

Repurchases after Being Well Known as Good News*

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JEL Classification: G30, G32, G35

Keywords: Share repurchases, payout policies

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Repurchases after Being Well Known as Good News

Abstract

Using recent U.S. data, we find that the long-horizon abnormal returns following repurchase announcements made after 2001 are much smaller than those following earlier announcements. Buyback firms' senior managers' equity-linked compensation exceeds that of matching firms, especially for repurchases announced after 2001, and transient institutional investors' holdings of buyback firms' shares become significantly smaller than the holdings of matching firms' following buyback announcements made by repeat repurchasers during 2002 and 2006. The results suggest that a large fraction of recent buybacks has not been motivated by fundamentals-based reasons such as undervaluation, and that non-fundamentals-based reasons such as managerial self-interests become more important in recent years

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1. Introduction

Dating to Ikenberry, Lakonishok, and Vermaelen (1995), the finding of positive abnormal returns following the announcements of open-market repurchases is one of the most established and well-known results in the empirical finance literature. A common interpretation of this finding is that managers announce repurchases when shares are undervalued, and the undervaluation is corrected slowly.¹ Examining various possible motives behind buyback decisions, Dittmar (2000) finds that undervaluation consistently explains buyback decisions during her sample period, 1977-1996, albeit other reasons for buybacks also explain buyback decisions during certain time periods within her sample period. In a more recent study, Peyer and Vermaelen (2009) show that long-term outperformance is still found for buybacks announced between 1991 and 2001, and conclude that open market share repurchases are responses to overreaction to bad news. However, Grullon and Michaely (2004) propose an alternative explanation that the long-horizon positive abnormal returns are due to decreases in risk that are only slowly reflected in prices.

In more recent studies, the results regarding the long-run abnormal performance of buyback firms are less consistent. For example, Barger, Bonaime, and Thomas (2017) find that the positive abnormal returns of buyback firms are realized only after the completion of repurchase programs, mostly on the dates of subsequent repurchases announcements. Moreover, Fu and Huang (2015) obtain a different result that the long-horizon post-announcement abnormal return following buyback announcements has disappeared for recent repurchases, while Manconi, Peyer, and Vermaelen (2018) study buybacks in 31 non-U.S. countries and find that long-term abnormal returns still exist. Researchers have also proposed various explanations for the increasing popularity of repurchases, which are not based on fundamentals of buyback firms: i) managers' motivation to mislead investors (Chan, Ikenberry, Lee, and Wang (2010)); ii) increased pressures of short-term investors (Gaspar, Massa, Matos, Patgiri, and Rehman (2012)); iii) overconfidence of CEOs (Banerjee, Humphery-Jenner, and Nanda (2018)); and iv) CEO's bonus structure tied to earnings per share (Cheng, Harford and Zhang (2015)).² If these non-fundamentals-based motives become dominant in recent buybacks, we will expect poorer performance of buyback firms following

¹ The hypothesis that managers announce buybacks to take advantage of undervaluation is supported by studies documenting the long-run outperformance of buyback firms (Ikenberry, Lakonishok, and Vermaelen (1995) and Chan, Ikenberry, and Lee (2004)) and survey results (Brav, Graham, Harvey, and Michaely (2005)). Consistent with the idea that the market might underreact to buyback announcements, Chan, Ikenberry, and Lee (2004) present evidence of positive earnings surprises following buyback announcements.

² Other papers that examine share repurchases in more recent years include Huang and Thakor (2013), Dittmar and Field (2015), Almeida, Fos, and Kronlund (2016), and Busch and Obernberger (2017). Huang and Thakor (2013) model and provide supporting evidence that managers use share repurchases to better align their views on investment opportunities with shareholders. Dittmar and Field (2015) use the recent data from 2004 to 2011 to examine managers' ability to time repurchases. Almeida, Fos, and Kronlund (2016) provide evidence that managers use share repurchases to meet analysts' earnings expectation. Focusing on actual share repurchases, Busch and Obernberger (2017) investigate how actual share repurchases affect stock price efficiency using 6,504 sample firms over the period between 2004 and 2010.

buyback announcements compared to the performance of buyback firms in earlier years when undervaluation is shown to be the dominant motive behind buyback decisions.

Given the wide range of hypotheses regarding the motivation behind buybacks and the increasing popularity of share repurchases in recent years, additional evidence will be useful. Therefore, we first summarize the fundamentals-based hypotheses proposed in earlier studies and alternative non-fundamentals-based hypotheses proposed in more recent studies, and then, discuss their empirical implications.³ Next, we use recent U.S. data, and examine both short- and long-horizon returns following repurchase announcements to investigate which hypothesis (or hypotheses) is most consistent with empirical results.

Specifically, using the U.S. open market share repurchases from 1994 to 2014, we find that the post-announcement performance of repurchasing firms during recent periods, especially that of the firms that repeatedly buy back shares between 2002 and 2006, is inferior to their performance in earlier periods. The mean post-announcement three-year buy-and-hold abnormal return (BHAR) of repurchasing firms in our 2002-2006 subsample is close to one tenth of the magnitude of the mean three-year BHAR in the 1994-2001 subsample, 20.06%. The mean BHAR in the 2002-2006 subsample is only 2.35% and is not significantly different from zero while the mean in the 2007-2014 subsample has rebounded to a significant 13.88% albeit it is significantly lower than the mean BHAR in the 1994-2001. The qualitative results using mean three-year cumulative abnormal returns (CARs) based on the Ibbotson (1975)'s regression across time and securities (RATS) method are similar in that the magnitudes of abnormal returns have significantly dropped after 2001. We also find qualitatively similar results when abnormal returns are measured by the corresponding Carhart (1997)'s four-factor alphas of equally-weighted calendar-time portfolios of buyback firms.

Other returns also differ: the mean abnormal returns in the year prior to the repurchase announcement are -6.06% and -6.14% in the 2002-2006 and 2007-2014 subsamples, respectively, in contrast to -13.3% in the 1994-2001 subsample, and the abnormal returns in the five-day window surrounding the announcement are also significantly smaller in the two more recent subsamples (2.00% for the first subperiod vs. 1.19% and 1.24% for the second and third subperiods, respectively). We also find evidence of even poorer performance by repeat repurchasers during the second subperiod, while repeat purchasers have performed better than non-repeaters in other subperiods. We define repeat

³ Dittmar (2000) also summarizes five explanations for buyback decisions, and shows that undervaluation explains buyback decisions during the whole sample period, 1977-1996, but other motives also explain buyback decisions during certain subperiods within the sample period. More specifically, she shows that the excess capital hypothesis and the optimal leverage ratio hypothesis are found to explain buyback decisions in many periods within her sample period. In addition, she finds that during the mid-1980s, takeover deterrence well explains buyback activities and during the late 1980s and the early 1990s, the prevention of stock options' dilution effects is likely to have motivated many buybacks. She emphasizes that the motives behind buybacks change over time.

repurchasers as firms that have announced buybacks at least twice within the past five years prior to buyback announcements or have outstanding buyback programs in more than 60% of the past five-year period.

The prevalence of repurchases and some characteristics of repurchasing firms have also changed. Over the last 30 years, open market share repurchases have become popular not only in the U.S., but also throughout the world.⁴ A large cut in dividend taxes in 2003 did not stop the popularity of share repurchases in the U.S., which indicates the possibility that factors other than undervaluation might have been playing large roles in the growth of buybacks after 2003.⁵ Unlike earlier buyback firms that tended to announce repurchases after experiencing poor returns, a significant fraction of recent buyback firms announced buybacks after price run-ups, especially during up markets prior to the recent global financial crisis.⁶ During 2002 and 2006, more than 50% of buyback firms, in contrast to 5% at the beginning of our sample period in 1994, are repeat repurchasers. In addition, in the 2002-2006 and 2007-2014 subsamples, we find only mixed evidence regarding the changes in risk, different from the earlier findings in Grullon and Michaely (2004).

Both the changes in the average long-horizon abnormal returns following buyback announcements and the changes in the mean abnormal returns in the year prior to the repurchase announcement suggest that undervaluation has become less important after 2001. The increased prevalence of buybacks during up markets prior to the global financial crisis is also consistent with the possibility that undervaluation provides a motivation for a smaller proportion of repurchases in recent years. In addition, the mixed results regarding risk changes in the later subperiods cast doubt on the possibility that risk changes become a more important factor in recent years.

In contrast, the results are consistent with the possibility that non-fundamental reasons for repurchases have become more important in later subperiods. We find that executives of repurchasing firms have more equity-based compensation than those of matched firms that do not announce repurchases, especially in recent years, indicating that recent buyback announcements are more likely to be motivated by managerial personal interests. In addition, the holdings of transient institutional investors in buyback firms become significantly smaller than those in matching firms after buyback

⁴ For example, Grullon and Michaely (2004) show that between 1983 and 2000, repurchase amounts in the U.S. grew at a rate of about 20% per year, while dividends grew only at a rate of about 6%. Aggregate repurchases over this period were nearly three times greater than the proceeds raised from initial public offerings. In a more recent paper, Floyd, Li and Skinner (2015) show that share repurchases in the U.S. have significantly increased from 1980 to 2012. According to their paper, total amount of dividends in 2012 U.S. dollars paid by Compustat industrial firms is \$276 billion in 2012 as compared to \$112 billion in 1983, while the corresponding amount of share repurchase is greater, \$282 billion, as compared to only \$11 billion in 1983.

⁵ We thank an anonymous referee for pointing this out.

⁶ The number of repurchases decreased following the burst of the internet bubble until 2003, and then increased until 2007 during the up market before the global financial crisis.

announcements made by repeat repurchasers during the 2002-2006 subperiod. These findings are consistent with the hypotheses that previously documented non-fundamentals-based motivations behind buyback decisions, such as short-term investors' pressures or personal interests of CEOs, become more important in recent buybacks, especially in those buybacks announced during up markets between 2002 and 2006. Moreover, although we cannot exclude the possibility that firms announce a series of buybacks due to the market's underreaction to prior announcements, the evidence suggests that significant undervaluation is not the key driver behind buyback announcements made after a series of buybacks announced in up markets prior to the recent global financial crisis.

The remainder of the paper is organized as follows. In Section 2, we summarize various hypotheses regarding share repurchases and their empirical implications. In Section 3, we describe the data, the characteristics of the sample firms, and the construction of the variables we use in later analyses. Section 4 presents the results regarding abnormal returns of buyback firms. In Section 5, we check whether the results are consistent with fundamentals-based explanations by examining the changes in risk, risk premiums, investments, leverage and operating performance following repurchase announcement. In Section 6, we examine alternative non-fundamentals-based explanations by presenting evidence regarding equity-linked compensation and transient institutional investors' ownership. Section 7 concludes.

2. Hypotheses

Both the evidence in the early literature documenting the long-run outperformance of repurchasing firms (for example, Ikenberry, Lakonishok, and Vermaelen (1995, 2000)) and survey results (Brav, Graham, Harvey, and Michaely (2005)) are consistent with the view that many or most share purchases are responses to undervaluation, and this interpretation is common. But the almost continuous buyback programs in place at some firms are difficult to square with undervaluation, and some of the more recent literature suggests that the continued growth of repurchases might be driven by a more heterogeneous set of factors. This section discusses the various hypotheses that have been proposed to explain the prevalence of repurchases and their empirical implications. In doing so, we divide the hypotheses into two categories, fundamentals-based vs. non-fundamentals-based ones.

2.1 Fundamentals-based hypotheses

Among the various fundamentals-based hypotheses proposed in earlier studies, we focus on two hypotheses with the most consistent empirical evidence, undervaluation and risk changes.

2.1.1 Undervaluation

The combination of positive abnormal returns on the announcements of repurchases and positive abnormal returns over the next several years following buyback announcements found in Ikenberry, Lakonishok, and Vermaelen (1995), Chan, Ikenberry, and Lee (2004), and elsewhere is commonly interpreted as evidence that firms carry out repurchases to exploit undervaluation of their shares. The long-horizon abnormal returns are consistent with undervaluation if one maintains the auxiliary hypothesis that some combination of behavioral biases and limits to arbitrage prevents the information reflected in the repurchase announcement from being immediately reflected into stock prices. In a more recent study, Peyer and Vermaelen (2009) show that long-term outperformance is still found for buybacks announced between 1991 and 2001, and conclude that open market share repurchases are responses to overreaction to bad news. Dittmar (2000) also concludes that firms repurchase stock to take advantage of undervaluation.

This hypothesis predicts that more recent repurchases should display similar return patterns. However, it has no implications for operating performance, since the failure of stock prices to correctly reflect firms' fundamental values can be consistent with improving, stable, or even deteriorating operating performance.

Peyer and Vermaelen (2009) show that small value stocks, which they argue are more likely to be undervalued, tend to perform better following buyback announcements. Ikenberry, Lakonishok, and Vermaelen (1995, 2000) similarly examine long-horizon performance conditional on book-to-market ratios, and find that "value" stocks announcing buybacks have positive long-run abnormal returns. A similar result in our more recent data would provide support for the undervaluation hypothesis. That said, a failure to find such a result would not necessarily reject the mispricing hypothesis. As Chan, Ikenberry, and Lee (2004) point out, if managers' perceptions of mispricing are due to non-public information, one would expect this type of mispricing to occur in all types of firms and thus not be restricted to "value" firms. Therefore, if private information is a key source of the undervaluation motivating a buyback, one does not necessarily expect to see differences in long-horizon performance when firms are sorted based on characteristics computed from publicly available information such as book-to-market ratios.

A finding that the abnormal returns associated with repeat buybacks are lower than those following initial repurchases will be consistent with buybacks being a response to undervaluation if one thinks that the threshold of mispricing that causes managers to undertake a repurchase program is smaller for repeat buybacks. This is plausible, as that threshold might be smaller once managers have experience with repurchases and become more comfortable with them as a corporate finance tool. But a finding that the abnormal returns associated with repeat buybacks are close to zero or small would suggest that repeat buybacks have a different motivation. Moreover, very frequent repurchase programs are difficult to reconcile with undervaluation being the motivation, as this would require that the firm is frequently or

continuously undervalued. However, such frequent repurchase programs are consistent with managers hubristically believing that their firms are frequently or continuously undervalued, and also with managers using repurchases programs to support stock prices as discussed in the next subsection.

2.1.2. Changes in risk

As firms mature, they are likely to have fewer growth options remaining, providing a reason to return cash to shareholders via repurchases. These changes are likely to be associated with risk changes, which in turn affect expected returns and valuation. As pointed out by Grullon and Michaely (2004), the observed outperformance of buyback firms could be due to these changes in risk, if they are not fully reflected in market prices on the announcement date. Alternatively, as Kumar, Sorescu, Boehme and Danielsen (2008) argue, the estimation uncertainties regarding growth options may decrease following buybacks, lowering risk and increasing valuations. This risk hypothesis is a special case of the undervaluation hypothesis that identifies investors' inability to fully recognize changes in risk.

The empirical implications of this hypothesis are straightforward—one should observe risk changes following repurchase announcements. This explanation also implies that changes in risk are negatively related to post-announcement returns. The risk hypothesis also suggests that one should not find abnormal improvements in their operating performance, consistent with the Grullon and Michaely (2004) findings. In addition, we do not expect to observe frequent repeat repurchases. Under the hypothesis that repurchases occur as growth options disappear and firms transition from “growth” to “value” firms, it seems unlikely that many firms have life cycles that include repeated transitions from “growth” to “value” firms.⁷

2.2 Non-fundamentals-based explanations

Although the results in many previous studies are consistent with the hypothesis that undervaluation is the main motive behind buybacks, previous studies also propose other non-fundamentals-based explanations. The following summarize these hypotheses.

2.2.1 Managers' self-interests under the new financial and economic environments

Following the burst of the internet bubble, the U.S. stock market experienced up markets until the start of the financial crisis around 2008. During the post-2001 up markets, we continue to observe increases in equity-linked executive compensation (Cheng, Harford, and Zhang (2015)) and pressures

⁷ Other fundamentals-based reasons include the following: i) the excess capital hypothesis emphasizing the advantages of buybacks compared to cash dividends (flexibility and tax advantages); ii) the optimal leverage ratio hypothesis; iii) the management incentive hypothesis dealing with the dilution effects of stock option compensation; and iv) the takeover deterrence hypothesis.

from transient institutional investors to repurchase more shares (Borochin and Yang (2017) and Gaspar, Massa, Matos, Patgiri, and Rehman (2012)). Therefore, the self-interest of top managers to increase the value of their compensation and/or to reduce pressures from transient institutional investors are likely to become more important in buyback decisions after 2001.

Cheng, Harford, and Zhang (2015) show that firms are more likely to buy back shares when CEOs' bonuses are directly tied to earnings per share (EPS) and that bonus-driven repurchasing firms do not exhibit positive long-run abnormal returns. In addition, Chan, Ikenberry, Lee, and Wang (2010) present evidence that a subset of buyback firms' managers, especially among those who own large amounts of vested stock options, seems to be using buyback announcements to boost stock prices by misleading investors. These studies are consistent with the possibility that managers' self-interest plays an important role in buyback decisions.

Related to the possibility of increased pressures from transient institutional investors, Gaspar, Massa, Matos, Patgiri, and Rehman (2012) show that firms with higher ownership of short-term investors tend to repurchase shares more frequently, and the market reacts less positively to announcements made by those firms. Moreover, Borochin and Yang (2017) show that the short-term oriented institutional investors' ownership has increased over the years,⁸ suggesting that pressure applied by these short-term oriented investors may have increased. To the extent that managers believe that increased earnings per share (EPS) from buybacks can lead to higher prices, managers are likely to be more willing to submit to the pressures from institutional investors, especially when they own more shares and receive a large amount of equity-linked compensation. Brav, Graham, Harvey, and Michaely (2005) show that increasing EPS is the second most important reason for buybacks chosen by interviewees of 167 repurchasers (76.1%), while the most important reason is undervaluation (78.9%).

These hypotheses have implications for executive compensation, changes in transient institutional investors' shareholdings, and analyst earnings forecasts. For example, we expect that firms with CEOs whose compensation is closely connected to stock performance and those firms with more transient institutional investors' shareholdings are more likely to buy back shares because of managerial self interest, and the stock performance of those firms following buybacks is likely to be inferior compared to other buyback firms. We also expect that earnings forecasts of those buyback firms are less positively revised following buyback announcements compared to other buyback firms, and analysts are less likely to issue buy recommendations for those buyback firms following buyback announcements.

