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Market Timing in Share Repurchases

An Empirical Comparison Between the First Two Studies that Examine the Actual Repurchase Prices of a Full Sample of U.S. Repurchasing Firms

Abstract: Recently, two studies examined actual share repurchases now that the SEC has mandated that U.S. firms disclose detailed reports of their repurchase activity. Dittmar and Field (2015) find evidence for managerial market timing and show that firms buy back before stock prices increase. Obernberger (2014) finds no post-repurchase abnormal returns and attributes repurchase activity to prior negative returns. This paper examines where these differences stem from and how they relate to market timing. I replicate the results of Dittmar and Field (2015), using the more comprehensive dataset of Obernberger (2014). I find that the two papers use two significantly different methods to estimate long-run performance. The proof or disproof of managerial market timing is entirely the result of the statistical method chosen to measure it. Using a different method, I find no robust evidence in favor of market timing. Sample differences are likely the reason why Dittmar and Field (2015) find that managers pay lower prices for their shares if they repurchase infrequently or buy shares on their own account. The influence of past returns on repurchase prices is then also twice as large in the Obernberger (2014) sample compared to the sample of Dittmar and Field (2015). It is recommended that future research first gains a further understanding of the data collection process before further investigating the potential of market timing in share repurchases.

Keywords: share repurchases, relative repurchase price, managerial timing ability, market timing, long-run performance, buyback anomaly, Fama and French (1993) calendar-time portfolio estimations.

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I. Introduction

The question whether firms time their financial decisions has received substantial attention. Understanding the motives behind these decisions is important because the use of private information to time the market may result in a wealth transfer among shareholders. Firms can take advantage of mispricing through a variety of corporate decisions. This is documented by several papers. For example, Baker and Wurgler (2000), Lowry (2003), and Rhodes–Kropf, Robinson, and Viswanathan (2005) respectively study seasoned equity offerings (SEO's), initial public offerings (IPO's), and mergers, and link these financing events to misvaluation.

Whereas a firm may issue stock to benefit from overvaluation, stock repurchases serve as a natural counter-example and could benefit firms that suffer from undervaluation. As such, the timing and performance of stock repurchases have been studied for over half a century[1]. Despite numerous examinations, research on stock repurchases has long been at a disadvantage as U.S. firms were not required to disclose detailed repurchase information until 2004[2]. Studies before 2004 often relied on repurchase announcements[3] or other proxies for actual repurchases. This creates difficulties in correctly detecting managerial timing ability, as many firms announce but never repurchase stock (Stephens and Weisbach, 1998), and proxies often deviate from the actual amount repurchased (Banyi, Dyl, and Kahle, 2008). The financial literature on share repurchases can therefore be segregated into two sorts: studies using actual repurchase data and those relying on announcement data and other proxies. There are some studies in the first group that use data from smaller U.S. samples[4] or other financial markets[5]. However, none of them examine SEC filings for a full sample of all U.S. repurchasing firms over several years, nor do they look at long-run performance. Such work would improve the ability to respectively examine cross-sectional variation and market timing. Recently, however, both Obernberger (2014) and Dittmar and Field (2015) completed the exhausting task of compiling such an extensive dataset. Surprisingly, their findings to some extent contradict each other.

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[1] See for example Masulis (1980).

[2] Following amendments to SEC Rule 10b-18, firms are required to provide detailed information about their repurchase activity in their quarterly SEC filings. These new disclosure requirements mandate firms to report, among other things, the numbers of shares repurchased, the average price paid per share, and the number of shares repurchased under a specific program. The amendment applies to all periods ending on or after March 2014. See Obernberger (2014) for a thorough overview of the regulation of share repurchases in the U.S.

[3] Open market repurchases are by far the most common repurchase method in the U.S. and represent more than 80% of the aggregate repurchasing value (Banyi et al., 2008). In this form, a firm announces that it is going to repurchase shares before it actually starts repurchasing. The announcement often states how many shares (also called program size) the firm intends to repurchase under the announced repurchase program.

[4] See Cook, Krigman, and Leach (2004), De Cesari et al. (2012) , and Ben-Rephael, Oded, and Wohl (2013).

[5] See Brockman and Chung (2001) and Zhang (2005) for Hong Kong, McNally, Smith, and Barnes (2006) for Canada, and Ginglinger and Hamon (2007) for France.

Dittmar and Field (2015) examine U.S. firms that repurchased stock between 2004 and 2011. The authors find that firms are able to repurchase stock at lower than average market prices, which provides evidence for market timing in the short-run. In addition, they show that firms pay lower prices if they repurchase infrequently, have insider buyers, or have recently experienced negative stock returns. They also report positive abnormal returns for up to three years following stock repurchases, which suggests that managers are able to time the market in the long-run as well. Subsequent returns are higher for firms that repurchase less often. The sample of Obernberger (2014) covers firms that repurchased between 2003 and 2010. Surprisingly, this sample is roughly forty percent larger. The author also finds that firms are able to repurchase stock at lower than average market prices, but attributes this empirical pattern to negative prior returns rather than a forward-looking ability of managers. Repurchases in this sample are not followed by positive abnormal returns and no evidence for market timing is found.

The central theme in this paper is to explain where the different findings of both studies stem from and how they relate to market timing. The question whether firms are able to expropriate selling stockholders is economically significant as both samples cover more than two trillion dollars' worth of share repurchases. Yet, the first two U.S. studies that could present irrefutable evidence in the long standing discussion on the market timing of share repurchases do not correspond. I will answer my research question in several steps, using the original and larger dataset provided by Obernberger (2014) to replicate the results of Dittmar and Field (2015).

I first examine the difference in sample size. Both papers claim to use a "full sample". Taking a closer look at both collection methods and linking the dataset of Obernberger (2014) to a repurchase variable from Compustat does not explain the significant size difference.

Second, I compare the firm- and repurchasing characteristics of both datasets. I find that the smaller sample of Dittmar and Field (2015) consists of firms that repurchase on average 30% (50%) more in absolute (relative) terms. These large repurchases are primarily made by infrequent repurchasers. Both datasets find that it are the large infrequent repurchasers that repurchase at a bargain. Dittmar and Field (2015) also find that those that repurchase infrequently show the highest long-run returns. This partly explains why they are the ones that predominantly find evidence in favor of market timing, as large and infrequent repurchasers are especially present in their sample.

Third, I will study actual repurchase prices. Dittmar and Field (2015) provide a comprehensive analysis on this matter, so re-performing the same tests with the Obernberger

(2014) sample should serve as a useful robustness check. The influence of repurchasing frequency on the repurchase price is smaller in the Obernberger (2014) sample. This is likely to be caused by the aforementioned sample difference. The influence of insider buying is not robust. The influence of past returns is twice as large compared to Dittmar and Field (2015). Overall, repurchase prices are always higher in the Obernberger (2014) sample. I also compare the repurchase prices with two naïve repurchase strategies and find that firms are able to buy at lower prices compared to other days prior to or within the repurchase month, but they are not able to look forward. As such, I find no evidence that managers in the Obernberger (2014) sample are able to time the market in the short-run.

Fourth and final, I look at long-run performance. Matching repurchasing firms on size and book-to-market or size and prior return does not provide abnormal buy-and-hold returns. The latter test shows that if repurchases are driven by negative returns, they later do not outperform firms that experienced the same decline in stock price. I also consider Fama and French (1993) calendar-time portfolio estimations. Both papers use this technique, but their exact methods differ significantly. In fact, I find the proof or disproof of managerial market timing is entirely the result of the statistical method chosen to measure it. Applying the method used by Dittmar and Field (2015) to the sample of Obernberger (2014) leads to abnormal performance. Yet, I find that both methods are subject to certain biases. I therefore use a different technique to perform calendar-time portfolio estimations and find no robust evidence in favor of market timing. In addition, there is only weak evidence that repurchase frequency and relative program size is related to market timing.

My study contributes to prior research by showing that the contradictory findings of Obernberger (2014) and Dittmar and Field (2015) stem from both sample- and methodological differences. I therefore recommend future research to always examine the robustness of the method chosen to perform calendar-time estimations. Yet, the dissimilarities in long-run performance that remain are not explained by statistical methods, outliers, or firm- or repurchasing characteristics. As such, I conclude that the two datasets also cover different repurchase programs. I therefore advise future research to first further examine where these differences stem from. Access to the sample of Dittmar and Field (2015) and a detailed discussion with the authors of both papers on their collection methods might offer an explanation. Understanding the critical steps in the exhaustive process of compiling a sample of repurchasing firms is critical, since future research is likely continue as actual repurchase data has only recently become available, datasets covering longer and future time periods are desired, and concerns of selling stockholders remain.

The remainder of this paper will be structured as follows: in the next section, a more thorough review of the current literature on share repurchases will be provided. Based on this review, I will formulate my research question. Chapter III describes the selection of the dataset, the construction of the variables, and the methods used to measure long-run performance. Chapter IV covers the empirical analysis in which I replicate the results of Dittmar and Field (2015) with the larger dataset of Obernberger (2014) and subsequently further examine long-run performance. Chapter V concludes.

II. Literature Review and Research Question

As already mentioned, U.S. firms were not required to disclose detailed repurchase information until 2004. The financial literature on share repurchases can therefore be segregated into two sorts: studies using actual repurchase data and those relying on announcement data and other proxies. This chapter provides a review of both types of studies, which together cover more than half a century of research examining the timing and performance of stock repurchases. I will summarize their findings; after which I will develop the research questions that will form the basis of the remainder of this study.

Repurchase Announcements

Much of the earlier work relies on repurchase announcement data, which can be easily retrieved from the Security Data Company (SDC) M&A database[6]. It is widely documented that firms that announce a repurchase program experience positive abnormal returns of between two and three percent around the announcement date[7]. The two most accepted explanations for the firm's choice to repurchase and the subsequent announcement returns are the free cash flow hypothesis and the signaling hypothesis[8].

According to the first theory, firms repurchase stock to distribute excess cash to shareholders (Jensen, 1986). Repurchasing mitigates the agency conflict of over-investment

[6] Early studies used newspapers like the Wall Street Journal as a data source (e.g., Vermaelen, 1981).
[7] See, among others, Masulis (1980), Dann (1981), Vermaelen (1981), Ofer and Thakor (1987), Constantinides and Grundy (1989), Lakonishok and Vermaelen (1990), Ikenberry, Lakonishok, and Vermaelen (1995), (1999), Stephens and Weisbach (1998), Grullon and Michaely (2002), (2004), Kahle (2002), Massa, Rehman, and Vermaelen (2007), Peyer and Vermaelen (2009), and Manconi, Peyer, and Vermaelen (2014). The earlier work focuses on tender offers, as open-market repurchases were not a popular instrument until the beginning of the 1990's.
[8] Other, less dominant, factors include a firm's leverage ratio, possible take-overs, the dilutive effect of stock options, industry concentration, and a reduction in systematic risk (Dittmar, 2000, Kahle, 2002, Bens et al., 2003, Grullon and Michaely, 2004, and Massa, Rehman and Vermaelen, 2007).

and is a more flexible and tax-efficient method than, e.g., debt-for-equity swaps and dividends. The reduction of shareholder concerns explains the positive announcement returns. The same hypothesis predicts that firms with excess cash and diminishing growth opportunities are more likely to repurchase, and this is confirmed by Stephens and Weisbach (1998) and Grullon and Michaely (2004). In contrast, the signaling theory suggests that firms repurchase to indicate undervaluation. Undervaluation is a result of information asymmetry between managers and the market. Announcing a repurchase program sends a valuable signal to the less informed market, hence the positive announcement returns.

However, announcement returns between two and three percent hardly seem large enough to correct for misvaluation. To place the magnitude in perspective, 3% is barely larger than the daily standard deviation of many stocks (Ikenberry, Lakonishok, and Vermaelen, 1995). A possible explanation is a sluggish market reaction, as documented for other corporate events, e.g., SEO's (Ritter, 1991) and IPO's (Loughran and Ritter, 1995). Therefore, if managers are able to time the market by anticipating stock returns, repurchasing firms should show long-term abnormal returns if the market doesn't immediately incorporate the information conveyed in the repurchase announcement. This "buyback anomaly" is documented by several studies, raising concern of managers expropriating selling stockholders.

Lakonishok and Vermaelen (1990) inspect tender offers between 1962 and 1986 and report 2-year abnormal returns of 23.11% following the initial announcement. Ikenberry, Lakonishok, and Vermaelen (1995) study open market repurchases between 1980 and 1990 and find abnormal buy-and-hold returns up to four year following the announcement. Conform the signaling hypothesis, they find the highest abnormal returns for the firms most likely to be undervalued. To check the robustness of Ikenberry, Lakonishok, and Vermaelen (1995), Ikenberry, Lakonishok, and Vermaelen (1999) perform an out-of-sample study and find long-term abnormal returns following buyback announcements in Canada. Massa, Rehman, and Vermaelen (2007) add to this by showing that returns are higher in less concentrated industries. Peyer and Vermaelen (2009) examine open market repurchases between 1991 and 2001 and find that the buyback anomaly had persisted. The authors show that the highest returns are generated by the firms with the steepest stock price decline in the six months preceding the announcement. Manconi, Peyer, and Vermaelen (2014) perform a global extension by examining both U.S. and non-U.S. buyback announcements between 1998 and 2008 and report similar results. In contrast to the previously mentioned studies, Fu, Huang, and Lin (2012) report that the buyback anomaly has disappeared in the 21st century. The authors inspect open-market repurchases and SEO's between 1980 and 2012. The authors confirm previous findings

for the events up to 2002, but find no significant outperformance (underperformance) following stock repurchases (SEOs) that follow announcements after 2002. They relate these finding to improved market efficiency following from higher institutional ownership, enhanced regulations, more financial analysts, increased liquidity, and reduced trading costs.

Although the aforementioned literature is extensive and covers 50 years of (international) stock repurchases, the absence of actual repurchase data poses limitations. Studying repurchase announcements does not provide irrefutable evidence in favor of timing ability for several reasons. First of all, Stephens and Weisbach (1998) show that some firms announce but never repurchase and that repurchases do not instantaneously follow announcements. In addition, new programs are often announced before the first one is completed and it may take several years to complete a program, if the firm completes the program at all. Moreover, Banyi, Dyl, and Kahle (2008) find that many repurchase programs are not covered in the SDC M&A database.

Next to repurchase announcements, several studies (e.g., Dittmar, 2000, and Jagannathan, Stephens, and Weisbach, 2002) use proxies to determine the actual number of shares repurchased. These measures are either derived from CRSP or Compustat and do not distinguish between market and non-market transactions, nor do they state the price for which the stock is repurchased. Banyi, Dyl, and Kahle (2008) examine the accuracy of these measures and show that even the most accurate proxy for the number of shares repurchased deviates by more than 30% in 16% of the cases. As such, the authors state that "many studies should be revisited now that the SEC mandates disclosure of precise information about share repurchases in Forms 10-Q and 10-K".

Actual Repurchase Data

Several papers find evidence for managerial timing ability by studying actual repurchases in more transparent markets than the pre-2004 U.S. disclosure environment. Brockman and Chung (2001) show that firms in Hong Kong repurchase at a lower price[9] than the ones obtained by simulating a naïve repurchase strategy. Zhang (2005) uses the variables size and book-to-market to match repurchasing firms in Hong Kong against a portfolio of control firms. The author finds abnormal three-year buy-and-hold returns, but only for the small value firms. McNally, Smith, and Barnes (2006) find that Canadian firms provide price support and have

[9] For the remainder of this paper the words "bargain", "discount", and "relative repurchase price" will refer to the difference between the average repurchase price and average market price and will be used interchangeably.

superior timing, as share prices show abnormal gains (losses) after (before) share repurchases. In contrast, Ginglinger and Hamon (2007) study repurchase activity in France and do not find proof of managerial timing ability. The authors suggest that the price support hypothesis provides the best explanation for their findings, as repurchasing firms act against market trends but prices do not increase after they repurchase.

Actual share repurchases in the U.S. have been examined by several papers. Cook, Krigman, and Leach (2004) use voluntarily disclosed repurchase data of 64 firms that repurchased in 1993 and 1994. The authors find that NYSE firms beat a naïve repurchase strategy, but NASDAQ firms do not. De Cesari et al. (2012) make use of the newly available monthly repurchase information and study 256 repurchasing firms between 2004 and 2006. They find that firms repurchase stock at a bargain, institutional ownership reduces the bargain, and repurchases are followed by abnormal returns. Ben-Rephael, Oded, and Wohl (2013) randomly pick 620 repurchasing firms evenly across NYSE size deciles. The authors find that firms repurchase their shares at a discount and show that this discount is negatively (positively) related to size (book-to-market).

Although the aforementioned studies provide fruitful insights, none of them examine SEC filings for a full sample of all U.S. repurchasing firms over several years, nor do they look at long-run performance. Such work would improve the ability to respectively examine cross-sectional variation and market timing. Recently, however, both Obernberger (2014) and Dittmar and Field (2015) completed the exhausting task of compiling such an extensive dataset. Surprisingly, their findings to some extent contradict each other.

Dittmar and Field (2015) examine 2,237 firms that repurchase stock as part of an open market repurchase program in a total of 38,900 repurchase-months between 2004 and 2011. The authors find evidence for managerial timing ability as firms are able to repurchase stock at lower than average market prices. The repurchase price is lower than the average market price during various windows, even throughout the 12 months surrounding or during the 6 months after the repurchase month. In addition, the authors find that the discount increases for firms that repurchase less frequently, have insider buyers, or have recently experienced negative stock returns. Finally, the authors find abnormal long-term returns for up to three years using both buy-and-hold abnormal returns and Fama and French (1993) three-factor calendar-time portfolios estimations. Abnormal returns are significantly higher for infrequent repurchasers.

Obernberger (2014) examines 2,934 firms that repurchase stock as part of an open market repurchase program in a total of 47,301 repurchase-months between 2003 and 2010.

Likewise, the author finds that firms are able to repurchase stock at lower than average market prices. In contrast to Dittmar and Field (2015), Obernberger (2014) attributes this finding to contrarian trading rather than market timing[10]. The contrarian trading hypothesis stipulates that repurchases are driven by negative returns and that firms simply buy back more when stock prices are lower. Even though firms have no timing ability ex-ante, the relation between realized returns and repurchase activity creates empirical patterns that suggest that firms are able to time the market. In addition, the author finds further evidence for the contrarian trading hypothesis as he shows that a large part of the discount is the result of buying after a drop in the stock price. Repurchases are not followed by abnormal returns, using both Fama and French (1993) three-factor calendar-time portfolios estimations and the Ibbotson's (1975) return across time and securities (IRATS) methodology.

Research Question

The literature review in the previous sections covers more than half a century of research examining the motivation, timing, and performance of repurchasing firms. Despite the numerous valuable contributions, the lack of a comprehensive set of actual repurchase data poses difficulties in presenting irrefutable evidence in favor of market timing. Obernberger (2014) and Dittmar and Field (2015) compiled such a dataset but present opposing evidence with respect to managerial timing ability. The goal of this paper is to explain where these differences stem from and how they relate to market timing. I will answer my research question in several steps, using the original and larger dataset provided by Obernberger (2014) to replicate the results of Dittmar and Field (2015).

I will start by examining the difference in sample size. Looking at the 2004-2010 period, the Obernberger (2014) sample comprehends 9,182 firm-years and 46,311 repurchase-months, whereas the sample of Dittmar and Field (2015) contains 6,527 firm-years and 33,512 repurchase-months. Both papers claim to use a "full sample", so a closer look at their collection methods and selection criteria might shed light on the difference and its possible influence on the results.

Secondly, I will compare the firm- and repurchasing characteristics of both datasets. Numerous studies document a relationship between these characteristics and the motivation,

[10] See Obernberger (2014) for a simple model and the derived empirical predictions for both the market timing and the contrarian-trading hypothesis. Although both theories are mutually non-exclusive, the empirical predictions that stem from the model can be used to validate the two hypotheses. Obernberger's (2014) empirical findings support the contrarian-trading hypothesis, but not the market timing hypothesis.

timing, and performance of repurchasing firms[11]. For example, Dittmar and Field (2015) show that infrequent repurchasers buy their shares back at a lower price and significantly outperform frequent repurchasers in the long-run. So like the previous step, comparing firm- and repurchasing characteristics could show that the two datasets cover different repurchase programs and consequently find opposing evidence with respect to managerial timing ability.

Third, I will analyze the difference between the average repurchase price and the average market price. The dataset of Obernberger (2014) seems more comprehensive at first sight, but the author's analysis of the bargain does not include measures of insider buying, information asymmetry, or enduring market overreaction. Using the dataset of Obernberger (2014) to analyze the bargain conform the methods of Dittmar and Field (2015) will therefore serve as a robustness check and lead to a more complete analysis of actual repurchase prices.

Finally, the conflicting findings on long-run performance require a thorough examination. Dittmar and Field (2015) provide buy-and-hold abnormal returns (BHAR) by matching firms on size and book-to-market. However, the contrarian trading hypothesis argues that repurchases are driven by negative returns. I will therefore provide BHAR's by matching firms on both size and book-to-market and size and past six-month returns (momentum). In addition, both authors use calendar-time portfolio estimations but only Dittmar and Field (2015) report abnormal performance. I will try to explain this in three ways. First, I will search for methodological differences between the two models and show how they influence the results. Second, I will test the influence of different sample (firm and repurchasing) characteristics on post-repurchase performance. This is done by randomly dropping certain types of repurchase programs from the dataset of Obernberger (2014), making it a closer representation of the sample of Dittmar and Field (2015). In addition, repeating the procedure of random selection 100 times sheds further light on the potential influence of outliers in the dataset of Obernberger (2014). Third, I will contribute to both studies by measuring the *weighted* average abnormal performance of repurchasing firms for up to four years after the repurchase month. This is done by using either the dollar repurchasing value or relative repurchasing value as portfolio weights in the calendar-time estimations. To find further support for Peyer and Vermaelen (2009) and Fu, Huang, and Lin (2012), I will investigate whether outperformance is related to undervaluation, institutional ownership, liquidity, and information asymmetry. Finally, I will check the robustness of my model by adding the investor

[11] See, e.g., Stephens and Weisbach (1998), Dittmar (2000), and Peyer and Vermaelen (2009).

sentiment index (Baker and Wurgler, 2006) and momentum factor (Carhart, 1997) as fourth factors to the original Fama and French (1993) three-factor model.

III. Data and Methodology

Sample Collections and Variable Construction

The repurchase data is directly taken from Obernberger (2014), therefore the collection process does not merit further discussion[12]. The original sample includes 47,301 observations (repurchase months). For each repurchase month, the dataset provides the number of shares repurchased as part of an open-market repurchase program and the average price paid for those shares. In addition, the dataset identifies the different repurchase programs and provides information about the initial program size, the duration of the program, and the remaining number of shares the firm can still repurchase as part of the open-market repurchase program. The dataset of Obernberger (2014) serves as a starting point and the firm-months are used as a stepping stone to retrieve additional data from CRSP, Compustat, the U.S. Department of Commerce, IBES, and Thomson Reuters.

Table 1 describes all variables used in this study. Most variables follow directly from Dittmar and Field (2015), but a few exceptions are made. First of all, Dittmar and Field (2015) do not define the variable "return volatility". I therefore follow Fu, Huang, and Lin (2012) and define return volatility as the average standard deviation of daily stock returns, measured over the 12 months prior to the repurchase month. Secondly, Dittmar and Field (2015) search repurchase announcements in Factiva in order to look for indicators of potential undervaluation. I do not link Factiva to my dataset as this is a time-consuming task and Dittmar and Field (2015) find no relation between this variable and market timing. Third, because Obernberger (2014) finds no evidence of market timing in the aggregate sample, I will examine whether outperformance is related to undervaluation (Peyer and Vermaelen, 2009) or changing market conditions (Fu, Huang, and Lin, 2012). Peyer and Vermaelen (2009) use the variables book-to-market, size, prior raw return, and the aforementioned data from Factiva to create an undervaluation index. I reconstruct a similar index, but exclude the data from Factiva. Fu, Huang, and Lin (2012) relate, among other things, improved liquidity, increased institutional investments, and increased analyst coverage to increased market efficiency and thus to fewer opportunities to exploit mispricing. I therefore use the variables liquidity ratio, the number of

[12] See the Appendix of Obernberger (2014) for an extensive description of the data collection issues that arise when collecting repurchase data from the 10-Q and 10-K filings and how they were dealt with accordingly.

analysts following, and the level of institutional and hedge fund ownership as proxies for price efficiency and include them in my analysis.

Relative Repurchase Price

Dittmar and Field (2015) construct a measure that compares the average repurchase paid in the repurchase month (as reported in the 10-K and 10-Q filings), $\overline{REP_0}$, against the average daily closing stock prices (from CRSP) over several comparison periods of *t* months before and after the repurchase month, $\overline{CP_{\pm t}}$. The authors refer to this variable as the relative repurchase price (RRP):

$$Relative\ Repurchase\ Price_{\pm t} = \frac{\overline{REP_0}}{\overline{CP_{\pm t}}} - 1 \quad (1)$$

The average closing price is measured over several windows: during the repurchase month (t=0), as well over one-, three-, and six-month windows before and after the repurchase month. If a manager is able to time the market in the short-run, the average repurchase price would be lower than the average stock price, making the RRP < 0. To find more robust evidence of market timing, the authors also construct the following forward-looking variable:

$$Relative\ Repurchase\ Price_{0,+t} = \frac{\overline{REP_0}}{\overline{CP_{0,+t}}} - 1 \quad (2)$$

The formula in (2) is the same as in (1), but it excludes the months *prior* to the repurchase month in the computation of the average daily closing price ($\overline{CP_{\pm t}}$). If managers are truly timing the market, it is expected that they are also able to repurchase at lower-than-future stock prices, making the RRP (2) again smaller than zero.

The construction of the relative repurchase price by Dittmar and Field (2015) differs from the method used by Obernberger (2014), as the latter only compares the average repurchase price with the average market price in the repurchase month (t=0). In contrast, the method of Dittmar and Field (2015) requires the daily CRSP closing prices for the 12 months surrounding the repurchase month (t=6, formulae (1)). Setting this extra criterion in CRSP results in a slight loss of observations, reducing the final sample to 46,483 repurchase months.

Long-Run Performance

Dittmar and Field (2015) use both buy-and-hold abnormal returns (BHAR's) and Fama and French (1993) three-factor calendar-time portfolios estimations to measure long-run

performance. I will use the same methods in my empirical analysis, but also make several alterations to them.

BHAR's are computed by subtracting the return of a benchmark asset from the return of a repurchasing firm. Dittmar and Field (2015) measure BHAR's over a horizon of three years and weigh each observation (repurchase month) equally when calculating the average BHAR. The authors match repurchasing firms against 25 (5x5) size and book-to-market portfolios. The 5 size and 5 book-to-market breakpoints are based on NYSE-listed firms, and the cut-off values (and monthly portfolio returns) can be easily retrieved from Kenneth French's website. I will not only replicate their work by using the repurchase data from Obernberger (2014), but I will also provide BHAR's by matching firms against 25 (5x5) size and past six-month return (momentum) portfolios. The reasoning behind this second method is based on the contrarian trading hypothesis, which argues that repurchases are driven by negative returns. For example, Peyer and Vermaelen (2009) find that firms that were "beaten up" the most prior to a repurchase announcement showed the highest long-run abnormal performance. Positive BHAR's will therefore provide further support for the forward-looking ability of managers, whereas non-positive BHAR's will be in line with the contrarian trading hypothesis.

