The Persistence of Share Repurchases, Financing, and Growth

Sadok El Ghoul
University of Alberta, Edmonton, ABT6G 2R6, Canada
elghoul@ualberta.ca

Omrane Guedhami
University of South Carolina, Columbia, SC 29208, USA
omrane.guedhami@moore.sc.edu

Hyunseok Kim
Sungkyunkwan University (SKKU), Seoul, 13063 Korea
khs8319@skku.edu

Jungwon Suh
Sungkyunkwan University (SKKU), Seoul, 13063 Korea
jungwonsuh@skku.edu

Abstract

This study documents evidence that share repurchases have become persistent in recent years, as an increasing number of firms repurchase shares year after year. This persistence means that share repurchases are now a long-term cash flow commitment. As a result, previous notions about share repurchases—such as considering them a means of distributing transitory cash flow, or a response to undervaluation or raising the debt ratio—have little explanatory power. Instead, share repurchases are linked to fast, consistent future growth, which is reflected in the high stock valuation of share repurchasing firms. Firms use cash flow as the primary source of capital to finance share repurchases year after year. This financing has cumulatively large effects on capital structure, as share repurchasing firms experience large, steady increases in retained earnings and comparable decreases in paid-in capital over time. On average, share repurchases do not displace investment, as share repurchasing firms invest actively to generate fast growth that in turn helps finance repeated share repurchases.

JEL classification: G31, G32, G35
Key words: Share repurchases, valuation, cash flow, retained earnings, capital structure

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This study documents evidence that share repurchases have become persistent in recent years, as an increasing number of firms repurchase shares year after year. This persistence means that share repurchases are now a long-term cash flow commitment. As a result, previous notions about share repurchases—such as considering them a means of distributing transitory cash flow, or a response to undervaluation or raising the debt ratio—have little explanatory power. Instead, share repurchases are linked to fast, consistent future growth, which is reflected in the high stock valuation of share repurchasing firms. Firms use cash flow as the primary source of capital to finance share repurchases year after year. This financing has cumulatively large effects on capital structure, as share repurchasing firms experience large, steady increases in retained earnings and comparable decreases in paid-in capital over time. On average, share repurchases do not displace investment, as share repurchasing firms invest actively to generate fast growth that in turn helps finance repeated share repurchases.

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1. Introduction

Previous studies put forth numerous explanations concerning the nature and determinants of share repurchases. Among other theories, the temporary cash flow hypothesis and the excess cash hypothesis postulate that firms use share repurchases as a means of distributing or unloading temporary cash flows and excess cash, respectively (Dittmar, 2000; Guay and Harford, 2000; Jagannathan, Stephens, and Weisbach, 2000; Lee and Suh, 2011). The undervaluation hypothesis holds that firms perform share repurchases when their stocks are undervalued (Stephens and Weisbach, 1998; Dittmar, 2000; Bonaimé, Öztekin, and Warr, 2014). Moreover, previous research provides evidence that stock repurchases are associated with stock options grants (Fenn and Liang, 2001); that firms use share repurchases to beat analysts' earnings estimates (Hrbar, Jenkins, and Johnson, 2006) and defend themselves against takeovers (Billett and Xue, 2007; Bargeron, Bonaimé, and Thomas, 2017); that managerial overconfidence leads to share repurchases (Chen and Wang, 2012); and so on.

Previous research as well as business media report that share repurchases have supplanted dividends as the primary payout method for U.S. listed firms. Our investigation further shows that the percentage of share repurchasing firms in the Compustat non-financial and non-utility universe increases from 0.2715 in 1980 to 0.4864 in 2017. We point out, however, that not only has the number of share repurchasing firms increased over time, but also increasing proportions of such firms have repurchased shares in consecutive years. In sum, share repurchases have become persistent.

To demonstrate that share repurchases are increasingly performed in more consecutive years, we plot the means of dummy variables that reflect the extent of consecutive share repurchases over the period 1980-2017. In Figure 1, the mean of *REP_5YR_C*—a dummy equal to one 1 if a firm repurchases shares consecutively every year in the next four years assuming that the firm repurchases shares in the current year—is about 30 percent in the early 1980s, but increases to over 65 percent in the 2010s. These findings suggest that close to 70 percent of share repurchasing firms continue to repurchase shares consecutively in the 2010s, whereas this percentage is only about 30 percent in the early 1980s. A similar pattern is found for the mean *REP_3YR_C*—a dummy equal to one 1 if a firm repurchases shares consecutively every year in the next two years assuming that the firm repurchases shares in the current year. This mean value gradually increases over time to almost an 80 percent level in the 2010s, suggesting that close to 80 percent of share repurchasing firms repurchase shares in at least two more years in recent years.

This persistence means that share repurchases have become a long-term cash-flow commitment for many firms. In response, researchers must measure the amount of share repurchases over a longer time

frame, instead of only for a single year, in investigating the motives behind and the effects of share repurchases. The persistence also means that share repurchases have substantial and lasting effects on the firm's asset or capital structure. In the present study, we depart from previous research by using the five-year sum of share repurchases as the main variable of share repurchases.

Our main sample of share repurchasing firms consists of 2,242 unique firms that announce share repurchase programs over the period 1994-2017. We identify those firms using the SDC Platinum database and then measure the amount of their share repurchases using cash-flow statement items using the Compustat database. To check the robustness and generality of our findings, we also examine an auxiliary sample of share repurchasing firms that are identified based solely on cash flow-statement items in Compustat. Our examination of the share repurchase announcement sample shows that as many as 75.56 percent of those announcement firms repurchase shares every year in the following four years in addition to the announcement year (i.e., at least five consecutive years). Also the cumulative sum of share repurchases increases over time so the mean (median) of the cumulative sum of share repurchases over the five-year period (t, t+4) is as large as 0.3125 (0.2157) of the beginning-of-period book assets.

To determine firm characteristics associated with share repurchases, we split the sample into two groups—top-half and bottom-half share repurchasing firms—based on the sum of share repurchases over five-years (t, t+4) scaled by the beginning-of-period book assets. We then compare the mean and median of the two groups' firm characteristics as measured at the beginning of the announcement year.

We find that top-half share repurchasing firms have higher Q (as well as industry-adjusted Q) than bottom-half share repurchasing firms, as top-half firms' mean (median) Q is 2.51 (2.15) compared to bottom-half firms' 1.65 (1.42). Top-half firms have a higher stock return run-up (also on the industry-adjusted basis) leading to the announcements than bottom-half firms. Also, on average, share repurchasing firms have positive stock return run-up (also on the industry-adjusted basis). These observations suggest that large share repurchases are associated with higher stock valuations and superior stock performance, and that stock underperformance is not a major force shaping share-repurchase decisions. We also find that top-half firms are more profitable than bottom-half firms, as the mean (median) return on assets is 0.2113 (0.2101) for top-half firms compared to 0.1669 (0.1556) for bottom-half firms.

To ascertain whether and how firm value (Tobin's Q) is associated with share repurchases, we estimate Tobit regressions of the amount of share repurchases for our sample of share repurchase announcement firms combined with non-share repurchasing Compustat firms over the period 1994-2016.

Indeed, Tobin's Q has a significant positive effect on the amount of share repurchases, whether this amount is measured for the announcement year alone or for the five-year period (t, t+4). Meanwhile, stock return run-up has an insignificant effect on the amount of share repurchases. Among other firm characteristics, firm size and operating profitability have significant positive effects on the amount of share repurchases. These findings suggest that share repurchase decisions are not driven by undervaluation or stock underperformance. Instead, the significant positive effects of Tobin's Q are consistent with the notion that share repurchases—particularly, large share repurchases—are performed by firms with high growth potential and the power to generate consistent earnings.

We then analyze the changes of firm characteristics of the share repurchase announcement firms, measured over the five-year period (t, t+4). We find that top-half share repurchasing firms grow faster than bottom-half share repurchasing firms. Over the five-year period, the mean annual asset growth and sales growth of top-half firms are 0.5814 and 0.4625, respectively, both of which are higher than the corresponding means of bottom-half firms (0.4521 and 0.3722, respectively). Top-half firms' fast growth is consistent with those firms' high Tobin's Q and stock return run-up prior to share repurchase announcements. Put differently, their valuations and stock performance may reflect fast growth to be realized in subsequent years. We also find that among the candidate sources of capital for share repurchases, retained earnings change most substantially over the five-year period and this change is much greater for top-half firms than for bottom-half firms. In comparison, the amount of debt issuance and the change in cash reserves over the five-year period are relatively small. The size of the increase in retained earnings is comparable to the size of share repurchases, particularly in the median value, which increases the possibility that retained earnings are the key source of capital to finance share repurchases.

In seeking further evidence that retained earnings are the primary source of capital for share repurchases, we examine top-half share repurchase firms' capital structure over the period (t-4, t+4) surrounding the share repurchase announcement year. Indeed, we find that the retained-earnings-to-assets ratio (the retained earnings ratio) displays a significant change, accompanied by a large comparable change in the paid-in-capital ratio. Over the nine-year period (t-4, t+4), the top-half share repurchase firms' mean (median) retained earnings ratio increases steadily from 0.2557 (0.3280) in year t-4 to 0.4409 (0.4472) in year t+4, thus by as much as 19 (12) percentage points. Over the same period, these mean (median) paid-in-capital ratios drop steadily from 0.3096 (0.2003) in year t-4 to 0.0737 (0.0329) in year t+4, thus falling by about 23 (17) percentage points. The shareholders' equity ratio decreases by much less than either the retained earnings ratio or the paid-in-capital ratio moves, as the mean (median)

shareholders' equity ratio decreases from 0.5631 (0.5591) in year *t*-4 to 0.5181 (0.5113) in year *t*+4, thus dropping by only about 4 percentage points. These findings provide further evidence that retained earnings are the primary means of financing share repurchases.

Our evidence of cumulatively large payouts from consecutive share repurchases raises concerns that share repurchases may divert too much capital away from investment, thereby causing underinvestment. We examine whether share repurchases—particularly large share repurchases—are associated with underinvestment. Following Biddle, Hillary, and Verdi (2009), we estimate a regression of investment on sales growth and use the residuals as a proxy for deviation from the expected investment. Firm-years with the most negative residuals are classified as underinvestment and those with the most positive residuals as over-investment. We find that share repurchase announcement firms (as well as the top-half firms among them) do not underinvest relative to the typical firm or matched rival firms, as the estimated likelihood of their underinvestment is much less than the 25 percent benchmark level. We also find that share repurchasing firms do not over-invest either relative to the typical firm or matched rival firms. This finding may suggest that share repurchases help curb excessive investments by distributing free cash flows to shareholders.

In summary, this study documents that share repurchases have become persistent in recent years, as an increasing number of firms repurchase shares year after year, probably based on multi-year programs that tend to be renewed when they expire. Share repurchases are linked to fast, consistent future growth, which is reflected in the high stock valuations of share repurchasing firms. Firms use cash flows as the primary source of capital to finance share repurchases year after year. This financing has cumulatively large effects on capital structure, as share repurchasing firms experience large, steady increases in retained earnings and comparable decreases in the paid-in capital over time. On average, share repurchases do not cause underinvestment, as share repurchasing firms invest actively to generate fast growth that in turn helps finance repeated share repurchases.

Our evidence suggests that existing share repurchase hypotheses—specifically the temporary cash-flow hypothesis, the undervaluation or stock underperformance hypothesis, and the underleverage hypothesis—have limited explanatory power for, or are even inconsistent with, actual share repurchases (which are now increasingly persistent). First, our evidence shows that share repurchases are backed by the consistent generation of internal funds over a sustained period, rather than by transitory cash flows, as share repurchasing firms experience steady and cumulatively large increases in retained earnings and those increases are comparable in size to decreases in the paid-in capital. Also, the size of repeated share

repurchases, particularly those by top-half share repurchase firms, is simply so large that it is unlikely such repurchases could be funded by nonrecurring, one-time windfall profits.

Second, contrary to the undervaluation or stock underperformance hypothesis, share repurchases are positively associated with high firm valuation or with superior stock performance prior to share repurchase announcements. Tobit regressions also suggest that firm value has a significant positive effect and stock return run-up has an insignificant effect on the amount of share repurchases after controlling for a set of firm characteristics. Third, it does not appear that firms repurchase shares with the intention of raising the leverage ratio, given that they finance much of their share repurchases—particularly in the case of large share repurchases—with retained earnings. Share repurchases have a neutral effect on the leverage ratio if they are financed with retained earnings, as the increases in retained earnings offset the decreases in paid-in-capital, resulting in no change in the amount of shareholder's equity or thus in the leverage ratio.

Instead, our evidence of repeated and cumulatively large share repurchases calls for a new explanation. We propose the consistent-growth hypothesis, which holds that share repurchases reflect firms' capacity or expectations of generating consistent cash flows in the years ahead. The consistent generation of cash flow is accompanied by share repurchasing firms' relatively fast growth in assets and sales. Consistent with their fast growth, share repurchasing firms do not underinvest as their investments are mostly at the moderate level. Accordingly, share repurchasing firms have high Tobin's Q, as qualities such as consistency and growth potential are embedded in their stock valuation. Our consistent-growth hypothesis is at odds with the conventional notion that firms transition to the mature, slow-growth phase from the fast-growth phase with their share repurchase (e.g., Grullon and Michaley 2004). Our additional analyses reveal that Tobin's Q is *negatively* related to the amount of share repurchases of the Compustat firms in the past (i.e., the period before 1994), which supports the firm-maturity hypothesis. However, Tobin's Q is *positively* related to the amount of share repurchases in recent years (i.e., the period after 1994). This reversal indicates that the motivations behind share repurchases have changed substantially with the emergence of share repurchase persistence.

The rest of the paper is organized as follows. Section 2 reviews previous research. Section 3 describes our data. Section 4 presents evidence that share repurchases have become persistent. Sections 5 and 6 perform main and additional empirical analyses, respectively. Section 7 concludes.

2. Review of existing studies on share repurchases

This section reviews the hypotheses and proxy variables put forth by extant U.S. studies regarding the motivations for share repurchases. As noted above, these studies report several reasons for corporate managers to distribute cash through share repurchases. For example, share repurchases provide corporate managers with flexibility in terms of timing and the amount of cash payouts (e.g., Grullon and Michaely, 2002). Along these lines, many researchers hypothesize that firms use share repurchases to pay out temporary cash flows (Dittmar, 2000; Guay and Harford, 2000; Jagannathan et al., 2000). These researchers use several different approaches in finding evidence for this temporary cash flow hypothesis. Guay and Harford (2000) estimate the transitory component from operating cash flows and find that it is positively related to the decision to repurchase shares. Jagannathan et al. (2000) and Dittmar (2000) use non-operating income as a proxy for temporary cash flows, and both find that non-operating income is positively related to share repurchases.