In addition, the high numbers of repeat repurchasers can be explained under these alternative hypotheses since these alternative reasons are likely to motivate firms to frequently repurchase shares. If

⁸ Borochin and Yang (2017) show that the percentage of dedicated institutional investors' ownership as a percentage of total institutional investors' ownership decreased from 10% in 1985 to below 3% in 2013, while the percentage of transient institutional investors increased from 20% to over 30% during the same period.

repeat repurchasers are more likely to buy back shares because of these non-fundamentals-based reasons, then the abnormal returns associated with repeat repurchases should be smaller than those associated with initial repurchases or repurchases made by the firms that infrequently buy back shares.

2.2.2 Managerial hubris

Banerjee, Humphery-Jenner, and Nanda (2018) find that more confident CEOs tend to repurchase shares more frequently, and the market reacts less positively to the announcements made by those firms. Managerial overconfidence is consistent with several of the explanations discussed above. For example, managers can be overconfident about their estimates of misvaluation, and/or their ability to mislead investors. If managerial hubris interacts with these other factors to drive repurchases, so that, for example, repurchases occur when shares are less undervalued, then repurchases partially driven by managerial hubris should be associated with lower abnormal returns compared to other repurchases.

Assuming that managerial hubris is greater in “up” markets as shown in Green, Hwang, and Wang (2015), this implies that the abnormal returns associated with repurchases during up markets should be lower. Overconfident CEOs are likely to overestimate their firms’ values even after high price run-ups during up markets, and repurchase shares. We expect those buyback firms perform poorly following buybacks. Moreover, overconfident CEOs are more likely to repurchase shares repeatedly, and therefore, under this explanation, repeat repurchasers are expected to perform poorly compared to other buyback firms.

3. Data and summary statistics

3.1. Data

Open market share repurchase announcement data are from the Securities Data Corporation (SDC) Platinum database for the period 1994-2014.⁹ The SDC Platinum database has complete coverage of share repurchases from 1994, and we end our sample in 2014 to allow us to analyze the performance of our sample firms for three years after their repurchase announcements. As in most previous studies of open market share repurchases, we exclude firms whose share price at the time of the announcement is below \$3 to avoid the potential extreme skewness in long-run performance measures (Loughran and Ritter (1996)). The return and accounting data are from the Center for Research in Security Prices (CRSP) and Compustat databases, respectively. Because we focus on common stocks, we include only securities

⁹ As shown in Michel, Oded and Shaked (2010), buyback firms using an accelerated share repurchase (ASR) method do not outperform their benchmarks. The number of ASRs during 2004 and 2007 is 127 in Michel, Oded and Shaked (2010) while the number of open market share repurchases (OMRs) in our sample during the same period is 2,385, indicating that ASRs are only about 5% of OMRs during the 2004-2007 period.

with CRSP share codes of 10 or 11. The final sample with available CRSP and Compustat data includes 11,795 share repurchase announcements made between 1994 and 2014.

To measure the abnormal performance of buyback firms, for each announcing firm we select five matching firms among non-initial public offering (IPO) firms in the same industry, and same size and book-to-market equity ratio (B/M) quintiles at the end of the month prior to the buyback announcement, excluding those that made a buyback announcement within the previous three years.¹⁰ Specifically, at the end of June of each year, we form size quintiles based on the market capitalization at the end of June and B/M quintiles using the book equity value at the fiscal year end that is at least four months prior to the formation month and the market capitalization at the end of December of the previous year.¹¹ Then, for each announcing firm we identify the non-IPO firms¹² in the same size and B/M quintiles and the same industry, based on the 12-industry classification available on the Kenneth French's website.¹³ Among these firms, we select the five with market capitalizations closest to that of the announcing firm at the end of the month prior to the buyback announcement.

If there are fewer than five non-IPO firms in the repurchasing firm's industry and size and B/M quintiles, we complete the set of five matching firms by choosing additional non-IPO firms from the same industry with market capitalizations closest to that of the repurchasing firm. If any of the matching firms later announce buybacks or are delisted, the matching firms' returns are replaced with the CRSP value-weighted market returns with dividends (VWRETD) from the date of the buyback announcement or the delisting date, respectively. Similar to Lee (1997), we use five matching firms' equally-weighted average returns, instead of matching portfolio returns used in the prior literature (e.g., Ikenberry, Lakonishok, and Vermaelen (1995)). Even though the benchmark portfolio approach is better at controlling for the characteristics of buyback firms, we use this approach to lessen the skewness bias present in long-term abnormal performance measures that are based on a matching portfolio approach (Barber and Lyon (1997)). The potential problem of using a single matching firm approach in dealing with this problem, as used in Loughran and Ritter (1995), is that the selected matching firms may not well reflect the characteristics represented by the relevant reference portfolio as emphasized in Lyon, Barber and Tsai (1999). We address this concern by using five, rather than one, to lessen the concern of noisy point estimates.

¹⁰ It is possible that an industry control can lead to the underestimation of abnormal performance when the main motivation behind share repurchases is an industry-wide undervaluation phenomenon. However, this concern does not seem to be critical given that we find qualitatively similar results even when no industry controls are used in alternative methods as described later.

¹¹ As in Fama and French (1993), NYSE size and B/M quintiles' cutoff points are used to form portfolios.

¹² IPO firms are defined as those with the first available date in the CRSP database being less than a year prior to the repurchase announcement date.

¹³ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

3.2. Summary Statistics

Figure 1 shows the number of buyback announcements in each year and the S&P 500 index level at the end of each year during the 1994-2014 sample period. Different from the expectation that more firms buy back shares following poor performance, the number of buyback announcements moves closely with the performance of the S&P 500, peaking in 1998 and 2007.¹⁴ There are significantly fewer buybacks during down markets, inconsistent with the notion that there are more undervalued stocks in down markets and that buybacks are mainly motivated by undervaluation.¹⁵ The figure also shows the percentage of buyback firms that are repeaters, defined as firms that either announced at least two repurchase programs during the previous five years prior to buyback announcements or had a repurchase program in place during at least 60% of the previous five-year period. The percentage of repeaters increased during our sample period and exceeded 50% in 2002, 2003, 2004, 2009, 2010 and 2012. For our buyback sample firms, the amount of cash dividends paid as a percentage of total payout amounts decreased over the sample period from around 40% in 1994 to below 30% in 2014.

Table 1 reports the characteristics of the full sample of buyback firms and the characteristics of subsamples of firms that announced buybacks during three subperiods, 1994-2001, 2002-2006 and 2007-2014. The first subperiod covers most of the sample period used in Peyer and Vermaelen (2009), 1991-2001. We divide the remaining sample period into additional two subperiods, 2002-2006 and 2007-2014, to examine whether the performance of firms that announced buybacks before and after the recent global financial crisis differed from the performance of firms announcing buybacks at other times.¹⁶ Panel A reports the summary statistics for all repurchasers who announce buybacks during the various periods, Panels B and C report the statistics for non-repeat and repeat buybacks, respectively, and Panel D presents the differences between the characteristics of non-repeat and repeat repurchasers.

In Panel A, the average five-day announcement period abnormal return is significantly different from zero in the full sample and all three subperiods, largest (2.00%) in the first subperiod, and of similar size (1.19% and 1.24%) during the second and third subperiods. As expected, the average industry, size

¹⁴ The increase in buybacks during the up markets can be motivated by increased desires to return cash back to shareholders in a flexible way when firms perform well. Moreover, if the valuation dispersion is pro-cyclical, then undervaluation-driven buybacks can simultaneously increase with the S&P 500 index. However, the slightly negative correlation between cross-sectional standard deviation of book-to-market ratios and the S&P 500 index levels (-0.17) during our sample period suggests that the positive correlation between the number of buybacks and the S&P 500 index is not likely to be due to undervaluation-driven buybacks.

¹⁵ It is possible that the decrease in buybacks during the financial crisis is due to the liquidity constraints or the increase in the market leverage ratio resulting from the significant drop in market capitalization even in the presence of perceived undervaluation by managers during the financial crisis. On a separate note, Hillert, Maug and Obernberger (2016) show that actual repurchases improve the liquidity, even in the times of a crisis.

¹⁶ It is possible to start our second subperiod from 2003 so that the period covers the one following the 2003 tax regulation change. We instead choose to start the second subperiod from 2002 so that the first period corresponds to the period used by Peyer and Vermaelen (2009). The alternative definition of the second subperiod yields qualitatively similar results.

and B/M-adjusted one-year abnormal return prior to the buyback announcements is significantly negative in the full sample and all three subperiods. Similar to the announcement returns, the magnitude is largest (−13.25%) during the first subperiod and of similar magnitudes (−6.06% and −6.14%) during the second and third subperiods. It is interesting to note that the average prior one-year raw return of repurchasing firms is 14.29% during the second subperiod while the average raw returns are below 8% during the first and third subperiods.

Sample firms in the first subperiod announce plans to buy back 6.64% of outstanding shares, with this target percentage dropping to 6.40% in the 2002-2006 subsample but then increasing to 7.37% in the 2007-2014 subsample. For the full sample, the average market capitalization (size) quintile is 2.41, where 1 is the smallest and 5 is the largest, indicating a tilt towards smaller stocks. The average size quintile is larger during the later two subperiods, albeit the differences are small (2.31, 2.49, and 2.52, for the first, second and third subperiods, respectively). We do not find any strong tilt towards value stocks, even though the hypothesis that repurchases are responses to undervaluation suggests that there might be. In fact, there is a slight tilt towards growth stocks and the tilt is greater in later periods, with the mean B/M quintile being 2.96, 2.71, and 2.83, for the first, second and third subperiods, respectively. Both dividend payout ratios and total payout ratios have increased over time for the sample buyback firms and their corresponding matching firms. The increase in total payout is especially noticeable in the last subperiod, 2007-2014.

Panels B and C report the statistics for non-repeaters and repeaters, respectively, and Panel D reports the differences between non-repeaters and repeaters. Non-repeaters' abnormal returns prior to buyback announcements are negative and significantly worse than repeaters'. It is also interesting to note that announcement period abnormal returns of non-repeaters and repeaters are of similar magnitudes, albeit the differences are statistically significantly different from zero (−0.22%, 0.49% and 0.06% for the first, second and third subperiods, respectively). This suggests that most of the time the market does not pay close attention towards whether an announcing firm is a repeat repurchaser. During the first subperiod, the average B/M quintile of non-repeaters is significantly lower than that of repeaters but the difference disappears in the second subperiod and then becomes significantly positive in the third subperiod, suggesting that repeaters are more likely to be growth stocks than non-repeaters in the last subperiod.

Total payout ratios have increased for both repurchasing and matching firms, including both non-repeaters and repeaters. Unsurprisingly, payout ratios of repeating buyback firms are significantly higher than those of non-repeating buyback firms.

4. Long-horizon returns following repurchase announcements

One key piece of evidence consistent with undervaluation is the positive long-term abnormal returns of buyback firms. To investigate whether undervaluation still explains most repurchase decisions in recent years, we examine the abnormal stock returns of buyback firms over various horizons up to three years using three different abnormal return measures.¹⁷ We first consider buy-and-hold abnormal returns, calculated by subtracting the equally-weighted average buy-and-hold returns of five matching firms from the return of the corresponding buyback firm. Due to potential problems in measuring long-horizon benchmark returns (Barber and Lyon (1997)), we also use two alternative approaches. The first is based on the Ibbotson's (1975) regression across time and securities (RATS) method, modified to use the Carhart's (1997) four-factor model to control for the market, size, value, and momentum effects. The second alternative is the calendar-time portfolio approach advocated by Fama (1998), also using the four-factor model.

For the RATS method, we estimate the four-factor cross-sectional regression model for each month from 36 months prior to and 36 months following the month of each repurchase announcement. Each intercept or "alpha" is interpreted as an estimate of the monthly abnormal return in the corresponding event month. An advantage of this approach is that it allows for changes in risk exposures by separately estimating regressions across sample firms in each event month.

For the calendar-time portfolio approach, in each calendar month starting from February 1994 we measure post-announcement performance over one- and three-year horizons by forming portfolios composed of the firms with buyback announcements made within the previous 12 and 36 months ending in the previous month. We then regress the monthly portfolio excess returns on the market, size, value, and momentum factors and report the regression intercepts or "alphas," which are estimates of the monthly abnormal returns during the 12- and 36-month periods following buyback announcements. We estimate regression models using both value- and equally-weighted average returns in order to examine the extent to which the results are driven by large or small firms.

Panel A in Table 2 reports the BHARs and RATS CARs over five different investment horizons for the entire sample period and three subsamples consisting of repurchases announced during 1994-2001, 2002-2006, and 2007-2014. Panel B reports the three-year BHARs for non-repeaters and repeaters, and the differences between the BHARs of non-repeaters and repeaters for the entire sample period and for the three subsamples. In each case, averages are on top and *p*-values are below in parentheses. Except for the last row in Panel B, the numbers of observations are reported below the *p*-values of BHARs, and the percentages of samples with positive BHARs are reported below the *p*-values of CARs. In addition, in columns (3)-(6), ***, **, and * indicate that the average returns for the second or third subsamples (i.e.,

¹⁷ For the firms with multiple classes of common stock, we calculate the value-weighted average return of all classes and use them as the returns of the buyback firms. This implies that we measure stock return performance of a firm, not a particular class of common stock, even when the firm repurchases a single class of common stock.

buybacks announced in the 2002-2006 and 2007-2014 subperiods) are significantly different from the average returns for the first subsample at the 1, 5 and 10 % levels, respectively.

In the full sample, buyback firms on average outperform their matching firms over all horizons, consistent with the existing results in the literature. Over the three-year horizon, the average BHAR is 14.18%, while the cumulative abnormal return based on the RATS method is 16.86%. Unsurprisingly, the alternative ways of calculating long-term abnormal returns result in different point estimates, though both the mean BHAR and mean CAR are significantly different from zero at the 1% significance level. But despite the large BHAR, the percentage of buyback firms with positive BHARs is only 52.94%, which indicates that a significant fraction of buyback firms does not outperform their industry, size and B/M-adjusted matching firms even though the mean BHAR is significantly positive.

Turning to the subperiods, during the first (1994-2001) subperiod the average three-year BHAR and RATS CAR are significant 20.06% and 25.85%, respectively, consistent with Peyer and Vermaelen (2009). However, based on the BHARs that control for the effects of industry, size, and B/M, only about 55% of the sample buyback firms outperform their matching firms over the three years following buyback announcements even during this time period.

Shifting attention to the second subperiod, 2002-2006, the abnormal performance of repurchasing firms is significantly smaller over the one-, two-, and three-year horizons, especially over the two- and three-year horizons. The two- and three-year BHARs and CARs for the 2002-2006 subsample are significantly lower than those in the 1994-2001 subsample at the 1% significance level, and the one-year BHARs and CARs are different at the 5% level. Over the three-year horizon the mean BHAR is only 2.35% and not significantly different from zero. While the three-year CAR is a significant 5.43%, it is much smaller than the three-year CAR of 25.85% for the 1994-2001 subsample. In this subsample only 46.07% of the buyback firms outperform their matching firms over the three years following buyback announcements.

During the last (2007-2014) subperiod, the one-, two-, and three-year BHARs and CARs of repurchasing firms remain significantly smaller than the corresponding returns during the first subperiod. For example, the mean three-year BHAR in the third subperiod is 13.88% versus 20.06% in the first subperiod, and the mean CAR in the third subperiod is 9.46%, substantially less than the 25.85% during the first subperiod. In sum, we find that abnormal returns are much lower for buybacks announced after the end of the sample period used in Peyer and Vermaelen (2009), especially during the second subperiod 2002-2006 before the onset of the global financial crisis. In addition, a large proportion of buyback firms do not outperform their industry, size and B/M- matched firms.

Panel B reports average three-year BHARs and CARs for non-repeaters and repeaters. During the first subperiod non-repeaters performed worse than repeaters, with average differences of -6.81% and

-6.57% in the BHARs and CARs, respectively. During the second subperiod, 2002-2006, repeaters perform very poorly with a three-year BHAR of -4.84%, and only 43.96% of repeaters outperform their benchmarks during this subperiod. On the other hand, the three-year mean BHAR of non-repeaters is a significant 9.75%, albeit only 48.25% of non-repeaters experience positive BHARs. Consistent with the BHARs, the mean CAR for non-repeaters, 9.36%, is significantly greater than the mean CAR of repeaters, 1.44%. The poor performance of repeaters disappears in the last subperiod. The results show that repeaters during up markets in the second subperiod prior to the global financial crisis do not outperform their benchmarks while repeaters in other subperiods do, indicating the possibility of somewhat different motivations driving repeated buyback announcements during up markets prior to the global financial crisis.

As indicated above, in addition to examining BHARs and RATS CARs we also use the calendar time approach. Table 3 reports monthly four-factor alphas of calendar time portfolios composed of the firms that have announced buybacks within the past one year (Panel A) or three years (Panel B) ending in the month prior to each calendar month during February 1994 and December 2017. We report the alphas estimated using both value-weighted and equally-weighted portfolio returns.

Consistent with the results for the BHARs and RATS CARs, the alphas of the equally-weighted returns are large and significant at both the one- and three-year horizons for both the full sample in the columns headed "All" and the first (1994-2001) subsample. Also, consistent with the previous results, the point estimates of the alphas of the equally-weighted returns are smaller for the second and third subsamples; the one- and three-year alphas for the 2007-2014 subsample are significantly different from those for the 1994-2001 subsample at the 1% and 5% levels, respectively. For the 2002-2006 subsample, point estimates of both one- and three-year alphas are much smaller compared to those for the first subperiod (0.684 vs. 0.378 and 0.585 vs. 0.256 for one- and three-year results, respectively) albeit the difference is statistically significant at the 10% level only for the three-year result.

Turning to the value-weighted portfolio alphas, the alphas are smaller than the equally-weighted alphas. The one-year value-weighted alphas for each subperiod and the value-weighted alpha for the second subperiod are not significantly different from zero. These differences between the performances of equally- and value-weighted portfolios indicate that the abnormal performance is mainly due to smaller buyback firms, consistent with the findings in Peyer and Vermaelen (2009). For our total sample, the difference between monthly alphas of value-weighted and equally-weighted portfolio returns for the three-year horizon is 22.0 basis points per month (19.0 basis points vs. 41.0 basis points), implying about 2.6% difference in annual abnormal return estimates.

