Are Open Market Share Repurchase Programs Really Flexible?

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ABSTRACT

I use the recent financial crisis and utilize the predetermined variations in stock repurchase program ending dates to show that open market share repurchase programs are not as flexible as one might expect. My difference-in-difference estimator shows that once firms have announced such programs, they sacrifice real activities to finish them. Specifically, firms with open market share repurchase programs ending after December 2007 cut 1.9 percentage points more of capital investment, four employees more per million dollars of capital stock, and 9 percentage points more of R&D expense to fund the share repurchases than otherwise similar firms with programs ending before December 2007. The reductions represent a 7%-15% decrease of pre-crisis levels. The freed-up capital indeed goes toward the share repurchase programs: firms buyback on average 84% of the predetermined amount of the shares.

Keywords: Payout, Share Repurchase, Corporate Investment, Financial Crisis

JEL Classification: G01, G31, G35

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I. Introduction

Share repurchase programs are playing an increasingly important role in firms' payout polices. In 1995, only 15% of publicly listed firms in the United States repurchased shares. This number increased to 45% by 2012. Meanwhile, the dollar amount of total share repurchases among publicly listed U.S. firms increased from $90 billion of real 2012 dollars in 1995 to $364 billion in 2012 (Farre-Mensa et al., 2014). Share repurchases have become the dominant form of corporate payout (Skinner, 2008; Floyd et al., 2015). Open market share repurchase programs represent more than 90% of all the share repurchase programs announced (Stephens and Weisbach, 1998; Grullon and Michaely, 2004).

Brav et al. (2005) survey 384 managers about their payout decisions. The managers report that they prefer open market share repurchases because share repurchase programs provide managers with great flexibility in the amount and timing of stock buybacks. Specifically, the managers can decide how many shares or the dollar amount to buyback at announcement. Meanwhile, they have the option to time the market and only buyback when the market conditions are favorable (Dittmar and Field, 2015). Additionally, the managers do not have to repurchase all the shares or the dollar amount announced. They can let the repurchase programs expire or retire them instead.

However, is this really the case in practice? Specifically, are the managers simply going to stop buying back their shares when facing financing difficulties that prevent them from doing so? In this paper, I would like to ask: given the flexibility of share repurchase programs, do managers cut their share repurchases to fund other firm activities? Or do the managers sacrifice firms' real activities to complete their share repurchase programs?

To unveil the true relation between firms' completion of open market share repurchase programs and financial policies is difficult due to endogeneity concerns. During normal times, the relation is predetermined and everything is anticipated. An ordinary least squares (OLS) regression of real outcome variables on share repurchase completion is

subject to omitted variable bias. In this paper, I consider open market share repurchase programs as contracts that are announced well ahead of time. I exploit the predetermined variations in open market share repurchase program ending dates surrounding the 2007 financial crisis to overcome the empirical difficulties. When firms announce their open market share repurchase programs, they also announce the ending dates of these programs. At announcement, it is difficult for the firms to anticipate the upcoming financial crisis. As a result, they were not able to strategically plan the optimum ending dates of their open market share repurchase programs to protect themselves against the downturn. My identifying assumption is that having repurchase programs with ending dates after the recent financial crisis is uncorrelated with firms' response to the crisis through channels other than share repurchases. I first identify a sample of firms who announced open market share repurchase programs before the recent financial crisis with ending dates after it (the treatment group). The control firms are those who announced open market share repurchase programs before the recent financial crisis whose programs also end before it.

Using a difference-in-difference approach, I find that firms sacrifice real activities to a great extent to fund their open market share repurchase programs. My difference-in-difference point estimates show that treatment group firms cut 1.9 and 9 percentage points more in capital investment and R&D expense, respectively, and layoff four more employees per million dollars of capital stock than control firms. These results are economically large. The cutbacks represent around 7% in capital investment, 6.9% in employment, and 15.4% in R&D expense of the pre-crisis level. In addition, I find that the firms in the treatment group complete their open market share repurchase programs at a very high rate, on average about 84%. The evidence confirms that the reductions from real activities are diverted to complete share repurchases. In conclusion, these results indicate that open market share repurchase programs are not as flexible as one might think. Once firms announce these programs, they will complete them, even at a cost.

One alternative explanation of the results is that firms have already completed the majority of their open market share repurchase programs before December 2007. If this is the case, all the treatment group would only have a small portion of share repurchases left. As a result, the decrease in real activities is not a consequence of share repurchase programs, rather some other factors affecting firms' decisions. To mitigate this concern, I hand-collected the share repurchase program status of all the treatment group around December 2007 from the closest 10-K or 10-Q filings. I find that the treatment group on average repurchased less than 35% of the predetermined amount, in terms of both dollar value and numbers of shares. The above findings indicate that firms are on track with their share repurchases and it is not trivial to finish buying the rest.

The most common concern with a difference-in-difference study is that the pre-treatment parallel trends between the treatment and control groups need to be satisfied. Having open market share repurchase programs ending after the recent financial crisis must be the only factor driving the reductions in real activities for my arguments to be valid. Further, I want to make sure that treatment and control firms have similar share repurchase program durations. For example, if one firm always announces repurchase programs with six-month durations and another firm always announces repurchase programs lasting two years, they might be fundamentally different. Another concern is that there might be a latent macro-level variable that is driving the sharp treatment-control contrast in the post-treatment period.

I address these concerns in several ways. First, I match a firm in the treatment group with a firm in the control group that has a similar duration. Second, I show that the outcome variables for the treatment and control groups have no difference in pre-exsiting trends. Meanwhile, I control for a battery of firm characteristics along with firm fixed effects, year fixed effects, and industry times year fixed effects. Third, I conduct placebo tests by assuming that a financial crisis takes place in December 2004, December 2005, and December 2006. If the results are due to an omitted variable bias, then I should

observe similar effects of open market share repurchase programs on firms' real activities during those placebo periods as well. However, the tests show no statistically significant differences between the treatment and control groups during the placebo periods. Fourth, I use the 2001 dotcom period as a further robustness check; in 2001, there is a recession but no credit supply shock. The goal is to differentiate the credit supply channel of the recent financial crisis. I do not find any differences in real activities between the treatment and control groups around 2001. Fifth, I implement a difference-in-difference matching estimator approach, developed by Abadie and Imbens (2006), by matching on firm size, Q, leverage, cash flow, cash holdings, duration of repurchase program, and industry. The results are qualitatively similar to my regression approach. Lastly, I utilize my full sample of repurchasing firms by adding controls for share repurchase duration. Specifically, instead of matching on duration, I add controls for share repurchase duration up to the 4th order polynomial to address the linearity assumption and interact all the control variables with the treated dummy to eliminate all possible differences between the treatment and control groups. I find qualitatively similar results.

Next, I split the sample based on whether the firms have long-term financial analyst forecast coverage. Analysts allocate their efforts to firms with good future prospects (McNichols and O'Brien, 1997). Firms with more analyst coverage get more attention from investors, hence realize lower capital costs (Merton, 1987). My results show that firms without long-term analyst forecast coverage cut back real activities significantly. Based on aforementioned theory by McNichols and O'Brien (1997) and Merton (1987), firms that scale back investment are those with an uncertain future and facing higher costs. They are better off using the funds to support their core activities. However, I find that the funds are diverted to share repurchases. This result provides further support that share repurchases are not flexible, even the firms in most need of resources are trying to complete them.

Further, I show that having open market share repurchase programs ending after the

recent financial crisis does not impose negative long-term consequences on firms' capital investment, employment, or R&D expense. Nevertheless, I am not trying to fully analyze the long-term effects of share repurchase programs. I simply extend the treatment window by two years. My results show positive coefficients on the long-term variables, although not all are statistically significant. Firms may have delayed their investment to after the crisis or they had better access to external financing so they did not need to take a hit on their real activities to fund open market share repurchase programs.

I next examine a subsample of share repurchase programs announced in 2006 and 2007. As these firms announce their repurchases so close to the recent financial crisis, they may have believed they were more resistant to financial downturns (Ouimet and Simintzi, 2015). I find these firms faced more severe cuts to real activities in magnitude as compared to the full sample, which includes all three years before the recent financial crisis.