Some authors hypothesize that firms use share repurchases to distribute excess capital. This excess capital hypothesis relates to the free cash flow hypothesis of Jensen (1986) in that excess capital gives rise to agency costs of over-investment unless it is distributed to shareholders. Dittmar (2000) uses cash holdings as a proxy for excess capital and finds that cash holdings are positively related to share repurchases. Lee and Suh (2011) examine the dataset of seven major countries' share repurchases and document evidence that firms tend to hold excess cash before their share repurchases, and that the source of their excess cash is the reduction in capital expenditures. Prior studies also propose the undervaluation (or signaling) hypothesis that firms use share repurchases to signal that their stocks are undervalued (Chan et al., 2004; Comment and Jarrell, 1991; Dann, 1981; Vermaelen, 1981). These studies find that firms experience positive excess returns around announcements of share repurchases and argue that such finding is consistent with the undervaluation hypothesis. In a similar vein, Stephens and Weisbach (1998) and Dittmar (2000) provide evidence for the undervaluation hypothesis by showing that firms conduct share repurchases when their stocks are undervalued in terms of market-to-book ratios and lagged stock returns. However, Grullon and Michaely (2004) reject the cash-flow-signaling hypothesis by documenting that share repurchases are not associated with improvements in operating performance. Taken together, prior studies suggest that share repurchases may signal undervaluation but not necessarily improvement in operating performance.

As noted above, the list of hypotheses does not stop here. Prior U.S. studies also provide evidence that the presence of stock option programs influences firms' decisions about share repurchases (Fenn and Liang, 2001; Jolls, 1998; Jun et al., 2009; Kahle, 2002); that firms use share repurchases to

beat analysts' earnings estimates (Hrbar, Jenkins, and Johnson, 2006; Gong, Louis, and Sun, 2008; Almeida, Fos, and Krolund, 2016); that firms use share repurchases to defend themselves against takeovers (Billett and Xue, 2007; Denis, 1990); and that some managers use share repurchases to mislead investors (Chan et al., 2010). Additionally, taxes may influence decisions to repurchase shares because, compared to dividends, share repurchases provide shareholders with tax benefits (Barclay and Smith, 1988; Black, 1976). Grullon and Michaely (2002) document that share repurchases become more frequent after tax reform in 1987 favors capital gains relative to dividend income. Hsieh and Wang (2008) document evidence that inside shareholders' tax preferences affect a firm's choice of payout method between dividends and share repurchases.

3. Data

Previous research uses two approaches to identifying share repurchasing firms or share repurchases. The first approach is based on share repurchase announcement records from the SDC database (e.g., Grullon and Michaely, 2004; Bargeron, Bonaimé, and Thomas, 2017). The second is based on the amount of share repurchases calculated as the purchase of common and preferred stock [PRSTKC] less any reduction in the preferred stock redemption value [PRTKRV] from the Compustat database. If this amount is positive, the firm is deemed as having repurchased shares in that year (e.g., Dittmar, 2000; Grullon and Michaely, 2002). We use both approaches to identify share repurchases.

Our main sample of share repurchasing firms is constructed using the first approach—using share repurchase announcement records collected from the SDC database—over the period 1994-2017. We define a share repurchase announcement year as the year in which INIT_AUTHOR in the database is 1, which means that a share repurchase program is authorized in that year. After identifying a share repurchase announcement year, we turn to the Compustat database to ensure that the firm follows through with actual share repurchases. We filter out share repurchases announcement firms if these firms' actual share repurchases are zero in the announcement year and the following two years, where the amount of share repurchases is measured by [PRSTKC] less any reduction in [PRTKRV]. We drop firms in the financial and utilities sectors and firm-years with negative book equity. We also drop firms if their key firm characteristics such as cash and cash flow are missing in any year over the period (t-4, t+4) around the announcement year (t). After this screen procedure, our main sample consists of 2,242 unique firms for the period 1994-2017.

Our auxiliary sample of share repurchasing firms is constructed based on the second approach:

using the amount of share repurchases as calculated as [PRSTKC] less any reduction in [PRTKRV] from the Compustat database. If this value is positive, we deem the firm as having repurchased shares in that year. We apply the same screening procedure as stated above for the construction of our main sample. Compared to the main sample, the auxiliary sample spans a longer period—1980-2017. As stated in Lee, Park, and Pearson (2015), the SDC database's coverage of share repurchase announcements is rather limited for the years prior to 1994. This limitation means that firms that repurchase shares may not be included as share repurchase announcement firms in the SDC in those early years. The second approach, which we use to construct our auxiliary sample, does not have this problem and thus allows us to analyze a longer period.

Appendix Table A.1 provides the definitions of the variables used in this study. To deal with extreme observations, we winsorize continuous variables at the bottom and top 1 percent of their respective distribution.

4. Prologue: an increasing trend of repeated share repurchases over the period 1980-2017

4.1. Proportions of firms that repurchase shares consecutively

In Table 1, the first column reports the percentage of share repurchasing firms in the Compustat non-financial and non-utility universe each year over the period 1980-2017. To demonstrate the extent to which firms repurchase shares consecutively, the other columns report the mean values of dummy variables ranging from *REP_1YR_C* to *REP_5YR_C*. *REP_nYR_C* is a dummy variable that equals 1 if a firm repurchases shares every year over the next *n*-1 years, and zero otherwise, conditional on the firm repurchasing shares in the current year. By definition, *REP_1YR_C* is 1. As an example, *REP_5YR_C* equals 1 if a firm repurchases shares consecutively every year in the next four years, provided the firm repurchases shares in the current year. The mean of *REP_nYR_C* can be interpreted as the likelihood that a share repurchasing firm continues to repurchase shares in at least *n* years consecutively.

The first column of the table shows a long-term rise in the proportion of firms that repurchase shares. The percentage of share repurchasing firms is 0.2715 in 1980 and increases to 0.4864 in 2017, although this increase is not monotonic over time. More importantly, the rest of the table shows that the increasing proportions of share repurchasing firms continue to repurchase shares consecutively in subsequent years. For example, the mean of *REP_2YR_C* is 0.6048 in 1980, suggesting that 60.48 percent of share repurchasing firms in 1980 repurchase shares in the following year. Although this mean does not increase monotonically, there is an upward trend. The mean of *REP_2YR_C* in 2016 is as high as 0.8292,

suggesting that 82.92 percent of share repurchasing firms in 2016 repurchases shares in the following year.

The means of the other variables, *REP_3YR_C*, *REP_4YR_C* and *REP_5YR_C*, display similar ascending trends. For example, the mean of *REP_5YR_C* is relatively modest (0.3071) in 1980 so 30.71 percent of share repurchasing firms in this year continue to repurchase shares consecutively in the following four years. This mean more than doubles to 0.6875 in 2013, suggesting that as many as 66.74 percent of share repurchasing firms in this year repurchase shares consecutively in the following four years.

These observations suggest that share repurchases have become persistent. Not only does the number or percentage of share repurchasing firms increase in the U.S. stock market, but also an increasing proportion of share repurchasing firms repurchase shares in consecutive years.

4.2. Logit regressions

In Table 2, we estimate logit regressions to further demonstrate that share repurchases have become persistent. The sample consists of firms in the Compustat non-financial and non-utility universe and spans the period 1980-2016.

The dependent variables in these logit regressions are a range of dummy variables (*REP1C_DUM*, *REP2C_DUM*, *REP3C_DUM* and *REP4C_DUM*) that indicate the extent to which firms repurchase shares in consecutive years. *REPnC_DUM* equals one if the firm repurchases shares consecutively for at least the next *n* years and zero otherwise. For example, *REP4C_DUM* equals one if the firm repurchases shares consecutively for at least four subsequent years, and zero otherwise. A common explanatory variable in all regressions is *REP_DUM*, a dummy variable that indicates whether the firm repurchases shares in the current year. Another common variable is *Time*, an integer variable that takes the value 1 if the firm-year belongs to the first year of the sample, 2 if it belongs to the second year of the sample, and so on. In Columns (2), (4), (6) and (8), we interact *REP_DUM* with *Time*.

In all Columns (1)-(8), *REP_DUM* has a significant positive coefficient, suggesting that firms that repurchase shares tend to repurchase shares in subsequent years. Also, in all columns, *Time* has a positive significant coefficient, reflecting the fact that the proportions of share repurchasing firms and those that repurchase shares several years in a row have increased. Finally, in Columns (2), (4), (6) and (8), the interaction *REP_DUM*×*Time* has a significant positive coefficient, suggesting that the extent to which share repurchasing firms continue to repurchase shares in consecutive years has increased. These results provide corroborating evidence that share repurchases have become persistent.

5. Main analyses

5.1. The SDC share-repurchase announcement sample

In Table 3, we analyze the continuity and amount of share repurchases over the five-year period (t, t+4)—where year t is the share-repurchase announcement year—for our sample of share repurchase announcement firms constructed from the SDC Platinum database. We calculate the amount of share repurchases for each firm-year using the *Compustat* cash-flow-statement variables, specifically as [PRSTKC] less any reduction in [PRTKRV].

Panel A shows that a high fraction of share-repurchase announcement firms repurchase shares consecutively: 87.60 percent of the announcement firms repurchase shares in years t and t+1, 75.47 percent of the announcement firms repurchase shares in years t, t+1 and t+2, and so on. The last column indicates that as many as 61.11 percent of those announcement firms repurchase shares every year in five consecutive years. The continuity of share repurchases in our share-repurchase announcement sample echoes the evidence of share repurchase persistence in the Compustat universe reported in Tables 1 and 2.

Panel A also shows that the cumulative sum of share repurchases increases steadily and monotonically with time. In the announcement year, the mean (median) amount of share repurchases scaled by the beginning-of-period book assets (denoted by REP_t/TA_{t-1}) is 0.0708 (0.0429). The mean (median) of the cumulative sum of share repurchases over the five-year period (t, t+4) scaled by the beginning-of-period book assets (denoted by $\Sigma REP_{(t,\, t+4)}/TA_{t-1}$) is as large as 0.3116 (0.2188). These results suggest that, on average, our sample firms distribute cash amounting to as much as 31.16 percent of the beginning-of-period assets over the five-year period.

In Panels B and C, we split the share repurchase announcement sample into non-dividend payers and dividend payers, respectively. For both non-dividend payers and dividend payers, share repurchases are highly persistent. 57.41 percent of non-dividend payers repurchase shares consecutively for five years (t, t+4) (in Panel B) and 64.07 percent of dividend payers do so (in Panel C). The cumulative sum of share repurchases increases with time for both groups. Meanwhile, this cumulative sum is greater for non-dividend payers than for dividend payers, as the mean (median) of five-year cumulative share repurchases (i.e., $\Sigma REP_{(t,\, t+4)}/TA_{t-1}$) is 0.3568 (0.2494) for non-dividend payers but 0.2753 (0.2010) for dividend payers.

These observations suggest that share repurchases, as they are performed over several consecutive years, will have cumulatively substantial effects on the firm's assets and capital structure. Therefore, in order to accurately determine the motivations for and effects of share repurchases, we need

to measure share repurchases and examine associated changes in firm characteristics over a period of multiple years, instead of for only a single individual year.

5.2. Firm characteristics of share repurchase announcement firms

In Table 4, we analyze an array of firm characteristics of our sample of share repurchase announcement firms. The table reports the mean and median of those firm characteristics as measured at the beginning of the year of share repurchase announcements. We tabulate these mean and median for the full sample and also separately for firms that make share repurchases in large amounts (which we term "top-half firms") and those that do so in small amounts (which we term "bottom-half firms"). Specifically, we rank the sample announcement firms into top-half and bottom-half firms based on the sum of share repurchases over the five-year period (t, t+4) scaled by the beginning-of-period book assets (TA_{t-1}). This split helps us determine whether firm characteristics vary with the amount of share repurchases.

The top row of the table shows that the mean (median) of the five-year sum of share repurchases is as large as 0.3116 (0.2188) for the full sample. However, this mean (median) is widely different between top-half and bottom-half share repurchasing firms, as the mean (median) is as high as 0.5253 (0.4418) for top-half firms, while it is only 0.0979 (0.0910) for bottom-half firms. Meanwhile, there is little difference in firm size ($log(TA_{t-1})$) between these two groups.

Interestingly, Tobin's Q is significantly higher for top-half share repurchasing firms than for bottom-half share repurchasing firms, as the top-half firms' mean (median) Q is 2.51 (2.15) compared to the bottom-half firms' 1.65 (1.42). Top-half firms have higher Tobin's Q on the industry-adjusted basis as well, as their mean (median) industry-adjusted Q (0.29 (0.07)) is positive but bottom-half firms have a negative mean (median) (-0.46 (-0.44)). These findings suggest that large share repurchases are associated with high firm valuations or high growth potential, but are not consistent with the notion that undervaluation is a key motive for share repurchases.

The table includes stock return run-up ($SRET_{t-1}$) as a proxy for stock underperformance. Both the mean and median of this variable are relatively high for top-half firms, as their mean (median) is 0.2332 (0.1477) compared to the bottom-half firms' 0.1928 (0.1014). A similar finding is obtained on the industry-adjusted basis, as the mean (median) industry-adjusted $SRET_{t-1}$ for top-half firms (0.1121 (0.0350)) is higher than for bottom-half firms (0.0603 (-0.0282)). We also note that the mean (median) of $SRET_{t-1}$ is positive and large for the full sample (0.2130 (0.1298)) and the mean (median) of the industry-adjusted $SRET_{t-1}$ is also positive (0.0862 (0.0064)). Taken together, our findings on Tobin's Q and stock

price run-up cast doubt on the notion that share repurchases are motivated by undervaluation or stock underperformance. If anything, firms that make repurchases in large amounts have high stock valuation and superior stock performance leading up to their share repurchase announcements, compared to firms that make repurchases in small amounts.