The results of three-year alphas of the long-short portfolios, long in non-repeaters and short in repeaters, indicate that repeaters perform significantly worse than non-repeaters during up markets in the

second subperiod, which is consistent with the BHAR and RATS CARs results. Even if repeat buybacks are generally motivated by the market's underreaction to prior buyback announcements as suggested by Barger, Bonaime, and Thomas (2017), repeat buybacks announced in up markets prior to the global financial crisis seem not to be mainly motivated by significant undervaluation.

In aggregate, these results comprise convincing evidence that the long-horizon returns following repurchase announcements during the latter two (2002-2006 and 2007-2014) subsamples differed from those in the first (1994-2001) subsample. For the three-year horizon, all of the measures based on equally-weighted returns - BHARs, RATS CARs, and calendar-time equally-weighted portfolio alphas - indicate that abnormal returns during the latter two subsamples were significantly different from those in the first subsample at least at the 10% level. For the BHARs and RATS CARs the differences are significant at the 1% level.

Figure 2 presents the time patterns of abnormal returns by showing CARs based on matching firms-adjusted abnormal returns (on the left) and alphas from the RATS method (on the right) starting from 36 months prior to the buyback announcements until 36 months following the announcements. Each figure has three lines showing the cumulative returns for the firms making repurchase announcements during the three subperiods. Here, the CARs based on matching firms are calculated by cumulating monthly abnormal returns calculated by subtracting the average monthly return of five matching firms. The buyback firms in our sample performed well up until between six months and one year prior to the buyback announcements, then experienced performance declines through the announcement date. When CARs are estimated based on the RATS, buyback firms in the second subperiod performed extremely well during the past three years prior to announcements with a three-year CAR of higher than 40%, which suggests that the undervaluation is less likely to be the main driver behind buybacks in the second subperiod. When CARs are calculated using matching firms, buyback firms' performance seem less impressive, especially for those in the first subperiod. However, we still find that buyback firms' performance over prior three-year horizons is not very poor compared to matching firms for those in the second and third subperiods. In addition, we do not observe significant increases in CARs following buyback announcements in the second subperiod regardless of the method used to calculate CARs.

A natural interpretation of the stock return performance after, at, and prior to the announcements is that during the latter two subperiods either (i) a larger proportion of repurchasing firms repurchased their shares for reasons other than undervaluation, or (ii) firms that repurchased their shares to address undervaluation did so when undervaluation was less severe. To further investigate whether undervaluation and other fundamental reasons become less important in later subperiods, in the next

section, we examine abnormal changes in buyback firms' risk and other characteristics around buyback announcements.

5. Fundamentals-based explanations

In this section, we examine changes in risk and other characteristics of buyback firms, including their operating performance and investment and financing activities, during the three years before and after buyback announcements. If undervaluation is the main motive behind buyback decisions, abnormal returns are not expected to be closely related to changes in risk and investment and financing activities while they are likely to be closely related to operating performance. In addition, we expect that small value firms that are more likely to be undervalued perform better than other types of firms. However, if risk changes are driving the long-term performance results, we expect that there will be significant decreases in risk and investment and external financing activities following buybacks while operating performance is not expected to significantly differ following buybacks. Given that the market and industry environments can affect investment and financing policies as well as risk characteristics and operating performance, we focus on abnormal changes after adjusting for the changes experienced by industry, size and B/M-matched firms.

5.1. Changes in risk, investment and financial policies and operating performance

As pointed out by Grullon and Michaely (2004), the observed outperformance of buyback firms could be due to the changes in risk, if they are not fully reflected in market prices on the announcement date. Alternatively, as Kumar, Sorescu, Boehme, and Danielsen (2008) argue, the estimation uncertainties regarding growth options may decrease following buybacks, lowering risk and increasing valuations. To investigate these hypotheses, we examine changes in risk around buyback announcements, focusing on matching firm-adjusted abnormal changes over the three-year horizons before and after buyback announcements. The risk measures we examine include one-factor market model betas, individual risk premium estimates based on the four-factor model, realized stock return volatilities, implied volatilities, and cash flow volatilities. Detailed descriptions of how we construct each variable are available in Appendix.

Consistent with Grullon and Michaely (2004), as shown in Panel A of Table 4, the subsample firms that announce repurchases between 1994 and 2001 on average experience significant decreases in beta compared to their matching firms. The average abnormal change of -0.048 implies that buyback firms' average expected annual return change from three years before to three years after the buyback announcement is about 20 basis points smaller than the comparable change experienced by matching firms, assuming an annual market risk premium of 5% ($-0.002 = -0.048 \times 5\%$). In contrast, abnormal

changes in the betas of buyback firms in the second subperiod are insignificantly positive, though abnormal changes become negative again, albeit insignificant, in the last subperiod.

As an alternative measure of risk changes, we estimate abnormal changes in individual risk premiums based on the four-factor model and report the results in Panel B of Table 4. Mean abnormal changes are all negative, significantly so in the first and second subperiods, but medians are either not significantly different from zero or positive except for the first subperiod during which the median change is significantly negative. When we separately examine the results for non-repeaters and repeaters, we find that in most cases, non-repeaters have larger decreases in both betas and four-factor model risk premia. These mean and median differences in the risk changes of non-repeaters and repeaters are significant at the 1% level for repurchase announcements during the last subperiod, but are either insignificant or less significant during the other subperiods.

Shifting attention to a measure of total risk, realized volatility, Panel A of Table 5 shows that abnormal changes in realized volatilities are significantly negative during the first and last subperiods. However, during the second subperiod, the average and median changes are positive but only the median change is significant. Implied volatilities based on subsets of the sample with available stock option data provide similar results except that we do not find significant abnormal changes in the last subperiod. Finally, across all subperiods, we do not find any significant decreases in the mean abnormal changes in operating cash flow volatilities as reported in Panel C.

To better understand abnormal and unadjusted changes in risk around buyback announcements, we report volatilities of weekly stock returns measured over each calendar quarter during the 12 quarters before and the 12 quarters following the quarter of buyback announcements in Figure 3. Buyback firms' realized and implied volatilities are lower than those of matching firms even before buyback announcements, indicated by negative matching firms-adjusted volatilities throughout the period shown.

In summary, the results are sensitive to the risk measure used, and abnormal changes in risk following buybacks are not stable across subperiods. That said, some of the results are consistent with the hypothesis that the stock return performance of buyback firms is related to changes in risk as proposed by Grullon and Michaely (2004). In particular, the largest decreases in betas, realized volatilities, and implied volatilities are found in the first subperiod, when the long-horizon abnormal returns are largest, and changes in betas, realized volatilities, and implied volatilities are positive, not negative, during the second subperiod, when there is limited evidence of positive long-horizon abnormal returns. On the other hand, the mean differences, Non-R - Repeater, are negative for betas, realized volatilities, and four-factor risk premia in all periods, though not always significant, but the differences in abnormal returns between non-repeaters and repeaters are not consistently positive but rather sometimes are significantly negative. Thus, some of the results, especially those for later subperiods, are not consistent with the hypothesis that

the abnormal returns are due to changes in risk that are not reflected in changes in stock prices on the announcement dates.

If significant decreases in risk following buybacks are due to exercises of growth options and the lack of investment opportunities as suggested by Grullon and Michaely (2004), then we expect to observe significant decreases in investments following buybacks. To examine this, we report abnormal changes in investment in Panel A of Table 6. Abnormal changes in investments are statistically significantly positive across all subperiods, though the economic magnitudes are quite small—for example, in the full sample the mean abnormal change is 0.072%.¹⁸ These results are inconsistent with the hypothesis that the buybacks are due to a lack of investment opportunities.

We also check abnormal changes in cash reserves and report the results in Panel B of Table 6. Even though untabulated results show that cash reserves decrease significantly after buybacks across all subperiods, the abnormal changes reported in Panel B of Table 6 are significantly negative only in the second subperiod.

Repurchasing firms return their cash back to shareholder through buybacks. If this is due to lack of investment opportunities, they may be less likely to raise external capital after buyback announcements. The implications of the results in Panel C of Table 6 on external financial activities depend on whether one looks at the means or medians. However, we find consistent differences between non-repeaters and repeaters across all three subperiods. Significantly negative abnormal changes are observed for non-repeaters while significantly positive abnormal changes are observed for repeaters as reported in Appendix Table 1. The results suggest that even if repeating buyback firms reduce their external financing following buyback announcements, the reductions experienced by repeating buyback firms are smaller than the reductions in external financing experienced by matching firms during the same period.

Even though buyback firms typically increase their leverage following buybacks, the comparisons with their matching firms reported in Panel D of Table 6 indicate that their leverage increases are on average significantly smaller than increases observed for their matching firms, except for the second subperiod where the mean and median changes are not significant.

Next, we turn our attention to abnormal changes in profitability. Grullon and Michaely (2004) find that even though buyback firms experience significant abnormal stock returns following buybacks, they do not experience abnormal improvements in their operating performance. This evidence supports their hypothesis that the outperformance of repurchasing firms is mostly driven by changes in risk. Consistent with the findings in Grullon and Michaely (2004), we do not find any significant abnormal increases in profitability following buybacks. Instead, abnormal changes in profitability are significantly negative across all subperiods. However, one noteworthy fact is that, even though we do not find any

¹⁸ Untabulated results show that unadjusted changes are significantly negative in the first and third subperiods.

increases in ROAs of buyback firms relative to ROAs of matching firms, ROAs of buyback firms are on average higher than ROAs of matching firms over the 25 quarters around buyback announcements as we find in unreported results.

Table 6 also reports abnormal changes in dividend and total payout ratios. There is only limited evidence of abnormal increases in dividend payouts, but we observe significant increases in abnormal total payouts, suggesting that the rapid growth in share repurchases in recent years is not due to the substitution of cash dividends with share repurchases. Rather, firms return more cash back to shareholders in recent years.

Peyer and Vermaelen (2009) present evidence that small and value stocks, which are more likely to be undervalued, tend to perform better following buyback announcements. To check whether this finding holds in more recent periods, we examine abnormal stock and operating performance and abnormal changes in risk and investment and financing activities across four groups, small value, small growth, large value and large growth stocks. In Appendix Table 2, we report the averages and the differences in averages between non-repeaters and repeaters.¹⁹ We find that small value firms did not perform well in recent years albeit they significantly outperformed during the first subperiod.²⁰ We find some weak evidence that the disappearance of significant outperformance of small value firms is due to less significant changes in risk following buyback announcements.

In sum, the univariate results suggest that fundamentals-based reasons such as undervaluation or changes in risk seem not to be the main motive behind buyback decisions in later subperiods, especially in up markets prior to the recent global financial crisis. In the following, we investigate whether we arrive at the same conclusion even when we check the validity of fundamentals-based explanations in multivariate settings.

5.2. Regression analyses

We have used a variety of return measures to document that the long-horizon abnormal performance of buyback firms during the second and third subperiods was less than that of firms that announced repurchases during the first period. In fact, buyback firms in the second subperiod did not significantly outperform their matching firms and they, especially repeaters, also did not experience significant abnormal decreases in risk. In this subsection we use regression analyses to investigate what factors are associated with the stock performance of buyback firms in recent years and whether there are

¹⁹ Alphas reported in Panel A are estimated using monthly value-weighted returns of calendar time portfolios composed of stocks with the given characteristics, which announced buybacks in the past 36 months.

²⁰ As pointed out earlier, if private information is the primary source of undervaluation motivating a buyback, one does not expect to see differences in long-horizon performance between value and growth firms when value and growth firms are defined using publicly available information such as book-to-market ratios.

significant changes in the roles of key drivers during the later subperiods, especially during up markets in the 2002-2006 subperiod. To control for possible industry and time fixed effects in the analysis, we include industry and year dummies in the analyses.²¹

We estimate the following regression model to examine the determinants of abnormal stock performance following buyback announcements:

$$\begin{aligned}
 AR_i = & \alpha + \beta_1 RepeatD_i + \beta_2 \Delta Vol_i + \beta_3 \Delta RPrem_i + \beta_4 \Delta OVol_i + \beta_5 \Delta ROA_i + \beta_6 \Delta Lev_i + \beta_7 \Delta Inv_i \\
 & + \beta_8 \Delta FD_i + \beta_9 \Delta Cash_i + \beta_{10} \Delta DPR_i + \beta_{11} \Delta TPR_i + \beta_{12} Size_i + \beta_{13} \frac{B}{M_i} + \beta_{14} AR - 1_i \\
 & + \beta_{15} Target_i + \beta_{16} \#SubAuth_i + \beta_{17} UnderD_i + \beta_{18} Industry \& YearDummies_i + e_i
 \end{aligned}$$

where AR is a three-year abnormal return measure, either BHAR or alpha from the 4-factor model. Different from the portfolio alphas used in Table 3, for these regressions alphas are calculated for each firm using monthly returns of each buyback firm and four factors over 37 months starting from the month of the buyback announcements. The variable $RepeatD$ is a dummy variable to indicate repeat buybacks, where a buyback is classified as a repeat buyback if it was announced by a firm that had at least two initial authorizations of repurchases within the past five years prior to buyback announcements or had an active repurchase program during 60% or more of the previous five-year period. All explanatory variables based on financial statements information with names beginning with the symbol “ Δ ” represent changes over three years (12 fiscal quarters) before and after the buyback announcements. In addition, the regressions include matching firm-adjusted abnormal returns during the one-year period prior to the announcement ($AR-1$), the number of shares targeted to repurchase at the announcement as a percentage of outstanding shares ($Target$), the number of subsequent authorizations that are considered to be a part of one program by SDC ($\#SubAuth$), and a dummy variable to indicate that undervaluation was a stated

²¹ The models we use are subject to endogeneity problems due to both omitted variables and simultaneity issues. Even though we handle possible latent variable problems caused by industry and time fixed effects by using industry and year dummies, it is still possible to have some omitted variables in the analyses. In addition, since we are using many contemporary explanatory variables with the dependent variable to understand what explains abnormal returns, ex post, we are subject to reverse causality or simultaneity problems. One way to handle these two concerns is to use an instrumental variable approach using instrument variables satisfying both exclusion and relevance criteria. However, finding such instrumental variables is not easy. In a dynamic panel setting, one way to deal with this kind of problem is to use the lagged value of the dependent variable as an instrument variable as shown in Arellano and Bond (1991). However, our setting is not a dynamic panel setting. Rather, it is an event-time cross-sectional setting. Therefore, it is not straightforward to apply such approaches. Even though we understand potential problems of finding appropriate instruments and models for endogenous variables, we tried 3-stage least squares regressions (3SLS) to deal with both problems. We use medians of five industry, size and BM-adjusted matching firms as instrumental variables of changes in risk premium, return on assets and leverage. Medians of matching firms are likely to satisfy the relevance criterion but it may not satisfactorily meet the exclusion criterion to the extent that they directly affect abnormal stock returns of our sample firms. Therefore, we decided not to report the 3SLS results that show similar results for the repeat repurchase indicator during the second subperiod.

motivation behind buyback announcements (*UnderD*).²² We also include industry and year dummies to control for possible industry and time fixed effects.

To see whether the roles of key drivers in explaining the stock return performance of buyback firms have changed over time, we estimate regression models separately for each subperiod. Alternatively, we also estimate the regressions using all sample observations with a dummy variable to indicate a particular subperiod and its interaction terms with some key explanatory variables.

Table 7 reports the results of regression analyses where the dependent variables are three-year BHARs and alphas from the four-factor model. We find that repeat repurchasers perform significantly worse than non-repeaters after controlling for other factors only during the second subperiod and for the full sample. Although the results are also consistent with repeat buybacks being motivated by the market's underreactions to prior buyback announcements, they are more consistent with repeat buybacks being motivated by non-fundamental reasons since the subperiods results show that the coefficient estimates are consistently significantly negative only during up markets prior to the global financial crisis.

To our surprise, changes in volatilities are positively related to stock performance for those buybacks in the first subperiod, and not closely related to performance in the second subperiod. Negative relations between change in volatility and stock performance are observed when BHARs are used as a performance measure in the third subperiod. Different from our expectations, risk premium changes are, in general, not significantly associated with three-year BHARs albeit they are significantly negatively associated with alphas during the first subperiod. We also find that operating cash flow volatilities are negatively related to stock performance.

Consistent with our expectation, changes in ROAs are significantly positively associated with abnormal stock returns across all subperiods. Even though buyback firms on average do not experience significant increases in the profitability following buyback announcements, increases in the profitability following buyback announcements positively affect the performance of buyback firms. In addition, we generally find a negative association between changes in leverage and stock performance, but the relation is significant only in the first subperiod. We also find a negative relation between changes in investments and stock performance, though the relation is significantly negative only in the first subperiod when BHARs are used as a dependent variable.

Changes in financial deficits are generally positively related to stock performance, suggesting that increasing external financing activities following buybacks do not negatively affect stock performance. Regarding payout policies, it is interesting to note that changes in dividend payouts are significantly

²² SDC Platinum has the purpose code assigned for each buyback announcement. Multiple codes can be assigned for one announcement. The variable *UnderD* is set to one if any of the purpose codes assigned by SDC is either "Undervaluation" or "Enhancement of Shareholder Value". If a firm reauthorizes existing buyback programs, SDC will group them into one program. We use only the initial authorization date as announcement dates.

negatively associated with stock performance in the second subperiod while changes in total payouts are significantly negatively associated with stock performance in the first subperiod.

Regarding other firm and buyback characteristics, we find significantly negative associations between size and stock performance, except for the last subperiod. Surprisingly, however, we find a significantly negative association between B/M and stock performance in the first subperiod, which might be due to the outperformance of large growth stocks in the first subperiod. We find that prior performance is negatively associated with future stock performance.

Finally, we find that buyback characteristics are only weakly associated with stock performance. The target percentage shares announced to repurchase is generally positively associated with stock performance but is insignificant in most cases. Similarly, the dummy to indicate undervaluation being one of the cited motivations is not significantly associated with stock performance, except in the second subperiod when BHARs are used as the performance measure.

