Do Stock Buybacks Cause Harm?
Evidence from Financially Distressed Firms

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ABSTRACT

Skeptics argue that stock buybacks in general are harmful. They argue that managers prioritize self-interest over investing in economically beneficial projects, to the detriment of employees and bondholders. Several U.S. politicians echo these concerns and have proposed legislation either restricting or eliminating buybacks. Recently, the Biden administration implemented a 1% excise tax and is proposing to quadruple the levy. This contrasts with a rich literature showing that buybacks on average are beneficial. Yet from a regulatory view, these studies are weak as the analysis is dominated by healthy companies and tends to focus narrowly on shareholders. Using principles of regulatory paternalism, we look more carefully for harm that buybacks might cause by focusing on financially vulnerable firms. Even in these more extreme cases, we find little evidence that buybacks harm any of the various stakeholders nor do we observe any material sign of underinvestment. These most vulnerable firms seemingly demonstrate restraint when executing buybacks, perhaps due to natural market disciplining forces from debt markets. Our findings provide no motivation for regulatory intervention either limiting or altogether terminating the transaction.

1. Introduction

A rich literature finds that stock buybacks are a tool managers can use to increase firm value. For example, stock buybacks by definition reduce equity in the firm, thus allowing under-levered firms the opportunity to move to a more optimal capital structure. According to the static trade-off theory of capital structure, firms trade off the potential increase in expected financial distress costs (Myers (1994)) to gain the benefits offered by debt financing (i.e., lower corporate taxes and lower agency costs of free cash flow). The static trade-off theory assumes markets are efficient. Yet once we allow for information asymmetries (e.g., Myers and Majluf (1984)), buybacks may also increase shareholder value for long-term investors if prices diverge below fair value and markets underreact to the news of a buyback thus enabling managers to repurchase undervalued stock. Numerous empirical papers validate this notion that buybacks are, generally speaking, beneficial to firms and their equityholders.

Despite these widely held views, some academics, government officials and market pundits heavily criticize stock repurchases. High on the list of criticisms is that buybacks necessarily divert capital away from new investment projects and also reduce firm liquidity, thereby decreasing the firm's financial stability (Chen and Wang (2012)). In so doing, the argument goes, buybacks deprive the firm of value-creating growth opportunities, the economy of expansion (and job growth) and increase bankruptcy risk, which in turn imposes financial distress costs on employees from job dislocation.

To explain why firms would pursue such sub-optimal behavior, these critics argue that managers either suffer from hubris or they selfishly use buybacks to benefit themselves by sending false signals to the market, thus increasing stock prices above fair value. This short-term aberration, in turn, creates an opportunity for insiders to sell their personal stock at inflated prices. Another dubious motivation critics argue is that managers use buybacks to increase earnings per share to receive bonuses tied to earnings per share targets. Finally, as is true with any leverage increasing transaction, buybacks arguably can be used to transfer wealth from bondholders to stockholders. Such a move may be good for share prices in the short run but bad for firm value in the long run if firms are punished with higher interest rates when refinancing that debt at a later date.

These criticisms appear to have at least some traction with decision-makers. For example, numerous U.S. politicians from both parties agree with the notion that buybacks hamper the firm's ability to effectively compete in labor or product markets or may materially and unnecessarily expose employees to the

costs associated with job dislocation when operations are suspended.[1] Bailouts of U.S. airline industry during the Covid crisis were heavily criticized as a needless consequence of airlines previously engaging in large buybacks before the crisis, which in the view of some unnecessarily harmed labor and made the industry vulnerable to an economic downturn.[2] For these and other reasons, politicians from both major parties have engaged in several attempts constrain or eliminate buybacks.[3,4] In 2018, U.S. Senator Tammy Baldwin introduced the Reward Work Act seeking to eliminate stock buybacks; similar legislation was introduced in the House in 2023.[5] Consistent with this sentiment, the Biden administration followed through on this push to impede buybacks by implementing a 1 % excise tax on the transaction via passage of the Inflation Reduction Act in 2022. The following year in his 2023 State of the Union address, Biden argued the tax should be quadrupled. This was followed up a few months later with the bi-partisan introduction of the Stock Buyback Accountability Act of 2023. Recently, this tax was included in Biden's 2024 budget although has not gone into effect. Relatedly, the SEC passed new regulation on buyback disclosures, motivated in part by a desire to increase compliance costs associated with stock repurchases (although the procedure was later struck down by the courts as onerous and lacking necessary cost-benefit analysis).

Because it is difficult to build a true counterfactual of what would happen if buybacks were banished, it is challenging to test the extent to which buybacks cause harm. Moreover, the existing literature showing the benefits of buybacks is, understandably, not particularly persuasive at assuaging to skeptics seeking to ban the transaction as these prior studies focus on the general population of companies. These populations are dominated by healthy firms where small changes in capitalization are not particularly threatening and as such are weak. These prior studies do not focus on companies most vulnerable to financial manipulation where the adverse effects of a buyback would, ex-ante, be most prevalent. Finding that shareholders on average benefit from buybacks is not a particularly compelling argument if, in fact, the transaction can be shown to be harmful in some applications. Further critique is that these studies tend to focus on shareholders. This narrow lens by-passes a key question of whether equity holders are benefitting while other stakeholders in the firm might be worse-off.

Similar to how adverse drug reactions in at-risk populations are evaluated by regulators, we look for adverse outcomes among all the various stakeholders in the firm by focusing on financially weak firms,

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[1] Insert supporting footnote.

[2] See https://www.cpreview.org/blog/2021/8/when-is-enough-enough-how-covid-19-exposed-the-airline-industrys-obsession-with-stock-buybacks. See also Tammy Baldwin proposal.

[3] See https://thehill.com/policy/finance/3590121-democrats-add-stock-buyback-tax-scrap-carried-interest-to-win-sinema-over/ and https://www.nytimes.com/2019/02/03/opinion/chuck-schumer-bernie-sanders.html.

[4] In 2019, Sen. Marco Rubio, as chairman of the Senate Committee on Small Business and Entrepreneurship, published a report titled "American Investment in the 21st Century." Rubio called for policymakers to eliminate incentives for stock buybacks and for businesspeople to prioritize the nation's long-term health over short-term profits.

[5] Other proposed bills aimed at eliminating stock buybacks include the H.R. 2694, the "Reward Work Act," introduced in May 2023 with 25 sponsors with the purpose bill of "prohibit(ting) companies from repurchasing shares in the open market, and for other reasons."

those which in relative are terms closest to bankruptcy at the time of the buyback announcement. If buybacks cause harm, the most deleterious effects should be evident in firms already in or near financial distress. Demonstrating this damage is seemingly important to motivate regulatory intervention.

Following Altman, Dai, and Wang (2024), we rely on Altman's (1968, 2018) Z-score to ex-ante measure the likelihood for financial distress. We supplement this by also looking at cases where firm cash flows are so strained as to barely cover interest payments.[6][7] Using a sample of 8,380 buyback announcements covering the period 1990 to 2021, we compare buyback firms to a control sample composed of firms with similar Z-scores, from the same industry and with similar market-cap, price-to-book ratio and prior six-month returns. We find no evidence that buybacks announced by zombie firms are harmful to shareholders. Short-term announcement returns are on average significantly positive and uncorrelated with Z-scores suggesting that markets do not perceive potential future harm in seemingly weak buyback cases. Further, using various approaches, we find that long-term excess returns are also significantly positive and clearly not worse for companies with low Z-scores. In fact, irrespective of which method we adopt, point estimates for the 48-month buy-and-hold excess return for firms in the bottom Z-score quintile is roughly +16% above that observed more generally. This higher performance suggests that managers in these zombie firms perceive their stock prices as more undervalued compared to similarly ranked peer firms, perhaps because of overly pessimistic views held by market participants. Similar to more viable firms who also perceive mispricing, this may be one reason why such financially distressed firms engage in what some might conclude is an ill-advised transaction.

Of course, a firm which feels it is undervalued must have the necessary financial resources to repurchase the stock, unless it is simply bluffing the market. As such, we investigate the source of funding for buybacks. In general, buyback firms tend to have higher profitability than their peers with similar Z-scores and that this positive, contemporary cash flow is, in fact, the primary source of buyback funding. For zombie buyback firms in the lowest Z-Score quintile, the two-year cumulative earnings reported during the fiscal year of the buyback announcement and the subsequent fiscal year average 17.20% of average total assets, which is approximately triple the 6.80% reported by their peers. Consistent with the notion that buybacks are funded out of contemporary earnings, long-term debt levels post buyback do not change much. For financially healthy firms ranked with the lowest potential for bankruptcy, these firms do exhibit a slight increase in debt which may be associated with a desire to affirmatively reshape the capital structure. However, for zombie-like buyback firms, debt levels are comparatively lower and show little difference from matched

[6] For ease of exposition, we refer to these financially distressed firms as "zombie" or "zombie-like" firms even though some might prefer to restrict this label to even further distressed organization (e.g., Altman, et. al. (2024)).

[7] In the Appendix Tables A5 to A8, we demonstrate that applying the interest rate coverage ratio criteria (a three-year moving average of less than one) yields similar results.

peer firms. Further, there is little evidence of a degradation in bond ratings over time, dispelling the notion that buybacks jeopardize the financial viability of the firm or transfer wealth from stockholders to bondholders.

Perhaps the most damning criticism of buybacks is that they unnecessarily divert capital investment and thus harm the economy.[8] Here again, there is no support for such a claim. Capital expenditures after stock buybacks are *not* significantly lower than that of comparable peer firms; buybacks are not displacing capital investment. Further, the dividend to asset ratio is unaffected by buybacks. The fact that this ratio tends to be higher among buyback firms is inconsistent with the critique that managers are using buybacks as a substitute for paying dividends in order to avoid paying higher net taxes to the government.

Another way to view how financial distress evolves after buybacks is to track Z-scores. If buybacks create financial distress, we should see a meaningful decline in Z-scores over time. For firms with the highest z -scores, we observe some downward reversion after a buyback (driven mostly by a decline in price to book levels), although their Z-scores still remain remarkably high, suggesting no sign of financial distress. Yet, we find the opposite with zombie-like buybacks; Z-scores for the riskiest buyback firms actually *improve* post-announcement. Interestingly, we find a similar result for the control firms in these most distressed cases, suggesting that common macro-factors are driving the upward revision in Z-scores. As such and in contrast to critics of the transaction, we see no evidence that buybacks diminish financial viability. Further, we see no uptick in bankruptcy filings among zombie-like buybacks as critics would otherwise suggest.

Another approach to addressing the question as to whether buybacks cause harm is to evaluate the question in reverse. If buybacks induce financial distress and thus bankruptcy, then buybacks should be prevalent in the years preceding a bankruptcy filing. Yet the data does not bear this out. Firms which eventually file for bankruptcy show a *reduced* likelihood of a buyback in the preceding five years. Instead, most bankruptcy cases are largely due to slowing sales and asset growth, higher levels of debt and higher growth in debt compared to matching firms. In cases of eventual failure, we see little capital in the preceding years being drained from the firm and returned to shareholders via stock buybacks. Instead, in the years preceding a bankruptcy, managers appear to naturally refrain from buybacks. Again, for those buyback cases we do observe, they tend to be funded with contemporary earnings and not with debt.

[8] For example, Lazonick, Sakinç and Hopkins (2020).

To some readers, our conclusions may appear to conflict with that of Chen and Wang (CW) (2012) who examine buybacks announced by "financially constrained" firms. They use several approaches, but primarily define financially constrained firms using the Kaplan and Zingales index (KZ) (1997). Chen and Wang (2012) conclude that constrained buyback firms subsequently perform poorly. It should be noted though that "financially constrained" is not equivalent to "financially distressed." Financially constrained firms as defined by KZ are firms with both *high* Tobin's Q and leverage, but low operating cash flows, cash balances and dividends. They need to raise external funds (debt or equity) to finance their investment opportunities. Interestingly, the mean Z-score for the buyback firms CW classify as most financially constrained in "Year - 1" is 6.13. With such a remarkably high Z-score, these firms by definition have very *low* probability for financial distress. In fact, their likelihood for distress differs little from the overall Z-score for their entire unconstrained sample of 6.40. The fact that these firms are announcing a buyback may mean that managers have no longer financing needs, possibly because they have cancelled their investment plans. CW suggest that "hubris" is motivating these buybacks, i.e., managers wrongly believe their stock is undervalued. Yet alternatively, it may also indicate the market's disappointment with this cancellation.