Calendar-time portfolio estimations are stylized by a single time-series regression in which monthly portfolios are formed by stocks that had an event in a specified event period. Dittmar and Field (2015) examine portfolios over time periods of 3, 6, 12, 24, and 36 months following the repurchase month. That is, firms are added in the month that they repurchase stock and the stock is retained in the portfolio for 3, 6, 12, 24, or 36 months. The portfolios are rebalanced on a monthly basis and the monthly average portfolio return, $R_{p,t}$, is used in the following regression:

$$R_{p,t} - R_{f,t} = a_j + b_j\left(R_{m.t} - R_{f,t}\right) + c_j SMB_t + d_j HML_t + \epsilon_{i,t} \quad (3)$$

$R_{f,t}$ is the risk-free rate, $R_{m.t}$ is the market return, SMB_t is the return of a portfolio of small firms minus the return of a portfolio of big firms, and HML_t is the return of a high book-to-market portfolio minus the return of a portfolio of low book-to-market firms in calendar month t. The coefficients a_j, b_j, and c_j are the results of the time-series regression, which I will run in Stata[13].

[13] The times-series regressions can easily be conducted through the use of a built-in tool, provided by the statistical package SAS. SAS only requires a request form in which the repurchasing firms and the respective repurchasing

Both Obernberger (2014) and Dittmar and Field (2015) use calendar-time portfolio estimations, but their methods differ on three grounds:

- Dittmar and Field (2015) use the value-weighted (VW) return of all NYSE-listed firms as the market return, $R_{m.t}$. In contrast, Obernberger (2014) uses the equal-weighted (EW) market return as the risk factor. The latter is in line with Loughran and Ritter (2000), who note that it should be the small firms that are misvalued. These misvalued firms would in turn be underrepresented when using the value-weighted return. EW portfolios generally outperform VW portfolios (Plyakha, Uppal, and Vilkov, 2012), and this is also the case in the sample period: the EW market portfolio outperforms the VW market portfolio with an average of 0.24% per month. I expect that this methodological difference will partially explain why Dittmar and Field (2015) find abnormal returns and why Obernberger (2014) does not.
- In the month of the repurchase, Dittmar and Field (2015) estimate the return of a firm, $R_{i,0}$, by comparing the average repurchase price with the month-end closing price. Obernberger (2014) however, sets $R_{i,0}$ equal to the monthly return provided by CRSP. As both papers report that the average repurchase price is lower than the average CRSP closing price[14], I expect that the different measurements of $R_{i,0}$ provide a second methodological explanation for why Dittmar and Field (2015) find abnormal returns but Obernberger (2014) does not.
- Obernberger (2014) uses ”unrestricted” portfolios, Dittmar and Field (2015) are ambiguous on whether they use “restricted” or “unrestricted” portfolios.[15] The difference between both approaches can easily be illustrated through the following example. Firm A and firm B are of the same size. Suppose that firm A repurchased stock in 10 of the past 12 months, whereas firm B repurchased on only one occasion. When creating an unrestricted portfolio in month 12, firm A is added 10 times, but firm

months are identified. The rest of the process is automated, but provides little freedom for the user. However, it is also possible to manually run the regressions by using statistical programs like Stata. In that case, the risk factors can easily be retrieved from Kenneth French’s website. I choose the latter method, as the manual computation provides me with more freedom, allowing me to show the difference between several methodological options. Untabulated tests verified that my basic model in Stata reports the same results as the automated model in SAS.

[14] Relative to the average CRSP closing during the repurchase month, Obernberger (2014) and Dittmar and Field (2015) respectively report an average bargain of -0.56% and -0.76%.

[15] The footnote on page 27 states “*For each calendar month of the sample period, we construct a portfolio comprising all firms making a repurchase within the prior 3, 6, 12, 24, or 36 months*.”, indicating that a restricted portfolio is used, as well as “*To do this, we add firms to the portfolio in the month that they repurchase stock, and the stock is retained in the portfolio for 3, 6, 12, 24, or 36 months*.”, indicating that an unrestricted portfolio is used.

B is added only once. In contrast, the restricted approach does not allow duplicates in the monthly portfolios, adding both firms only once in the portfolio of month 12. Now suppose that Firm A repurchased in each repurchasing month 1% of its outstanding shares, whereas firm B repurchased on the single occasion 10% of its outstanding shares. It is in this example intuitively clear that firm A will be overrepresented in an unrestricted portfolio, since both firms are essentially repurchasing the same amount. Because Dittmar and Field (2015) find that infrequent repurchasers outperform frequent repurchasers and infrequent repurchasers are underrepresented in an unrestricted portfolio, I expect that the restricted approach outperforms the unrestricted approach. If Dittmar and Field (2015) use an unrestricted portfolio, it would provide a third methodological explanation for why they find abnormal returns but Obernberger (2014) does not.

Each of the three differences could partially explain the different findings of both papers from a methodological point of view. However, simply applying the method of Dittmar and Field (2015) to the data of Obernberger (2014) does not allow me to investigate the underlying influence of each methodological choice. So, in order to correctly examine the influence of each difference on abnormal performance, I will model my calendar-time estimations in eight (2x2x2) different ways. In addition, I will not only look at the difference between restricted and unrestricted portfolios, but I will also consider weighted portfolios. Specifically, I will use either the dollar repurchasing value or relative repurchasing value (measured relative to the firm's market capitalization) as portfolio weights in the calendar-time estimations. These two portfolios represent an investor who invested (with hindsight) the same amount each month throughout the sample period, who based the monthly portfolio on either the absolute or relative amount repurchased by firms, and repurchased at the same prices as the firms did. Finally, I will check the robustness of my model by adding the investor sentiment index (Baker and Wurgler, 2006), SEN_t , and momentum factor (Carhart, 1997), MOM_t , as fourth factors to the original Fama and French (1993) three-factor model:

$$R_{p,t} - R_{f,t} = a_j + b_j\left(R_{m.t-}R_{f,t}\right) + c_j SMB_t + d_j HML_t + e_j SEN_t + \epsilon_{i,t} \quad (4)$$

$$R_{p,t} - R_{f,t} = a_j + b_j\left(R_{m.t-}R_{f,t}\right) + c_j SMB_t + d_j HML_t + e_j MOM_t + \epsilon_{i,t} \quad (5)$$

The investor sentiment and momentum factor can respectively be downloaded from Jeff Wurgler's and Kenneth French's websites.

It is important to note that both measures of long-run performance have advantages and disadvantages. Obernberger (2014) provides an extensive overview of the long-standing discussion on how to measure the long-run performance of corporate events. The author concludes that it is best to use both the IRATS method and the Fama and French calendar-time estimations. I will provide BHAR's and will not use the IRATS methodology for three reasons. First of all, I use the data of Obernberger (2014). Using the same methodology will provide the same results. Second, Dittmar and Field (2015) do not use the IRATS methodology so I cannot examine the influence of the two different samples. In contrast and third, Dittmar and Field (2015) use BHAR's. Applying the same method on a different dataset allows me to examine the influence of the two different samples.

IV. Empirical Analysis

Sample Size

The contradictory findings of both papers could simply be the effect of examining different datasets. This could be the case as the number of observations in both samples differ significantly; Looking at the 2004-2010 period, the Obernberger (2014) dataset comprehends 9,182 firm-years and 46,311 repurchase-months, whereas the sample of Dittmar and Field (2015) contains only 6,527 firm-years and 33,512 repurchase-months. This difference of ±40% is surprising as Dittmar and Field (2015) claim to use a "full sample of repurchasing firms". A closer look at the two collection methods might offer an explanation.

Both samples are constructed by use of a script that retrieves all 10-Q and 10-K filings from EDGAR. Obernberger (2014) uses Autoit, Dittmar and Field (2015) use Perl. If programmed correctly, it should not matter which program is used. Both papers are only interested in publicly announced open-market repurchases, and therefore delete accelerated repurchase programs, tender offers, and privately negotiated repurchases. Dittmar and Field (2015) do not explicitly state that they exclude Dutch auctions. However, even if they did not exclude Dutch auctions, the rareness of this repurchase procedure would make the influence of the inclusion negligible[16]. All other selection criteria are fairly similar except for one step: only Dittmar and Field (2015) use the "purchases of stock" variable from the Statement of Cash Flows from Compustat to identify repurchasing firms that were not identified by the original script. I examine the influence of this difference by linking this Compustat variable to the

[16] For example, the final sample of Obernberger (2014) contains 6,462 open-market repurchase programs, while the author excluded only 128 tender offers and Dutch auction programs (1.9%).

dataset of Obernberger (2014). Compustat identifies 2,805 repurchasing firms between 2004 and 2010. 96.6% (2,709) of these firms are also covered in the sample of Obernberger (2014). In addition, 86 firms are not identified by Compustat and 96 firms are not covered by Obernberger (2014). I manually checked several of the 10-K and 10-Q filings of the latter group and found that these firms indeed repurchased shares, but that these repurchases were not part of an open-market repurchase program. As such, I conclude that the sample of Obernberger (2014) is not missing any relevant data by not linking the SEC-sample to the Compustat variable.

Comparing the two collection methods does not lead to a reason to assume that the two datasets are different. As such, I cannot explain why the sample of Obernberger (2014) comprehends 41% more firm-years and 38% more repurchase-months than the sample of Dittmar and Field (2015). The next steps are to examine whether the difference in sample size leads to different firm- and repurchasing characteristics, and if this is the case, how these differences relate to market timing.

Firm- and Repurchasing Characteristics

Aggregate Repurchasing Value

Using the method of Dittmar and Field (2015), Figure 1 shows the aggregate annual repurchasing value ($B) and its relation to the ±6 month RRP and 3-year buy and hold returns (BHAR's). The authors conclude three things: the aggregate annual repurchasing value varies over time, is positively related to the ±6 month RRP, and is inversely related 3-year BHAR's. The first two findings hold for the Obernberger (2014), but I find no relationship between aggregate annual repurchasing value and BHAR's.

I find that the aggregate annual repurchasing value is larger for the Obernberger (2014) sample for all years except 2007. It is, however, important to mention that while the Obernberger (2014) sample contains 38% more observations, the aggregate repurchasing value between 2004 and 2010 is only 5.9% larger (Panel C). In other words, the average observation in the sample of Dittmar and Field (2015) buys back 30% (or 15.1 million dollars) more. In addition, the RRP is always slightly lower for the sample of Dittmar and Field (2015) and the BHAR's are almost always larger. The BHAR's will be further examined later on. For now, it is important to note that the sample of Dittmar and Field (2015) consists of firms that repurchase relatively larger dollar amounts, at larger discounts, and with higher subsequent BHAR's.

Repurchasing Frequency

Dittmar and Field (2015) segregate their sample based on repurchasing frequency: those that repurchase four or fewer times are infrequent repurchasers and those that repurchase at least nine times a year are frequent repurchasers. I segregate the sample of Obernberger (2014) using the same method. The results are presented in Figure 2. The Obernberger (2014) sample comprehends 41% more firm-years. Panel A shows that these additional firm-years are spread evenly throughout the sample period. The percentage of infrequent, moderate, and frequent repurchasers is roughly the same for both samples. It is, however, important to note that even though the relative amount of infrequent repurchasers is almost the same for both samples (±50%), their contribution to the aggregate repurchasing value is almost twice as large for sample of Dittmar and Field (2015) (11.5% vs 19.2%).

Summary Statistics

Dittmar and Field (2015) document that frequent and infrequent repurchasers differ on many dimensions. Among other things, they show that frequent repurchasers are larger, more profitable, less volatile, and have higher book-to-market and dividend payout ratios. Looking at the median, the authors find that infrequent repurchasers buy relatively more of their market value back per month, while frequent repurchasers buy more than three times as much on an annual basis. This last difference could indicate that repurchase motives are related to repurchasing frequency.

The summary statistics of both samples are provided in Table 2. Panel A segregates the samples by repurchasing frequency and Panel B segregates the samples into firms that buy back at either a discount or a premium. The sample of Obernberger (2014) covers larger firms. This is due to outliers, as the medians of the two samples are more similar. In addition, the firms in this sample have a lower return on assets, market-to-book, cash-to-assets, and dividend payout ratio. Nonetheless, the relationship between repurchasing frequency and firm characteristics is the same for both samples. The discrepancy between the mean and median (annual) repurchase size for infrequent repurchasers indicates that there are outliers present in the sample of Dittmar and Field (2015). In addition, the average monthly relative repurchase value is 50% larger in the sample of Dittmar and Field (2015). Finally, the main take-away from Panel B is that only 26% of the firm-years in the sample of Obernberger (2014) repurchase at a discount, compared to 43% in the sample of Dittmar and Field (2015).

The first step in my empirical analysis provided no explanation as to why the sample of Obernberger (2014) is roughly 40% larger. This section has shown that these additional

observations are spread evenly throughout the sample period and that the percentage of infrequent, moderate, and frequent repurchasers is roughly the same for both samples. The relationship between repurchasing frequency and firm characteristics is similar as well: frequent repurchasers are larger, more profitable, less volatile, and have higher book-to-market and dividend payout ratios. However, a few differences arise. The sample of Dittmar and Field (2015) consists of firms that repurchase on average 30% (or 15.1 million dollars) more in absolute terms, 50% in relative terms, at larger discounts and with higher subsequent BHAR's. These large (both absolute and relative) repurchases are made by infrequent repurchasers. As a result, the contribution of infrequent repurchasers to the aggregate repurchasing value is almost twice as large for the sample of Dittmar and Field (2015) (11.5% vs 19.2%). Finally, the sample of Obernberger (2014) covers larger firms with lower return on assets, market-to-book, cash-to-assets, and dividend payout ratios. The next step is to examine how these differences relate to the bargain and market timing in the short-run.

Actual Repurchase Prices and Market Timing

RRP and Naïve Repurchasing Strategies

Figure 3 provides the mean and median bargains of both samples. The bargains are presented per year and measured over various comparison periods (Panel A – Panel G). Dittmar and Field (2015) find that the average RRP is negative for all comparison periods, suggesting that managers do not only time the days within the month in which they repurchase, but also repurchase in a month in which the price is low relative to longer horizons (e.g., the ±6 month RRP). Premiums are only paid when using the forward looking comparison periods for the years 2007 and 2008 (Panel E – Panel G). This is in line with Figure 1, which already indicated that firms pay more when aggregate annual repurchases are higher.

The mean and median bargains of the Obernberger (2014) sample follow the same time-series pattern. However, irrespective of which comparison window I use, the mean and median RRP are always lower for the sample of Dittmar and Field (2015). These differences are most profound when I include the months before the repurchase (Panel A – Panel D), indicating that repurchasing firms in the sample of Dittmar and Field (2015) were relatively more "beaten up" in the months before the repurchase.

To further examine whether firms time the days within the month in which they repurchase and or time the month in which the repurchase price is low relative to longer horizons, I compare the RRP with two naïve repurchase strategies. These two strategies are similar to the "uniform" and "proportionate" strategy used by Cook, Krigman, and Leach

(2004). In the uniform (or fixed share) strategy, a firm repurchases the same number of shares each day within the repurchase month. In the proportionate (or fixed dollar) strategy, a firm repurchases the same dollar amount each day within the repurchase month. As a result of the latter strategy, firms buy back more when stock prices are low. This contrarian trading strategy creates empirical patterns, which suggest that ex-post, firms are able to time the market. Unfortunately, I can only compare the naïve strategies with the RRP of the Obernberger (2014) sample as I do not have the repurchase data of Dittmar and Field (2015). The results are displayed in Panel H and Panel I. Looking only at the repurchase month (Panel H), the firms are able to beat the two naïve repurchase strategies. The average RRP of the fixed dollar strategy is -0.24%, whereas the actual RRP is -0.60%. This difference is significant and proves the first part of the statement: firms time the repurchase days within the month in which they repurchase. I look at the RRP of the two naïve strategies in Panel I in order to verify the second part of the statement. Neither of these strategies time their buybacks within the repurchasing month. As such, a negative RRP is solely the result of timing the repurchase month within a longer horizon. Both the fixed share and fixed dollar RRP are positive (negative) for the windows excluding (including) the months prior to the repurchase. This means that managers are able to buy back in months that are low compared to *prior* months, but they are not able to buy back in months that are low compared to *future* months. As such I conclude that the firms in the sample of Obernberger (2014) buy back at a discount, but a lower discount compared to Dittmar and Field (2015). In addition, firms are able to buy at lower prices compared to other days prior to or within the repurchase month, but are not able to look forward.

RRP and Repurchasing Frequency

Dittmar and Field (2015) investigate whether repurchase prices are related to repurchasing frequency. The bargains are sorted by repurchasing frequency and the results are presented in Table 3. The authors find that that the RRP is monotonically increasing in repurchasing frequency: frequent repurchasers always pay more than infrequent repurchasers. These differences are significant for all comparison windows. Performing the same analysis on the Obernberger (2014) sample shows again that these firms always pay more compared to the sample of Dittmar and Field (2015). The differences between frequent and infrequent repurchasers become smaller but remain significant. The smaller differences are to a large extent the result of higher RRP for infrequent repurchasers (e.g., -5.9% vs. -8.2% for the longest time period). However, the analysis in Table 3 does not account for firm characteristics. The

relationship between market timing and repurchasing frequency will therefore be examined in a multivariate setting in the next section.

Cross-Sectional Variation in the RRP

Dittmar and Field (2015) regress the relative repurchase price on firm characteristics, prior market return, and repurchasing frequency, including year and firm fixed effects. Two indicator variables that are equal to one if a firm repurchased frequently or infrequently are included to account for repurchasing frequency. The regression results, using all the different event windows for the RRP, are reported in Table 4. The authors find that after controlling for all the aforementioned factors, infrequent repurchasers manage to pay significantly less, irrespective of the event window. This finding suggests that frequent repurchasers buy back their stock for motives other than misvaluation. In addition, smaller firms, firms with more volatile stock, firms with a lower book-to market, and firms with low prior market returns are more likely to time the market. The same analysis is performed on the dataset of Obernberger (2014). The main difference between both samples is that the economic significance of the infrequent indicator variables is lower for the Obernberger (2014) sample. For example, the +6 month RPP is only 0.8% lower for infrequent repurchasers, compared to 2% in the sample of Dittmar and Field (2015). All the other relationships are roughly the same, except for the six-month prior market return. This last inconsistency weakens the claim that managers are able to time the aggregate stock market.

Insider Trading

Further support of managerial market timing would be obtained if managers of undervalued firms buy back shares on their own account. Dittmar and Field (2015) conjecture that, if managers can time the market, firms should pay a lower RRP when insiders are repurchasing shares on a personal scale as well. The authors follow Jenter (2005) and use net insider buying (insider purchases minus insider sales, provided by Thomson Reuters Insider Filing Data Feed) as a proxy for misvaluation. Table 5 sorts both samples into quartiles based on net insider buying. It is important to note here that merging the original samples with Thomson Reuters reduces the number of observations drastically in the dataset of Dittmar and Field (2015). As a result, the Obernberger (2014) sample is now almost twice as large. As with the previous size differences, there is no reasonable explanation for this.

Consistent with the hypothesis, firms with more insider buying pay significantly less in both samples. The differences between the quartiles, however, are again larger for the Dittmar

and Field (2015) sample. However, the results are inconsistent for the windows excluding the months prior to the repurchase: the influence of insider buying becomes insignificant for the Obernberger (2014) sample and opposite for the Dittmar and Field (2015) sample. Examining insider trading in a multivariate setting might offer an explanation for these inconsistencies as it accounts for the noise stemming from firm- and repurchasing characteristics. Therefore, Table 6 repeats the regression analysis presented in Table 4, but includes net insider buying as an independent variable. Table 6 confirms that firms with more insider buying pay less. The influence is always significant for the Dittmar and Field (2015) sample. The variable in the Obernberger (2014) sample becomes insignificant in the last two forward looking windows, thereby questioning the forward-looking ability of managers. The influence of the other variables remain unchanged after controlling for insider buying.

Information Asymmetry, Market Overreaction, and Liquidity

Three other factors that have the potential to influence the repurchase price are information asymmetry, market overreaction, and liquidity. If there is less information available about the true value of a firm, it is more likely to be mispriced, which in turn increases the opportunity for managers to repurchase at a bargain. Thus the higher the level of information asymmetry, the lower the relative repurchase price. In addition, Peyer and Vermaelen (2009) show that managers buy back shares as a response to a market overreaction to bad news. As such, we can expect that those firms that were "beaten up" the most due to a market overreaction are able to repurchase at the lowest prices. Third, Keswani, Yang, and Young (2007) relate repurchase prices to liquidity. The argument is related to price support, conjecturing that firms repurchase to support share prices. As such, the hypothesis stipulates that less liquid firms are more willing to repurchase at a premium because they are more in need of price support.

Dittmar and Field (2015) examine the influence of these factors by adding them into the regression model. The same method is applied to the sample of Obernberger (2014). Table 7 repeats the analysis presented in Table 6, but includes measures for information asymmetry and market overreaction. Two proxies are included to measure the level of information asymmetry: the number of analysts following the stock and the dispersion in analysts' forecasts. The first (second) variable decreases (increases) with the level of information asymmetry. Three variables are included to measure the level of market overreaction in the six months prior to the repurchase: the change in average analysts' EPS forecast, the percentage of analysts who downgrade the stock, and the prior buy and hold abnormal return. The variables are retrieved from IBES and CRSP and are described in Table 1. Table 7 shows that for both

samples, the measures for information asymmetry are insignificant. The only significant measure for market overreaction is prior six-month firm abnormal return. This finding is consistent with the contrarian trading hypothesis, which stipulates that repurchases are driven by negative returns. The influence of prior abnormal return is statistically significant for both samples. However, the economic significance is twice as large for the Obernberger (2014) sample. The significance of insider buying has disappeared after controlling for information asymmetry and market overreaction in both samples. The infrequency indicator is no longer significant for the Obernberger (2014) sample, further indicating that the relative repurchase price in this sample is driven by past returns rather than repurchasing frequency and thus market timing.

Table 8 repeats the regression presented in Table 7, but includes a measure for liquidity. Dittmar and Field (2015) use the bid-ask spread as a proxy for liquidity. This measure is insignificant for the Obernberger (2014) sample and shows an opposite relationship for the Dittmar and Field (2015) sample. I therefore follow Fu, Huang, and Lin (2012) and use a firms' liquidity ratio (average daily absolute return divided by trading volume) as an alternative proxy for liquidity. This measure is insignificant as well, which further indicates that the need for price support does not drive share repurchases.

The first section in my empirical analysis provided no explanation as to why the dataset of Obernberger (2014) is roughly 40% larger. Yet, the sample of Dittmar and Field (2015) consists of firms that repurchase on average 30% (or 15.1 million dollars) more in absolute terms and 50% more in relative terms. These large repurchases are primarily made by infrequent repurchasers, making the contribution of infrequent repurchasers to the aggregate repurchasing value almost twice as large for the sample of Dittmar and Field (2015) (11.5% vs 19.2%). This section has shown that for both samples, the RRP is monotonically increasing in repurchasing frequency: infrequent repurchasers always pay less than frequent repurchasers. The difference in RPP between frequent and infrequent repurchasers is, however, smaller for the Obernberger (2014) sample. This finding holds in a multivariate setting. For example, regressions onto the +6 month RPP show that the discount for infrequent repurchasers is only 0.8% larger in the Obernberger (2014) sample, compared to 2% in the sample of Dittmar and Field (2015). Further evidence for managerial market timing is initially found by adding a measure for insider trading into the regression analysis, but the robustness of this variable disappears after including measures for information asymmetry and market overreaction. The latter analysis shows that the influence of prior abnormal firm return (measuring market overreaction) is significant in both samples. However, the economic significance is twice as

large for the Obernberger (2014) sample. Interestingly, the infrequency indicator variable is no longer significant in this sample after including prior abnormal return. The analysis so far has found evidence for both managerial timing ability and contrarian trading. Managerial timing is especially found within infrequent repurchasers. The fact that firms that repurchase large amounts on an infrequent basis are more represented in the sample of Dittmar and Field (2015) explains why the authors find larger bargains and evidence for market timing in the short-run. In contrast, the bargains in the larger sample of Obernberger (2014) are better explained by past returns and not by market timing. Comparing the RRP in this dataset with two naïve repurchase strategies shows that managers are able to buy back in months that are low compared to prior months, but they are not able to look forward and buy back in months that are low compared to future months. The next step is to further examine market timing by looking at long-run performance.

Long-Run Performance and Market Timing

Buy-and-Hold Abnormal Returns

Figure 1 showed an inconsistency between the buy-and-hold abnormal returns (BHAR's) of both samples. Based on matching firms against 25 (5x5) size and book-to-market portfolios, Dittmar and Field (2015) found positive BHAR's, especially in the years where aggregate repurchasers were lower. The Obernberger (2014) sample mainly showed negative BHAR's. Table 9 further examines the BHAR's of the Obernberger (2014) sample. Firms are not only matched on size and book-to-market, but are also matched against 25 (5x5) size and past six-month return (momentum) portfolios. The reasoning behind this second method is based on the contrarian trading hypothesis, which argues that repurchases are driven by negative returns. Positive BHAR's will therefore provide further support for the forward-looking ability of managers, whereas non-positive BHAR's will be in line with the contrarian trading hypothesis. Mean, value-weighted mean, and median three-year BHAR's are presented in Table 9. Regardless of the comparison window, the sample of Obernberger (2014) always significantly underperforms the benchmark. For example the three-year mean BHAR based on equal-weighted size and momentum portfolios is -6.7%. In Panel B, I only include the first repurchase of each buyback program. The stock price might adjust immediately for undervaluation after the first repurchase. As such, subsequent repurchasers would not be able to exploit undervaluation. The BHAR's in Panel B, however, do not improve. As such, I find no further support for managerial timing ability.

Calendar-Time Portfolio Estimations: Methodological Differences

As mentioned in chapter III, the methods used by both papers to perform calendar-time portfolio estimations differ on three grounds. Obernberger (2014) forms "unrestricted" portfolios, uses the equal-weighted market return as the risk factor, and sets the return of a firm in the repurchase month equal to the monthly return provided by CRSP (CRSP Return). In contrast, Dittmar and Field (2015) are ambiguous about whether they form "restricted" or "unrestricted" portfolios, use the value-weighted market return as the risk factor, and set the return of a firm in the repurchase month equal to the month-end closing prices divided by the average repurchase price (RRP Return). In order to correctly examine the influence of each difference on abnormal performance, I will model my calendar-time estimations in eight (2x2x2) different ways. As stated before, I conjecture that the method used by Obernberger (2014) is the least likely to show abnormal performance, while the method chosen by Dittmar and Field (2015) is the most likely to find abnormal performance.

Table 9 repeats the analysis of Dittmar and Field (2015) by modeling the dataset of Obernberger (2014) in eight different ways. The left column shows the original results of Dittmar and Field (2015). The other eight columns are replications of the Obernberger (2014) sample. Of those eight, the column denoting "D&F replicates the method used by Dittmar and Field (2015) (assuming that Dittmar and Field (2015) formed restricted portfolios). The column denoting "Ob." replicates the method used by Obernberger (2014).

In Panel A, I replicate the results of Obernberger (2014) in order to verify the correctness of my model. The unrestricted, equal-weighted, CRSP portfolios column matches the original results[17]. As such, I conclude that I have modelled my calendar-time estimations in Stata correctly.