In summary, the results in Table 7 consistently suggest that poorer performance of repeating buyback firms is observed only in the second subperiod after controlling for other factors. In addition, among variables considered in our regression analyses, only changes in ROA are significantly associated with stock performance in a consistent way across subperiods, which is unsurprising. For all others, either signs or significances of coefficients change depending on time periods or abnormal return measures. Finally, even though risk changes can be a possible explanation for outperformance of buyback firms, we do not find consistent relation between risk changes and stock performance across subperiods and abnormal return and risk measurements.

To check the robustness of the results in Table 7 and to test the significance of the changes in the roles of key variables in different subperiods, Appendix Table 3 reports the results of regressions using all sample observations with a dummy variable to indicate a particular subperiod and its interaction terms with some key explanatory variables. The coefficients on the interactive dummy variables given by the products of *SubD* and *RepeatD* are not significant when we estimate regressions separately for the second (columns (1) and (2)) and third (columns (3) and (4)) subperiods, but become significantly negative when we estimate the regression using all samples in the second and third subperiods together in columns (5) and (6), suggesting that repeaters' performance is significantly worse than other buyback firms' during the second and third subperiods. Among others, the coefficients of the interaction of the *SubD* dummy with changes in leverage are significantly positive across all columns, indicating that increase in leverage had smaller negative effects on stock performance in later subperiods.

Finally, unreported results based on difference-in-difference approaches²³ to estimate the effects of buybacks on stock performance after controlling for possible confounding factors also show that repurchasing firms in the second subperiod do not perform significantly better than their matching firms over three years following buyback announcements, consistent with the findings in Tables 2 and 3. Overall, the regression results provide evidence that buyback firms in the second subperiod, especially repeaters, perform significantly worse than others even after controlling for other factors.

These results suggest that fundamentals-based motives do not explain buyback decisions in later subperiods, especially those made in the second subperiod. In the next section, we examine whether empirical results for later subperiods are better explained by non-fundamentals-based explanations discussed earlier.

6. Non-fundamentals-based explanations

The poorer performance of buyback firms in the second subperiod is possibly due to the unfortunate timing of these buybacks prior to the global financial crisis since it is possible that firms that return cash back to shareholders through share repurchases suffer more during a crisis due to the reduced buffer needed to survive the crisis period. However, relatively stable investments made by buyback firms in the second subperiod following buyback announcements cast doubt on this explanation. In this section, we examine how alternative explanations based on non-fundamentals explain buyback decisions in later subperiods. As discussed earlier, the wide use of equity-linked executive compensation and the increase in the ownership of transient institutional investors in later subperiods suggest that non-fundamentals-based motives are likely to have played an increasing role in later subperiods. Excellent stock performance of buyback firms in the second subperiod prior to buyback announcements, as shown in Figure 2, is also consistent with the possibility that buyback decisions in up markets prior to the global financial crisis are driven by managerial self-interests to further boost up share prices for their benefits and/or by increased pressures from transient institutional investors. To closely explore this possibility, we closely examine equity-linked executive compensation and transient institutional investors' shareholdings.

The three left-hand side panels of Figure 4 show the matching-firm-adjusted level of senior managers' equity-linked compensation as a percentage of total compensation for buyback firms that

²³ For this approach, we use both repurchasing firms and their corresponding five industry, size and B/M-adjusted matching firms' values. Dependent variables are changes in three-year buy-and-hold returns and alphas from the four-factor model. Different from the regression analyses used in Table 7, all share repurchase related variables are not included here. Instead, a dummy variable to indicate share repurchasing firms is added. Finally, instead of matching firms-adjusted abnormal prior return, raw returns over the one-year period prior to buyback announcements are used.

announced repurchases during the three subperiods, 1994-2001, 2002-2006, and 2007-2014. Executive compensation data are from the S&P ExecuComp database and details on how we construct these variables are explained in the Appendix. The results show that equity-linked compensation of buyback firms is greater than that of matching firms both before and after buyback announcements for the firms that announced repurchases during the second and third subperiods, indicating that managers of buyback firms in the second and third subperiods had stronger incentives to support their stock prices compared to the managers of matching firms. This finding, combined with the previous finding of lower abnormal returns during the second and third subperiods, is consistent with the hypothesis that at least some buybacks during the second and third subperiods were motivated by a desire to support stock prices, rather than to take advantage of undervaluation.

Panel A of Table 8 reports mean and median matching firm-adjusted abnormal equity-linked executive compensation over the three-year period prior to buyback announcements. The results show that the average equity-linked executive compensation of buyback firms is significantly greater than the average of matching firms prior to buyback announcements in the second and third subperiods, while we do not find such results in the first subperiod. During the second subperiod, we also find that repeaters' mean and median compensation are significantly greater than mean and median of non-repeaters. These results indicate that managerial incentives to use buybacks to support stock prices were likely to be stronger during the last two subperiods compared to those present in the first subperiod.²⁴

If buybacks are due to pressures from short-term oriented institutional investors, we expect to observe significant decreases in transient institutional investors' holdings after buyback announcements. Using the classification of institutional investors made by Bushee (2001) and the institutional holdings information from the Thomson Reuters' Institutional (13f) Holdings data (s34), we report matching firm-adjusted transient institutional investors' holdings three years before and after buyback announcements in Panels B and C of Table 8.²⁵ Prior to buyback announcements, we find that average transient investors' holdings of buyback firms are significantly greater than those of matching firms while median holdings of buyback firms tend to be insignificantly smaller than medians of matching firms. We also find that matching firm-adjusted transient investors' holdings of non-repeaters are significantly higher than those of repeaters, which is in contrast to our expectation. However, when we examine holdings following buyback announcements, we find that both mean and median transient investors' holdings of repeaters are

²⁴ One can argue that increased equity-linked compensation during the second and third subperiods are inconsistent with managerial incentives to boost up stock prices using buyback announcements since any increases in stock prices due to buybacks motivated by non-fundamental reasons are likely to be reversed and therefore, will not benefit managers. However, increased earnings per share (EPS) resulting from buybacks is likely to increase bonuses of managers. This will incentivize managers to succumb to the pressures of short-term institutional investors as far as there is no penalty (i.e., price drops more than prior increases), even when they believe that price increases will be reversed later.

²⁵ The data are available on the Brian Bushee's website (<http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html>).

significantly smaller than those of matching firms in the second subperiod, consistent with the possibility that transient investors sell their shares of repeat repurchasers after buyback announcements. We also check analysts' earnings forecasts and recommendations and find the results that support the possibility that non-fundamentals drive buyback decisions in the second subperiod.²⁶

To further check the validity of these explanations in multivariate settings, we use the regression models reported in Table 7 together with the highest quartile indicator variables of matching firm-adjusted equity-linked compensation (*HComp*) and holdings of transient institutional investors (*HTran*) over the three-year period prior to buyback announcements. We form quartiles in each year using repurchasing firms announced buybacks during the year. The results presented in Table 9 show that in general, firms in the highest quartiles of matching firm-adjusted equity-linked compensation or transient institutional investors' holdings do not exhibit significantly different abnormal performance compared to others after controlling for other factors. However, when we look at the repeaters in the highest quartiles, we find significantly poorer performance compared to others in the second subperiod as shown at the bottom rows of Table 9, which report the sums of coefficients of *HComp* (or *HTran*) and *RepeatD*, and their p-values. These results are consistent with the possibility that at least during up markets prior to the financial crisis, many firms made buyback decisions due to non-fundamentals-based reasons such as managers' self-interests to boost up stock prices or pressures from short-term investors.

7. Summary and conclusion

Prior to the Jobs and Growth Tax Relief Reconciliation Act of 2003, returning excess cash to shareholders through buybacks benefited taxable shareholders by providing tax savings relative to cash dividend payments. However, even after the disappearance of the tax advantages following the Act, the growth of buybacks did not stop, and more firms have continued to use buybacks as a way of returning cash to shareholders. As some critics of buybacks point out, firms started to increase their buybacks even in up markets prior to the recent global financial crisis, which is not easily reconciled with undervaluation being the main motivation for buybacks. These trends suggest that the most frequently cited motivation behind buybacks, i.e., undervaluation, is not likely to be the main driver behind recent buybacks.

²⁶ In unreported results, we check abnormal changes in analysts' earnings forecasts and forecasts errors one month before and one month after buyback announcements using earnings forecasts data from IBES. The results indicate that mean abnormal changes in earnings forecasts are significantly negative and earnings forecasts errors are not significant in the second subperiod, supporting the possibility that undervaluation is a less likely explanation for buybacks announced in the second subperiod. We also check analysts' recommendations around buyback announcements in Figure 4, and find that analysts issue worse recommendations, especially for repeaters in the second subperiod, following buybacks announcements, further supporting the possibility that undervaluation is not the main driver behind buybacks announced during the up markets prior to the financial crisis.

We closely examine the long-term performance and various investment and financing policies of buyback firms during the 2002-2006 and 2007-2014 periods, and compare them with those of buyback firms during the earlier 1994-2001 period to investigate whether undervaluation is still a dominant factor in buyback decisions. We find that the long-horizon abnormal returns following repurchase announcements made after 2001 are much smaller than those following earlier announcements. Firms that announce repurchases during the 2002-2006 period do not consistently outperform their benchmark firms. We also find that repeat buyback announcers during recent up markets in the 2002-2006 period perform more poorly than non-repeat announcers, which is in contrast with the implications of Barger, Bonaime, and Thomas (2017). These results suggest that undervaluation seems to have played a less important role in recent buyback decisions. In addition, we find that relative to benchmark firms, risk does not significantly decrease during this period, which is different from the results in other periods. Moreover, we do not find evidence supporting other fundamentals-based explanations.

We further investigate whether the relatively poor performance of buybacks in up markets prior to the global financial crisis is due to changes in the main drivers behind buybacks. We check whether the long-term performance evidence is consistent with alternative explanations that are based on non-fundamental reasons. For example, it is possible that in recent years, firms are under more pressure to return cash to shareholders from transient institutional investors who are aware of the market's positive reaction to buyback announcements and want to earn even higher returns after experiencing positive returns. Alternatively, it is possible that managers whose compensation is tightly linked to stock performance have become more aware of buyback's positive announcement effects in recent years and use buyback announcements to boost stock prices for their own benefit. If these non-fundamental related motivations dominate buyback waves in recent up markets, one expects poorer performance of repurchasing firms in recent years.

The long-term performance evidence is consistent with these hypotheses. In addition, repeat buyback announcements are more likely to be motivated by non-fundamentals-based reasons and therefore, inferior performance of repeat buyback announcers is expected, especially when those are announced in up markets during which undervaluation is less likely. We find that repeat buyback announcers perform significantly more poorly than non-repeat announcers only during the 2002-2006 subperiod, which suggests that motivations behind repeated announcements of buybacks during up markets prior to the global financial crisis is likely to be different from the motivations behind those made in other times.

In a recent paper, Fu and Huang (2015) provide an explanation for the disappearance of long-run abnormal returns following share repurchases and seasoned equity offerings.²⁷ The results in our paper suggest that the increased presence of short-term oriented investors, which has led firms to base their buyback decisions less on fundamentals-based reasons, can be a reason behind the changes in stock performance following share repurchases. As pointed out by Cheng, Harford and Zhang (2015), managerial personal incentives can also affect share repurchase decisions and therefore, increased equity-linked compensation in more recent periods can be another possible explanation for poorer average performance of recent buyback firms.

The results in the paper indicate that both investors and regulators need to pay close attention to possibly different motivations behind buybacks in making their investment decisions and policy recommendations. Even though the Internal Revenue Service (IRS) may be less concerned about regular buybacks given the significantly smaller tax advantages of buybacks relative to cash dividends under the current tax rules, investors and regulators should be more concerned about those firms that regularly announce buybacks, especially during up markets.

Our results suggest that even though firms announce buybacks for a variety of reasons, buyback announcements are less likely to be motivated by fundamentals-based reasons when the market is going up and a large fraction of both institutional investors and managers are short-term oriented. Given that the positive average market response to buyback announcements is well known, the fraction of managers and institutional investors that are likely to use buybacks to take advantage of well-known positive announcement effects of buybacks even when they do not have misvaluation- or fundamentals-based reasons to buy back shares is large enough that it should not be ignored. Investors should not naively interpret the announcements of buybacks as positive signals, and regulators should continue to pay attention to the possibility of buybacks being used as a way to manipulate stock prices.

²⁷ In their 2003-2012 sample, Fu and Huang (2015) estimate three-year average abnormal returns of -2.52% , -2.94% , -1.89% , and 5.32% using BHARs, RATS CARs, value-weighted calendar-time portfolio returns, and equal-weighted calendar-time portfolio returns, respectively (see their Table 1). The average RATS CAR of -2.94% is significantly different from zero at the 5% level. In contrast, our Tables 2 and 3 report positive abnormal returns, some of which are significant, using all four methodologies in both our 2002-2006 and 2007-2014 subsamples. In the RATS and calendar-time results we benchmark using the Fama-French-Carhart four-factor model, while Fu and Huang (2015) benchmark using the Fama-French three-factor model; for the BHARs we match on size, B/M, and industry while Fu and Huang (2015) match on size, B/M, and momentum. In untabulated results, we try to reproduce the Fu and Huang (2015) RATS CARs and calendar-time portfolio results by benchmarking using the same three-factor model they use, and are unable to do so. Using repurchases announced during 2003-2012 and the three-factor model, we estimate a three-year average RATS CAR of 5.22% and equal and value-weighted calendar-time portfolio returns of 0.196% and 0.143% per month, equivalent to $36 \times 0.196\% = 7.06\%$ and $36 \times 0.143\% = 5.15\%$ over three years. Our average RATS CAR and equal-weighted calendar time portfolio abnormal return are significantly different from zero at the 1% level and our value -weighted calendar time portfolio returns are significantly different from zero at the 5% level.

Appendix Definitions of variables²⁸

The following describe how each variable is measured. In most analyses, matching firm-adjusted abnormal changes in performance, risk and investment and financial policies are calculated by subtracting average changes experienced by five industry, size and B/M-adjusted matching firms from changes of the corresponding repurchasing firm. In most analyses, changes are measured by comparing average values estimated over three years before and three years after buyback announcements.

Variables	Definitions
5-day AR	Announcement period abnormal return calculated as returns of repurchasing firms over five-day period around buyback announcement dates (-2, +2) minus average returns of five industry, size and B/M-adjusted matching firms over the same period.
AR-1	Prior abnormal return that is the difference between REP-1 and MAT-1 where REP-1 and MAT-1 are average raw returns over the one-year period prior to buyback announcements for repurchasing firms and industry, size, and B/M-matched control firms, respectively.
B/M quintile (B/M)	At the end of each June starting from 1993, book-to-market equity ratio (B/M) quintiles are formed based on the book value of equity at the nearest fiscal year end with at least a four-month lag and the market capitalization at the end of December of the previous calendar year. Cutoff points are based only on the NYSE-listed firms.
Beta from CAPM (Beta)	To estimate beta from the CAPM, monthly market risk premiums and risk free rates from the Kenneth French's website are used. ²⁹ Prior risk loadings are based on the coefficient estimates using 36 monthly returns prior to announcements and post risk loadings are based on the coefficient estimates using 37 monthly returns starting from the month of buyback announcements.
Buy-and-Hold Abnormal Returns (BHAR)	Buy-and-hold abnormal returns (BHARs) are calculated by subtracting the equally-weighted average buy-and-hold return of five industry, size, and B/M-matched firms from the corresponding buy-and-hold return of buyback firms. Five matching firms are selected for each buyback firm among those in the same industry (based on 12 industry classifications available on the Kenneth French's website) and size and B/M quintiles with the closest market capitalizations at the end of the month prior to buyback announcements. Size and B/M quintiles are formed as explained in this table.
Cash Reserve (Cash)	Cash reserve is defined as cash and short-term investments (CHEQ) over total assets (ATQ).

²⁸ Quarterly Compustat reports cumulative values from the beginning of the fiscal year for capital expenditures (CAPXY), dividends (DVY), financial deficit related variables (SSTKY, DLTISY and DLTRY), and repurchase related variables (PRSTKCCY, PRSTKCY and PRSTKPCY). For these variables, we estimate quarterly amounts by subtracting the relevant values of the previous quarter from the reported values of the quarter except for the first fiscal quarter.

