, all reported repurchase announcements of US-companies are retrieved from Securities Data Corporation (SDC) mergers and acquisition and repurchases databases. For the short-term analysis this results in an initial sample data set of 1,563 open market repurchase announcements, 161,300 firm-days and 732 repurchasing firms. For the long-term analysis, this results in an initial sample data set of 1,563 open market repurchase announcements, 98,146 firm-months and 732 repurchasing firms. These announcement dates, the accompanying share prices, share volume, monthly returns, ticker, as well as further information could be found at the Center for Research in Security Prices (CRSP) database online.[1]

[1] Attachment 1 (A3) shows the retrieved variables from CRSP (made *cursif)*.

As mentioned earlier, the event study is being used to find the [-1,+1] daily cumulative abnormal return around the event. This method is not submissive to measurement errors and is proven to be a good measurement for abnormal returns in the short run, by former researchers. For the calculation of long-term abnormal return this thesis first makes use of the Fama-French (1993) 3-factor model. Even though this method is still submissive to some measurement errors, as mentioned by Barber and Lyon (1997), it is a popular method for calculating cumulative abnormal returns (CARs) in the long run. The second method, which is used and suggested by the researchers Barber and Lyon (1997), is the buy-and-hold abnormal returns (BHAR) model. Both models are popular for calculating abnormal returns in the long-term and both are submissive to different measurement errors. This thesis uses both models to calculate abnormal returns and so gives two different views on the anomaly. These different views can be used for concluding on the best performing stocks regarding repurchasing firms.

It is shown that indeed an average increase of 2.36% abnormal return exist within the 2 days around the event. This implies that the market processes the news, and fully and correctly reflects the new information into the stock price. Furthermore, this research provides indicators of evidence that in a period of four years after the share repurchase announcement, on average cumulative abnormal returns of 105,41% are realized.[2] The popular benchmark Fama-French (1993) 3-factor model (used to calculated CARs), only calculates a -3.58% normal return over four years.[3] These results indicate, that the buyback anomaly prevails. Therefore, the research can make inferences for the goal of the thesis.

The aim of this study is to test the long-term performance of the dataset for different firm specific characteristics. This paragraph discusses the results of the Book-to-Market ratio and firm size as characteristics of the firm. It is found that the biggest overreaction of positive abnormal returns after the share repurchase announcement is caused by small firms and value firms (low Book-to-Market) on average. In other words, the abnormal returns are the highest for the subgroups containing the smallest firms and the firms with the lowest Book-to-Market ratio. Summarizing the results on size and Book-to-Market, the market seems to underreact mostly to the buyback announcements made by small-firm stocks and value stocks. That makes small-firm stocks and value stocks in case of a share repurchase announcement more attractive for investment opportunities.

Another characteristic that is used is the past performance of a company. Peyer and Vermaelen (2008) argue with their *overreaction hypothesis* that the long-term excess returns are a correction of an overreaction to bad news prior to the repurchases. In contrary, the results of this thesis suggest that the firms that performed substantially poor prior to the repurchase announcement do not experience the highest long-term abnormal returns after the repurchase announcement. The results suggest that all the

[2] This research obtained the abnormal returns from the averaged intercepts of the Fama-French (1993) 3-factor regression. See equation 3.3 what the variables are of this regression.
[3] See figure 1 for a graphical illustration of these numbers.

quintiles give large cumulative abnormal returns after the repurchase announcement. Remarkable, the quintiles with positive prior 6 month raw returns, show even more positive cumulative abnormal returns compared to bad performing quintiles. Conclusion is that prior negative returns are no prediction for the long-term positive returns after the repurchase announcement. In other words, the results suggest that prior negative performance alone is not an indicator for positive cumulative abnormal return in the long-run. This is in contradiction to former studies. Despite this contradiction, conclusions can be drawn about the buyback anomaly using these results. They clearly state an overreaction of investors after the event regardless from prior performance.

Next, the paper tests the effect of industries on share repurchase announcements and on the abnormal return performance.[4] The results suggest that the following three industries are negatively correlated to the repurchase anomaly: Manufacturing (1), Finance-Insurance-Real-Estate (2), and Services (3). The research conveys, that for four years after the repurchase announcement excluding one of these industries increases the positive average abnormal return from 0,97% (significant at the 1% level) to 1,40% (significant at the 1% level). In other words, these industries experience negative average abnormal returns. This indicates that excluding these industries out of the sample improves the abnormal return of the portfolio. Conclusions can be drawn about the buyback anomaly using these results. They show a negative overreaction after the event for the mentioned industries above.

As a last grouping firm's stock characteristic a time dummy is included to incorporate the effect of the financial crisis. Seeing my sample covers the whole financial crisis, this dummy aims to identify the effect of the heat of the crisis[5]. In other words, this dummy aims to exclude the most volatile months which are caused by the heat of the crisis. Using this dummy, it is evaluated if this crisis has an effect on the stock price performance after the repurchase announcement. The research shows that four years after the repurchase announcement, inserting the dummy for the heat of the crisis (September 2007 – December 2008), increases the positive average abnormal return from 0,97% (significant at the 1% level) to 1,72% (significant at the 1% level). This indicates that leaving out the time effect of the heat of the crisis, by inserting the dummy, improves the average abnormal return of the portfolio. Which indicates that the heat of the crisis has a negative effect on average abnormal return.

Studying stock price movements around major events, as for example IPOs, mergers, stock splits, spinoffs, and share repurchases helps researchers make conclusions about the effect of the news on the share price and, therefore, the effect of the event in total. Many studies have been done on these kind of events (e.g. IPOs (Ritter, 1991), mergers (Agrawal et al., 1992), proxy contests (Ikkenberry and Lakonishok, 1993), and spinoffs (Cusatis et al. 1993). Mitchell and Stafford (2000), Peyer and

[4] Retrieved from: http://siccode.com/en/
[5] Keep in mind that companies like to repurchase during a crisis (when stock prices fall).

Vermaelen (2008), and Dittmar (2008) have found that after the news is incorporated in the price of the stocks of repurchasing companies, the stock prices keep performing in an inefficient manner. They show with similar techniques as this research, that the buyback anomaly prevails.

Barber & Lyon (1997) argue that researchers should calculate abnormal returns as the simple buy-and-hold return on a sample firm, minus the simple buy-and-hold return on a reference portfolio or control firm. This model is called the Buy-and-Hold Abnormal Return (BHAR) method. The model of BHAR is known for being a "precise measure of investor experience since it captures the effect of price movements an investor experiences over a time period" (Barber & Lyon, 1997). However, Barber and Lyon (1997) and Kothari and Warner (1997) provide simulation evidence showing that common estimation procedures can produce biased $\overline{BHAR}$ estimates. In particular, biases arise from new listings, rebalancing of benchmark portfolios, as well as the skewess of multi-year abnormal returns.

Despite the fact that the 3-factor model does not precisely measure investor experience, Fama (1998) chooses this model above the $BHAR$ methodology. Fama (1998) claims that the systematic errors of the $BHAR$ method are compounded with long-horizon returns. This phenomena is called 'the bad model problem'. Especially in the long run the bad model problem errors magnify. The reason for this is that bad-model errors in expected returns grow faster with the return horizon than the volatility of the returns. Therefore, Fama (1998) strongly advocates a monthly 3-factor approach for measuring long-term abnormal performance. In this study, both models are tested and the outcomes are compared.

This thesis finds arguments for the existence of the repurchase anomaly within the sample. Almost all numbers reported for the long run abnormal returns are significant with the 1% level. The results suggest that it is most likely that small companies and value companies are subject to underreaction of the market on its long-term abnormal returns after the repurchase announcement. Moreover, the financial crisis is negatively correlated with the abnormal returns within the sample. Finally, the thesis finds that Financial Institutions, Manufacturing firms and Services firms are negatively correlated to the abnormal returns within the sample. Most likely the results are influenced by the financial crisis. Future research is needed to provide more information on other possible characteristics that cause large abnormal reaction in the long run. The focus of this thesis was to bring out the best selection characteristics for investors. The recommendation for future research is to give the results of this thesis extra strength, increasing the stability of the results.

The remainder of this paper is organized as follows: Section 2 reviews the current state of literature. Section 3 elaborates on the theoretical framework and explains the methodology used to generate the results. The empirical results as summarized, analysed and discussed in section 4. Section 5 concludes on the results with specific recommendations for future research regarding the subject.

2. Literature Review

2.1 The Efficient Market Hypothesis

The efficient market hypothesis (EMH) is the starting point for this research and many other researches in Finance. It is the cornerstone of modern Finance and this theory was first introduced by Fama & Malkiel in 1970. This theory states that all information available is incorporated in a stock price and so financial markets are information efficient. Information on the other hand has to be processed by the investor in the right way. Fama & Malkiel (1970) assumed that every investor acted 'rational' in the early years of their theory. Nowadays research made clear that on the average investors act 'rational' when investing in financial markets. The notion of an informationally efficient market traces back to Louis Bachelier, the French mathematician who is recognized as the founder of option pricing theory. Early researchers like Alfred Cowles, Holbrook Working, Harry Roberts, Eugene Fama, M.F. Maury Osborne and Maurice Kendall found that stock prices exhibited no predictable price patterns. The 1992 edition of Professor Burton Malkiel's book *A Random Walk Down Wall Street* (Campbell, Lo, and MacKinlay 1997) provides a nice definition of efficiency:

> "A capital market is said to be efficient if it fully and correctly reflects all relevant information in determining security prices. Formally, the market is said to be efficient with respect to some information set … if security prices would be unaffected by revealing that information to all participants. Moreover, efficiency with respect to an information set … implies that it is impossible to make economic profits by trading on the basis of that information set."

This definition implies that one can test market efficiency by studying the price reactions caused by information released to the market. If prices do not change on an information release, then the market is efficient with respect to that information. The former researchers have come to the conclusion that stock prices are basically right. All publicly information is incorporated in the stock prices and this is called the semi-strong Efficient Market Hypotheses. Markets react quickly and mostly efficient when news comes in. But there are some anomalies that cannot be predicted by EMH or asset pricing models and those price shocks are interesting for researchers.

2.2 Buyback Anomaly

In this paper the anomalous price behaviour around share repurchases by companies is being researched and so the current state of literature is summarized in this section. The definition in last section stated that market efficiency can be tested by studying price reactions caused by information released to the market. This is mainly the essence of this research and other researchers in the past regarding the repurchase subject. This section summarizes the literature about the buyback anomaly or in other words, repurchase anomaly.