I replicate the full sample results of Dittmar and Field (2015) in Panel B. Looking at all the results provided in this Panel, I find that on average, using the RRP return instead of the CRSP return increases abnormal performance by 0.19% per month. The restricted portfolios outperform the unrestricted portfolios by 0.11% per month. Lastly, choosing the value-weighted risk factor over the equal-weighted risk factor leads to an outperformance of 0.05% per month. In accordance with my hypothesis, I find that the Obernberger (2014) method

[17] The results show minor differences. This is because my dataset is slightly smaller than the original sample used by Obernberger (2014) (46,483 instead of 47,301 observations). As stated in Chapter III, the small loss in observations occurs because replicating the results of Dittmar and Field (2015) requires the daily CRSP closing prices for the 12 month surrounding the repurchase month. Obernberger (2014) only required the CRSP closing prices of the repurchase month. Setting this extra criteria in CRSP results in the slight loss of observations. Untabulated tests verified that my basic model in Stata reports the same results as the automated model in SAS.

reports the lowest abnormal performance, while the method chosen by Dittmar and Field (2015) results in the highest abnormal performance. In fact, the contradictory findings of both papers are entirely explained by these three methodological differences. The type of return chosen in the repurchase month has the largest influence, then the type of monthly portfolio formed, and only then the market risk factor. Using the "D&F" method to form portfolios of the Obernberger (2014) sample leads to a statistically and economically significant outperformance of 10.08% (36 months x 0.28%) over 36 months. The "Ob." methods only leads to a statically insignificant outperformance of 3.24% over 36 months. The proof or disproof of managerial market timing is thus entirely the result of the statistical method chosen to measure it.

Panels C through F repeat the analysis of Dittmar and Field (2015) by comparing the alphas of various subgroups. Panel C forms portfolios of infrequent and frequent repurchasers. The original results showed that both portfolios exhibited significantly positive alphas over all horizons, with the infrequent portfolios outperforming the frequent ones. These findings are not confirmed when examining the Obernberger (2014) sample. Infrequent repurchasers only outperform frequent repurchasers in the first six months after the repurchase when applying the "D&F" method. These results reconfirm that the influence of repurchase frequency is mainly driven by the presence of a subset of large infrequent repurchasers in the dataset of Dittmar and Field (2015).

Panel D segregates the sample by the level of insider buying. Table 7 already showed that the robustness of this variable disappears after including measures for information asymmetry and market overreaction. Panel D shows that the high portfolios never outperform the low ones. In addition, the high insider buying portfolios only report significant alphas when using the most liberal methods on the shorter windows. Panel E forms portfolios based on prior six-month return. Although the regression analysis showed that prior return heavily influences the bargain, it is not related to long-run abnormal performance. The alphas are also lower and less significant than the original results of Dittmar and Field (2015). Panel F segregates the sample by the three-month forward looking RPP. Abnormal performance of the discount subsample on the shorter windows is of course a self-fulfilling prophecy, but the alphas remain positive and significant in the longer windows. The results are, regardless of the method used, similar to the findings of Dittmar and Field (2015).

For the full sample, the contradictory findings of both papers on managerial market timing are entirely explained by the different methods used to measure it. A discussion on which method is the most appropriate will follow later. For the subsample analysis, applying

the method of Dittmar and Field (2015) to the dataset of Obernberger (2014) does not lead to similar results. The different results could thus be the consequence of sample differences. The next section will answer whether the differences in firm- and repurchasing characteristics explain the dissimilarities regarding long-run performance.

Calendar-Time Portfolio Estimations: Replicating the Sample of Dittmar and Field (2015)

This section will examine whether it are not only methodological differences, but also sample differences that explain the contradictory findings regarding long-run performance. The two samples could differ in three ways. First, the datasets could cover different *types* of firms. In this case, different firm- and repurchasing characteristics drive the differences between the alphas. This could be the case, as previous sections have shown that the contribution of infrequent repurchasers to the aggregate repurchasing value is almost twice as large for the sample of Dittmar and Field (2015). In addition, the sample of Obernberger (2014) covers larger firms with lower return on assets, market-to-book, cash-to-assets, and dividend payout ratios. Second, the differences could be driven by the presence of outliers in either of the two samples. Finally, the datasets could simply cover different firms, and these differences are not related to firm- or repurchasing characteristics.

I will examine each of these three possibilities on the assumption that all the repurchase programs in the sample of Dittmar and Field (2015) are also covered in the dataset of Obernberger (2014). This seems a reasonable assumption after the verification in Compustat described in the first section of this chapter. I will perform the test by replicating the dataset of Dittmar and Field (2015) from the dataset of Obernberger (2014). The replication will be based upon the firms- and repurchasing characteristics of both samples. This is done by identifying 7,543 repurchase programs within the sample of Obernberger (2014), removing the 2% of programs that are conducted by the largest firms, and keeping the 15% of infrequent repurchase programs that repurchase the most relative to their market value. For the remaining repurchase programs, I separate the programs based on repurchasing frequency and randomly keep 30% of each of the frequency groups. I repeat this procedure a 100 times in order to test the influence of outliers. The results are reported in Table 11. Panel A shows the (mean) summary statistics of the 100 newly created subsamples. These can be compared with the original repurchasing and frequency characteristics shown in Table 2. Comparing both tables shows that the subsamples are now relatively similar to the original sample of Dittmar and Field (2015). Panels B through F repeat the calendar-time portfolio estimations of Table 10. I will replicate the method of Dittmar and Field (2015), thus forming “restricted” and “unrestricted” portfolios,

but only using the value-weighted market return as the risk factor and setting the return of a firm in the repurchase month equal to the month-end closing prices divided by the average repurchase price (RRP Return). If the alphas of most of the subsamples are now closer to the original results of Dittmar and Field (2015), I conclude that the conflicting findings on long-run performance are driven by firm- and repurchasing characteristics. Outliers drive the differences if the alphas of the subsamples show a wide variation. Lastly, both samples simply cover different repurchase programs if the alphas of most of the subsamples have not come closer to the original results of Dittmar and Field (2015). These differences are then not related to firm- or repurchasing characteristics.

Panel B of Table 11 shows that the alphas of the full 100 subsamples are only slightly higher than the ones shown in Panel B of Table 10. This is not surprising, as Table 10 already verified that for the full sample, it are methodological differences and not sample differences that lead to the contradictory findings of both papers. However, the alphas shown in Panels C through F do not come closer to the results of Dittmar and Field (2015) compared to the same panels of Table 10. This weakens the claim that for Panel C, the influence of repurchase frequency is mainly driven by the presence of a subset of large infrequent repurchasers in the dataset of Dittmar and Field (2015). The mean and median of all alphas in Table 11 are almost identical. The standard deviation indicated that the variation between the 100 simulated samples is very low. I therefore conclude that the influence of outliers is negligible. In addition, it seems that the two samples also cover different repurchase programs, but these differences are unrelated to firm- or repurchasing characteristics.

Dittmar and Field (2015) provided more sample information in Panel B of Table 2. This panel showed that 43.1% of their firms repurchased at a discount, compared to only 25.6% in the sample of Obernberger (2014). Table 12 repeats the analysis of Table 11, but controls for this sample difference as well. This is done by randomly keeping 50% (20%) of each frequency group that repurchased at a discount (premium), instead of simply 30% of each frequency group. As expected, the new alphas have increased compared to Table 10 and 11. Other than that, not much has changed. So for the full samples, I conclude that applying the same method to measure long-run performance in both samples leads to the same results. But neither outliers nor firm- or repurchasing characteristics explain why the relationship between repurchasing frequency, insider buying, and abnormal performance is stronger within the sample of Dittmar and Field (2015).

Calendar-Time Portfolio Estimations: Weighted Portfolios

The previous sections have shown that the methods used to perform calendar-time portfolio estimations could differ in three ways. I believe that the method used in this section best measures whether managers *successfully* time the market, and whether they are thus able to expropriate selling stockholders on a large scale. For the repurchase month, it is best to measure a firm's return by comparing the repurchase price with the CRSP month-end closing price. This is the price that firms actually pay, and thus best measures whether or not managers are able to time the market. Actual repurchases are only disclosed on a quarterly basis, so using the return provided by CRSP would not end estimate the abnormal performance of an investment strategy that financial investors could mimic.[18]. Both the equal-weighted and value-weighted market return are used in comparable studies as the risk factor[19], but it is clear that the equal-weighted risk factor is the more robust measure and leads to lower alphas[20]. Lastly, neither "restricted" nor "unrestricted" portfolios weigh each repurchase correctly. A restricted approach overweighs infrequent repurchasers. The unrestricted approach incorrectly assumes that repurchasing more often automatically means repurchasing more[21]. I will measure whether the firms are actually making an abnormal profit by using portfolio weights. I will use two different weights to create the monthly portfolios. First, I will use the dollar repurchasing value as portfolio weights (dollar weights). Second, I will use the relative repurchasing value (measured relative to the firm's market capitalization) as portfolio weights (relative weights). These two portfolios represent an investor who invested (with hindsight) each month the same amount throughout the sample period, who based the monthly portfolio on either the absolute or relative amount repurchased by firms, and repurchased at the same prices as the firms did. Both methods measure whether the firms included in the sample are able to make an abnormal return by repurchasing their own shares. The difference is that the first method uses the dollar return of aggregate repurchases as a scale for success, while the second method measures the average firm's relative return on its "repurchasing investment". As value-weighted portfolios are less

[18] A measure for abnormal performance that could be mimicked by investors would have to use a time period that starts only after the publication after the quarterly results (10-Q or 10-K). This would mean that firms are added into the monthly portfolios after either one, two, or three months following the actual repurchase month. This drastically reduces the opportunity for an individual investor to benefit from undervaluation. It is thus better to measure the potential for market timing from the firm's perspective, thus using actual repurchase prices to measure the return in the repurchase month.

[19] For example, Peyer and Vermaelen (2009) use the equal-weighted market return as the risk factor. Massa, Rehman, and Vermaelen (2007), and Fu, Huang, and Lin (2012) use the value-weighted market return as the risk factor.

[20] For example, Panel B of Table 10 shows that using the value-weighted risk factor instead of the equal-weighted risk factor leads to an average outperformance of 0.05% per month.

[21] For more information, see the example in the last section of chapter III.

likely to detect abnormal returns[22], I expect that the dollar-weighted portfolios will report lower alphas than the relative-weighted portfolios.

The results are reported in Table 13. Abnormal returns are now measured for up to 48 months after the repurchase. Panel A uses the original Fama and French (1993) three-factor model. Significant abnormal returns are found for the relative-weighted portfolios, but only for the first six months following the repurchase. The dollar weighted portfolios show no abnormal performance. This indicates that within the first six months after the repurchase, it is the smaller firms that make an abnormal return on their repurchasing investment. The investor sentiment index (Baker and Wurgler, 2006) and momentum factor (Carhart, 1997) are respectively added to the regressions as a robustness check in Panels B and C. Adding the investment index does not improve the model, adding the momentum factor does. As can be seen, the momentum variable is significant and the adjusted R-squared in Panel C is higher compared to Panel A. In addition, the statistical, but not the economic, significance of the alphas has improved as well. For example, the relative-weighted portfolio reports an abnormal return of 9.12% in four years (48months x 0.19%), significant at the 1% level. I consider this figure to be economically significant, yet low compared to the 21.12% that Peyer and Vermaelen (2009) find following repurchasing announcements between 1991 and 2001. I will therefore include both the Fama and French (1993) three-factor and the Carhart (1997) four-factor regressions in the remainder of my analysis in order to check the robustness of my results.

Panels D through G repeat the subsample analysis of Tables 10, 11, and 12. Panel D reports that infrequent repurchasers outperform frequent repurchasers, but only in the first six months after the repurchase and using relative weights. However, both infrequent and frequent repurchasers show abnormal performance for most periods when using the relative weights (up to 14.4% over four years). The dollar weights again show no abnormal performance. Panel E shows no real influence of insider trading on long-run performance. Panel F does not provide any new insights either. Panel G confirms that those that managed to repurchase at a discount (premium) compared to the average CRSP in the three months after the repurchase, continue to outperform (underperform) for up to four years following the repurchase. These results hold for both the dollar- and relative-weighted portfolios. However, untabulated results found insignificant alphas for the (+3, +48) window. This means that the abnormal performance for the (0, +48) period is driven by the abnormal return in the first three months following the repurchase. This weakens the claim that those that managed to purchase at a discount also

[22] See Brav, Geczy, and Gompers (2000) or Mitchell and Stafford (2000).

perform well on longer horizons, nor does it reveal a profitable trading rule that could be copied by financial investors.

Panels H through K are based upon the findings of Fu, Huang, and Lin (2012). The authors find that the disappearance of long-run outperformance in more recent repurchase samples is related to improved market efficiency. They link market efficiency with higher institutional ownership, enhanced regulations, more financial analysts, increased liquidity, and reduced trading costs. Panel H therefore segregates the sample by the level of institutional ownership. It is expected that firms with lower levels of institutional ownership are more likely to be undervalued, and are thus more likely to show long-run outperformance. This is not confirmed in Panel H. Panel I segregates the sample by the level of hedge-fund ownership, but no relation could be found. Panel J splits the sample based on the firm's liquidity ratio (average daily absolute return divided by trading volume). I find no relationship between liquidity and market timing, which is in line with both Table 8 and the original findings of Dittmar and Field (2015). Panel K separates the sample by the number of analysts following the stock. It is expected that the lower the number of level analysts following the stock, the higher the level of information asymmetry, and thus the potential for undervaluation and subsequent abnormal performance. This is not confirmed in Panel K. Overall, I find no relationship between market efficiency and long-run performance.

I construct an adjusted[23] undervaluation index (U-Index) using the method of Peyer and Vermaelen (2009). The authors find that firms that score higher on the U-Index are more likely to be undervalued and thus show long-run abnormal performance. Yet, they also find that the predictive power of prior six-month return is still higher than the predictive power of the U-Index. Panel F already showed that prior six-month return is not related to long-run performance within the Obernberger (2014) sample. Panel L is not able to find a relation with the U-Index as well. Finally, I divide the sample into quartiles based on the relative size of the repurchase programs. The underlying idea here is that the relative size of the repurchase program might indicate the value of the private information the manager has. As such, firms that repurchase in order to benefit from undervaluation might be more apparent in the higher quartiles. Panel M compares the alphas of the highest quartile with the lowest quartile. The highest quartile reports the highest alphas, but they are not always significant, nor are they significantly higher than the alphas of the lowest quartile. There is thus a weak relation between

[23] I do not include data from Factiva in the undervaluation index as this is a time-consuming task and Dittmar and Field (2015) find no relation between this variable and market timing. See Table 1 for variable definitions.

program size and long-run performance. Table 2 already showed that the average monthly relative repurchase value is fifty percent larger in the sample of Dittmar and Field (2015). Together with Panel M, this provides a minor contribution to the explanation of the contradictory findings of the two papers on market timing.

Overall, Table 13 does not provide robust evidence in favor of managerial timing ability. The full sample reports abnormal performance for up to four years following repurchases, but only when I estimate the alphas by use of relative-weighted portfolios and a four-factor model that uses the value-weighted CRSP market return as the risk factor. For both the full- and subsample analysis, I find that the relative-weighted portfolios outperform the dollar-weighted portfolios. This indicates that it are the smaller firms that outperform the market. In addition, I find some weak evidence that repurchase frequency and relative program size are related to market timing. No relationship could be found with prior market return, undervaluation, insider buying, or market efficiency.

V. Conclusion and Recommendations

The main goal of this paper is to explain the different results of Obernberger (2014) and Dittmar and Field (2015): the first two studies to examine the actual repurchase prices of a full sample of U.S. repurchasing firms over several years. I answered my research question in several steps, using the original and larger dataset provided by Obernberger (2014) to replicate the results of Dittmar and Field (2015). Examining the collection methods and linking the dataset to Compustat provided no explanation as to why the sample of Obernberger (2014) contains forty percent more observations. Yet, the sample of Dittmar and Field (2015) consists of firms that repurchase on average 30% (50%) more in absolute (relative) terms. These large repurchases are primarily made by infrequent repurchasers, making the contribution of infrequent repurchasers to the aggregate repurchasing value almost twice as large for the sample of Dittmar and Field (2015). Both datasets find that it are especially the infrequent repurchasers that repurchase a relatively large part of their equity that are able to buy back at a bargain. This partly explains why it are Dittmar and Field (2015) who predominantly find evidence in favor of market timing, as large and infrequent repurchasers are especially present in their sample. The overall influence of repurchase frequency on the relative repurchase price (RRP) is also smaller for the Obernberger (2014) sample, a finding that also holds in a multivariate setting. The same sample difference is also likely to explain why the overall RRP, regardless of the comparison window, is always lower for the sample of Dittmar and Field (2015). I also

compare the repurchase price of the Obernberger (2014) sample with two naïve repurchase strategies and find that firms are able to buy at lower prices compared to other days prior to or within the repurchase month, but are not able to look forward. Evidence in favor of managerial market timing could be found by examining insider trading, but I do not find this variable to be robust. In contrast, repurchase prices in the Obernberger (2014) sample are better explained by past returns. The economic influence of past returns on the RRP in this dataset is twice as large as it is in the sample of Dittmar and Field (2015). As such, I find no evidence that managers in the larger Obernberger (2014) sample are able to time the market in the short-run. I find it to be likely that the increased presence of large, infrequent repurchasers in the smaller dataset of Dittmar and Field (2015) led the authors to find results in favor of short-run managerial timing ability.

The contradictory findings on long-run performance are almost entirely explained by methodological differences. The methods used by both papers to perform Fama and French (1993) calendar-time portfolio estimations differ in three ways. As such, I can use eight (2x2x2) different methods to estimate abnormal returns. Of those eight methods, I find that the one used by Obernberger (2014) is the most conservative option and does not report outperformance. The method chosen by Dittmar and Field (2015) is the only method that presents evidence in favor of market timing by reporting abnormal returns for up to three years following repurchases. Thus for the full sample, I find that the proof or disproof of managerial market timing is entirely the result of the statistical method chosen to measure it. Yet, simply changing the statistical method does not lead to the same results for the subsample analysis. I therefore further examine the influence of repurchasing frequency, insider buying, and market timing by replicating the dataset of Dittmar and Field (2015) from the dataset of Obernberger (2014). I do not find evidence that either the statistical method, outliers, or firm- or repurchasing characteristics explain why the relationship between repurchasing frequency, insider buying, and abnormal performance is stronger in the sample of Dittmar and Field (2015). It therefore appears that the two samples cover different repurchase programs, but the influence of these differences on long-run performance is not captured by firm- or repurchasing characteristics.

Finally, I contributed to the prior literature regarding actual share repurchases by providing alternative methods to measure long-run performance. Matching repurchasing firms on size and book-to-market or size and momentum did not provide abnormal buy-and-hold returns. Additionally, I used both the absolute and relative repurchasing value as portfolio weights in the calendar-time estimations in order to mitigate the biases of “restricted” and “unrestricted” portfolios. Using these weights best measures whether managers successfully

time the market, and whether they are thus able to expropriate selling stockholders on a large scale. However, I do not find robust evidence in favor of managerial timing ability by using portfolio weights. In addition, there is only weak evidence that repurchase frequency and relative program size are related to market timing. I am not able to show that the disappearance of managerial market timing is related to increased market efficiency (Fu, Huang, and Lin, 2012).

My study has shown that the contradictory findings of Obernberger (2014) and Dittmar and Field (2015) stem from both sample- and methodological differences. The latter could be easily explained in this paper and has shown that it is recommended that future research always examine the robustness of their method chosen to perform calendar-time estimations. However, the question why both papers work with considerably different samples remains unanswered. I therefore advise future research to first further examine where these differences stem from. Access to the sample of Dittmar and Field (2015) and a detailed discussion with the authors of both papers on their collection methods might offer an explanation. It is clear that compiling a full dataset of actual repurchases is an exhausting task. Understanding the critical steps in this manual process will reduce the numbers of errors that future academics can make when working in the new field of available SEC repurchase data. This is important since future research is likely continue as actual repurchase data has only recently become available, datasets covering longer and future time periods are desired, and concerns of selling stockholders remain.

VI. References

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VII. Tables and Figures

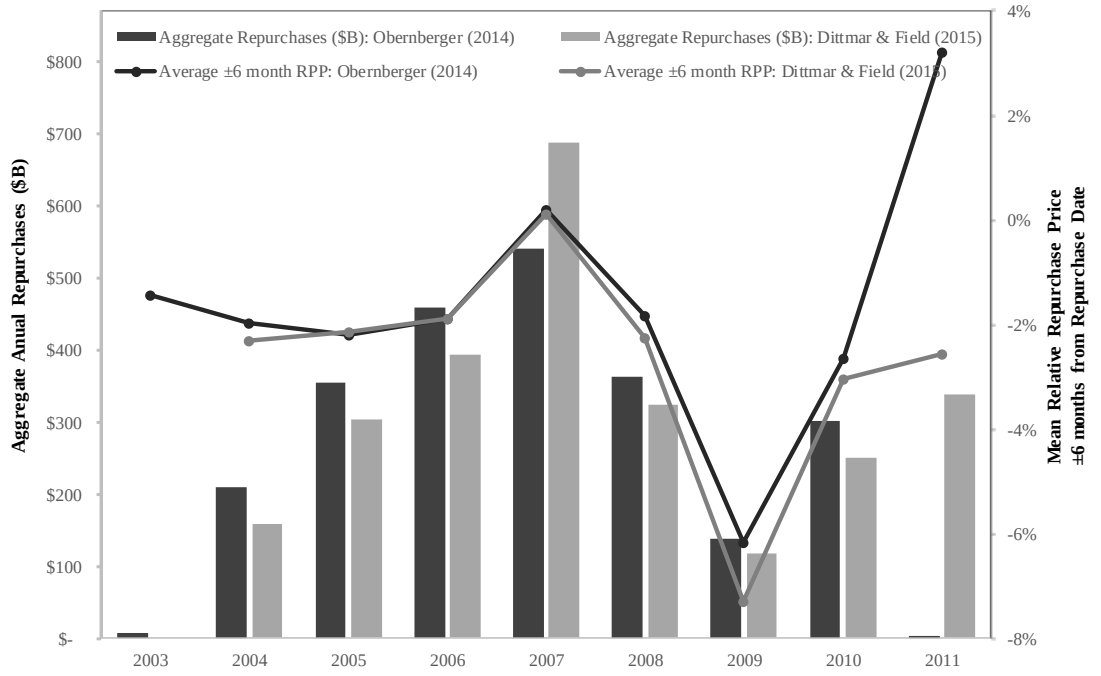
Table 1: Variable definitions
This table defines all the variables used in the subsequent tables. All variables retrieved from Compustat are measured at the fiscal year-end prior the repurchase month unless mentioned otherwise.

Variable	Definition	Source
Infrequent repurchaser	Indicator variable, equal to one if a firms repurchases four of fewer months in a given year.	SEC 10Q or 10K
Moderate repurchaser	Indicator variable, equal to one if a firms repurchases between four and nine months in a given year.	SEC 10Q or 10K
Frequent repurchaser	Indicator variable, equal to one if a firms repurchases nine or more months in a given year.	SEC 10Q or 10K
Relative Repurchase Price (RRP)	The percentage difference between the average repurchase price paid by the firm during the repurchase month (SEC 10Q or 10K) and the average stock closing prices for variable windows surrounding the repurchase month (CRSP).	SEC 10Q or 10K / CRSP
Repurchase size / MV	Average price paid for the shares repurchased times the number of shares repurchased (SEQ 10Q or 10K) divided by the average daily market cap from the previous quarter (CRSP).	SEC 10Q or 10K / CRSP
Annual repurchase size / MV	Annual sum of monthly repurchases (SEQ 10Q or 10K) divided by the average daily market cap from the previous year (CRSP).	SEC 10Q or 10K / CRSP
Program size	Program size (SEQ 10Q or 10K) scaled by shares outstanding at the beginning of the program (CRSP).	SEC 10Q or 10K / CRSP
Liquidity ratio	The daily average of the absolute stock return divided by the trading volume, measured over the twelve months prior the repurchase month.	CRSP
Return volatility	The average standard deviation of daily stock returns, measured over the twelve months prior the repurchase month.	CRSP
Prior six month market return	The CRSP value-weighted index return over the six months prior the repurchase month.	CRSP
Prior six month firm abnormal return	Compounded daily excess returns of the repurchasing firm (over the CRSP value-weighted index), measured over the six months prior the repurchase month.	CRSP
Bid-ask spread	Average of the daily bid-ask spreads, measured over the six months prior the repurchase month.	CRSP
Market-to-book	Annual average of the daily market value of equity (CRSP) plus the (current portion of) long-term debt, divided by total assets (Compustat).	CRSP / Compustat
Leverage	(Current portion of) long-term debt divided by total assets.	Compustat
Return on assets	Income before extraordinary items (total of the four quarters prior the repurchase month) divided by total assets.	Compustat
Cash-to-assets	Cash and cash equivalents, divided by total assets.	Compustat
Dividend payout ratio	Total dividends divided by total assets.	Compustat
Total assets (nlog)	(The natural log of) total assets, adjusted for inflation, given in 2011 dollars.	Compustat / U.S. Department of Commerce
Number of analysts (nlog)	(The natural log of) the number of analysts following the stock in the month prior the repurchase month.	IBES
Percent of analysts downgrades	The number of downgrades divided by the total number of recommendations in the month prior the repurchase month.	IBES
Change in six month average EPS forecast	The average EPS forecast six months prior the repurchase month minus the average EPS forecast in the repurchase month, divided by the average EPS forecast in the repurchase month.	IBES
EPS forecast dispersion	Standard deviation of EPS forecasts divided by the average EPS forecast in the month prior the repurchase month.	IBES
Net insider buying	Insider purchases minus insider sales in the repurchase month (as listed on SEC forms 3,4 and 5, retrieved from Thomson Reuters), divided by the average shares outstanding in the quarter prior the repurchase month (CRSP).	Thomson Reuters / CRSP
Institutional ownership	The number of shares held by institutional (13f) holdings in the quarter prior the repurchase month (Thomson Reuters) divided by the average total shares outstanding in the quarter prior the repurchase month (CRSP).	Thomson Reuters / CRSP
Hedge Fund ownership	The number of shares held by mutual fund (12s) holdings in the quarter prior the repurchase month (Thomson Reuters) divided by the average total shares outstanding in the quarter prior the repurchase month (CRSP).	Thomson Reuters / CRSP
Undervaluation Index (U-Index)	The U-Index is computed following Peyer and Vermaelen (2009), but misses the stated motivation for mispricing. As a consequence, firms are ranked from 1-15 (the sum of book-to-market, size and prior raw return are all ranked on a scale of 1-5) with cut-off values at < 8 and > 10.	CRSP / Compustat / IBES
Stated motivation of mispricing	Indicator variable, equal to one if repurchase program announcement includes a mention of "undervaluation" or "best use of money". Variable is only linked to the repurchase data and results of Dittmar and Field (2015) and not to the repurchase data of Obernberger (2014).	Factiva

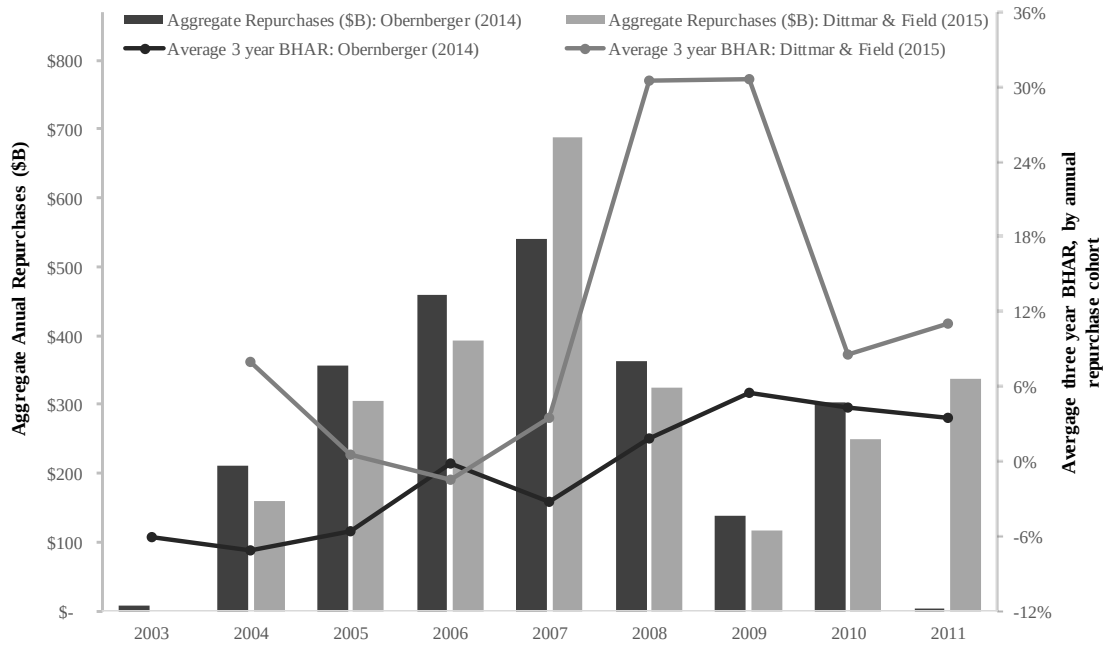
Figure 1: Aggerage Annual Dolllar Value of Repurchases versus the Relative Repurchase Price (RPP) and three year buy-and hold abnormal returns (BHAR's).