²⁹ http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html

Dividend Payout Ratio (DPR)	Average dividend payout ratio over a measurement horizon longer than a quarter is defined as the sum of quarterly cash dividends (calculated using DVY) over the sum of quarterly net incomes (NIQ) during the measurement period. When the sum of net incomes is zero or negative, DPR is set to be missing.
Dummy for Undervaluation (UnderD)	Dummy for undervaluation indicates those with the Purpose Code assigned by the SDC Platinum database being either “Undevaluation” or “Enhancement of Shareholder Value”.
Equity-linked compensation (EComp)	Equity-linked compensation as a percentage of total compensation (TDC1). Equity-linked compensation is defined as option awards (OPTION_AWARDS, OPTION_AWARDS_BLK_VALUE, or OPTION_AWARDS_FV, whichever is available first in the order written) plus stock awards (STOCK_AWARDS or STOCK_AWARDS, whichever is available first in the order written. If both stock awards variables are missing but option awards are positive, then stock awards are assumed to be zero). If equity-linked compensation based on this definition cannot be calculated due to missing data, then equity-linked compensation is alternatively defined as total compensation (TDC1) – salary plus bonus (TOTAL_CURR) – non-equity compensation (NONEQ_INCENT). All are from S&P’s ExecuComp and the names of variables are in parentheses.
Financial deficit (FD)	Financial deficit is defined as financial deficits (total amount of net external capital raised) over total assets (ATQ). Quarterly financial deficit is defined as: sale of common and preferred stocks (SSTKY) – purchase of common and preferred stocks (PRSTKCY) + long-term debt issuance (DLTISY) – long-term debt reduction (DLTRY).
Highest Compensation Quartile Indicator (HComp)	Quartiles of equity-linked compensation (EComp) are formed every year using repurchasing firms announced buybacks during the year. Firms in the highest quartile have the value of one while others have the value of zero.
Highest Transient Institutional Investors’ Holdings Quartile Indicator (HTran)	Quartiles of transient institutional investors’ holdings are formed every year using repurchasing firms announced buybacks during the year. Firms in the highest quartile have the value of one while others have the value of zero.
Implied Return Volatilities (IVol)	Implied volatilities are from OptionMetrics and represent average daily implied volatilities of the nearest-money call options with the shortest time to maturity among the options with at least 21 days to maturities. Implied volatilities are available from 1996.
Investment (Inv)	Investment is measured as capital expenditures (CAPXY) over total assets (ATQ).
Leverage (Lev)	Leverage is defined as long-term debt (DLTTQ) over total assets (ATQ).
Number of Subsequent Authorizations (#SubAuth)	Number of subsequent authorizations is the number of authorizations made following the initial authorization, which are classified as a part of one program by the SDC Platinum database.
Operating cash flow volatilities (OVol)	Operating cash flow volatilities are standard deviations of quarterly operating cash flows (OIBDPQ) over average of total assets (ATQ) at the beginning and

	end of the quarter measured over the number of quarters within the measurement period.
Operating Performance (ROA)	Operating performance is measured by quarterly operating cash flows (OIBDPQ) as a percentage of total assets (ATQ).
Realized Return Volatilities (Vol)	Realized volatilities are standard deviations of monthly returns over the measurement period.
Repeat repurchasing firms (RepeatD)	Repeat repurchasers are defined as buyback firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements, or those that have active repurchase programs over 60% of the time during the past five years.
Risk Premiums from the 4-Factor Model (RPrem)	Risk premiums based on the 4-factor model is the sum of each risk coefficient estimate times the average premium of the corresponding risk factor over the period, 1991 – 2017. Monthly risk premiums of four factors, market, size, value and momentum, are from the Kenneth French’s website. Prior risk loadings are based on the coefficient estimates using 36 monthly returns prior to buyback announcements and post risk loadings are based on the coefficient estimates using 37 monthly returns on and after announcement dates. We set the risk premium to be missing if the estimated risk premium is negative. The average monthly market, size, value and momentum risk premiums during 1991 and 2017 were 0.72%, 0.22%, 0.25%, and 0.47%, respectively.
Target Shares (Target)	Target shares represent the percentage of outstanding shares targeted to repurchase at the initial announcements.
Total Payout Ratio (TPR)	Average total payout ratio is defined as the sum of quarterly dividends (DVY) plus share repurchases over the sum of quarterly net incomes (NIQ) during the measurement period. Share repurchase amounts are defined as the purchase of common stock (PRSTKCCY, cash flow statement) if available. Otherwise, they are defined as the purchase of common and preferred stock (PRSTKPCY, cash flow statement) when it is available). We set TPR to be zero when the sum of net incomes is zero or negative.
Transient Institutional Investors’ Holdings	Bushee (2001) classify active institutional investors as dedicated, quasi-indexers and transient institutions based on a factor analysis and cluster analysis approach. Transient institutions are characterized by high portfolio turnover and highly diversified portfolio holdings. The classification data are available on the Brian J. Bushee’s website (http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html). The institutional holdings information is obtained from the Thomson Reuters’ Institutional (13f) Holdings data (s34).

Appendix Table 1
Abnormal changes in firm characteristics and operating performance over
three-year periods before and after buyback announcements:
For repeaters and non-repeaters

Matching firm-adjusted abnormal changes in firm characteristics and operating performance before and after buyback announcements are reported in this table for Repeaters and Non-Repeaters. Details on how we measure various firm characteristics and operating performance measures are available in Appendix. Changes in investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) are average quarterly investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) over the three-year period following buyback announcements minus average investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) over the three-year period prior to buyback announcements. For each buyback, five industry, size and B/M-adjusted matching firms' changes are calculated over the same horizons as those used for the corresponding buyback firm and the average of five (or less depending on the availability of the data) changes is subtracted from the corresponding buyback firm's change to calculate matching firm-adjusted abnormal changes in investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR). In each cell under the column "Mean" ("Median"), average (median) matching firm-adjusted abnormal changes are reported on top, p-values for the test of significance of mean (median) are reported in parentheses, and the number of observations (the percentage of firms with positive matching firm-adjusted abnormal changes) are reported at the bottom. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In columns (3) - (6), ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	Mean (1)	Median (2)	Mean (3)	Median (4)	Mean (5)	Median (6)	Mean (7)	Median (8)
Panel A: Matching Firm-Adjusted Abnormal Changes in Investment (Inv, %)								
Non-Repeater	0.081 (0.000)	0.059 (0.000)	0.107 (0.000)	0.039 (0.000)	0.044 (0.016)	0.021* (0.000)	0.075 (0.000)	0.040 (0.000)
	3,227	54.29%	1,196	57.11%*	1,914	55.33%	6,337	55.14%
Repeater	0.121 (0.005)	0.078 (0.001)	0.032** (0.136)	0.022** (0.003)	0.068 (0.000)	0.019* (0.000)	0.066 (0.000)	0.024 (0.000)
	606	56.77%	1,021	55.93%	1,726	56.14%	3,353	56.19%
Panel B: Matching Firm-Adjusted Abnormal Changes in Cash Reserves (Cash, %)								
Non-Repeater	0.283 (0.040)	0.292 (0.001)	0.051 (0.842)	0.066 (0.627)	-0.128* (0.521)	0.029* (0.920)	0.136 (0.190)	0.200 (0.012)
	4,165	52.58%	1,297	50.42%	1,916	50.26%*	7,378	51.60%
Repeater	0.092 (0.572)	0.149 (0.317)	-0.792*** (0.000)	-0.168** (0.012)	0.041 (0.822)	-0.082 (0.733)	-0.192 (0.073)	-0.030 (0.251)
	1,358	52.06%	1,314	48.25%**	1,728	49.07%*	4,400	49.75%
Panel C: Matching Firm-Adjusted Abnormal Changes in Financial Deficits (FD, %)								
Non-Repeater	-0.348 (0.000)	-0.077 (0.012)	-0.255 (0.016)	-0.130 (0.057)	-0.403 (0.000)	-0.170* (0.000)	-0.347 (0.000)	-0.125 (0.000)
	3,001	49.02%	1,100	46.82%	1,797	45.41%**	5,898	47.51%
Repeater	0.691 (0.000)	0.535 (0.000)	0.295** (0.002)	0.218** (0.001)	0.211*** (0.001)	0.156*** (0.000)	0.321 (0.000)	0.236 (0.000)
	544	60.85%	911	54.88%**	1,598	53.94%**	3,053	55.45%
Panel D: Matching Firm-Adjusted Abnormal Changes in Leverage (Lev, %)								
Non-Repeater	-0.717 (0.000)	-0.777 (0.000)	-1.043 (0.000)	-0.509 (0.000)	-1.165* (0.000)	-0.917 (0.000)	-0.891 (0.000)	-0.774 (0.000)
	4,161	45.33%	1,296	46.76%	1,909	44.05%	7,366	45.25%
Repeater	0.064 (0.774)	0.003 (0.636)	0.864** (0.000)	0.317* (0.003)	0.640* (0.001)	0.202 (0.042)	0.529 (0.000)	0.176 (0.002)
	1,357	50.04%	1,314	51.90%	1,723	51.07%	4,394	51.00%
Panel E: Matching Firm-Adjusted Abnormal Changes in Operating Performance (ROA, %)								
Non-Repeater	-0.637 (0.000)	-0.235 (0.000)	-0.171*** (0.001)	-0.040*** (0.077)	-0.358*** (0.000)	-0.113*** (0.000)	-0.479 (0.000)	-0.160 (0.000)
	3,929	35.61%	1,271	46.81%***	1,889	43.14%***	7,089	39.62%

Repeater	-0.308 (0.000)	-0.088 (0.000)	-0.225 (0.000)	-0.079 (0.000)	-0.121*** (0.000)	-0.052*** (0.000)	-0.209 (0.000)	-0.076 (0.000)
	1,298	35.21%	1,283	36.48%	1,698	43.11%***	4,279	38.72%
Panel F: Matching Firm-Adjusted Abnormal Changes in Dividend Payout Ratio (DPR, %)								
Non-Repeater	3.570 (0.018)	0.000 (0.007)	2.061 (0.439)	0.000*** (0.311)	4.046 (0.094)	0.000** (0.906)	3.428 (0.004)	0.000 (0.276)
	3,058	47.35%	1,148	41.55%***	1,835	44.85%*	6,041	45.49%
Repeater	1.418 (0.695)	0.000 (0.623)	4.417 (0.050)	0.000 (0.053)	3.768 (0.091)	-0.723 (0.207)	3.537 (0.017)	0.000 (0.842)
	603	47.76%	1,010	48.71%	1,683	45.45%	3,296	46.88%
Panel G: Matching Firm-Adjusted Abnormal Changes in Total Payout Ratio (TPR, %)								
Non-Repeater	32.111 (0.000)	5.377 (0.000)	42.440 (0.000)	24.735*** (0.000)	41.044 (0.000)	33.046*** (0.000)	36.086 (0.000)	13.169 (0.000)
	3,024	56.94%	898	65.59%***	1,274	65.46%***	5,196	60.53%
Repeater	7.698 (0.120)	0.000 (0.553)	23.926** (0.000)	12.451*** (0.000)	7.466 (0.331)	0.214 (0.838)	12.515 (0.001)	1.020 (0.000)
	1,210	45.21%	1,142	59.28%***	1,427	50.11%**	3,779	51.31%

Appendix Table 2

Abnormal returns and abnormal changes of performance, risk, investment and financial policy across size and b/m groups over three-year periods before and after buyback announcements

Alpha from the calendar time portfolio and average matching firm-adjusted abnormal changes in performance, risk, leverage, payout policies over three-year periods before and after buyback announcements are reported for each size and B/M groups. Alphas of monthly portfolios composed of buyback firms that announced buybacks in the past 36 months are estimated based on the four-factor model using value-weighted portfolio returns. At the end of June of each year, five size portfolios are formed based on the market capitalization at the end of June and five B/M portfolios are formed based on the book values of equity at the nearest fiscal year end with at least a four-month lag and the market values of equity at the end of December of the previous year using the NYSE cutoff points. Value (growth) firms are those at the lowest (highest) B/M portfolio and small (large) firms are those at the smallest (largest) size portfolio. Details on how we measure each variable are available in Appendix and the headings of previous tables. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In columns (3)-(6) except for those rows for “Non-Rep - Repeater”, ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively. Bold numbers indicate that they are significantly different from zero at least at the 10% significance level.

		1994-2001		2002-2006		2007-2014		All	
		Value	Growth	Value	Growth	Value	Growth	Value	Growth
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Alpha from the 4-Factor Model (Alpha)									
All	Small	0.385	0.121	0.068	-0.573	-0.104*	0.438	0.068	0.216
	Large	0.437	0.487	0.303	0.037	-0.118	0.327	0.116	0.322
Non-Rep - Repeater	Small	-0.003	-0.006	0.009	-0.002	-0.005	0.003	-0.003	0.002
	Large	0.003	0.003	-0.002	0.004	-0.001	0.000	-0.001	0.003
Panel B: Matching Firm-Adjusted Abnormal Changes in Operating Performance (ROA)									
All	Small	-0.233	-1.748	-0.009***	-0.804***	-0.058***	-0.654***	-0.149	-1.215
	Large	-0.118	-0.727	0.591	0.075***	-1.095	-0.298***	-0.289	-0.346
Non-Rep - Repeater	Small	-0.171	-1.011	0.398	0.052	-0.116	-0.026	-0.079	-0.591
	Large	-0.019	-0.198	0.750	-0.284	-0.101	-0.456	0.377	-0.439
Panel C: Matching Firm-Adjusted Abnormal Changes in Risk Premium (4-Factor Model) (RPrem)									
All	Small	-5.657	-8.506	-4.776**	-6.600*	0.651**	1.401*	-3.737	-5.139
	Large	2.105	0.408	1.521	-0.783	0.828	0.785	1.400	0.217
Non-Rep - Repeater	Small	-1.742	-19.547	5.436	8.301	-0.279	0.823	-0.329	-2.237
	Large	-4.004	-1.954	-2.524	0.067	-1.696	-2.273	-1.597	-1.298
Panel D: Matching Firm-Adjusted Abnormal Changes in Realized Volatilities (Vol)									
All	Small	-0.670	-1.030	0.836*	0.022	-0.574*	-0.564	-0.411	-0.660
	Large	-0.239	0.074	0.277	0.320	0.883	0.415	0.379	0.261
Non-Rep - Repeater	Small	-0.577	-0.906	-0.697	1.382	-0.638	-1.211	-0.705	-0.487
	Large	-1.894	-0.282	-0.488	-0.672	-0.332	-0.424	-0.873	-0.492
Panel E: Matching Firm-Adjusted Abnormal Changes in Investment (Inv)									
All	Small	0.207	0.083	0.021**	0.199	0.060**	-0.054	0.110	0.071
	Large	0.089	0.060	0.095	0.014	0.288	0.091	0.196	0.058
Non-Rep - Repeater	Small	-0.036	-0.667	0.023	-0.081	0.039	0.409	0.074	0.075
	Large	0.109	-0.237	-0.065	0.033	-0.029	-0.042	-0.060	-0.084
Panel F: Matching Firm-Adjusted Abnormal Changes in Financial Deficits (FD)									
All	Small	0.070	-0.904	0.270	-0.132	-0.080	-0.392	0.042	-0.580
	Large	0.484	0.165	-0.048	-0.357	0.245	0.209	0.164	0.037
Non-Rep - Repeater	Small	-1.332	-4.060	0.398	-0.379	-0.226	-0.062	-0.267	-0.977
	Large	1.201	-1.296	-0.097	-0.742	0.082	-0.306	0.116	-0.689
Panel G: Matching Firm-Adjusted Abnormal Changes in Leverage (Lev)									
All	Small	1.254	-1.778	0.052***	0.107	-0.713***	-2.501	0.515	-1.546
	Large	-0.445	-0.210	1.806*	0.360	1.399*	1.143	0.972	0.416
Non-Rep - Repeater	Small	-2.174	-3.661	-1.582	-1.894	1.678	-0.510	-0.864	-1.521
	Large	3.624	-1.139	-5.242	-4.978	-1.593	-1.760	-2.433	-2.566

Appendix Table 3
Coefficients of subperiod dummies from regression analyses
using all sample buybacks

Industry, size and B/M-adjusted 3-year buy-and-hold abnormal returns (BHARs) and alpha (Alpha) from the 4-factor model are regressed on various factors. Details on how we estimate BHARs are available in Appendix. Each buyback firm's alpha is estimated using monthly returns of each firm and four factors over 37 months starting from the month of buyback announcements. Alphas represent monthly abnormal returns while BHARs represent 3-year abnormal returns, both of which are in %. All basic variables are defined in Appendix and changes of these variables are defined as repurchasing firms' changes in average quarterly values over three years before and after buyback announcements. All explanatory variables are in percentages except for dummy variables and quintiles. All variables used in Table 7 plus a dummy indicating each subperiod and its interaction terms with key variables are included in each regression but only the coefficients of subperiod dummy and its interactions terms are reported in this table together with the coefficients of key variables. In columns (1) and (2), the subperiod dummy (SubD) indicates buyback announcements made between 2002 and 2006. SubDs are similarly defined in other columns. The regressions include all sample firms with available information during 1994 and 2014. P-values based on heteroskedasticity-adjusted standard errors are reported in parentheses. ***, ** and * indicate that the number are significantly different from zero at the 1%, 5% and 10% significance levels, respectively.

	2002-2006		2007-2014		2002-2014	
	BHAR (1)	Alpha (2)	BHAR (3)	Alpha (4)	BHAR (5)	Alpha (6)
SubD	-12.699*** (0.002)	-0.137* (0.067)	-0.382 (0.915)	-0.117* (0.060)	-9.405** (0.012)	-0.142** (0.033)
SubD×RepeatD	-6.506 (0.185)	-0.117 (0.221)	5.759 (0.200)	0.106 (0.199)	-10.283* (0.098)	-0.242** (0.041)
SubD×ΔVol	-0.378 (0.455)	-0.025** (0.019)	-0.893* (0.068)	-0.044*** (0.000)	-0.843 (0.161)	-0.064*** (0.000)
SubD×ΔRPrem	0.029 (0.917)	0.008 (0.149)	0.078 (0.780)	0.015*** (0.003)	0.087 (0.744)	0.018*** (0.000)
SubD×ΔOVol	0.671 (0.842)	-0.008 (0.892)	3.069 (0.376)	0.106* (0.071)	3.044 (0.369)	0.075 (0.206)
SubD×ΔROA	-2.649 (0.185)	0.064 (0.108)	1.615 (0.411)	-0.022 (0.551)	-0.432 (0.833)	0.032 (0.398)
SubD×ΔLev	0.663* (0.054)	0.015** (0.019)	0.585* (0.079)	0.011* (0.081)	1.238*** (0.001)	0.024*** (0.000)
SubD×ΔInv	1.689 (0.700)	0.058 (0.482)	1.029 (0.837)	0.010 (0.910)	0.687 (0.871)	0.041 (0.583)
RepeatD	-5.175* (0.064)	-0.051 (0.312)	-11.496*** (0.000)	-0.140** (0.028)	2.578 (0.653)	0.151 (0.169)
ΔVol	0.362 (0.244)	0.045*** (0.000)	0.723** (0.039)	0.057*** (0.000)	0.786 (0.147)	0.080*** (0.000)
ΔRPrem	-0.070 (0.658)	-0.030*** (0.000)	-0.096 (0.551)	-0.032*** (0.000)	-0.067 (0.751)	-0.036*** (0.000)
ΔOVol	-4.159** (0.041)	-0.068* (0.052)	-4.982** (0.017)	-0.111*** (0.003)	-5.635** (0.042)	-0.116** (0.018)
ΔROA	15.625*** (0.000)	0.259*** (0.000)	14.314*** (0.000)	0.283*** (0.000)	15.324*** (0.000)	0.261*** (0.000)
ΔLev	-0.671*** (0.001)	-0.017*** (0.000)	-0.667*** (0.002)	-0.016*** (0.000)	-1.219*** (0.000)	-0.027*** (0.000)
ΔInv	-5.982** (0.013)	-0.110** (0.011)	-6.731*** (0.006)	-0.119*** (0.007)	-6.491** (0.026)	-0.127** (0.017)
AR-1	-24.767*** (0.000)	-0.258*** (0.000)	-24.860*** (0.000)	-0.253*** (0.000)	-23.595*** (0.000)	-0.226*** (0.001)
Other control variables	Included	Included	Included	Included	Included	Included
Adjusted R ²	0.109	0.151	0.104	0.152	0.109	0.162
Sample Size	5,109	5,109	5,109	5,109	5,109	5,109

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Table 1
Summary statistics

This table reports the summary statistics of open-market share repurchases announced during 1994 and 2014. N is the number of announcements. 5-day AR is the repurchase firm's return measured over the 5-day window (-2, 2) minus the corresponding average return of five industry, size, and B/M-matched control firms. REP-1 and MAT-1 are average raw returns over the one-year period prior to buyback announcements for repurchasing firms and matching firms, respectively. AR-1 is the difference between REP-1 and MAT-1. Target Shares (%) is the percentage of shares announced to buyback at the announcement as a percentage of total outstanding shares. Size quintile (1 is the smallest) is based on the market value of repurchasing firm's equity at the end of June prior to the announcement relative to all NYSE firms. BM quintile (1 is the lowest) is based on the ratio of the book value to the market value of equity. REP (MAT) DPR and TPR represent repurchasing firms' (matching firms') average dividend payout ratios and total payout ratios over the past three years prior to the announcement of share repurchases, respectively. Except for the number of observations (N), averages are reported. For abnormal returns, p-values for the test of mean being zero are reported in parentheses. Panels A, B and C report the results for all sample buybacks, repeat repurchasers and non-repeat repurchasers, respectively. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In Panel D, the differences in values between non-repeat repurchasers and repeat repurchasers are reported. All variables are winsorized at the 1st and 99th percentiles. In columns (2)-(3), ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significance levels, respectively. In Panel D, bold characters indicate that the difference between non-repeaters and repeaters is significantly different from zero at least at the 10% significance level.