2. Related literature

Over the last four decades, there has been extensive research on the effect of buybacks on both short- and long-term shareholder value. Initially, research focused on explaining the positive short-term returns observed when buybacks are announced (Dann (1981), Vermaelen (1981)). This is consistent with buybacks being initially interpreted by the market as a positive signal, especially when insiders are not selling their shares.

Buybacks have become global since 2000. Before then, repurchases were frowned upon by regulators in many countries for several reasons including the ability of buybacks to: potentially manipulate stock prices, serve as an indirect way to engage in insider trading, avoid paying taxes on dividends, and as a method that hurts creditors and other stakeholders with fixed claims including employees (Wang, Yin, and Yu (2021)). Over time each of these criticisms has been addressed. Concerns about manipulation were dealt with by imposing restrictions on trading volume. Concerns about insider trading were to some extent dealt with by blackout periods prior to earnings announcements limiting days where buyback trades could occur. Concern about creditors was easily mitigated via covenants.

One of the biggest drivers for why buybacks are announced relates to the extensive use of employee and executive incentive stock options (Kahle (2002)) which have the potential to dramatically decrease leverage in the firm and amplify the number of shares outstanding. By construction, a buyback can offset the implied

issuance of equity (or dilution in ownership) when options are exercised. Options can also be beneficial if a company chooses to replace dividends with buybacks. First, they serve to disgorge cash in a globally tax efficient manner. But further, managers who are compensated at least in part with options also benefit as this eliminates the implied increase in their options' strike price which occurs when dividends are paid, a change which is avoided with the same wealth transfer occurs through a buyback.

Regarding long-horizon returns, Ikenberry, Lakonishok, and Vermaelen (1995) were first to report the repurchase anomaly within U.S. data after examining long-term returns subsequent to open market repurchases, the most common technique firms use to harvest their own shares. They find that excess returns are especially large for value stocks. Subsequently, Ikenberry, Lakonishok, and Vermaelen (2000) confirm their U.S. findings using Canadian firms, again finding value stocks generated higher abnormal returns, a notion consistent with underpricing. Note that in contrast to the benefits mentioned supra, the value creation for long-term holders comes at the expense of other shareholders who sell their undervalued shares to the company. Reinforcing this, Chan, Ikenberry, and Lee (2004) affirmed the continuity of drifts after repurchases, observable both in the short- and-long term. More recent studies by Manconi, Peyer, and Vermaelen (2019) using global data, and Lee, Park, and Pearson (2020) ascertain the persistence of positive long-term abnormal returns using more recent data. So, the buyback anomaly seems to persist over time and is global. The long-term positive excess returns are the strongest evidence against the hypothesis that managers manipulate stock prices for short-term gains. If manipulation was falsely forcing market prices to rise above fair value, by definition this would mandate that long-run excess returns subsequent to buyback announcements should at some point be *negative*. Numerous studies fail to identify negative abnormal returns at any horizon following buybacks.

Gong, Louis, and Sun (2008) put forth persuasive evidence suggesting that the post-repurchase performance improvement, as documented by Lie (2005), likely stems from pre-repurchase downward earnings management. Peyer and Vermaelen (2009) offer robust evidence supporting the overreaction hypothesis as a driver of long-term abnormal returns. Their research reveals that stocks often record the most notable positive long-term excess returns following a significant stock price dip in the prior six months. Other variables that are significantly related to long-term returns include stated managerial confidence (Peyer and Vermaelen (2009)), volatility (Evgeniou, et al. (2018)), gender diversity (Evgeniou and Vermaelen (2017)), managerial trustworthiness (Huang, Snellman, and Vermaelen (2022)), net insider buying (Cziraki, Lyandres, and Michaely (2021)), sentiment (Liang (2016)), governance quality (Caton et al. (2016)) and whether the repurchase is executed using an accelerated buyback mechanism (Michel et al. (2011)). Grullon and Michaely (2004) do not find evidence that repurchase programs are followed by an increase in operating performance. Instead, they report that buybacks are followed by a reduction in systematic risk, and thus

argue that the long-term excess returns subsequent to buybacks is explained by markets only slowly learning that buybacks signal a reduction in the cost of capital.

Despite this rich literature supporting the benefits of buybacks to shareholders, a public perception as expressed in the main-stream media and also by some politicians[9] vociferously argues otherwise. These arguments of harm to other stakeholders are also expressed by academics such as Lazonick, Sakinç and Hopkins (2020).[10] There are two common theses often emerging from these skeptics. First, these critics argue that buybacks make firms financial unstable and thus impose financial distress costs on workers. Second, they argue that buyback programs have detrimental effects on economic growth, and thus harm society at large. They argue that repurchases, by construction, divert capital away from investment and innovation, and instead help managers achieve other short-term objectives, such as artificially enhancing earnings per share, which in turn can directly and indirectly affect management's compensation.

Of course, the argument that buybacks destroy growth and innovation in the economy relies on two key assumptions. First, is that buyback firms have positive NPV investment opportunities which are being abandoned when a buyback is executed. Second, this assertion also implies that these firms are constrained from capital markets and thus are prohibited from obtaining additional external capital to finance new projects in the future by issuing new equity or debt. This second issue contradicts, though, Fried and Wang (2018) who find that repurchased stock is often times reissued in later periods so that firms are not "starved" for cash by share repurchases.

Clearly, this issue of limited access to capital markets is not binding for most public companies. However, for a narrow subset of firms in financial distress, access to capital may indeed be problematic. Here, concern about underinvestment by zombie-like firms could be a material concern and a plausible argument against buybacks, at least for this small segment of cases. Another concern is that buybacks are used to manipulate earnings per share to increase compensation tied to EPS targets (Brav et al. (2005), Cheng, Harford, and Zhang (2015)) or to meet analyst forecasts (Almeida et. al. (2018)). As a result, firms pursue short-term objectives at the expense of long-term growth opportunities. Note that this is not really a critique of buybacks but a critique of rewarding managers for reaching short-term earnings targets. Again, these arguments could hold for profitable firms, but one would expect that this is less true for firms in financial distress.

[9] Natalia Renta. "Congress Takes Historic Step to Tax Stock Buybacks" Inequality.org. August 10, 2022. (See https://inequality.org/research/congress-takes-historic-step-to-tax-stock-buybacks/#:~:text=%E2%80%9CI%20hate%20stock%20buybacks%2C%E2%80%9D,prolonged%2C%20heated%20negotiations%20amongst%20Democrats.%20https://www.cnbc.com/2021/03/02/elizabeth-warren-rips-stock-buybacks-as-nothing-but-paper-manipulation.html\)

[10] See also, https://www.newyorker.com/business/currency/the-economist-who-put-stock-buybacks-in-washingtons-crosshairs)

3. Data & Methods

3.1. The sample

We begin by forming a sample using all open-market share repurchase events listed on the Securities Data Corporation (SDC) Platinum database over the period 1990-2021. Consistent with previous papers, we exclude firms whose share price at the time of the announcement is less than $3. Return information is obtained from CRSP and accounting data from Compustat. We only include securities with a CRSP share code of either 10 or 11 which are identified as trading on either the NYSE, AMEX, or NASDAQ stock markets and record returns up through 2023. Because of the regulated nature of certain companies, we exclude financials (SICs between 6000 and 6999), public utilities (SICs between 4900 and 4999), and firms classified as public administration (SICs between 9100 and 9999).

3.2. Z as a measure of Financial Distress

To the extent that stock buybacks cause harm to corporations, it should be most evident in firms less viable firms nearest to default. As such, we need a measure of financial distress or bankruptcy risk. We start by using Altman's (1968) Z-score to accomplish this. Other measures of bankruptcy exist, yet Z-score is straightforward to calculate using only public information and poses the fewest restrictions on providing a risk estimate for our sample. The Z-Score's simplicity and effectiveness have led to its widespread adoption by financial institutions, investment analysts and industry practitioners. We apply Altman's model as such:

$$Z = 1.2 \cdot \frac{Working\ Capital}{Total\ Assets} + 1.4 \cdot \frac{Retained\ Earnings}{Total\ Assets} + 3.3 \cdot \frac{EBIT}{Total\ Assets} + 0.6 \cdot \frac{Market\ Value\ of\ Equity}{Book\ Value\ of\ Total\ Liability} + 0.99 \cdot \frac{Sales}{Total\ Assets} \quad (1)$$

In the tables which follow, we sort firms into quintiles based on Z. The cutoffs defining each quintile are formed each year relative to only NYSE stocks which satisfy our inclusion criteria. NASDAQ firms are then sorted into Z quintiles based on these NYSE cutoffs. [11]

Table 1 confirms that Z is indeed associated with the potential for bankruptcy. Over the period 1999 to 2018, those firms sorted into the highest Z score quintile experience bankruptcy at the rate of 9 per 10,000 (0.09%) with three years of being classified. The observed rate of bankruptcy increases monotonically as we move to lower Z-score quintiles. For quintile 1 firms, the rate of bankruptcy jumps noticeably to 197

[11] We also applied the Altman, Dai, and Wang (2024) Z''-Score model, and the main conclusions remain consistent. The results are provided in the Internet Appendix.

per 10,000 (1.97%) within three years of sorting.[12] If we look across individual years, we see that Z seemingly does a good job each year of identifying firms most at risk of future bankruptcy. For example, during the years leading into the Great Recession (2006 to 2008) we see an uptick in the frequency of bankruptcy for Z1 firms of 2.89% on average; the corresponding mean for Z5 firms for those same years is .04% with two of those three years showing no bankruptcies at all.

If we take the firms categorized within in the lowest quintile (Z1) and sort them further into three additional subgroups, the result is noisy, but the same patterns emerge. Firms with the lowest sub-ranking within Z1 report a higher incidence of bankruptcy, on average, compared to other firms classified within that bottom Z quintile ranking. Separation across these three sub-groups year to year, though, is not always consistent. While we rank firms in the cross-section, Altman (1968) uses an absolute Z-score cut-off value of 1.8 to identify firms most at-risk of bankruptcy. Although perhaps a slightly stricter method for identifying at-risk firms, the overall failure rate using this absolute measure (2.09%) is similar to that observed using the relative approach we use to define Z1 firms (1.97%).

3.3. The Control Sample

Given that we wish to study the most suspicious buyback cases with relatively low financial viability, we need to control firms who have similar poor financial characteristics, particularly with respect to their likelihood for bankruptcy. These should be distressed firms similar to our buyback firms along many dimensions, but whose management for whatever reason chose not to initiate a buyback. To accomplish this matching, as a firm announces a buyback, we first identify all firms at that same point in time which are also classified in the same Fama-French twelve industry. From this list, we eliminate all stocks which made an initial public offering (IPO) in the previous year or announced a buyback within the prior five years. From this potential list, we calculate the Robust Mahalanobis Distance (RMD) between the buyback target and each potential control firm in that same industry. Among these firms, we choose the five firms with the shortest RMD when matched on the basis of firm-size (log market capitalization at the end of the prior June), book-to-market (from the prior June), Z-score at the time of the announcement, and six-month total return prior to the buyback announcement (ending five days before the buyback announcement).[13]

[12] The percentages shown in Table 1 for each year reflect values over the subsequent three years.

[13] To avoid look-ahead bias, we do not screen control firms by whether they subsequently announce a buyback. Thus, it is possible some of our matching firms also eventually announce a buyback.

4. Abnormal Return Evidence

4.1. The Short-Run Evidence

Table 3 reports mean five-day abnormal returns for our sample overall and stratified by Z score. Here, abnormal performance for a given buyback firm is defined as the five-day holding period return surrounding the buyback date (day $t-2$ through day $t+2$) less the equal-weighted mean holding period return of the five control firms matched to that buyback firm.[14]

If buybacks pose a detrimental cost on the firm, or at least to its shareholders (say by increasing the risk of bankruptcy), we should find the abnormal market reaction to buybacks announced by firms most at risk of financial distress to be lower, if not negative, compared to otherwise. This is clearly not the case. In Table 3, there is no evidence that the market perceives buybacks in low-Z firms to be harmful. In fact, the mean announcement return for Z1 firms is 1.59% and is significantly different from zero at the 1% level. Looking over time, we see no time period where financially constrained firms received a negative reaction. If we switch to using a Z-score of 1.8, we again see no evidence that the market perceives the news of a buyback as harmful or that the transaction might potentially move the firm into financial peril.