On the other hand, sales and asset growth rates (measured from year *t*-2 to year *t*-1) of top-half firms are not higher than those of bottom-half firms. In fact, the mean (median) sales growth for top-half firms is 0.1266 (0.0900), which is slightly lower than the corresponding value for bottom-half firms (0.1335 (0.0961)). Therefore, despite their high Tobin's Q, top-half firms do not record faster growth in the preceding years compared to bottom-half firms. Meanwhile, top-half firms have higher operating profitability than bottom-half firms, as the mean (median) ROA for top-half firms is 0.2101 (0.1984) compared to 0.1659 (0.1549) for bottom-half firms. Consistent with their high profitability, top-half firms have higher retained earnings ratios, as their mean (mean) retained earnings ratio (0.3379 (0.3824)) is higher than that for bottom-half firms (0.2983 (0.3011)). Top-half firms also have relatively large cash holdings, as their mean (median) cash ratio (0.2066 (0.1509)) is higher than that for bottom-half firms (0.1298 (0.0714)). On the other hand, top-half firms use less debt than bottom-half firms, as the mean (median) debt ratio of top-half firms (0.1367 (0.1028)) is lower than that of the bottom-half firms (0.1917 (0.1724)).

In untabulated results, we construct the same table as Table 4 after splitting the full sample into non-dividend payers and dividend payers. The comparisons of top- and bottom-half repurchasing firms both among non-dividend payers and among dividend payers yield similar findings to those in Table 4. Most importantly, in both groups, top-half repurchasing firms have higher mean and median Q (as well as industry-adjusted Q) than bottom-half repurchasing firms. Moreover, in both groups, top-half repurchasing firms have higher stock return run-up (as well as industry-adjusted stock return run-up) than bottom-half repurchasing firms. Therefore, large share repurchases are associated with higher stock valuation and superior stock performance, irrespective of whether share repurchasing firms also pay dividends.

5.3. Tobit regressions of share repurchases

We estimate Tobit regressions to identify the relations between firm characteristics and share repurchases. We focus on the effects of Tobin's Q and stock return run-up ($SRET_{t-1}$) on share repurchases. The negative effects of these variables would be consistent with the undervaluation and stock

underperformance hypotheses, respectively, which hold that firms repurchase shares to address stock undervaluation and stock return underperformance, respectively. Positive effects, however, would indicate that firms with high valuation or superior stock performance repurchase shares.

In Table 5's Tobit regressions, the dependent variables are the amount of share repurchases in the announcement year in Panel A and the five-year sum of share repurchases over (t, t+4) in Panel B. These dependent variables are scaled by the beginning-of-period book assets. Regressions are estimated for a sample that consists of the share-repurchase announcement firms and non-share repurchasing firms in the non-financial and non-utility Compustat universe.

In Panel A's Column (1), Tobin's Q is an explanatory variable with firm size (*log(TA)*) as the sole control variable. In Columns (3), $SRET_{t-1}$ is added as an additional explanatory variable along with an array of firm characteristics as control variables as in previous studies (e.g., Dittmar, 2000; Lee and Suh, 2011). In both Columns (1) and (3), Tobin's Q enters significantly with positive coefficients. The significant positive effect of Tobin's Q remains unchanged in regressions that control for industry fixed effects in Columns (4) and (6). Meanwhile the coefficient on $SRET_{t-1}$ is insignificant in Columns (2) and (3) and continues to be insignificant in Column (5) and (6), where we control for industry-fixed effects. Thus, the results consistently suggest that Tobin's Q has significant positive effects but $SRET_{t-1}$ has insignificant effects on share repurchases.

Panel B's Tobit regressions, where the five-year sum of share repurchases is the dependent variable, yield similar results. Tobin's Q has significant positive effects on share repurchases in the columns in which it is an explanatory variable. Meanwhile, $SRET_{t-1}$ has insignificant effects in the columns in which it is an explanatory variable.

In summary, Tobit regression results do not suggest that firms perform share repurchases to respond to undervaluation or stock underperformance. Instead, the significant positive effects of Tobin's Q suggest that firms with high valuation or high growth potential tend to repurchase shares.

5.4. Five-year changes in firm attributes after share repurchases

In Table 6, we analyze the changes of firm characteristics of share-repurchase announcement firms, measured over the five-year period (t, t+4), where year t is the announcement year. As in Table 4, we compare these changes for top-half and bottom-half firms; we also analyze the full sample.

An observation that stands out from the table is that top-half share repurchasing firms exhibit higher asset and sales growth rates than bottom-half share repurchasing firms. The mean five-year asset

growth and sales growth of top-half firms are 0.5814 and 0.4625, respectively, both of which are higher than the corresponding means of bottom-half firms (0.4521 and 0.3722, respectively). Top-half firms' fast growth is consistent with our earlier observations that those firms command high Tobin's Q (in Table 4) and that Tobin's Q has a significantly positive effect on the amount of share repurchases (in Table 5). Therefore, those firms that repurchase shares in large amounts have high stock valuations, potentially because these valuations reflect fast sales and asset growth to be realized in subsequent years.[1] Meanwhile, the increase in physical assets of top-half firms is not large compared to bottom-half firms, as both the mean and median of $\Delta PPE_{(t-1,\ t+4)}/TA_{t-1}$ of top- and bottom-half firms are about the same. This finding could suggest that top-half firms' faster growth does not come in the form of large capital expenditures, but in some other form, such as large SG&A or R&D spending or increases in intangible assets.

The remainder of Table 6 examines variables with which we can determine the primary source of capital that funds share repurchases. We consider cash reserves, debt issuance, and retained earnings as candidate sources of capital. The table shows that the mean and median of the five-year change in cash reserves ($\Delta Cash_{(t-1,\ t+4)}/TA_{t-1}$) are positive for both top-half and bottom-half share repurchasing firms. Although cash reserves increase much less than book assets over the five-year period in both mean and median, this observation suggests that cash reserves are unlikely to be the major source of capital that funds share repurchases. Also, debt increases over the five-year period, as the mean (median) of $\Delta Debt_{(t-1,\ t+4)}/TA_{t-1}$ is 0.1275 (0.0418) for the full sample. However, the increase in debt is much lower than the amount of share repurchases over the five-year period, as the mean (median) five-year share repurchase is as large as 0.3116 (0.2188). Thus, debt issuance is also unlikely to be the major capital source for share repurchases.

In contrast, retained earnings increase in large amounts over the five-year period, as the mean (median) $\Delta RE_{(t-1,\ t+4)}/TA_{t-1}$ is as high as 0.2207 (0.1940) for the full sample. The median of $\Delta RE_{(t-1,\ t+4)}/TA_{t-1}$ (0.1940) in particular is comparable in size to the median of the five-year sum of share repurchases (0.2188). Moreover, top-half firms' retained earnings increase much more than those of bottom-half firms, as the mean (median) $\Delta RE_{(t-1,\ t+4)}/TA_{t-1}$ of top-half firms (0.2926 (0.2735)) is more than double the mean (median) of bottom-half firms (0.1436 (0.1184)). This finding adds to the likelihood that retained earnings are the primary source of capital to fund share repurchases. Corroborating evidence can be obtained by

[1] It is worth noting that top-half firms do not display faster growth than bottom-half firms before their announcements as described above in Table 4. This finding could mean that the high Tobin's Q of top-half firms before their announcements reflects anticipated faster growth in the years ahead.

analyzing cash flow—which is the source of retained earnings—over the five-year period. Share repurchasing firms generate large cash flow, as the mean (median) five-year cash flow, denoted by $\Sigma CF_{(t, t+4)}/TA_{t-1}$, is as large as 0.7009 (0.6442) for the full sample. Moreover, the mean (median) five-year cash flow of top-half firms (0.8630 (0.7927)) is much greater than that of bottom-half firms (0.5389 (0.4951)), suggesting that large share repurchases are associated with the generation of large cash flows. These findings lend support to the notion that share repurchasing firms—particularly those that repurchase shares in large amounts—turn to internally generated firms as the major source of capital to finance share repurchases.

In short, among the candidate sources of capital for share repurchases, retained earnings appear to be the primary source of capital that finances share repurchases, and particularly large share repurchases. In comparison, debt issuance and cash reserves appear to play minor roles in financing share repurchases.

5.5. Change in capital structure over (t-4, t+4) for top-half share repurchasing firms

We seek further evidence that retained earnings are the primary source of capital for share repurchases. We posit that as firms finance share repurchases by retaining cash flows, they will experience substantial increases in the retained-earnings-to-assets ratio and also that this pattern is more pronounced for top-half share repurchasing firms.

In Table 7's Panel A, we restrict our attention to top-half share repurchasing firms and tabulate the mean and median of capital structure components (scaled by book assets) each year over (t-4, t+4), along with the cash ratio. In contrast to Table 6, Table 7 covers a longer window that includes three years (t-4, t-1) preceding share repurchase announcements a means of identifying long-term underlying forces that shape share repurchases. We restrict our attention to top-half share repurchasing firms, because those firms are likely to experience more substantial changes in capital structure with large share repurchases—or equivalently, those firms will more vividly exhibit the types of effects that share repurchases have on capital structure. In Panels B and C, we tabulate the mean and median values separately top-half share repurchasing firms among non-dividend payers and those among dividend payers, respectively. This split into non-dividend payers and dividend payers is necessitated by the fact that firms' capital structure—for example, the debt-to-assets ratio and the retained earnings-to-assets ratio—varies widely depending on whether the firm pays dividends.

Indeed, Panel A shows that top-half firms' retained-earnings-to-assets ratio (the retained earnings

ratio) increases in the announcement year and also steadily in subsequent years. The mean (median) retained earnings ratio gradually increases from 0.3507 (0.3886) in year *t*-1 to 0.4409 (0.4452) in year *t*+4. This rise in the retained earnings ratio is a continuation of the upward trend in the years preceding the share repurchase announcements, as the mean (median) retained earnings ratio gradually increases from 0.2557 (0.3280) in year *t*-4 to 0.3507 (0.3887) in year *t*-1. This observation potentially arises because many of the share repurchase announcement firms repurchase shares in preceding years. All in all, top-half share repurchasing firms experience considerable increases in their retained earnings ratio over the period (*t*-4, *t*+4).

Top-half firms' considerable increases in the retained earnings ratio are accompanied by almost equally considerable decreases in the paid-in-capital ratio. Over the period (*t*-4, *t*+4), the mean (median) paid-in-capital ratio drops steadily from 0.3096 (0.2003) in year *t*-4 to 0.0737 (0.0329) in year *t*+4. It appears that increases in the retained earnings ratio work to offset decreases in the paid-in-capital ratio, as the mean retained-earnings ratio increases by about 19 percentage points while the mean paid-in-capital ratio decreases by about 23 percentage points over the period (*t*-4, *t*+4). As a result, the shareholders' equity ratio (SEQ/TA) decreases, but not as much as either the retained earnings ratio or the paid-in-capital ratio moves. The mean (median) shareholders' equity ratio decreases from 0.5631 (0.5591) in year *t*-4 to 0.5181 (0.5113) in year *t*+4—thus by only about 4 percentage points. These patterns reinforce the notion that repurchasing firms, particularly those that repurchase shares in large amounts, primarily use retained earnings to finance their repurchases.

Panels B and C show that top-half share repurchasing firms among both non-dividend payers and dividend payers experience steady and cumulatively significant increases in the retained earnings ratio. However, the size of the increase is much greater for non-dividend payers, as these firms' mean (median) retained earnings ratio increases from 0.0807 (0.2034) in year *t*-4 to 0.3721 (0.4072) in year *t*+4, i.e., by as much as about 29 (20) percentage points. These firms experience correspondingly large decreases in the paid-in-capital ratio, as the mean (median) paid-in-capital ratio drops from 0.5352 (0.3538) to 0.2115 (0.1505), i.e., by as much as about 32 (20) percentage points. For dividend payers, the increase in the retained earnings ratio is relatively modest, as its mean (median) increases from 0.4225 (0.4350) in year *t*-4 to 0.5126 (0.4790) in year *t*+4, i.e., by about 9 (4.5) percentage points. Correspondingly, the drop in these firms' paid-in-capital ratio is relatively modest as well, as its mean (median) decreases from 0.1029 (0.0792) in year *t*-4 to -0.0609 (-0.0017) in year *t*+4, i.e., by about 16 (8)

percentage points.[2]

Turning our attention to the cash ratio, the mean (median) cash ratio decreases only slightly with share repurchases. For example, in Panel A, this mean (median) decreases from 0.2066 (0.1509) in year *t*-1 to 0.1874 (0.1410) in year *t*+4. The change in this mean (median) is also small from year *t*-4 to *t*-1. The relatively small change in the cash ratio has two implications. First, cash reserves are unlikely to be the major source of capital to financing share repurchases. Second, share repurchasing firms save little of retained earnings in cash reserves despite the fact that their retained earnings increase significantly.

In short, among the capital structure components, the retained earnings ratio displays the most significant change, accompanied by the corresponding large change in the paid-in-capital ratio. There is evidence that the size of the increase in the retained earnings is comparable to the size of the decrease in the paid-in-capital ratio. These findings provide further evidence that firms use retained earnings as their primary means of financing share repurchases.

5.6. Underinvestment and over-investment of share repurchasing firms

Our findings suggest that share repurchasing firms distribute substantial amounts of cash to shareholders with their consecutive share repurchases. Their large cash distributions raise concern that share repurchases may displace investment. A related notion is that share repurchases reflect poor management or, more specifically, managers' inability to identify and develop growth opportunities. In our next analysis, we seek to determine whether share repurchases (particularly large share repurchases) are associated with underinvestment.

Our framework of estimating underinvestment is drawn from Biddle, Hillary, and Verdi (2009), who estimate a regression of investment on growth opportunities (as measured by sales growth) and then use the residuals as a firm-specific proxy for deviation from expected investment. The regression model is as follows:

$$Investment_{i,t} = \alpha_0 + \alpha_1 Sales\ Growth_{i,t-1} + \varepsilon_{i,t}, \quad (1)$$

where $Investment_{i,t}$ is total investment of firm *i* in year *t* scaled by book assets in year *t*-1, and *Sales*

[2] Unlike non-dividend paying share repurchasing firms, dividend-paying repurchasing firms' increase in their retained earnings ratios is smaller in size than their decrease in their paid-in-capital ratios. This difference in size could be because, unlike non-dividend paying firms, these firms' dividend payouts—which reduce retained earnings—prevent retained earnings from growing quickly.