	1994-2001 (1)	2002-2006 (2)	2007-2014 (3)	All (4)
Panel A: All				
N	5,536	2,613	3,646	11,795
5-day AR	2.00% (0.000)	1.19%*** (0.000)	1.24%*** (0.000)	1.58% (0.000)
REP -1	1.46%	14.29%***	7.26%***	6.09%
MAT -1	14.73%	19.98%**	13.21%**	15.42%
AR -1	-13.25% (0.000)	-6.06%*** (0.000)	-6.14%*** (0.000)	-9.46% (0.000)
Target Shares (%)	6.64	6.40***	7.37**	6.81
Size quintile	2.31	2.49***	2.52***	2.41
B/M quintile	2.96	2.71***	2.83***	2.86
REP DPR	13.79%	13.27%***	18.61%***	15.46%
MAT DPR	21.69%	21.79%***	29.12%***	24.12%
REP TPR	31.14%	52.53%***	86.47%***	52.88%
MAT TPR	37.35%	47.50%***	75.21%***	51.32%
Panel B: Non-Repeat repurchasers				
N	4,175	1,299	1,918	7,392
5-day AR	1.94% (0.000)	1.44%* (0.000)	1.27%*** (0.000)	1.68% (0.000)
REP -1	-1.43%	12.46%***	5.01%***	2.68%
MAT -1	13.63%	18.74%***	12.53%	14.24%
AR -1	-15.04% (0.000)	-6.63%*** (0.000)	-7.84%*** (0.000)	-11.69% (0.000)
Target Shares (%)	6.77	6.47*	7.40***	6.88
Size quintile	2.27	2.37**	2.23	2.28
B/M quintile	2.84	2.68***	2.90	2.83
REP DPR	12.70%	11.92%	15.12%***	13.27%
MAT DPR	21.55%	21.97%	28.90%***	23.62%
REP TPR	28.51%	44.11%***	57.15%***	38.46%

MAT TPR	37.78%	49.68%***	71.34%***	48.59%
Panel C: Repeat repurchasers				
N	1,361	1,314	1,728	4,403
5-day AR	2.16%	0.95%***	1.21%***	1.43%
REP -1	(0.000)	(0.000)	(0.000)	(0.000)
MAT -1	10.35%	16.09%***	9.76%	11.83%
AR -1	18.09%	21.22%**	13.97%***	17.41%
	-7.74%	-5.50%	-4.24%***	-5.70%
	(0.000)	(0.000)	(0.000)	(0.000)
Target Shares (%)	6.25	6.33	7.35***	6.70
Size quintile	2.43	2.61***	2.83***	2.64
B/M quintile	3.31	2.73***	2.76***	2.92
REP DPR	19.56%	14.85%***	22.48%**	19.62%
MAT DPR	22.13%	21.60%	29.36%***	24.96%
REP TPR	38.49%	59.81%***	115.96%***	74.91%
MAT TPR	36.07%	45.40%***	79.46%***	55.82%
Panel D: Difference between Non-Repeat and Repeat repurchasers				
N	2,814	-15	190	2,989
5-day AR	-0.22%	0.49%**	0.06%	0.25%
REP -1	-11.78%	-3.63%***	-4.75%***	-9.15%
MAT -1	-4.46%	-2.48%	-1.45%*	-3.16%
AR -1	-7.30%	-1.13%***	-3.60%**	-5.99%
Target Shares (%)	0.52	0.14	0.05**	0.18
Size quintile	-0.16	-0.24	-0.60***	-0.37
B/M quintile	-0.48	-0.05***	0.14***	-0.09
REP DPR	-6.86%	-2.93%**	-7.36%	-6.35%
MAT DPR	-0.58%	0.37%	-0.47%	-1.34%
REP TPR	-9.98%	-15.70%	-58.81%***	-36.45%
MAT TPR	1.71%	4.28%	-8.12%***	-7.24%

Table 2

Buy-and-hold abnormal returns (BHARs) and cumulative abnormal returns (CARs)

Buy-and-hold abnormal returns (BHARs) and cumulative abnormal returns (CARs) are reported for three subperiods and for total. BHARs are calculated by subtracting average buy-and-hold return of industry, size, and B/M-matched firms from the corresponding buy-and-hold return of buyback firms while CARs are calculated using monthly alphas estimated based on the Ibbotson (1975)'s regression across time and securities (RATS) method. In Panel B, BHARs and CARs over the three-year period following buyback announcements are reported for non-repeat purchasers and repeat purchasers. We also report differences in BHARs and CARs between non-repeat and repeat repurchasers. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In each cell under the "BHAR", average BHAR is reported on top, p-value is reported in parentheses and the number of buybacks is reported at the bottom. Under the "CAR" column, CAR is reported on top, p-value is reported in parentheses and the percentage of buybacks with positive BHAR is reported at the bottom. P-values of CARs are calculated based on standard errors estimated assuming independence of monthly alphas being cumulated. In the "Non-R - Repeater" row of Panel B, the differences in BHARs and CARs between non-repeaters and repeaters are reported on top and p-values are reported at the bottom. All variables are winsorized at the 1st and 99th percentiles. In columns (3)-(6), ***, **, * indicate significantly different values between the first subperiod and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	BHAR	CAR	BHAR	CAR	BHAR	CAR	BHAR	CAR
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Total Sample (BHAR)								
3-month	2.88%	2.54%	1.94%	2.39%	2.59%	1.28%*	2.58%	2.24%
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
6-month	5,536	54.52%	2,613	53.65%	3,646	54.22%	11,795	54.23%
	3.44%	3.86%	2.06%	4.13%	3.19%	1.87%**	3.06%	3.51%
1-year	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	5,525	53.00%	2,612	52.76%	3,631	54.31%	11,768	53.35%
2-year	5.63%	7.12%	2.45%**	4.76%**	4.60%**	2.96%***	4.61%	5.78%
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
3-year	5,483	52.93%	2,599	50.44%**	3,609	53.01%	11,691	52.40%
	10.95%	16.56%	3.55%***	4.74%***	6.97%***	5.44%***	8.07%	11.07%
3-year	(0.000)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	5,313	53.25%	2,517	47.83%***	3,550	52.48%	11,380	51.81%
3-year	20.06%	25.85%	2.35%***	5.43%***	13.88%***	9.46%***	14.18%	16.86%
	(0.000)	(0.000)	(0.151)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
3-year	4,839	54.89%	2,318	46.07%***	3,348	54.87%	10,505	52.94%
Panel B: Non-Repeater vs. Repeater (3-year)								
Non-Repeater	18.39%	24.65%	9.75%**	9.36%***	11.57%**	6.36%***	15.07%	17.94%
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Repeater	3,654	53.48%	1,142	48.25%***	1,730	52.66%	6,526	52.34%
	25.20%	31.22%	-4.84%***	1.44%***	16.36%***	12.94%***	12.73%	15.85%
Non-R - Repeater	(0.000)	(0.000)	(0.009)	(0.362)	(0.000)	(0.000)	(0.000)	(0.000)
	1,185	59.24%	1,176	43.96%***	1,618	57.23%**	3,979	53.91%
Non-R - Repeater	-6.81%	-6.57%	14.59%***	7.91%***	-4.79%	-6.58%	2.34%	2.09%
	(0.042)	(0.000)	(0.000)	(0.000)	(0.079)	(0.000)	(0.193)	(0.002)

Table 3

4-factor alphas based on the monthly calendar time portfolio approach

Alphas estimated from the monthly 4-factor model (Carhart (1997)) are reported in this table. In each month, buyback portfolios are formed, which are composed of stocks with open market share repurchases announced within the past one-year (in Panel A) and three-year (in Panel B) periods. Monthly value-weighted returns and equally-weighted returns of these portfolios are used to estimate the alphas. Portfolios are formed using all sample buyback firms as well as using only non-repeaters and repeaters, separately. “Non-R – Repeater” rows represent the results of the long-short portfolios, long in non-repeaters and short in repeaters. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. The intercept (alpha) is reported on top and p-value based on heteroskedasticity-adjusted standard errors is reported at the bottom. In columns (3)-(6), ***, **, * indicate significantly different values between the first subperiod and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	VW (1)	EW (2)	VW (3)	EW (4)	VW (5)	EW (6)	VW (7)	EW (8)
Panel A: One-Year								
# of Months	108	108	71	71	106	106	263	263
All	0.230 (0.230)	0.684 (0.000)	0.026 (0.863)	0.378 (0.012)	0.048 (0.616)	0.200*** (0.022)	0.167 (0.057)	0.451 (0.000)
Non-Repeater	0.205 (0.471)	0.688 (0.000)	0.130 (0.613)	0.449 (0.010)	-0.218 (0.175)	0.206** (0.057)	0.117 (0.330)	0.471 (0.000)
Repeater	0.218 (0.412)	0.700 (0.002)	-0.031 (0.844)	0.296 (0.054)	0.238 (0.044)	0.229* (0.049)	0.221 (0.065)	0.455 (0.000)
Non-R - Repeater	-0.003 (0.992)	-0.021 (0.913)	0.161 (0.577)	0.153 (0.281)	-0.456 (0.026)	-0.023 (0.862)	-0.100 (0.515)	0.013 (0.897)
Panel B: Three-Year								
# of Months	132	132	95	95	130	130	287	287
All	0.170 (0.063)	0.585 (0.000)	0.026 (0.803)	0.256* (0.066)	0.230 (0.002)	0.232** (0.000)	0.190 (0.000)	0.410 (0.000)
Non-Repeater	0.134 (0.316)	0.590 (0.000)	0.322 (0.023)	0.352 (0.015)	0.193 (0.144)	0.189*** (0.015)	0.258 (0.001)	0.413 (0.000)
Repeater	0.122 (0.512)	0.608 (0.001)	-0.148 (0.267)	0.146* (0.349)	0.268 (0.001)	0.318 (0.000)	0.153 (0.089)	0.441 (0.000)
Non-R - Repeater	0.125 (0.290)	-0.031 (0.698)	0.470 (0.010)	0.206 (0.095)	-0.076 (0.619)	-0.130 (0.211)	0.108 (0.316)	-0.030 (0.688)

Table 4

Abnormal changes in risk loadings and risk premiums: CAPM and 4-factor model over three-year periods before and after buyback announcements

Matching firm-adjusted abnormal changes in beta and risk premiums are reported in this table. For each repurchasing firm, the CAPM and the 4-factor model (Carhart (1997)) are used to estimate the risk loadings using monthly returns over 73 months around announcement dates (36 months prior to and 36 months following announcements). Prior risk loadings are based on the coefficient estimates using 36 monthly returns prior to announcements and post risk loadings are based on the coefficient estimates using 37 monthly returns on and after announcement dates. Using the same time horizons used for repurchasing firms' risk loading estimations, corresponding risk loadings of industry, size, and B/M-matched firms are estimated. The average of five matching firms' loadings is used as the benchmark changes. Matching firm-adjusted abnormal changes are differences in changes in betas and risk premiums before and after announcements after controlling for average changes of matching firms. In Panel A, matching firm-adjusted changes in beta from the CAPM are reported and in Panel B, matching firm-adjusted risk premiums calculated based on the estimated risk loadings and the average risk premiums in the 4-factor model, which are estimated over the period, 1991 – 2017, are reported. Risk premiums are set to be missing when estimated risk premiums are zero or negative. All variables are winsorized at the 1st and 99th percentiles. In each cell of column “Mean” (“Median”), the average (median) matching firm-adjusted changes before and after buyback announcements are reported on top, p-values for the test of significance of mean (median) are reported in parentheses, and the number of observations (the percentage of firms with positive matching firm-adjusted changes) are reported at the bottom (except for the “Non-R - Repeater” rows that show the difference between Non-Repeater and Repeater). Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In columns (3)-(6) except for those rows for “Non-R - Repeater”, ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	Mean (1)	Median (2)	Mean (3)	Median (4)	Mean (5)	Median (6)	Mean (7)	Median (8)
Panel A: Matching Firm-Adjusted Abnormal Changes in Beta from CAPM (Beta)								
All (%)	-0.048 (0.000)	-0.046 (0.000)	0.013** (0.556)	0.023*** (0.288)	-0.025** (0.093)	-0.013* (0.242)	-0.027 (0.003)	-0.018 (0.004)
	5,160	47.56%	2,391	51.28%***	3,553	49.34%	11,104	48.93%
Non-Repeater	-0.061 (0.000)	-0.057 (0.000)	-0.005 (0.894)	0.003 (0.929)	-0.087 (0.000)	-0.068 (0.000)	-0.058 (0.000)	-0.048 (0.000)
(%)	3,890	47.40%	1,195	50.13%*	1,852	46.33%	6,937	47.59%
Repeater	-0.009 (0.662)	-0.030 (0.138)	0.031 (0.270)	0.038** (0.076)	0.043** (0.028)	0.043*** (0.011)	0.024 (0.072)	0.016 (0.066)
(%)	1,270	48.03%	1,196	52.42%**	1,701	52.62%**	4,167	51.16%
Non-R - Repeater	-0.051 (0.102)	-0.027 (0.202)	-0.036 (0.261)	-0.036 (0.261)	-0.130 (0.000)	-0.111 (0.000)	-0.082 (0.000)	-0.064 (0.000)
Panel B: Matching Firm-Adjusted Abnormal Changes in Risk Premium based on 4-Factor Model (RPrem)								
All (%)	-3.113 (0.000)	-0.265 (0.044)	-2.425*** (0.000)	-0.181 (0.200)	-0.515*** (0.103)	0.703*** (0.006)	-2.134 (0.000)	0.168 (0.497)
	4,890	49.28%	2,351	49.43%	3,377	53.27%***	10,618	50.58%
Non-Repeater	-3.148 (0.000)	-0.237 (0.086)	-2.874 (0.001)	-0.637 (0.160)	-1.400** (0.003)	0.130 (0.953)	-2.634 (0.000)	-0.142 (0.048)
(%)	3,663	49.49%	1,151	48.05%	1,749	50.54%	6,563	49.52%
Repeater	-3.010 (0.000)	-0.337 (0.274)	-1.993 (0.003)	0.195 (0.749)	0.436*** (0.288)	1.132*** (0.000)	-1.326 (0.000)	0.469 (0.091)
(%)	1,227	48.66%	1,200	50.75%	1,628	56.20%***	4,055	52.31%
Non-R-Repeater	-0.138 (0.886)	0.100 (0.949)	-0.881 (0.190)	-0.832 (0.190)	-1.836 (0.001)	-1.001 (0.000)	-1.309 (0.010)	-0.611 (0.033)

Table 5

Abnormal changes in realized and implied returns volatilities and operating cash flows volatilities over three-year periods before and after buyback announcements

Matching firm-adjusted abnormal changes in realized and implied returns volatilities and volatilities of quarterly operating cash flows before and after buyback announcements are reported in this table. Realized volatilities are estimated using 73 monthly returns around buyback announcements while implied volatilities are from OptionMetrics, and represent average daily implied volatilities of the nearest-money call options with the shortest time to maturity among the options with at least 21 days to maturities. Implied volatilities are available from 1996. Operating cash flow volatilities are standard deviations of quarterly operating cash flows (OIBDPQ) over average of total assets (ATQ) at the beginning and at the end of the quarter. Prior risk measures are based on the estimates using the data over the 36-month period prior to announcements and post estimates are based on the estimates using the data over the 37-month period starting from the month of announcements. Using the same time horizons used for repurchasing firms' estimates, corresponding risk measures of industry, size, and B/M-matched firms are estimated. The average of five matching firms' estimates is used as the benchmark changes. Matching firm-adjusted abnormal changes are differences between changes of buyback firms before and after announcements and average changes of matching firms. In each cell under the column "Mean" ("Median"), average (median) matching firm-adjusted abnormal changes are reported on top, p-values for the test of significance of mean (median) are reported in parentheses, and the number of observations (the percentage of firms with positive matching firm-adjusted abnormal changes) are reported at the bottom (except for the "Non-R - Repeater" rows that show the difference between Non-Repeater and Repeater). Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In columns (3) - (6) except for those rows for "Non-R- Repeater", ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	Mean	Median	Mean	Median	Mean	Median	Mean	Median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Matching Firm-Adjusted Abnormal Changes in Realized Volatilities (Vol, %)								
All	-0.735 (0.000)	-0.573 (0.000)	0.137*** (0.241)	0.236*** (0.024)	-0.318*** (0.001)	-0.106*** (0.009)	-0.413 (0.000)	-0.276 (0.000)
	5,534	44.04%	2,613	52.09%***	3,643	48.67%***	11,790	47.25%
Non-R - Repeater	-0.421 (0.031)	-0.291 (0.011)	-0.792 (0.001)	-1.026 (0.000)	-1.039 (0.000)	-0.997 (0.000)	-0.849 (0.000)	-0.807 (0.000)
Panel B: Matching Firm-Adjusted Abnormal Changes in Implied Volatilities (IVol, %)								
All	-1.332 (0.000)	-0.951 (0.000)	0.356*** (0.216)	0.609*** (0.029)	-0.136*** (0.530)	-0.088*** (0.434)	-0.400 (0.007)	-0.166 (0.030)
	1,984	45.11%	1,521	53.71%***	2,651	49.42%***	6,156	49.09%
Non-R - Repeater	-0.956 (0.122)	-1.162 (0.024)	-2.478 (0.000)	-1.697 (0.000)	-1.574 (0.000)	-1.974 (0.000)	-1.840 (0.000)	-1.777 (0.000)
Panel C: Matching Firm-Adjusted Abnormal Changes in Operating Cash Flows Volatilities (OVol, %)								
All	-0.005 (0.823)	0.000 (0.893)	0.024 (0.338)	0.013 (0.166)	0.030 (0.174)	0.039** (0.001)	0.013 (0.345)	0.013 (0.014)
	5,158	50.04%	2,530	51.58%	3,568	52.97%***	11,256	51.31%
Non-R - Repeater	-0.124 (0.014)	-0.019 (0.020)	-0.144 (0.004)	-0.009 (0.122)	-0.054 (0.232)	-0.050 (0.094)	-0.106 (0.000)	-0.029 (0.000)