To get a more complete picture about share repurchase flexibility, I examine whether the cutback on real activities spillover to operating activities. I look at the profit margin and sales growth to get an idea of operating performance changes between the treatment and control groups. I find that the treatment group experiences 1 percentage point lower profit margin than the control group. That's equivalent to a 6% decrease in pre-crisis level profit margin. I also find the treatment group had a 2.8 percentage point lower sales growth rate than the control firms.

This paper contributes to the extensive literature on share repurchases that focus on their (in)flexibility and completion. Many papers document the reasons why firms buyback their stocks, such as stock price undervaluation (Ikenberry et al., 1995; Brockman and Chung, 2001; Peyer and Vermaelen, 2009), to mitigate agency problems by returning excess cash to investors (Dittmar, 2000), employee stock option exercise anti-dilution (Kahle, 2002), and managers think share repurchase programs are the best investments

as compared to other investment opportunities (Grullon and Michaely, 2004).[1] However, fewer researchers examine the completion of open market share repurchase programs. Papers mainly focus on the reasons why firms complete their share repurchases. For example, Stephens and Weisbach (1998) find that firms increase their share repurchases when the degree of perceived undervaluation is lower. Oded (2009) models the free cash flow and adverse selection problems in share repurchase decisions and finds that the wider the bid-ask spread, the lower the share repurchase completion rate. Chemmanur and Li (2014) finds that institutional trading immediately after an open market repurchase announcement has significant predictive power for the actual purchases by the firm. Bonaimé (2012) documents that a firm's reputation from prior repurchase activities is a determinant of the current repurchase completion rate. Firms have higher announcement returns of new share repurchase programs given they completed their prior programs. In this paper, I examine the real and operational consequences of completing share repurchase programs as this has yet to be reported in the literature.

To the best of my knowledge, I am the first to document the (in)flexibility of open market share repurchase programs and through the lens of real activities. Almeida et al. (2015) also looks at the real consequences of share repurchase programs and finds that share repurchases are associated with reductions in employment and investment. However, these authors focus only on earnings per share (EPS) motivated repurchases, which could be different from other repurchases. On the other hand, the identification strategy in my paper forces me to focus on the consequences of completing repurchase programs in the aftermath of the recent financial crisis. Thus, the results may not generalize to other, normal periods.

The rest of the paper is organized as the following: In Section II, I discuss the empirical strategy and sample selection. The main results are presented in Section III, while Section IV provides additional results. I describe the robustness tests in Section V and conclude

[1] The list here is not exhaustive. See Farre-Mensa et al. (2014) for a review of the literature.

in Section VI.

II. Empirical Design

I start this section with institutional background on open market share repurchase programs and discuss the identification strategy. I then describe the data and the construction of the variables. I also present the summary statistics.

A. Open Market Share Repurchase Programs

Open market share repurchase programs are becoming increasingly popular among U.S. firms. By 2013, over 40% of U.S. publicly traded firms had initiated open market share repurchase programs, more than threefold the 1995 figure (Skinner, 2008).

After the board of directors' approval, firms usually make public announcements about their open market share repurchase programs. In the announcements, firms disclose the total dollar amount and/or total number of shares for repurchase. Those two numbers are generally fixed values instead of ranges. Firms on average have open market share repurchase programs as large as 7% of their total number of shares outstanding (Stephens and Weisbach, 1998). In the announcements, firms also inform investors about the time frame of their open market share repurchase programs, usually with specific ending dates. Some firms choose the announcement day as the starting date while others announce a specific future date as the inception date.[2] The announcements often have disclaimers stating that the managers have the flexibility to decide when and how much to buyback given market conditions throughout the programs. When the managers decide to buyback,

[2]On the announcement day, investors usually observe a 2%-4% abnormal stock return (Lie, 2005) as a positive signal from the market.

they hire a broker-dealer to repurchase shares on their behalf on the open market. The time period between the ending of one program to the starting of the next is usually about two years (Skinner, 2008). The following two paragraphs are excerpts from General Motors Co. and Apple Inc.'s announcements of open market share repurchase programs, respectively.

> *"General Motors Co. (NYSE: GM) today announced a comprehensive capital allocation framework, as improving business performance and strong capital discipline enable increased returns to shareholders. GM said a foundational element of its approach will be to return all available free cash flow to shareholders while it maintains an investment-grade balance sheet underpinned by a target cash balance of $20 billion ... GM also announced that its Board of Directors authorized the initial repurchase of $5 billion in GM shares to begin immediately and conclude before the end of 2016..."*[3]

> *"Apple today announced plans to initiate a dividend and share repurchase program commencing later this year ... Additionally, the Company's Board of Directors has authorized a $10 billion share repurchase program commencing in the Company's fiscal 2013, which begins on September 30, 2012. The repurchase program is expected to be executed over three years, with the primary objective of neutralizing the impact of dilution from future employee equity grants and employee stock purchase programs..."*[4]

B. The 2007 financial crisis

The recent financial crisis is widely regarded as a supply shock in the academic literature. During this period, firms had a hard time accessing external financing. Almeida et al. (2012) document a dramatic credit spread increase for both short- and long-term credit instruments. Ivashina and Scharfstein (2010) find that bank lending falls in all types of loans. Gorton (2009) theoretically models that banks are flying to quality, which leads to

[3]Retrieved at http://media.gm.com/media/us/en/gm/news.detail.html/content/Pages/news/us/en/2015/mar/0309-allocation-framework.html on April 24th, 2015.

[4]Retrieved at https://www.apple.com/pr/library/2012/03/19Apple-Announces-Plans-to-Initiate-Dividend-and-Share-Repurchase-Program.html on April 24th, 2015.

the increased cost of all forms of external capital (Caballero and Krishnamurthy, 2008). During this crisis, the firms in my sample experienced the same credit contractions in the capital markets and needed additional resources to maintain operations and payout. This environment provides me with a natural setting in which the external financing channel to fund share repurchases is shut down.[5] Firms were forced to use their internal funds.

I choose December 2007 as the cutoff date for the identification strategy. The National Bureau of Economic Research (NBER) determines this date to be the beginning point of a recession.[6] NBER finds that the economy reached the peak of its previous expansion in December 2007 using a host of economy-wide measures of economic activity. Consequently, the firms in my sample would start to experience the recession as the economy entered a trough.

C. Identification Strategy

In the spirit of Almeida et al. (2012) and Ouimet and Simintzi (2015), I treat share repurchase programs as contracts that are negotiated and signed ahead of time. Similar to firms' debt maturities that are predetermined with a specific due date as in Almeida et al. (2012) and the labor contracts that are signed at random times but require renewal at a specific future date as in Ouimet and Simintzi (2015), open market share repurchase programs are announced ahead of time with predetermined program ending dates. At the announcements, it was difficult for the managers to correctly predict that the economy will peak in December 2007 and then begin to decline. Therefore, the managers were not able to strategically set the ending dates of their open market share repurchase programs ex ante. I assume that repurchase programs that end after the crisis are uncorrelated

[5]Farre-Mensa et al. (2014) find that about half the firms engage in payout activities and raise external capital to fund for those payouts simultaneously. The popular press also has numerous articles about firms issuing debt to fund share repurchases. For example, please see a recent article on Johnson & Johnson in *The Wall Street Journal* ("A $10 Billion Buyback Doesn't Kill Johnson & Johnson's Deal Hopes", retrieved at http://on.wsj.com/1Pu6AtZ on October 15, 2015).

[6]For more details, please see http://www.nber.org/dec2008.pdf.

with firms' response to the crisis through channels other than share repurchases.

I assign firms into the treatment and control groups based on the announcement and ending dates of their open market share repurchase programs. I require all firms to have announced open market share repurchase programs before December 2007. Firms with open market share repurchase programs ending after December 2007 are assigned to the treatment group, while firms with repurchase programs ending before December 2007 are assigned to the control group. Figure 1 provides an illustration of the assignment of treated and control groups.

[Place Figure 1 about here]

During normal times, the relation between share repurchase decisions and firm policies are predetermined and all firm activities are anticipated. Hence I need to utilize the predetermined variations in the repurchase program ending dates around the 2007 financial crisis as an experiment to examine whether firms will take advantage of the flexibility features of open market share repurchase programs. However, there are four potential concerns I would like to address in some detail.