$Growth_{i,t-1}$ is the percentage change in sales from year t-2 to t-1. Equation (1) is estimated for each industry-year in the Compustat universe over the period 1994-2016 as long as the industry-year includes at least 20 observations based on the Fama and French 48-industry classification. We then rank firms based on the magnitude of the residuals (i.e., deviations from expected investment) into quartiles to create three groups. Firm-years in the bottom quartile (i.e., the most negative residuals) are classified as underinvestment, those in the middle two quartiles as normal investment, and those in the top quartile (i.e., the most positive residuals) as over-investment.

In an alternative estimation approach in Equation (2), we consider the five-year sum of total investment over (t, t+4) as the dependent variable—in place of $Investment_{i,t}$ in Equation (1)—before creating three groups based on the residuals. The regression model is as follows:

$$\sum Investment_{i,(t,t+4)} = \beta_0 + \beta_1 Sales\ Growth_{i,t-1} + \varepsilon_{i,(t,t+4)}, \tag{2}$$

Panel A of Table 8 reports the relative frequency (i.e., the likelihood) of underinvestment, normal investment, and over-investment for all share-repurchase announcement firms (All), as well as top-half firms (High REP) and bottom-half firms (Low REP), respectively. As before, top-half and bottom-half firms are identified based on the sum of five-year share repurchases over the period (t, t+4). In the left and right columns of the panel, underinvestment, normal investment, and over-investment are determined based on the residuals from the regressions of one-year investment (Equation (1)) and five-year investment (Equation (2)), respectively.

The results do not suggest that share repurchasing firms underinvest or over-invest. To aid the reader in making inferences, we note that the likelihood of underinvestment or over-investment should equal 25 percent and that of normal investment should equal 50 percent for a randomly selected firm. In comparison, the estimated likelihoods of underinvestment and over-investment for all share repurchase announcement firms are lower (20.7% and 17.8%, respectively) than the 25 percent benchmark level, as reported in the left columns of the panel. We therefore conclude that share repurchasing firms are less likely to underinvest or over-invest than a typical firm. Consequently, the likelihood of normal investment for the share repurchasing firms is as high as 61.5%, which is much higher than the 50 percent benchmark level. Panel A also shows that top-half firms have a slightly lower likelihood of underinvestment (18.4%) than bottom-half firms (23.0%). Moreover, top-half firms have a much higher likelihood of over-

investment (19.7%) than bottom-half firms (15.9%), which is consistent with our earlier finding that top-half firms grow faster than bottom-half firms.

In the right columns of Panel A, where the likelihoods of underinvestment and over-investment are determined based on five-year investments, similar findings emerge. Share repurchasing firms do not underinvest or over-invest relative to the typical firm, as their likelihoods of both underinvestment and over-investment (19.4% and 16.7%, respectively) are well below the 25 percent benchmark level. Also, top-half firms have a lower likelihood of underinvestment (18.3%) but a higher likelihood of over-investment (19.3%) than bottom-half firms, whose likelihoods of underinvestment and over-investment are 20.5% and 14.1%, respectively.

For comparison, Panels B and C tabulate the likelihoods of underinvestment, normal investment, and over-investment of the samples of matched firms selected from non-share repurchasing firms. Matching is performed based on year and size in Panel B and year, industry, and size in Panel C, respectively. In both panels, the likelihood of normal investment is close to 50%, unlike in share repurchasing firms (as reported in Panel A). Also, the likelihood of underinvestment is high for these matched firms compared to share repurchasing firms. This finding is particularly true for the year-industry-and-size matched sample in Panel C, as the likelihood of underinvestment is 30.2% for one-year investment and 29.5% for five-year investment. These percentages are much higher than the likelihood of underinvestment for share repurchasing firms in Panel A. Therefore, share repurchasing firms are much less likely to underinvest than size-matched industry peers.

In short, share repurchases (even large share repurchases) are not associated with underinvestment. In fact, share repurchasing firms, particularly top-half firms, are much less likely to underinvest than a typical firm or a matched industry peer. Share repurchasing firms do not over-invest either, as their likelihood of over-investment is much lower than that of the typical firm.

In Table 9, we estimate multinomial logit regressions to determine whether share repurchasing firms underinvest or over-invest after controlling for firm characteristics that influence investment. In Panel A, underinvestment, normal investment, and over-investment are defined based on the residuals from the regression of one-year investments (i.e., Equation (1)). In Columns (1)-(4), where the dependent variable is underinvestment versus normal investment, both the share repurchase dummy and the top-half share repurchase dummy have significant negative coefficients, although this coefficient loses significance in Column (2). Similarly, in Columns (5)-(8), where the dependent variable is over-investment versus normal investment, both the share repurchase dummy and the top-half share repurchase

dummy have negative coefficients. Taken together, the results suggest that share repurchasing firms and top-half share repurchasing firms do not underinvest or over-invest.

Panel B repeats multinomial logit regressions by defining underinvestment, normal investment, and over-investment using the residuals from the regression of five-year investments (i.e., Equation (2)). The results continue to suggest that share repurchasing firms or top-half share repurchasing firms neither underinvest nor over-invest. Both the share repurchase dummy and the top-half share repurchase dummy have significant negative coefficients in Columns (1)-(4) where regressions determine underinvestment versus normal investment, and also in Columns (5)-(8) where regressions determine over-investment versus normal investment.

Therefore, our multinomial logit regressions provide further evidence that share repurchasing firms (even top-half share repurchasing firms) do not underinvest. The regression results also suggest that share repurchasing firms do not over-invest either. We cautiously interpret this observation as suggesting that share repurchases help curb excessive investments by distributing free cash flows to shareholders.

6. Additional Analyses

6.1. Tobit regressions for the periods before and after 1994

Previous studies report that firm value, as measured by Tobin's Q or the market-to-book ratio, has a negative impact on share repurchases, which is consistent with the undervaluation hypothesis (e.g., Dittmar (2000)). Therefore, our finding of Tobin's Q's positive impact on share repurchases must be reconciled with those earlier findings. We estimate Tobit regressions of share repurchases separately for two periods: the period 1980-1993 and the period 1994-2017. We conjecture that our finding of a positive effect of Tobin's Q arises partly because our main sample spans relatively recent years in which share repurchases are performed more consecutively, and also partly because our main measure of share repurchase is the five-year sum of share repurchases instead of share repurchases in each individual year.

In Table 10, we report Tobit regression results for the period 1980-1993 in Panel A and the period 1994-2017 in Panel B, respectively. The estimation is performed on the non-financial and non-utility firms in the Compustat universe and share repurchases are measured by [PRSTKC] less any reduction in [PSTKRV].[3] Indeed, in Panel A, where regressions are estimated for the period before 1994, Tobin's Q has significant negative coefficients in Columns (1) and (3), where the dependent variable is

[3] In Table 10's estimations, we do not use the SDC share repurchase announcement firms to identify share repurchasing firms, given the concern that the SDC database covers only a limited number of share repurchasing firms in early years.

the present year's share repurchases (REP_t/TA_{t-1}). This result lends support to previous studies' findings that undervaluation is a key motive for share repurchases (e.g., Dittmar (2000)). However, Tobin's Q's coefficient turns positive and significant in Columns (4) and (6), where the dependent variable is the five-year sum of share repurchases ($\Sigma REP_{(t,t+4)}/TA_{t-1}$). This finding suggests that consistent and cumulatively large share repurchases are positively associated with high firm value (so such repurchases are not driven by undervaluation) even in the early years. Meanwhile, $SRET_{t-1}$ has positive coefficients in the columns where it is included as an explanatory variable, so the stock underperformance hypothesis does not hold even in the early years.

The results in Panel B, where regressions are estimated over the period 1994-2017, are qualitatively the same as those we obtained from Table 5, where we identified share repurchasing firms using the SDC database's share repurchase announcement records. Tobin's Q has a significant and positive effect on share repurchases, whether they are measured for the present year or for the five-year period. Meanwhile, $SRET_{t-1}$'s coefficient is significantly positive in some columns but overall has inconsistent signs.

Summing up, there is evidence that undervaluation used to be a motivation for share repurchases, but such is no longer the case, as share repurchases are positively associated with high stock valuation or high investment opportunities in recent years. These observations suggest that the motivation of share repurchases has shifted over time, as share repurchases are now performed in more consecutive years and by firms that grow relatively quickly and generate cash flow consistently over time.

6.2. Characteristics of non-share repurchasing firms

In several of our analyses above, we compare firms that repurchase shares in large amounts over five years (i.e., top-half share repurchasing firms) with those that repurchase shares in small amounts over those years (i.e., bottom-half share repurchasing firms) as a means of identifying distinguishing characteristics of share repurchases. This approach may appear somewhat unusual, as it does not compare share repurchasing firms with non-share repurchasing firms. Behind our embrace of this approach is the observation that a high percentage of firms repurchase shares intermittently even if they do not repurchase shares consecutively. This observation means that if we define the benchmark group as those firms that never repurchase shares in any year over a sustained period, then the benchmark group will include only a small number of firms that have rather unique firm characteristics.

In Table 11, Panel A shows that the number of firms decreases to only 590 out of a total of 2,783

firms in 2010 if we define the benchmark group as those firms that do not repurchase shares in any year over the nine-year period (t-4, t+4). This group has the following firm characteristics: high Tobin's Q, small firm size, poor profitability, negative retained earnings and large increases in paid-in capital. We note that these are typical firm characteristics that previous research attaches to frequent equity issuance (e.g., DeAngelo, DeAngelo and Stulz, 2010). Panels B and C yield similar interpretations for the years 2005 and 2000, respectively. In a nutshell, share repurchases are so common in recent years—as the majority of firms repurchase shares consecutively or intermittently—that firms that never repurchase shares are both few in number and a special breed (e.g., young, unprofitable, and potentially overvalued). Comparing share repurchasing firms with those non-share repurchasing firms would be almost equivalent to comparing share repurchasing firms with frequent equity issuers.

Therefore, a comparison of share repurchasing firms and non-share repurchasing firms is not likely to give us useful insights into the forces that shape share repurchases. Instead, our results suggest that we can learn the nature of share repurchases as well as the motivations for these repurchases and their effects by comparing firms that repurchase shares in large amounts (or in more consecutive years) with those that repurchase shares in small amounts (or only intermittently).

6.3. How similar or different are dividends and share repurchases?

Our evidence of increasing persistence in share repurchases raises the question of whether and how share repurchases and dividends are now similar to or different from each other. We estimate Tobit regressions of the five-year sum of dividends, share repurchases, and total payouts to compare the effects of a set of firm characteristics on the decision to pay dividends vs. the decision to repurchase shares. The set of firm characteristics are determinants of dividends and share repurchases previously identified as explanatory variables (e.g., Dittmar, 2000; Chay and Suh, 2009). The estimation is performed for the non-financial and non-utility Compustat firms over the period 1994-2017.

In Table 12's Panel A, we report Tobit regression results for the full sample of firms. The coefficients on firm characteristics have consistent signs for regressions of dividends and share repurchases. For example, Tobin's Q has significant positive effects on both dividends (Columns (1) and (4)) and share repurchases (Columns (2) and (5)). Stock return volatility ($RETVOL_{t-1}$) has significant negative effects on both dividends and share repurchases. However, the size of some of these coefficients differs substantially between regressions of dividends and share repurchases.

Overall, our impression is that despite the fact that firms perform share repurchases increasingly

in more consecutive years, firms still consider share repurchases as a flexible method of distributing cash flow—or equivalently, they still see dividends as sticky compared to share repurchases. This impression is based on two observations from Panel A's regression results. First, stock return volatility has a greater negative effect on dividends than it does on share repurchases, suggesting that firms facing high cash-flow uncertainty are more likely to avoid dividends than to avoid share repurchases. Second, high Tobin's Q has a greater positive effect on share repurchases than it does on dividends. These findings are consistent with the notion that firms with high investment opportunities have more to gain from choosing a flexible payout method (vs. a sticky payout method), as doing so allows such firms to delay and/or exercise investment in a timely manner.

In Panel B, we estimate the same regressions only for dividend-paying firms. Interestingly, the size of coefficients on Tobin's Q is similar in regressions of dividends and share repurchases, although Tobin's Q has significant positive effects on both dividends and share repurchases. This finding suggests that the above result, which indicates that high Q firms prefer the flexible payout method, is driven by those high-Q firms that do not pay dividends. Meanwhile, firm size ($log(TA_{t-1})$) has a positive effect on share repurchases but a negative effect on dividends. Profitability (ROA_{t-1}) has a greater positive effect on share repurchases than it does on dividends. Further, the retained earnings ratio (RE_{t-1}/TA_{t-1}) has a positive effect on share repurchases but its effect is insignificant on dividends. Taken together, large, profitable, and financially mature companies tend to choose to distribute cash more through share repurchases in addition to than through dividends.

Finally, a common observation from both Panels A and B is that profitability (ROA_{t-1}) has a greater positive effect on share repurchases than it does on dividends. This finding suggests that the ability to generate cash flow is more important in the decision to repurchase shares (or to do so in large amounts) than in the decision to pay dividends.

7. Concluding remarks

This study reveals that an increasing number of firms repurchase shares repeatedly year after year. Cumulatively large share repurchases are associated with fast growth, which is reflected in high stock valuations. Firms use cash flow as the primary source of capital to finance share repurchases year after year. As a result, firms that repurchase shares in large amounts and in consecutive years experience substantial increases in retained earnings and comparable decreases in the paid-in capital over time. On average, share repurchases do not cause underinvestment, as share repurchasing firms invest actively to

generate fast growth that in turn helps finance repeated share repurchases.

Our evidence suggests that existing share repurchase hypotheses—specifically, the temporary cash-flow hypothesis, the undervaluation or stock underperformance hypothesis, and the underleverage hypothesis—have limited explanatory power or are even inconsistent with actual share repurchases (which are now increasingly persistent). Instead, our evidence of repeated and cumulatively large share repurchases calls for a new explanation. We propose the consistent-growth hypothesis, which holds that share repurchases reflect firms' capacity or expectations of generating consistent cash flows in the years ahead. The consistent generation of cash flow is accompanied by share repurchasing firms' relatively fast growth in assets and sales. Consistently with their fast growth, share repurchasing firms do not underinvest as their investments are mostly at a moderate level. Accordingly, share repurchasing firms have high Tobin's Q, as qualities such as consistency and fast growth are embedded in their stock valuation.

Table A.1
Description of key variables
The mnemonics in square brackets correspond to *Compustat* data items.