4.2. The Long-Run Evidence

One might argue that in the short-run markets may not be able to fully perceive or anticipate the increased potential harm for future financial distress that a stock buyback might cause. If so, then one might discount the short-run return evidence around the buyback announcement date as insufficient evidence. If buybacks are harmful to the firm, which should see material evidence in long-term returns, at least among financially vulnerable firms. This would also be consistent with the hypothesis offered by some critics that managers might be causing harm by announcing buybacks in order to artificially manipulate prices in the near term. As such, we consider the long-horizon return evidence. We do this two ways. First, we estimate four-year buy-and-hold abnormal returns starting in the month following the buyback announcement. Second, we apply Ibbotson's returns across time series technique (or RATS) using the Fama-French five-factor model, also starting in the month subsequent to the buyback announcement.

4.2.a Buy-and-hold Abnormal Returns

Table 4 Panel A reports buy-and-hold abnormal returns for our sample, both overall and for various subgroupings stratified on the basis of their ex-ante exposure to financial distress. These returns are calculated over various horizons ranging from three- to forty-eight months. We find no compelling evidence of a

[14] By not rebalancing throughout this five-day period, both the buyback firm and the matching firms are less prone to upward return basis due to bid-ask bounce or mean reverting inter-day noise exacerbated by otherwise implied daily rebalancing.

decline in long-term stock returns. For the overall buyback sample, the abnormal return (controlling for industry, size, book-to-market, and six-month return prior to the announcement) is positive at traditional significance levels for each holding period from three to forty-eight months. If we focus more narrowly on the Z1 firms, again we see no evidence of adverse market performance. These firms which have a higher propensity for failure have a positive average abnormal performance of 24.40 % relative to control firms with the same matching characteristics measured over a four-year horizon, significant at the 1% level. This compares to a mean abnormal holding period return for all other firms ranked Z2 through Z5 of 8.48% (also significant at the 1% level). If we build a long-short portfolio of Z1 against Z2 through Z5 combined, the arbitrage spread at the three- and four-year mark is 9.66% and 16.00% respectively with both estimates significant at the 5% level. Sorting the Z1 portfolio further to a more granular level, we see no evidence of poor performance even among those firms with the very highest propensity for failure. Similar inferences are obtained in Panel B using an absolute Z-score cutoff value of 1.8.

Additionally, in Appendix Tables A1 through A3, we further subdivide the entire sample period into three distinct sub-periods: 1990-1999, 2000-2009, and 2010-2021 to examine any temporal heterogeneity in these Buy-and-Hold Abnormal Returns (BHAR). Across these intervals, we see no evidence of a negative drift in BHAR overall or more specifically for firms with low Z-scores. This reinforces our initial conclusion; there is no indication either in the cross section or time-series that stock buybacks cause harm, even among firms most at risk for financial distress.

4.2.b Fama-French Five-Factor RATS

The BHAR approach gives equal emphasis to each buyback case. Here, we switch methods and apply the Fama-French five-factor model using Ibbottson's return across time series approach (RATS) (1975) and thus treat all cases occurring in a given month as a single case. For all buyback firms in our sample, we align them in event time where $j = 0$ represents the month when the open market repurchase is announced. Then for each month j where j goes from zero to forty-eight, we estimate a cross-sectional regression where the excess return for each firm is regress on the corresponding Fama-French factor returns for that same month. The resulting alpha from this regression represents the abnormal return for each event month j. We estimate these alphas over specified time periods ranging from +12 to +48 months. Here, a buyback firm remains in the sample as long as possible and simply falls from the sample as time lapses or after the last partial month in which its returns are recorded on CRSP. The intercepts obtained from these alpha j values are then summed up to derive the cumulative abnormal return (CAR) figures. The standard error for a given event window is determined by taking the square root of the sum of the squares of the monthly standard errors. Comparisons between this table and the buy-and-hold approach will differ for a variety of reasons. A key reason is that as we cumulate alphas in this RATS procedure, we are implicitly assuming monthly

rebalancing which can lead to an upward bias in our point estimates. Further, unlike the previous approach, this method reduces the impact of any given firm during heavy buyback windows of time.

Consistent with what we observed earlier using buy-and-hold returns, in Table 5 we see no evidence that firms which announce a buyback show any sign of distress at least as measured by future equity returns. For the entire buyback sample, the 48-month CAR is 14.7% (monthly 0.31%) and is significant at traditional confidence levels. Focusing more narrowly on Z1 firms or firms with absolute Z scores below 1.8, we see no evidence that they experience comparatively poor stock performance. Delving further into the Z1 portfolio, when examining firms with the highest exposure to financial distress (Z1-Low), once again, there is no indication of poor long-term abnormal performance. Again, these results are inconsistent with the notion that managers manipulate stock prices above fair value by giving false signals. Perhaps more importantly, by focusing on buyback firms already at or near financial distress we find no evidence that buybacks somehow cause harm, at least to shareholders. Rather, managers in distressed firms appear (like managers in any other undervalued firm) to be using a share repurchase as a tool to create value for long-term shareholders.

This analysis, of course, is only looking at one stakeholder of the firm, the shareholder. Alternatively, it is plausible that gains to shareholders might be coming at the expense of other stakeholders (bondholders, employees or the government). Or alternatively, it may be the case that these gains to shareholders come at the expense of underinvestment in positive NPV projects. In the next section, we explore these alternative hypotheses in detail.

5. The Funding Source for Buybacks and Underinvestment

5.1 Internal Financing

One criticism levied against buybacks is that these distributions of capital to shareholders drain away resources which could be used to reinvest in the business. (Of course, the same criticism could also be levied against dividends, as well.) Moreover, a second criticism is that buybacks needlessly subject firms to high leverage as they seek to finance the buyback by issuing new debt, thus exposing these firms and their employees to the disruptive forces associated with bankruptcy.

To the extent that buybacks cause harm due to underinvestment or a perversion of capital structure, we should see a decrease in capital expenditure and a meaningful increase in leverage. Further, we should see deterioration in various measures of operating performance relative to a control sample if buybacks somehow weaken a firm's competitive stance in the economy. Of course, these patterns should be most apparent in firms with low Z scores who are either in or near the brink of financial distress. As such, we consider two questions in this section. First, we look at capital flows into and out of the firm before and after the

buyback announcement to assess their financing source. Second, we examine new capital investment in buyback firms relative to comparably matched peer firms.

In Table 6, we aggregate the flows from the fiscal year of the announcement with those from the following fiscal year, yielding a two-year cumulative figure, to account for any potential changes in flow.[15, 16] All variables are normalized using the firm's average total assets, determined from the start and end of the fiscal year in which the announcements were made. We use the cash flow identity[17]:

$$(Earning + F.other + Invsale.net + Dlt.net + Sppe + Sstk.net + Dst.net) - (CapEx + Div + Acq) + \epsilon = Chech \quad (2)$$

Variables are defined as follows:

- $Earning$: Income Before Extraordinary Items (Compustat Item 123) + Depreciation and Amortization (Item 125) + Extraordinary Items and Discontinued Operations (Item 124).
- $F.other$ (other funds): Deferred Taxes (Item 126) + Equity in Net Loss (Earnings) (Item 106) + Funds from Operations – Other (Item 217).
- $Invsale.net$ (net sale of investment): Sale of Investments (Item 109) – Increase in Investments (Item 113).
- $Dlt.net$ (net of long-term debt issuance): Long-Term Debt – Issuance (Item 111) – Long-Term Debt – Reduction (Item 114).
- $Sppe$ (net sale of property, plant and equipment): Sale of Property, Plant and Equipment (Item 107) + Sale of Property, Plant, and Equipment and Sale of Investments – Loss (Gain) (Item 213).
- $Sstk.net$ (net sale of common and preferred stock): Sale of Common and Preferred Stock (Item 108) – Purchase of Common and Preferred Stock (Item 115).
- $Dst.net$: Change in Current Debt (Item 301).
- $CapEx$: Capital Expenditures (Item 128).
- Div: Cash Dividends (Item 127).
- Acq: Acquisitions (Item 129).
- $Chech$: Change in Cash and Cash Equivalents – Increase (Decrease) (Item 274).
- ϵ (residuals to make the cash identity equation holds): Source of Funds – Other (Item 218) + Uses of Funds – Other (Item 219) + Working Capital Change – Other – Increase (Decrease) (Item 236).

[15] Overlooking the fiscal year of the announcement and focusing solely on the subsequent fiscal year doesn't alter our conclusion. The table can be provided upon request.

[16] We measure actual repurchases over a two-year window since Stephens and Weisbach (1998) show that firms acquire 67–79% of shares announced within a two-year period.

[17] The cash flow identity and the components used to formulate the variables are derived from the "Cash Statement by Source and Use of Funds" section in the Compustat North America User's Guide. Certain variables are aggregated to assess the net impact of a firm's activities.

Looking at all buyback cases first, we see in Table 6 Panel A that the repurchase amount as a function of total assets in the year of the announcement and year +1 is 8.23% of total assets. Without any doubt, it is readily apparent that on average the primary funding source for these buybacks is contemporary earnings – which are roughly three times the buyback amount (at 23.11%). Further, it is interesting to note that this level of earnings is roughly double the level of cash flow we see in matching control firms. On average, we see little evidence on average of a material shift in debt financing, the liquidation of divisions or the sale of securities as a funding source for the buyback. This result is consistent with survey evidence that which CFOs report nearly two decades ago (Brav, Brav, Graham, Harvey, and Michaely (2005)).[18]

Yet, a more interesting question is how financially distressed firms finance their buybacks. Because of their situation, are they potentially putting the viability of their firm at risk via these buybacks? Table 6 also reports this cash flow identify stratified by Z group. For firms most at risk of financial distress, we do see a meaningful outflow of capital devoted to net stock repurchases equal to -1.82% of total assets, yet it is interesting to note that this flow is less than a quarter of what is observed more generally. Further, the level of contemporaneous cashflows covers the buyback amount by more than eight times. Digging deeper into each of the sub-categories within Z1, we continue to see those buybacks, even in the most extreme cases, are funding with internally generate profits with little reliance on new debt.[19] This is consistent with the notion that managers are repurchasing stock but are imposing self-restraint when doing so.

Consistent with internal financing as the primary funding source, Panel B shows there is no significant difference in net long-term debt issuance (*Dlt.net*) between the two fiscal years following the event. The 8.29% difference in net stock repurchases of Z1 firms cannot be ascribed to flows from other funds ($F.other$), net sales of investments ($Invsale.net$) or change in current debt ($Dst.net$). Instead, looking further we clearly see that these buybacks, even in these most distressed organizations, are primarily funded through contemporary earnings ($Earning$). Meanwhile, the sale of property, plant, and equipment plays a more secondary role in their financing for Z1 firms.

5.1 Underinvestment

Another claim that critics of buybacks profess is that buyback firms withhold new capital investment and thus harm the firm's productive capability in the future and threaten job formation. Again, focusing on the year of and the year after the buyback announcement, we see no support for this claim. Capital investment ($CapEx$) is about the same as or higher compared to the corresponding control group, both overall

[18] Although El Ghoul et al. (2024) apply a different technique, they too conclude that buybacks, in general, are internally finance.

[19] In fact, for the most extreme cases categorized in Z1-Low, we see positive equity flows suggesting that managers on average may be authorizing buybacks so that they have the option to repurchase stock but are showing even further restraint by choosing to repurchase few shares, if any.

and in each sub-category of Z score. Further, we see no cut in dividend payments, on average, nor cuts in acquisitions as a potential funding source for the buybacks. The fact that there is no evidence that the buyback firms cut their dividends when they buy back stock is consistent with the hypothesis that dividends are sticky, and that firms do not see buybacks and dividends as perfect substitutes.