First, I want to make sure that treatment and control firms have similar share repurchase program durations. For example, if one firm always announces repurchase programs with six-month durations and another firm always announces repurchase programs lasting two years, they might be fundamentally different. To mitigate this concern, I match firms in the treatment group with firms in the control group that have close or the same share repurchase program durations. The matched firms might differ in program starting and ending dates; however, they have almost the same program length. One potential drawback is that this matching process reduces the sample size. To fully utilize my control sample and to address some concerns about matching on duration, I use the full control group in the robustness test.[7] Specifically, I include durations up to

[7] I present this result in Table 13.

the fourth order polynomials, as well as interact all the control variables with the treated dummy as controls. I find qualitatively similar results.

Second, one might argue that since open market share repurchases are so flexible, the managers have the power to not repurchase or to change the ending dates after they realize the financial crisis is imminent. This will possibly contaminate the identification strategy because the ending dates become endogenously determined. However, Bargeron et al. (2015) hand-collected firms' announcements about changing or altering their open market share repurchase programs from news resources for the 1980-2010 period. They find that only 2% of firms make such changes. It is unlikely that the results are driven by this small set of firms.

Third, one might argue that around the cut-off date, the treatment group might have already finished the majority of their share buyback targets. The identification strategy will not unveil the true situation of the treated firms. To address this issue, I hand-collected the treatment group's share repurchase program status around December 2007 from their closest 10-K or 10-Q reports. I find that the treatment group on average only repurchased about 35% of the predetermined amounts of shares as well as dollars. As of that point in time, the treatment group had not yet completed the majority of their goals.[8] This exercise mitigates the concerns that the firms try to accelerate their share repurchases before the financial crisis and had only a small fraction of repurchases not yet completed, supporting that the identification strategy is able to deliver the true effects of the open market share repurchase programs.

Lastly, the control group could be somewhat special since they just happen to finish their repurchases before December 2007. Their managers might have some superior

[8]I find that as of December 2007, on average 355 days had elapsed for the repurchase programs of the treated firms. These programs had an average duration of 1,300 days, so roughly speaking, the firms were about a quarter way through the share repurchase programs as of December 2007. Meanwhile approximately two-thirds of the shares (dollar amount) remained unrepurchased. The evidence above shows that the treatment group was on track with their share repurchases instead of being anomalies in the market.

skills to predict the financial crisis. Skinner (2008) finds that firms announce new share repurchase programs every other year; the announcement gap in my sample is around 2.4 years. Since firms do not have share repurchase programs one immediately after another, the control group must just have completed their previous repurchase programs and are in the gap period. The managers might have anticipated the financial crisis. So they decided to not announce new programs. I argue that this happens naturally as it is part of the characteristics of open market share repurchase programs. For the treatment group, the predetermined ending dates had not yet arrived in December 2007.

D. Sample Selection

The data used in this paper come from two main sources. I use the Securities Data Company (SDC) Mergers and Acquisitions database for open market share repurchase deals, including announcement date, completion date, number of shares (dollar value) authorized, number of shares (dollar value) repurchased, etc. I complement the SDC data with Compustat data for firm characteristics.

For the SDC data, I require the share repurchase programs to be open market share repurchase programs only. I only keep deals with non-missing ending dates. I drop deals where the ending dates are earlier than the announcement dates. Lastly, I require that the deals have matching data from Compustat. I merge the two datasets based on CUSIP and construct treatment and control groups following the procedure described above. I follow Almeida et al. (2012) to apply common filters to the data. I define the pre-crisis period as from 2005 to 2007 and the post-crisis period as from 2009 to 2011. In the 2008 annual reports, firms with fiscal year ending in the early half of the year include a substantial portion of their activities from calendar year 2007. This accounting issue will bias the results in an unclear direction. Thus, I decide to exclude 2008 as a transition year following Ouimet and Simintzi (2015).

For my identification strategy to work, it is crucial that the treatment and control groups have similar share repurchase program durations. For each of the 802 firms that satisfy the treatment group criteria, I find a control firm that has the closest program duration. I present the mean, median, and distributional tests of the matching on duration in Table 1, Panel A.

E. Construction of Variables and Summary Statistics

The main outcome variables are *capital investment*, *employment*, and *R&D expense*. *Capital investment* is defined as capital expenditures scaled by lagged total capital stock (capx/ppent).[9] *Employment* is defined as the number of employees per million dollars of lagged capital stock (emp×1000/ppent). *R&D expense* is defined as the total research and development expense scaled by lagged total capital stock (xrd/ppent). Following Almeida et al. (2004) and Rauh (2006), I include *size*, *Tobin's Q*, *leverage*, *cash holdings*, and *cash flow* as control variables. *Size* is the natural logarithm of total assets (log(at)). *Tobin's Q* is the ratio of the market value of assets to the book value of assets. *Leverage* is the sum of short-term debt (dlc) and long-term debt (dltt). *Cash* is cash and short-term investments (che). *Cash flow* is the sum of income before extraordinary items (ib) and depreciation and amortization (dp). To alleviate endogeneity concerns, I measure all of the control variables prior to the treatment period. All the variables are deflated and scaled accordingly. I winsorize all the variables at the 1% level to reduce the effect of outliers.

[Place Table 1 about here]

Panels B and C in Table 1 present the summary statistics for 2007, which is the pre-event year. Panel B shows the mean, standard deviation, 25th percentile, 50th percentile,

[9] I present the Compustat variable names in parentheses.

and 75th percentile values of the entire sample. On average, *capital investment* and *R&D expense* are around 27% and 58% of firm's capital stock, respectively; each firm has about 58 employees per each million dollars of capital stock. Panel C shows the mean, standard deviation, 25th percentile, 50th percentile, and 75th percentile values of the treatment and control groups separately.

III. Are Repurchases Really Flexible

In my analysis, I use a difference-in-difference estimation approach. Specifically, I estimate regressions of the following form:

$$y_{it} = \beta_1 \cdot post_{it} \times treated_{it} + \delta \cdot X_{it} + \lambda_i + \tau_t + \alpha_j \times \tau_t + \epsilon_{it}. \quad (1)$$

In equation (1), i, j, and t index firm, industry, and year. $post_{it} = 1$ if firm i is in years 2009-2011. $treated_{it} = 1$ if firm i is in the periods when treatment occurs. X_{it} is a set of time-varying firm-level control variables discussed above. λ_i is firm fixed effects, τ_t is year fixed effects, $\alpha_j \times \tau_t$ is industry-year fixed effects, and ϵ_{it} is the error term. β_1, the coefficient of the interaction term, is the focus of the analysis.

[Place Table 2 about here]

To properly implement a difference-in-difference estimation, I have to make sure that the outcome variables of the treatment and control groups follow parallel trends during the periods leading up to the 2007 financial crisis. In Table 2, I present the results. As one can see, the treatment and control groups are statistically similar.

[Place Table 3 about here]

Table 3 reports the main findings. In the regression generating the baseline results, I regress *capital investment*, *employment*, and *R&D expense* on the interaction term, along with firm and year fixed effects to control for unobservable firm heterogeneity and changing economic conditions, respectively. I find a negative and significant coefficient on the interaction term (columns 1, 4, and 7). The results show that firms are cutting their real activities to fund their open market share repurchase programs. I add firm-level controls and report the results in columns 2, 5, and 8 for *capital investment*, *employment*, and *R&D expense*, respectively, to rule out the common factors driving corporate policies. The results remain qualitatively the same as the baseline results. I then add industry times year fixed effects to control for industry-specific environment changes (columns 3, 6, and 9). I find that firms with repurchase programs ending after December 2007 on average cut their investment-to-capital ratio by 1.9 percentage points more than similar firms with share repurchase programs ending before December 2007. Similarly, the treatment group on average terminates four more employees per million dollars of capital stock than the control group while the treatment group on average decreases their R&D expense-to-capital ratio by 9 percentage points more than the control group. In economic terms, these results convey that the 1.9 percentage point decrease in capital investments represents a 7% drop in pre-crisis capital investment levels, the reduction of four employees per million dollars of capital stock represents a drop of 6.9% in pre-crisis employment levels, and the 9 percentage point decrease in R&D expense represents a drop of 15.4% in pre-crisis R&D expense levels. In summary, I show that firms with open market share repurchase programs ending after December 2007 face a substantial reduction in their real activities compared to firms with programs ending before December 2007. The findings are statistically significant and economically large.