The figures in Panels A and B provide bar graphs of the aggregate annual repurchases ($B) from 2004-2011. Each panel provides the results of Dittmar and Field (2015), as well as their replicated results using the repurchase data of Obernberger (2014). For Panel A, the solid line presents the mean relative repurchase price for each year, 2003-2011, where the RRP (relative repurchase price) is measured as the percentage difference between the average repurchase price paid by the firm during the repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP for the six months surrounding the repurchase month. For Panel B, the solid line presents average three-year buy-and-hold abnormal returns, by annual cohort, relative to 25 size and B/M matched portfolios obtained from Kenneth French's website. Finally, Panel C shows the aggregate repurchase value in table format.

Panel A: Aggregate Repurchases (left scale) versus average ±6 month RPP (right scale)



Panel B: Aggregate Repurchases (left scale) versus average three-year BHAR's (right scale)



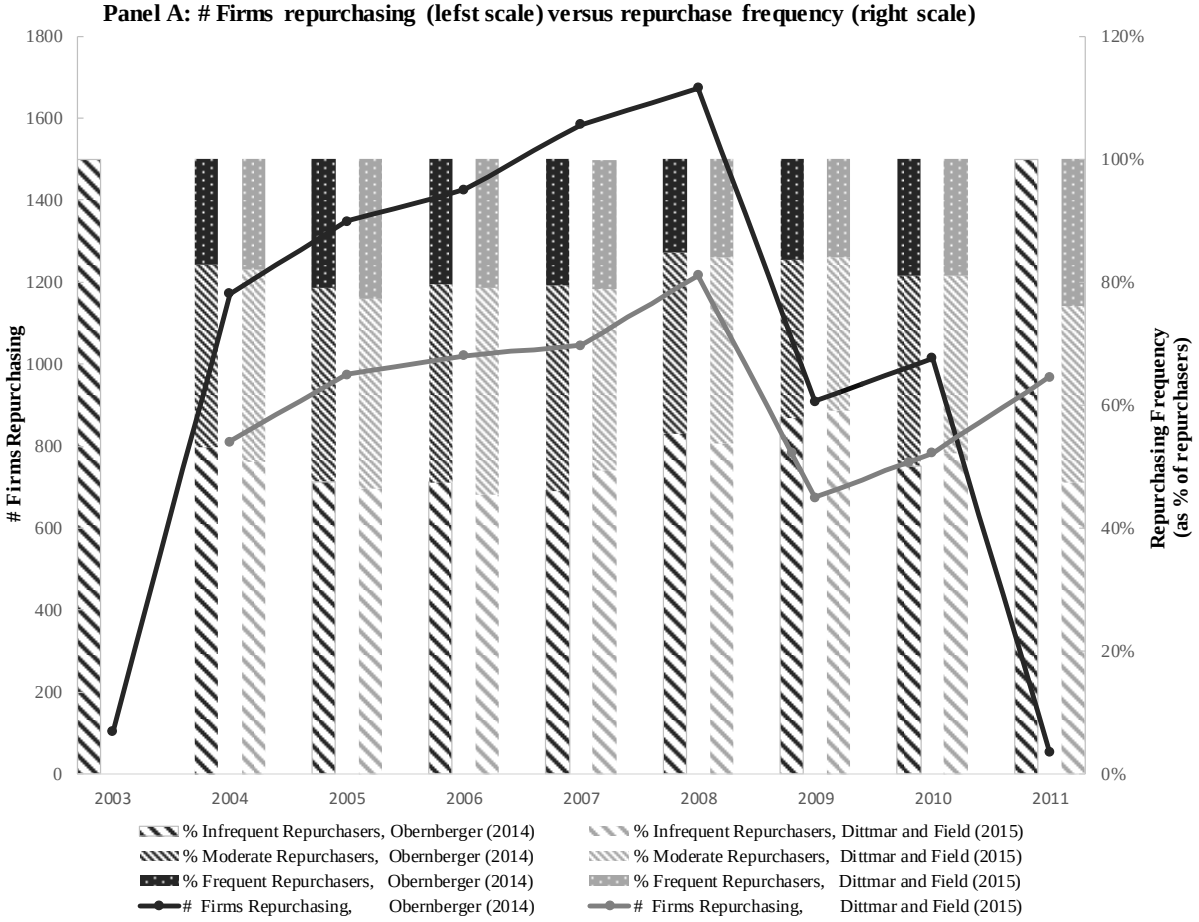
Panel C: Annual and aggregate repurchases ($B)

	Full	**2004-2010**	2003	2004	2005	2006	2007	2008	2009	2010	2011
Obernberger (2014)	**$2.371**	**$ 2.367**	$ 9	$ 210	$ 356	$ 459	$ 541	$ 362	$ 137	$ 302	$ 4
Dittmar & Field (2015)	**$2.573**	**$ 2.235**	$ -	$ 159	$ 304	$ 393	$ 688	$ 324	$ 117	$ 250	$ 338
% Difference	**-7,8%**	**5,9%**	-	32,2%	17,0%	16,8%	-21,4%	11,8%	17,3%	20,7%	-98,8%

Figure 2: Summary statistics for firms conducting repurchasing, summarized by firm-year and repurchasing frequency

Panel A provides line graphs of the number of firms repurchasing per year, as a well as stacked bar graphs in which the firms are segregated on their repurchase frequency following Dittmar and Field (2015). Firms are included in the sample if they conducted at least one repurchase in any given year from 2003-2011. In each calendar year, firms are categorized based upon the frequency of repurchases. Infrequent repurchasers are firms that repurchase one to four times in a given year, moderate repurchasers are firms that repurchase five to eight times in a given year, and frequent repurchasers are firms that repurchase at least nine times in a given year. More information about the total number of firm-years and the aggregate value per repuchase frequency is provided in Panel B. Each panel provides the results of Dittmar and Field (2015), as well as their replicated results using the repurchase data of Obernberger (2014).

Panel A: # Firms repurchasing (lefst scale) versus repurchase frequency (right scale)



Panel B: Full Sample and Aggregate Value ($B)

			Repurchasing frequency (as % of repurchases)		
			Infrequent	Moderate	Frequent
Obernberger (2014)	Repurchasing Firms	9.287	51,6%	30,1%	18,2%
	% of aggregate $ value of repurchases		11,5%	24,1%	64,4%
Dittmar & Field (2015)	Repurchasing Firms	7.496	50,2%	30,0%	19,8%
	% of aggregate $ value of repurchases		19,2%	22,5%	58,3%

Table 2: Summary Statistics, segregated on repurchase frequency and repurchase price

Both samples represent repurchasing firm-years, in which a firm-year observation consists of a firm conducting at least one repurchase during a given year from 2003-2011. Each panel provides the results of Dittmar and Field (2015) (D & F), as well as their replicated results using the repurchase data of Obernberger (2014) (Ob.). The table provides means (medians) of characteristics of these repurchasing firm-years. In Panel A, firms are categorized based on repurchase frequency: infrequent repurchasers are firms that repurchase one to four times during the year, moderate repurchasers are firms that repurchase five to eight times a year, and frequent repurchasers are firms that repurchase at least nine times per year. In Panel B, firms are categorized by whether the majority (at least 75%) of their monthly repurchases in a given year were bought at a discount to the firm's average stock price on CRSP for the same month. For both panels, accounting variables are summarized at the firm-year, measured at the fiscal year end before the repurchase month, except for RepurchSize/MV, which is summarized at the firm-month observation (frequency in which repurchase data are available). See table 1 for variable definitions. ***,**,* indicate significant differences between the groups presented at the 1%, 5% and 10% levels, respectively, using t-tests for means and the Wilcoxon non-parametric test for medians.

Panel A: Summary Statistics by repurchase frequency

			Repurchase frequency						Difference: Frequent - Infrequent	
	Full Sample		Infrequent		Moderate		Frequent			
Firm characterstic	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Total assets (millions)	14.923	6.993	8.003	3.380	12.300	5.321	38.835	18.718	30.832***	15.339***
	(1.174)	(1.044)	(843)	(684)	(1.257)	(1.249)	(3.402)	(2.999)	(2.559**)	(2.315***)
Market-to-book	1.42	1.82	1.39	1.75	1.41	1.88	1.50	1.94	0.116***	0.189***
	(1.12)	(1.455)	(1.11)	(1.378)	(1.11)	(1.508)	(1.18)	(1.626)	(0.070**)	(0.248***)
Return on assets	5.32%	6.05%	4.56%	4.76%	5.74%	7.00%	6.78%	7.90%	2.22%***	3.14%***
	(4.79%)	(6.36%)	(4.28%)	(5.50%)	(4.90%)	(6.82%)	(5.88%)	(7.61%)	(1.60%***)	(2.11%***)
Leverage	17.45%	17.18%	17.68%	17.45%	16.54%	16.34%	18.33%	17.77%	0.65%	0.32%
	(13.77%)	(13.63%)	(13.55%)	(13.24%)	(13.00%)	(12.40%)	(15.81%)	(16.17%)	(2.26%***)	(2.93%***)
Cash-to-assets	16.95%	19.50%	18.00%	20.53%	16.18%	19.65%	15.24%	16.65%	-2.77%***	−3.88%***
	(8.97%)	(12.53%)	(9.51%)	(13.44%)	(8.44%)	(13.10%)	(8.44%)	(10.56%)	(-1.07%**)	(−2.88%***)
Dividend payout ratio	1.18%	3.56%	1.02%	3.01%	1.24%	3.75%	1.53%	4.66%	0.51%***	1.65%***
	(0.21%)	(0.00%)	(0.00%)	(0.00%)	(0.28%)	(0.00%)	(0.50%)	(2.24%)	(0.50%***)	(2.24%***)
Bid-ask spread	0.59%	0.44%	0.69%	0.55%	0.57%	0.36%	0.36%	0.28%	-0.33%***	−0.27%***
	(0.15%)	(0.15%)	(0.18%)	(0.18%)	(0.14%)	(0.13%)	(0.09%)	(0.10%)	(-0.09%***)	(−0.08%***)
Repurchase size / MV	0.74%	1.12%	0.85%	2.49%	0.67%	0.87%	0.54%	0.56%	-0.31%***	−1.93%*
	(0.38%)	(0.37%)	(0.40%)	(0.44%)	(0.38%)	(0.42%)	(0.34%)	(0.32%)	(-0.06%***)	(−0.12%***)
Annual repurch / MV	3.46%	5.69%	2.01%	5.73%	4.49%	5.44%	5.89%	5.98%	3.88%***	0.25%
	(2.19%)	(2.38%)	(1.05%)	(1.19%)	(3.46%)	(3.64%)	(4.82%)	(4.57%)	(3.77%***)	(3.38%***)
Observations	9.286	7.496	4.432	3.765	2.897	2.250	1.959	1.481		
(%)			47,7%	50,2%	31,2%	30,0%	21,1%	19,8%		

Panel B: Summary Statistics by repurchase discount or premium

			≥75% repurchases bought at discount?					
	Full Sample		No		Yes		Difference: No - Yes	
Firm characterstic	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Total assets (millions)	14.926	6.993	17.695	8.242	9.020	5.346	8.675***	2.896***
	(1.173)	(1.044)	(1.214)	(1.198)	(1.102)	(0.897)	(112***)	(0.301***)
Market-to-book	1.41	182	1.37	1.839	1.52	1.802	-0.148***	0.038
	(1.12)	(1.455)	(1.08)	(1.468)	(1.22)	(1.44)	(-0.14***)	(0.034*)
Return on assets	5.33%	6.05%	4.89%	6.34%	6.23%	5.67%	-1.34%***	0.67%**
	(4.82%)	(6.36%)	(4.29%)	(6.47%)	(5.70%)	(6.21%)	(-1.41%)***	(0.27%**)
Leverage	17.45%	17.18%	17.62%	17.23%	17.10%	17.11%	0.52%	0.11%
	(13.75%)	(13.63%)	(14.08%)	(13.98%)	(12.98%)	(13.03%)	(-1,10%*)	(0.95%)
Cash-to-assets	16.94%	19.50%	16.58%	19.21%	17.73%	19.87%	-1.15%**	−0.66%
	(9.01%)	(12.53%)	(8.55%)	(12.23%)	(10.24%)	(13.09%)	(-1.69%***)	(−0.87%*)
Dividend payout ratio	1.20%	3.56%	1.17%	3.94%	1.19%	3.05%	-0.02%	0.89%*
	(0.21%)	(0.00%)	(0.23%)	(0.00%)	(0.14%)	(0.00%)	(0.07%**)	(0.00%)
Bid-ask spread	0.59%	0.44%	0.64%	0.40%	0.48%	0.49%	0.17%***	−0.09%***
	(0.15%)	(0.15%)	(0.15%)	(0.14%)	(0.15%)	(0.16%)	(0.00%***)	−0.03%***)
Repurchase size / MV	0.74%	1.12%	0.74%	1.30%	0.74%	0.74%	-0.01%	0.56%
	(0.38%)	(0.37%)	(0.39%)	(0.39%)	(0.37%)	(0.35%)	(0.02%)	(0.04%***)
Aanual repurch / MV	3.63%	5.69%	3.81%	7.71%	2.74%	3.03%	1.07%***	4.68%
	(2.32%)	(2.38%)	(2.55%)	(3.04%)	(1.52%)	(1.64%)	(1.03%***)	(1.41%***)
Observations	9.286	7.496	6.910	4.262	2.376	3.234		
(%)			74,4%	56,9%	25,6%	43,1%		

Figure 3: Mean and median relative repurcase prices (RPP) per year

The figures in Panel A - G show the relative repurchase prices of the sample obtained and used by Dittmar and Field (2015) (consisting of 38,900 monthly repurchases), as well as the relative repurchase data of the sample obtained and used by Obernberger (2014) (consisting of 46,483 monthly repurchases). The line graphs present a measure of the percentage difference between the average and median repurchase price paid by a firm during the repurchase month (as reported in the 10-K) and the average closing stock prices (as reported on CRSP) during the repurchase month, as well as windows around the repurchase: the repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months. This percentage is termed the RRP (relative repurchase price) and is measured using the method of Dittmar and Field (2015):

RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1.

Panel H and I compare the actual mean RRP of Obernberger (2014) with the mean of two naïve repurchase strategies. In the first naïve repurchase strategy, a firms repurchases the same number of shares each day in the repurchase month (fixed share strategy). In the second naïve repurchase strategy, a firms repurchases the same dollar amount each day during the repurchase month (fixed dollar strategy). ***,**,* indicate significant differences between the groups presented at the 1%, 5% and 10% levels, respectively, using t-tests for means and the Wilcoxon non-parametric test for medians.

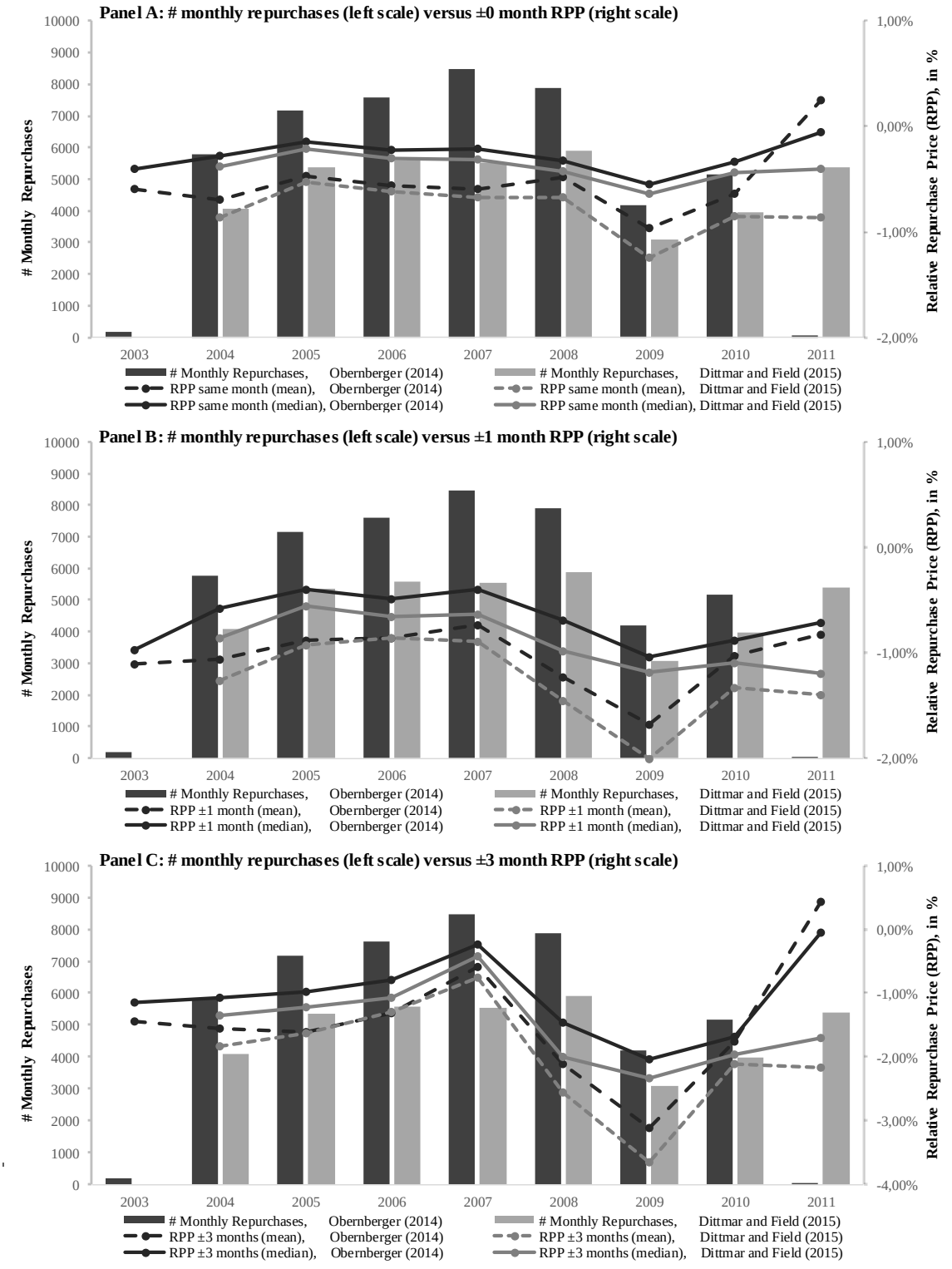


Figure 3: Continued

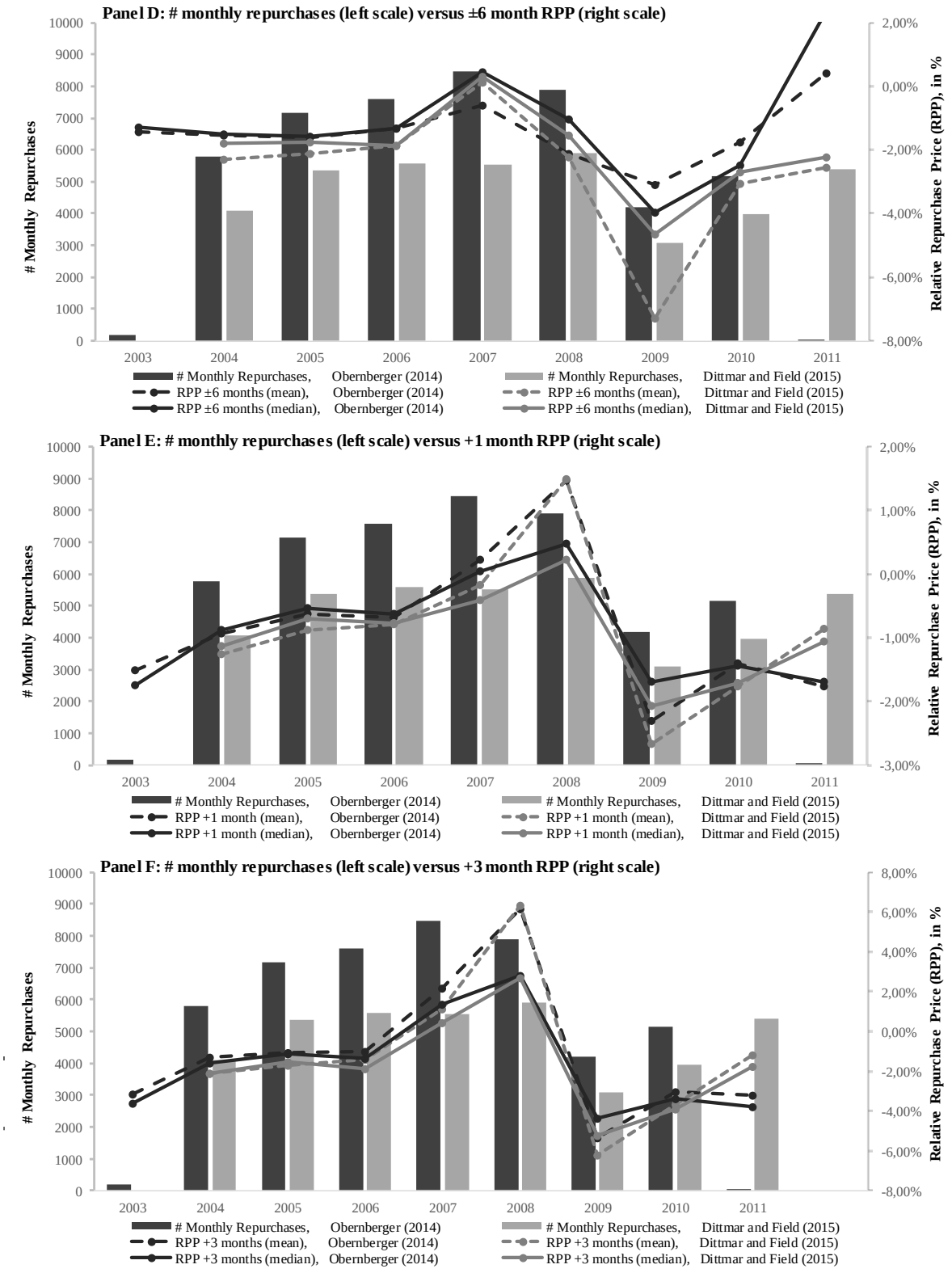
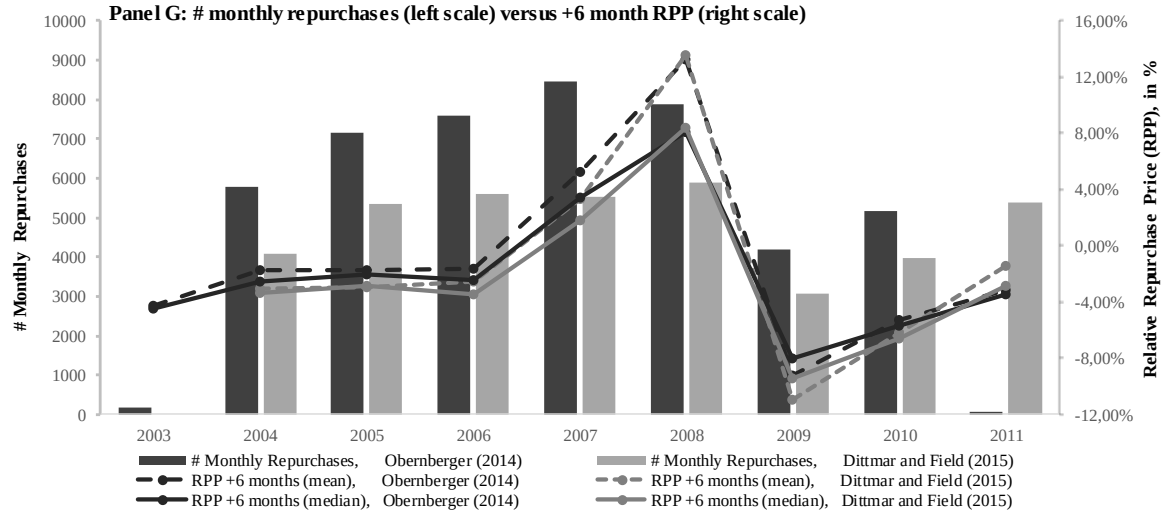


Figure 3: Continued



Panel H: Analysis of mean actual RPP (±0 month RPP) of Oberberger (2014) compared to two naïve repurchase strategies, per year

By Year, ±0 month RPP	#Monthly repruchases	Fixed share strategy (a)	Fixed dollar strategy (b)	Actual RPP (c)	(c) - (a)	(c) - (b)
2003	172	-	-0,10%	-0,59%	-0,59% ***	-0,49% **
		-	(-0,05%)	(-0,41%)	(-0,41%) ***	(-0,36%) ***
2004	5.799	-	-0,15%	-0,70%	-0,70% ***	-0,55% ***
		-	(-0,05%)	(-0,28%)	(-0,28%) ***	(-0,23%) ***
2005	7.165	-	-0,14%	-0,47%	-0,47% ***	-0,34% ***
		-	(-0,05%)	(-0,15%)	(-0,15%) ***	(-0,10%) ***
2006	7.598	-	-0,14%	-0,56%	-0,56% ***	-0,42% ***
		-	(-0,05%)	(-0,22%)	(-0,22%) ***	(-0,17%) ***
2007	8.467	-	-0,17%	-0,60%	-0,60% ***	-0,43% ***
		-	(-0,06%)	(-0,22%)	(-0,22%) ***	(-0,16%) ***
2008	7.892	-	-0,50%	-0,49%	-0,49% ***	0,01%
		-	(-0,18%)	(-0,33%)	(-0,33%) ***	(-0,15%) ***
2009	4.193	-	-0,45%	-0,96%	-0,96% ***	-0,51% ***
		-	(-0,16%)	(-0,55%)	(-0,55%) ***	(-0,39%) ***
2010	5.162	-	-0,17%	-0,64%	-0,64% ***	-0,47% ***
		-	(-0,08%)	(-0,34%)	(-0,34%) ***	(-0,26%) ***
2011	44	-	-0,19%	0,25%	0,25%	0,44%
		-	(-0,07%)	(-0,06%)	(-0,06%)	(0,01%)

Panel I: Analysis of mean actual RPP (various windows) , of Oberberger (2014) compared to two naïve repurchase strategies, full sample

Full Sample, different windows	#Monthly repruchases	Fixed share strategy (a)	Fixed dollar strategy (b)	Actual RPP (c)	(c) - (a)	(c) - (b)
±0 month RPP	46,483	-	-0,24%	-0,60%	-0,60% ***	-0,36% ***
		-	(-0,07%)	(-0,26%)	(-0,26%) ***	(-0,19%) ***
±1 month RPP	46,483	-0,41%	-0,65%	-1,02%	-0,61% ***	-0,37% ***
		(-0,19%)	(-0,30%)	(-0,57%)	(-0,38%) ***	(-0,27%) ***
±3 month RPP	46,483	-1,00%	-1,23%	-1,61%	-0,61% ***	-0,38% ***
		(-0,60%)	(-0,71%)	(-1,00%)	(-0,40%) ***	(-0,29%) ***
±6 month RPP	46,483	-1,41%	-1,63%	-2,02%	-0,61% ***	-0,39% ***
		(-0,86%)	(-0,98%)	(-1,29%)	(-0,43%) ***	(-0,32%) ***
+1 month RPP	46,483	0,21%	-0,03%	-0,41%	-0,62% ***	-0,38% ***
		(-0,16%)	(-0,26%)	(-0,59%)	(-0,43%) ***	(-0,23%) ***
+3 month RPP	46,483	0,74%	0,49%	0,10%	-0,63% ***	-0,38% ***
		(-0,34%)	(-0,45%)	(-0,86%)	(-0,52%) ***	(-0,41%) ***
+6 month RPP	46,483	1,66%	1,41%	1,02%	-0,64% ***	-0,39% ***
		(-0,60%)	(-0,74%)	(-1,10%)	(-0,50%) ***	(-0,36%) ***

Table 3: Mean (median) relative repurchase price (RPP) by repurchase frequency

The table reports the median (median) relative repurchase prices of the sample used by Dittmar and Field (2015) (consisting of 38,900 monthly repurchases) and the sample used by Obernberger (2014) (consisting of 46,483 monthly repurchases). The relative repurchase price represents the percentage difference between the average (median) repurchase price paid by a firm during the repurchase month (as reported in the 10-K) and the average closing stock prices (as reported on CRSP) during the repurchase month, as well as windows around the repurchase: the repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months. This percentage is termed the RRP (relative repurchase price), measured using the method of Dittmar and Field (2015): RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1. Means and medians are reported by repurchasing frequency. "Difference of infrequent – frequent" measures the significance of the difference in relative repurchase price for monthly repurchasers minus that for infrequent repurchases (those repurchasing fewer than five times a year). ***,**,* indicate significant differences between the groups presented at the 1%, 5% and 10% levels, respectively, using t-tests for means and the Wilcoxon non-parametric test for medians.