While Table 6 reports the dividend and financing policies in the immediate years following the buyback, Table 7 and 8 take a longer view of potential changes in leverage and dividend policy. As expected, higher Z scores correspond with lower leverage. Only buyback firms classified in Z1 show a significantly higher level of debt compared to the matching sample. Buyback firms classified in the Z5 sample on the other hand show significantly lower financial leverage than their matching firms. However, these differences are unrelated to the year of the buyback. As such, the buyback itself does not appear to signal a move to higher target leverage. Instead, the buybacks appear to be opportunistic: taking advantage of undervaluation, at times when the firm's contemporary earnings can finance the transaction.

The column labeled "Dif" in Table 7 presents the average difference between post-announcement performance (from T+1 to T+4) and pre-announcement performance (from T-4 to T-1). On average, among all groups, only the Zombie firms (Z1 firms) show no significant increase in leverage in the four years following the event compared to the four years preceding it. The other cases do show a change.

Table 8 shows that, as expected, firms with lower financial distress pay more dividends, however the buyback itself does not signal a change in dividend policy relative to the control firms. One criticism of buybacks is that they are driven simply by tax motivations. This table does not lend support to the substitution hypothesis due to taxes.

In short, while there may be extreme, individual cases where buybacks cause harm, we see no general evidence on average consistent with the claim that buyback firms are placing themselves in peril by increasing leverage and simultaneously cutting back on new investment. Rather, it appears that undervalued firms are financing these buybacks with excess capital over and above their concurrent investment needs in order to take advantage of undervaluation. This opportunistic behavior appears to have no impact on long-term financial policies, such as dividend policy and capital structure.

6. Buybacks and their Impact on Financial Distress

6.1. Z Scores

If buybacks cause harm as critics suggest by pushing the firm into financial distress, we should observe a decline in Z scores subsequent to buyback announcements, particularly for those firms where managers choose to repurchase a meaningful portion of their share base. If it is the case that managers are too

aggressive in buyback stock, then the harm caused by buybacks cause should be tied, at some level, to the scale of equity base being retired.

To assess this, we divide buyback firms into quintiles based on the change in their outstanding shares from the announcement day to six months later. Table 11 details the variation in Z-Scores from four years before to four years after the buyback announcement. Notably, firms in the "Share Chg 1" quintile (firms which have the greatest contraction in their share base), experience an average decrease in outstanding shares of -10.65%, compared to a 3.92% increase in their matched counterparts. Among these large buyback programs, we observe a minor decline in their average Z-Score in the four years after compared to the four years preceding the announcement; a decline in Z-Score from about 5.5 to about 4.3. Yet this post-buyback Z-score of 4.3 indicates that even these large programs do not place the firm in financial peril though their Z-Score is slightly lower than that of matching firms at T+4. For cases where the share base actually *expands* subsequent to the buyback announcement ("Share 5"), the financial health of buyback firms is stronger than that of their matching firms. Interestingly though, even in these cases where the share base is expanding, we also see modest deterioration in the absolute level of the Z-score in both the buyback firms and in the control firms. These trends suggest a common macro-economic event occurring around some buyback announcements. Yet with respect to the critics of buyback programs, we find no indication that stock buybacks lead to a meaningful deterioration in firm financial health, regardless of the level of quantity of shares repurchased.

Table 9 is structured similar to Table 11 but shows the evolution of Z-scores for buyback and matching firms stratified by their Z-score ranking at the time of the announcement. Focusing first on high Z-score firms in Z5 (low financial distress risk), we see some evidence of a decline in mean Z from 7.75 to 5.93. However, notwithstanding this decline in Z-score, it is again clear that the risk of bankruptcy in the post-buyback period is still remarkably low; there is no evidence of material financial distress attributable to the buyback. Interestingly, we also see a similar downward move in Z-scores for the matching firms suggesting that some type of macro-event unrelated to the buyback was occurring around the time of these buyback announcements. As a final point, it is also interesting to note that firms with naturally low financial distress risk (firms categorized in Z5) dominate the sample, comprising roughly 40% of buyback cases. With such a tilted sample bias, this suggests that managers appear to exhibit natural conservative tendencies where financially distressed organizations organically shy away from this transaction. Given the seeming self-regulation, this draws into question the need for regulatory intervention.

Of course, the Z5 population is not our primary target of interest. Instead, the buybacks of greatest concern for regulators should be low Z firms who at the time of the announcement have more exposure to financial distress. For Z1 firms who announce a buyback, we see no evidence of a subsequent decline in Z-

score. In fact, in Table 9 we see a mild *increase* in the average Z-score from 1.37 (T-1) to 1.68 (T+4) over the four years following the announcement. Interestingly, though, this is also accompanied by an increase in the mean Z-score for the matching firms as well. Again, we reach the conclusion that there is no meaningful evidence of a change in bankruptcy risk from firms most at risk for financial failure which can be attributed to buybacks.

6.2. Credit Ratings

If stock repurchases inflict harm on the future financial health of the firm, we should observe a decline in the credit ratings of these firms as they repurchase stock. This should be particularly true for low Z-score firms. In Table 10, we report median credit ratings by Z score at the time of the buyback announcement. Again, consistent with our findings on how Z evolves surrounding buyback announcements, there is little evidence of an erosion in credit worthiness after a buyback announcement. Following the repurchase announcement, the median credit rating for Z1 firms is *upgraded* from BB to BB+ within two years. For all other firms combined (with Z-scores ranging from Z2 to Z5), there is no evidence of a change in creditworthiness; they consistently maintain a BBB+ rating after the buyback announcement. The only evidence of a mild degradation in rating is observed in firms categorized in Z5; their rating declines from A to A- within the two years following the buyback. This mild reversion in rating may be related to broader macro-economic conditions, but not withstanding this change, these high credit ratings do not suggest these buyback firms are imperiled.

7. Do Buybacks Lead to Firm Bankruptcy

In the preceding sections, we began by examining all firms engaging in share repurchase announcements and looked for their propensity for failure. In this section, we adopt the reverse. Here, we shift attention to all firms which have filed for bankruptcy. By looking at the complete population of bankruptcies (the most extreme form of financial distress), we can carefully document the extent to which share buybacks were a material cause for bankruptcy filing. To the extent we can find evidence that buybacks are a material cause leading to eventual bankruptcy, then perhaps policy intervention limiting buybacks might plausibly be worth consideration.

We begin by extracting bankruptcy filings for either Chapters 7 or 11 from the Audit Analytics database. We then analyze financial performance in the five fiscal years preceding the bankruptcy filing date. To ensure data integrity, we exclude cases lacking financial data for the full five-year period prior to their bankruptcy filing date. We also construct a matching sample at fiscal year $t-5$. Here, we minimize the distance between each treatment firm and its corresponding matching firm based on four crucial factors:

firm size, BM ratio, Z-score, and Fama-French 12 industry classification. Firm size (specifically the logarithm of market capitalization) is determined at the end of June in fiscal year $t-5$. The BM ratio is calculated using the book equity value for the last fiscal year-end in $t-6$ and the market capitalization at the end of December of the previous year. The Z-score is then derived from the financial data available for the last fiscal year-end in $t-6$. By employing this matching procedure, we ensure that the treatment firms and their respective matching firms are comparable in terms of essential financial metrics and industry characteristics.

Consistent with our earlier work, we focus on bankruptcy filings between 1990 and 2021. After eliminating observations with missing values and merging the dataset with CRSP, the final bankruptcy sample comprises 729 observations. As before, for each bankrupt firm we identify five matching control firms. Table 12 reports the quality of the match. As before, we have a perfect match within Fama-French 12 industry classification. Furthermore, no statistically significant differences are found between bankrupt and matching control firms in relation to BM, Z-Score, or Size.

To address the possibility that bankruptcies may cluster in particular moments in time, we extend our matching technique to encompass the entire economy. Here, we compare our treatment firms against *all* other existing firms in the market. The inclusion of the whole economy group serves to establish a baseline for assessing what may be happening in the broader economy. In summary, our analysis encompasses three groups of firms: the bankrupt firms, their matching counterparts (on a one-to-five ratio), and the economy in aggregate (encompassing all other firms in the market).

Figure 3, Figure 4, and Figure 5 provide an overview of the temporal evolution of firm characteristics across the aforementioned three groups. Five years prior to the bankruptcy filing of treatment firms, there is no statistically significant difference in Z-Score between the treatment firm group and the matching firm group, as illustrated in Table 13. However, as time progresses, the Z-Score of the bankrupt firm group gradually declines from 2.94 to 0.58 and becomes significantly lower than that of the matching firm group. This consistent pattern conforms to the interpretation of the Z-Score as a measure of firm health, indicating that the Z-Score of firms that eventually go bankrupt tends to decrease as one would expect. In contrast, the Z-Score of the entire economy remains relatively stable, hovering around a value of 5, a level considerably higher than that of both the treatment and matching firms. This divergence can be attributed to the presence of relatively high positive values in the Z-Score distribution of the entire economy, even after applying winsorization to all financial variables at the 5% and 95% levels. In addition to the change in Z-Score evident in these figures, we see that treatment firms (those heading towards eventual bankruptcy in five years) generally exhibit significantly lower sales growth, lower asset growth, lower dividend payout, and

lower profitability (both ROA and ROE). Consistent with intuition, these firms show significantly higher leverage in comparison to their matched sample.

Is it possible that buyback programs contribute to financial distress and the eventual failure of these companies? One approach to investigate this is to examine whether firms that eventually go bankrupt spend disproportionately more on repurchasing common shares compared to their matching firms. Previous evidence we reported in Figure 5 does not align with this hypothesis. Nevertheless, we investigate this question here. We see no significant difference in the total shareholder payout ratio (scaled by assets) between treatment firms and matching firms starting five years prior to the bankruptcy filing. However, starting from year -4, the total shareholder payout ratio of treatment firms consistently decreases below that of matching firms; the gap between the two groups reaches its maximum in the last year.

Total shareholder payout is defined here as the sum of dividends and purchases of common and preferred stock. Removing the factor of dividend payout ratio, we observe that the scaled value of purchases of common and preferred stocks follows a similar pattern to the total shareholder payout ratio. Treatment firms, in the years preceding their bankruptcy filing significantly curtail the level of capital allocated to repurchase common and preferred shares compared to their matched counterparts. Furthermore, these expenditures by treatment firms are considerably below the corresponding levels seen in the entire economy. In short, to the extent we find distress firms repurchasing shares, managers in these firms have largely self-regulated and shut these programs down in advance of eventual bankruptcy.

In addition to examining the purchase of common and preferred stocks, we also investigate the incidence of buyback announcement events over time across the three groups. If buyback operations were a significant driver of bankruptcy, we would expect to observe a higher incidence of such events for treatment firms compared to matching firms and the entire economy group in certain years preceding the bankruptcy filing. Yet again, the empirical evidence contradicts this hypothesis. As depicted in Table 14, the incidence of buyback announcements for treatment firms is consistently lower than that of the matching firms and the entire economy group. From five years prior to the bankruptcy filing to four years before, only 4.39% of treatment(bankrupt) firms have announced buybacks. This percentage gradually decreases to 0.08% one year prior to the filing date.

To summarize, instead of focusing on the financial health of firms engaging in buybacks, this subsection takes a reverse approach by examining all firms which eventually file for bankruptcy. The financial health of these treatment firms, of course, deteriorates over the five years leading into the filing. These firms exhibit slower sales and asset growth, lower revenue, and higher levels of debt compared to the matching firms. It is these organic challenges more so than buybacks which appear to be the fundamental threats to their eventual demise. Further, we observe a significant disparity in the incidence of buyback

announcements between treatment firms and matching firms. The frequency of repurchase announcements for treatment firms is significantly lower. Additionally, the amount of money allocated to the purchase of common and preferred shares, scaled by assets, is also lower for treatment firms compared to matching firms.

These findings support the notion that firms repurchase are not a fundamental cause of bankruptcy. These failures are largely driven by adverse organic shifts in firm performance paired with high-debt loads, attributes we are not seeing in buyback firms (even those with low Z-scores). There is no evidence that buybacks are a key factor driving firm failures.