[Place Table 4 about here]

So far, I have shown a decrease in investment activities if the firms have open market

share repurchase programs ending after the crisis. However, one might ask whether those with freed-up liquidity indeed go on to fund the share repurchases. In Table 4, I present the post-event repurchase completion rate of the treatment group. I report the percentage of shares repurchased in column (1) and the percentage of dollar value repurchased in column (2). I find that half of the firms complete their open market share repurchase programs within three years after announcement in terms of both the percentage of shares and dollar value. On average, the treatment group buys back 84% of the per-determined amount announced. The completion rates are fairly stable across different repurchase time horizons. This finding is consistent with the repurchase schedule reported in Stephens and Weisbach (1998). This table shows that the firms that cut back on real activities actually did spend the money on open market share repurchase programs instead of diverting the funds to other activities.

[Place Table 5 about here]

For comparative purposes, I report the share repurchase completion rates from a few studies in Table 5. Stephens and Weisbach (1998) back out share repurchase completion rate from dollars spent on repurchases divided by average share price. They find that firms buyback around 82% of the announced shares. Oded (2009) and Bonaimé (2012) use the same SDC data as I do but examine difference sample periods. They find firms complete 92% and 73% of the announced programs, respectively. In a more recent study, Chemmanur and Li (2014) hand-collected actual share repurchase completion data from 10-K and 10-Q. They report an 86% completion rate. My overall sample has a completion rate of around 84%. This result is in line with the aforementioned literature. I can conclude that the liquidity diverted from firms' investments are used to fund the open market share repurchase programs to historical level. These results show that open market share repurchase programs are not as flexible as one might think. Once firms announce these programs, they will complete them even if they need to sacrifice their

real activities. Additionally, Bonaimé (2012) reports a 20% increase in announcement return given completion of prior share repurchase programs. Her findings provide partial explanatory power for why firms are trying to complete the share repurchase programs, as firms care about their reputations and the market expects them to complete their repurchase programs.

However, I do not claim that open market share repurchase programs are at all inflexible. From the data, I observe a 62% decrease in open market share repurchase program announcements in 2009.[10] This finding is consistent with Almeida et al. (2012) and Floyd et al. (2015), in which they both report a reduction in share repurchase announcements during the recent financial crisis. The popular press has also widely reported the decrease in share repurchase initiations, with a historical low in 2009.[11] In summary, I show that open market share repurchase programs are not as flexible as they appear. Firms still have the ability to not announce them. However, once they announce such programs, they will conclude them even if they need to take reductions in real activities.

IV. Additional Results

In this section, I examine a split sample using a long-term analyst forecast coverage subsample. I then examine the longer term consequences of open market share repurchase programs on firms' real activities. I also examine repurchase programs announced in the near term only (i.e. 2006 and 2007). And lastly I consider two operating outcome variables.

[10] In the SDC data, open market share repurchase announcements have decreased from 397 in 2008 to 152 in 2009.

[11] For example, see *The Wall Street Journal* article "Companies' Stock Buybacks Help Buoy the Market" published on September 15, 2014 at http://www.wsj.com/articles/companies-stock-buybacks-help-buoy-the-market-1410823441.

A. Long-Term Analyst Coverage

McNichols and O'Brien (1997) show that analysts allocate their efforts to firms with good future prospects. Merton (1987) documents that firms with more analyst coverage gets more attention from investors and leads to a lower cost of capital. Jung et al. (2015) find that changes in analyst interest is positively associated with future changes in the fundamentals. One can infer that firms without long-term analyst coverage need more resources at the current stage to maintain normal activities. Since open market share repurchase programs appear to have flexibility, one would not expect to see the firms without long-term analyst coverage to cut real activities to fund the share repurchases. If such firms indeed cut capital investment, employment, and R&D expense to buyback shares, then share repurchases are not really flexible.

[Place Table 6 about here]

I split the sample based on firms' long-term analyst forecast coverage. I obtain financial analyst forecast coverage data from I/B/E/S. I define long-term forecast as forecasting firms' EPS more than three years ahead. I use analyst four-year and five-year forecasts in my test. I code a firm as having long-term coverage if at least one analyst is reporting future EPS on the firm. I report the results in Table 6. I implement the same regression specification as in equation (1). I report the four-year coverage sample in columns (1) - (6) and the five-year coverage sample in columns (7) - (12). I find that firms without long-term analyst coverage cut back capital investment, employment, and R&D expense. The results are statistically significant. The magnitudes are higher than the full sample I reported in Table 3, which means the firms in this subsample are cutting back more.

I also tab the data to see if there are any differences in share repurchase completion rates between firms with and without long-term analyst coverage. In unreported results,

I find that the completion rates between the two groups are qualitatively similar.[12] And the completion rates are in line with the full sample and the literature. This evidence shows that the firms without long-term coverage diverted the funds from real activities to share repurchases. In summary, the results in general support my hypothesis that open market share repurchases are not as flexible as construed.

B. Longer-Term Real Consequences

So far, I have shown the effects of open market share repurchase programs on firms' real activities during a three-year window since the onset of the financial crisis. My empirical strategy requires a narrow window. Naturally one might ask whether those open market share repurchase programs induce longer-term consequence to firms' investment strategies. It would also be interesting to see how firms adjust their financial policies when the overall economic condition improves. I am not trying to provide a thorough analysis of long-term effects of share repurchases. I simply extend the treatment window to 2013 (i.e. 2009-2013), which is the last year with a reasonable amount of data.

[Place Table 7 about here]

I define $laterPost = 1$ if firm i is in 2012 and 2013 and interact it with the treatment dummy. I extend the main specifications in Table 3 by adding this interaction term to equation (1).[13] I present the results in Table 7. The coefficients of the main interaction term $treat \times post$ are of similar magnitude with the main results and statistically significant. However, the coefficients of the second interaction term $laterPost \times treated$ are all positive, which means share repurchases do not impose negative

[12] The results are available upon request.

[13] Specifically, I estimate $y_{it} = \beta_1 \cdot post_{it} \times treated_{it} + \beta_2 \cdot laterPost_{it} \times treated_{it} + \delta \cdot X_{it} + \lambda_i + \tau_t + \alpha_j \times \tau_t + \epsilon_{it}$.

long-term consequences. Firms escalate investment activities after the financial crisis. The coefficients are statistically significant for capital investment but not for employment and R&D expense.

One possible explanation is that firms delayed their investments to after the financial crisis when there were better investment opportunities. Another possible explanation is that the wedge in investment between the treatment and control groups became smaller. Recall that the later period is year 2012 and 2013, so this might be due to the fact that the treatment group got better access to external financing when the economy began to recover.

C. Recently Announced Repurchase Programs

In this subsection, I restrict the sample to be firms with open market share repurchase programs announced in 2006 and 2007 only. Both the treatment and control groups announced share repurchases during this narrower time window. By restricting the announcement period, I can rule out some time series or macroeconomic conditions that might drive the results. And in the same vein of Ouimet and Simintzi (2015), I can mitigate the concerns about firms intentionally choose to announce share repurchases before a financial crisis because they think they can better manage potential downturns.

[Place Table 8 about here]

I present the findings in Table 8. I conduct regressions using the same nine specifications as for Table 3. I report capital investment as the outcome variable in columns (1) - (3), employment as the outcome variable in columns (4) - (6), and R&D expense as the outcome variable in columns (7) - (9). I find similar results to Table 3. However, the magnitudes of the difference-in-difference point estimates are higher for this

sample under all three outcome variables. Specifically, the effects on capital investment, employment, and R&D expense are 27%, 50%, and 20% larger than the full sample. Firms that announce repurchase programs in 2006 and 2007 took much deeper cuts to their real activities, meaning that the firms cannot really time financial crises. This result indirectly shows that the recent financial crisis is a surprise to the firms because the firms announced their programs so close to the crisis realized bigger scale-backs on average.

D. Operating Outcomes

The discussion above focuses on firms' real activities. It is natural to ask whether firms with open market share repurchase programs ending after December 2007 have better or worse operating performance than similar firms with programs ending before. I examine two measures of operating outcome: profit margin and sales growth. Since anything related to firms' assets and equity is contaminated in the setting, I focus on sales-related variables.

I define profit margin as operating income divided by lagged sales. I calculate sales growth as the ratio of the difference between firms' sales in year t and year $t-1$ to firms' sales in year $t-1$. I implement a similar regression specification as in equation (1) by replacing the outcome variables.