Two major reasons for repurchasing shares are analysed in the theoretical literature. The first is that management uses open-market share repurchases to signal better prospects (e.g. Bhattacharya (1979), Miller and Rock (1985), Vermaelen (1984)). These papers suggest that repurchases can be used as a costly signal about future cash flows when markets are incomplete. As demonstrated by these papers, the repurchase decision can reveal information about future earnings and profitability to the market. Later empirical research on this subject was done by Ikenberry, Lakonishok, and Vermaelen (1995), Peyer and Vermaelen (2008), and Obernberger (2013). They came to the conclusion that managers' motivation to repurchase is more the mispricing of the stock at a given time than that they are actually try to signal the market.

Once anomalies become known, they should disappear as investors try to take advantage of them (Schwert 2003). Schwert argued in his paper that many notorious anomalies have disappeared through time, even if the anomalies existed in the sample period in which they were first identified. Though, the buyback anomaly persisted through time and that makes it interesting to research more of it. Former research has been done for example by Ikenberry et al. (1995). Ikenberry et al. (1995) say the following about the buyback announcement:

> "If, in management's assessment, the firm is undervalued, they might choose to buy back stock. Making such an announcement is thus argued as serving a valuable signal to a less informed marketplace. If markets respond efficiently, prices should adjust immediately in an unbiased manner. The new equilibrium price should fully reflect the 'true' value of the new information, and no wealth transfer should occur between long-term shareholders and those selling share to the firm."

These researchers investigated the stock-price performance of firms that announced a share repurchase between 1980 and 1990. They find average abnormal buy-and-hold returns of 12.1% over the 4 years following the announcement. The research of ILV finds that managers try to take advantage of a perceived mispricing of their share. This is consistent with the CFO survey results of (Brav. Et al., 2005), they report that undervaluation is the most important factor driving a repurchase, which is on the other hand in line with the research of Peyer and Vermaelen (2008). Peyer and Vermaelen have found that open market repurchases are a response to a market overreaction to bad news: significant analyst downgrades combined with overly pessimistic forecasts of long-term earnings.

In the 2008 paper of Peyer and Vermaelen they test three hypotheses. The importance of this paper makes it useful for this research to lay out these hypotheses a little more. First is the *risk-change hypothesis*, proposed by Grullon and Michaely (2004), argues that the excess returns reflect not a signal about future cash flows, but about future risk changes. The argument by them is that the repurchase signals a decline in growth prospects, which should lower the risk of the stock. Second, the

liquidity hypothesis argues that a repurchase reduces liquidity. As Pástor and Stambaugh (2003) find that their liquidity factor is priced, it is possible that the abnormal returns are due to this omitted liquidity factor. Third, the *overreaction hypothesis* assumes that the long-term excess returns are a correction of an overreaction to bad news prior to the repurchases. Peyer and Vermaelen found strong support for the overreaction hypothesis in their paper of 2008.

During the crisis another important paper about share repurchases is written. Again the pioneers in the field Peyer and Vermaelen published a paper together with Tilburg University's professor Alberto Manconi in 2013. In this paper the worldwide anomalous behaviour is researched. Interestingly they used the same three hypotheses as described in the last paragraph added with some new ones. They find that long-run abnormal returns after buyback announcements follow the same pattern in non-U.S. firms as documented by prior literature for U.S. firms extending the buyback puzzle to the global level. Also more qualitative analysis is conducted to explain buybacks. Cross-country differences in corporate governance quality and regulatory differences can explain variation in the short- and long-run abnormal returns. Though, the researchers restricted their sample to announcement dates between 1998 and 2008 which filters out the financial crisis data.

Dittmar and Dittmar (2008) state on the other hand that repurchases do not predict higher returns. They find, contrarily to former researchers no evidence that market timing drives stock repurchase waves. They do not challenge the fact that firms experience abnormal returns following repurchasing announcements but they do question if the abnormal returns are evidence of managers timing the market. The paper of Dittmar and Dittmar (2008) also contributes to the literature on stock repurchases by providing evidence on the reason that stock repurchases occur in waves. The results of this paper call into question the impact of market timing on trends in corporate decision making.

The latest research is done by Obernberger (2013), he analysed the long-run performance of share repurchases to support his *market-timing hypothesis*. According to this hypothesis repurchases would be followed by positive abnormal returns and average market prices would thus be higher than average repurchase prices. Instead of former researchers he uses newly available repurchase data from quarterly filings which companies are obliged to report by the Rule 10b-18 adopted by the Securities and Exchange Commission. He finds that with his dataset returns around buyback announcements are close to zero and subsequent returns are no longer abnormally high in the medium or long-run. This means there is no support for the *market-timing hypothesis*. Obernberger (2013) concludes that neither recent repurchase announcements nor actual repurchases convey information. This is more or less in line with Peyer and Vermaelen (2008) with the extent to that companies repurchase shares because they are "undervalued," they are not doing so because they expect earnings to increase; rather, they are buying back stock because they disagree with the market's forecast that earnings will decline in future

years. Positive result that did come from this research was the support for the *contrarian-trading hypothesis*. Repurchases are triggered by negative pre-announcement stock price returns and that is something were researchers are in line with each other. Hong et al. (2008) furthermore present a model and empirical evidence for the U.S. that firms act as buyers of last resort, i.e. provide liquidity to investors when no one else will. The results of Hong et al. (2008) are also in line with the survey by Brav et al. (2005), where CFOs indicate price support as one of the most important motivations for repurchase trading.

Interesting to see is that there is still no common sense about the timing of CEO's share repurchases. That is why it is very interesting to research this phenomenon. This research will try to add an extra view to this discussion with new data on the US stock market. In section 2.3 the importance of the data sample timing will be stated. Section 2.4 will give the hypothesis development.

2.3 The current crisis

"It's only when the tide goes out that you learn who's been swimming naked" – Warren Buffet, 1992 Letter to Shareholders

The buyback anomaly literature is based on data before the current credit crisis. With the enfolding of the crisis and the effects it has on the equity market, the crisis should make an effect on the buyback anomaly. The crisis started early in 2007 in the United States (which is worlds' biggest financial market). Since 2007 the financial markets have suffered catastrophic losses. These were originally triggered by the threat of massive defaults of subprime borrowers in the mortgage markets. The resulting subprime crisis of 2007 led rapidly to massive declines in the market values of large portfolios of highly rated asset-backed securities (ABS).

In 2008 the subprime crisis spilled over and became the beginning of a worldwide depression in which the world is climbing out these days. The financial markets suffered from the losses of the large financial corporations as Morgan Stanley, AIG, Lehmann Brothers, Bearn Stearns, Fannie Mae, Freddie Mac, Wachovia, Washington Mutual, and many others. Most remarking event was the bankruptcy of Lehmann Brothers on 15 September 2008.

The default of the subprime borrowers was fuelled by some inefficiency in the financial system. The reliance and failure of the Credit Rating Agencies made it possible to fuel the crisis. According to many observers, CRAs underestimated the credit risk associated with structured credit products (Pagano and Volpin, 2010). For instance, according to the International Monetary Fund (IMF), more than three quarters of all private residential mortgage backed securities issued in the United States from 2005 to 2007 that were rated AAA by Standard & Poor's are now rated below BBB-, i.e., below

investment grade. The IMF in 2008 concludes that "While downgrades are expected to some extent, a large number of them – in particular when they involve several notches at the same time or when the downgrading takes place within a short period after issuance or after another downgrade – are evidence of rating failure."

These market failures led to more repurchases and increasing total repurchase volume in the US in the years 2007 until 2014 (table 1) for these numbers. In section 2.2 the literature is come to common sense that repurchases are triggered by negative stock returns. That explains the increasing number of repurchases. Using the empirical methods of Peyer and Vermaelen (2009) to test the repurchases from 2007-2013 this research will try to give a new view on the *undervalued hypothesis.* Maybe this will result in remarkably numbers that prove that a trading strategy with repurchasing stocks during crises. In the next two paragraphs this research will tell in more detail what these two hypotheses are and how they can be used.

2.4 Hypotheses development

Market reaction to new information can be tested on the hand of the share prices of a company. This research is about the repurchase announcement (new information) and the share price reaction of the market around that peace of new information. Former researchers have proven that the news causes a positive short term daily cumulative abnormal return. This research will test the share price reaction of a stock chronologically around the repurchase announcement, henceforth called the 'event' in this research. This research hypothesis that the market treats repurchase announcements with scepticism, leading prices to adjust slowly over time. For example Ikenberry et al. (1995), provided evidence for this phenomena and this research will re-test this hypothesis with new data and new conclusions for investors.

2.4.1 Short-term analysis

Short-term performance is calculated for a 3 day window of the day before and after the event, and the event day itself off course. As mentioned before, with event study (introduced by Fama et al. 1969) the abnormal stock price reactions with respect to news can be investigated. This research will use the event study to obtain that the news of repurchase is incorporated in the stock price within days around the event. For the short-term the research hypothesises that the market will identify and processes the repurchase announcement in the stock price of the relevant company.

Hypothesis 1:

A repurchase announcement is positively correlated to stock price performance and so the abnormal returns in the short-term will be positive.

2.4.2 Long-term analysis

The prices after the repurchase announcement slowly adjust over time. This is what the Underreaction Hypothesis of Ikenberry et al. (1995) refers or the overreaction hypothesis of Peyer and Vermaelen (2008). Lakonishok and Vermaelen (1990) find that on average, prices remain at bargain levels for at least two years. Other examples of delayed market reactions include IPOs (Ritter, 1991), mergers (Agrawal et al., 1992), proxy contests (Ikkenberry and Lakonishok, 1993), and spinoffs (Cusatis et al. 1993).

When estimating long-term abnormal returns, several methodological issues arise. Brown and Warner (1980, 1985) simply define abnormal return as the difference between the actual return of a security at any time and the returns estimated by a model for expected returns. Several ways emerge to calculate expected returns. Brown and Warner (1980,1985) focus on the characteristics of abnormal stock returns. On the other hand, Barber & Lyon (1997) document the empirical power and specification of test statistics designed to detect long-run abnormal stock returns. They argued that many of the common methods used to calculate long-run abnormal stock returns are conceptually flawed and/or lead to biased test statistics. The researchers Barber & Lyon argue in their paper that researchers should calculate abnormal returns as the simple buy-and-hold return on a sample firm less the simple buy-and-hold return on a reference portfolio or control firm. This model is called Buy-and-Hold Abnormal Return (BHAR) method, henceforth BHAR. The model of BHAR is being known for being a "precise measure of investor experience since it captures the effect of price movements an investor experiences over a time period" (Barber & Lyon, 1997). However, Barber and Lyon (1997) and Kothari and Warner (1997) provide simulation evidence showing that common estimation procedures can produce biased $\overline{BHAR}$ estimates. In particular, biases arise from new listings, rebalancing of benchmark portfolios, and skewness of multi-year abnormal returns. Large sample sizes mitigate many of these biases. So that is in favour of this research. The common conclusion of these methodology papers is that "measuring long-term abnormal performance is treacherous." For this research these biases will be in the data too and will be accounted as given. As the goal of this thesis is not to find the valid abnormal returns, but this research is looking for portfolio selection characteristics.