Share repurchase (*REP*)	The amount of share repurchase, as measured by the purchase of common and preferred stock [PRSTKC] less any reduction in the preferred stock redemption value [PRTKRV]
Dividend (*DIV*)	Dividends [DVC]
Total payout (TotalPay)	(Dividend + Share repurchases)
Tobin's Q (*Q*)	market value of total assets [AT + CSHO × PRCC_F – CEQ – TXDB] / book assets [AT]
Industry-adjusted Tobin's Q	Q less mean industry Q at the SIC two-digit level
Stock returns (*SRET*)	1-year holding period return using monthly stock returns with a minimum of 6 months during the previous year from CRSP database
Industry-adjusted stock returns	*SRET* less mean industry *SRET* at the SIC two-digit level
Paid-in capital to assets ratio	Paid-in capital [CSTK + CAPS – TSTK] / book assets [AT]
Retained earnings to assets ratio (*RE/TA*)	Retained earnings [RE] / book assets [AT]
Shareholders' equity to assets ratio (*SEQ/TA*)	Shareholders' equity [SEQ] / book assets [AT]
Debt-to-asset ratio (*Debt/TA*)	Total debts [DLTT + DLC] / book assets [AT]
Firm Size (*Log(TA)*)	Natural log of book assets [AT]
Operating profitability (*ROA*)	Earnings before interest and taxes [OIBDP] / beginning-of-the-year total assets [AT] during the previous year
Cash holdings (*CASH*)	Cash and short-term investments [CHE] / book assets [AT]
Stock return volatility (*RETVOL*)	The standard deviation of monthly stock returns for a given year
Asset growth (*Asset Growth*)	One-year growth rate of book assets [AT] from the previous year
Sales growth (*Sales Growth*)	One-year growth rate of sales [SALE]
Cash flow (*CF*)	Cash flow [NI + DP]
Investment	Total investment, as measured by the sum of capital expenditures, R&D and acquisitions less the sale of PP&E: that is, [CAPX] + [XRD] + [ACQ] – [SPPE].

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Figure 1: Graphical illustration of consecutive share repurchases over the period 1980-2017

The graph plots the means of two consecutive-share-repurchase dummy variables for each year over the period 1980-2017. The sample includes non-financial and non-utility Compustat firms. *REP_5YR_C* is a dummy variable that equals 1 if a firm repurchases shares every year over the next four years and zero otherwise, conditional on the fact that the firm repurchases shares in the current year. Similarly, *REP_3YR_C* is 1 if a firm repurchases shares consecutively every year in the next two years, conditional on the fact that the firm repurchases shares in the current year. The mean of *REP_nYR_C* each year can be interpreted as the likelihood of a share repurchasing firm to continue to repurchase shares in at least *n* years consecutively. Share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Share repurchasing firms are defined as those for which the amount of share repurchase is positive.

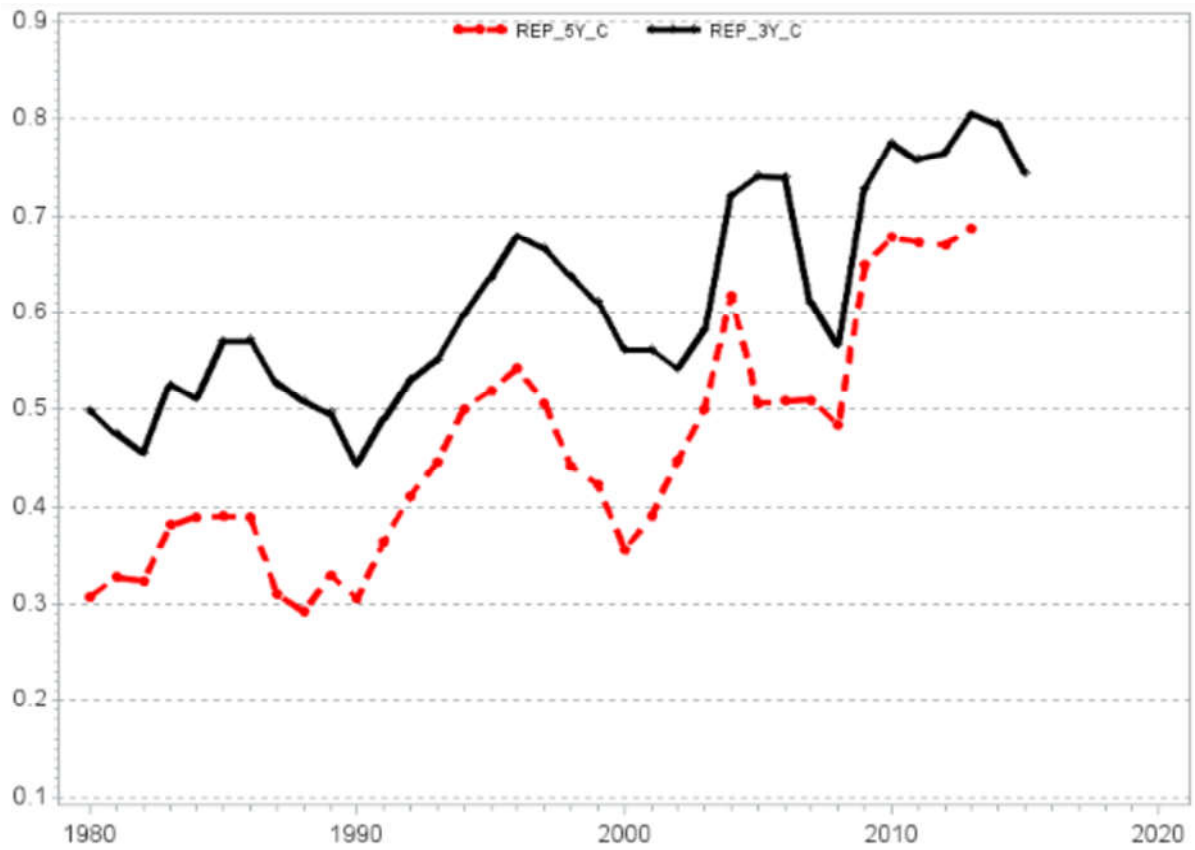

Table 1: Repeated share repurchase of Compustat firms over the period 1980-2017

The table reports the percentage of share repurchase firms and the means of consecutive-share-repurchase dummy variables for each year over the period 1980-2017. The sample includes non-financial and non-utility Compustat firms. The first column presents the percentage of share repurchasing firms each year. The next columns present the means of *REP_nYR_C* each year. *REP_nYR_C* is a dummy variable that equals 1 if a firm repurchases shares every year over the next *n*-1 years and zero otherwise, conditional on the fact that the firm repurchases shares in the current year. So by definition, *REP_1YR_C* is 1. As an example, *REP_5YR_C* is 1 if a firm repurchases shares consecutively every year in the next four years assuming that the firm repurchases shares in the current year. The mean of *REP_nYR_C* each year can be interpreted as the likelihood of a share repurchasing firm to continue to repurchase shares in at least *n* years consecutively. The amount of share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Share repurchasing firms are defined as those for which the amount of share repurchase is positive.

Year	The percentage of firms that repurchase shares	Mean of dummy variables that indicate that the firm repurchases shares consecutively in the next *n*-1 years conditional on the fact that the firm repurchases shares in the current year				
	Percentage	*REP_1YR_C*	*REP_2YR_C*	*REP_3YR_C*	*REP_4YR_C*	*REP_5YR_C*
1980	0.2715	1.0000	0.6048	0.4989	0.3590	0.3071
1981	0.2684	1.0000	0.7063	0.4752	0.3889	0.3279
1982	0.3105	1.0000	0.5962	0.4564	0.3785	0.3231
1983	0.2672	1.0000	0.6673	0.5258	0.4181	0.3815
1984	0.3274	1.0000	0.6848	0.5123	0.4560	0.3897
1985	0.3312	1.0000	0.6771	0.5707	0.4764	0.3903
1986	0.3286	1.0000	0.7546	0.5721	0.4590	0.3892
1987	0.4286	1.0000	0.6931	0.5275	0.4212	0.3103
1988	0.4009	1.0000	0.6678	0.5091	0.3697	0.2929
1989	0.3551	1.0000	0.7279	0.4973	0.3797	0.3299
1990	0.3963	1.0000	0.6329	0.4448	0.3646	0.3060
1991	0.3146	1.0000	0.6316	0.4908	0.4033	0.3650
1992	0.2820	1.0000	0.6714	0.5307	0.4607	0.4120
1993	0.2791	1.0000	0.6819	0.5520	0.4873	0.4462
1994	0.2919	1.0000	0.7232	0.5981	0.5305	0.5008
1995	0.3179	1.0000	0.7368	0.6368	0.5785	0.5197
1996	0.3391	1.0000	0.7721	0.6795	0.5822	0.5426
1997	0.3817	1.0000	0.8067	0.6670	0.5847	0.5068
1998	0.4764	1.0000	0.7643	0.6383	0.5247	0.4420
1999	0.4673	1.0000	0.7837	0.6115	0.4968	0.4228
2000	0.4659	1.0000	0.7284	0.5619	0.4602	0.3562
2001	0.4465	1.0000	0.7271	0.5619	0.4288	0.3905
2002	0.4258	1.0000	0.7387	0.5435	0.4838	0.4485
2003	0.3968	1.0000	0.6803	0.5824	0.5336	0.5011

2004	0.3675	1.0000	0.8067	0.7216	0.6651	0.6174
2005	0.4076	1.0000	0.8296	0.7419	0.6763	0.5066
2006	0.4407	1.0000	0.8329	0.7411	0.5498	0.5091
2007	0.4766	1.0000	0.8534	0.6107	0.5407	0.5101
2008	0.5324	1.0000	0.6752	0.5679	0.5259	0.4843
2009	0.4154	1.0000	0.7940	0.7290	0.6695	0.6493
2010	0.4420	1.0000	0.8638	0.7753	0.7210	0.6787
2011	0.4950	1.0000	0.8500	0.7592	0.7040	0.6732
2012	0.4956	1.0000	0.8411	0.7662	0.7219	0.6710
2013	0.4886	1.0000	0.8688	0.8054	0.7411	0.6875
2014	0.4981	1.0000	0.8880	0.7951	0.7232	-
2015	0.5146	1.0000	0.8524	0.7452	-	-
2016	0.4974	1.0000	0.8292	-	-	-
2017	0.4864	1.0000	-	-	-	-

Table 2: Logit regression of consecutive share repurchases

The table reports logit regression results that are estimated for non-financial and non-utility Compustat firms over the period 1980-2017. The dependent variables in these logit regressions are a range of dummy variables (*REP1C_DUM*, *REP2C_DUM*, *REP3C_DUM* and *REP4C_DUM*) that indicate whether firms repurchase shares in consecutive years. *REPnC_DUM* equals one if the firm repurchases shares consecutively in the next n years and zero otherwise. For example, *REP4C_DUM* equals one if the firm repurchases shares consecutively over the next four years and zero otherwise. A common explanatory variable in all regressions is *REP_DUM*, a dummy variable that indicates whether the firm repurchases shares in the current year. *Time* is an integer variable that takes the value 1 if the firm-year belongs to the first year of the sample, 2 if it belongs to the second year of the sample and so on. In Columns (2), (4), (6) and (8), *REP_DUM* × *Time* is the interaction of *REP_DUM* with *Time*. The amount of share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Share repurchasing firms are defined as those for which the amount of share repurchase is positive.

	Dependent variable							
	REP1C_DUM		*REP2C_DUM*		*REP3C_DUM*		*REP4C_DUM*	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
REP_DUM	2.476***	2.187***	2.355***	2.123***	2.343***	2.154***	2.361***	2.218***
	(114.965)	(69.022)	(99.379)	(59.386)	(87.521)	(53.135)	(80.212)	(48.938)
Time	0.036***	0.022***	0.041***	0.027***	0.045***	0.033***	0.048***	0.038***
	(24.583)	(11.467)	(21.903)	(12.395)	(19.165)	(12.400)	(16.812)	(12.288)
REP_DUM ×Time		0.028***		0.022***		0.017***		0.013***
		(10.521)		(7.656)		(5.380)		(3.667)
Intercept	-2.122***	-1.986***	-2.645***	-2.510***	-3.199***	-3.075***	-3.548***	-3.447***
	(-33.440)	(-32.951)	(-39.318)	(-38.596)	(-41.302)	(-40.716)	(-41.641)	(-41.212)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	No	No	No	No	No
N	100,441	100,441	97,504	97,504	94,531	94,531	91,596	91,596
Pseudo R^2	0.2560	0.2575	0.2352	0.2361	0.2248	0.2253	0.2178	0.2180

Table 3: Share repurchase continuity in our main sample of share-repurchase-announcement firms

The table reports the percentage of share repurchasing firms and the mean and median of the amount of share repurchases for the sample of share-repurchase announcement firms over the period 1994-2016. The table covers the five-year period (*t*, *t*+4) starting with the announcement year (year *t*). Share repurchase announcements are identified from the SDC Platinum database. Specifically, share repurchase announcement is the firm-year in which INIT_AUTHOR is 1. We also use the Compustat database to ensure that the firm follows through with share repurchases. We filter out share repurchase announcement firms if these firms' actual share repurchases are zero in the announcement year and the following two years, where share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. We also drop firms if their key firm characteristics such as cash and cash flow etc. are missing any year over the period (*t*-4, *t*+4) around the announcement year. $\%(REP_{t+i}>0)$ is the percentage of firms that repurchase shares at year *t*+i, where i=0, 1, 2, 3 or 4. $\%(REP_C_{(t,t+i)}>0)$ is the percentage of firms that repurchase shares consecutively from t to *t*+i, where i=0, 1, 2, 3 or 4. REP_{t+i}/TA_{t-1} is the amount of share repurchases in a given year i scaled by the beginning-of-period book assets (i.e., TA_{t-1}). $\Sigma REP_{(t,t+i)}/TA_{t-1}$ is the cumulative amount of share repurchases up to a given year i scaled by TA_{t-1}. The amount of share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Panel A includes all share repurchasing announcement firms in the sample; Panel B includes only non-dividend payers among them; and Panel C includes only dividend payers among them.