	Repurchase window		**Repurchase window**						**Repurchase window**					
	Repurchase month		**±1 month**		**±3 months**		**±6 months**		**+1 month**		**+3 months**		**+6 months**	
Repurchase frequency	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Infrequent repurchasers														
Once per year	-1,01%	−1,73%	-2,44%	−3,54%	-4,16%	−5,92%	-5,88%	−8,19%	-1,30%	−2,15%	-1,45%	−2,84%	-1,35%	−3,24%
	(-0,56%)	(−1,00%)	(-1,75%)	(−2,76%)	(-3,17%)	(−5,11%)	(-4,58%)	(−7,25%)	(-1,49%)	(−2,24%)	(-2,41%)	(−4,01%)	(-3,97%)	(−5,91%)
2-4 times a year	-1,02%	−1,27%	-1,92%	−2,35%	-3,45%	−4,27%	-4,88%	−6,13%	-0,75%	−1,15%	-0,27%	−1,27%	0,45%	−1,39%
	(-0,61%)	(−0,80%)	(-1,33%)	(−1,92%)	(-2,55%)	(−3,60%)	(-3,58%)	(−5,34%)	(-0,95%)	(−1,39%)	(-1,37%)	(−2,44%)	(-1,98%)	(−3,96%)
Moderate repurchasers														
5-8 times a year	-0,64%	−0,81%	-1,00%	−1,22%	-1,44%	−1,73%	-1,64%	−1,96%	-0,36%	−0,66%	0,35%	−0,34%	1,68%	0,33%
	(-0,34%)	(−0,50%)	(-0,63%)	(−0,99%)	(-1,01%)	(−1,43%)	(-1,24%)	(−1,87%)	(-0,53%)	(−0,92%)	(-0,72%)	(−1,50%)	(-0,71%)	(−2,16%)
Frequent repurchasers														
9-11 times a year	-0,36%	−0,50%	-0,53%	−0,65%	-0,68%	−0,83%	-0,64%	−0,74%	-0,19%	−0,47%	0,34%	−0,35%	1,23%	−0,07%
	(-0,16%)	(−0,28%)	(-0,29%)	(−0,53%)	(-0,41%)	(−0,67%)	(-0,41%)	(−0,67%)	(-0,41%)	(−0,70%)	(-0,57%)	(−1,18%)	(-0,75%)	(−1,85%)
Monthly	-0,20%	−0,17%	-0,27%	−0,22%	-0,32%	−0,24%	-0,29%	−0,02%	-0,23%	−0,20%	-0,15%	−0,18%	0,05%	−0,03%
	(-0,08%)	(−0,09%)	(-0,11%)	(−0,21%)	(-0,10%)	(−0,08%)	(-0,03%)	(-0,11%)	(-0,46%)	(−0,50%)	(-0,87%)	(−0,96%)	(-1,27%)	(−1,52%)
Infrequent - Frequent														
Means	-0,82%***	−0,93%***	-1,72%***	−1,99%***	-3,22%***	−3,84%***	-4,73%***	−5,87%***	-0,6%***	−0,89%***	-0,28%	−1,15%***	0,16%	−1,54%***
Medians	(-0,52%***)	(−0,63%***)	(-1,26%***)	(−1,60%***)	(-2,50%***)	(−3,30%***)	(-3,70%***)	(−5,14%***)	(-0,55%***)	(−0,85%***)	(-0,64%***)	(−1,50%***)	(-0,99%***)	(−2,42%***)

Table 4: Regressions of relative repurchase price (RPP)

The table reports the results of regressing firm and repurchasing characteristics on the relative repurchase price. Results are reported from Dittmar and Field (2015) (D & F), as well as their replicated results using the repurchase data of Obernberger (2014) (Ob.). The RRP (relative repurchase price) is measured following Dittmar and Field (2015) and representse percentage difference between the average repurchase price paid by the firm during a repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP, during various windows: repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months, where: RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1. Accounting variables are summarized at the firm-year, measured at the fiscal year end before the repurchase month. See table 1 for variable definitions. As Dittmar and Field (2014) do not define return volatility, it is replaced by the average standard deviation of daily returns for the past 12 months prior the repurchase month (Fu & Huang, 2014) when regressing the Obernberger (2014) repurchase data. The regressions include year and firm fixed effects and clustered standard errors at the firm level. P-values are in parentheses; ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Repurchase window						**Repurchase window**					
	±1 month		**±3 months**		**±6 months**		**+1 month**		**+3 months**		**+6 months**	
	Ob.	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Infrequent Repurchasers	-0.005***	−0.006***	-0.009***	−0.014***	-0.014***	−0.022***	-0.003**	−0.004***	-0.004*	−0.010***	-0.008**	−0.020***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.027)	(0.006)	(0.064)	(0.000)	(0.029)	(0.000)
Frequent Repurchasers	0.003***	0.003***	0.005***	0.005***	0.006***	0.006***	0.001	0.002*	-0.001	0.002	-0.004	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.001)	(0.250)	(0.089)	(0.727)	(0.478)	(0.214)	(0.759)
Ln(total assets)	-0.005**	−0.004*	-0.006*	−0.003	-0.005	0.011**	0.010***	0.013***	0.034***	0.046***	0.061***	0.081***
	(0.046)	(0.068)	(0.085)	(0.445)	(0.262)	(0.025)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	-0.001	−0.004***	-0.002*	0.001	-0.006***	0.018***	0.006***	0.005***	0.016***	0.019***	0.027***	0.035***
	(0.315)	(0.000)	(0.062)	(0.331)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	-0.000***	−0.010	-0.000	−0.025**	0.000	−0.040**	-0.000*	−0.021**	0.000	−0.036*	0.001**	−0.030
	(0.007)	(0.231)	(0.165)	(0.047)	(0.135)	(0.034)	(0.072)	(0.035)	(0.876)	(0.075)	(0.048)	(0.344)
Leverage	0.000**	0.004	0.000*	0.003	0.000	−0.002	0.000	0.013*	-0.000	0.010	-0.000	0.012
	(0.016)	(0.505)	(0.054)	(0.801)	(0.171)	(0.872)	(0.392)	(0.090)	(0.439)	(0.540)	(0.176)	(0.655)
Cash-to-assets	0.000	−0.000	0.000	−0.004	0.000	0.009	0.000	−0.019***	0.000**	−0.043***	0.001***	−0.054***
	(0.866)	(0.974)	(0.846)	(0.580)	(0.231)	(0.433)	(0.129)	(0.003)	(0.034)	(0.001)	(0.005)	(0.008)
12 Month standard deviation (Ob.) / return volatility (D&F)	-0.073	−0.182*	-0.354***	−0.880***	-0.750***	−1.660***	-0.172*	−0.292**	0.113	−0.610**	-0.060	−1.214***
	(0.413)	(0.090)	(0.002)	(0.000)	(0.000)	(0.000)	(0.078)	(0.018)	(0.523)	(0.017)	(0.821)	(0.000)
Prior six month market return	-0.215***	0.019***	-0.912***	0.089***	-1.830***	0.244***	-0.117***	0.034***	-0.823***	0.091***	-1.832***	0.177***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.246***	0.029*	0.962***	0.013	1.893***	−0.115***	0.023	−0.114***	0.509***	−0.380***	1.300***	−0.662***
	(0.000)	(0.097)	(0.000)	(0.623)	(0.000)	(0.001)	(0.489)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.116	0.140	0.158	0.177	0.226	0.274	0.117	0.130	0.212	0.228	0.332	0.353
Observations	46,173	37,283	46,173	37,283	46,173	37,283	46,173	37,283	46,173	37,283	46,173	37,283

Table 5: Mean (median) relative repurchase price (RPP) by level of insider trading

The table reports the median (median) relative repurchase prices of the sample used by Dittmar and Field (2015) and the sample used by Obernberger (2014). The table reports repurchases by firms during months in which insiders also trade on their own account only, resulting in 17,622 (32,197) repurchase months for Dittmar & Field (2015) (Obenberger (2014)). Insider trading is measured following Dittmar and Field (2015) and represents net insider purchases minus insider sales for each month, scaled by the shares outstanding at the end of the prior period. The RRP (relative repurchase price) is measured following Dittmar and Field (2015) and represents percentage difference between the average repurchase price paid by the firm during the repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP, during various windows: the repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months, where: RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1. Firms are broken into quartiles, based upon the amount of relative insider buying (insider buys minus insider sells). ***,**,* indicate significant differences between the groups presented at the 1%, 5% and 10% levels, respectively, using t-tests for means and the Wilcoxon non-parametric test for medians.

	Repurchase window		**Repurchase window**						**Repurchase window**					
	Repurchase month		**±1 month**		**±3 months**		**±6 months**		**+1 month**		**+3 months**		**+6 months**	
Insider Trading	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Quartile 1	-0,74%	−0.94%	-0,76%	−0.63%	-0,82%	−0.03%	-0,70%	0.90%	-0,72%	−1.26%	-0,31%	−1.26%	0,45%	−0.93%
(less insider buying)	(-0,26%)	(−0.50%)	(-0,37%)	(−0.24%)	(-0,38%)	(0.32%)	(-0,39%)	(0.92%)	(-0,57%)	(−1.10%)	(-0,86%)	(−1.65%)	(-1,18%)	(−2.40%)
Quartile 2	-0,53%	−0.73%	-0,63%	−0.57%	-0,76%	−0.17%	-0,75%	0.44%	-0,30%	−0.88%	0,20%	−0.84%	1,07%	−0.64%
	(-0,26%)	(−0.39%)	(-0,37%)	(−0.30%)	(-0,38%)	(0.02%)	(-0,39%)	(0.45%)	(-0,57%)	(−0.90%)	(-0,86%)	(−1.53%)	(-1,18%)	(−2.16%)
Quartile 3	-0,54%	−0.64%	-0,89%	−0.71%	-1,28%	−0.74%	-1,45%	−0.47%	-0,28%	−0.68%	0,31%	−0.67%	1,23%	−0.31%
	(-0,22%)	(−0.31%)	(-0,48%)	(−0.55%)	(-0,80%)	(−0.44%)	(-0,90%)	(−0.26%)	(-0,51%)	(−0.80%)	(-0,70%)	(−1.39%)	(-0,94%)	(−2.12%)
Quartile 4	-0,73%	−0.89%	-1,68%	−2.31%	-2,76%	−4.09%	-3,53%	−5.50%	-0,61%	−0.81%	-0,06%	−0.48%	1,08%	−0.01%
(more inider buying)	(-0,31%)	(−0.37%)	(-0,88%)	(−1.38%)	(-1,60%)	(−2.71%)	(-2,09%)	(−3.87%)	(-0,61%)	(−0.96%)	(-0,84%)	(−1.50%)	(-0,79%)	(−2.33%)
Q4 - Q1														
Means	0,01%	0.06%	-0,92%***	−1.68%***	-1,95%***	−4.06%***	-2,84%***	−6.40%***	0,11%	0.45%***	0,25%	0.78%***	0,64%**	0.92%***
Medians	(-0,52%)	(0.13%)	(-1,27%***)	(−1.14%***)	(-2,56%***)	(−3.03%***)	(-3,83%***)	(−4.80%***)	(-0,54%)	(0.13%***)	(-0,73%**)	(0.15%)	(-1,10%***)	(0.07%)

Table 6: Regressions of relative repurchase price (RPP), including insider trading

The table reports the results of regressing firm and repurchasing characteristics on the relative repurchase price, including net insider buying (insider purchases minus insider sales, scaled by shares outstanding). Results are reported from Dittmar and Field (2015) (D & F), as well as their replicated results using the repurchase data of Obernberger (2014) (Ob.). The RRP (relative repurchase price) is measured following Dittmar and Field (2015) and represents the percentage difference between the average repurchase price paid by the firm during a repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP, during various windows: repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months, where: RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1. Accounting variables are summarized at the firm-year, measured at the fiscal year end before the repurchase month. See table 1 for variable definitions. As Dittmar and Field (2014) do not define return volatility, it is replaced by the average standard deviation of daily returns for the past 12 months prior the repurchase month (Fu & Huang, 2014) when regressing the Obernberger (2014) repurchase data. The regressions include year and firm fixed effects and clustered standard errors at the firm level. P-values are in parentheses; ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Repurchase window						**Repurchase window**					
	±1 month		**±3 months**		**±6 months**		**+1 month**		**+3 months**		**+6 months**	
	Ob.	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Infrequent Repurchasers	-0.006***	−0.007***	-0.010***	−0.015***	-0.014***	−0.023***	-0.003***	−0.023***	-0.006**	−0.013***	-0.011***	−0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.007)	(0.000)	(0.011)	(0.000)	(0.008)	(0.000)
Frequent Repurchasers	0.003***	0.003***	0.004***	0.005***	0.005**	0.006**	0.001	0.003	-0.001	0.002	-0.004	0.003
	(0.001)	(0.005)	(0.002)	(0.008)	(0.011)	(0.035)	(0.246)	(0.470)	(0.783)	(0.435)	(0.252)	(0.470)
Net insider buying	-0.112***	−0.007***	-0.141***	−0.015***	-0.163***	−0.023***	-0.074*	−0.008***	-0.103	−0.003***	-0.124	−0.008***
	(0.004)	(0.000)	(0.006)	(0.000)	(0.006)	(0.000)	(0.086)	(0.000)	(0.144)	(0.001)	(0.123)	(0.000)
Ln(total assets)	-0.005*	−0.004	-0.007*	−0.000	-0.005	0.019***	0.011***	0.088***	0.038***	0.048***	0.068***	0.088***
	(0.056)	(0.170)	(0.079)	(0.955)	(0.415)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	-0.002**	−0.004***	-0.005***	0.001	-0.009***	0.016***	0.004***	0.034***	0.013***	0.018***	0.022***	0.034***
	(0.041)	(0.000)	(0.003)	(0.469)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	-0.000*	−0.003	-0.000	−0.021	0.000	−0.038	-0.000	−0.002	0.000	−0.014	0.001***	−0.002
	(0.074)	(0.801)	(0.554)	(0.310)	(0.126)	(0.209)	(0.285)	(0.950)	(0.206)	(0.563)	(0.006)	(0.950)
Leverage	0.000**	0.003	0.000	0.004	0.000	0.002	0.000	0.009	-0.000	0.006	-0.000	0.009
	(0.038)	(0.711)	(0.122)	(0.790)	(0.168)	(0.909)	(0.224)	(0.802)	(0.723)	(0.782)	(0.451)	(0.802)
Cash-to-assets	-0.000	0.006	-0.000	−0.003	0.000	0.009	0.000	−0.037	0.000	−0.024	0.001*	−0.037
	(0.741)	(0.389)	(0.622)	(0.743)	(0.777)	(0.553)	(0.352)	(0.120)	(0.141)	(0.104)	(0.052)	(0.120)
12 Month standard deviation (Ob.) /	-0.185**	−0.295*	-0.489***	−0.911***	-1.022***	−1.561***	-0.217*	−1.387***	0.137	−0.777***	-0.101	−1.387***
return volatility (D&F)	(0.029)	(0.061)	(0.000)	(0.001)	(0.000)	(0.000)	(0.065)	(0.000)	(0.467)	(0.002)	(0.734)	(0.000)
Prior six month market return	-0.235***	0.019***	-0.922***	0.073***	-1.786***	0.208***	-0.144***	0.153***	-0.860***	0.087***	-1.801***	0.153***
	(0.000)	(0.002)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.278***	0.052**	0.995***	0.038	1.867***	−0.120**	0.043	−0.726***	0.512***	−0.398***	1.216***	−0.726***
	(0.000)	(0.042)	(0.000)	(0.308)	(0.000)	(0.018)	(0.244)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.138	0.222	0.169	0.250	0.219	0.317	0.122	0.352	0.202	0.236	0.313	0.352
Observations	32,021	16,866	32,021	16,866	32,021	16,866	32,021	16,866	32,021	16,866	32,021	16,866

Table 7: Regressions of relative repurchase price (RPP), including insider trading, measures of information asymmetry and market overreaction

The table reports the results of regressing firm and repurchasing characteristics on the relative repurchase price, as well as several potential measures indicating undervaluation. Results are reported from Dittmar and Field (2015) (D & F), as well as their replicated results using the repurchase data of Obernberger (2014) (Ob.). Results are reported for both the full sample and a sample in which the first repurchases following the announcement are omitted. The RRP (relative repurchase price) is measured following Dittmar and Field (2015) and represents the percentage difference between the average repurchase price paid by the firm during a repurchase month (as reported in the 10-K) and the average closing stock prices as reported on CRSP, during various windows: repurchase month plus or minus one, three, and six months and the repurchase month plus one, three, and six months, where: RRP = (Average repurchase price paid)/(Average closing price from CRSP) – 1. Accounting variables are summarized at the firm-year, measured at the fiscal year end before the repurchase month. See table 1 for variable definitions. As Dittmar and Field (2014) do not define return volatility, it is replaced by the average standard deviation of daily returns for the past 12 months prior the repurchase month (Fu & Huang, 2014) when regressing the Obernberger (2014) repurchase data. In addition, the regressions for Obernberger (2014) exclude the stated motivation of mispricing. The regressions include year and firm fixed effects and clustered standard errors at the firm level. P-values are in parentheses; ***, **, and * indicate significance at the 1%, 5%, and 10% level, respectively.

	Full sample						**Full sample, omitting first repurchase after announcement**					
	+1 month		**+3 months**		**+6 months**		**+1 month**		**+3 months**		**+6 months**	
	Ob.	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Infrequent Repurchasers	-0.003	−0.006***	-0.006	−0.014***	-0.012**	−0.023***	-0.002	−0.005**	-0.005	−0.014***	-0.011*	−0.022***
	(0.117)	(0.004)	(0.118)	(0.000)	(0.035)	(0.000)	(0.384)	(0.012)	(0.194)	(0.000)	(0.096)	(0.000)
Frequent Repurchasers	0.000	0.001	-0.002	−0.000	-0.006	0.000	0.000	0.001	-0.001	0.000	-0.005	0.001
	(0.968)	(0.642)	(0.428)	(0.967)	(0.219)	(0.978)	(0.870)	(0.594)	(0.686)	(0.874)	(0.311)	(0.846)
Net insider buying	-0.109	0.001	-0.115	−0.001	-0.124	−0.005***	-0.088	0.000	-0.115	−0.001	-0.141	−0.005***
	(0.109)	(0.260)	(0.318)	(0.171)	(0.320)	(0.000)	(0.218)	(0.381)	(0.386)	(0.150)	(0.303)	(0.000)
Ln(total assets)	0.010**	0.011***	0.042***	0.047***	0.081***	0.085***	0.010**	0.011**	0.044***	0.046***	0.084***	0.083***
	(0.022)	(0.005)	(0.000)	(0.000)	(0.000)	(0.000)	(0.024)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.006***	0.004***	0.021***	0.016***	0.035***	0.029***	0.007***	0.004***	0.023***	0.015***	0.039***	0.028***
	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	0.000	−0.013	0.001*	−0.005	0.001**	0.015	-0.000	−0.016	0.001*	−0.006	0.001**	0.016
	(0.969)	(0.305)	(0.089)	(0.842)	(0.030)	(0.700)	(0.980)	(0.220)	(0.075)	(0.814)	(0.022)	(0.687)
Leverage	0.000	0.010	-0.000	0.009	-0.000	0.006	0.000	0.009	-0.000	0.010	-0.000	0.012
	(0.547)	(0.365)	(0.507)	(0.704)	(0.445)	(0.880)	(0.482)	(0.437)	(0.721)	(0.688)	(0.525)	(0.738)
Cash-to-assets	0.000	−0.004	0.000*	−0.023	0.001*	−0.037	0.000	−0.003	0.000	−0.020	0.000	−0.034
	(0.158)	(0.623)	(0.097)	(0.159)	(0.051)	(0.163)	(0.121)	(0.713)	(0.218)	(0.227)	(0.210)	(0.206)
12 Month standard deviation (Ob.) /	-0.437**	−0.554***	-0.045	−0.788***	-0.385	−1.532***	-0.393*	−0.584***	-0.035	−0.780**	-0.363	−1.492***
return volatility (D&F)	(0.030)	(0.006)	(0.901)	(0.008)	(0.466)	(0.000)	(0.056)	(0.007)	(0.931)	(0.012)	(0.539)	(0.001)
Prior six month market return	-0.186***	0.030***	-0.958***	0.084***	-1.930***	0.140***	-0.176***	0.029***	-0.900***	0.083***	-1.858***	0.139***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(number of analysts)	-0.002	−0.004*	-0.002	−0.008	-0.003	−0.006	0.000	−0.003	-0.000	−0.006	-0.001	−0.005
	(0.365)	(0.088)	(0.535)	(0.112)	(0.615)	(0.412)	(0.900)	(0.179)	(0.945)	(0.190)	(0.881)	(0.549)
Percent of analyst downgrades	-0.000	0.016	0.008	0.011	0.027**	0.014	-0.001	0.013	0.006	0.010	0.025*	0.018
	(0.923)	(0.165)	(0.346)	(0.536)	(0.048)	(0.530)	(0.790)	(0.297)	(0.514)	(0.577)	(0.095)	(0.448)
Eps forecast dispersion	-0.001	−0.001	-0.001	−0.003	-0.001	−0.003	-0.001	−0.001	-0.001	−0.004*	-0.001	−0.005
	(0.412)	(0.531)	(0.449)	(0.195)	(0.529)	(0.413)	(0.387)	(0.443)	(0.376)	(0.099)	(0.449)	(0.205)
Change in six month average EPS	0.000	0.003	-0.000	0.010*	0.000	0.016*	0.000	0.003	-0.000	0.010*	-0.000	0.018*
forecast	(0.856)	(0.236)	(0.909)	(0.085)	(0.884)	(0.086)	(0.891)	(0.238)	(0.801)	(0.072)	(0.951)	(0.068)
Stated motivation of mispricing		−0.001		−0.002		−0.002		−0.001		−0.001		0.001
		(0.434)		(0.612)		(0.729)		(0.523)		(0.863)		(0.899)
Prior six month firm abnormal return	0.011***	0.006*	0.049***	0.027***	0.090***	0.046***	0.012**	0.005	0.051***	0.027***	0.094***	0.047***
	(0.008)	(0.092)	(0.000)	(0.000)	(0.000)	(0.000)	(0.019)	(0.164)	(0.000)	(0.000)	(0.000)	(0.000)
Intercept	0.081	−0.095***	0.514***	−0.386***	1.116***	−0.702***	0.061	−0.093***	0.439***	−0.383***	1.017***	−0.695***
	(0.102)	(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.244)	(0.007)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.142	0.154	0.232	0.224	0.348	0.342	0.159	0.157	0.246	0.226	0.357	0.346
Observations	17,929	15,206	17,929	15,206	17,929	15,206	15,376	14,432	15,376	14,432	15,376	14,432

Table 8: Regressions of relative repurchase price (RPP), including insider trading, measures of information asymmetry, market overreaction and liquidity

The table repeats the analysis presented in Table 7, but includes the bid-ask spread as a measure of stock liquidity. As an alternative proxy for liquidity, the liquidity ratio (Fu, Huang,, & Li, 2014) is added in the third collum of each of the three repurchase windows. The liquidity ratio is defined as the past 12 month average of the daily absolute return, divided by the average daily trading volume. See table 1 for the defintions of the remaining variables.