8. Self-restraint in the execution of Buyback Programs

Critics of buybacks who seek to either reduce or eliminate the transaction because of its potential to harm the firm may not be considering the rational actions of the firm's agents. If we assume that managers have some self-interest (financial, reputational or otherwise) in seeing the firm survive into the future and if we also assume that buybacks could, if inappropriately applied, put a firm in financial peril, then we should expect firms with high exposure to financial distress to voluntarily repurchase less stock subsequent to a buyback authorization announcement compared to firms who have less ex-ante distress. Note that open market repurchase authorizations are options to repurchase stock, not firm commitments.

8.1. Buybacks as a function of Total Assets

In Table 15, we report the amount of capital firms spend on stock buybacks as a function of total assets at year-end prior to the year of the buyback announcement. Skipping the buybacks amounts expended in the year in which the buyback authorization announcement was made (a partial year), we report buyback amounts for the next three full fiscal years. Consistent with this notion of managerial self-restraint, we see that firms with high Z scores (and thus little ex-ante exposure to financial distress) repurchase more stock compared to those with low Z scores. For example, three years after the buyback announcement, firms classified as Z1 on average repurchase less than firms in the Z2~Z5 group, with rates of 2.97% compared to 4.57%. This sign of self-restraint may explain why we see little evidence of increased financial distress among firms which seemingly have higher exposure to financial distress at the time of the buyback announcement.

8.2. Changes in Actual net share count

An alternative approach to observing whether managers of low z-score firms exhibit self-restraint when executing buybacks is to look at overall share count over time. Whereas in the prior section we were looking

at the gross amount of funds spent on buybacks, looking at actual share counts allows us to also take into account any issuance of stock the firm might simultaneously be making. For example, even if there are no material financing needs, firms may be buying back meaningful quantities of stock to offset the share issuance effects arising from employee stock options or stock grants, thus clouding the picture of just how much of a fundamental shift in equity structure of the firm is really occurring.

Thus, in this section, we calculate the percentage change in actual shares outstanding relative to the buyback announcement day by using the following formula:

$$Pct = \frac{Share_{the\ end\ of\ month} - Share_{announcement\ day}}{Share_{announcement\ day}} \quad (3)$$

where $Share$ denotes the shares outstanding.

Table 16 presents the changes in actual share count over the three years following buyback announcements. As anticipated, in the full sample, buyback firms issue notably fewer net shares on average compared to control firms, with rates of 0.58% versus 13.47%, respectively. The median 48-month net share change for buyback firms stands at a negative -3.58%, while for the control sample, it's positive at 3.10%. Examining the proportion of instances where shares outstanding decrease within three years post-buyback, the buyback firm cohort exhibits a higher ratio compared to the control group.

When comparing buyback firms in the Z1 group to those in the Z2~Z5 group, the Z1 group exhibits greater net share changes, both in mean (8.82% vs. -0.24%) and median (-1.14% vs. -3.74%). Additionally, while 53.07% of firms in the Z1 group reduced their shares, this percentage is surpassed by the Z2~Z5 group at 64.78%. These findings indicate that managers of firms with lower Z-Scores tend to be more conservative in actions.

To better understand the temporal change in shares outstanding over the same duration, we detail the cumulative percentage changes on a quarterly basis in Table A4. When comparing the Z1 and Z2~Z5 groups once more, it's evident that the shares outstanding for low Z-Score firms grew at a faster pace compared to high Z-Score firms during the initial three quarters. This again reinforces the notion that managers of firms with lower Z-Scores demonstrate prudence in their buyback strategies.

9. Employment and Post-Announcement Operating Performance

While we have established that capital is indeed being distributed to shareholders, it is unresolved to this point as to whether this gain for shareholders is coming at the expense of workers. If buybacks directly or indirectly cause some harm to the firm or its constituents, particularly its employees, it should be evident

in employment trends and also in the firm's post-announcement operating performance. Are workers harmed?

9.1 Are Workers Harmed?

If buybacks have a direct, adverse effect on employment, we should see a noticeable decline in the employment base. In Table 17, we report employment trends prior to and following announcement of a buyback. To avoid the impact of large firms with skewed employment bases, we focus on medians. Looking at all buyback cases in our sample, we see no evidence of a decline in employment. In fact, employment after the buyback tends to increase gradually post-announcement. Focusing on the Z1 cases, we see a minor but unsignificant decline employment in the year following the announcement, but four years after the buyback we see employment is actually higher compared to prior to the buyback and the overall trend in employment shows no significant difference from the control group. Similar results were held for each of the sub-groups within Z1.

9.2 Do firms become more efficient, perhaps at the expense of workers?

Critics suggest that buybacks divert money away from workers and toward shareholders, thus depriving employees of salary and wages. Obtaining good data on wages is difficult. However, we attempt to address this in Table 19 by reporting SGA as a function of total assets surrounding the buyback announcement. If wages were being crimped, we should see a contraction in SGA. While there is a change in the overall level of SGA across Z groupings, matching firms show the same directional shift. When we look at relative trends over time and across Z groupings, we reach a similar conclusion; there is no evidence of a meaningful change in SGA as a function of total assets either before or after a buyback announcement.

In the sections which follow, we explore various accounting measures as a function of the firm's total assets for both buyback and control firms. In each of these tables, we treat the announcement quarter as $t = 0$. We then cumulate information in groups of four quarters to create "four years" of accounting information both prior to and following the announcement quarter. This is done for both sample and control firms.

Sales to Assets (or asset turnover), a measure of firm productivity, is associated with the Z grouping. High Z scores are associated with high asset turnover and likewise low Z firms are associated with low asset turnover. This holds for buyback and control firms alike. However, over time we see in Table 20 no meaningful break in this ratio between the buyback and control firms. The overall trend in asset turnover is slightly negative (consistent with Grullon and Ikenberry (2024)). This contradicts the notion that workers are being forced to absorb productivity gains. We do observe a bump in productivity for low Z-score firms following a buyback announcement, however we see the same trend in control firms, as well.

9.1. Does ROA decline after a buyback?

If buybacks divert capital away from new capital investment in a sub-optimal fashion, we should see a decrease in ROA over time. Table 21, however, suggests little downward trend in firm profitability. Attributable, at least in part to the definition of Z, we do observe that high Z score firms have higher ROA compared to low Z firms. However, within Z1 grouping, we do not see an adverse trend in profitability.

We do observe that buyback firms tend to report uniformly higher ROA compared to their corresponding control firms. This is especially true in the year before the buyback and the subsequent years. There is no clear reason for such a distinction, however this result is consistent with the idea that managers of buyback firms may be more confident about the long-term prospects, at least relative to firms with the same Z scores who do not tend to buy back their own shares. This higher level of confidence may have led to the buyback announcement if managers believed that the market did not share this optimism.

10. Are Managers Undoing the Adverse Effects of Stock Buybacks Before They Materialize?

If we suppose for a moment that buybacks do meaningfully raise the specter of firm failure in the future, why is it that we do not see signs of financial distress in the post-buyback period? One possibility might be that buyback firms, particularly those categorized as Z1, are issuing shares via seasoned equity offerings in the post-announcement period. If so, rational managers seeking to keep their firms away from bankruptcy may be pre-emptively issuing stock, thus improving their liquidity, their leverage and lowering their risk of financial distress. In essence, these firms might be unwinding whatever harm might have been caused through previously buying back stock, thus obscuring the adverse effect of the buyback transaction.

As a check, we show the frequency of a seasoned equity offering subsequent to a buyback announcement for our sample overall and by Z grouping. In Table 23, we find little evidence of this kind of strategic behavior. Viewed in absolute terms, it is true that we see more SEOs subsequent to a buyback announcement in Z1 firms compared to Z5 firms. For example, after three years we see that Z1 buyback companies are more than twice as likely to have an SEO (10.50%) versus Z5 companies (4.05%). However, it is interesting to note that these trends contrast sharply with the matching control firms. For example, roughly half of the control firms (47.49%) matched against the Z1 firms in our sample had an SEO in the post-announcement period. This compares to only 10.50% for sample firms over the same period. This result is also consistent with the hypothesis that the buyback firms are reluctant to issue equity because they believe they are undervalued.

Relative to other buyback firms who have little exposure to financial distress, the Z5 firms in our sample do tend to issue stock less frequently. The extent of this activity is dwarfed by the issuing activity of control firms with similar firm characteristics and Z scores who chose not to announce a buyback. In sum, there is little evidence to suggest that buyback firms are using equity markets to "unravel" any harm that might have been caused by a buyback.

11. Summary and Conclusions.

Despite a rich literature outlining the potential benefits for share repurchases to enhance shareholder value, critics of the transaction have emerged in recent years urging regulatory restraint or in some cases elimination of buybacks. These arguments have had at least some traction as the U.S. enacted a 1% excise tax on buybacks for the first time in 2022 and legislation has been proposed to quadruple the tax.

Critics offer a host of complaints. Key among them is that buybacks drain equity capital away from the firm, forcing the company to forego positive NPV projects, which in turn robs the economy of socially beneficial growth. This underinvestment, in turn, is argued to damage employees by shrinking the firm and reducing job growth. A further key argument is that by reducing equity in the firm, buybacks increase the propensity for bankruptcy and thus unnecessarily expose the firm to the costs of financial distress including job dislocation, a cost employees must bear.

Addressing these criticisms is difficult as building a true counterfactual where buybacks are constrained is challenging. In this paper, however, we investigate the extent to which buybacks might cause harm by looking at the most suspicious cases where critics of the transaction seemingly might have a good point; where a buyback might plausibly be deemed ill-advised because of the potential for its deleterious impact on the firm and its employees. As such, we examine share buybacks announced by zombie-like firms, firms which relative to other firms are either in or near financial distress. These are firms where one might be reasonably skeptical of managers' motives; these firms already have higher debt loads and lower market to book ratios. Further, by being perceived as in distress, these firms have less access to external financing thus placing them at greater risk of underinvestment. It is among these more extreme cases where if the claims of buyback skeptics were true, the evidence should be most robust. Addressing these criticisms is important as they drive to the heart of how capital markets function.

We measure financial distress using Z-scores developed by Altman in his seminal paper (1968). After extensive examination, we find no evidence that stock buybacks harm the firm or any of its various stake-holders. Upon announcement of a buyback, we see no evidence of a short-term negative market reaction to buybacks, even among the most suspicious cases with relatively low financial viability. Contrary to the

notion of manipulation, post-announcement long-run shareholder excess returns are positive, on average, not negative as manipulation would otherwise imply if managers were falsely moving short-term prices above fair value. In fact, point estimates for post-announcement long-run excess returns are highest among the most suspicious firms with the lowest Z-scores, a result consistent with undervaluation as being a primary motive in these cases.

Contrary to the notion that repurchases adversely affect the leverage position of firm, we find no evidence to support this claim. Generally speaking, new debt is not a common financing source for buybacks. Instead, contemporaneous cashflows in the year surrounding buyback are by far the key funding mechanism as they are roughly three times the scale of the stock eventually repurchased. For financially distressed buybacks, their cashflows compared to what they actually repurchase are even higher - approximately nine times larger than the amount of stock they reacquire. Looking over longer horizons, we see only modest increases in the debt-to-asset ratio. This increase in leverage is driven by robustly financed firms who have low default risk. Consistent with the benefits of this transaction, the vast majority of buyback firms are, in fact, characterized as having low default risk and appear to be intentionally using repurchases as a tool to optimize their capital structure. For suspicious cases where buyback firms already suffer from comparatively poor financial viability and where one might have concern over even more leverage, we seen no evidence of harm. Debt to asset ratios in these firms show almost no change four years after the buyback announcement, again consistent with the notion that buybacks on average are *not* financed with new debt but instead with contemporaneous cashflows. In these cases, assets sales are also an uncommon source of funding, suggesting that firms are typically not scaling down their businesses in order to buy back stock.

Skeptics also argue that buybacks may expropriate wealth from bondholders to stockholders. We see no evidence of such behavior, on average. Bond credit ratings show little change from before to after the buyback, even for firms with comparatively low Z-scores. This suggests that bond covenants may already be at work serving as a naturally regulating constraint, limiting poor actors from using buybacks to potentially harm bondholders.