Panel A: All share repurchase announcement firms

Year (i)		0	1	2	3	4
$\%(REP_{t+i}>0)$		100.00%	87.60%	80.06%	78.06%	76.00%
$\%(REP_C_{(t,t+i)}>0)$		100.00%	87.60%	75.47%	67.48%	61.11%
	Mean	0.0708	0.0573	0.0484	0.0477	0.0448
REP_{t+i} / TA_{t-1}	Median	0.0429	0.0307	0.0222	0.0203	0.0199
	N	2,242	2,242	2,242	2,242	2,242
	Mean	0.0708	0.1319	0.1884	0.2491	0.3116
$\Sigma REP_{(t,t+i)} / TA_{t-1}$	Median	0.0429	0.0894	0.1291	0.1717	0.2188
	N	2,242	2,242	2,242	2,242	2,242

Panel B: Non-dividend payers

Year (i)		0	1	2	3	4
$\%(REP_{t+i}>0)$		100.00%	85.17%	76.35%	73.95%	74.45%
$\%(REP_C_{(t,t+i)}>0)$		100.00%	85.17%	71.54%	62.63%	57.41%
	Mean	0.0768	0.0632	0.0503	0.0533	0.0520
REP_{t+i} / TA_{t-1}	Median	0.0445	0.0295	0.0205	0.0215	0.0221
	N	998	998	998	998	998
	Mean	0.0768	0.1452	0.2064	0.2789	0.3568
$\Sigma REP_{(t,t+i)} / TA_{t-1}$	Median	0.0445	0.1022	0.1459	0.1922	0.2494
	N	998	998	998	998	998

Panel C: Dividend payers

Year (i)		0	1	2	3	4
%(REP_{t+i} >0)		100.00%	89.55%	83.04%	81.35%	77.25%
%($REP_C_{(t,t+i)}$ >0)		100.00%	89.55%	78.62%	71.38%	64.07%
	Mean	0.0659	0.0525	0.0469	0.0433	0.0390
REP_{t+i} / TA_{t-1}	Median	0.0421	0.0315	0.0236	0.0196	0.0174
	N	1,244	1,244	1,244	1,244	1,244
	Mean	0.0659	0.1213	0.1739	0.2253	0.2753
$\Sigma REP_{(t,t+i)} / TA_{t-1}$	Median	0.0421	0.0832	0.1208	0.1587	0.2010
	N	1,244	1,244	1,244	1,244	1,244

Table 4: Firm characteristics of share repurchase announcement firms

The table reports the mean and median of firm characteristics for share repurchase announcement firms as well as for top-half and bottom-half firms by the five-year sum of share repurchases (i.e., $\Sigma REP_{(t,t+4)} / TA_{t-1}$) among them. These firm characteristics are the beginning-of-the-year values of the share repurchase announcement years. The sample covers the period over the period 1994-2016. Share repurchase announcements are identified using the SDC Platinum database. Specifically, share repurchase announcement is the year in which INIT_AUTHOR is 1. We also use the Compustat database to ensure that the firm follows through with actual share repurchases. We filter out share repurchase announcement firms if these firms' actual share repurchases are zero in the announcement year and the following two years, where share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. We also drop firms if their key firm characteristics such as cash and cash flow etc. are missing any year over the period (t-4, t+4) around the announcement year. Panel A includes all share repurchase announcement firms; Panel B includes non-dividend payers among them; and Panel C includes dividend payers among them. In each Panel, we rank firms into top-half and bottom-half subgroups based on the five-year sum of share repurchases over (t, t+4) scaled by the beginning-of-period book assets (i.e., $\Sigma REP_{(t,t+4)} / TA_{t-1}$). *REP5C_DUM* is the dummy variable that equals one if the firm repurchases shares consecutively in the present year and subsequent next four years and zero otherwise. REP_t/TA_{t-1} is the amount of share repurchase in the present year scaled by the beginning-of-the year book assets. The definitions of the other variables are provided in Appendix Table A.1. N is the number of firm-year observations.

	All			Top half			Bottom half		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
$\Sigma REP_{(t,t+4)} / TA_{t-1}$	2,242	0.3116	0.2188	1,121	0.5253	0.4418	1,121	0.0979	0.0910
REP5C_DUM	2,242	0.6111	1.0000	1,121	0.8046	1.0000	1,121	0.4175	0.0000
REP_t / TA_{t-1}	2,242	0.0708	0.0429	1,121	0.1092	0.0823	1,121	0.0323	0.0215
$log\ (TA_{t-1})$	2,242	20.72	20.66	1,121	20.92	20.93	1,121	20.53	20.34
Q_{t-1}	2,242	2.08	1.72	1,121	2.51	2.15	1,121	1.65	1.42
Ind. adj. Q_{t-1}	2,242	-0.08	-0.23	1,121	0.29	0.07	1,121	-0.45	-0.44
$SRET_{t-1}$	2,242	0.2130	0.1298	1,121	0.2332	0.1477	1,121	0.1928	0.1014
Ind. adj. $SRET_{t-1}$	2,242	0.0862	0.0064	1,121	0.1121	0.0350	1,121	0.0603	-0.0282
ROA_{t-1}	2,242	0.1891	0.1747	1,121	0.2113	0.2011	1,121	0.1669	0.1556
Sales $growth_{t-1}$	2,242	0.1272	0.0925	1,121	0.1258	0.0900	1,121	0.1287	0.0953
Asset $growth_{t-1}$	2,242	0.1435	0.0781	1,121	0.1359	0.0770	1,121	0.1511	0.0789
$Cash_{t-1} / TA_{t-1}$	2,242	0.1682	0.1050	1,121	0.2066	0.1509	1,121	0.1298	0.0714
$Debt_{t-1} / TA_{t-1}$	2,242	0.1631	0.1368	1,121	0.1364	0.1022	1,121	0.1897	0.1729
RE_{t-1} / TA_{t-1}	2,242	0.3287	0.3484	1,121	0.3507	0.3887	1,121	0.3067	0.3082
$Dividend_{t-1} / TA_{t-2}$	2,242	0.0138	0.0040	1,121	0.0148	0.0000	1,121	0.0129	0.0064

Table 5: Tobit regressions of share repurchases

The table reports the results of Tobit regressions of the amount of share repurchases for the period spanning 1994-2017. In Panel A, the dependent variable is the amount of share repurchase in the current year scaled by lagged book assets (REP_t/TA_{t-1}); In Panel B, it is the sum of share repurchases over five years including the current year and the following four years scaled by the beginning-of-period book assets ($\Sigma REP_{(t,t+4)}/TA_{t-1}$). These regressions are estimated on the sample that consists of the share repurchase announcement firms and non-share repurchasing firms in the non-financial and non-utility Compustat universe. The amount of share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Industry-fixed effects are based on the Fama-French 48 industries classification. The definitions of the explanatory variables are provided in Appendix Table A.1.

Panel A: Current year's share repurchase is the dependent variable.

	Dependent variable: REP_t/TA_{t-1}					
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	0.009***		0.007***	0.011***		0.007***
	(8.867)		(4.865)	(10.181)		(4.536)
$SRET_{t-1}$		-0.0003	-0.002		0.001	-0.0002
		(-0.092)	(-0.572)		(0.405)	(-0.078)
$log\ (TA_{t-1})$	0.020***	0.023***	0.016***	0.023***	0.024***	0.018***
	(22.592)	(24.692)	(16.002)	(24.466)	(24.802)	(16.764)
ROA_{t-1}			0.196***			0.179***
			(13.259)			(11.735)
$Cash_{t-1} / TA_{t-1}$			0.122***			0.115***
			(11.348)			(10.263)
$Debt_{t-1} / TA_{t-1}$			-0.073***			-0.089***
			(-6.000)			(-7.131)
RE_{t-1} / TE_{t-1}			0.024***			0.022***
			(9.879)			(8.927)
$RETVOL_{t-1}$			-0.325***			-0.303***
			(-9.505)			(-8.730)
$Dividend_{t-1} / TA_{t-2}$			-0.368***			-0.335***
			(-6.005)			(-5.439)
Intercept	-0.453***	-0.460***	-0.341***	-0.600***	-0.594***	-0.482***
	(-22.256)	(-22.454)	(-15.843)	(-12.674)	(-12.622)	(-11.594)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes
N	5,559	4,169	4,159	5,500	4,124	4,114
Pseudo R^2	1.6074	-0.9984	-1.9697	3.1091	-1.3251	-2.1721

Panel B: Five-year sum of share repurchases is the dependent variable

	Dependent variable: $\Sigma REP_{(t,t+4)} / TA_{t-1}$					
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	0.043***		0.042***	0.050***		0.038***
	(11.106)		(8.281)	(12.571)		(7.442)
$SRET_{t-1}$		0.002	-0.013		0.007	-0.005
		(0.165)	(-1.191)		(0.737)	(-0.522)
$log\ (TA_{t-1})$	0.085***	0.098***	0.070***	0.097***	0.105***	0.078***
	(25.426)	(28.525)	(20.382)	(28.245)	(29.469)	(21.768)
ROA_{t-1}			0.773***			0.700***
			(15.064)			(13.435)
$Cash_{t-1} / TA_{t-1}$			0.450***			0.416***
			(12.036)			(10.925)
$Debt_{t-1} / TA_{t-1}$			-0.272***			-0.319***
			(-6.412)			(-7.463)
RE_{t-1} / TE_{t-1}			0.085***			0.075***
			(10.161)			(9.082)
$RETVOL_{t-1}$			-1.183***			-1.085***
			(-9.931)			(-9.153)
$Dividend_{t-1} / TA_{t-2}$			-1.689***			-1.449***
			(-7.876)			(-6.849)
Intercept	-1.920***	-1.937***	-1.499***	-2.371***	-2.331***	-1.930***
	(-24.645)	(-25.568)	(-19.865)	(-14.646)	(-14.885)	(-14.485)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes
N	5,559	4,169	4,159	5,500	4,124	4,114
Pseudo R^2	0.1530	0.2223	0.4515	0.2948	0.3081	0.5142

Table 6: Five-year changes of firm characteristics after share repurchase announcements

The table reports the mean and median of five-year changes of various firm characteristics for share repurchase announcement firms as well as for top-half and bottom-half firms by the five-year sum of share repurchases (i.e., $\Sigma REP_{(t,t+4)}/TA_{t-1}$) among them. The sample covers the period over the period 1994-2016. Share repurchase announcements are identified using the SDC Platinum database. Specifically, share repurchase announcement is the year in which INIT_AUTHOR is 1. We also use the Compustat database to ensure that the firm follows through with actual share repurchases. We filter out share repurchase announcement firms if these firms' actual share repurchases are zero in the announcement year and the following two years, where share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. We also drop firms if their key firm characteristics such as cash and cash flow etc. are missing any year over the period (t-4, t+4) around the announcement year. We split the sample of share repurchase announcement firms into top-half and bottom-half firms based on the five-year sum of share repurchases over (0, +4) scaled by the beginning-of-period book assets (TA_{-1}) (i.e., $\Sigma REP_{(t,t+4)}/TA_{t-1}$). $\Delta X_{(t-1,t+4)}$ is the change in a given variable over five years from t-1 to t+4. $\Sigma X_{(t,\ t+4)}$ is the cumulative sum of a given variable over five years from t to t+4. N is the number of firm-year observations. The definitions of the variables are provided in Appendix Table A.1.

	All			Top half			Bottom half		
	N	Mean	Median	N	Mean	Median	N	Mean	Median
$\Sigma REP_{(t,t+4)} / TA_{t-1}$	2,242	0.3116	0.2188	1,121	0.5253	0.4418	1,121	0.0979	0.0910
REP5C_DUM	2,242	0.6111	1.0000	1,121	0.8046	1.0000	1,121	0.4175	0.0000
REP_t / TA_{t-1}	2,242	0.0708	0.0429	1,121	0.1092	0.0823	1,121	0.0323	0.0215
$\Delta TA_{(t-1,t+4)} / TA_{t-1}$	2,242	0.5167	0.3316	1,121	0.5814	0.3608	1,121	0.4521	0.2917
$\Delta Sales_{(t-1,t+4)} / Sales_{t-1}$	2,242	0.4174	0.2986	1,121	0.4625	0.3401	1,121	0.3722	0.2521
$\Sigma CF_{(t,t+4)} / TA_{t-1}$	2,242	0.7009	0.6442	1,121	0.8630	0.7927	1,121	0.5389	0.4951
$\Delta Cash_{(t-1,t+4)} / TA_{t-1}$	2,242	0.0568	0.0196	1,121	0.0724	0.0225	1,121	0.0412	0.0170
$\Delta PPE_{(t-1,t+4)} / TA_{t-1}$	2,242	0.0998	0.0420	1,121	0.0985	0.0452	1,121	0.1010	0.0385
$\Delta RE_{(t-1,t+4)} / TA_{t-1}$	2,242	0.2181	0.1939	1,121	0.2926	0.2735	1,121	0.1436	0.1184
$(\Delta RE_{(t-1,t+4}+\Sigma DIV_{(t,t+4)})/TA_{t-1}$	2,242	0.3114	0.2880	1,121	0.3990	0.3743	1,121	0.2239	0.1965
$\Delta(Paid\text{-}in\ capital)_{(t-1,t+4)}/TA_{t-1}$	2,242	-0.0225	-0.0237	1,121	-0.0798	-0.1348	1,121	0.0348	-0.0002
$\Delta SEQ_{(t-1,t+4)} / TA_{t-1}$	2,242	0.2149	0.1117	1,121	0.2400	0.1062	1,121	0.1898	0.1155
$\Delta Debt_{(t-1,t+4)} / TA_{t-1}$	2,242	0.1267	0.0439	1,121	0.1403	0.0614	1,121	0.1132	0.0266
$\Delta(D/A)_{(t-1,t+4)}$	2,242	0.0299	0.0034	1,121	0.0465	0.0142	1,121	0.0133	0.0000
$\Sigma DIV_{(t,t+4)} / TA_{t-1}$	2,242	0.0888	0.0481	1,121	0.1006	0.0590	1,121	0.0770	0.0461

Table 7: Capital structure and related components over (t-4, t+4) of top-half share repurchasing firms

The table reports the mean and median of capital structure components along with cash reserves each year over the period (*t*-4, *t*+4) around the share repurchase announcement year (i.e., year *t*). The sample covers the period over the period 1994-2016. The tabulation includes only top-half share repurchase firms among share repurchase announcement firms, where top-half share repurchase firms are the firm-years for which the five-year sum of share repurchases over (t, t+4) scaled by the beginning-of-period book assets (TA_{-1}) is above the median. The sample includes share repurchase announcement firms that are identified using the SDC Platinum database. Specifically, share repurchase announcement is the year in which INIT_AUTHOR is 1. We also use the Compustat database to ensure that the firm follows through with actual share repurchases. We filter out share repurchase announcement firms if these firms' actual share repurchases are zero in the announcement year and the following two years, where share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. We also drop firms if their key firm characteristics such as cash and cash flow etc. are missing any year over the period (*t*-4, *t*+4) around the announcement year. Panel A includes top-half share repurchasing firms among all share-repurchase announcement firms; Panel B includes the top-half share repurchasing firms among non-dividend paying share-repurchase announcement firms; and Panel C includes top-half share repurchasing firms among dividend payers. N is the number of firm-year observations. The definitions of the variables are provided in Appendix Table A.1.