	Repurchase window								
	+1 month			**+3 months**			**+6 months**		
	Ob.	**Ob.**	**D & F**	**Ob.**	**Ob.**	**D & F**	**Ob.**	**Ob.**	**D & F**
Infrequent Repurchasers	-0.003	-0.003	−0.006***	-0.006	-0.006	−0.014***	-0.012**	-0.012**	−0.023***
	(0.109)	(0.109)	(0.004)	(0.112)	(0.112)	(0.000)	(0.034)	(0.032)	(0.000)
Frequent Repurchasers	-0.000	-0.000	0.001	-0.002	-0.002	−0.000	-0.006	-0.006	0.000
	(0.977)	(0.988)	(0.619)	(0.401)	(0.404)	(0.987)	(0.213)	(0.208)	(0.952)
Net insider buying	-0.111	-0.109	0.001	-0.117	-0.114	−0.001	-0.125	-0.123	−0.005***
	(0.105)	(0.112)	(0.268)	(0.310)	(0.327)	(0.163)	(0.316)	(0.329)	(0.000)
Ln(total assets)	0.011**	0.010**	0.011**	0.043***	0.042***	0.046***	0.082***	0.081***	0.083***
	(0.013)	(0.024)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market-to-book	0.006***	0.006***	0.004***	0.021***	0.021***	0.016***	0.035***	0.035***	0.028***
	(0.002)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Return on assets	0.000	0.000	−0.017	0.001*	0.001*	−0.010	0.001**	0.001**	0.003
	(0.931)	(0.966)	(0.207)	(0.084)	(0.090)	(0.679)	(0.030)	(0.029)	(0.947)
Leverage	0.000	0.000	0.011	-0.000	-0.000	0.010	-0.000	-0.000	0.007
	(0.552)	(0.530)	(0.338)	(0.502)	(0.520)	(0.678)	(0.442)	(0.452)	(0.839)
Cash-to-assets	0.000	0.000	−0.004	0.000	0.000*	−0.023	0.001*	0.001*	−0.036
	(0.168)	(0.153)	(0.630)	(0.101)	(0.096)	(0.160)	(0.052)	(0.052)	(0.165)
12 Month standard deviation (Ob.) / return volatility (D&F)	-0.517***	-0.419**	−0.477***	-0.155	-0.003	−0.686***	-0.441	-0.323	−1.298***
	(0.006)	(0.039)	(0.003)	(0.663)	(0.994)	(0.008)	(0.412)	(0.547)	(0.001)
Prior six month market return	-0.193***	-0.189***	0.031***	-0.967***	-0.959***	0.084***	-1.934***	-1.921***	0.140***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Ln(number of analysts)	-0.002	-0.002	−0.004*	-0.002	-0.002	−0.008*	-0.003	-0.003	−0.007
	(0.367)	(0.397)	(0.077)	(0.538)	(0.561)	(0.099)	(0.616)	(0.637)	(0.371)
Percent of analyst downgrades	-0.000	-0.000	0.015	0.008	0.009	0.009	0.027**	0.028**	0.011
	(0.924)	(0.969)	(0.188)	(0.341)	(0.303)	(0.587)	(0.047)	(0.041)	(0.627)
Eps forecast dispersion	-0.001	-0.001	−0.001	-0.001	-0.001	−0.003	-0.001	-0.001	−0.003
	(0.402)	(0.418)	(0.574)	(0.441)	(0.457)	(0.214)	(0.525)	(0.537)	(0.457)
Change in six month average EPS forecast	0.000	0.000	0.003	-0.000	-0.000	0.010*	0.000	0.000	0.017*
	(0.861)	(0.858)	(0.220)	(0.900)	(0.906)	(0.081)	(0.888)	(0.896)	(0.081)
Stated motivation of mispricing			−0.001			−0.002			−0.002
			(0.442)			(0.618)			(0.737)
Prior six month firm abnormal return	0.011***	0.011***	0.006*	0.049***	0.048***	0.028***	0.090***	0.102***	0.047***
	(0.008)	(0.009)	(0.088)	(0.000)	(0.000)	(0.000)	(0.000)	0.000	(0.000)
Bid-ask spread	0.003		−1.429	0.005		−1.903	0.002		−4.349*
	(0.163)		(0.462)	(0.222)		(0.382)	(0.624)		(0.066)
Liquidity Ratio		-0.000			-0.000*			0.000	
		(0.202)			(0.060)			(0.436)	
Intercept	0.081*	0.084*	−0.088**	0.514***	0.517***	−0.377***	1.115***	1.279***	−0.682***
	(0.100)	(0.087)	(0.011)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Adjusted R^2	0.143	0.143	0.154	0.233	0.231	0.224	0.348	0.339	0.343
Observations	17,926	17,917	15,206	17,926	17,917	15,206	17,926	17,584	15,206

Table 9: Long-run abnormal buy and hold returns following stock repurchases, further analysis

The table provides the three-year buy-and-hold abnormal returns of the repurchasing firms gathered by Obernberger (2014). The returns are reported by annual cohort, relative to 25 size-B/M and 25 size-momentum matched portfolios obtained from Kenneth French's website. The columns report the mean, median and weighted mean abnormal returns, using either Kenneth French's equal or value-weighted matched portfolios return as a benchmark. Total assets in the last fiscal year end prior the repurchase is used as the scale for the weighted mean. Panel A presents results for the full sample. In panel B, I identify 6,613 different repurchase programs in the repurchase data of Obernberger (2014) and keep only the first observation of each repurchase program. T-test are conducted to to the significance of the (weighted) mean abnormal buy and hold returns. ***, **, and * indicate significance of coefficients at the 1%, 5%, and 10% level, respectively.

Panel A: Full Sample

			Size and B/M						Size and Momentum					
			Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Period	**N**	**%**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**
2003	151	0,4%	-11,5% ***	-20,3% *	-21,0%	-6,1%	-13,0%	-13,8%	-14,6% ***	-24,1%	-19,9%	-9,3% **	-7,2%	-14,7%
2004	5171	12,5%	-9,5% ***	-10,5% ***	-19,2%	-7,2% ***	-2,4%	-16,1%	-9,0% ***	-7,7% ***	-19,6%	-5,4% ***	3,1%	-15,2%
2005	6280	15,2%	-1,7% **	-16,6% ***	-8,7%	-5,7% ***	-16,9% ***	-12,6%	-0,1%	-13,8% ***	-6,4%	0,2%	-8,6% ***	-6,2%
2006	6633	16,0%	0,0%	-9,4% ***	-4,0%	-0,2%	-9,4% ***	-4,4%	-1,7% ***	-17,3% ***	-4,9%	-1,6% ***	-19,0% ***	-4,7%
2007	7657	18,5%	-7,5% ***	-14,6% ***	-8,7%	-3,3% ***	-10,0% ***	-5,0%	-13,9% ***	-23,3% ***	-14,6%	-13,2% ***	-24,2% ***	-14,0%
2008	7098	17,1%	-9,3% ***	-22,2% ***	-17,8%	1,8% **	-13,1% ***	-7,7%	-13,6% ***	-29,1% ***	-19,5%	-10,8% ***	-26,3% ***	-17,5%
2009	3698	8,9%	-3,5% *	-18,9% ***	-21,5%	5,5% ***	-5,0%	-15,5%	-0,3%	-18,4% ***	-19,1%	1,4%	-14,1% ***	-17,8%
2010	4678	11,3%	5,4% ***	-6,0% ***	-5,0%	4,3% ***	-3,5% *	-5,5%	5,8% ***	-0,8%	-3,3%	6,3% ***	1,0%	-2,0%
2011	50	0,1%	4,6%	-16,5%	2,5%	3,4%	-16,1%	1,1%	3,6%	-6,0%	5,2%	5,2%	-4,6%	6,8%
2003-2011	**41.416**	**100%**	**-4,2%** ***	**-13,8%** ***	**-10,9%**	**-1,1%** ***	**-9,4%** ***	**-8,5%**	**-5,7%** ***	**-16,6%** ***	**-12,1%**	**-4,4%** ***	**-13,9%** ***	**-13,9%**

Panel B: Only first repurchase of each repurchase program

			Size and B/M						Size and Momentum					
			Equal-weighted			Value-weighted			Equal-weighted			Value-weighted		
Period	**N**	**%**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**	**Mean**	**Weigh. Mean**	**Median**
2003	97	1,5%	-12,7% **	-17,1%	-18,4%	-6,8%	-7,9%	-12,5%	-15,1% ***	-19,8%	-16,8%	-8,6% *	1,0%	-13,2%
2004	1329	20,1%	-8,0% ***	-7,4% **	-18,4%	-5,7% ***	-0,5%	-15,9%	-7,3% ***	-3,4%	-17,6%	-4,0% **	7,6% *	-14,2%
2005	963	14,6%	-1,6%	-13,0%	-9,0%	-5,7% ***	-13,7%	-13,0%	-0,7%	-10,8%	-6,9%	-1,0%	-4,6%	-7,9%
2006	985	14,9%	1,8%	-8,8%	-6,6%	1,6%	-9,7%	-6,4%	-0,2%	-15,2% **	-6,8%	-0,1%	-15,8%	-6,2%
2007	1269	19,2%	-9,2% ***	-14,7% **	-13,6%	-4,5% ***	-9,6% *	-9,4%	-16,2% ***	-27,5% ***	-18,9%	-15,5% ***	-28,5% ***	-17,6%
2008	1066	16,1%	-6,8% **	-11,4%	-20,7%	5,4% *	-4,2%	-10,0%	-13,5% ***	-18,5% ***	-24,9%	-9,9% ***	-19,0% ***	-21,1%
2009	359	5,4%	1,2%	-16,1%	-25,8%	12,1%	-8,2%	-16,8%	2,8%	-8,6%	-26,1%	4,8%	-7,5%	-24,4%
2010	542	8,2%	6,6% *	4,1%	-7,3%	4,7%	6,9%	-8,9%	7,3% **	5,8%	-2,0%	6,9% *	6,9%	-2,2%
2011	3	0,0%	-42,9%	1,5%	-21,0%	-49,3%	-2,3%	-37,1%	-52,8%	-10,1%	-24,8%	-51,1%	1,0%	-30,8%
2003-2011	**6.613**	**100%**	**-4,0%** ***	**-10,7%** ***	**-13,6%**	**-0,8%**	**-6,9%** **	**-10,7%**	**-6,4%** ***	**-14,1%** ***	**-14,1%**	**-4,9%** ***	**-10,2%** ***	**-13,9%**

Table 10: Long-run performance, Fama French calendar-time portfolio estimation

The table reports Fama-French regressions of market returns for various return windows following stock repurchases from 2003-2011. Results are reported from Dittmar and Field (2015) (D & F) (38,900 repurchase months, Panel B-F) and Obernberger (2014) (Ob.) (47,301 repurchase months, Panel A), as well as their replicated results using the repurchase data of Obernberger (2014) (Ob.) (46,483 repurchase months). For each calendar month of the sample period, I construct a portfolio comprising all firms making a repurchase within the prior 3, 6, 12, 24, or 36 months. To do this, I add firms to the portfolio in the month that they repurchase stock and the stock is retained in the portfolio for 3, 6, 12, 24, or 36 months. Portfolios are rebalanced each month and an equal-weighted portfolio excess return is calculated. The resulting time series of monthly excess returns is regressed on the three Fama-French (1993) factors: the market return minus the risk-free rate (RMRF), returns on a portfolio of small firms minus returns on a portfolio of big firms (SMB), and returns on a high BM portfolio minus returns on a low BM portfolio (HML). The estimated intercept from the regression of portfolio returns is used as a measure of abnormal performance. In addition, I examine the influence of methodological differences between both papers on 3 different grounds:

• Using either unrestricted or restricted portfolios, in which I do / do not allow a firm to be added to the portfolio if is already in the portfolio due to a prior repurchase within the event window. Eventus constructs unrestricted portfolios by default, but the overweighting of frequent repurchasers in an unrestricted portfolio could lead to a potential bias.
• Using either the equal-weighted (Obernberger, 2014) or value-weighted market return as the RMRF factor (Dittmar & Field, 2015).
• Set the repurchase month return as either the monthly return from CRSP (CRSP return) or the percentage difference between the average repurchase price and the month-end closing price (RPP Return). Obernberger (2014) excludes the repurchase month, Dittmar and Field (2015) use the latter method.

Panel A uses the results of Obernberger (2014) as a benchmark, Panels B through F use the results of various subsamples of Dittmar and Field (2015) as a benchmark. See table 1 for variables definitions. T-tests (chi-square tests) are used to test the significane of the intercept (significance of the difference between subsample intercepts). ***, **, and * indicate significance of coefficients at the 1%, 5%, and 10% level, respectively.

Panel A: Full Sample, results Obernberger (2014) as benchmark

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	Ob. (2014)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(-6,-1)	-0,27% *	-0,48% ***	-0,48% ***	-0,28% ***	**-0,28% *** **	**-0,26% * **	-0,26% *	-0,07%	-0,07%
(0,0)	-0,27% *	-0,25% *	0,50% **	-0,13%	**0,54% *** **	**-0,25% * **	0,50% **	-0,13%	0,54% ***
(+1,+6)	0,08%	0,28%	0,28%	0,39% **	**0,39% ** **	**0,07% **	0,07%	0,17%	0,17%
(+1,+12)	0,07%	0,27%	0,27%	0,35% *	**0,35% * **	**0,07% **	0,07%	0,14%	0,14%
(+1,+24)	0,06%	0,20%	0,20%	0,25%	**0,25% **	**0,07% **	0,07%	0,10%	0,10%
(+1,+36)	0,04%	0,18%	0,18%	0,18%	**0,18% **	**0,09% **	0,09%	0,08%	0,08%

Panel B: Full Sample, results Dittmar & Field (2015) as benchmark

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	D&F (2015)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(0,+3)	0,40% ***	-0,02%	0,45% ***	0,07%	**0,51% *** **	**0,02% **	0,20%	0,11%	0,28% **
(0,+6)	0,40% ***	0,00%	0,37% **	0,10%	**0,44% *** **	**0,02% **	0,10%	0,12%	0,19%
(0,+12)	0,30% ***	0,04%	0,32% **	0,11%	**0,38% *** **	**0,03% **	0,06%	0,10%	0,13%
(0,+24)	0,30% ***	0,03%	0,28% **	0,08%	**0,32% ** **	**0,04% **	0,05%	0,07%	0,08%
(0,+36)	0,30% ***	0,03%	0,28% **	0,04%	**0,28% ** **	**0,06% **	0,07%	0,05%	0,06%

Table 10: Continued

Panel C: Subsample analysis, by firm repurchasing frequency.

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	D&F (2015)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(0,+3)									
Infrequent	0,80% ***	0,04%	0,75% ***	0,15%	**0,83% *** **	**0,07%**	0,53% ***	0,18%	0,62% ***
Frequent	0,20% ***	0,06%	0,13%	0,15% *	**0,17%**	**0,08%**	0,09%	0,17% *	0,17% *
Frequent - Infrequent	-0,60% ***	0,02%	-0,62% **	0,00%	**-0,66% *** **	**0,01%**	-0,44% **	-0,01%	-0,45% ***
(0,+6)									
Infrequent	0,70% ***	0,11%	0,58% ***	0,22%	**0,68% *** **	**0,11%**	0,36% **	0,22%	0,46% ***
Frequent	0,20% **	0,09%	0,19%	0,17% *	**0,23%**	**0,10%**	0,10%	0,18% *	0,17% *
Frequent - Infrequent	-0,50% ***	-0,02%	-0,39%	-0,05%	**-0,45% ** **	**-0,01%**	-0,26%	-0,04%	-0,29% *
(0,+12)									
Infrequent	0,60% ***	0,08%	0,38% **	0,16%	**0,45% *** **	**0,09%**	0,21%	0,16%	0,28% *
Frequent	0,20% *	0,13%	0,12%	0,18% *	**0,15%**	**0,13%**	0,12%	0,18% *	0,17%
Frequent - Infrequent	-0,40% ***	0,05%	-0,26%	0,02%	**-0,30%**	**0,04%**	-0,09%	0,02%	-0,11%
(0,+24)									
Infrequent	0,50% ***	0,10%	0,31% **	0,15%	**0,35% ** **	**0,09%**	0,16%	0,14%	0,20%
Frequent	0,20% **	0,08%	0,12%	0,10%	**0,14%**	**0,11%**	0,11%	0,13%	0,13%
Frequent - Infrequent	-0,30% ***	-0,02%	-0,19%	-0,05%	**-0,21%**	**0,02%**	-0,05%	-0,01%	-0,07%
(0,+36)									
Infrequent	0,50% ***	0,08%	0,26% *	0,09%	**0,26% ** **	**0,11%**	0,16%	0,11%	0,16%
Frequent	0,20% **	0,15%	0,24%	0,11%	**0,20% * **	**0,16%**	0,16%	0,12%	0,12%
Frequent - Infrequent	-0,30% ***	0,07%	-0,02%	0,02%	**-0,06%**	**0,05%**	0,00%	0,01%	-0,04%

Panel D: Subsample analysis, by amount of net insider purchases

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	D&F (2015)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(0,+3)									
Low insider net buys	0,20%	0,13%	0,19%	0,22% **	**0,26% * **	**0,18%**	0,21%	0,26% **	0,28% **
High insider net buys	0,60% ***	0,11%	0,45% ***	0,21%	**0,52% *** **	**0,15%**	0,41% **	0,25% *	0,48% ***
High - Low	0,40% *	-0,02%	0,26%	-0,01%	**0,26%**	**-0,03%**	0,20%	-0,01%	0,20%
(0,+6)									
Low insider net buys	0,30% **	0,14%	0,14%	0,23% **	**0,23% * **	**0,18%**	0,16%	0,27% **	0,25% **
High insider net buys	0,50% ***	0,10%	0,29% **	0,20%	**0,38% *** **	**0,16%**	0,27% *	0,26% *	0,36% **
High - Low	0,20%	-0,04%	0,15%	-0,03%	**0,15%**	**-0,02%**	0,11%	-0,01%	0,11%
(0,+12)									
Low insider net buys	0,30% **	0,10%	0,08%	0,16%	**0,14%**	**0,14%**	0,11%	0,20% *	0,17%
High insider net buys	0,50% ***	0,15%	0,26% *	0,22%	**0,33% ** **	**0,17%**	0,21%	0,24% *	0,28% *
High - Low	0,20%	0,05%	0,18%	0,06%	**0,19%**	**0,03%**	0,10%	0,04%	0,11%
(0,+24)									
Low insider net buys	0,30% ***	0,09%	0,08%	0,13%	**0,11%**	**0,13%**	0,10%	0,16%	0,13%
High insider net buys	0,40% **	0,01%	0,09%	0,05%	**0,13%**	**0,02%**	0,03%	0,05%	0,07%
High - Low	0,10%	-0,08%	0,01%	-0,08%	**0,02%**	**-0,11%**	-0,07%	-0,11%	-0,06%
(0,+36)									
Low insider net buys	0,30% **	0,13%	0,13%	0,12%	**0,12%**	**0,17%**	0,15%	0,16% *	0,13%
High insider net buys	0,40% ***	0,05%	0,12%	0,05%	**0,12%**	**0,05%**	0,06%	0,04%	0,04%
High - Low	0,10%	-0,08%	-0,01%	-0,07%	**0,00%**	**-0,12%**	-0,09%	-0,12%	-0,09%

Table 10: Continued

Panel E: Subsample analysis, by prior six month return

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	D&F (2015)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(0,+3)									
Prior return negative	0,50% ***	-0,12%	0,27%	-0,02%	**0,34% ** **	**-0,09%**	0,13%	0,01%	0,21%
Prior return positive	0,26% ***	-0,12%	0,29% *	-0,04%	**0,34% *** **	**-0,08%**	0,12%	-0,01%	0,17%
Negative - Positive	0,24%	0,00%	-0,02%	0,02%	**0,00%**	**-0,01%**	0,01%	0,02%	0,04%
(0,+6)									
Prior return negative	0,40% **	-0,19%	0,12%	-0,09%	**0,20%**	**-0,20%**	-0,07%	-0,10%	0,03%
Prior return positive	0,40% ***	0,00%	0,27% *	0,09%	**0,33% *** **	**0,05%**	0,13%	0,13% *	0,20% **
Negative - Positive	0,10%	-0,19%	-0,15%	-0,18%	**-0,13%**	**-0,25%**	-0,20%	-0,23%	-0,17%
(0,+12)									
Prior return negative	0,40% **	-0,10%	0,15%	-0,02%	**0,21%**	**-0,17%**	-0,07%	-0,09%	0,00%
Prior return positive	0,30% ***	0,07%	0,24%	0,13%	**0,29% ** **	**0,10%**	0,12%	0,16% **	0,18% **
Negative - Positive	0,00%	-0,17%	-0,09%	-0,15%	**-0,08%**	**-0,27%**	-0,19%	-0,25%	-0,18%
(0,+24)									
Prior return negative	0,30% **	-0,07%	0,14%	-0,03%	**0,18%**	**-0,14%**	-0,06%	-0,10%	-0,02%
Prior return positive	0,30% **	0,06%	0,18%	0,09%	**0,21% ***	**0,11%**	0,10%	0,13% *	0,13%
Negative - Positive	0,00%	-0,13%	-0,04%	-0,12%	**-0,03%**	**-0,25%**	-0,16%	-0,23%	-0,15%
(0,+36)									
Prior return negative	0,30% *	-0,03%	0,17%	-0,03%	**0,17%**	**-0,07%**	0,00%	-0,07%	0,00%
Prior return positive	0,30% ***	0,07%	0,19%	0,06%	**0,18%**	**0,12%**	0,12%	0,10%	0,10%
Negative - Positive	0,00%	-0,10%	-0,02%	-0,09%	**-0,01%**	**-0,19%**	-0,12%	-0,17%	-0,10%

Panel F: Subsample analysis, by whether relative repurchase price (RRP) was done at a discount or premium to average CRSP price for three months after repurchase.

		Restricted portfolios				Unrestricted portfolios			
		Equal-weighted market return		Value weighted-market return		Equal-weighted market return		Value weighted-market return	
	D&F (2015)	CRSP Return	RPP Return	CRSP Return	RPP Return (D&F)	CRSP Return (Ob.)	RPP Return	CRSP Return	RPP Return
(0,+3)									
Repurchased at discount	2,60% ***	1,50% ***	1,92% ***	1,58% ***	**1,96% *** **	**2,18% *** **	2,52% ***	2,25% ***	2,57% ***
Repurchased at premium	-2,60% ***	-1,97% ***	-1,60% ***	-1,89% ***	**-1,54% *** **	**-2,58% *** **	-2,44% ***	-2,51% ***	-2,38% ***
Discount - Premium	5,20% ***	3,47% ***	3,52% ***	3,47% ***	**3,50% *** **	**4,76% *** **	4,96% ***	4,76% ***	4,95% ***
(0,+6)									
Repurchased at discount	1,40% **	0,69% ***	0,88% ***	0,78% ***	**0,95% *** **	**1,18% *** **	1,29% ***	1,26% ***	1,37% ***
Repurchased at premium	-1,10% ***	-0,91% ***	-0,59% ***	-0,81% ***	**-0,51% *** **	**-1,35% *** **	-1,26% ***	-1,25% ***	-1,17% ***
Discount - Premium	2,50% ***	1,60% ***	1,47% ***	1,59%	**1,46% *** **	**2,53% *** **	2,55% ***	2,51% ***	2,54% ***
(0,+12)									
Repurchased at discount	0,90% ***	0,37% ***	0,46% ***	0,44% ***	**0,52% *** **	**0,68% *** **	0,71% ***	0,74% ***	0,76% ***
Repurchased at premium	-0,50% ***	-0,49% ***	-0,24%	-0,41% **	**-0,18%**	**-0,80% *** **	-0,76% ***	-0,73% ***	-0,69% ***
Discount - Premium	1,40% ***	0,86% ***	0,70% ***	0,85% ***	**0,70% *** **	**1,48% *** **	1,47% ***	1,47% ***	1,45% ***
(0,+24)									
Repurchased at discount	0,70% ***	0,28% **	0,36% ***	0,32% ***	**0,39% *** **	**0,46% *** **	0,46% ***	0,49% ***	0,49% ***
Repurchased at premium	-0,30% **	-0,34% **	-0,15%	-0,30% **	**-0,11%**	**-0,55% *** **	-0,53% ***	-0,51% ***	-0,50% ***
Discount - Premium	1,00% ***	0,62% ***	0,51% **	0,62% ***	**0,50% *** **	**1,01% *** **	0,99% ***	1,00% ***	0,99% ***
(0,+36)									
Repurchased at discount	0,60% ***	0,27% **	0,35% **	0,26% ***	**0,34% *** **	**0,39% *** **	0,39% ***	0,38% ***	0,38% ***
Repurchased at premium	-0,20%	-0,27% *	-0,09%	-0,27% *	**-0,09%**	**-0,39% ** **	-0,38% **	-0,40% ***	-0,39% **
Discount - Premium	0,80% ***	0,54% ***	0,44% **	0,53% ***	**0,43% *** **	**0,78% *** **	0,77% ***	0,78% ***	0,77% ***

Table 11: Fama French calendar-time portfolio estimation: replicating the dataset of Dittmar & Field (2015) based on repurchasing frequency and firm characterstics.

Table 11 repeats the analysis presented in Table 9 but shows the results of 100 different subsamples generated from the original repurchase data of Oberberger (2014). I test whether the differences of long-run performance between Oberberger (2014) and Dittmar and Field (2015) are driven by differences in i) firm characteristics, ii) outliers or ii) different repurchase programs covered in the dataset. This is tested by replicating the dataset of Dittmar and Field (2015) from the dataset of Oberberger. First, I identify 7,543 different repurchase programs in the repurchase data of Oberberger (2014), drop the 2% programs of the largest firms and keep the 15% of the infrequent repurchase programs that repurchase the most relative to their market value. For the remaining repurchase programs, I seperate the programs on repurchasing freqeuncy and randomly keep 30% of each of the 3 groups. I repeat this procedure 100 times. Panel A shows the summary statistics of the 100 subsamples as described in table 1; Panel B through F repeat the analysis described in table 9, but always include the RPP and use the value weighted index as a benchmark. ***, **, and * indicate significance of coefficients at the 1%, 5%, and 10% level, respectively.