Where calendar time approach as the Fama-French 3-factor model does not precisely measure investor experience Fama (1998) argues against the $BHAR$ methodology because the systematic errors that arise with imperfect expected return proxies are compounded with long-horizon returns. This phenomena is called 'the bad model problem'. Many researchers are unable to find a proper model for measuring expected (normal) returns, and all models show problems describing average returns. Especially in the long run the bad model problem errors magnify and the reason for that is that bad-model errors in expected returns grow faster with the return horizon than the volatility of returns. Therefore, Fama strongly suggests a monthly calendar-time portfolio approach for measuring long-

term abnormal performance. First, monthly returns are less sensitive to the bad model problem. Second, by forming monthly calendar-time portfolios, all cross-correlations of event-firm abnormal returns are automatically accounted for in the portfolio variance. That is why this thesis will test both models to use its outcomes to compare it to on and another. Both models suffer from different biases but when giving the same results the results of this thesis are very valid to use for conclusions and further research. Furthermore, when if the results will be biased the message and direction will be correct on average. Since this research's goal is to identify the best performing portfolio to invest in during the time of a financial crisis. That is why the two approaches/model for calculation abnormal return will be used to test the following hypothesis.

Hypothesis 2:

A repurchase announcement is positively correlated to stock price performance and so the abnormal returns in the long-term will be positive.

To be able to test the selection characteristics more, hypotheses will be used to test each one of them. In further research it is made clear that firms with a specific characteristic are more or less likely to be mispriced. Mispricing seems to have a positive correlation with abnormal returns in the long-term. Loughran and Ritter (2000) pointed out that value weighting portfolios decreases the power to identify abnormal returns as it is less likely that large firms repurchase stock because they are undervalued. Moreover, Peyer and Vermaelen (2008) showed that firm size and Book-to-Market is negatively correlated to long-term abnormal return.

Hypothesis 3:

Firm size is negative correlated to long-term abnormal return and so firm size is a good selection characteristic for an investment portfolio.

Hypothesis 4:

Book-to-Market ratio of a firm is negative correlated to long-term abnormal return and so the Book-to-Market is a good selection characteristic for an investment portfolio.

Also is prior stock price performance a good approximation for future long-term abnormal returns. Which makes the research come to the following hypothesis.

Hypothesis 5:

Prior stock price performance is negatively correlated to long-term abnormal return and so the prior stock price performance is a good selection characteristic for an investment portfolio.

As mentioned before in this section the current financial crisis lies in the sample period of this research and could make a great influence on the outcomes. That is why this research will test the timing of the repurchases with a dummy for the time the crisis took place. This brings the research to test the following hypothesis.

Hypothesis 6:

The heat of the financial crisis is negatively correlated to long-term abnormal return so the dummy variable for the heat of the crisis is positive to the average abnormal return.

Finally, the effect of the industry the firm is in will be tested. With the financial crisis the financial institutions and its related industry is expected to be negatively correlated with the financial crisis. That is why this research will test the different industries with multiple dummies for the industries of the firms in the sample. This brings the research to test the following hypothesis.

Hypothesis 7:

Industries are correlated to long-term abnormal return and so can be a good selection characteristics for an investment portfolio, including a dummy will yield the best performing industries.

3. Research Method

3.1 Sample selection and data

The starting point for the sample selection is the Securities Data Corporation (SDC) mergers and acquisition and repurchases databases. In SDC the announcement dates of repurchases can be found in the time zone from January 2007 until December 2013. With these announcement dates the accompanying share prices, share volume, monthly returns, ticker and more could be found at the Center for Research in Security Prices (CRSP) database online. Only US companies will be used for this_research.

The initial dataset comprises 1,577 repurchase announcements. In addition, to circumvent the problem of skewed long-term return calculations (Loughran and Ritter, 1996), this research eliminates events where the stock price 1 week before the announcement is smaller than $3. The final sample data set comprises 1,221 open market repurchase announcements and 98,146 firm-months and 732 repurchasing firms. Furthermore, the thesis will edit the data so that the data will be equally weighted. This thesis requires every repurchasing firm to have monthly returns within the sample dataset time span for 48 months after the repurchase and 6 months before the buyback. This means that all repurchases after December 2008 will be deleted from the dataset and also repurchasing firms that went bankrupt or stopped trading in the open market. This results in a 278 open market repurchase announcements and 15,568 firm-months and 175 repurchasing firms that announced between January 2007 and December 2009.

In order to match the announcement dates of SDC and the monthly returns of CRSP the research used Stata to edit the data. Count the months before and after the event and also match event date to date zero. All to calculate the abnormal returns with the use of event study and time-series regressions.

3.2 Short-term abnormal returns around the events

Short-term performance is calculated over a 3 day window. One day before and one day after the repurchase announcement. When abnormal returns are calculated over such short interval, the results are not overly sensitive to the benchmark used. Thus, this thesis reports results using a straightforward approach, calculating abnormal returns with the event study of Fama et al. 1969.

Event studies, introduced by Fama et al. (1969), produce useful evidence on how stock prices respond to information releases. The basic idea is to find the abnormal return attributable to the event being studied by adjusting for the return that stems from the price fluctuation of the market as a whole. With use of regressions the abnormal return can be retrieved. First start with looking at the daily cumulative

abnormal returns (CAR) [-1,+1`] using the market model with an equally weighted CRSP index of NYSE and ASE firms:

$$r_{it} = \alpha + \beta r_{mt} \tag{3.1}$$

Using an event study in Stata with a event window of 1 day before the event and 1 day after the event and an estimation window of 60 days before the event until 30 days[6] before the event. To get sufficient data the research drops all company's without all days of trading within both the windows. Calculating the betas of the specific companies announced to buy back their shares. Next, calculating the abnormal returns:

$$AR_i = R_{it} - R_i \tag{3.2}$$

3.3 Long-term abnormal returns

Ritter (1991) was among the first to argue that cumulative abnormal returns (CARs) and Buy-and-Hold Abnormal Returns (BHARs) can be used to answer different questions. Ritter (1991) documents that firms that go public underperform an equally weighted market index. Consequently, over long horizons, this research anticipate that the population mean for cumulative abnormal returns will be positively biased. Barber & Lyon (1997) refers to this bias as the *new listing bias*. Both models of CAR and BHAR suffer from the *new listing bias*. Both models suffer from different biases but when giving the same results the results of this thesis are very valid to use for conclusions and further research. That is why the two approaches/models for calculation abnormal return will be used. The BHAR model will be used following Barber & Lyon (1997), Lyon et al. (1999) and many others and the Fama-French 3-factor model will be used following Peyer and Vermaelen (2008) and many others.

3.3.1 Calendar-Time Abnormal Returns: Fama-French 3-factor model

The research will first test the long-term abnormal returns by using the Fama-French (1993) three-factor model to compute abnormal returns. This regression methodology is proven to be a good measure in the long run for big datasets. It is also used in the paper of Peyer and Vermaelen (2008) to measure its performance on a new dataset so that this research will be able to analyze and compare the results of the two papers. That is why this research will use this method. As suggested by Fama (1998) a monthly calendar-time portfolio approach for measuring long-term abnormal performance will be applied. This approach will be initiated with creating Calendar Time Portfolios (CTP). The CTP-method creates a monthly portfolio of all firms which announced an open market repurchase in the previous 36 months. These portfolios are created from January 2007 up to December 2010. The portfolios are recalculated each month which infer that the portfolios differ each month in quality and

[6] As in Fama et al. (1969)

quantity. This data then provides the CTP return in month *t* as the average equal weighted return of each company in the portfolio,

$$CTP_t = \sum_{i=1}^{n} w_i R_{i,t} \tag{3.3}$$

For every event, a monthly regression will be run and the sum of the alphas of equation 3.3 will be reported in table 2. Within table 2 like in Peyer and Vermaelen the subsamples with respect to book-to-market (BM) quintiles and size quintiles will be made. Again, to analyze the behaviour of the abnormal returns around events and to compare the two papers – this one and the one of Peyer and Vermaelen (2008). Also this research will not follow Mitchel and Stafford's (2000) suggestion to calculate value-weighted portfolio returns for the sample of 278 firms that announced an open market share repurchase, because that would skew the data. The following regression is run each event month j:

$$\left(R_{i,t} - R_{f,t}\right) = a_j + b_j\left(R_{m,t} - R_{f,t}\right) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t}\ , \tag{3.4}$$

where $R_{i,t}$ is the monthly return on security *I* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate[7] and the return on the equally weighted CRSP index of NYSE and ASE firms. SMB_t and HML_t are the monthly return on the size and BM factor in month *t*. The monthly returns on SMB_t and HML_t are extracted from the Wharton Database using the Fama-French data. The coefficient a_j is the result of a monthly (in event time) cross-sectional regression. The cumulative abnormal return (CAR) numbers will be sums of the intercepts a_j over the relevant event-time window. The standard error (denominator of the t-statistic) for a given event window is the square root of the sum of the squares of the monthly standard errors. For the calculation of the abnormal returns define $R_{i,t}$ as the month *t* simple return on a sample firm, E($R_{i,t}$) as the month *t* expected return for the sample firm, and $AR_{i\tau} = R_{i,t} - E(R_{i,t})$ as the abnormal return in month *t*. Cumulating across τ periods yields a cumulative abnormal return (CAR):

$$CAR_{i\tau} = \sum_{t=1}^{\tau} AR_{it} \tag{3.5}$$

The advantage of this methodology is that changes in the riskiness of the equity from before to after the buyback, e.g., due to changes in leverage, are better accounted for. The reason is that month-by-month after the buyback, the factor loadings are allowed to change. So for every company time-series regression are made, which are followed by month-by-month cross-sectional regressions for the alphas. These alphas are the abnormal return averages which can be studied for the average anomaly effect throughout time.

[7] One-month US T-bill for the corresponding event month *j*.