[Place Table 9 about here]

The results are reported in Table 9. Columns (1) - (3) report the profit margin results. Firms with repurchase programs ending after December 2007 on average experience a 1 percentage point lower profit margin than otherwise similar firms with share repurchase programs ending before December 2007. This decrease in profit margin is statistically significant and economically large. It represents a 6% drop in pre-crisis profit margin.

Columns (4) - (6) show the results using sales growth as the outcome variable. The treatment group has a 2.8 percentage point slower sales growth rate than the control group. In summary, I can see that firms with open market share repurchase programs ending after the recent financial crisis not only have to sacrifice their real activities to finish their share repurchase but also experience operational downturns. This might be a consequence of lower investment activities.

V. Robustness Tests

In this section, I present several robustness checks. I first check the main results use an Abadie and Imbens (2006) matching estimator approach. I then perform the placebo tests for my difference-in-difference regression. I also use the dotcom recession as an additional placebo period. And lastly I utilize my full control group.

A. Matching Estimator

There may be other subtle firm heterogeneities producing the results. I alleviate this concern using a difference-in-difference matching estimator approach (Abadie and Imbens, 2006) by following Almeida et al. (2012) and Bliss et al. (2015). This approach accounts for both observable firm characteristics and unobservables. Specifically, I require firms in the treatment and control groups to be similar in firm size, Tobin's Q, leverage, cash flow, cash holdings, duration of repurchase programs, and industry. Tests between the matched treatment and control groups reveal no statistical difference between them.

[Place Table 10 about here]

I report the results in Table 10. Panel A shows the summary statistics of the matching procedure. The *p-value* of the *t-test* statistic between the treatment and control groups

reveals no significant difference between them on any of the dimensions I matched upon. This finding confirms that the matching was successful. I show the matching estimator coefficients, along with the regression results from Table 3 in Panel B. The results are qualitatively the same.

B. Placebo Tests

The identification strategy relies on the assumption that the treatment and control groups follow parallel trends in the period leading up to December 2007. Even though I have shown that the treatment and control groups have no statistical difference in terms of the outcome variables and I control for a battery of firm characteristics, I cannot completely rule out the possibility that a latent variable may be driving both the choices of open market share repurchase programs' ending time and firms' real activities.

In order to strengthen the results, I conduct the same experiment I did for the 2007 crisis period in Table 3 around three placebo periods. Specifically, I perform the same tests around December 2004, December 2005, and December 2006. Following my empirical strategy, I sort firms into placebo treatment and control groups based on the ending dates of their open market share repurchase programs. Using the December 2004 test as an example, I assign firms with open market share repurchase programs ending after December 2004 to the treatment group and firms with open market share repurchase programs ending before December 2004 io the control group. If there is an unobservable factor driving the results, open market share repurchase programs should have effects on firms' financial outcomes during the three placebo periods as well.

[Place Table 11 about here]

The results from the three placebo periods are shown in Table 11. Columns (1)-(3)

present results from the December 2006 placebo crisis, columns (4)-(6) present results from the December 2005 placebo crisis, and columns (7)-(9) present results from the December 2004 placebo crisis. For brevity, I only report the results from the fully fledged model and only report the coefficients of the key interaction term $treat \times post$. Notably, I do not observe any statistically or economically significant relation between the treatment and control groups during the placebo periods. In conclusion, these findings are consistent with the argument that the results I observe are driven by having open market repurchase programs ending after the recent financial crisis.

C. Dotcom Recession Test

The results have shown a consistent relation between having open market repurchase programs ending after December 2007 and a reduction in investments. However, it is possible that such effects are due to a demand shock or "macro effect" (Almeida et al., 2012), that is firms might be more likely to cut investments during a recession and this likelihood is higher for firms with open market repurchase programs going into the recession. In order to examine this, I use a period that did not experience a credit supply shock but was a recession. Specifically, I use the 1999-2003 period, known as the dotcom period, during which firms experienced a recession as defined by NBER without external financing shortage.

[Place Table 12 about here]

This test is similar to the placebo tests. Firms with open market share repurchase programs ending after February 2001 are assigned to the treatment group and firms with open market share repurchase programs ending before February 2001 are assigned into the control group.[14] If my main findings are due to a recession, I should also see similar

[14]I choose February 28, 2001 as the cutoff for this exercise because NBER defines March 2001 as the peak of the dotcom period.

effects during the dotcom era.

Table 12 shows that coefficients of the interaction term $treat \times post$ are not statistically significant. There are no observable differences between the treatment and control groups. In short, the results are not likely due to the dotcom recession or demand shocks.

D. Full Sample Test

The main tests were conducted on a sample matched on share repurchase durations. I do so to mitigate the issue that firms of different program durations might be fundamentally different. This approach addresses the endogeneity concern but leaves a large portion of available data unused. In this subsection, I utilize the full sample by controlling for share repurchase durations. Specifically, I use the same basic set up as in equation (1). However, I add controls for share repurchase duration and interactions. In the regression, I control for duration by including up to the fourth order polynomial terms. I also interact all the control variables with the treatment dummy to capture the differences between the treatment and control groups. These additional controls help to deal with issues associated with the difference in time span of the repurchase programs and the different starting and ending dates.

[Place Table 13 about here]

I report the results in Table 13. In the regressions for the results in columns (3), (7), and (11), I include interactions between the treatment dummy and all other control variables except for duration. In the regressions for the results in columns (4), (8), and (12), I include all the interactions, as well as higher order duration controls. I find qualitatively similar results to those reported in Table 3.

VI. Concluding Remarks

Open market share repurchase programs are widely regarded as flexible tools in firms' payout policy. The firms can decide not only the timing but also the amount of buybacks. In this paper, I challenge this traditional view and ask whether open market share repurchase programs are really flexible. I use the onset of the 2007 financial crisis as the experimental setting and utilize the predetermined variations in open market share repurchase program ending dates to overcome empirical difficulties in the literature to address the question.

I find evidence that open market share repurchase programs are not as flexible as one might expect. Although the firms still have the freedom to decide whether or not to announce repurchase programs, once such programs are in place, they will sacrifice real activities to complete the programs. I find that firms with open market share repurchase programs ending after December 2007 cut 1.9 percentage point more of capital investment, four employees more per million dollars of capital stock, and 9 percentage points more of R&D expense to fund the share repurchases than otherwise similar firms with such programs ending before December 2007. The reductions are economically large. They represent a 7%-15% decrease in pre-crisis levels. I show that the freed-up capital indeed goes toward the share repurchase programs - firms buyback on average 84% of the predetermined amount of shares. In additional tests, I find that firms with no long-term analyst coverage cut back more real activities to divert to share repurchases. These results further suggest that repurchases are not flexible since these firms are the ones in most need of capital. I also report that open market share repurchase programs do not impose negative consequences on treatment group firms' longer-term real activities, which might due to firms delaying investments or better overall financing conditions. Treatment group firms also suffer some degree of operational loss, which might be a result of an investment cut. The results are robust to the placebo tests, as well as a battery of other robustness

tests.

My paper provides policy implications to firms. Managers have the choice of whether or not to announce share repurchase programs. However, if they ever decide to initiate such programs, they should make sure that they can complete them before doing so (i.e., they have enough resources to complete them or have emergency plans for unexpected events). Otherwise, if there are negative shocks to the firms or the overall economy, the managers cannot easily complete the programs without taking on costly cutbacks.

For future research, it would be helpful to obtain interim data on the exact amount of shares repurchased from the 10-Q and 10-K filings. With the additional data, one can better understand the subtle changes in the relation between firms' financial decisions and share repurchase decisions, hence obtaining deeper knowledge of the issue.

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Figure 1. Assignment of Treated and Control Groups

This figures shows the selection criteria for the treatment and control groups. The notations above the axis demonstrate the control group and the notations below the axis depict the treatment group. I require firms to have open market share repurchase programs completed before December 2007 to be included in the control group. I require firms to have open market share repurchase programs with predetermined ending dates after December 2007 to be part of the treatment group. Both treatment and control groups announce their share repurchase programs before the cutoff date.