Consistent with this finding, we also see no evidence that buybacks induce a meaningful increase in bankruptcy risk. Looking at the most financially vulnerable buyback cases, we see no degradation in Z-score following a buyback. In fact, the frequency of eventual bankruptcy is actually *lower* among buyback firms with low Z-scores compared to matching control firms who have similarly low financial viability. Further, if we instead examine the problem in reverse and look at all bankruptcies of public U.S. firms, we find few cases attributable to buybacks. Managers in these failed companies appear to show natural restraint in the years leading up to the bankruptcy. Little capital in firms which eventually go bankrupt escapes in the form of a buyback, again perhaps due to the natural oversight and restraint imposed by bond covenants.

A commonly cited claim of buyback critics is that buybacks either directly or indirectly harm employees. While obtaining granular evidence on employment conditions is challenging, at a high level we see no validation for this claim. Looking at employment levels as reported in 10-k filings, we see no evidence of a contraction in employment post-buyback. Using Cost of Goods Sold and SG&A as a proxy for wages, we see no sharp decline post-buyback in general, or more specifically among financially strapped firms. Looking at low Z-score firms specifically, they tend to employ more workers compared to peer firms matched on the basis of size and other factors. Post-announcement, rather than see employment contraction we actually witness modest employment growth.

Critics also claim that stock repurchases indirectly harm employment by diverting capital away from positive NPV projects which would otherwise generate jobs and expand the economy. Again, the evidence does not support this conjecture. We find no evidence that buyback firms suffer from underinvestment. Point estimates of capital expenditures around stock buybacks are slightly *higher* than that of control firms, even among firms with relatively high financial distress. Moreover, firms with relatively high financial distress choosing to buy back stock exhibit unusually low sales to asset ratios and unusually high profitability. With such comparatively low asset productivity but high cash flows, it is not that surprising that managers are choosing to forego even further (unproductive) investment and are instead choosing to return capital to shareholders. In short, there is no evidence that buybacks on average harm employees.

Another stakeholder who might be adversely affected by stock buybacks is arguably the federal government if managers use buybacks as a tool to lower firm dividend payments, thus reducing the income taxes the government would otherwise collect. While we see individual cases where companies announce that their buyback is a substitute for cash dividends, we see no broadscale evidence of this. Dividends as a function of total assets post-buyback announcement are *not* declining on average over time. In fact, this ratio is slightly higher for buyback firms compared to matching control firms and is also growing at a slightly faster pace compared to non-buyback firms following a buyback announcement. This is true even for firms showing relatively high financial distress.

To assuage skeptics of buybacks who argue for regulatory intervention of buybacks or perhaps even elimination of the transaction, it is important to point out that managers of buyback firms appear to exhibit natural self-restraint, even among the most suspicious buyback cases. In these more extreme cases, their buyback programs are smaller on average, do not rely on external financing and are instead funded with internally generated operating cash flows. While this restraint may be a natural consequence of bond covenants imposed by capital markets, evidence in this paper fails to motivate further regulatory intervention. The argument that if the buyback was eliminated would cause firms to invest more is specious. Buyback

firms already tend to have lower asset productivity, suggesting that the firm is not trading off productive investment in order to buyback stock.

Although we do not see evidence of bad behavior in buyback firms, why is it that we see any buyback cases among firms seemingly at or near financial peril – cases we earlier deemed as suspicious in this paper? We find several reasons. First, managers in low Z-score firms appear to behave similar to any other undervalued firm who wishes to take advantage of mispricing to benefit of long-term shareholders. This is consistent with the positive, post-announcement long-horizon returns observed for low Z-score buybacks. These firms also tend to have higher profitability than similarly control firms, yet these buyback firms also suffer from lower asset productivity. With comparatively high free cash flows yet seemingly idle capacity (and thus less than fully compelling reasons to aggressively invest in additional assets), it is rational to expect managers in these low-Z score firms to respond by distributing this unneeded capital to shareholders in the form of buybacks or dividend payments.

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Figures

Figure 1 Decomposition of Z Score Time Series

This figure illustrates the temporal evolution of the five key components in the Z-Score calculation from 1970 to 2021. Label *wcta_fct* represents working capital to total assets, *reta_fct* retained earnings to total assets, *ebitta_fct* earnings before interest and taxes (EBIT) to total assets, *metl_fct* market value of equity to book value of total liabilities, and *saleta_fct* sales to total assets. All these five factors have been multiplied by their corresponding Z-Score coefficients.

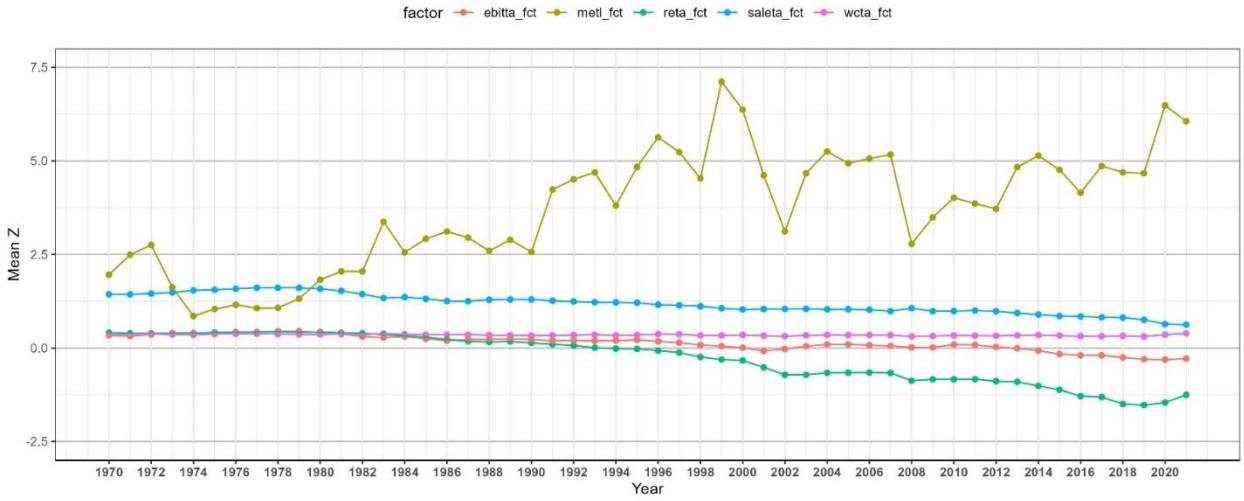


Figure 2 Z-score Change Before and After the Buyback across Z-Quintile Groups

This figure plots the mean Z-Scores for different Z quintile groups spanning four years before and after the buyback event. Solid dots depict the full sample, hollow dots represent Z1 group, and solid triangles symbolize the combined Z2 to Z5 groups. The color blue represents the buyback sample, while the color red represents their matching sample.

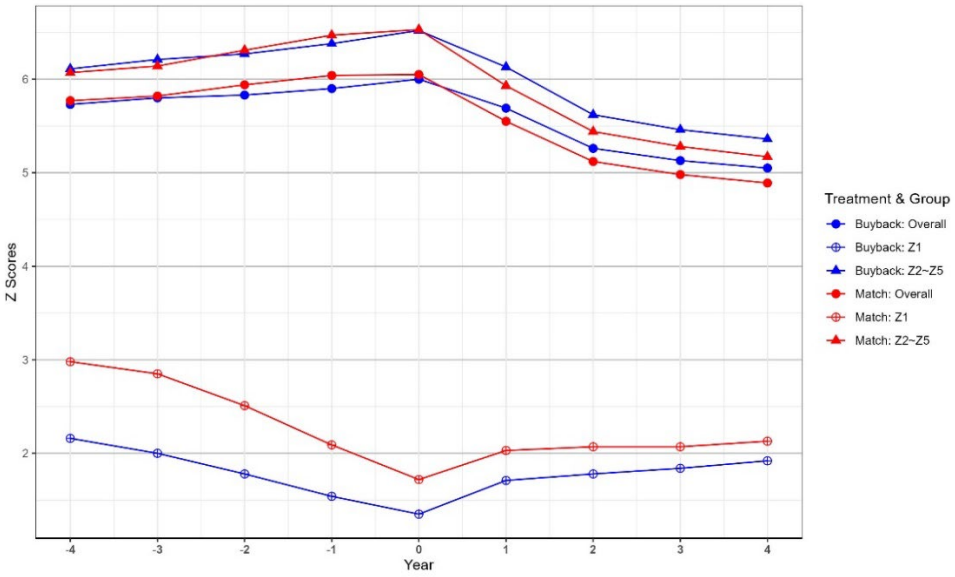


Figure 3 Comparative Analysis of Firm Characteristics over Time across Three Groups – Part 1

This figure presents the time series comparison of firm characteristics for three groups: treatment firms, their matching firms and the entire economy (including all firms in the market). The X-axis represents different fiscal years preceding the bankruptcy filing of treatment firms. Yearly sale growth is calculated as $(sale_t - sale_{t-1})/sale_{t-1}$, where t denotes the fiscal year. Asset growth is defined similarly as $(total\ asset_t - total\ asset_{t-1})/total\ asset_{t-1}$. Dividend/Asset is derived by dividing $dividend_t$ by $total\ asset_t$. Observations with missing values in the dividend variable were excluded. The economy group is depicted by the red line, the matching firm group is represented by the blue line, and the treatment firm group is indicated by the green line.

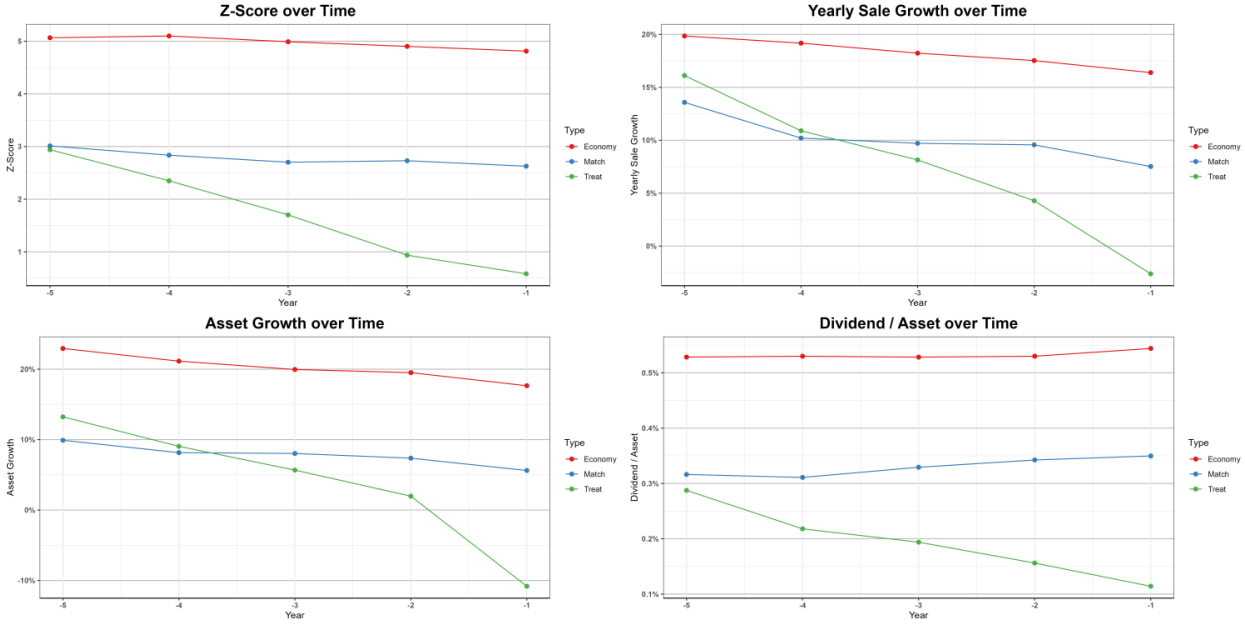


Figure 4 Comparative Analysis of Firm Characteristics over Time across Three Groups – Part 2

This figure provides an extended comparison of firm characteristics among three groups: treatment firms, their matching firms, and the entire economy (including all firms in the market). The X-axis represents different fiscal years preceding the bankruptcy filing of treatment firms. Debt/Asset is derived by dividing $Debt_t$ by TA_t (Total Asset). ROA is defined as $coalesce(Oibdp_t, Sale_t - Xopr_t, Revt_t - Xopr_t)/((TA_{t-1} + TA_t)/2)$, where $Oibdp$ represents operating income before depreciation, $Xopr$ denotes total operating expenses, and $Revt$ represents total revenue. The $coalesce$ function retrieves the first non-missing value from the given parameters. ROE is defined as $coalesce(Oibdp_t, Sale_t - Xopr_t, Revt_t - Xopr_t)/((BE_{t-1} + BE_t)/2)$, where BE represents the book equity value. Total shareholder payout/Asset is defined as $(Dividend_t + Prstkc_t)/TA_t$, where $Prstkc$ denotes the purchase of common and preferred stocks. The economy group is depicted by the red line, the matching firm group is represented by the blue line, and the treatment firm group is indicated by the green line.