Panel A: All share repurchase announcement firms

		t-4	*t*-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3	*t*+4
Paid-in capital / TA	Mean	0.3096	0.2846	0.2630	0.2316	0.1780	0.1417	0.1207	0.0961	0.0737
	Median	0.2003	0.1955	0.1769	0.1672	0.1288	0.0920	0.0750	0.0506	0.0329
	N	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
RE / TA	Mean	0.2557	0.2829	0.3133	0.3507	0.3856	0.4080	0.4201	0.4307	0.4409
	Median	0.3280	0.3512	0.3662	0.3887	0.4101	0.4276	0.4390	0.4407	0.4452
	N	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
SEQ / TA	Mean	0.5631	0.5663	0.5753	0.5808	0.5634	0.5503	0.5407	0.5287	0.5181
	Median	0.5597	0.5655	0.5759	0.5820	0.5661	0.5521	0.5403	0.5253	0.5113
	N	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
Debt / TA	Mean	0.1571	0.1526	0.1430	0.1364	0.1492	0.1600	0.1664	0.1742	0.1830
	Median	0.1234	0.1231	0.1153	0.1022	0.1183	0.1300	0.1348	0.1499	0.1579
	N	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121
Cash / TA	Mean	0.1968	0.2004	0.2057	0.2066	0.1990	0.1930	0.1895	0.1861	0.1874
	Median	0.1253	0.1348	0.1460	0.1509	0.1478	0.1411	0.1426	0.1372	0.1410
	N	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121	1,121

Panel B: Non-dividend payers

		t-4	*t*-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3	*t*+4
Paid-in capital / TA	Mean	0.5352	0.4977	0.4645	0.4164	0.3497	0.3027	0.2782	0.2416	0.2115
	Median	0.3538	0.3294	0.3121	0.2908	0.2467	0.2187	0.2000	0.1824	0.1505
	N	499	499	499	499	499	499	499	499	499
RE / TA	Mean	0.0807	0.1186	0.1644	0.2252	0.2769	0.3124	0.3335	0.3543	0.3721
	Median	0.2034	0.2327	0.2609	0.3048	0.3458	0.3680	0.3917	0.4061	0.4079
	N	499	499	499	499	499	499	499	499	499
SEQ / TA	Mean	0.6130	0.6164	0.6296	0.6414	0.6279	0.6185	0.6130	0.6010	0.5905
	Median	0.6234	0.6276	0.6438	0.6527	0.6359	0.6359	0.6449	0.6276	0.6188
	N	499	499	499	499	499	499	499	499	499
Debt / TA	Mean	0.1355	0.1301	0.1181	0.1090	0.1189	0.1238	0.1263	0.1323	0.1408
	Median	0.0674	0.0722	0.0643	0.0475	0.0514	0.0505	0.0569	0.0714	0.0839
	N	499	499	499	499	499	499	499	499	499
Cash / TA	Mean	0.2748	0.2756	0.2795	0.2773	0.2669	0.2559	0.2488	0.2471	0.2487
	Median	0.2265	0.2515	0.2520	0.2543	0.2437	0.2326	0.2265	0.2191	0.2271
	N	499	499	499	499	499	499	499	499	499

Panel C: Dividend payers

		t-4	*t*-3	*t*-2	*t*-1	*t*	*t*+1	*t*+2	*t*+3	*t*+4
Paid-in capital / TA	Mean	0.1029	0.0905	0.0774	0.0611	0.0191	-0.0094	-0.0289	-0.0453	-0.0609
	Median	0.0792	0.0732	0.0704	0.0664	0.0344	0.0166	0.0039	0.0006	-0.0017
	N	622	622	622	622	622	622	622	622	622
RE / TA	Mean	0.4225	0.4372	0.4550	0.4730	0.4937	0.5066	0.5119	0.5145	0.5169
	Median	0.4350	0.4431	0.4487	0.4684	0.4757	0.4797	0.4841	0.4846	0.4790
	N	622	622	622	622	622	622	622	622	622
SEQ / TA	Mean	0.5237	0.5255	0.5299	0.5316	0.5115	0.4957	0.4817	0.4687	0.4571
	Median	0.5061	0.5110	0.5188	0.5211	0.4986	0.4870	0.4723	0.4488	0.4323
	N	622	622	622	622	622	622	622	622	622
Debt / TA	Mean	0.1744	0.1710	0.1643	0.1585	0.1725	0.1873	0.1986	0.2096	0.2199
	Median	0.1495	0.1582	0.1519	0.1368	0.1495	0.1697	0.1812	0.1960	0.2094
	N	622	622	622	622	622	622	622	622	622
Cash / TA	Mean	0.1299	0.1349	0.1413	0.1455	0.1399	0.1381	0.1366	0.1327	0.1337
	Median	0.0810	0.0887	0.0972	0.1024	0.0994	0.0914	0.0946	0.0931	0.0906
	N	622	622	622	622	622	622	622	622	622

Table 8: Underinvestment or over-investment of share repurchasing firms

The table's Panel A reports the relative frequency (i.e., likelihood) of underinvestment, normal investment and over-investment for all share repurchase announcement firms (All), the top-half firms (High REP) and the bottom-half firms (Low REP). Share repurchase announcement firms are split into top- and bottom-half firms based on the size of share repurchases as measured by the five-year sum of share repurchases over (t, t+4) scaled by the beginning-of-period book assets (TA_{t-1}). The sample covers the period over the period 1994-2016. Share repurchase announcement firms are identified from the SDC Platinum so they are defined as those that announce share repurchases. We measure the actual share repurchases of those announcement firms and measure the five-year sum of share repurchases (scaled by the beginning-of-period book assets). To determine under-, normal- and over-investment, we classify share repurchasing firms into quartiles based on residuals from regressions. In the left part of each Panel, the regression model is $Investment_{i,t} = \alpha_0 + \alpha_1\ Sales\ Growth_{i,t-1} + \varepsilon_{i,t+1}$, where the dependent variable is investment in year t scaled by TA_{t-1}. In the right part of each Panel, the regression model is $\Sigma\ Investment_{i,\ (t,\ t+4)} = \beta_0 + \beta_1\ Sales\ Growth_{i,t-1} + \varepsilon_{i,(t,t+4)}$, where the dependent variable is five-year sum of investment over (t, t+4) scaled by TA_{t-1}. Investment is total investment, as measured by [CAPX] + [XRD] + [AQC] – [SPPE]. The regressions are estimated using all non-financial and non-utility Compustat firms over the period 1994-2017. We use regression residuals (i.e., deviations from predicted investment) to sort firms' years into quartile. Firm-years in the bottom quartile (i.e., the most negative residuals) are classified as under-investing, those in the middle two quartiles as the benchmark group, and those in the top quartile (i.e., the most positive residuals) as over-investing. Then we tabulate the relative frequencies for share repurchasing firms and also matched firms. To help the reader understand the reported numbers, in Panel A, 20.7% is the percentage of under-investing firms among all share repurchasing firms, 18.4% is the percentage of such firms among the top-half share repurchasing firms and 23.0% is the percentage of such firms among the bottom-half share repurchasing firms. Panels A and B report relative frequencies for two sets of matched firms: first based on firm size and second based on the combination of firm size and industry (FF 48 industries), respectively. These matched firms are selected among non-financial and non-utility Compustat firms that do not repurchase shares any year over the period (t-4, t+4) around the year that our sample repurchase firm announces share repurchases. Share repurchases are measured by [PRSTKC] less any reduction in [PSTKRV]. N is the number of firm-years. The sample covers the period 1994-2017. The definitions of the variables are provided in Appendix Table A.1.

Panel A: Share repurchase announcement firms

		1-year investment			5-year investment		
		All	High REP (Top half)	Low REP (Bottom half)	All	High REP (Top half)	Low REP (Bottom half)
Likelihood of underinvestment	N	445	199	246	417	198	219
	Prob (%)	20.7	18.4	23.0	19.4	18.3	20.5
Middle two quartiles	N	1,326	671	655	1,378	677	701
	Prob (%)	61.5	61.9	61.2	63.9	62.5	65.5
Likelihood of over-investment	N	384	214	170	360	209	151
	Prob (%)	17.8	19.7	15.9	16.7	19.3	14.1

Panel B: Year-and-size matched firms

		1-year investment			5-year investment		
		All	High REP (Top half)	Low REP (Bottom half)	All	High REP (Top half)	Low REP (Bottom half)
Likelihood of underinvestment	N	389	194	195	419	213	206
	Prob (%)	19.8	19.8	19.7	21.3	21.7	20.9
Middle two quartiles	N	1,063	523	540	1,070	522	548
	Prob (%)	54.0	53.3	54.7	54.4	53.2	55.6
Likelihood of over-investment	N	518	265	253	478	247	231
	Prob (%)	26.3	27.0	25.6	24.3	25.2	23.5

Panel C: Year-industry-and-size-matched firms

		1-year investment			5-year investment		
		All	High REP (Top half)	Low REP (Bottom half)	All	High REP (Top half)	Low REP (Bottom half)
Likelihood of underinvestment	N	322	186	136	314	171	143
	Prob (%)	30.2	33.6	26.4	29.5	30.9	27.9
Middle two quartiles	N	492	230	262	530	268	262
	Prob (%)	46.1	41.6	50.9	49.7	48.5	51.1
Likelihood of over-investment	N	254	137	117	222	114	108
	Prob (%)	23.8	24.8	22.7	20.8	20.6	21.1

Table 9: Multinomial logit regression of underinvestment or over-investment

The table reports results of multinomial logit regressions to predict the likelihood that a firm's investment will be in one of the extreme quartiles as opposed to the middle quartiles. *REPUR_DUMMY* is a dummy variable that equals 1 for share repurchasing firms, and 0 for other firms. *TOP_HALF_REPUR* is a dummy variable that equals 1 for the top-half repurchasing firms by the five-year sum of share repurchases over the period (t, t+4) scaled by the beginning-of-period book assets, where year t is share repurchase announcement year. Share repurchasing firms are identified from the SDC Platinum so they are defined as those that announce share repurchases. In both Panels A and B, the first regressions (I) compare under-investing firms against the benchmark firms; the second regressions (II) compare over-investing firms against the benchmark firms. Under-investing, over-investing and benchmark groups are identified based on residuals from regressions. In Panel A, the regression model is $Investment_{i,t} = \alpha_0 + \alpha_1\ Sales\ Growth_{i,t-1} + \varepsilon_{i,t+1}$, where the dependent variable is investment in year t. *Investment* is total investment, as measured by [CAPX] + [XRD] + [AQC] – [SPPE], scaled by TA_{t-1}. In Panel B, the regression model is $\Sigma Investment_{i,(t,\,t+4)} = \beta_0 + \beta_1\ Sales\ Growth_{i,t-1} + \varepsilon_{i,(t,t+4)}$, where the dependent variable is five-year sum of investment over (t, t+4) scaled by TA_{t-1}. The regressions are estimated using all non-financial and non-utility Compustat firms over the period 1994-2017. We use regression residuals (i.e., deviations from predicted investment) to sort firms years into quartile. Firm-years in the bottom quartile (i.e., the most negative residuals) are classified as under-investing, those in the middle two quartiles as the benchmark group, and those in the top quartile (i.e., the most positive residuals) as over-investing. Share repurchases are measured by [PRSTKC] less any reduction in [PSTKRV]. N is the number of firm-years. The sample covers the period 1994-2017. The definitions of the variables are provided in Appendix Table A.1.

Panel A:Investment is measured for a single year (t)

	Regressions (I)				Regressions (II)			
	Underinvestment=1, Normal investment=0				Over-investment=1, Normal investment=0			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
$REPUR_Dummy_t$	-0.202***	-0.077			-0.296***	-0.250***		
	(-3.996)	(-1.543)			(-6.311)	(-5.358)		
$Top_Half_REPUR_Dummy_t$			-0.465***	-0.300***			-0.250***	-0.176*
			(-4.484)	(-2.943)			(-2.646)	(-1.900)
DIV_Dummy_t	-0.177***	-0.006	-0.177***	-0.006	-0.597***	-0.459***	-0.602***	-0.459***
	(-3.868)	(-0.107)	(-3.871)	(-0.108)	(-17.025)	(-10.751)	(-17.154)	(-10.744)
$log\ (TA_t)$		-0.092***		-0.091***		-0.063***		-0.066***
		(-5.135)		(-5.112)		(-4.689)		(-4.947)
ROA_t		-0.433***		-0.425***		0.821***		0.810***
		(-2.950)		(-2.898)		(7.009)		(6.915)
$Debt_t / TA_t$		0.309**		0.310**		0.805***		0.818***
		(2.291)		(2.298)		(7.437)		(7.555)
$Cash_t / TA_t$		-0.329**		-0.326**		0.852***		0.843***
		(-2.419)		(-2.397)		(8.022)		(7.955)
$RETVOL_t$		0.045		0.039		1.245***		1.278***
		(0.178)		(0.157)		(5.729)		(5.888)
Intercept	0.870***	2.630***	0.866***	2.620***	-0.392***	0.331	-0.405***	0.375
	(6.136)	(7.332)	(6.100)	(7.305)	(-2.746)	(1.154)	(-2.854)	(1.314)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	47,740	35,919	47,740	35,919	46,798	35,634	46,798	35,634
Pseudo R^2	0.1309	0.1394	0.1310	0.1396	0.0501	0.0586	0.0494	0.0579

Panel B: Investment is measured for a five-year sum over the period (t, t+4)