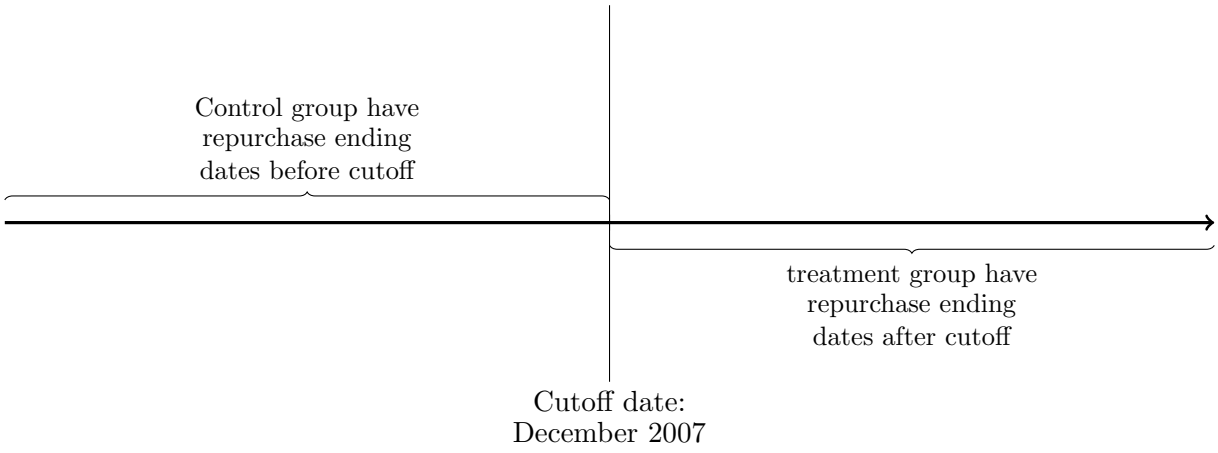

Table 1. Summary Statistics

This table reports summary statistics. Panel A reports the matching results on share repurchase program duration. Panel B reports the summary statistics of the entire sample. While Panel C reports the summary statistics of the treatment and control groups. All of the control variables are measured in 2007 (the year prior to crisis). The treatment group is defined as firms who have open market share repurchase programs in place and completed before December 2007. The control group includes firms that have open market share repurchase programs announced before December 2007 with predetermined ending dates after December 2007.

Panel A: Matching for the Duration Variable (days)

	Mean	SD	P25	p50	p75
Treatment	1,351	1,159	473	950	1,921
Control	1,338	1,117	470	952	1,921

Mean *p-value*	Median *p-value*	Kolmogorov-Smirnov Test *p-value*
0.83	0.98	0.99

Panel B: The Entire Sample

	Mean	SD	P25	p50	p75
Capital investment	0.27	0.19	0.14	0.22	0.32
Employment	57.69	80.34	17.41	37.78	65.49
R&D expense	0.58	1.19	0.02	0.13	0.62
Size	7.18	1.92	5.85	7.10	8.42
Q	1.92	1.08	1.18	1.75	2.42
Leverage	0.19	0.19	0.02	0.18	0.29
Cash holdings	0.16	0.16	0.04	0.096	0.23
Cash flow	0.85	1.30	0.28	0.58	1.02

Panel C: Treatment and Control Groups

	Mean	SD	P25	p50	p75	Mean	SD	P25	p50	p75
	Treatment Group					Control Group				
Capital investment	0.29	0.21	0.16	0.23	0.35	0.23	0.15	0.13	0.20	0.28
Employment	63.01	92.16	17.10	38.03	67.52	48.84	53.73	17.60	36.58	57.56
R&D expense	0.66	1.31	0.02	0.15	0.69	0.44	0.93	0.02	0.12	0.48
Size	7.26	1.88	5.93	7.29	8.49	7.01	1.99	5.70	6.86	8.15
Q	2.02	1.12	1.22	1.81	2.49	1.74	0.97	1.02	1.60	2.19
Leverage	0.18	0.17	0.01	0.17	0.27	0.20	0.17	0.03	0.18	0.31
Cash holdings	0.16	0.15	0.04	0.10	0.25	0.15	0.17	0.03	0.09	0.21
Cash flow	0.96	1.39	0.33	0.63	1.10	0.67	1.11	0.24	0.51	0.94

Table 2. Pre-existing Trends in Capital Investment, Employment, and R&D Expense

This table presents the difference of the change in average capital investment, employment, and R&D expense to capital stock ratio between the treatment and control groups. The base year, year t, is 2008. For example, the first row reports the change from year $t-2$ to $t-1$. This is the change in the outcome variables from year 2006 to 2007. Column (1) reports the change in capital investment. Column (2) reports the change in employment. Column (3) reports the change in R&D expense. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Outcome Change	Capital Investment	Employment	R&D Expense
	(1)	(2)	(3)
$t-2$ to $t-1$	-0.01	-0.45	-0.01
	(0.01)	(2.00)	(0.05)
$t-3$ to $t-2$	-0.00	-1.92	-0.01
	(0.01)	(1.75)	(0.05)
$t-4$ to $t-3$	-0.00	2.64	0.03
	(0.01)	(-1.89)	(0.05)
$t-3$ to $t-1$	0.00	-2.36	0.02
	(0.02)	(2.28)	(0.06)
$t-4$ to $t-1$	-0.01	-1.30	-0.04
	(0.02)	(3.32)	(0.73)

Table 3: Are Share Repurchases Really Flexible?

This table reports the effects of having open market share repurchase programs ending after December 2007 on firms' real activities. The sample is from 2005 to 2011. Year 2008 is omitted as a transition year. In columns (1) - (3), I use capital investment (capx/ppent) as the outcome variable in the regression. In columns (4) - (6), I use employment (emp·1000/ppent) as the outcome variable in the regression. And in columns (7) - (9), I use R&D expense (xrd/ppent) as the outcome variable in the regression. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Capital Investment			Employment			R&D Expense		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat×post	-0.0190*	-0.022*	-0.0186*	-4.370**	-4.026*	-3.973*	-0.0878**	-0.0867**	-0.0899**
	(0.0103)	(0.0114)	(0.0113)	(1.946)	(2.161)	(2.191)	(0.0393)	(0.0420)	(0.0448)
Size		-0.0224	-0.0180		-19.20***	-21.17***		-0.310	-0.357
		(0.0507)	(0.0507)		(7.210)	(7.732)		(0.203)	(0.224)
Q		0.0156	0.0191		0.674	2.368		0.0137	0.0401
		(0.0155)	(0.0157)		(3.771)	(3.727)		(0.108)	(0.115)
Leverage		0.0428	0.0621		5.261	9.885		0.0209	0.106
		(0.0869)	(0.0878)		(15.12)	(15.56)		(0.511)	(0.537)
Cash holdings		0.0741	0.0772		-12.37	-14.41		0.562	0.491
		(0.108)	(0.109)		(23.94)	(23.94)		(0.448)	(0.413)
Cash flow		0.0416**	0.0395**		6.988	6.563		0.0974	0.0982
		(0.0170)	(0.0175)		(4.834)	(4.898)		(0.0723)	(0.0713)
Year FE	Y	Y	Y	Y		Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × year FE	N	N	Y	N	N	Y	N	N	Y
Observations	3,433	2,934	2,934	3,410	2,913	2,913	2,361	2,007	2,007
R^2	0.649	0.668	0.680	0.921	0.926	0.928	0.909	0.921	0.923

Table 4: Post Event Repurchase Completion Rate

This table reports the share repurchase completion rate of the treatment group one, two, and three years after the event. Columns (1) - (2) report the percentage of shares completed and columns (3) - (4) report the percentage of dollar values completed.

Horizon	N	% Shares Repurchased	N	% Value Repurchased
	(1)	(2)	(3)	(4)
Repurchases completed within one year	60	89.03	61	77.11
Repurchases completed between one and two years	99	97.97	101	84.97
Repurchases completed between two and three years	48	85.34	48	82.88
Repurchases completed after three years	217	83.16	220	84.28
Total	424	87.69	430	83.27

Table 5: Repurchase Completion Rate in the literature

This table presents the completion rates of share repurchases from a few representative studies in the literature. Column (1) depicts the data source of the respective study. Column (2) presents the sample periods. And Column (3) presents the completion rates.