Table 6
Abnormal changes in firm characteristics and operating performance over
three-year periods before and after buyback announcements

Matching firm-adjusted abnormal changes in firm characteristics and operating performance before and after buyback announcements are reported in this table. Details on how we measure various firm characteristics and operating performance measures are available in Appendix. Changes in investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) are average quarterly investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) over the three-year period following buyback announcements minus average investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR) over the three-year period prior to buyback announcements. For each buyback, five industry, size and B/M-adjusted matching firms' changes are calculated over the same horizons as those used for the corresponding buyback firm and the average of five (or less depending on the availability of the data) changes is subtracted from the corresponding buyback firm's change to calculate matching firm-adjusted abnormal changes in investments (cash reserves, financial deficits, leverage, operating performance, DPR or TPR). In each cell under the column "Mean" ("Median"), average (median) matching firm-adjusted abnormal changes are reported on top, p-values for the test of significance of mean (median) are reported in parentheses, and the number of observations (the percentage of firms with positive matching firm-adjusted abnormal changes) are reported at the bottom (except for the "Non-R - Repeater" rows that show the difference between Non-Repeater and Repeater). Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. In columns (3) - (6) except for those rows for "Non-R- Repeater", ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	Mean (1)	Median (2)	Mean (3)	Median (4)	Mean (5)	Median (6)	Mean (7)	Median (8)
Panel A: Matching Firm-Adjusted Abnormal Changes in Investment (Inv, %)								
All	0.087 (0.000)	0.064 (0.000)	0.072 (0.000)	0.028 (0.000)	0.055 (0.000)	0.0202** (0.000)	0.072 (0.000)	0.032 (0.000)
	3,833	54.68%	2,217	56.56%	3,640	55.71%	9,690	55.50%
Non-R - Repeater	-0.040 (0.461)	-0.018 (0.547)	0.076 (0.019)	0.017 (0.090)	-0.024 (0.319)	0.002 (0.593)	0.008 (0.688)	0.015 (0.409)
Panel B: Matching Firm-Adjusted Abnormal Changes in Cash Reserves (Cash, %)								
All	0.236 (0.034)	0.259 (0.001)	-0.373*** (0.023)	-0.103*** (0.162)	-0.048*** (0.724)	-0.030** (0.780)	0.013 (0.862)	0.104 (0.158)
	5,523	52.45%	2,611	49.33%***	3,644	49.70%***	11,778	50.91%
Non-R - Repeater	0.192 (0.460)	0.142 (0.215)	0.842 (0.010)	0.234 (0.044)	-0.169 (0.534)	0.110 (0.888)	0.328 (0.038)	0.229 (0.009)
Panel C: Matching Firm-Adjusted Abnormal Changes in Financial Deficits (FD, %)								
All	-0.188 (0.006)	0.046 (0.642)	-0.006 (0.935)	0.025 (0.518)	-0.114 (0.017)	-0.016 (0.260)	-0.119 (0.001)	0.009 (0.588)
	3,545	50.83%	2,011	50.47%	3,395	49.43%	8,951	50.22%
Non-R - Repeater	-1.039 (0.000)	-0.612 (0.000)	-0.550 (0.000)	-0.349 (0.000)	-0.614 (0.000)	-0.327 (0.000)	-0.669 (0.000)	-0.362 (0.000)
Panel D: Matching Firm-Adjusted Abnormal Changes in Leverage (Lev, %)								
All	-0.525 (0.000)	-0.600 (0.000)	-0.083* (0.652)	-0.090** (0.459)	-0.309* (0.034)	-0.382 (0.001)	-0.360 (0.000)	-0.420 (0.000)
	5,518	46.48%	2,610	49.35%**	3,632	47.38%	11,760	47.40%
Non-R - Repeater	-0.781 (0.008)	-0.780 (0.000)	-1.908 (0.009)	-0.827 (0.009)	-1.806 (0.000)	-1.118 (0.000)	-1.420 (0.000)	-0.951 (0.000)
Panel E: Matching Firm-Adjusted Abnormal Changes in Operating Performance (ROA, %)								
All	-0.555 (0.000)	-0.176 (0.000)	-0.198*** (0.000)	-0.065*** (0.000)	-0.246*** (0.000)	-0.074*** (0.000)	-0.377 (0.000)	-0.113 (0.000)
	5,227	35.51%	2,554	41.62%***	3,587	43.13%***	11,368	39.29%
Non-R - Repeater	-0.329 (0.000)	-0.147 (0.000)	0.054 (0.417)	0.039 (0.012)	-0.237 (0.000)	-0.061 (0.007)	-0.270 (0.000)	-0.084 (0.000)

Panel F: Matching Firm-Adjusted Abnormal Changes in Dividend Payout Ratio (DPR, %)								
	3.216	0.000	3.164	0.000	3.913	0.000***	3.466	0.000
All	(0.021)	(0.008)	(0.073)	(0.565)	(0.018)	(0.344)	(0.000)	(0.336)
	3,661	47.42%	2,158	44.90%*	3,518	45.14%*	9,337	45.98%
Non-R -	2.152	0.000	-2.357	0.000	0.278	0.723	-0.109	0.000
Repeater	(0.567)	(0.559)	(0.505)	(0.049)	(0.933)	(0.408)	(0.955)	(0.430)
Panel G: Matching Firm-Adjusted Abnormal Changes in Total Payout Ratio (TPR, %)								
	25.134	1.824	32.076	17.484***	23.304	15.900	26.161	7.403
All	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	4,234	53.59%	2,040	62.06%***	2,701	57.35%***	8,975	56.65%
Non-R -	24.412	5.377	18.515	12.284	33.577	32.832	23.571	12.148
Repeater	(0.000)	(0.000)	(0.058)	(0.000)	(0.003)	(0.000)	(0.000)	(0.000)

Table 7

Regression analyses of 3-year abnormal returns

Industry, size and B/M-adjusted 3-year buy-and-hold abnormal returns (BHARs) and alpha (Alpha) from the 4-factor model are regressed on various factors. Details on how we estimate variables used in this table are available in Appendix. Each buyback firm's alpha is estimated using monthly returns of each firm and four factors over 37 months starting from the month of buyback announcements. Alphas represent monthly abnormal returns while BHARs represent 3-year abnormal returns, both of which are in %. Changes of explanatory variables are defined as repurchasing firms' changes in average quarterly values over three years before and after buyback announcements. All explanatory variables are in percentages except for dummy variables and quintiles. Regressions are run separately using sample buybacks in each subperiod in columns (1) – (6). P-values based on heteroskedasticity-adjusted standard errors are reported in parentheses. ***, ** and * indicate that the number are significantly different from zero at the 1%, 5% and 10% significance levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	BHAR (1)	Alpha (2)	BHAR (3)	Alpha (4)	BHAR (5)	Alpha (6)	BHAR (7)	Alpha (8)
RepeatD	-3.626 (0.677)	-0.029 (0.801)	-10.921*** (0.010)	-0.109** (0.038)	-4.348 (0.305)	-0.002 (0.978)	-6.355** (0.046)	-0.079* (0.078)
ΔVol	1.986** (0.025)	0.095*** (0.000)	0.507 (0.577)	0.021 (0.244)	-0.748** (0.045)	0.003 (0.782)	0.695 (0.122)	0.048*** (0.003)
ΔRPrem	-0.058 (0.874)	-0.036** (0.020)	-0.098 (0.320)	-0.022 (0.100)	0.071 (0.762)	-0.018 (0.162)	-0.077 (0.653)	-0.028*** (0.001)
ΔOVol	-5.173* (0.069)	-0.106 (0.154)	-4.089 (0.272)	-0.103** (0.044)	-1.759 (0.695)	-0.008 (0.901)	-3.730** (0.044)	-0.073* (0.072)
ΔROA	16.811*** (0.000)	0.299*** (0.001)	13.318** (0.012)	0.323*** (0.003)	16.148*** (0.001)	0.292*** (0.001)	15.636*** (0.000)	0.289*** (0.000)
ΔLev	-0.949* (0.058)	-0.019*** (0.003)	0.069 (0.847)	0.002 (0.806)	-0.183 (0.647)	-0.007 (0.254)	-0.401* (0.093)	-0.012*** (0.003)
ΔInv	-4.816** (0.040)	-0.079 (0.104)	-2.486 (0.565)	-0.067 (0.502)	-5.339 (0.406)	-0.136 (0.228)	-4.009* (0.068)	-0.073* (0.087)
ΔFD	3.112* (0.080)	0.021 (0.340)	0.996 (0.240)	0.030 (0.131)	0.923 (0.347)	0.035* (0.065)	2.010** (0.010)	0.031*** (0.007)
ΔCash	0.777* (0.080)	0.020** (0.026)	0.057 (0.836)	0.008 (0.331)	0.319 (0.490)	0.001 (0.862)	0.506** (0.025)	0.012** (0.011)
ΔDPR	-0.040 (0.450)	-0.001 (0.352)	-0.119* (0.083)	-0.003* (0.085)	-0.011 (0.831)	-0.001 (0.310)	-0.049 (0.110)	-0.002*** (0.005)
ΔTPR	-0.054*** (0.005)	-0.002** (0.010)	-0.013 (0.393)	-0.000 (0.260)	-0.018 (0.370)	-0.000 (0.402)	-0.027** (0.012)	-0.001*** (0.009)
Size	-9.218*** (0.003)	-0.166*** (0.006)	-4.187*** (0.004)	-0.051** (0.041)	-0.785 (0.736)	-0.077* (0.054)	-4.170*** (0.007)	-0.093*** (0.000)
B/M	-5.752*** (0.003)	-0.080* (0.071)	0.395 (0.832)	0.049 (0.171)	-3.111 (0.229)	-0.013 (0.673)	-3.279** (0.013)	-0.025 (0.259)
AR-1	-28.073** (0.034)	-0.127 (0.588)	-21.155* (0.065)	-0.176** (0.027)	-19.542*** (0.006)	-0.296*** (0.006)	-24.116*** (0.000)	-0.221** (0.020)
Target	0.072 (0.840)	0.002 (0.732)	-0.064 (0.927)	0.010 (0.226)	0.981* (0.054)	0.017*** (0.001)	0.594** (0.024)	0.012*** (0.001)
#SubAuth	1.627 (0.120)	0.001 (0.972)	0.807 (0.622)	0.010 (0.633)	2.757 (0.216)	0.020 (0.463)	1.616** (0.036)	0.010 (0.545)
UnderD	4.870 (0.451)	0.138 (0.352)	6.947 (0.120)	0.072 (0.459)	0.362 (0.910)	-0.075 (0.393)	2.822 (0.330)	0.014 (0.853)
Intercept	72.324*** (0.000)	0.726** (0.029)	42.911** (0.014)	0.600** (0.031)	14.893 (0.355)	0.535** (0.017)	41.454*** (0.000)	0.535*** (0.000)
Industry & Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R ²	0.130	0.214	0.099	0.164	0.104	0.126	0.105	0.149
Sample Size	1,745	1,745	1,216	1,216	2,148	2,148	5,109	5,109

Table 8

Abnormal executive compensation and transient institutional investors' holdings over three years around buyback announcements

Matching firm-adjusted equity-linked executive compensation and transient institutional investors' holdings are reported in this table. Executive compensation data are from the S&P ExecuComp database which provides compensation information for top five (up to 9) executives of S&P 1500 companies starting from 1992. Details on how we measure annual equity-linked compensation (EComp) are available in Appendix. EComp is the average annual EComp over the three-year period prior to buyback announcements. For transient institutional holdings, we identify transient institutional investors using the classification available on the Brian J. Bushee's website (<http://acct.wharton.upenn.edu/faculty/bushee/IIclass.html>) and find their holdings from the Thomson Reuters' Institutional (13f) Holdings data (s34). For each buyback, five industry, size and B/M-adjusted matching firms' EComp or holdings are calculated over the same horizons as those used for the corresponding buyback firm and the average of five (or less depending on the availability of the data) values is subtracted from the corresponding buyback firm's value to calculate matching firm-adjusted values. In each cell under the column "Mean" ("Median"), average (median) matching firm-adjusted values are reported on top, p-values for the test of significance of mean (median) are reported in parentheses, and the number of observations (the percentage of firms with positive matching firm-adjusted changes) are reported at the bottom (except for the "Non-R - Repeater" rows that show the difference between Non-Repeater and Repeater). Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years or those that have active repurchase programs over 60% of the time during the past five years. In columns (3)-(6) except for those rows for "Non-R - Repeater", ***, **, * indicate significantly different values between the first subperiod (1) and the corresponding subperiod at the 1, 5 and 10 percent significant levels, respectively.

	1994-2001		2002-2006		2007-2014		All	
	Mean (1)	Median (2)	Mean (3)	Median (4)	Mean (5)	Median (6)	Mean (7)	Median (8)
Panel A: Matching Firm-Adjusted Equity-Linked Compensation Prior to Buyback Announcements (EComp,%)								
All	0.091 (0.801)	-0.577 (0.414)	1.760*** (0.000)	2.306*** (0.218)	2.545*** (0.000)	3.286*** (0.000)	1.422 (0.000)	1.845 (0.000)
	2,243	47.75%	1,340	50.75%*	2,320	57.16%***	5,903	52.13%
Non-Repeater	0.216 (0.601)	-0.441 (0.494)	1.454 (0.025)	1.460* (0.471)	2.754*** (0.000)	3.309*** (0.000)	1.241 (0.000)	1.380 (0.140)
	1,663	47.50%	622	48.23%	1,078	55.19%***	3,363	50.10%
Repeater	-0.284 (0.701)	-0.664 (0.637)	2.040*** (0.000)	2.773*** (0.017)	2.361*** (0.000)	3.279*** (0.000)	1.669 (0.000)	2.550 (0.000)
	580	48.45%	718	52.92%	1,242	58.86%***	2,540	54.80%
Non-R - Repeater	0.500 (0.548)	0.223 (0.516)	-0.586 (0.087)	-1.312 (0.087)	0.393 (0.076)	0.030 (0.000)	-0.428 (0.295)	-1.169 (0.108)
Panel B: Matching Firm-Adjusted Transient Institutional Holdings Prior to Buyback Announcements (%)								
All	0.578 (0.000)	-0.283 (0.381)	0.732** (0.000)	-0.290 (0.239)	0.958* (0.000)	-0.0110* (0.000)	0.730 (0.000)	-0.223 (0.000)
	5,501	46.79%	2,613	48.30%	3,631	49.90%***	11,745	48.09%
Non-Repeater	0.810 (0.000)	-0.247 (0.007)	1.246* (0.000)	0.037 (0.007)	1.739*** (0.000)	0.843*** (0.000)	1.128 (0.000)	-0.051 (0.000)
	4,145	47.33%	1,299	50.35%*	1,905	53.70%	7,349	49.52%
Repeater	-0.132 (0.423)	-0.363 (0.003)	0.223 (0.319)	-0.636 (0.258)	0.095 (0.585)	-0.626*** (0.077)	0.063 (0.559)	-0.516 (0.001)
	1,356	45.13%	1,314	46.27%	1,726	45.71%	4,396	45.70%
Non-R - Repeater	0.942 (0.000)	0.116 (0.002)	1.023 (0.003)	0.674 (0.022)	1.645 (0.000)	1.469 (0.000)	1.065 (0.000)	0.465 (0.000)
Panel C: Matching Firm-Adjusted Transient Institutional Holdings Following Buyback Announcements (%)								
All	0.345 (0.002)	-0.474 (0.400)	-0.181 (0.168)	-1.031*** (0.000)	0.702 (0.000)	0.107*** (0.000)	0.338 (0.000)	-0.460 (0.389)
	5,501	46.43%	2,613	41.83%***	3,631	50.56%***	11,745	46.68%
Non-Repeater	0.541 (0.000)	-0.330 (0.430)	0.399 (0.052)	-0.632 (0.524)	1.180*** (0.000)	0.528*** (0.000)	0.682 (0.000)	-0.230 (0.004)
	4,145	47.41%	1,299	45.65%	1,905	52.60%***	7,349	48.44%
Repeater	-0.254 (0.234)	-0.909 (0.001)	-0.756* (0.000)	-1.255* (0.000)	0.175 (0.336)	-0.190** (0.915)	-0.236 (0.030)	-0.827 (0.000)
	1,356	43.44%	1,314	38.05%***	1,726	48.32%***	4,396	43.74%
Non-R - Repeater	0.795 (0.002)	0.580 (0.005)	1.155 (0.000)	0.623 (0.001)	1.005 (0.000)	0.718 (0.001)	0.917 (0.000)	0.597 (0.000)

Table 9

Regression analyses of 3-year abnormal returns:

Impact of equity-linked compensation and transient institutional investors

Industry, size and B/M-adjusted 3-year buy-and-hold abnormal returns (BHARs) and alpha (Alpha) from the 4-factor model are regressed on various factors used in Table 7 plus the highest quartile indicators of matching firm-adjusted equity-linked compensation (HComp) and holdings of transient institutional investors (HTran) over the three-year period prior to buyback announcements. Quartiles are formed in each year using repurchasing firms announced buybacks during the year. Details on how we estimate variables used in this table are available in Appendix. Each buyback firm's alpha is estimated using monthly returns of each firm and four factors over 37 months starting from the month of buyback announcements. Alphas represent monthly abnormal returns while BHARs represent 3-year abnormal returns, both of which are in %. Changes of explanatory variables are defined as repurchasing firms' changes in average quarterly values over three years before and after buyback announcements. All explanatory variables are in percentages except for dummy variables and quintiles. Regressions are run separately using sample buybacks in each subperiod in columns (1) – (6). P-values based on heteroskedasticity-adjusted standard errors are reported in parentheses. ***, ** and * indicate that the number are significantly different from zero at the 1%, 5% and 10% significance levels, respectively. At the bottom rows, the sums of coefficients of HComp (HTran) and RepeatD and their p-values are reported.