3.3.2 Buy and Hold Abnormal Return BAHR-model

The paper of Lyon et al. (1999) provides two different methods for BHARs. In the first method the researchers calculate the monthly mean return of each portfolio and compound this over *t* months of interest. In the second method they first compound the returns of each company over *t* months of interest, and then sum the compounded returns per month over the different companies. In this research the second method will be used since it simulates the returns real investors would experience, and is, amongst others, the method of choice for Mitchell and Stafford (2000), Ikenberry et al. (1995) and Kothari and Warner (2004). To calculate the Buy-and-Hold Abnormal Returns (BHAR), equation 3.6 will be used:

$$BHAR_i = \prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{benchmark,t}) , \quad (3.6)$$

where $\prod_{t=1}^{T}(1 + R_{i,t})$ is the compounded return of security I from t = 1 up to t = T, where t is monthly. The second part of the equation, $\prod_{t=1}^{T}(1 + R_{benchmark})$ being the compounded expected return from t = 1 up to t = T. That gives that $BHAR_i$ is the compounded abnormal return of the security over the period T. This study, following Ikenberry et al. (1995), an equally-weighted investment in each security is assumed, starting the month following the repurchase. The matching portfolio benchmark (e.g. Mitchell and Stafford (2000), Ikenberry et al. (1995)) is used as benchmark. This benchmark is based on matching the characteristics of the benchmark with the characteristics of an event firm; either by creating a matching portfolio of firms or matching an index such as CRSP index returns based on size deciles. This study will only match firms based on size deciles from the CRSP annually market value index returns. For the calculation of BHARs the thesis uses quintiles instead of deciles. Unfortunately CRSP only provides deciles and that is why this research will use deciles for the calculation of the matching portfolios.

To be able to compare BHARs to CARs this thesis will use a period of four years after the repurchase announcement. The portfolio is rebalanced at the end of each year, setting the compounded returns equal to zero. This is to prevent that a small set of extreme compounded returns dominate the total four year BHARs. Following Ikenberry et al. (1995), and Lyon et al. (1999), a size-based benchmark will be set up.

3.4 Categorizing-portfolios by industry and crisis data

To construct a simple test on how the open market repurchasing firms' stock price performance of this thesis' sample is performing this research will make use of a crisis dummy with the Fama-French (1993) 3-factor model. With use of this dummy this research will be easily to be able to calculate the performance without the crisis. To control for several stages of the crisis multiple dummies will be included. Exactly four dummies will be created, three for the years 2007, 2008 and 2009 and one for the heat of the financial crisis.

Also for the control of industry specifics a dummy will be created for the financial industries. As mentioned before the current financial crisis led to major breakdowns of larger financial institutions. For thesis, and its portfolio creation, it is interestingly to see if financial institutions in the sample have influence on the long-term abnormal returns. The dummy will be created for the primary four digit SIC codes from 6000 to 6999.

4. Results

4.1 Data description

As written in chapter 3 the research will test the long-term returns after Open Market Share Repurchases to test if the buyback anomaly still exists. Especially during a financial crisis. With these results we can compare the abnormal returns to the benchmark the CRSP equally weighted index of NYSE, ASE and NASDAQ firms. This research uses the program Stata and identifies panel data in it with Ticker as the panel entity.

4.2 Short-term abnormal returns around the events

With use of Stata this research requires every repurchasing firm to have monthly returns within the sample dataset time span for 48 months after the repurchase and 6 months before the buyback. This means that all repurchases after December 2008 will be deleted from the dataset and also repurchasing firms that went bankrupt or stopped trading in the open market. This effort results in a dataset of 1221 repurchasing firms. To control for errors in detecting long-term abnormal stock returns this research follows the paper of Barber & Lyon (1996) control for misspecification by matching sample to firms to control for similar sizes and book-to-market ratios. To compare the data on firms' specifics and make a first step to portfolio creation, the firms will be divided and analyzed in to quintiles based on size and book-to-market (BM) values. Firms are assigned to a size quintile based on the equity market value of the firm in the event month. For BM quintiles the value of BM in the repurchasing month is used. This results in the number of groups reported in table 1 panel A, and table 2 panel Bs' last rows. The research examines both short-term returns surrounding the announcement and long-term performance following the announcement. Table 1 reports univariate statistics for the open market repurchase sample and the short-term returns by year. The average abnormal return in the 3 days around the announcement is 2.36%. This is consistent with earlier findings (e.g., Peyer and Vermaelen, 1981, 2008). Also the fraction sought in the repurchase is comparable to Peyer and Vermaelen, with 8.46% of the shares outstanding. The number of events is significantly larger in the heat-years of the crisis: 2007 & 2008. The descriptive statistics on open market share purchases are reported. As can be clearly seen is that in the heat of the crisis the most events took place and the prior medium-term returns are the worst. The first part – that manager's buyback after significant downgrades in the stock prices – seems to be correct. Moreover, it seems that the market processes the new information. According to the EMH the after open market announcement abnormal returns should approximate zero. The second step of this chapters' research will be to check the long-term abnormal returns after the open market repurchase announcements with the two methods of CAR and BHAR.

Table 1
Descriptive statistics on open market share repurchases

Year	Number of events	CAR[-1,+1]	Fraction sought	Prior 6-month raw returns
2007	284	2.43%	8.08%	-10,52%
2008	265	2.32%	8.35%	-10,98%
2009	147	2.37%	8.83%	7,48%
2010	122	2.34%	9.55%	12,75%
2011	181	2.32%	8.29%	2,54%
2012	122	2.33%	7.70%	10,26%
2013	100	2.43%	12.37%	13,15%
All Years	1221	2.36%	8.46%	-0,47%

4.3 Long-term abnormal returns

The first test is to investigate whether there are still long-run abnormal returns after the announcement of open market share repurchases. As mentioned before, the research requires every repurchasing firm to have monthly returns within the sample dataset time span for 48 months after the repurchase. This means that all repurchases after December 2008 will be deleted from the dataset and also repurchasing firms that went bankrupt or stopped trading in the open market. This effort results in a dataset of 278 repurchasing firms. In order to investigate the long-term abnormal returns equation *3.4* is being used. To compare the results different time spans of long-term returns are being made. These time spans after the repurchase months are: 12 months, 24 months, 36 months and 48 months. For these time spans the cumulative abnormal returns (CARs) and the monthly average abnormal returns (ARs) will be calculated. The Fama-French (1993) regression *3.4* the intercepts are called: Jensen's alpha. In finance, Jensen's alpha (or Jensen's Performance Index, ex-post alpha) is used to determine the abnormal return of a security or portfolio of securities over the theoretical expected return. The estimated intercepts are monthly estimates of abnormal performance in spirit to Jensen's alpha, but controls for size and book-to-market factors in addition to the overall market.[8]

[8] Which is measure with the equally weighted CRSP index.

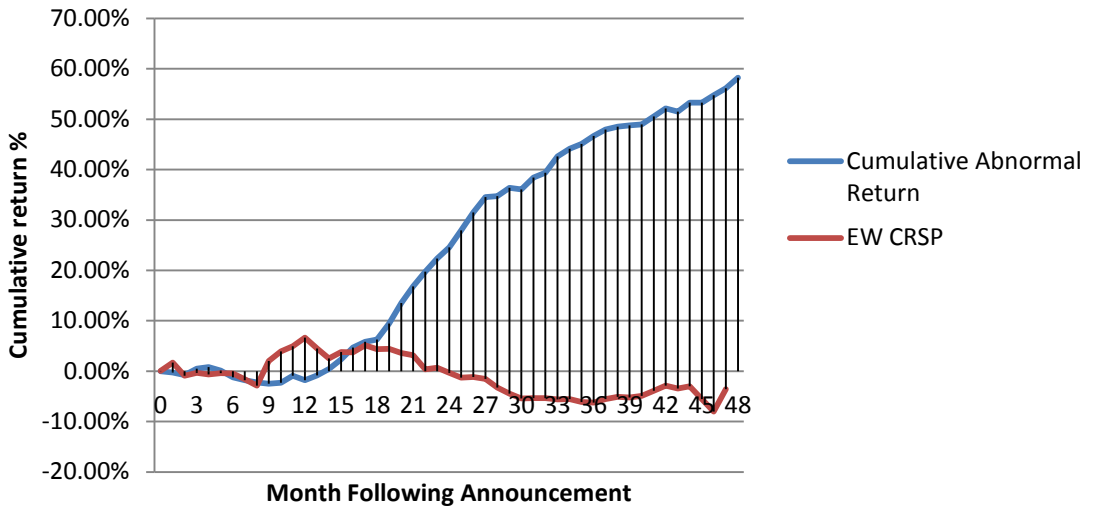

Fig. 1: Comparative monthly cumulative abnormal returns following open market share repuchase announcements 2007-2013.

This figure plots the cumulative abnormal return (CAR) up to 48 months following the announcement of an open market repurchase for the full sample dataset. Abnormal returns are calculated using Fama-French (1993) resulting in equation 3.3 with three factors excess Market return, Small minus Big and High minus low, respectively. Comparison is made between the abnormal returns and the equally weighted CRSP index excess return to compare the long-term performance of the market compared to the repurchase portfolio.

Figure one graphs the cumulative abnormal returns over the months following the repurchase announcement (blue line). The red line is the equally weighted CRSP index, which exemplifies the market excess return over the months after the repurchase announcement. This figure clearly shows the abnormal performance compared to a benchmark as the equally weighted CRSP index. In the first 12 months the repurchasing firms underperform on average, but in the longer term than 12 months the repurchasing firms beat the index on average. Over an hundred percent after four years on average the sample beats the benchmark. This indicates major opportunity for arbitrage to investors.

Table two and three show the CARs and ARs for different equally weighted portfolios. The CARs are just the cumulated abnormal returns that are calculated with the intercepts of regression *3.4.* Calculating the monthly average AR's is done with the command *xtreg* in Stata using firm fixed effects[9].

$$average\ AR = (\sum AR_t)/n \tag{4.1}$$

where AR_t is the monthly intercept of regression *3.3* and *t* corresponds to calendar time. The monthly returns are measured at the end of each month. The *n* is the number of months in the event window

[9] Firm fixed effects gives the same results as Random effects, and the Hausman test indicates to use the Fixed Effects model. See Attachment A2 for the results of the Hausman test.

which are clearly stated in the tables. A down effect of using *xtreg* is that it decreases significance since for every group it makes it decreases one degree of freedom in the model (Stock & Watson, 2003). Under the CAR approach, abnormal returns are calculated each month relative to a benchmark and the aggregated over time. This procedure assumes monthly rebalancing, with sample firms receiving equal portfolio weights each month. This creates a different average abnormal return for every month *j* from the event. The results of this are reported in tables 2 & 3.