Panel A: Summary Statistics by repurchase frequency

			Repurchase frequency						Difference: Frequent - Infrequent	
	Full Sample		Infrequent		Moderate		Frequent			
Firm characterstic	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Total assets (millions)	5.567	6.993	3.742	3.380	5.444	5.321	10.566	18.718	6.823***	15.339***
	(1.166)	(1.044)	(862)	(684)	(1.219)	(1.249)	(2.745)	(2.999)	(1.883***)	(2.315***)
Market-to-book	1.45	1.82	1.40	1.75	1.46	1.88	1.56	1.94	0.157***	0.189***
	(1.15)	(1.455)	(1.14)	(1.378)	(1.14)	(1.508)	(1.23)	(1.626)	(0.09***)	(0.248***)
Return on assets	5.71%	6.05%	5.10%	4.76%	5.95%	7.00%	6.91%	7.90%	1.81%***	3.14%***
	(5.09%)	(6.36%)	(4.73%)	(5.50%)	(5.06%)	(6.82%)	(6.08%)	(7.61%)	(1.35%***)	(2.11%***)
Leverage	17.17%	17.18%	17.57%	17.45%	16.48%	16.34%	17.22%	17.77%	-0.34%***	0.32%
	(13.60%)	(13.63%)	(13.60%)	(13.24%)	(12.94%)	(12.40%)	(14.79%)	(16.17%)	(1.13%***)	(2.93%***)
Cash-to-assets	17.46%	19.50%	18.68%	20.53%	16.57%	19.65%	15.71%	16.65%	-2.98%***	−3.88%***
	(9.63%)	(12.53%)	(10.52%)	(13.44%)	(9.09%)	(13.10%)	(8.64%)	(10.56%)	(-1.88%***)	(−2.88%***)
Dividend Payout	1.15%	3.56%	0.97%	3.01%	1.22%	3.75%	1.50%	4.66%	0.53%***	1.65%***
	(0.16%)	(0.00%)	(0.00%)	(0.00%)	(0.23%)	(0.00%)	(0.44%)	(2.24%)	(0.44%***)	(2.24%***)
Bid-ask spread	0.52%	0.44%	0.58%	0.55%	0.52%	0.36%	0.34%	0.28%	-0.24%***	−0.27%***
	(0.15%)	(0.15%)	(0.17%)	(0.18%)	(0.14%)	(0.13%)	(0.10%)	(0.10%)	(-0.07%***)	(−0.08%***)
Repurchase size / MV	0.92%	1.12%	1.19%	2.49%	0.71%	0.87%	0.56%	0.56%	-0.63***	−1.93%*
	(0.42%)	(0.37%)	(0.51%)	(0.44%)	(0.39%)	(0.42%)	(0.32%)	(0.32%)	(-0.21%***)	(−0.12%***)
Annual repurch / MV	4.25%	5.69%	3.03%	5.73%	4.93%	5.44%	6.41%	5.98%	3.38%***	0.25%
	(2.93%)	(2.38%)	(1.51%)	(1.19%)	(3.83%)	(3.64%)	(5.31%)	(4.57%)	(3.80%***)	(3.38%***)
Observations	-	7.496	-	3.765	-	2.250	-	1.481		
(%)			50,1%	50,2%	30,9%	30,0%	19,0%	19,8%		

Panel B: Full Sample

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	**Median**	**Mean**	**St Dev.**	**Median**	**Mean**	**St. Dev**
(0,+3)	0,40% ***	0,55% ***	0,54%	0,05%	0,30% **	0,30%	0,05%
(0,+6)	0,40% ***	0,46% ***	0,46%	0,05%	0,22%	0,22%	0,05%
(0,+12)	0,30% ***	0,36% **	0,35%	0,04%	0,14%	0,15%	0,04%
(0,+24)	0,30% ***	0,27% **	0,26%	0,04%	0,10%	0,10%	0,04%
(0,+36)	0,30% ***	0,23% **	0,23%	0,03%	0,08%	0,08%	0,04%

Panel C: Subsample analysis, by firm repurchasing frequency.

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	**Median**	**Mean**	**St Dev.**	**Median**	**Mean**	**St Dev.**
(0,+3)							
Infrequent	0,80% ***	0,87% ***	0,87%	0,08%	0,64% ***	0,65%	0,09%
Frequent	0,20% ***	0,21%	0,20%	0,08%	0,17%	0,17%	0,07%
Frequent - Infrequent	-0,60% ***	-0,66% ***	0,67%	0,00%	-0,47% **	-0,48%	-0,01%
(0,+6)							
Infrequent	0,70% ***	0,70% ***	0,70%	0,08%	0,52% ***	0,52%	0,07%
Frequent	0,20% **	0,24%	0,24%	0,07%	0,17%	0,17%	0,07%
Frequent - Infrequent	-0,50% ***	-0,46%	-0,46%	-0,02%	-0,35% *	-0,35%	-0,01%
(0,+12)							
Infrequent	0,60% ***	0,45% **	0,46%	0,07%	0,32% **	0,31%	0,06%
Frequent	0,20% *	0,18%	0,19%	0,05%	0,18%	0,18%	0,06%
Frequent - Infrequent	-0,40% ***	-0,27%	-0,27%	-0,01%	-0,14%	-0,13%	0,00%
(0,+24)							
Infrequent	0,50% ***	0,34% **	0,35%	0,05%	0,23%	0,23%	0,05%
Frequent	0,20% **	0,14%	0,15%	0,05%	0,14%	0,14%	0,06%
Frequent - Infrequent	-0,30% ***	-0,20%	-0,20%	0,00%	-0,09%	-0,09%	0,01%
(0,+36)							
Infrequent	0,50% ***	0,27% *	0,27%	0,05%	0,18%	0,18%	0,04%
Frequent	0,20% **	0,20%	0,20%	0,04%	0,14%	0,14%	0,05%
Frequent - Infrequent	-0,30% ***	-0,07%	-0,07%	-0,01%	-0,04%	-0,04%	0,01%

Table 11: Continued

Panel D: Subsample analysis, by amount of net insider purchases

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Low insider net buys	0,20%	0,31% *	0,31%	0,09%	0,31% *	0,31%	0,09%
High insider net buys	0,60% ***	0,55% ***	0,54%	0,11%	0,50% **	0,50%	0,11%
High - Low	0,40% *	0,24%	0,24%	0,02%	0,19%	0,19%	0,02%
(0,+6)							
Low insider net buys	0,30% **	0,26% *	0,26%	0,07%	0,27% *	0,27%	0,07%
High insider net buys	0,50% ***	0,37% **	0,38%	0,10%	0,37% **	0,37%	0,10%
High - Low	0,20%	0,11%	0,12%	0,03%	0,10%	0,10%	0,03%
(0,+12)							
Low insider net buys	0,30% **	0,16%	0,16%	0,07%	0,16%	0,16%	0,07%
High insider net buys	0,50% ***	0,30% *	0,31%	0,08%	0,26%	0,27%	0,09%
High - Low	0,20%	0,14%	0,15%	0,01%	0,10%	0,10%	0,02%
(0,+24)							
Low insider net buys	0,30% ***	0,11%	0,11%	0,06%	0,11%	0,10%	0,06%
High insider net buys	0,40% **	0,16%	0,15%	0,07%	0,13%	0,12%	0,08%
High - Low	0,10%	0,05%	0,05%	0,02%	0,02%	0,02%	0,02%
(0,+36)							
Low insider net buys	0,30% **	0,13%	0,13%	0,05%	0,13%	0,13%	0,05%
High insider net buys	0,40% ***	0,16%	0,16%	0,08%	0,12%	0,11%	0,08%
High - Low	0,10%	0,03%	0,03%	0,03%	-0,01%	-0,02%	0,04%

Panel E: Subsample analysis, by prior six month return

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Prior return negative	0,50% ***	0,38% **	0,38%	0,07%	0,25%	0,24%	0,08%
Prior return positive	0,26% ***	0,35% ***	0,35%	0,06%	0,18%	0,18%	0,06%
Negative - Positive	0,24%	0,03%	0,03%	0,01%	0,07%	0,06%	0,02%
(0,+6)							
Prior return negative	0,40% **	0,25% *	0,24%	0,08%	0,09%	0,08%	0,08%
Prior return positive	0,40% ***	0,36% ***	0,36%	0,06%	0,23% **	0,23%	0,06%
Negative - Positive	0,10%	-0,11%	-0,12%	0,02%	-0,14%	-0,14%	0,03%
(0,+12)							
Prior return negative	0,40% **	0,23%	0,23%	0,06%	0,05%	0,05%	0,07%
Prior return positive	0,30% ***	0,28%	0,28%	0,04%	0,18%	0,18%	0,05%
Negative - Positive	0,00%	-0,05%	-0,05%	0,01%	-0,13%	-0,13%	0,02%
(0,+24)							
Prior return negative	0,30% **	0,18%	0,18%	0,05%	0,01%	0,02%	0,05%
Prior return positive	0,30% **	0,20%	0,20%	0,04%	0,14%	0,14%	0,04%
Negative - Positive	0,00%	-0,02%	-0,02%	0,01%	-0,13%	-0,13%	0,01%
(0,+36)							
Prior return negative	0,30% *	0,17%	0,17%	0,07%	0,02%	0,03%	0,07%
Prior return positive	0,30% ***	0,17%	0,17%	0,04%	0,12%	0,13%	0,04%
Negative - Positive	0,00%	0,00%	0,00%	0,03%	-0,10%	-0,09%	0,04%

Panel F: Subsample analysis, by whether relative repurchase price (RRP) was done at a discount or premium to average CRSP price for three months after

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Repurchased at discount	2,60% ***	2,10% ***	2,10%	0,05%	2,64% ***	2,64%	0,06%
Repurchased at premium	-2,60% ***	-1,63% ***	-1,63%	0,07%	-2,42% ***	-2,42%	0,07%
Discount - Premium	5,20% ***	3,73% ***	3,73%	-0,03%	5,06% ***	5,06%	-0,01%
(0,+6)							
Repurchased at discount	1,40% **	1,07% ***	1,07%	0,05%	1,43% ***	1,42%	0,05%
Repurchased at premium	-1,10% ***	-0,58% ***	-0,58%	0,08%	-1,17% ***	-1,16%	0,08%
Discount - Premium	2,50% ***	1,65% ***	1,66%	-0,03%	2,60% ***	2,58%	-0,03%
(0,+12)							
Repurchased at discount	0,90% ***	0,60% ***	0,60%	0,04%	0,79% ***	0,79%	0,04%
Repurchased at premium	-0,50% ***	-0,28%	-0,28%	0,07%	-0,69% ***	-0,69%	0,07%
Discount - Premium	1,40% ***	0,88% ***	0,88%	-0,03%	1,48% ***	1,48%	-0,03%
(0,+24)							
Repurchased at discount	0,70% ***	0,44% ***	0,44%	0,03%	0,52% ***	0,52%	0,03%
Repurchased at premium	-0,30% **	-0,18%	-0,19%	0,06%	-0,48% ***	-0,48%	0,06%
Discount - Premium	1,00% ***	0,62% ***	0,62%	-0,03%	1,00% ***	1,00%	-0,03%
(0,+36)							
Repurchased at discount	0,60% ***	0,38% ***	0,38%	0,03%	0,43% ***	0,42%	0,03%
Repurchased at premium	-0,20%	-0,16%	-0,16%	0,06%	-0,37% ***	-0,38%	0,06%
Discount - Premium	0,80% ***	0,54% ***	0,54%	-0,03%	0,80% ***	0,80%	-0,03%

Table 12: Fama French calendar-time portfolio estimation: replicating the dataset of Dittmar & Field (2015) based on repurchasing frequency, firm characterstics and relative repurchase price

This table repeats the analysis presented in table 11, but uses the relative repurchase price (as described in table 1) as another criteria when replicating the sample of Dittmar and Field (2015). First, I identify 7,543 different repurchase programs in the repurchase data of Obernberger (2014), drop the 2% programs of the largest firms and keep the 15% of the infrequent repurchase programs that repurchase the most relative to their market value. For the remaining repurchase programs, I seperate the programs on repurchasing freqeuncy and whether the repurchase was done at a discount or a premium. I randomly keep 50% of the 3 groups that repurchased at a discount and 20% of the 3 groups that repurchased at a premium . I repeat this procedure 100 times. Panel A shows the summary statistics of the 100 subsamples as described in table 2; Panel B through F repeat the analysis described in table 9, but always include the RPP and use the value weighted index as a benchmark. ***, **, and * indicate significance of coefficients at the 1%, 5%, and 10% level, respectively.

Panel A1: Summary Statistics by repurchase frequency

			Repurchase frequency						Difference: Frequent - Infrequent	
	Full Sample		Infrequent		Moderate		Frequent			
Firm characterstic	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Total assets (millions)	5.320	6.993	3.568	3.380	5.282	5.321	10.640	18.718	7.072***	15.339***
	(1.164)	(1.044)	(849)	(684)	(1.301)	(1.249)	(2.809)	(2.999)	(1.960***)	(2.315***)
Market-to-book	1.49	1.82	1.45	1.75	1.52	1.88	1.58	1.94	0.13***	0.189***
	(1.20)	(1.455)	(1.17)	(1.378)	(1.21)	(1.508)	(1.28)	(1.626)	(0.11***)	(0.248***)
Return on assets	5.93%	6.05%	5.27%	4.76%	6.34%	7.00%	7.17%	7.90%	1.91%***	3.14%***
	(5.42%)	(6.36%)	(5.04%)	(5.50%)	(5.52%)	(6.82%)	(6.31%)	(7.61%)	(1.27%**)	(2.11%***)
Leverage	17.11%	17.18%	17.48%	17.45%	16.54%	16.34%	17.02%	17.77%	-0.46%***	0.32%
	(13.41%)	(13.63%)	(13.32%)	(13.24%)	(12.97%)	(12.40%)	(14.51%)	(16.17%)	(1.19%***)	(2.93%***)
Cash-to-assets	17.86%	19.50%	19.17%	20.53%	16.83%	19.65%	15.71%	16.65%	-3.46***	−3.88%***
	(10.21%)	(12.53%)	(11.03%)	(13.44%)	(9.54%)	(13.10%)	(8.76%)	(10.56%)	(-2.27%***)	(−2.88%***)
Dividend Payout	1.14%	3.56%	0.97%	3.01%	1.26%	3.75%	1.43%	4.66%	0.46%***	1.65%***
	(0.12%)	(0.00%)	(0.00%)	(0.00%)	(0.23%)	(0.00%)	(0.44%)	(2.24%)	(044%***)	(2.24%***)
Bid-ask spread	0.50%	0.44%	0.57%	0.55%	0.48%	0.36%	0.33%	0.28%	-0.24%***	−0.27%***
	(0.14%)	(0.15%)	(0.16%)	(0.18%)	(0.14%)	(0.13%)	(0.10%)	(0.10%)	(-0.06%***)	(−0.08%***)
Repurchase size / MV	0.92%	1.12%	1.18%	2.49%	0.70%	0.87%	0.55%	0.56%	-0.63%***	−1.93%*
	(0.42%)	(0.37%)	(0.50%)	(0.44%)	(0.38%)	(0.42%)	(0.32%)	(0.32%)	(-0.18%***)	(−0.12%***)
Annual repurch / MV	4.15%	5.69%	2.99%	5.73%	4.83%	5.44%	6.41%	5.98%	3.42%***	0.25%
	(2.81%)	(2.38%)	(1.48%)	(1.19%)	(3.76%)	(3.64%)	(5.33%)	(4.57%)	(3.85%***)	(3.38%***)
Observations		7.496	-	3.765	-	2.250	-	1.481		
(%)			51,3%	50,2%	30,3%	30,0%	18,4%	19,8%		

Panel A2: Summary Statistics by repurchase discount or premium

			≥75% repurchases bought at discount?					
	Full Sample		No		Yes		Difference: No - Yes	
Firm characterstic	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**	**Ob.**	**D & F**
Total assets (millions)	5.320	6.993	5.956	8.242	4.436	5.346	1.520***	2.896***
	(1.164)	(1.044)	(1.247)	(1.198)	(1.068)	(0.897)	(179***)	(0.301***)
Market-to-book	1.49	1.82	1.45	1.839	1.56	1.802	-0.11***	0.038
	(1.20)	(1.455)	(1.15)	(1.468)	(1.25)	(1.44)	(-0.10***)	(0.034*)
Return on assets	5.93%	6.05%	5.53%	6.34%	6.47%	5.67%	-0.94%***	0.67%**
	(5.42%)	(6.36%)	(5.03%)	(6.47%)	(5.99%)	(6.21%)	(-0.96%***)	(0.27%**)
Leverage	17.11%	17.18%	17.31%	17.23%	16.84%	17.11%	0.46%***	0.11%
	(13.41%)	(13.63%)	(13.73%)	(13.98%)	(12.81%)	(13.03%)	(0.92%***)	(0.95%)
Cash-to-assets	17.86%	19.50%	17.46%	19.21%	18.41%	19.87%	-0.95%***	−0.66%
	(10.21%)	(12.53%)	(9.63%)	(12.23%)	(10.92%)	(13.09%)	(-1.29%***)	(−0.87%*)
Dividend Payout	1.14%	3.56%	1.13%	3.94%	1.16%	3.05%	-0.03%**	0.89%*
	(0.12%)	(0.00%)	(0.17%)	(0.00%)	(0.00%)	(0.00%)	(0.17%***)	(0.00%)
Bid-ask spread	0.50%	0.44%	0.55%	0.40%	0.44%	0.49%	0.11%***	−0.09%***
	(0.14%)	(0.15%)	(0.14%)	(0.14%)	(0.14%)	(0.16%)	(0.00%)	−0.03%***)
Repurchase size / MV	0.92%	1.12%	0.97%	1.30%	0.86%	0.74%	0.11%***	0.56%
	(0.42%)	(0.37%)	(0.44%)	(0.39%)	(0.39%)	(0.35%)	(0.05%***)	(0.04%***)
Annual repurch / MV	4.15%	5.69%	4.78%	7.71%	3.28%	3.03%	1.50%***	4.68%
	(2.81%)	(2.38%)	(3.54%)	(3.04%)	(2.03%)	(1.64%)	(1.51%***)	(1.41%***)
Observations	-	7.496	-	4.262	-	3.234		
(%)			58,1%	56,9%	41,9%	43,1%		

Panel B: Full Sample

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	**Median**	**Mean**	**St Dev.**	**Median**	**Mean**	**St. Dev**
(0,+3)	0,40% ***	0,83% ***	0,83%	0,04%	0,50% ***	0,49%	0,04%
(0,+6)	0,40% ***	0,69% ***	0,69%	0,05%	0,38% ***	0,38%	0,04%
(0,+12)	0,30% ***	0,52% ***	0,52%	0,04%	0,25% *	0,25%	0,04%
(0,+24)	0,30% ***	0,38% ***	0,38%	0,03%	0,16%	0,16%	0,03%
(0,+36)	0,30% ***	0,30% **	0,31%	0,03%	0,11%	0,12%	0,03%

Table 12: Continued

Panel C: Subsample analysis, by firm repurchasing frequency.

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Infrequent	0,80% ***	1,19% ***	1,19%	0,07%	0,90% ***	0,91%	0,08%
Frequent	0,20% ***	0,40% **	0,40%	0,07%	0,28% **	0,28%	0,08%
Frequent - Infrequent	-0,60% ***	-0,79% ***	-0,80%	0,01%	-0,62% ***	-0,63%	0,01%
(0,+6)							
Infrequent	0,70% ***	0,92% ***	0,93%	0,07%	0,69% ***	0,69%	0,07%
Frequent	0,20% **	0,39% **	0,40%	0,06%	0,25% **	0,25%	0,07%
Frequent - Infrequent	-0,50% ***	-0,53% *	-0,53%	-0,01%	-0,44% **	-0,44%	0,00%
(0,+12)							
Infrequent	0,60% ***	0,60% ***	0,59%	0,06%	0,41% **	0,41%	0,06%
Frequent	0,20% *	0,29% *	0,29%	0,06%	0,24% *	0,23%	0,06%
Frequent - Infrequent	-0,40% ***	-0,31%	-0,30%	0,00%	-0,17%	-0,18%	0,01%
(0,+24)							
Infrequent	0,50% ***	0,44% **	0,44%	0,05%	0,29% *	0,29%	0,05%
Frequent	0,20% **	0,24% *	0,24%	0,06%	0,18%	0,18%	0,06%
Frequent - Infrequent	-0,30% ***	-0,20%	-0,20%	0,01%	-0,11%	-0,11%	0,02%
(0,+36)							
Infrequent	0,50% ***	0,34% **	0,33%	0,05%	0,22% *	0,22%	0,04%
Frequent	0,20% **	0,25% **	0,25%	0,05%	0,15%	0,15%	0,06%
Frequent - Infrequent	-0,30% ***	-0,09%	-0,08%	0,00%	-0,07%	-0,07%	0,01%

Panel D: Subsample analysis, by amount of net insider purchases

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Low insider net buys	0,20%	0,55% ***	0,53%	0,08%	0,54% ***	0,53%	0,08%
High insider net buys	0,60% ***	0,86% ***	0,86%	0,08%	0,81% ***	0,81%	0,09%
High - Low	0,40% *	0,31%	0,33%	0,00%	0,27%	0,28%	0,01%
(0,+6)							
Low insider net buys	0,30% **	0,40% ***	0,41%	0,07%	0,41% ***	0,42%	0,08%
High insider net buys	0,50% ***	0,60% ***	0,61%	0,08%	0,58% ***	0,58%	0,09%
High - Low	0,20%	0,20%	0,20%	0,01%	0,17%	0,17%	0,01%
(0,+12)							
Low insider net buys	0,30% **	0,26% *	0,26%	0,05%	0,28% *	0,28%	0,06%
High insider net buys	0,50% ***	0,49% ***	0,50%	0,08%	0,45% ***	0,45%	0,09%
High - Low	0,20%	0,23%	0,24%	0,03%	0,17%	0,17%	0,03%
(0,+24)							
Low insider net buys	0,30% ***	0,21%	0,21%	0,05%	0,21%	0,21%	0,06%
High insider net buys	0,40% **	0,23%	0,23%	0,07%	0,18%	0,19%	0,08%
High - Low	0,10%	0,02%	0,02%	0,02%	-0,03%	-0,02%	0,02%
(0,+36)							
Low insider net buys	0,30% **	0,20% *	0,20%	0,04%	0,21%	0,21%	0,06%
High insider net buys	0,40% ***	0,17%	0,17%	0,06%	0,11%	0,11%	0,07%
High - Low	0,10%	-0,03%	-0,03%	0,02%	-0,10%	-0,10%	0,01%

Panel E: Subsample analysis, by prior six month return

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Prior return negative	0,50% ***	0,59% ***	0,59%	0,06%	0,40% **	0,39%	0,06%
Prior return positive	0,26% ***	0,58% ***	0,58%	0,05%	0,37% ***	0,36%	0,06%
Negative - Positive	0,24%	0,01%	0,01%	0,00%	0,03%	0,03%	0,00%
(0,+6)							
Prior return negative	0,40% **	0,37% **	0,35%	0,08%	0,17%	0,16%	0,08%
Prior return positive	0,40% ***	0,56% ***	0,56%	0,05%	0,40% ***	0,39%	0,06%
Negative - Positive	0,10%	-0,19%	-0,21%	0,03%	-0,23%	-0,23%	0,02%
(0,+12)							
Prior return negative	0,40% **	0,32% **	0,32%	0,05%	0,12%	0,12%	0,06%
Prior return positive	0,30% ***	0,44% ***	0,44%	0,04%	0,30% ***	0,30%	0,04%
Negative - Positive	0,00%	-0,12%	-0,12%	0,01%	-0,18%	-0,18%	0,02%
(0,+24)							
Prior return negative	0,30% **	0,23% *	0,23%	0,05%	0,04%	0,05%	0,06%
Prior return positive	0,30% **	0,30% **	0,30%	0,04%	0,22% *	0,22%	0,04%
Negative - Positive	0,00%	-0,07%	-0,08%	0,01%	-0,18%	-0,18%	0,02%
(0,+36)							
Prior return negative	0,30% *	0,23% *	0,23%	0,07%	0,08%	0,08%	0,07%
Prior return positive	0,30% ***	0,24%	0,24%	0,03%	0,16%	0,16%	0,04%
Negative - Positive	0,00%	-0,01%	-0,01%	0,03%	-0,08%	-0,09%	0,04%

Table 12: Continued

Panel F: Subsample analysis, by whether relative repurchase price (RRP) was done at a discount or premium to average CRSP price for three months after

		Restriced Portfolio			Unrestricted Portfolio		
	D&F (2015)	Median	Mean	St Dev.	Median	Mean	St Dev.
(0,+3)							
Repurchased at discount	2,60% ***	2,26% ***	2,26%	0,04%	2,74% ***	2,74%	0,04%
Repurchased at premium	-2,60% ***	-1,53% ***	-1,53%	0,06%	-2,36% ***	-2,36%	0,07%
Discount - Premium	5,20% ***	3,79% ***	3,78%	-0,02%	5,10% ***	5,10%	-0,02%
(0,+6)							
Repurchased at discount	1,40% **	1,22% ***	1,22%	0,04%	1,54% ***	1,53%	0,04%
Repurchased at premium	-1,10% ***	-0,49% **	-0,49%	0,09%	-1,11% ***	-1,11%	0,09%
Discount - Premium	2,50% ***	1,71% ***	1,71%	-0,04%	2,65% ***	2,64%	-0,04%
(0,+12)							
Repurchased at discount	0,90% ***	0,70% ***	0,70%	0,03%	0,85% ***	0,85%	0,03%
Repurchased at premium	-0,50% ***	-0,21%	-0,20%	0,08%	-0,62% ***	-0,61%	0,08%
Discount - Premium	1,40% ***	0,91% ***	0,89%	-0,05%	1,47% ***	1,47%	-0,04%
(0,+24)							
Repurchased at discount	0,70% ***	0,49% ***	0,49%	0,03%	0,54% ***	0,54%	0,03%
Repurchased at premium	-0,30% **	-0,11%	-0,11%	0,07%	-0,42% **	-0,42%	0,07%
Discount - Premium	1,00% ***	0,60% ***	0,60%	-0,04%	0,96% ***	0,96%	-0,03%
(0,+36)							
Repurchased at discount	0,60% ***	0,41% ***	0,41%	0,03%	0,43% ***	0,43%	0,03%
Repurchased at premium	-0,20%	-0,13%	-0,13%	0,07%	-0,37% **	-0,36%	0,07%
Discount - Premium	0,80% ***	0,54% ***	0,54%	-0,04%	0,80% ***	0,79%	-0,04%

Table 13: Long-run aggregate performance, Fama French calendar-time portfolio estimation

The table reports Fama-French regressions of market returns for various return windows following stock repurchases from 2003-2011, generated from the same dataset as used by Obernberger (2014) (46,483 repurchase months). For each calendar month of the sample period, I construct a portfolio comprising all firms making a repurchase within the prior 3 - 48 months. To do this, I add firms to the portfolio in the month that they repurchase stock and the stock is retained in the portfolio for 3 - 48 months. As I measure abnormal performance from the firm's perspective, I set the return in the repurchase month return equal to the percentage difference between the average repurchase price and the month-end closing price (RPP Return). Portfolios are rebalanced each month and a weighted portfolio excess return is calculated. The resulting time series of monthly excess returns is regressed on the three Fama-French (1993) factors: the market return minus the risk-free rate (RMRF), returns on a portfolio of small firms minus returns on a portfolio of big firms (SMB), and returns on a high BM portfolio minus returns on a low BM portfolio (HML). In addition, I extend the Fama-French 3-factor model with the investor sentiment index of Baker and Wurgely (2006) or the momentum factor of Carhart (1997) (Carhart 4-factor model). The estimated intercept from the regression of portfolio returns is used as a measure of abnormal performance. In addition, I look into the influence of two different options, resulting in 4 different models:

• To measure the aggregate dollar gain / loss made by repurchasing firms I use the dollar repurchasing value as weights (dollar weights) when creating the monthly portfolios. As a second option, I use the amount repurchased relative to the market cap in the end of the previous month as weights (relative weights) so that I can measure the average firm's relative return on its "repurchasing investment".

• Using either the equal-weighted (Equal-W) or value-weighted (Value-W) market return as the RMRF factor.

Panel A, B and C present the results for the full sample, each time using a different Fama-French model. Panels D through M provide results for various subsamples of repurchasing firms, using either the 3-factor or (Carhat) 4-factor model. See table 1 for variable definitions. ***, **, and * indicate significance of the alpha's at the 1%, 5%, and 10% level, respectively. [a], [b], and [c] indicate significance of the fourth Fama-French coefficient (investort sentiment or momentum factor) in panel B and C at the 1%, 5%, and 10% level, respectively.