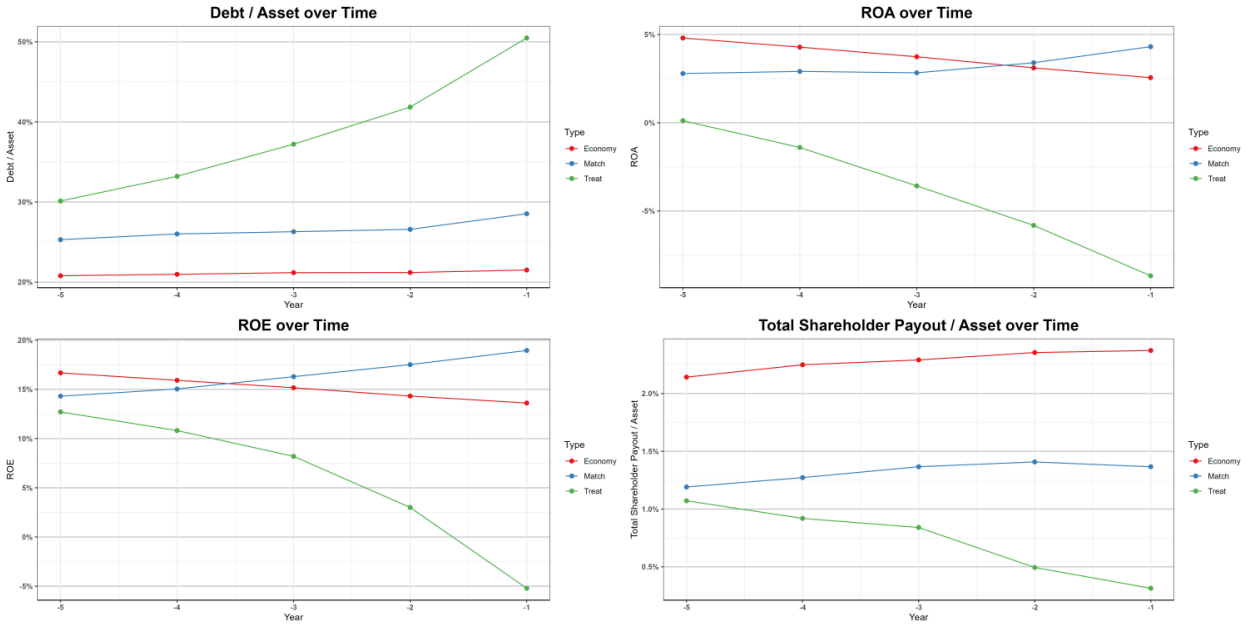
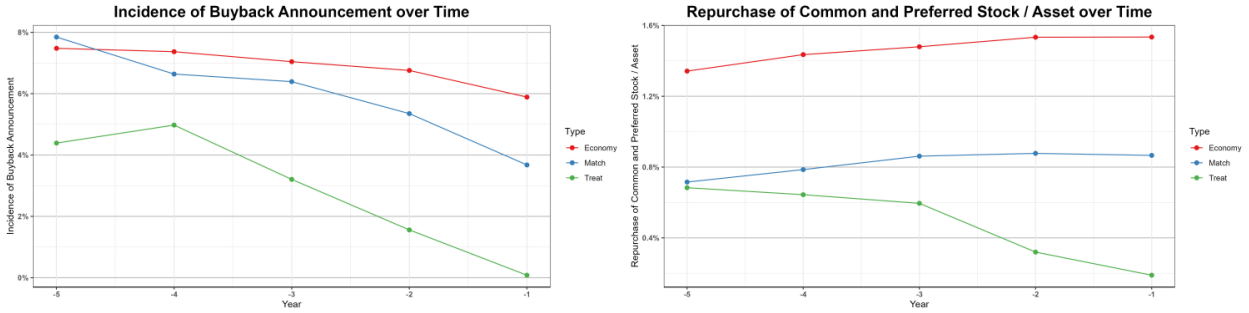


Figure 5 Buyback Announcements and Operations over Time

This figure presents an analysis of buyback announcements and operations over time across three groups: treatment firms, their matching firms, and the entire economy (including all firms in the market). The left panel depicts the frequency of buyback announcement events. By aligning the bankruptcy filing date of all treatment firms, we tally the number of buyback announcement events within each one-year time interval for five consecutive years preceding the filing date. The right panel illustrates the purchase of common and preferred stocks (scaled by asset). The economy group is depicted by the red line, the matching firm group is represented by the blue line, and the treatment firm group is indicated by the green line.



Tables

Table 1 Bankruptcy Frequency Across Z Scores

This table displays the likelihood of firms declaring bankruptcy within a three-year period following each July. It encompasses all firms listed in the CRSP database, with the exception of financial institutions (SIC codes 6000-6799), public administrations (SIC codes 9100-9999), and public utilities (SIC codes 4900-4999). This inclusion is broader than merely buyback companies. The numerator in this probability ratio represents the total count of firms that have filed for Chapter 7 or 11 bankruptcy within the three years post each July. The denominator pertains to the total number of firms each July with available Z-scores and corresponding Z quintile groupings. Data concerning bankruptcy filings is sourced from the Audit Analytics Database. Firms denoted as $Z_{<1.8}$ have a Z-Score less than 1.8.

Year	$Z_{<1.8}$	Z1			Z1	Z2	Z3	Z4	Z5
		Low	Medium	High					
1999	3.37%	4.44%	2.29%	0.67%	2.90%	0.99%	0.90%	0.20%	0.00%
2000	4.53%	4.55%	6.67%	0.87%	4.27%	0.28%	1.48%	0.21%	0.20%
2001	3.85%	4.92%	2.26%	2.38%	3.72%	0.28%	0.00%	0.45%	0.00%
2002	2.17%	2.35%	4.00%	0.00%	2.20%	0.00%	0.00%	0.21%	0.12%
2003	1.12%	1.19%	0.84%	0.78%	1.05%	0.55%	0.56%	0.00%	0.28%
2004	1.41%	0.96%	2.26%	1.15%	1.32%	0.57%	0.29%	0.00%	0.23%
2005	1.22%	0.96%	1.67%	0.00%	0.93%	0.94%	0.27%	0.00%	0.00%
2006	2.77%	2.48%	3.33%	2.15%	2.62%	0.62%	0.29%	0.48%	0.00%
2007	3.47%	3.74%	2.86%	1.04%	3.07%	0.62%	0.57%	0.00%	0.13%
2008	3.35%	4.04%	2.97%	0.00%	2.97%	0.31%	0.59%	0.00%	0.00%
2009	0.91%	1.60%	0.00%	0.00%	0.97%	0.28%	0.00%	0.00%	0.00%
2010	0.69%	1.29%	0.00%	0.00%	0.73%	0.30%	0.00%	0.00%	0.00%
2011	1.08%	1.00%	1.98%	0.00%	0.98%	0.32%	0.00%	0.00%	0.00%
2012	0.61%	1.00%	0.00%	0.00%	0.61%	0.74%	0.00%	0.00%	0.00%
2013	2.28%	3.19%	1.72%	0.00%	2.17%	0.35%	0.00%	0.30%	0.00%
2014	2.59%	3.75%	0.97%	0.85%	2.46%	0.71%	0.33%	0.00%	0.19%
2015	2.42%	3.82%	0.00%	0.92%	2.32%	0.34%	0.00%	0.00%	0.18%
2016	0.78%	0.80%	0.90%	1.04%	0.88%	0.36%	0.36%	0.00%	0.37%
2017	1.15%	1.48%	0.00%	2.11%	1.30%	0.00%	0.36%	0.00%	0.20%
2018	2.10%	2.75%	0.96%	1.16%	2.02%	0.38%	0.38%	0.00%	0.00%
Average	2.09%	2.51%	1.78%	0.76%	1.97%	0.45%	0.32%	0.09%	0.09%

Table 2 Matching Performance

This table presents the matching performance of different groups. Variable Size denotes the log of market capitalization, variable BM stands for the book-to-market ratio, and variable prior return is the raw returns in the six months prior to firms repurchase announcement, ending five days before the announcement day. To assess the quality of this matching, we compute the average of the variables for the five matched firms for each repurchasing firm. "N" represents the number of 1-to-5 matching pairs. "B" represents buyback firms while "M" represents matching firms. "Z1" represents the lowest Z-Score quintile groups while "Z2~Z5" denotes the aggregate of Z-Score quintile groups from 2 through 5. The *t*-stats are reported in parentheses.

Variable	Full Sample (N=8,380)			Z1 (N=838)			Z2~Z5 (N=7,542)		
	Mean(B)	Mean(M)	Mean Dif	Mean(B)	Mean(M)	Mean Dif	Mean(B)	Mean(M)	Mean Dif
Size	7.00	6.64	0.36***	7.15	6.77	0.37***	6.98	6.63	0.35***
			(12.87)			(4.38)			(12.11)
B/M	0.50	0.52	-0.02***	0.71	0.72	-0.01	0.47	0.50	-0.02***
			(-3.64)			(-0.35)			(-3.99)
Prior Return	-0.02	-0.02	-0.01	0.03	0.02	0.00	-0.03	-0.02	-0.01*
			(-1.55)			(0.21)			(-1.85)
Z-Score	6.15	6.23	-0.07	1.04	1.51	-0.47***	6.72	6.75	-0.03
			(-0.72)			(-5.17)			(-0.25)
FF12 Industry	Perfectly Controlled			Perfectly Controlled			Perfectly Controlled		

Table 3 Five-Day Abnormal Returns Following Repurchase Announcements Across Z-Quintile Groups Over Time

This table reports the 5-day abnormal return of repurchase announcements across different Z quintile groups over different time periods. The 5-day time window includes two days before, two days after, and the announcement day. The table provides the abnormal returns of the repurchasing firms over their matching firms along with their t-stats and the number of observations. Panel A delineates the categories based on Z-Quintile distinctions. The labels "Z1-Low", "Z1-Medium", and "Z1-High" represent tripartite divisions within the Z1 group. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. ∗∗∗, ∗∗, and ∗ indicate that abnormal returns are significant at the 1%, 5%, and 10% significance levels, respectively.