Over 12 (24, 36, 48) months this research finds cumulative average abnormal returns of 3,93% (45,35%, 84,18%, 105,41%) for the full sample all significant at the 1% level except for 12 months, as reported in panel A of table 2. Table 2 also stratifies the sample in subsamples by firm size which is calculated with the market capitalization. Annual market capitalization values are retrieved from the CRSP index and companies stay in the first year market capitalization quintile for the whole period up to 48 months. The firms are assigned to quintiles based on market capitalization relative to the size of all CRSP firms in that same year. As in Peyer and Vermaelen (2008), size is expected to be negatively correlated with long-term abnormal returns, as it seems more likely that small firms are mispriced than large firms. As shown in Table 2, panels A and B, the smallest firm quintile displays the highest long-term abnormal returns (123,01%) after 48 months, and an average monthly abnormal return of 1,07% after 48 months. This seems to prove the statement that small firms are most likely to be mispriced. Note that all quintiles form small to large outperform the benchmark and are almost all significant at the 1% level. For the full sample of 278 events, the research finds highly significant average monthly returns of -0,04% (0,61%, 0,90%, 0,97%) using 12- (24-, 36-, 48-) month event windows. The economic magnitude of the abnormal returns seems to have increased compared with the Peyer and Vermaelen results. The difference in dataset with Peyer and Vermaelen is the time. Possible conclusions about the financial crisis can be drawn with these numbers. Peyer and Vermaelen found over 12 (24, 36, 48) months cumulative abnormal returns of 2,67% (10,54%, 18,60%, 24,25%), all significant at the 1% level. Summarizing Table 2, the market seems to under react to buyback announcements, in particular to the announcements made by small stocks. That makes small firm stocks more attractive for investment opportunities.

The results of the calendar-time approach are shown also in Table 3, but with the difference in subsample stratification by Book-to-Market ratio. Following the approach of Ikenberry et al. (1995), and Peyer and Vermaelen (2008), this research classifies firms into quintiles according to their Book-to-Market ratio using data at the fiscal year-end prior to the repurchase announcement. The quintile ranges are determined by all Compustat firms in a given year. Consistent with their results Table 3 reports that "value" stocks (high Book-to-Market firms) outperform "glamour" stocks. For example, after 48 months, the firms in the top Book-to-Market quintile display a positive and significant cumulative abnormal return of 134,09% (significant at the 1% level). The firms in the lowest Book-to-

Market quintile outperform by 108,53% (significant at the 1% level) after 48 months. Panel B of Table 3, reports that the average abnormal return is 1,08% (significant at the 1% level) for value stocks. Glamour stocks, on the other hand, display a 0,81% (significant at the 1% level) average abnormal return. Summarizing Table 3, the market seems to under react to buyback announcements, in particular to the announcements made by value stocks. That makes value stocks more attractive for investment opportunities.

Summarizing, Figure 1 and Table 2 & 3 show clear proof that the buyback anomaly prevails and that on average cumulative abnormal returns of repurchasing firms gives remarkable results. Markets seem to behave very similar during the last decades: the market underreacts to buyback announcements, this effect magnifies during a crisis. A possible explanation for this effect may be the drop in investor sentiment, a drop in market efficiency and the investors believe in an efficient market, makes the anomaly increase in magnitude and prevail for the years 2007-2013. The next section will section will stratify repurchasing firms by prior announcement returns for investment opportunities.

Table 2
Long-Term Abnormal Returns after open market repurchase announcements stratified by Size

Panel A: Fama-French calendar-time approach CARs

Months	Full sample		Largest firm quintile		Size quintile 4		Size quintile 3		Size quintile 2		Smallest firm quintile	
	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)
[+1,+12]	3,93%	(-1,08)	10,49%	(2,20)***	7,44%	(1,74)*	4,82%	(-0,86)	2,09%	(-0,48)	-2,93%	(-0,48)
[+1,+24]	45,35%	(8,81)***	49,46%	(7,36)***	47,70%	(7,92)***	68,57%	(8,65)***	26,13%	(4,19)***	52,59%	(6,06)***
[+1,+36]	84,18%	(13,43)***	79,47%	(9,69)***	78,63%	(10,71)***	110,34%	(11,40)***	69,93%	(9,13)***	101,66%	(9,59)***
[+1,+48]	105,41%	(14,67)***	97,63%	(10,34)***	95,82%	(11,39)***	134,99%	(12,10)***	94,02%	(10,65)***	123,01%	(10,08)***
Observations:	419		81		80		80		91		87	

Panel B: Fama-French calendar-time approach average ARs (xtreg)

	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)
12 months	-0,04%	(-0,30)	0,26%	(-0,83)	0,09%	(-0,32)	-0,15%	(-0,53)	-0,10%	(-0,33)	-0,31%	(-0,85)
24 months	0,61%	(6,62)***	0,60%	(2,77)***	0,65%	(3,17)***	0,68%	(2,88)***	0,25%	(1,06)	0,67%	(2,46)***
36 months	0,90%	(11.86)***	0,78%	(4,50)***	0,87%	(5,07)***	0,87%	(4,66)***	0,71%	(3,77)***	1,09%	(4,51)***
48 months	0,97%	(14.79)***	0,81%	(5,25)***	0,92%	(6,26)***	0,97%	(6,06)***	0,84%	(5,22)***	1,07%	(5,37)***

Both panels using Fama-French (1993) three-factor model for the sample of 278 firms that announced an open market share repurchase. Regression 3.3 is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t}$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The interact is a variable to prevent collinearity between the variables SMB_t and HML_t. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test.

Table 3
Long-Term Abnormal Returns after open market repurchase announcements stratified by Book-to-Market

Panel A: Fama-French calendar-time approach CARs

Months	BM lowest (glamour stocks)		BM quintile 2		BM quintile 3		BM quintile 4		BM highest (value stocks)	
	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)	CAR	(t-value)
[+1,+12]	15,56%	(3,17)***	-3,54%	(-0,63)	11,83%	(2,40)***	-1,30%	(-0,26)	7,36%	(-1,31)
[+1,+24]	47,73%	(6,86)***	42,71%	(5,32)***	70,13%	(10,07)***	33,36%	(4,64)***	59,08%	(7,41)***
[+1,+36]	82,25%	(9,64)***	69,88%	(7,13)***	115,08%	(13,55)***	76,35%	(8,68)***	105,38%	(10,82)***
[+1,+48]	108,35%	(11,01)***	78,57%	(6,96)***	142,91%	(14,63)***	90,81%	(8,96)***	134,09%	(11,97)***
Observations:	82		87		79		90		81	

Panel B: Fama-French calendar-time approach average ARs (xtreg)

	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)	Monthly average AR	(t-value)
12 months	0,47%	-1,64	-0,46%	(-1,48)	0,05%	(-0,15)	-0,32%	(-1,08)	-0,31%	(-0,24)
24 months	0,74%	(3,62)***	0,38%	-1,64	0,63%	(2,52)***	0,34%	(-1,43)	0,75%	(3,07)***
36 months	0,96%	(5,68)***	0,60%	(3,34)***	0,91%	(4,65)***	0,83%	(3,86)***	1,01%	(5,02)***
48 months	1,05%	(6,97)***	0,58%	(3,84)***	1,05%	(6,19)***	0,85%	(4,68)***	1,08%	(6,38)***

Both panels using Fama-French (1993) three-factor model for the sample of 278 firms that announced an open market share repurchase. Regression 3.3 is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t}$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The interact is a variable to prevent collinearity between the variables SMB_t and HML_t. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test.

In Table 4, the long-term returns for subsamples on the base of the prior 6 month raw returns are reported. As mentioned before, when a stock has collapsed and is followed by a repurchase announcement, it may indicate that the management repurchases because it believes the market has overreacted to some presumably bad news. In particular, the research allocates events to prior return quintiles based on their raw stock returns compared with all CRSP firms' raw returns in the 6 months prior to firms' repurchase announcement, ending at announcement day/month. In other words, the quintile cut offs are determined by the full distribution of all CRSP firms with available return data for the corresponding period. While this procedure results in a slightly uneven number of observations per quintile, it avoids the problem that the lowest return quintile is more likely to pick up events in down markets. Table 4 shows the CARs and the monthly average ARs for the different quintiles.

As can be seen in table 4 the firms that were beaten up the most prior to the repurchase announcement do not experience the highest long-term abnormal returns after the repurchase announcement. As shown in Panel A of Table 4, firms in the lowest prior raw return quintile experience average abnormal returns of -47,52% (significant at the 1% level) in the 6 months prior to the announcement of the repurchase. The lowest prior raw return quintile shows a positive cumulative abnormal return of 94,13% (significant at the 1% level) in the 48 months after the repurchase announcement. The quintile with the highest prior raw returns experiences an cumulative abnormal stock price increase of 184,04% (significant at the 1% level) in the 48 months after the repurchase announcement. Interestingly, because this is higher than the quintile with the lowest raw returns. This is not in line with the results of Peyer and Vermaelen (2008). The (0,0) abnormal returns are only negative for quintile 3. No conclusions can be drawn about these numbers since those are not statistically significant.[10] Interestingly is to see that all the quintiles give large cumulative abnormal returns after the repurchase announcement. Even the quintiles with positive prior 6 month raw returns show more positive cumulative abnormal returns after the repurchase announcement. The quintiles from low until high returns for 48 months are: 94,13%, 72,36%, 75,24%, 108,07%, 184,04%. All these numbers are statistically significant at the 1% level. Contrarian to former research prior negative returns are no prediction for the long-term returns after the repurchase announcement like in Peyer and Vermaelen (2008). Still conclusions can be drawn about the buyback anomaly with these numbers. They clearly state an overreaction of investors after the event.

As in Peyer and Vermaelen (2008) it seems possible that the long-run abnormal returns are a consequence of three effects. First, momentum of the financial crisis which causes all the quintiles to have positive, and significant abnormal returns. Second, an overreaction to some kind of information

[10] (0,0) stands for (beginning, end) months in event time, where 0 is the month in which the initial announcement was made. (0,0) thus refers to the return in the months of the announcement of the event.

prior to the repurchase that made the stock price fall below fair value. Second, an under reaction to the information contained in the share repurchase announcement. The results in Table 4 indicate that positive prior raw returns are the best portfolio selection variable. This is contrarian to other researchers and it seems that the momentum of the financial crisis created this. Section 4.5 will handle the momentum of the financial crisis on the data. But first, the Buy-and-Hold abnormal returns will be calculated to test the data with a second model next to the cumulative abnormal returns.