Panel A: Full sample, Fama French 3-factor model

	Dollar weights				Relative weights			
	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)
(0,+3)	-0,08%	(0,79)	-0,01%	(0,92)	0,37% **	(0,87)	0,45% ***	(0,91)
(0,+6)	-0,09%	(0,82)	-0,01%	(0,95)	0,23%	(0,90)	0,32% **	(0,92)
(0,+12)	-0,05%	(0,86)	0,01%	(0,95)	0,14%	(0,91)	0,21%	(0,93)
(0,+24)	-0,03%	(0,88)	0,00%	(0,95)	0,12%	(0,91)	0,16%	(0,93)
(0,+36)	0,01%	(0,87)	-0,01%	(0,95)	0,10%	(0,90)	0,10%	(0,94)
(0,+48)	0,10%	(0,87)	0,01%	(0,96)	0,20%	(0,91)	0,13%	(0,94)

Panel B: Full sample, investor sentiment included as 4th factor

	Dollar weights				Relative weights			
	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)
(0,+3)	-0,10%	(0,81) [b]	-0,04%	(0,93)	0,31% *	(0,88)	0,36% *	(0,92) [b]
(0,+6)	-0,10%	(0,83) [b]	-0,04%	(0,95)	0,18%	(0,90)	0,24%	(0,93) [b]
(0,+12)	-0,11%	(0,86) [c]	-0,05%	(0,95)	0,08%	(0,92)	0,15%	(0,93) [c]
(0,+24)	-0,12%	(0,89) [c]	-0,05%	(0,95)	0,03%	(0,92)	0,10%	(0,94)
(0,+36)	-0,11%	(0,89) [c]	-0,04%	(0,96)	0,01%	(0,92)	0,08%	(0,94)
(0,+48)	-0,11%	(0,89) [c]	-0,04%	(0,95)	-0,01%	(0,92)	0,07%	(0,94)

Panel C: Full sample, Fama French 4-factor (Carhart) model

	Dollar weights				Relative weights			
	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)	Equal-W	(Adj. R^2)	Value-W	(Adj. R^2)
(0,+3)	-0,12%	(0,82) [a]	-0,02%	(0,93) [c]	0,38% **	(0,88) [b]	0,47% ***	(0,94) [a]
(0,+6)	-0,12%	(0,84) [a]	-0,01%	(0,95) [c]	0,24%	(0,91) [a]	0,34% ***	(0,96) [a]
(0,+12)	-0,05%	(0,86)	0,01%	(0,96) [a]	0,15%	(0,92) [a]	0,21% **	(0,97) [a]
(0,+24)	-0,03%	(0,88)	0,03%	(0,97) [a]	0,15%	(0,92) [a]	0,19% **	(0,97) [a]
(0,+36)	0,01%	(0,87)	0,03%	(0,97) [a]	0,14%	(0,91) [a]	0,15% *	(0,97) [a]
(0,+48)	0,10%	(0,87)	0,05%	(0,97) [a]	0,24% *	(0,91) [a]	0,19% ***	(0,98) [a]

Panel D: Subsample analysis, by firm repurchasing frequency.

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Infrequent	0,09%	0,17%	0,71% ***	0,80% ***	0,07%	0,18%	0,74% ***	0,83% ***
Frequent	-0,10%	-0,03%	0,11%	0,19% *	-0,14%	-0,04%	0,11%	0,20% *
Frequent - Infrequent	-0,19%	-0,20%	-0,60% **	-0,61% ***	-0,21%	-0,22%	-0,63% *	-0,63% ***
(0,+6)								
Infrequent	0,03%	0,13%	0,51% ***	0,62% ***	0,03%	0,14%	0,54% ***	0,64% ***
Frequent	-0,08%	-0,02%	0,11%	0,17%	-0,11%	-0,03%	0,11%	0,19% *
Frequent - Infrequent	-0,11%	-0,15%	-0,40% *	-0,45% **	-0,14%	-0,17%	-0,43% *	-0,45% ***
(0,+12)								
Infrequent	-0,12%	-0,05%	0,30% *	0,38% **	-0,12%	-0,04%	0,31% **	0,38% ***
Frequent	0,01%	0,05%	0,20%	0,24% **	-0,01%	0,04%	0,21%	0,26% ***
Frequent - Infrequent	0,13%	0,10%	-0,10%	-0,14%	0,11%	0,08%	-0,10%	-0,12%
(0,+24)								
Infrequent	-0,01%	0,04%	0,24%	0,29% *	0,03%	0,09%	0,28% *	0,33% ***
Frequent	-0,02%	-0,01%	0,17%	0,19% *	-0,04%	0,00%	0,18%	0,22% **
Frequent - Infrequent	-0,01%	-0,05%	-0,07%	-0,10%	-0,07%	-0,09%	-0,10%	-0,11%
(0,+36)								
Infrequent	0,03%	0,03%	0,21%	0,21%	0,07%	0,10%	0,24%	0,27% ***
Frequent	0,04%	-0,02%	0,21%	0,17%	0,02%	0,00%	0,23%	0,21% ***
Frequent - Infrequent	0,01%	-0,05%	0,00%	-0,04%	-0,05%	-0,10%	-0,01%	-0,06%
(0,+48)								
Infrequent	0,09%	0,02%	0,23% *	0,17%	0,13%	0,09%	0,27% **	0,23% ***
Frequent	0,05%	-0,04%	0,28% *	0,19% *	0,04%	-0,02%	0,30% **	0,24% ***
Frequent - Infrequent	-0,04%	-0,06%	0,05%	0,02%	-0,09%	-0,11%	0,03%	0,01%

Table 13: Continued

Panel E: Subsample analysis, by amount of net insider purchases

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Low insider net buys	-0,09%	-0,02%	0,27%	0,34% **	-0,12%	-0,02%	0,28%	0,35% **
High insider net buys	-0,01%	0,29%	0,48% **	0,56% ***	-0,02%	0,30%	0,50% ***	0,58% ***
High - Low	0,08%	0,31%	0,21%	0,22%	0,10%	0,32%	0,22%	0,23%
(0,+6)								
Low insider net buys	-0,11%	0,08%	0,35% *	0,44% ***	-0,12%	0,08%	0,36% *	0,46% ***
High insider net buys	-0,07%	0,10%	0,37% **	0,46% ***	-0,06%	0,10%	0,39% **	0,48% ***
High - Low	0,04%	0,02%	0,02%	0,02%	0,06%	0,02%	0,03%	0,02%
(0,+12)								
Low insider net buys	0,10%	-0,05%	0,20%	0,26%	0,12%	-0,04%	0,20%	0,26% *
High insider net buys	0,15%	0,15%	0,27%	0,34% **	0,16%	0,15%	0,28% *	0,35% ***
High - Low	0,05%	0,20%	0,07%	0,08%	0,04%	0,19%	0,08%	0,09%
(0,+24)								
Low insider net buys	0,29% *	-0,03%	0,15%	0,19%	0,33% ***	0,01%	0,18%	0,22% *
High insider net buys	0,19% *	0,09%	0,11%	0,14%	0,22% **	0,13%	0,13%	0,18%
High - Low	-0,10%	0,12%	-0,04%	-0,05%	-0,11%	0,12%	-0,05%	-0,04%
(0,+36)								
Low insider net buys	0,21%	0,10%	0,23%	0,22% *	0,27% ***	0,15%	0,26% *	0,27% ***
High insider net buys	0,17%	0,00%	0,09%	0,08%	0,21% ***	0,05%	0,12%	0,13%
High - Low	-0,04%	-0,10%	-0,14%	-0,14%	-0,06%	-0,10%	-0,14%	-0,14%
(0,+48)								
Low insider net buys	0,17%	0,07%	0,27% *	0,20% *	0,23% ***	0,12%	0,30% **	0,25% ***
High insider net buys	0,19% *	0,06%	0,29% *	0,21%	0,24% ***	0,12%	0,33% **	0,28% **
High - Low	0,02%	-0,01%	0,02%	0,01%	0,01%	0,00%	0,03%	0,03%

Panel F: Subsample analysis, by prior six month return

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Prior return negative	-0,17%	-0,10%	0,36% *	0,45% **	-0,18%	-0,09%	0,38% **	0,47% ***
Prior return positive	-0,18%	-0,12%	0,29%	0,35% ***	-0,25%	-0,15%	0,26%	0,34% ***
Negative - Positive	0,01%	0,02%	0,07%	0,10%	0,07%	0,06%	0,12%	0,13%
(0,+6)								
Prior return negative	-0,28%	-0,20%	0,17%	0,28%	-0,29%	-0,19%	0,20%	0,30% **
Prior return positive	0,00%	0,07%	0,20%	0,28% ***	-0,04%	0,06%	0,19%	0,28% ***
Negative - Positive	-0,28%	-0,27%	-0,03%	0,00%	-0,25%	-0,25%	0,01%	0,02%
(0,+12)								
Prior return negative	-0,27%	-0,21%	0,10%	0,18%	-0,27%	-0,20%	0,12%	0,18% *
Prior return positive	0,06%	0,11%	0,18%	0,24% **	0,05%	0,11%	0,18%	0,24% ***
Negative - Positive	-0,33%	-0,32% **	-0,08%	-0,06%	-0,32%	-0,31% **	-0,06%	-0,06%
(0,+24)								
Prior return negative	-0,15%	-0,12%	0,07%	0,11%	-0,13%	-0,08%	0,11%	0,15% *
Prior return positive	0,03%	0,06%	0,16%	0,19% *	0,02%	0,07%	0,17%	0,21% **
Negative - Positive	-0,18%	-0,18%	-0,09%	-0,08%	-0,15%	-0,15%	-0,06%	-0,06%
(0,+36)								
Prior return negative	-0,04%	-0,05%	0,06%	0,05%	-0,02%	0,00%	0,10%	0,11%
Prior return positive	0,02%	0,01%	0,15%	0,14%	0,01%	0,03%	0,17%	0,18% **
Negative - Positive	-0,06%	-0,06%	-0,09%	-0,09%	-0,03%	-0,03%	-0,07%	-0,07%
(0,+48)								
Prior return negative	0,08%	-0,01%	0,18%	0,11%	0,10%	0,04%	0,22%	0,18% **
Prior return positive	0,10%	0,02%	0,25% *	0,18% *	0,09%	0,05%	0,27% **	0,23% ***
Negative - Positive	-0,02%	-0,03%	-0,07%	-0,07%	0,01%	-0,01%	-0,05%	-0,05%

Panel G: Subsample analysis, by whether relative repurchase price (RRP) was done at a discount or premium to average CRSP price for three months after repurchase.

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Repurchased at discount	1,68% ***	1,72% ***	2,75% ***	2,80% ***	1,66% ***	1,71% ***	2,78% ***	2,82% ***
Repurchased at premium	-1,99% ***	-1,93% ***	-2,47% ***	-2,40% ***	-2,02% ***	-1,93% ***	-2,46% ***	-2,39% ***
Discount - Premium	3,67% ***	3,65% ***	5,22% ***	5,20% ***	3,68% ***	3,64% ***	5,24% ***	5,21% ***
(0,+6)								
Repurchased at discount	0,76% ***	0,83% ***	1,53% ***	1,61% ***	0,73% ***	0,82% ***	1,54% ***	1,63% ***
Repurchased at premium	-1,18% ***	-1,10% ***	-1,30% ***	-1,20% ***	-1,18% ***	-1,09% ***	-1,27% ***	-1,18% ***
Discount - Premium	1,94% ***	1,93% ***	2,83% ***	2,81% ***	1,91% ***	1,91% ***	2,81% ***	2,81% ***
(0,+12)								
Repurchased at discount	0,46% ***	0,51% ***	0,87% ***	0,94% ***	0,44% ***	0,51% ***	0,87% ***	0,94% ***
Repurchased at premium	-0,76% ***	-0,70% ***	-0,80% ***	-0,73% ***	-0,75% ***	-0,69% ***	-0,79% ***	-0,73% ***
Discount - Premium	1,22% ***	1,21% ***	1,67% ***	1,67% ***	1,19% ***	1,20% ***	1,66% ***	1,67% ***
(0,+24)								
Repurchased at discount	0,31% **	0,34% ***	0,60% ***	0,63% ***	0,30% **	0,35% ***	0,61% ***	0,66% ***
Repurchased at premium	-0,57% ***	-0,54% ***	-0,49% **	-0,45% **	-0,55% ***	-0,50% ***	-0,45% **	-0,41% ***
Discount - Premium	0,88% ***	0,88% ***	1,09% ***	1,08% ***	0,85% ***	0,85% ***	1,06% ***	1,07% ***
(0,+36)								
Repurchased at discount	0,27% *	0,25% ***	0,48% ***	0,47% ***	0,25% *	0,27% ***	0,50% ***	0,52% ***
Repurchased at premium	-0,41% **	-0,43% ***	-0,36% *	-0,37% **	-0,39% **	-0,38% ***	-0,31% *	-0,30% **
Discount - Premium	0,68% ***	0,68% ***	0,84% ***	0,84% ***	0,64% ***	0,65% ***	0,81% ***	0,82% ***
(0,+48)								
Repurchased at discount	0,31% **	0,23% ***	0,53% ***	0,46% ***	0,30% **	0,26% ***	0,55% ***	0,51% ***
Repurchased at premium	-0,23%	-0,32% **	-0,20%	-0,27% *	-0,21%	-0,27% **	-0,15%	-0,20% *
Discount - Premium	0,54% **	0,55% ***	0,73% ***	0,73% ***	0,51% **	0,53% ***	0,70% ***	0,71% ***

Table 13: Continued

Panel H: Subsample analysis, by level of institutional ownership

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Below sample median	-0,09%	-0,04%	0,35% **	0,43% ***	-0,14%	-0,05%	0,37% **	0,45% ***
Above sample median	0,06%	0,14%	0,47% **	0,55% ***	0,03%	0,14%	0,47% **	0,56% ***
High - Low	0,15%	0,18%	0,12%	0,12%	0,17%	0,19%	0,10%	0,11%
(0,+6)								
Below sample median	-0,13%	-0,07%	0,32% **	0,41% **	-0,17%	-0,08%	0,34% **	0,43% ***
Above sample median	0,06%	0,15%	0,31% *	0,41% ***	0,05%	0,16%	0,32% *	0,42% ***
High - Low	0,19%	0,22%	-0,01%	0,00%	0,22%	0,24%	-0,02%	-0,01%
(0,+12)								
Below sample median	-0,04%	0,01%	0,24%	0,31% **	-0,05%	0,01%	0,25% *	0,31% **
Above sample median	0,07%	0,14%	0,23%	0,31% **	0,07%	0,14%	0,24%	0,31% ***
High - Low	0,11%	0,13%	-0,01%	0,00%	0,12%	0,13%	-0,01%	0,00%
(0,+24)								
Below sample median	-0,02%	0,00%	0,18%	0,21% *	-0,04%	0,00%	0,20%	0,24% ***
Above sample median	0,10%	0,14%	0,23%	0,27% *	0,11%	0,17%	0,26%	0,31% ***
High - Low	0,12%	0,14%	0,05%	0,06%	0,15%	0,17%	0,06%	0,07%
(0,+36)								
Below sample median	0,04%	0,01%	0,21%	0,20% *	0,01%	0,02%	0,23% *	0,24% ***
Above sample median	0,12%	0,11%	0,18%	0,17%	0,12%	0,15%	0,21%	0,23% **
High - Low	0,08%	0,10%	-0,03%	-0,03%	0,11%	0,13%	-0,02%	-0,01%
(0,+48)								
Below sample median	0,07%	-0,02%	0,25%	0,18% *	0,05%	0,00%	0,27% **	0,23% ***
Above sample median	0,26% *	0,18%	0,30%	0,22% *	0,27% *	0,23% **	0,33% **	0,28% ***
High - Low	0,19%	0,20%	0,05%	0,04%	0,22%	0,23% *	0,06%	0,05%

Panel I: Subsample analysis, by level of hedge fund ownership

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Below sample median	0,25%	0,20%	0,48%	0,34%	0,83%	0,90%	0,97%	1,58%
Above sample median	1,02%	1,00%	0,76%	0,54%	1,67% **	2,03% **	1,51% *	0,92%
High - Low	0,77%	0,80%	0,28%	0,20%	0,84%	1,13%	0,54%	-0,66%
(0,+6)								
Below sample median	-0,06%	-0,08%	0,57%	0,50%	-0,10%	-0,15%	0,62%	0,55%
Above sample median	0,83%	0,84%	0,62%	0,55%	0,89%	0,88%	0,71%	0,52%
High - Low	0,89%	0,92%	0,05%	0,05%	0,99%	1,03%	0,09%	-0,03%
(0,+12)								
Below sample median	-0,05%	-0,01%	0,56%	0,51%	-0,07%	-0,06%	0,55%	0,49%
Above sample median	0,93%	1,00%	0,48%	0,46%	0,91%	0,94%	0,49%	0,44%
High - Low	0,98% *	1,01% *	-0,08%	-0,05%	0,98%	1,00%	-0,06%	-0,05%
(0,+24)								
Below sample median	-0,09%	-0,13%	0,38%	0,29%	-0,09%	-0,13%	0,39%	0,29%
Above sample median	0,68% *	0,67% *	0,61% **	0,54% **	0,68% *	0,66% *	0,61% **	0,51% **
High - Low	0,77% **	0,80% **	0,23%	0,25%	0,77%	0,79%	0,22%	0,22%
(0,+36)								
Below sample median	0,01%	-0,04%	0,35%	0,25%	-0,02%	-0,08%	0,32%	0,22%
Above sample median	0,67% **	0,65% **	0,56% **	0,50% **	0,67% **	0,63% **	0,56% **	0,40% **
High - Low	0,66%	0,69%	0,21% **	0,25% **	0,69% **	0,71% **	0,24%	0,18%
(0,+48)								
Below sample median	-0,14%	-0,18%	-0,06%	-0,11%	0,01%	-0,02%	0,09%	0,06%
Above sample median	0,19%	0,14%	0,08%	0,05%	0,32%	0,29%	0,22%	0,28% *
High - Low	0,33%	0,32%	0,14%	0,16%	0,31%	0,31%	0,13%	0,22%

Panel J: Subsample analysis, by liquidity ratio

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Below sample median	-0,09%	-0,02%	0,38% **	0,47% ***	-0,13%	-0,03%	0,39% **	0,48% ***
Above sample median	0,08%	0,13%	0,28%	0,35% **	0,09%	0,15%	0,29% *	0,37% **
High - Low	0,17%	0,15%	-0,10%	-0,12%	0,22%	0,18%	-0,10%	-0,11%
(0,+6)								
Below sample median	-0,10%	-0,02%	0,22%	0,32% **	-0,12%	-0,02%	0,23%	0,34% ***
Above sample median	0,03%	0,10%	0,19%	0,28% *	0,05%	0,12%	0,21%	0,29% **
High - Low	0,13%	0,12%	-0,03%	-0,04%	0,17%	0,14%	-0,02%	-0,05%
(0,+12)								
Below sample median	-0,05%	0,01%	0,18%	0,25%	-0,06%	0,01%	0,18%	0,25% **
Above sample median	-0,02%	0,03%	0,07%	0,14%	-0,01%	0,04%	0,08%	0,14%
High - Low	0,03%	0,02%	-0,11%	-0,11%	0,05%	0,03%	-0,10%	-0,11%
(0,+24)								
Below sample median	-0,03%	0,00%	0,14%	0,18%	-0,03%	0,02%	0,17%	0,22% **
Above sample median	-0,02%	0,00%	0,07%	0,11%	0,03%	0,05%	0,10%	0,14%
High - Low	0,01%	0,00%	-0,07%	-0,07%	0,06%	0,03%	-0,07%	-0,08%
(0,+36)								
Below sample median	0,01%	-0,01%	0,12%	0,11%	0,00%	0,02%	0,14%	0,16%
Above sample median	0,06%	0,04%	0,12%	0,12%	0,12%	0,11%	0,16%	0,17% *
High - Low	0,05%	0,05%	0,00%	0,01%	0,12%	0,09%	0,02%	0,01%
(0,+48)								
Below sample median	0,10%	0,01%	0,23%	0,15%	0,09%	0,05%	0,26% *	0,21% **
Above sample median	0,09%	0,01%	0,17%	0,10%	0,16%	0,09%	0,21%	0,16% *
High - Low	-0,01%	0,00%	-0,06%	-0,05%	0,07%	0,04%	-0,05%	-0,05%

Table 13: Continued

Panel K: Subsample analysis, by number of analysts following

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Below sample median	-0,16%	-0,09%	0,41% *	0,49% ***	-0,18%	-0,09%	0,43% **	0,52% ***
Above sample median	-0,26%	-0,18%	0,24%	0,33% **	-0,27%	-0,17%	0,26%	0,35% ***
High - Low	-0,10%	-0,09%	-0,17%	-0,16%	-0,09%	-0,08%	-0,17%	-0,17%
(0,+6)								
Below sample median	-0,25%	-0,17%	0,18%	0,27%	-0,27%	-0,17%	0,20%	0,29% **
Above sample median	-0,15%	-0,06%	0,28% *	0,38% **	-0,16%	-0,05%	0,30% *	0,40% ***
High - Low	0,10%	0,11%	0,10%	0,11%	0,11%	0,12%	0,10%	0,11%
(0,+12)								
Below sample median	-0,23%	-0,17%	0,09%	0,16%	-0,23%	-0,16%	0,10%	0,16%
Above sample median	-0,03%	0,03%	0,15%	0,22%	-0,03%	0,04%	0,16%	0,22% *
High - Low	0,20%	0,20%	0,06%	0,06%	0,20%	0,20%	0,06%	0,06%
(0,+24)								
Below sample median	-0,09%	-0,05%	0,09%	0,12%	-0,07%	-0,01%	0,11%	0,16%
Above sample median	-0,05%	-0,02%	0,14%	0,18%	-0,03%	0,02%	0,17%	0,22% **
High - Low	0,04%	0,03%	0,05%	0,06%	0,04%	0,03%	0,06%	0,06%
(0,+36)								
Below sample median	-0,03%	-0,05%	0,09%	0,08%	-0,01%	0,01%	0,12%	0,13%
Above sample median	-0,08%	-0,10%	0,15%	0,15%	-0,06%	-0,05%	0,18%	0,21% **
High - Low	-0,05%	-0,05%	0,06%	0,07%	-0,05%	-0,06%	0,06%	0,08%
(0,+48)								
Below sample median	0,03%	-0,05%	0,20%	0,13%	0,06%	0,01%	0,24% *	0,19% **
Above sample median	0,00%	-0,08%	0,24%	0,17%	0,03%	-0,02%	0,28% *	0,23% **
High - Low	-0,03%	-0,03%	0,04%	0,04%	-0,03%	-0,03%	0,04%	0,04%

Panel L: Subsample analysis, by use of an undervaluation index

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
U-index < 8 (out of 15)	-0,16%	-0,10%	0,02%	0,09%	-0,21%	-0,12%	-0,02%	0,08%
U-index > 10 (out of 15)	0,31%	0,38% *	0,34%	0,42% **	0,32%	0,40% *	0,36% *	0,44% **
High - Low	0,47%	0,48% *	0,32%	0,33%	0,53% *	0,52% **	0,38%	0,36% **
(0,+6)								
U-index < 8 (out of 15)	-0,07%	0,00%	0,12%	0,20% *	-0,11%	-0,01%	0,10%	0,20% *
U-index > 10 (out of 15)	0,08%	0,17%	0,13%	0,23%	0,10%	0,19%	0,16%	0,26%
High - Low	0,15%	0,17%	0,01%	0,03%	0,21%	0,20%	0,06%	0,06%
(0,+12)								
U-index < 8 (out of 15)	0,03%	0,08%	0,20%	0,27% **	0,01%	0,08%	0,20%	0,27% ***
U-index > 10 (out of 15)	0,01%	0,08%	0,04%	0,11%	0,03%	0,09%	0,05%	0,11%
High - Low	-0,02%	0,00%	-0,16%	-0,16%	0,02%	0,01%	-0,15%	-0,16%
(0,+24)								
U-index < 8 (out of 15)	0,02%	0,04%	0,20%	0,24% **	0,00%	0,05%	0,21%	0,26% ***
U-index > 10 (out of 15)	-0,03%	0,01%	0,05%	0,10%	0,01%	0,06%	0,08%	0,13%
High - Low	-0,05%	-0,03%	-0,15%	-0,14%	0,01%	0,01%	-0,13%	-0,13%
(0,+36)								
U-index < 8 (out of 15)	0,02%	0,00%	0,21%	0,20% *	0,00%	0,02%	0,22%	0,24% ***
U-index > 10 (out of 15)	-0,01%	-0,02%	0,06%	0,07%	0,03%	0,05%	0,10%	0,12%
High - Low	-0,03%	-0,02%	-0,15%	-0,13%	0,03%	0,03%	-0,12%	-0,12%
(0,+48)								
U-index < 8 (out of 15)	0,09%	0,00%	0,30% **	0,22% **	0,08%	0,03%	0,31% **	0,26% ***
U-index > 10 (out of 15)	0,06%	-0,02%	0,11%	0,05%	0,11%	0,07%	0,14%	0,11%
High - Low	-0,03%	-0,02%	-0,19%	-0,17%	0,03%	0,04%	-0,17%	-0,15%

Panel M: Subsample analysis, by relative repurchase program size

	3-Factor model				4-Factor model			
	Dollar weights		Relative weights		Dollar weights		Relative weights	
	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W	Equal-W	Value-W
(0,+3)								
Lowest quartile	-0,39%	-0,31% *	0,34% *	0,43% ***	-0,41% *	-0,31% *	0,35% *	0,44% ***
Highest quartile	0,15%	0,23%	0,55% ***	0,65% ***	0,12%	0,23%	0,56% ***	0,67% ***
High - Low	0,54% **	0,54% *	0,21%	0,22%	0,53% *	0,54% **	0,21%	0,23%
(0,+6)								
Lowest quartile	-0,20%	-0,10%	0,17%	0,27% *	-0,19%	-0,09%	0,19%	0,28% **
Highest quartile	0,14%	0,23%	0,28%	0,38% **	0,12%	0,23%	0,29%	0,40% ***
High - Low	0,34%	0,33%	0,11%	0,11%	0,31%	0,32%	0,10%	0,12%
(0,+12)								
Lowest quartile	-0,04%	0,02%	0,16%	0,23%	-0,04%	0,02%	0,17%	0,23% *
Highest quartile	0,20%	0,27% *	0,21%	0,28% *	0,19%	0,27% *	0,21%	0,28% **
High - Low	0,24%	0,25%	0,05%	0,05%	0,23%	0,25%	0,04%	0,05%
(0,+24)								
Lowest quartile	0,00%	0,03%	0,06%	0,09%	0,02%	0,06%	0,08%	0,13%
Highest quartile	0,17%	0,20%	0,24%	0,28% *	0,16%	0,22%	0,26%	0,32% **
High - Low	0,17%	0,17%	0,18%	0,19%	0,14%	0,16%	0,18%	0,19%
(0,+36)								
Lowest quartile	0,03%	0,01%	0,11%	0,10%	0,04%	0,05%	0,14%	0,15%
Highest quartile	0,21%	0,20%	0,17%	0,16%	0,21%	0,23% *	0,20%	0,22%
High - Low	0,18%	0,19%	0,06%	0,06%	0,17%	0,18%	0,06%	0,07%
(0,+48)								
Lowest quartile	0,08%	-0,01%	0,22%	0,15%	0,10%	0,04%	0,26%	0,21% *
Highest quartile	0,34% **	0,26% **	0,25%	0,18%	0,33% **	0,29% **	0,29% *	0,25% **
High - Low	0,26%	0,27%	0,03%	0,03%	0,23%	0,25%	0,03%	0,04%