Study	Data Source	Sample Period	% Shares Repurchased
My entire sample	SDC - mergers and acquisitions	2005-2011	84%
Stephens and Weisbach (1998)	Compustat - $ spent on repurchase divide by average price	1981-1992	82%
Oded (2009)	SDC - mergers and acquisitions	2003-2004	92%
Bonaimé (2012)	SDC - mergers and acquisitions	1988-2007	73%
Chemmanur and Li (2014)	Hand-collected from 10-K and 10-Qs	2004-2010	86%

Table 6: Long-term Analyst Forecast Coverage

This table reports the results using subsamples based on whether the firm has long-term financial analyst forecast coverage. The tests used to generate the results follow those in Table 3. The sample is from 2005 to 2011. Year 2008 is omitted as a transition year. For the results in columns (1) - (6), I split the sample using four-year analyst coverage and for the results in columns (7) - (12), I splits the sample using five-year analyst coverage. The outcome variables are capital investment, employment, and R&D expense. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	Four-Year Forecast						Five-Year Forecast					
Variables	Capital Investment		Employment		R&D Expense		Capital Investment		Employment		R&D Expense	
	Coverage	No Coverage	Coverage	No Coverage	Coverage	No Coverage	Coverage	No Coverage	Coverage	No Coverage	Coverage	No Coverage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treat×post	-0.003	-0.031**	0.375	-7.650**	-0.009	-0.136*	0.015	-0.035**	1.090	-6.351**	0.014	-0.134**
	(0.013)	(0.015)	(0.943)	(3.676)	(0.015)	(0.073)	(0.011)	(0.014)	(0.810)	(3.158)	(0.014)	(0.063)
Size	0.035	0.033	-2.922	-11.180**	0.030	-0.214	-0.001	0.041	1.073	-10.310**	0.091	-0.167
	(0.033)	(0.035)	(2.654)	(5.404)	(0.086)	(0.146)	(0.039)	(0.030)	(2.476)	(4.353)	(0.132)	(0.119)
Q	0.032**	0.015	0.959	3.950	-0.035	0.113	0.039***	0.019	1.262	5.018	0.003	0.086
	(0.014)	(0.024)	(1.324)	(6.186)	(0.050)	(0.171)	(0.012)	(0.021)	(1.039)	(5.108)	(0.056)	(0.158)
Leverage	0.121	0.015	14.970	-4.375	0.077	-0.037	0.077	0.035	16.320*	1.504	0.083	-0.006
	(0.096)	(0.119)	(9.754)	(22.070)	(0.230)	(0.736)	(0.094)	(0.107)	(8.235)	(19.950)	(0.243)	(0.697)
Cash holdings	0.262*	-0.001	10.000	-21.540	0.949*	0.306	0.297*	0.033	14.470	-17.950	1.392	0.362
	(0.149)	(0.131)	(14.810)	(29.570)	(0.542)	(0.439)	(0.160)	(0.122)	(14.610)	(26.540)	(1.075)	(0.434)
Cash flow	0.029**	0.041*	3.634***	7.250	0.057	0.081	0.028	0.034*	0.140	5.382	-0.002	0.084
	(0.012)	(0.025)	(0.693)	(7.094)	(0.052)	(0.085)	(0.020)	(0.019)	(1.200)	(5.401)	(0.051)	(0.079)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	998	1,789	996	1,776	667	1,242	605	2,182	603	2,169	425	1,484
R^2	0.789	0.626	0.964	0.914	0.940	0.921	0.882	0.626	0.963	0.917	0.894	0.923

Table 7: Longer-Term Consequences of Share Repurchase Programs

This table reports the longer-term effects of having open market share repurchase programs ending after December 2007 on firms' real activities. I include an additional interaction term *treat* × *laterPost* in the regression in addition to the tests conducted to produce the results in Table 3. The sample period is 2005 to 2013. I define 2012 and 2013 as the longer period. Year 2008 is omitted as a transition year. In columns (1) - (3), I use capital investment (capx/ppent) as the outcome variable in the regression. In columns (4) - (6), I use employment (emp·1000/ppent) as the outcome variable in the regression. And in columns (7) - (9), I use R&D expense (xrd/ppent) as the outcome variable in the regression. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Capital Investment			Employment			R&D Expense		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat × post	-0.018*	-0.022**	-0.019*	-3.809**	-3.857*	-3.846*	-0.073**	-0.076**	-0.080*
	(0.009)	(0.011)	(0.010)	(1.786)	(2.081)	(2.147)	(0.035)	(0.038)	(0.041)
Treat × laterPost	0.020*	0.027**	0.031***	1.636	2.657	2.828	0.004	0.014	0.024
	(0.011)	(0.012)	(0.012)	(2.855)	(3.496)	(3.571)	(0.036)	(0.041)	(0.040)
Size		-0.039	-0.033		-21.660***	-23.770***		-0.334*	-0.374*
		(0.044)	(0.044)		(7.169)	(7.501)		(0.195)	(0.214)
Q		0.014	0.019		-1.237	0.666		0.019	0.041
		(0.014)	(0.014)		(3.876)	(3.878)		(0.110)	(0.119)
Leverage		0.039	0.063		3.198	8.910		0.075	0.151
		(0.079)	(0.081)		(15.380)	(15.800)		(0.503)	(0.526)
Cash holdings		0.119	0.128		-11.039	-13.160		0.506	0.454
		(0.104)	(0.105)		(23.060)	(22.940)		(0.418)	(0.394)
Cash flow		0.039**	0.036**		8.520*	7.974*		0.114	0.117*
		(0.015)	(0.016)		(4.367)	(4.535)		(0.070)	(0.069)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × year FE	N	N	Y	N	N	Y	N	N	Y
N	4,458	3,705	3,705	4,432	3,683	3,683	3,074	2,537	2,537
R^2	0.623	0.642	0.655	0.911	0.917	0.919	0.903	0.918	0.920

Table 8: Newly Announced Repurchase Programs

This table reports the results using subsamples based on whether the repurchase programs are announced in 2006 and 2007. I follow the tests conducted to produce the results in Table 3. The sample is from 2005 to 2011. Year 2008 is omitted as a transition year. In columns (1) - (3), I use capital investment (capx/ppent) as the outcome variable in the regression. In columns (4) - (6), I use employment (emp·1000/ppent) as the outcome variable in the regression. And in columns (7) - (9), I use R&D expense (xrd/ppent) as the outcome variable in the regression. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Capital Investment			Employment			R&D Expense		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat×post	-0.023*	-0.027**	-0.024*	-6.005**	-6.235**	-5.994**	-0.102**	-0.104**	-0.107**
	(0.012)	(0.013)	(0.013)	(2.406)	(2.613)	(2.644)	(0.049)	(0.051)	(0.053)
Size		-0.014	-0.011		-23.780***	-24.900***		-0.380	-0.423
		(0.046)	(0.047)		(8.747)	(9.570)		(0.310)	(0.327)
Q		0.005	0.008		-0.593	0.448		-0.024	0.001
		(0.018)	(0.018)		(4.344)	(4.222)		(0.132)	(0.141)
Leverage		-0.023	0.010		1.786	5.716		-0.203	-0.110
		(0.101)	(0.103)		(17.850)	(18.420)		(0.676)	(0.724)
Cash holdings		0.097	0.104		-12.630	-14.200		0.964*	0.818*
		(0.108)	(0.104)		(29.900)	(29.920)		(0.513)	(0.437)
Cash flow		0.068***	0.069***		11.310	11.480		0.187**	0.190**
		(0.023)	(0.023)		(7.726)	(7.678)		(0.077)	(0.074)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × Year FE	N	N	Y	N	N	Y	N	N	Y
N	2,684	2,276	2,276	2,661	2,255	2,255	1,874	1,575	1,575
R^2	0.658	0.682	0.699	0.918	0.926	0.928	0.910	0.925	0.927

Table 9. Operating Outcomes

This table reports the effects of having open market share repurchase programs ending after December 2007 on firms' operating outcomes. Profit margin is defined as the operating income divided by the lagged sales. Sales growth is the ratio of the difference between firms' sales in year t and year *t-1* to firms' sales in year *t-1*. The sample is from 2005 to 2011. Year 2008 is omitted as a transition year. In columns (1) - (3), I use profit margin as the outcome variable and in columns (4) - (6), I use sales growth as the outcome variable. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Profit Margin			Sales Growth		
	(1)	(2)	(3)	(4)	(5)	(6)
Treat×post	-0.006	-0.010**	-0.009**	-0.018**	-0.029***	-0.028***
	(0.005)	(0.005)	(0.004)	(0.008)	(0.009)	(0.009)
Size		0.062***	0.061***		0.075***	0.070***
		(0.009)	(0.009)		(0.017)	(0.018)
Q		0.043***	0.045***		0.061***	0.062***
		(0.007)	(0.007)		(0.013)	(0.012)
Leverage		0.119***	0.119***		0.304***	0.313***
		(0.035)	(0.035)		(0.093)	(0.091)
Cash holdings		0.004	0.011		-0.160*	-0.150*
		(0.035)	(0.035)		(0.082)	(0.080)
Cash flow		0.014***	0.012***		0.010	0.006
		(0.003)	(0.003)		(0.010)	(0.010)
Year FE	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Industry × Year FE	N	N	Y	N	N	Y
N	3,434	2,935	2,935	3,434	2,935	2,935
R^2	0.816	0.843	0.858	0.424	0.449	0.494