Table 4
Long-term abnormal returns after open market repurchases stratified by 6-month prior returns

Panel A: Fama-French calendar-time approach CARs

Months	Prior return lowest (t-stat)		Prior return 2 (t-stat)		Prior return 3 (t-stat)		Prior return 4 (t-stat)		Prior return highest (t-stat)	
	CAR (t-value)		CAR (t-value)		CAR (t-value)		CAR (t-value)		CAR (t-value)	
(-6,-1)	-47,52%	(-8.78)***	-19,85%	(-5.83)***	0,77%	(0.30)	18,34%	(6.81)***	58,64%	(18.26)***
(0,0)	1,41%	(0.64)	1,20%	(0.89)	-0,18%	(-0.17)	1,32%	(1.22)	0,45%	(0.34)
(+1,+12)	0,80%	(0.11)	-5,18%	(-1.07)	3,82%	(1.01)	12,55%	(3.21)***	33,64%	(7.49)***
(+1,+24)	47,61%	(4.47)***	18,69%	(2.64)***	21,14%	(3.91)***	47,59%	(8.54)***	83,93%	(13.34)***
(+1,+36)	79,54%	(6.16)***	52,18%	(6.05)***	55,14%	(8.26)***	84,65%	(12.38)***	149,22%	(19.51)***
(+1,+48)	94,13%	(6.35)***	72,36%	(7.29)***	75,24%	(9.76)***	108,07%	(13.68)***	184,04%	(20.91)***
Obs.:	60		96		71		60		77	

Panel B: Fama-French calendar-time approach ARs

	Monthly average AR (t-stat)		Monthly average AR (t-stat)		Monthly average AR (t-stat)		Monthly average AR (t-stat)		Monthly average AR (t-stat)	
12 months	-0,29%	(-1.06)	-0,51%	(-2.67)***	-0,05%	(0.22)	0,48%	(2.10)***	0,90%	(4.29)***
24 months	0,55%	(2.80)**	0,05%	(0.30)	0,24%	(1.34)	0,93%	(5.16)***	1,18%	(7.35)***
36 months	0,83%	(4.92)***	0,45%	(3.37)***	0,63%	(4.13)***	1,20%	(7.68)***	1,47%	(11.04)***
48 months	0,84%	(5.78)***	0,57%	(4.91)***	0,77%	(5.56)***	1,27%	(8.98)***	1,51%	(12.68)***

Panel A: subsamples by prior return which parameters are set by the entire CRSP database. The parameters are:
-16.89%, -0.30%, 9.99%, 24.45% for the quintiles' cumulative 6-month prior event raw returns. Panel A reports cumulative abnormal returns (AAR) in percent using Fama-French (1993) three-factor model for the sample of 278 firms that announced an open market share repurchase. Regression 3.3 is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + \varepsilon_{i,t}$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The interact is a variable to prevent collinearity between the variables SMB_t and HML_t. The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test.
Panel B: subsamples the same quintiles as in panel A. Panel B reports monthly average abnormal returns retrieved with a single *xtreg* regression of regression *3.3* using fixed effects using each company as the group variable.

4.4 Long-term abnormal returns: Buy and Hold Abnormal Return BAHR-model

As shown in Table 5, the buy-and-hold abnormal return for the full sample is -13,22% (significant at the 10% level) after 48 months. As mentioned before, size is expected to be negatively correlated with long-term abnormal returns, as it seems more likely that small firms are more mispriced than large firms. As shown in Table 5, the smallest firm quintile displays the lowest long-term abnormal returns (-86,34%) after 48 months. This seems to prove the statement that small firms are most likely to be mispriced, but in a completely opposite (negative) way than Table 2 reported. The two smallest deciles contain negative abnormal returns. Table 5 shows overall for the deciles 3-10 positive abnormal returns, which is more in line with the results of Tables 1, 2, 3, and 4.

Table 6 shows deciles containing firms ranked according to its past 6 month raw performance. The bound created with use of the full CRSP index containing all NYSE/AMEX/NASDAQ companies are shown in attachment 3 (A3). Similar to Table 5 the gross of the abnormal returns are negative. Though in Table 6 the numbers do not show recognizable patterns and show many insignificant abnormal returns. This means the data are not statistically significantly nor economically significant. Which makes that for Table 6 no conclusions can be drawn regarding these data nor can the best decile for investment opportunity be selected. The only conclusion that can be drawn from Table 6 is that past performance is not a usable indicator for selection characteristics regarding the BHAR method.

The differences between the CARs and BHARs result from the effect of monthly compounding; CARs ignore compounding, while BHARs include the effect of compounding. If individual security returns are more volatile than the returns on the market index, it can be shown that CARs will be greater than BHARs if the BHAR is less than or equal to zero. As the annual BHAR becomes increasingly positive, the difference between the CAR and BHAR will be becoming smaller and smaller. The BHARs in Table 5 are all below 13% and according to the research of Barber and Lyon (1997) this indicates that CARs will be larger. This effect is shown in Tables 2, 3, and 4 and so this effect applies to this research too.

Table 5
Long-Term Abnormal Returns after open market repurchase announcements

Panel A: Buy-and-Hold Abnormal Returns stratified by size

Months	Full sample	Largest firm decile	Size decile 9	Size decile 8	Size decile 7	Size decile 6	Size decile 5	Size decile 4	Size decile 3	Size decile 2	Smallest firm decile
	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR
[+1,+12]	-0.59% ***	5.34%	1.93%	1.21%	10.78%	11.86% **	9.72%	3.38%	3.67%	-2.12%	-31.24% ***
[+1,+24]	-8.03%	3.50%	3.42%	6.40%	15.89% *	9.32% *	6.12%	6.24%	7.73%	-16.18%	-53.28% ***
[+1,+36]	-11.52%	3.85%	7.56%	9.01%	21.11% ***	7.71% *	3.66%	8.79%	5.53%	-22.59% ***	-73.43% ***
[+1,+48]	-13.22% *	3.79%	13.77% *	11.25%	21.62% ***	10.44%	3.15%	20.10%	5.65%	-23.37% ***	-86.34% ***
Observations:	178	16	17	17	18	20	22	19	14	20	15

Panel B: Buy-and-Hold Abnormal Returns stratified by Book-to-Market value

	BM highest (value stock)	BM decile 9	BM decile 8	BM decile 7	BM decile 6	BM decile 5	BM decile 4	BM decile 3	BM decile 2	BM lowest (glamour stock)
	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR
[+1,+12]	-16.68% ***	-11.20% ***	-2.67%	0.87%	1.01%	13.14%*	0.88%	13.18%***	3.66%	-2.53%
[+1,+24]	-26.50 ***	-17.05% ***	-5.17% *	-0.42%	1.38%	11.00%	3.49%	10.56***	-0.57%	-14.44% ***
[+1,+36]	-34.80***	-24.01% ***	-8.03% **	-3.08%	-2.68%	9.72%	0.59%	14.07**	3.13%	-14.44%***
[+1,+48]	-41.49% ***	-26.53% ***	-9.95% ***	-6,58*	-4.75%	7.14%	-0.73%	16.25%**	14.07%	-14.44%***
Observations:	17	20	30	20	28	23	21	11	7	1

Panel A and B:
This table contains the Buy-and-Hold Abnormal Returns measured for the periods of 12 (24, 36, 48) months after the repurchase announcement. The CRSP equally weighted NYSE/AMEX/NASDAQ market index is used as the benchmark return. The CRSP only outputs only deciles for its market value index. Post-event monthly excess returns of each sample firm are regressed on size with equation 3.5,

$$BHAR_i = \prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{benchmark,t}) \,, \tag{3.5}$$

where $\prod_{t=1}^{T}(1 + R_{i,t})$ is the compounded return of security *I* from *t* = 1 up to *t* = T, where *t* is monthly. The second part of the equation, $\prod_{t=1}^{T}(1 + R_{benchmark})$ being the compounded expected return from *t* = 1 up to *t* = T. That gives that $BHAR_i$ is the compounded abnormal return of the security over the period T. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test. With observations the firms within the decile are meant. Deciles are created with use of the entire database of Compustat annual fiscal year ends values of Market value, Book value per share and Share Outstanding. See attachement 3 (A3) for details about the decile bounds.

Table 6: Long-term abnormal returns after open market repurchases stratified by 6-month prior returns

Buy-and-Hold Abnormal Returns stratified by size

Months	Prior return highest	Decile 9	Decile 8	Decile 7	Decile 6	Decile 5	Decile 4	Decile 3	Decile 2	Prior return lowest
	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR	BHAR
(-6,-1)	24.76% ***	15.89% ***	4.24%	-0.29%	-1.09%	-	-5.16% **	-2.61% **	-10.13% ***	-13.25%***
(0,0)	0.40%	0.49%	0.95%	3.96%	0.94%	-	2.80%	2.36%	1.35%	2.48%
(+1,+12)	-39.55% ***	-2.37% ***	-10.35%	14.98% ***	1.06% ***	-	1.43% ***	5.48% ***	-2.92% **	-1.63% ***
(+1,+24)	-22.83% ***	-7.13% ***	-19.11%	15.16% ***	-4.45%	-	-5.35%	-2.31%	-8.83% ***	13.05% ***
(+1,+36)	-55.08% ***	-23.62% ***	-18.52%	9.18%	-13.13% ***	-	-13.56% ***	-22.94% ***	3.49% ***	-3.41% ***
(+1,+48)	-10.01% ***	-41.56% ***	15.19%	6.88%	-17.47% ***	-	-19.18% ***	-43.08% ***	19.18% ***	-17.16% ***
Obs.:	117	130	116	63	280	0	50	211	192	127

This table contains the Buy-and-Hold Abnormal Returns measured for the periods of 12 (24, 36, 48) months after the repurchase announcement. The CRSP equally weighted NYSE/AMEX/NASDAQ market index is used as the benchmark return. The CRSP only outputs only deciles for its market value index. Post-event monthly excess returns of each sample firm are regressed on size with equation 3.5,

$$BHAR_i = \prod_{t=1}^{T}(1 + R_{i,t}) - \prod_{t=1}^{T}(1 + R_{benchmark,t}) \,, \tag{3.5}$$

where $\prod_{t=1}^{T}(1 + R_{i,t})$ is the compounded return of security *I* from *t* = 1 up to *t* = T, where *t* is monthly. The second part of the equation, $\prod_{t=1}^{T}(1 + R_{benchmark})$ being the compounded expected return from *t* = 1 up to *t* = T. That gives that $BHAR_i$ is the compounded abnormal return of the security over the period T. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test. With observations the firms within the decile are meant. Deciles are created with use of the entire database of CRSP monthly returns of all firms trading on NYSE/AMEX/NASDAQ between January 2007 and December 2013. See attachement 3 (A3) for details about the decile bounds.