	1994-2001		2002-2006		2007-2014		All	
	BHAR (1)	Alpha (2)	BHAR (3)	Alpha (4)	BHAR (5)	Alpha (6)	BHAR (7)	Alpha (8)
HComp	1.235 (0.797)	0.121 (0.254)	-1.317 (0.742)	-0.141 (0.237)	5.259 (0.237)	0.041 (0.264)	1.197 (0.686)	0.017 (0.709)
HTran	3.017 (0.223)	-0.024 (0.868)	-6.914 (0.363)	-0.242 (0.205)	2.506 (0.403)	0.097 (0.156)	0.302 (0.897)	-0.030 (0.678)
RepeatD	2.094 (0.819)	0.076 (0.531)	-12.424* (0.052)	-0.214** (0.023)	-3.203 (0.576)	0.061 (0.377)	-4.428 (0.264)	-0.049 (0.418)
ΔVol	-0.336 (0.721)	0.077*** (0.005)	-0.583 (0.374)	0.020 (0.462)	-1.738*** (0.006)	-0.008 (0.541)	-0.908** (0.025)	0.031** (0.037)
ΔRPrem	-0.373 (0.414)	-0.040*** (0.006)	-0.317 (0.365)	-0.026* (0.077)	-0.180 (0.641)	-0.024** (0.038)	-0.380* (0.092)	-0.033*** (0.000)
ΔOVol	-6.494** (0.025)	-0.052 (0.314)	-7.433** (0.020)	-0.073 (0.101)	0.905 (0.839)	0.054 (0.522)	-4.086* (0.067)	-0.027 (0.467)
ΔROA	9.252** (0.012)	0.109 (0.120)	12.890*** (0.005)	0.276*** (0.003)	15.363*** (0.000)	0.294*** (0.000)	12.299*** (0.000)	0.211*** (0.000)
ΔLev	-1.028* (0.088)	-0.024** (0.010)	0.038 (0.937)	0.002 (0.820)	-0.012 (0.974)	-0.001 (0.852)	-0.343 (0.186)	-0.010** (0.017)
ΔInv	0.899 (0.802)	-0.018 (0.742)	-0.116 (0.969)	-0.080 (0.318)	-14.392* (0.056)	-0.282* (0.069)	-4.502 (0.175)	-0.102 (0.109)
ΔFD	0.828 (0.563)	-0.013 (0.696)	0.841 (0.313)	0.004 (0.878)	0.869 (0.458)	0.030* (0.090)	0.799 (0.248)	0.011 (0.463)
ΔCash	1.115 (0.174)	0.025** (0.026)	0.185 (0.415)	0.011 (0.281)	0.603 (0.222)	0.008 (0.217)	0.754** (0.012)	0.015*** (0.003)
ΔDPR	0.014 (0.893)	-0.002 (0.396)	-0.002 (0.977)	-0.001 (0.614)	-0.063 (0.402)	-0.001 (0.262)	-0.053 (0.253)	-0.002** (0.013)
ΔTPR	-0.106*** (0.002)	-0.002*** (0.002)	-0.026 (0.323)	-0.000 (0.545)	-0.002 (0.878)	-0.000 (0.910)	-0.034** (0.029)	-0.000 (0.101)
Size	-15.522*** (0.000)	-0.288*** (0.000)	-4.464* (0.074)	-0.112* (0.056)	0.080 (0.973)	-0.053* (0.099)	-4.685** (0.021)	-0.116*** (0.000)
B/M	-4.691* (0.096)	-0.161** (0.030)	-1.214 (0.470)	0.038** (0.047)	0.012 (0.995)	-0.015 (0.615)	-1.552 (0.219)	-0.049* (0.078)
AR-1	-28.942* (0.054)	-0.066 (0.763)	-15.925 (0.167)	-0.218 (0.257)	-16.312** (0.045)	-0.259** (0.016)	-21.983*** (0.001)	-0.196* (0.086)
Target	0.057 (0.919)	0.006 (0.663)	0.592 (0.442)	0.017 (0.197)	0.877** (0.049)	0.009* (0.070)	0.726** (0.012)	0.012** (0.013)
#SubAuth	1.370 (0.301)	-0.005 (0.871)	0.885 (0.544)	0.014 (0.562)	2.964 (0.142)	0.036 (0.254)	1.681** (0.043)	0.014 (0.402)
UnderD	7.775	0.046	5.711	0.080	1.303	-0.009	2.913	0.009

	(0.354)	(0.836)	(0.369)	(0.332)	(0.741)	(0.935)	(0.402)	(0.923)
Intercept	98.304***	1.610***	44.141	0.848	2.338	0.416**	36.734***	0.759***
	(0.000)	(0.001)	(0.101)	(0.119)	(0.884)	(0.041)	(0.004)	(0.000)
Industry & Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.139	0.201	0.117	0.166	0.106	0.145	0.0972	0.132
Sample Size	1,002	1,002	807	807	1,599	1,599	3,408	3,408
HComp+RepeatD	3.329	0.197	-13.741	-0.355	2.056	0.102	-3.231	-0.032
	(0.745)	(0.318)	(0.099)	(0.070)	(0.815)	(0.301)	(0.552)	(0.716)
HTran+RepeatD	5.111	0.052	-19.338	-0.456	-0.697	0.158	-4.126	-0.079
	(0.556)	(0.817)	(0.134)	(0.046)	(0.907)	(0.137)	(0.392)	(0.458)

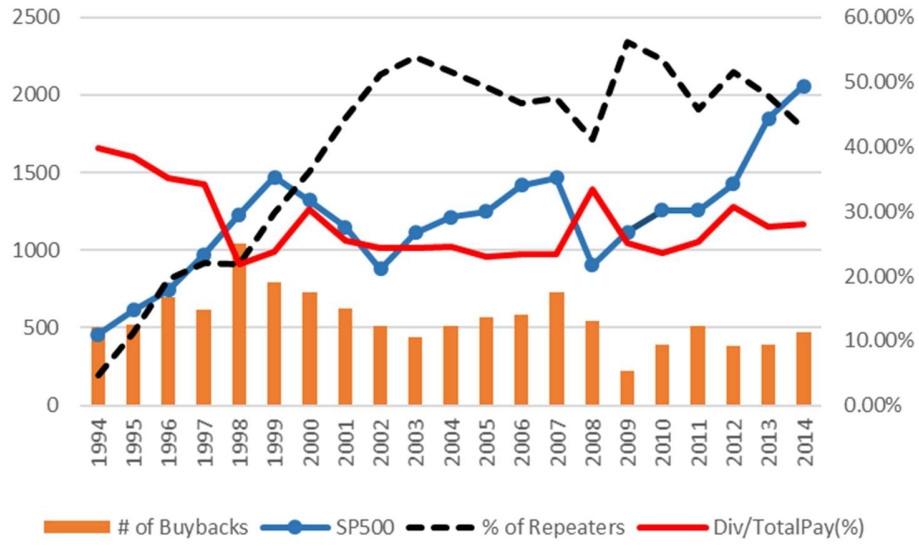


Figure 1. Number of buybacks, percentage of repeating buyback announcements and average cash dividends as a percentage of total payout amounts. This figure shows the number of buybacks, the percentage of repeating buyback announcements and average cash dividends as a percentage of total payout amounts per year during our sample period, 1994-2014. Repeat repurchasers are those firms that have at least two initial authorizations of repurchases within the past five years prior to buyback announcements or those that have active repurchase programs over 60% of the time during the past five years. Cash dividends as a percentage of total payout amounts represent the aggregate amount of cash dividends over the aggregate amount of total payout of sample firms in each year. SP500 refers to the S&P 500 Index level at the end of each year.

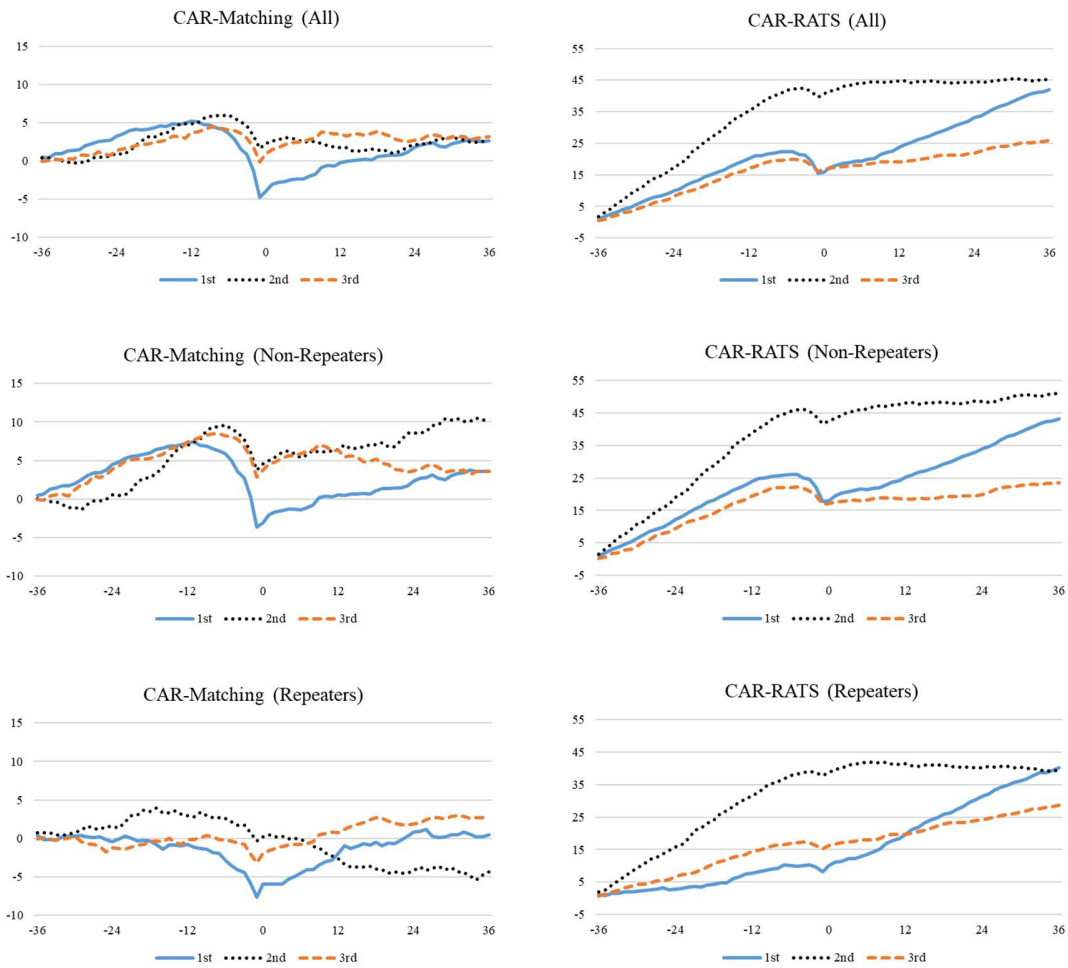


Figure 2. CARs. This figure shows cumulative abnormal returns (CARs) starting from 36 months prior to the month of buyback announcements and ending 36 months following the month of announcements. The figures on the left-hand side are CARs based on abnormal returns calculated by subtracting the average monthly returns of five industry, size and BM-adjusted matching firms while monthly abnormal returns on the right-hand side are calculated from the modified return across time and securities (RATS) method (Ibbotson (1975)) using the four-factor model (Carhart (1997)). 1st, 2nd and 3rd represent sample periods, 1994-2001, 2002-2006 and 2007-2014, respectively.

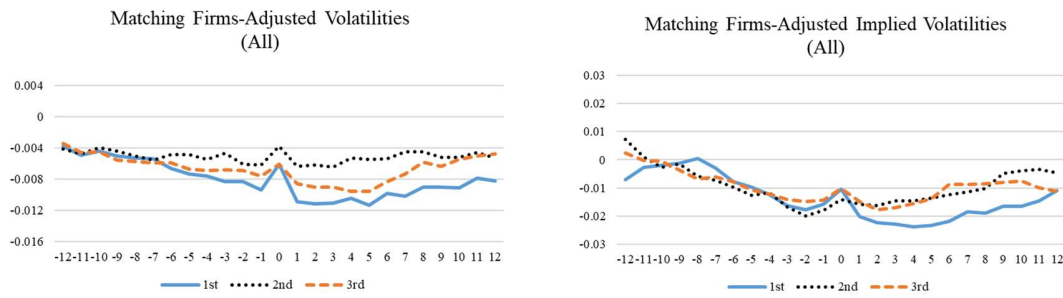


Figure 3. Volatilities around share repurchase announcements. This figure shows matching firms-adjusted realized and implied volatilities over a quarter from 12 quarters prior to the quarter of buyback announcements and ending 12 quarters following the quarter of announcements. The Appendix explains how each variable is measured. 1st, 2nd and 3rd represent sample periods, 1994-2001, 2002-2006 and 2007-2014, respectively.

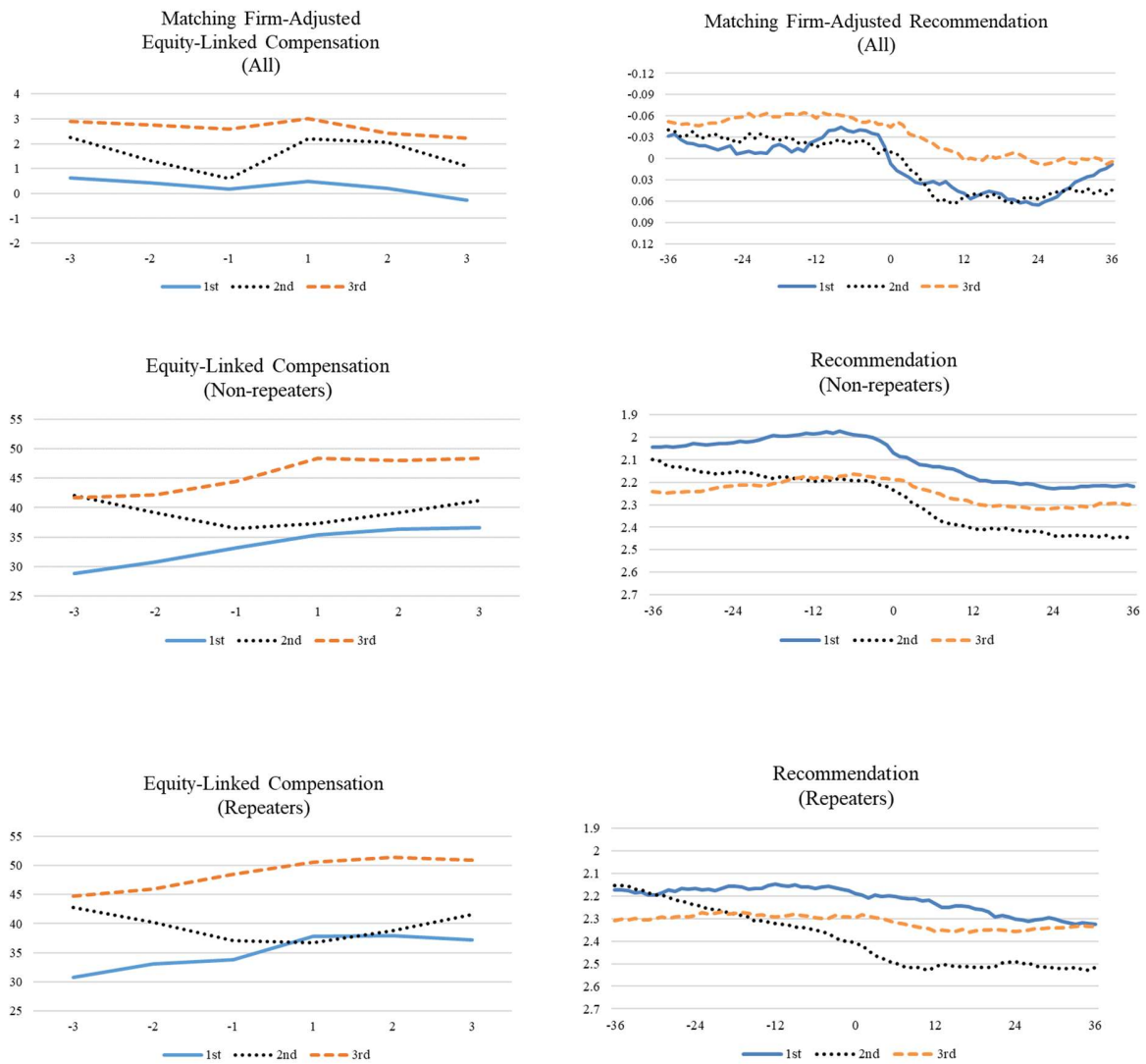


Figure 4. Equity-Linked Compensation and Analysts Recommendations. This figure shows matching firms-adjusted and unadjusted average equity-linked compensation as a percentage of total compensation and average analysts recommendation scores from three years before and three years after buyback announcements. Details on how we measure equity-lined compensation are described in Appendix. Mean analysts recommendation scores are from IBES (1 = strong buy; 2 = buy; 3 = hold; 4 = sell; 5 = strong sell). Matching firm adjustments are made by subtracting the average of five (or less depending on the availability) industry, size and BM-adjusted matching firms' mean values. 1st, 2nd and 3rd represent sample periods, 1994-2001, 2002-2006 and 2007-2014, respectively.