Table 10. Matching Estimator

This table reports the results using Abadie and Imbens (2006) matching estimator approach. I match firms in the treatment and control groups in terms of firm size, Q, leverage, cash flow, cash holdings, duration of repurchase programs, and industry. Panel A reports the differences between the treatment and control group after matching. Panel B column (1) presents the matching estimator coefficients and column (2) shows the regression results from Table 3. All the variables are winsorized at the 1% level. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Summary Statistics for Treatment and Control

Variables	Treatment	Control	Mean p-value
	(1)	(2)	(3)
Investment	-0.070	-0.078	0.581
Employment	-4.093	-2.830	0.730
R&D Expense	-0.049	0.001	0.457
Size	7.220	7.271	0.781
Q	2.110	2.080	0.756
Leverage	0.171	0.167	0.836
Cash holdings	0.179	0.176	0.846
Cash flow	0.953	0.952	0.996
Repurchase duration	1,648.300	1,649.400	0.994

Panel B: Matching Estimator

	Abadie and Imbens Matching Estimator ATT	Regression Result (from Table 3)
	(1)	(2)
Investment	-0.018*	-0.019*
	(0.009)	(0.011)
Employment	-5.660**	-3.973*
	(2.311)	(2.191)
R&D expense	-0.087**	-0.090**
	(0.044)	(0.045)

Table 11: Placebo Tests

This table reports the effects of having open market share repurchase programs ending after three placebo crisis periods on firms' real activities. For each period, the sample is from three years before the placebo crisis to three years after. For consistency reasons, the event year is omitted as a transition year. In columns (1) - (3), I use December 2006 as the placebo crisis. In columns (4) - (6), I use December 2005 as the placebo crisis. And in columns (7) - (9), I use December 2004 as the placebo crisis. For brevity, I only report results from the fully fledged model and the coefficients of the interaction term. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

	2006 Placebo Crisis			2005 Placebo Crisis			2004 Placebo Crisis		
Variables	Capital Investment	Employment	R&D Expense	Capital Investment	Employment	R&D Expense	Capital Investment	Employment	R&D Expense
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat × post	0.018	-1.115	-0.003	0.010	0.800	0.025	-0.013	-0.438	0.003
	(0.012)	(2.207)	(0.038)	(0.012)	(2.324)	(0.043)	(0.013)	(1.994)	(0.032)
Common controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
N	2,942	2,918	1,977	2,757	2,728	1,871	2,179	2,169	1,417
R^2	0.653	0.925	0.925	0.634	0.918	0.915	0.594	0.926	0.947

Table 12: Dotcom Recession Tests

This table reports the effects of having open market share repurchase programs ending after February 2001 on firms' real activities. The sample is from 1998 to 2004. Year 2001 is omitted as a transition year. In columns (1) - (3), I use capital investment (capx/ppent) as the outcome variable in the regression. In columns (4) - (6), I use employment (emp·1000/ppent) as the outcome variable in the regression. And in columns (7) - (9), I use R&D expense (xrd/ppent) as the outcome variable in the regression. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Investment			Employment			R&D Expense		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Treat × post	0.005	0.001	0.005	-0.829	-0.119	-0.528	-0.018	-0.007	-0.004
	(0.013)	(0.015)	(0.014)	(1.824)	(2.144)	(2.142)	(0.035)	(0.039)	(0.044)
Size		-0.041	-0.038		0.441	0.467		-0.013	-0.021
		(0.046)	(0.046)		(7.847)	(7.963)		(0.110)	(0.113)
Q		0.015	0.014		1.452	1.167		0.022	0.021
		(0.012)	(0.012)		(1.276)	(1.294)		(0.023)	(0.024)
Leverage		-0.014	-0.032		22.940	21.520		0.184	0.210
		(0.110)	(0.110)		(24.660)	(25.190)		(0.218)	(0.227)
Cash holdings		0.078	0.079		-28.910	-29.380		-0.145	-0.133
		(0.131)	(0.128)		(41.760)	(41.400)		(0.452)	(0.467)
Cash flow		0.047***	0.047***		5.463**	5.403**		-0.031	-0.031
		(0.018)	(0.018)		(2.444)	(2.358)		(0.039)	(0.039)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × year FE	N	N	Y	N	N	Y	N	N	Y
N	3,019	2,562	2,562	3,019	2,560	2,560	1,905	1,587	1,587
R^2	0.549	0.569	0.577	0.897	0.902	0.904	0.908	0.916	0.919

Table 13: Full Sample Regression Results

This table repeats the same test in Table 3 with the inclusion of all the control firms. The sample is from 2005 to 2011. Year 2008 is omitted as a transition year. In columns (1) - (4), I use capital investment (capx/ppent) as the outcome variable in the regression. In columns (5) - (8), I use employment (emp·1000/ppent) as the outcome variable in the regression. And in columns (9) - (12), I use R&D expense (xrd/ppent) as the outcome variable in the regression. The control variables are defined as in Almeida et al. (2004) and Rauh (2006). All the variables are winsorized at the 1% level. The regressions are at the firm-year level. I control for year and firm fixed effects throughout. Robust standard errors are clustered at the firm level and reported in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively.

Variables	Investment				Employment				R&D Expense			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Treat × post	-0.008*	-0.009*	-0.014*	-0.014*	-3.210**	-3.460***	-4.986***	-4.999***	-0.056**	-0.054*	-0.081*	-0.081*
	(0.005)	(0.006)	(0.008)	(0.008)	(1.325)	(1.324)	(1.877)	(1.882)	(0.028)	(0.033)	(0.048)	(0.048)
Size		-0.032	-0.032	-0.032		-16.770**	-16.640**	-16.630**		-0.466***	-0.461***	-0.461***
		(0.033)	(0.033)	(0.033)		(7.062)	(7.044)	(7.046)		(0.174)	(0.172)	(0.172)
Q		0.018	0.019	0.019		1.014	1.043	1.050		-0.006	-0.008	-0.008
		(0.016)	(0.017)	(0.017)		(3.119)	(3.197)	(3.198)		(0.057)	(0.057)	(0.057)
Leverage		0.087	0.085	0.085		8.272	7.944	7.950		0.207	0.197	0.197
		(0.068)	(0.069)	(0.069)		(14.260)	(14.530)	(14.540)		(0.268)	(0.269)	(0.269)
Cash holdings		0.029	0.028	0.028		-12.810	-12.590	-12.550		0.647	0.664	0.664
		(0.105)	(0.107)	(0.107)		(23.570)	(24.310)	(24.330)		(0.538)	(0.556)	(0.556)
Cash flow		0.030***	0.028***	0.028***		5.777**	5.591**	5.590**		-0.048	-0.052	-0.052
		(0.011)	(0.011)	(0.011)		(2.448)	(2.450)	(2.451)		(0.061)	(0.062)	(0.062)
Repurchase duration		-0.000	-0.000	-0.000		0.002	-0.001	-0.009		0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)		(0.006)	(0.001)	(0.008)		(0.000)	(0.000)	(0.000)
Higher order duration	N	Y	N	Y	N	Y	N	Y	N	Y	N	Y
Treat × all duration terms	N	N	N	Y	N	N	N	Y	N	N	N	Y
Treat × all other controls	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Industry × year FE	N	N	Y	N	N	N	Y	N	N	N	Y	N
N	11,615	10,039	10,039	10,039	11,528	9,962	9,962	9,962	8,013	6,848	6,848	6,848
R^2	0.635	0.659	0.659	0.659	0.912	0.921	0.921	0.921	0.893	0.904	0.904	0.904