4.5 Categorizing-portfolios by industry and crisis data

Many dummies are used with the Fama-French (1993) 3-factor model for the sample of 484 firms that announced an open market share repurchase. The two dummies with the biggest magnification in the results are reported in Table 7 & Table 8. These dummies are the Crisis Dummy and the Financial Industry Dummy. As the numbers in Table 6 report, the monthly average abnormal return retrieved with *xtreg* from Stata increase with the insertion of the Crisis Dummy. This dummy creates a one the months between September 2007 and December 2008 and a zero otherwise. This helps to increase the abnormal returns even more (compared to the full sample) from 0,97% (significant at the 1% level) to 1.72% (significant at the 1% level) for the 48 months after the repurchase announcement. It seems that the market underreacts even more with data outside the crisis months. Which may indicate that the crisis has a negative correlation to the buyback anomaly. Which makes the crisis not a good window of opportunity as a portfolio characteristics.

Table 7

Long-Term Abnormal Returns after open market repurchase announcements

Fama-French calendar-time approach ARs with Crisis Dummy

Month	Full Sample		Crisis Dummy	
	Monthly average AR	(t-stat)	Monthly average AR	(t-stat)
[+1,+12]	-0,04%	(-0,30)	1,30%	(7,42)***
[+1,+24]	0,61%	(6,62)***	2,06%	(18,96)***
[+1,+36]	0,90%	(11.86)***	1,96%	(23,01)***
[+1,+48]	0,97%	(14.79)***	1,72%	(24,02)***
Observations:	484		484	

This table is using Fama-French (1993) three-factor model for the sample of 484 firms that announced an open market share repurchase. Regression is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_j Dummy_t + \varepsilon_{i,t}$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The interact is a variable to prevent collinearity between the variables SMB_t and HML_t . The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test.
Table 7 reports monthly average abnormal returns retrieved with a single *xtreg* regression of regression *3.3* using fixed effects using each company as the group variable.
The dummy is made for the period between September 2007 and December 2008, this was the heat of the crisis. This dummy was made for filtering out extremely negative returns.

As mentioned before, with fixed effects regressions anything that is constant within the fixed unit is filtered out, regardless of whether it is observed or not. This is why fixed effects models are so popular. But it also means that it is possible to estimate (at least not without resorting to some tricks) the effects of variables that are fixed within units. The problem is one of perfect multicollinearity

between the industry dummy variable and the constant term known as the dummy variable trap. The result is that the implicit assumption of the columns of the matrix of explanatory variables being independent of one another has been violated, and hence there is not enough separate information in the sample to be able to calculate the values of all of the coefficients. The ($X'X$) matrix will be singular and therefore its inverse will not exist. To control for multicollinearity, either the thesis has to drop the industry dummy or the intercept. In Table 8, the numbers reported for the Financial Industry Dummy are calculated with a normal OLS regression. This is because of multicollinearity. The Financial Industry Dummy helps to increase the abnormal returns even more (compared to the full sample) from 0,97% (significant at the 1% level) to 1.40% (significant at the 1% level) for the 48 months after the repurchase announcement. It seems that the market underreacts more to a portfolio of repurchasing firms without the Financial Industry firms included. Which may indicate that the Financial Industry has a negative correlation to the buyback anomaly. Which makes the exemption of the Financial Industry a good window of opportunity as a portfolio characteristics.

Table 8

Long-Term Abnormal Returns after open market repurchase announcements

Fama-French calendar-time approach ARs with Industry Dummy

Month	Full Sample (fixed effects)		Financial Industry Dummy (normal regression)	
	Monthly average AR	(t-stat)	Monthly average AR	(t-stat)
[+1,+12]	-0,04%	(-0,30)	0.29%	(1,77)*
[+1,+24]	0,61%	(6,62)***	1.09%	(8.79)***
[+1,+36]	0,90%	(11.86)***	1.37%	(13.32)***
[+1,+48]	0,97%	(14.79)***	1.40%	(15.66)***
Observations:	484		484	

This table is using Fama-French (1993) three-factor model for the sample of 484 firms that announced an open market share repurchase. Regression is run each event month j:

$$(R_{i,t} - R_{f,t}) = a_j + b_j(R_{m,t} - R_{f,t}) + c_j SMB_t + d_j HML_t + e_j Dummy_t + \varepsilon_{i,t}$$

where $R_{i,t}$ is the monthly return on security *i* in the calendar month *t* that corresponds to the event month *j*, with *j* = 0 being the month of the repurchase announcement. $R_{f,t}$ and $R_{m,t}$ are the risk-free rate and the return on the equally weighted CRSP index, respectively. SMB_t and HML_t are the monthly return on the size and BM factor in month t, respectively. The interact is a variable to prevent collinearity between the variables SMB_t and HML_t . The numbers reported are sums of the intercepts a_t of cross-sectional regressions over the relevant event-time periods expressed in percentage terms. The significance levels are indicated by *,**,*** and correspond to a significance level of 10%, 5%, 1%, respectively, using a two-tailed test. Table 7 reports the dummy of the SIC codes within the range of 6000-6700 for the Finance, Insurance, and Real Estate industry. The two other negative correlated industries (Manufacturing and Services) show similar results.

5. Conclusions

The abnormal price behaviour related to tender offer and open market share repurchases still persists. The analysis of open market share repurchases in the period 2007-2013 shows that there are still significant long-term abnormal returns in the 48 months following the buyback announcement. The efficient market hypothesis states that when news is available, the market will be efficient regarding to the news. In other words, current equity markets are proven to be information efficient and so the stock prices fully and correctly reflect all available information. This research first tested if the news is incorporated. In table 1 it is shown that indeed an average of 2.36% abnormal return within the 2 days around the event. This implies that the market processes the news and fully and correctly reflects the new information into the stock price (an average rise of 2.36% cumulative abnormal return).

Ritter (1991) was among the first to argue that cumulative abnormal returns (CARs) and Buy-and-Hold Abnormal Returns (BHARs) can be used to answer different questions. That is why this thesis includes the two different measurements of abnormal return to get valid and correct report of the statistics. Which makes it easier for this thesis to make conclusions about the data when comparing the results of the two models. The model of BHAR is being known for being a "precise measure of investor experience since it captures the effect of price movements an investor experiences over a time period" (Barber & Lyon, 1997). However, Barber and Lyon (1997) and Kothari and Warner (1997) provide simulation evidence showing that common estimation procedures can produce biased $\overline{BHAR}$ estimates. The Fama-French 3-factor model does not precisely measure investor experience according to Barber and Lyon (1997). Fama (1998) argues against the $BHAR$ methodology because the systematic errors that arise with imperfect expected return proxies are compounded with long-horizon returns. This phenomena is called 'the bad model problem' by Fama (1998). Therefore, Fama strongly advocates a monthly calendar-time portfolio approach for measuring long-term abnormal performance.

The cumulative abnormal returns of this research are very positive. Positive cumulative abnormal return of 105,41% (significant at the 1% level) is reported in Table 2 for the 48 months following the open market share repurchase announcement. This number signals that the market underreacts the repurchase announcement and keeps processing the information in the months after the repurchase announcement in a positively manner.

The buy-and-hold abnormal returns of this research are negative for the full sample. The buy-and-hold abnormal return is -13,22% (significant at the 1% level) is reported in Table 5 for the 48 months following the open market share repurchase announcement. This number signals that the market overreacts the repurchase announcement in the months after the repurchase announcement. This is

contrarian to the numbers retrieved with the calendar-time portfolio approach. Though, conclusions can be drawn about for the goal of this thesis, creating portfolio selection characteristics.

As in Peyer and Vermaelen (2008) it seems possible that the long-run abnormal returns are a consequence of three effects. First, momentum of the financial crisis which causes all the quintiles to have positive, and significant abnormal returns. Second, an overreaction to some kind of information prior to the repurchase that made the stock price fall below fair value. Third, an under reaction to the information contained in the share repurchase announcement. The results in Table 4 indicate that positive prior raw returns are not the best portfolio selection variable. This is contrarian to other researchers and it seems that the momentum of the financial crisis created this.

The differences between the CARs and BHARs result from the effect of monthly compounding; CARs ignore compounding, while BHARs include the effect of compounding. As the annual BHAR becomes increasingly positive, the difference between the CAR and BHAR (CAR minus BHAR) will approach zero and eventually become negative. The BHARs in Table 5 are all below 13% and according to the research of Barber and Lyon (1997) this indicates that CARs will be larger. This effect is shown in Tables 2, 3, and 4 and so this effect applies to this research too. This induces that the results in the Tables are empirically correct.

The conclusion of this research is that markets underreact to open market repurchase announcements between January 2007 and December 2013 in the United States of America of firms which are trading on NYSE/AMEX or NASDAQ. Especially, the market underreacts to small firms, value firms, non-financial industry firms. Next to that, the financial crisis is negatively correlated with the abnormal returns of the share repurchase announcement sample dataset of this thesis. This makes an ideal portfolio with repurchasing firms to consist of small non-financial value stock firms. Inserting a dummy for the most volatile months of the crisis helps to increase the average abnormal return even further.

This thesis found arguments for existence of the repurchase anomaly within the thesis' sample. Almost all numbers reported for the long run abnormal returns are significant with the 1% level. The results of this thesis suggest that it is most likely that small, value companies are subject to under reaction of the market on its long-term abnormal returns after the repurchase announcement. Moreover, the financial crisis is negatively correlated with the abnormal returns within the thesis sample. Finally, the thesis finds that Financial Institutions, Manufacturing firms and Services firms are negatively correlated to the abnormal returns within the thesis sample. Most likely the results of this thesis are influenced by the financial crisis. This thesis set the first step to portfolio selection characteristics, future research is needed to provide more information for other characteristics that cause the largest abnormal reaction in the long run. The focus of this thesis was to bring out the best selection characteristics for investors.

The recommendation for future research to give the results of this thesis extra strength are be to increase the stability of this thesis' results. As former researchers Barber and Lyon (1997) and Fama (1998) state, there are many biases in within these two models and better test have to be developed to improve the quality of the results and to eliminate any biases within the models.

Literature

Agrawal, A., Jaffe, J., & Mandelker, G. (1992). The post-merger performance of acquiring firms: A re-examiniation of an anomaly. *The Journal of Finance 47*, 1605-1621.

Amtenbrink, F., & Haan, J. d. (2011, January). Credit Rating Agencies. Dutch National Bank Working Paper.

Banyi, M. L., Dyl, E. A., & Kahle, K. M. (2008). Errors in estimating share repurchases. *Journal of Corporate Finance 14*, 460-474.

Barber, B. M., & Lyon, J. D. (1997). Detecting long-run abnormal stock returns: The empirical power and specification of test statistics. *Journal of Financial Economics 43*, 341-372.