	Regressions (I)				Regressions (II)			
	Underinvestment=1, Normal investment=0				Over-investment=1, Normal investment=0			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
REPUR_Dummy$_t$	-0.263***	-0.124*			-0.330***	-0.274***		
	(-4.104)	(-1.934)			(-5.652)	(-4.747)		
Top_Half_REPUR_Dummy$_t$			-0.505***	-0.305***			-0.295***	-0.258**
			(-4.334)	(-2.629)			(-2.865)	(-2.567)
DIV_Dummy$_t$	-0.214***	0.023	-0.216***	0.021	-0.733***	-0.554***	-0.740***	-0.555***
	(-3.508)	(0.297)	(-3.550)	(0.273)	(-14.006)	(-8.430)	(-14.136)	(-8.444)
log (TA$_t$*)*		-0.076***		-0.076***		-0.123***		-0.126***
		(-3.376)		(-3.387)		(-6.754)		(-6.959)
ROA$_t$		-1.447***		-1.435***		1.818***		1.811***
		(-6.920)		(-6.883)		(10.902)		(10.865)
Debt$_t$ */ TA*$_t$		0.069		0.072		0.275		0.288*
		(0.361)		(0.380)		(1.623)		(1.704)
Cash$_t$ */ TA*$_t$		-0.331*		-0.324*		1.560***		1.558***
		(-1.858)		(-1.824)		(9.983)		(9.998)
RETVOL$_t$		0.411		0.399		1.240***		1.262***
		(1.196)		(1.163)		(4.047)		(4.117)
Intercept	0.982***	2.490***	0.982***	2.490***	-0.267	1.229***	-0.274	1.281***
	(5.876)	(5.560)	(5.864)	(5.571)	(-1.478)	(3.277)	(-1.527)	(3.428)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	30,616	23,931	30,616	23,931	30,100	23,646	30,100	23,646
Pseudo R^2	0.1770	0.1964	0.1772	0.1965	0.0576	0.0866	0.0567	0.0860

Table 10: Tobit regressions of share repurchases for two sub-periods over the period 1980-2017

The table reports the results of Tobit regressions of share repurchases for the two sub-periods: the period 1980-1993 (Panel A) and the period 1994-2017 (Panel B). These estimations are performed on the sample that consists of non-financial and non-utility Compustat firms. In each Panel, we use two dependent variables: (i) the amount of share repurchase in the current year scaled by lagged book assets (REP_t/TA_{t-1}) and (ii) the sum of share repurchases over five years (t, t+4) scaled by the beginning-of-period book assets ($\Sigma REP_{(t,t+4)}/TA_{t-1}$). The amount of share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Industry-fixed effects are based on the Fama-French 48 industries classification. The definitions of the explanatory variables are provided in Appendix Table A.1.

Panel A: Estimation for the period 1980-1993

	Dependent variable: REP_t/TA_{t-1}			Dependent variable: ($\Sigma REP_{(t,t+4)}/TA_{t-1}$)		
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	-0.0003		-0.004***	0.025***		0.013***
	(-0.768)		(-7.012)	(20.926)		(8.941)
$SRET_{t-1}$		0.001*	0.003***		0.029***	0.004
		(1.679)	(2.800)		(9.835)	(1.176)
$log(TA_{t-1})$	0.006***	0.007***	0.005***	0.017***	0.017***	0.016***
	(25.323)	(25.595)	(16.463)	(21.701)	(19.351)	(16.493)
ROA_{t-1}			0.036***			0.230***
			(9.444)			(19.882)
$Cash_{t-1} / TA_{t-1}$			0.032***			0.124***
			(9.371)			(10.847)
$Debt_{t-1} / TA_{t-1}$			-0.036***			-0.134***
			(-10.846)			(-12.138)
RE_{t-1} / TE_{t-1}			0.002***			0.0004
			(4.501)			(0.287)
$RETVOL_{t-1}$			-0.119***			-0.182***
			(-11.548)			(-5.624)
$Dividend_{t-1} / TA_{t-2}$			0.033*			0.026
			(1.939)			(0.478)
Intercept	-0.147***	-0.159***	-0.116***	-0.424***	-0.372***	-0.409***
	(-18.003)	(-17.525)	(-11.804)	(-15.578)	(-12.125)	(-12.843)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	29,137	24,245	23,826	22,353	18,445	18,140
Pseudo R^2	-0.1647	-0.1703	-0.2645	0.1904	0.1834	0.4577

Panel B: Estimation for the period 1994-2017

	Dependent variable: REP_t/TA_{t-1}			Dependent variable: $(\Sigma REP_{(t,t+4)}/TA_{t-1})$		
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	0.006***		0.004***	0.052***		0.042***
	(26.058)		(12.178)	(55.114)		(33.514)
$SRET_{t-1}$		0.002***	-0.002***		0.042***	-0.004
		(3.240)	(-3.343)		(14.554)	(-1.357)
$log(TA_{t-1})$	0.011***	0.012***	0.010***	0.038***	0.043***	0.038***
	(57.561)	(52.134)	(41.210)	(52.500)	(47.579)	(41.552)
ROA_{t-1}			0.087***			0.413***
			(31.572)			(36.814)
$Cash_{t-1} / TA_{t-1}$			0.050***			0.180***
			(20.308)			(17.898)
$Debt_{t-1} / TA_{t-1}$			-0.057***			-0.209***
			(-21.732)			(-19.429)
RE_{t-1} / TE_{t-1}			0.001***			0.002***
			(4.930)			(2.793)
$RETVOL_{t-1}$			-0.177***			-0.401***
			(-27.319)			(-15.646)
$Dividend_{t-1} / TA_{t-2}$			-0.040***			-0.528***
			(-3.476)			(-11.611)
Intercept	-0.282***	-0.281***	-0.239***	-0.864***	-0.857***	-0.830***
	(-39.105)	(-33.703)	(-29.469)	(-30.441)	(-24.460)	(-25.617)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
N	56,190	43,400	42,583	39,324	30,171	29,707
Pseudo R^2	-0.3088	-0.2309	-0.4366	0.2436	0.1864	0.4577

Table 11: Firm characteristics of share repurchasing firms vs. non-share repurchasing firms

The table reports the mean and median of selected firm characteristics of share repurchasing firms and non-share repurchasing firms in the years 2010 (Panel A), 2005 (Panel B) and 2000 (Panel C), respectively. Share repurchase is measured by [PRSTKC] less any reduction in [PRTKRV]. Row [0] includes all non-financial and non-utility Compustat firms in a given year. Row [1] includes firms that repurchase shares in the present year; that is, firms for which share repurchase is positive in the present year. Row [2] includes firms that do not repurchase shares in the present year; that is, firms in Row [0] minus firms in Row [1]. Row [3] includes firms that do not repurchase shares in the current year and any year during the previous four years (t-4, t-1); that is, firms in Row [2] minus firms whose share repurchase is positive any year over (t-4, t-1). Row [4] includes firms that do not repurchase shares any year over the period (t-4, t+4); that is, firms in Row [3] minus firms that repurchase shares any year during the following four years (t+1, t+4). Definitions of firm characteristics are provided in Appendix Table A.1.

Panel A: Year 2010

		N	Q_{t-1}	$log\ (TA_{t-1})$	ROA_{t-1}	RE_{t-1}/TA_{t-1}	Δ (Paid-in capital) / TA_{t-1}
[0]: All firms	Mean	2,783	1.87	20.16	0.0805	-0.5627	0.6647
	Median		1.39	20.11	0.1033	0.1261	0.0505
[1]: firms that repurchase shares in the present year	Mean	1,230	1.79	20.74	0.1253	-0.0399	0.1564
	Median		1.47	20.67	0.1229	0.2543	0.0065
[2]: [0] minus [1]	Mean	1,553	1.94	19.69	0.0438	-0.9859	1.0837
	Median		1.32	19.55	0.0824	0.0482	0.0997
[3]: [2] minus those that repurchase shares any year during (-4, -1)	Mean	892	2.24	19.34	0.0056	-1.5808	1.6721
	Median		1.40	19.25	0.0776	-0.0518	0.1462
[4]: [3] minus those that repurchase shares any year during (0, +4)	Mean	590	2.39	19.07	-0.0219	-2.1231	2.2948
	Median		1.43	18.88	0.0642	-0.1418	0.2299

Panel B: Year 2005

		N	Q_{t-1}	$log\ (TA_{t-1})$	ROA_{t-1}	RE_{t-1}/TA_{t-1}	Δ (Paid-in capital) / TA_{t-1}
[0]: All firms	Mean	2,961	2.20	19.83	0.1291	-0.2418	0.7130
	Median		1.73	19.78	0.1388	0.1343	0.0826
[1]: firms that repurchase shares in the present year	Mean	1,207	2.18	20.71	0.1735	0.1251	0.1365
	Median		1.81	20.66	0.1616	0.2497	-0.0001
[2]: [0] minus [1]	Mean	1,754	2.22	19.23	0.0972	-0.5015	1.1454
	Median		1.66	19.14	0.1156	0.0332	0.1699
[3]: [2] minus those that repurchase shares any year during (-4, -1)	Mean	1,070	2.43	19.11	0.0834	-0.6166	1.5304
	Median		1.77	19.04	0.1146	-0.0185	0.2422
[4]: [3] minus those that repurchase shares any year during (0, +4)	Mean	644	2.42	18.87	0.0443	-0.7371	2.2186
	Median		1.76	18.68	0.1026	-0.0519	0.3499

Panel C: Year 2000

		N	Q_{t-1}	$log\ (TA_{t-1})$	ROA_{t-1}	RE_{t-1}/TA_{t-1}	Δ (Paid-in capital) / TA_{t-1}
[0]: All firms	Mean	3,046	2.97	19.46	0.1169	-0.0164	0.9257
	Median		1.48	19.33	0.1486	0.1388	0.0967
[1]: firms that repurchase shares in the present year	Mean	1,419	2.49	19.98	0.1642	0.1968	0.3684
	Median		1.42	19.93	0.1751	0.2505	0.0338
[2]: [0] minus [1]	Mean	1,627	3.41	19.00	0.0725	-0.2059	1.4626
	Median		1.58	18.84	0.1230	0.0529	0.2664
[3]: [2] minus those that repurchase shares any year during (-4, -1)	Mean	1,081	4.03	18.92	0.0517	-0.2912	1.8248
	Median		1.90	18.77	0.1190	0.0000	0.3637
[4]: [3] minus those that repurchase shares any year during (0, +4)	Mean	713	3.87	18.79	0.0209	-0.3610	1.9019
	Median		1.78	18.63	0.1032	-0.0061	0.4261

Table 12: Tobit regressions of dividends, repurchases and total pay

The table reports the results of Tobit regressions of the five-year sum of dividends (*DIV*), share repurchases (*REP*) and total pay (*TotalPay*) over the period 1994-2017. These estimations are performed on the sample that includes non-financial and non-utility Compustat firms. The dependent variable in each Column is the sum of a given payout amount (*PAY*) over five years including the current year and the following four years scaled by the beginning-of-period book assets. That is, $\Sigma PAY_{(t,t+4)}/TA_{t-1}$, where *PAY* = *DIV*, *REP* or *TotalPay*. *TotalPay* is the sum of dividends and share repurchases. Unlike the first three Columns, Columns (4)-(6) control for industry fixed effects based on the Fama-French 48 industries classification. The definitions of the explanatory variables are provided in Appendix Table A.1.

Panel A: All sample firms

	Dep. var.: $\Sigma PAY_{(t,t+4)}/TA_{t-1}$, where *PAY* = *DIV*, *REP* or *TotalPay*.					
	DIV	*REP*	*TotalPay*	*DIV*	*REP*	*TotalPay*
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	0.016***	0.064***	0.085***	0.018***	0.059***	0.080***
	(4.471)	(17.506)	(21.267)	(5.179)	(16.591)	(20.172)
$RETVOL_{t-1}$	-1.059***	-0.342***	-0.828***	-0.973***	-0.370***	-0.814***
	(-15.308)	(-7.821)	(-16.262)	(-14.620)	(-8.665)	(-16.162)
RE_{t-1} / TA_{t-1}	0.112***	0.014**	0.035***	0.109***	0.013**	0.035***
	(7.756)	(2.205)	(4.796)	(7.632)	(2.146)	(4.906)
ROA_{t-1}	0.214***	0.357***	0.471***	0.215***	0.337***	0.462***
	(7.076)	(12.422)	(14.014)	(7.454)	(11.487)	(13.385)
$log(TA_{t-1})$	0.013***	0.026***	0.023***	0.009***	0.031***	0.026***
	(5.789)	(12.296)	(9.238)	(4.005)	(14.010)	(9.871)
Intercept	-0.237***	-0.564***	-0.432***	-0.145**	-0.763***	-0.528***
	(-5.362)	(-13.362)	(-8.548)	(-2.317)	(-10.340)	(-6.841)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes
N	32,864	30,071	30,071	32,864	30,071	30,071
Pseudo R^2	0.5212	0.3406	0.3828	0.6057	0.4086	0.4176

Panel B: Dividend-paying firms only

	Dep. var.: $\Sigma PAY_{(t,t+4)}/TA_{t-1}$, where *PAY* = *DIV*, *REP* or *TotalPay*.					
	DIV	*REP*	*TotalPay*	*DIV*	*REP*	*TotalPay*
	(1)	(2)	(3)	(4)	(5)	(6)
Q_{t-1}	0.061***	0.058***	0.124***	0.060***	0.051***	0.117***
	(12.060)	(6.570)	(11.999)	(12.514)	(5.884)	(11.080)
$RETVOL_{t-1}$	-0.570***	-0.149*	-0.669***	-0.522***	-0.180**	-0.673***
	(-10.657)	(-1.726)	(-7.474)	(-10.591)	(-2.151)	(-7.799)
RE_{t-1} / TA_{t-1}	0.019	0.098***	0.087***	0.024*	0.081***	0.078***
	(1.355)	(5.139)	(3.743)	(1.804)	(4.178)	(3.460)
ROA_{t-1}	0.189***	0.388***	0.556***	0.161***	0.413***	0.547***
	(4.318)	(5.722)	(6.573)	(3.862)	(6.081)	(6.280)
$log(TA_{t-1})$	-0.013***	0.028***	0.006*	-0.015***	0.031***	0.007**
	(-5.884)	(10.689)	(1.826)	(-6.628)	(11.908)	(2.258)
Intercept	0.304***	-0.641***	-0.128*	0.283***	-0.758***	-0.233**
	(6.484)	(-11.102)	(-1.931)	(5.376)	(-9.593)	(-2.506)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry FE	No	No	No	Yes	Yes	Yes
N	12,868	12,273	12,273	12,868	12,273	12,273
Pseudo R^2	-0.4546	1.1815	1.2182	-0.5161	1.5200	1.3588