Bhattacharya, S. (1979). Imperfect information, dividend policy, and "the bird in the hand" fallacy. *Bell Journal of Economics 10*, 259-270.

Brav, A., Graham, J., Harvey, C., & Michaely, R. (2005). Payout Policy in the 21st Century. *Journal of Financial Economics*, 483-528.

Brown, S., & Warner, J. (1980). Measuring security performance. *Journal of Financial Economics 8*, 205-258.

Brown, S., & Warner, J. (1985). Using daily sock returns: The case o event studies. *Journal of Financial Economics 14*, 205-258.

Campbell, J., Lo, A., & Mackinlay, A. (1997). The Econometrics of Financial Markets. *Cambridge University Press*, 559-562.

Cusatis, P., Miles, J., & Woolridge, J. (1993). Restructuring trough spinoffs: The stock market evidence. *Journal of Finacial Economics 33*, 293-311.

Dittmar, A., & Dittmar, R. (2007, January). The Timing of Stock Repurchases. University of Michigan: Stephen M. Ross School of Business.

Fama, E. (1998). Market efficiency, long-term returns, and behavioral finance. *Journal of Financial Economics 49*, 283-306.

Fama, E. F., & Malkiel, B. G. (1970). Efficient Capital Markets: A review of theory and empirical work. *The Journal of Finance*, 383-417.

Fama, E., & French, K. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics 43*, 283-306.

Fama, E., & Malkiel, B. (1970). Efficient Capital Markets: A review of theory and empirical work. *The Journal of Finance*, 383-417.

Fama, E., Fisher, L., Jensen, M., & Roll, R. (1969). The adjustment of stock prices to new information. *International Economic Review 10*, 1-21.

Grullon, G., & Michaely, R. (2004). The Information Content of Share Repurchase Programs. *Journal of Finance*, 651-681.

Hong, H., Wang, J., & Yu, J. (2008). Firms as buyers of last resort. *Journal of Finacial Economics*, 119-145.

Ibbotson, R. (1975). Price Performance of Common Stock New Issues. *Journal of Financial Economics*, 235-272.

Ikenberry, D., Lakonishok, J., & Vermaelen, T. (1995). Market underreaction to open market share repurchases. *Journal of Financial Economics*, 181-208.

IMF. (2008). *Global Financial Stability Report.*

Jarrow, R., & Chatterjea, A. (2013). *An introduction to: Derivative Securities, Financial Markets and Risk Management.* New York: W.W. Norton and Company.

Jensen, M. (1968). The Performance of Mutual Funds in the Period 1945-1964. *Journal of Finance 23*, 389-416.

Jensen, M. (1986). Agency costs of free cash flow, corporate finance, and takeovers. *The American economic review*, 323-329.

Jensen, M., & Meckling, W. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 306-360.

Jones, R., & Wermers, R. (2011). Active Management in Mostly Efficient Markets. *Financial Analysts Journal*, 29-45.

Lakonishok, J., & Vermaelen, T. (1990). Anomalous Price Behavior Around Repurchase Tender Offers. *The Journal of Finance*, 456-476.

Longstaff, F. A. (2010). The subprime credit crisis and contagion in financial markets. *Journal of Financial Economics*, 436-450.

Loughran, T., & Ritter, J. (1996). Long-term market overreaction: The effect of low-priced stocks. *Journal of Finance*, 361-389.

Lyon, J., Barber, B., & Tsai, C. (1999). Improved methods for tests of long-run abnormal stock returns. *Journal of Finance 54*, 165-201.

Manconi, A., Peyer, U., & Vermaelen, T. (2013). *Buybacks around the World.* Fontainebleau Cedex: INSEAD.

Merton, M. H., & Modgliani, F. (1961). Dividend policy, growth and the valuation of shares. *Journal of Business 34*, 411-433.

Merton, M. M., & Rock, K. (1985). Divdend policy under asymmetric information. *Journal of Finance 40*, 1031-1051.

Mitchell, M., & Stafford, E. (2000). Managerial Decisions and Long-Term Stock Price Perfromance. *Journal of Business*, 287-329.

Modigliani, F., & Miller, M. (1961). Dividend policy, growth, and the valuation of shares. *Journal of Business*, 411-433.

Obernberger, S. (2013). The Timing of Share Repurchases. *European Financial Management Association Conference*.

Pagano, M., & Roell, A. (1996). The choice of stock ownership structure: Agency costs, monitoring and the decision to go public. *Quarterly Journal of Economics*.

Pagano, M., & Volpin, P. (2010). Credit ratings failures and policy options. *Economic Policy*, 403-431.

Pástor, L., & Stambaugh, R. (2003). Liquidity Risk and Expected Stock Returns. *Journal of Finance*, 642-685.

Peyer, U., & Vermaelen, T. (2009). The nature and persistence of buyback anomalies. *Review of Financial Studies*, 1693-1745.

Ritter, J. (1991). The long-run performance of initial public offerings. *The Journal of Finance 47*, 3-27.

Schwert, G. (2003). *Anomalies and Market Efficiency, in Handbook of the Economics of Finance 2.* Amsterdam/London and New York: Elsevier/North-Holland.

Stock, J. H., & Watson, M. W. (2003). Introduction to Econometrics.

Tain, B. A., & Kini, O. (1994). The Post-Issue Operating Performance of IPO Firms. *The Journal of Finance*, 1699-1726.

Vermaelen, T. (1984). Repurchase tender offers, signalling and mangerial incentives. . *Journal of Financial and Quantitative Analysis 19*, 163-181.

Attachment

A1: Variable description

Variable name (*retrieved from CRSP)*	**Description**
Permno	Identifier to each event firm
date	Date of the actual repurchase
ticker	Trading identifier to each event firm. Ticker is used worldwide to identify the company's stock.
comnam	Company's name
prc	Price of company's stock or Bid/Ask average
ret	Monthly return
ewrtd	Equally-Weighted Return-incl. Dividends
ewrtx	Equally-Weighted Retrun-excl. Dividends
set	Number which indicates to which 'set' this row belongs to
DateAnnounced	Date announced of repurchase program by company
TargetPrimarySICCode	Target Primary SIC Code (U.S. Industry code)
TargetIndustrySector	Name of the company's industry sector
Status	Status of the repurchase program
sought	Percentage of shares the company is looking to repurchase
Price1day	Price of stock 1 day before event
Price1week	Price of stock 1 week before event
Price4weeks	Price of stock 4 weeks before event
eventcount	Number of events per ticker
ticker_id	Created identifier specially for this dataset
datenum	Number of months in the dataset chronologically sorted. The first month in history gets the number 1, and the second the number 2, and the third....., ...
datem	Number of the month. Indication the 12 months within a year. Where 1 = January and 12 is December.
td	The number of the month where the event took place.
dif	Difference in months between event and the month of the relevant month of the row.

A2: Hausman's test for panel data

Table 3:
Hausman test for Fixed or Random effects

Variables	**Coefficients**	
	Fixed (b)	Random (B)
$(R_{m,t} - R_{f,t})$	0.728	0.728
SMB	0.160	0.160
HML	0.382	0.382

b = consistent under H_0 and H_1; obtained from xtreg with Stata

B = inconsistent under H_1; efficient under H_0; obtained from xtreg with Stata

In this case, Random effects (RE) is preferred under the null hypothesis due to higher efficiency, while under the alternative Fixed effects (FE) is at least consistent and thus preferred. The following table shows the H_0 and the H_1:

	$H_0$is true	$H_1$is true
B (RE estimator)	Consistent Efficient	Inconsistent
b (FE estimator)	Consistent Inefficient	Consistent

As can be seen in the table above b is consistent and B is inconsistent which indicates that fixed effects occur in the data.

A3: Decile Cutoffs

Table A3: Cutoffs for deciles of Tables 5 and 6

Cutoffs of the Buy-and-Hold (BHAR) Book-to-Market decile cutoffs

Deciles	BM	BM	SIZE (millions)	SIZE (millions)	Prior Return	Prior Return
	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
1	∞	-0.0239	∞	33.12	∞	-36.15%
2	-0.0239	0.1501	33.12	65.90	-36.15%	-16.89%
3	0.1501	0.2772	65.90	131.91	-16.89%	-7.06%
4	0.2772	0.3923	131.91	249.42	-7.06%	-0.30%
5	0.3923	0.5132	249.42	431.11	-0.30%	4.82%
6	0.5132	0.6516	431.11	632.68	4.82%	9.99%
7	0.6516	0.8269	632.68	1253.03	9.99%	15.91%
8	0.8269	1.0618	1253.03	2280.16	15.91%	24.46%
9	1.0618	1.5399	2280.16	4300.21	24.46%	40.36%
10	1.5399	∞	4300.21	∞	40.36%	∞

Decile cutoffs are calculated with the Compustat entire database. Using Fiscal annual data for the variable Market Value, Book value per Share and Common Shares Outstanding. Calculating Book-to-Market with the following equation:

$$BM_{i,t} = BE_{i,t,}/ME_{i,t}$$

where $BM_{i,t}$ is the Book-to-Market value for firm *i* in fiscal year *t*. $BE_{i,t,}$and $ME_{i,t}$ are the Book-Equity value and Market Equity value, respectively. For prior return, the 6 month prior raw returns are calculated for the full CRSP dataset with monthly returns for all firms trading within the period of 2007-2013.

A4: Industry Dummies

Table 8

Long-Term Abnormal Returns after open market repurchase announcements

Fama-French calendar-time approach coefficients

	Fama-French 3-factor regression with Industry Dummies	
	Coefficient	**(t-stat)**
Dummy Agriculture, Forestry, Fishing	0	(omitted)
Dummy Mining	0	(omitted)
Dummy Construction	0.0004714	0.04
Dummy Manufacturing	-0.0025074	-0.23
Dummy Transportation & Public Utilities	0.000233	0.02
Dummy Wholesale Trade	0.0079649	0.62
Dummy Retail Trade	0.0006725	0.06
Dummy Finance, Insurance, Real Estate	-0.0048858	-0.45
Dummy Services	-0.0061535	-0.55
Dummy Public Administration	0.01366	1.03

This table is using Fama-French (1993) three-factor model for the sample of 484 firms that announced an open market share repurchase. The numbers reported are the coefficients for regression following the 12 months of an open market share repurchase announcement. With the hand of the accompanying SIC codes the different dummies for each industry are created.[11] For the industry Agriculture, Forestry, Fishing and the industry Mining the dummies are omitted because of collinearity. In this case because these two industries contain too little observations.

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[11] Retrieved from: http://siccode.com/en/