	Full sample	**Different Time Periods**				
		1990~1999	**2000~2004**	**2005~2009**	**2010~2014**	**2015~2021**
Panel A: Categorization using Z-Quintile						
	2.09%***	2.20%**	3.77%	2.89%***	-0.46%	1.57%
Z1-Low	(3.41)	(2.23)	(1.56)	(3.26)	(-0.29)	(0.55)
	244	90	25	71	39	19
	1.58%***	-0.16%	1.56%	3.73%**	3.11%***	2.35%**
Z1-Medium	(3.27)	(-0.23)	(0.93)	(2.34)	(3.13)	(2.13)
	294	118	28	38	50	60
	1.19%**	2.81%***	1.62%	-0.43%	0.52%	0.72%
Z1-High	(2.59)	(3.93)	(0.93)	(-0.36)	(0.53)	(0.72)
	299	92	25	55	55	72
	1.59%***	1.46%***	2.29%**	1.97%***	1.16%*	1.48%**
Z1	(5.37)	(3.13)	(2.04)	(2.91)	(1.71)	(1.99)
	837	300	78	164	144	151
	1.68%***	2.03%***	1.54%***	1.88%***	0.63%***	1.69%***
Z2-Z5	(16.29)	(11.64)	(4.80)	(7.70)	(3.18)	(6.69)
	7,542	3,068	877	1,326	1,209	1,062
Mean Dif	-0.09%	-0.57%	0.75%	0.09%	0.53%	-0.21%
$(Z1 - Z2{\sim}Z5)$	(-0.28)	(-1.15)	(0.64)	(0.12)	(0.75)	(-0.27)
	1.67%***	1.98%***	1.60%***	1.89%***	0.69%***	1.66%***
Overall	(17.15)	(12.06)	(5.19)	(8.23)	(3.59)	(6.94)
	8,379	3,368	955	1,490	1,353	1,213
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8						
	1.46%***	0.86%	2.56%**	2.85%***	0.89%	1.25%*
$Z_{<1.8}$	(4.56)	(1.49)	(2.34)	(3.60)	(1.23)	(1.95)
	727	219	76	117	130	185
Mean Dif	-0.22%	-1.20%**	1.05%	1.04%	0.22%	-0.48%
$(Z_{<1.8} - Z_{\geq 1.8})$	(-0.66)	(-1.99)	(0.92)	(1.26)	(0.30)	(-0.70)

Table 4 BHAR across Different Z Groups and Time Periods

This table reports buy-and-hold abnormal returns across different quintile groups of Z and various holding periods. Z1 is equally divided into three subgroups based on Z-Score: low, medium, and high. If a control firm announces a buyback or is delisted during a specified calculation period, such as a 6-month return, its missing values are substituted by the market value-weighted return (VWRETD). That firm will be excluded from the portfolio in the next holding period. Should there be missing values for the 'treat' firm during a calculation period, for instance, a 6-month return, these missing values are replaced by market returns. In subsequent return calculations, such as a 12-month return, both this 'treat' firm and its corresponding control firms are excluded from the sample. Observations nearing the end of the sample period are omitted if their projected return timeframe extends beyond the sample's end date. Z2~Z5 represents the aggregate of Z quintile group 2 to 5. Mean Dif $(Z1 - Z2{\sim}Z5)$ denotes the mean difference of BHAR between Z1 and the aggregate of Z2 to Z5. Panel A delineates the categories based on Z-Quintile distinctions. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. Mean Dif $(Z_{<1.8} - Z_{\geq 1.8})$ denotes the mean difference of BHAR between groups with Z-Score below 1.8 and those 1.8 or above. Before portfolio formation, returns are winsorized at the 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Buy-and-Hold Abnormal Return					
	3-month	**6-month**	**1-year**	**2-year**	**3-year**	**4-year**
Panel A: Categorization using Z-Quintile						
Full Sample	1.24%***	1.75%***	2.79%***	3.26%***	4.51%***	9.95%***
	(5.74)	(5.46)	(5.26)	(3.36)	(3.67)	(5.98)
	8,377	8,351	8,256	7,861	7,295	6,729
Z1-Low	3.58%**	3.27%	8.28%**	9.74%*	17.97%*	25.98%**
	(2.33)	(1.50)	(2.36)	(1.77)	(1.95)	(1.98)
	244	243	239	226	196	170
Z1-Medium	1.60%	0.81%	0.66%	1.82%	6.16%	16.29%
	(1.43)	(0.51)	(0.26)	(0.43)	(0.97)	(1.52)
	294	294	289	276	249	228
Z1-High	1.02%	1.04%	2.76%	3.96%	16.48%***	32.79%***
	(1.05)	(0.77)	(1.25)	(1.09)	(2.69)	(2.76)
	299	295	293	278	245	222
Z1	1.96%***	1.58%	3.59%**	4.68%*	12.85%***	24.40%***
	(2.86)	(1.64)	(2.31)	(1.84)	(3.14)	(3.60)
	837	832	821	780	690	620
Z2~Z5	1.15%***	1.76%***	2.69%***	3.08%***	3.61%***	8.48%***
	(5.07)	(5.19)	(4.77)	(2.96)	(2.80)	(4.99)
	7,540	7,519	7,435	7,081	6,604	6,106
Mean Dif	0.80%	-0.16%	0.91%	1.66%	9.66%**	16.00%**
$(Z1 - Z2{\sim}Z5)$	(1.11)	(-0.16)	(0.55)	(0.60)	(2.25)	(2.29)
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8						
$Z_{<1.8}$	2.54%***	2.19%**	3.86%**	4.13%	11.68%**	19.13%***
	(3.46)	(2.03)	(2.23)	(1.41)	(2.55)	(2.75)
	727	722	707	658	587	519
Mean Dif	1.42%*	0.51%	1.21%	1.14%	8.23%*	9.86%
$(Z_{<1.8} - Z_{\geq 1.8})$	(1.85)	(0.45)	(0.67)	(0.37)	(1.73)	(1.38)

Table 5 Fama-French IRATS

For every event month, denoted as j, where j=0 represents the month when the open market repurchase is announced, a cross-sectional regression is conducted. The regression involves analyzing the monthly excess returns of buyback firms in the corresponding calendar month, t, for event month j, over the FF5-factors for the same month. The resulting alpha j represents the abnormal returns for each event month j, within a specified time period of (+1, +12). The intercepts obtained from these alpha j values are then summed up to derive the cumulative abnormal return (CAR) figures. The standard error for a given event window is determined by taking the square root of the sum of the squares of the monthly standard errors. Z2~Z5 represents the aggregate of Z quintile group 2 to 5. Mean Difference ($Z1 - Z2{\sim}Z5$) denotes the mean difference of alpha j between Z1 and the aggregate of Z2 to Z5. Panel A delineates the categories based on Z-Quintile distinctions. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. Mean Difference ($Z_{<1.8} - Z_{\geq 1.8}$) denotes the mean difference of alpha j between groups with Z-Score below 1.8 and those 1.8 or above. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Months			
	(+1, +12)	**(+1, +24)**	**(+1, +36)**	**(+1, +48)**
Panel A: Categorization using Z-Quintile				
Full Sample	0.28%***	0.32%***	0.30%***	0.31%***
	(7.12)	(10.66)	(11.99)	(14.00)
Z1-Low	0.48%	0.37%*	0.49%**	0.47%***
	(1.49)	(1.66)	(2.56)	(2.83)
Z1-Medium	-0.06%	-0.01%	0.06%	0.21%
	(-0.28)	(-0.05)	(0.44)	(1.61)
Z1-High	0.12%	0.31%**	0.49%***	0.43%***
	(0.66)	(2.18)	(4.19)	(4.09)
Z1	0.14%	0.20%**	0.31%***	0.35%***
	(1.06)	(2.12)	(3.84)	(4.66)
Z2~Z5	0.30%***	0.33%***	0.30%***	0.30%***
	(7.33)	(10.67)	(11.52)	(13.35)
Mean Difference ($Z1 - Z2{\sim}Z5$)	-0.16%	-0.13%	0.01%	0.05%
	(-1.34)	(-1.38)	(0.12)	(0.55)
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8				
$Z_{<1.8}$	0.15%	0.18%*	0.29%***	0.31%***
	(1.05)	(1.77)	(3.28)	(3.90)
Mean Difference ($Z_{<1.8} - Z_{\geq 1.8}$)	-0.15%	-0.15%*	-0.02%	0.01%
	(-1.19)	(-1.78)	(-0.19)	(0.09)

Table 6 Funding Source of Buyback Events First Fiscal Year Following the Buyback Announcements

This table reports the funding sources of buyback events over the Z quintile groups. The variables are based on the combined data from the fiscal year of the announcement and the subsequent fiscal year, representing a two-year sum. "Earning" is defined as the sum of Income Before Extraordinary Items (Compustat Item 123), Depreciation and Amortization (Item 125), and Extraordinary Items and Discontinued Operations (Item 124); "F.other" as the sum of Deferred Taxes (Item 126), Equity in Net Loss (Earnings) (Item 106), and Funds from Operations – Other (Item 217); "Invsale.net" as the net sale of investment, calculated by Sale of Investments (Item 109) – Increase in Investments (Item 113); "Dlt.net" as the net of long-term debt issuance, calculated by Long-Term Debt – Issuance (Item 111) – Long-Term Debt – Reduction (Item 114); "Sstk.net" as net sale of common and preferred stock, calculated by Sale of Common and Preferred Stock (Item 108) – Purchase of Common and Preferred Stock (Item 115); "Sppe" as sale of property, plant and equipment (Item 107) + Sale of Property, Plant, and Equipment and Sale of Investments – Loss(Gain) (Item 213). "Dst.net" represents Change in Current Debt (Item 301). "CapEx" denotes Capital Expenditures (Item 128). "Div" represents Cash Dividends (Item 127). "Acq" represents Acquisitions (Item 129). "Chech" represents Cash and Cash Equivalents – Increase(Decrease) (Item 274). "ϵ" represents residuals to make the accounting identity equation holds, which is the sum of the Source of Funds – Other (Item 218), Uses of Funds – Other (Item 219), and Working Capital Change – Other – Increase (Decrease) (Item 236). The cash identity equation is as follows:

$$(Earning + F.other + Invsale.net + Dlt.net + Sppe + Sstk.net + Dst.net) - (CapEx + Div + Acq) + \epsilon = Chech$$

All variables are normalized by the firm's average total assets, calculated from the beginning and end of the fiscal year when the announcements occurred. Panel A presents the funding source decomposition. Panel B presents the mean difference between repurchasing firms and matching firms. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	N	Earning	F.other	Invsale.net	Dlt.net	Sppe	Sstk.net	Dst.net	CapEx	Div	Acq	ϵ	Chech
Full Sample	Repurchasing	2,754	23.11%	4.22%	-0.14%	4.21%	0.99%	-8.23%	0.62%	12.31%	2.71%	6.64%	-1.91%	1.20%
	Matching	2,754	12.63%	6.43%	-0.68%	4.40%	0.81%	4.49%	0.78%	13.22%	2.30%	7.41%	-3.36%	2.58%
Z1-Low	Repurchasing	55	12.55%	6.82%	2.36%	7.07%	3.96%	2.48%	0.79%	20.50%	1.99%	3.46%	-4.02%	6.08%
	Matching	55	-0.21%	8.45%	1.01%	4.03%	2.75%	9.35%	4.02%	19.27%	0.73%	6.49%	-2.05%	0.88%
Z1-Medium	Repurchasing	73	19.18%	4.54%	-0.44%	2.82%	4.25%	-2.55%	0.17%	18.81%	1.23%	4.74%	-1.31%	1.89%
	Matching	73	10.07%	3.10%	0.13%	6.67%	1.44%	7.90%	0.68%	15.63%	0.49%	6.94%	-4.92%	2.01%
Z1-High	Repurchasing	64	18.92%	3.16%	1.44%	4.96%	3.29%	-4.68%	0.85%	15.59%	1.67%	7.47%	-4.35%	-1.13%
	Matching	64	9.08%	5.54%	0.37%	5.99%	1.60%	2.38%	1.01%	18.23%	1.24%	5.53%	-0.67%	0.29%
Z1	Repurchasing	192	17.20%	4.73%	0.99%	4.75%	3.85%	-1.82%	0.58%	18.22%	1.59%	5.28%	-3.10%	2.08%
	Matching	192	6.80%	5.45%	0.46%	5.69%	1.87%	6.47%	1.75%	17.54%	0.81%	6.34%	-2.68%	1.11%
Z2~Z5	Repurchasing	2,562	23.56%	4.18%	-0.23%	4.17%	0.78%	-8.71%	0.62%	11.87%	2.80%	6.74%	-1.82%	1.13%
	Matching	2,562	13.07%	6.50%	-0.76%	4.30%	0.73%	4.34%	0.71%	12.90%	2.41%	7.48%	-3.41%	2.69%
$Z_{<1.8}$	Repurchasing	159	17.17%	4.60%	0.56%	4.68%	3.64%	-1.75%	0.51%	18.17%	1.59%	4.77%	-1.52%	3.36%
	Matching	159	6.37%	5.56%	0.67%	4.87%	1.82%	7.55%	1.56%	16.62%	0.62%	6.78%	-2.84%	1.54%
$Z_{\geq 1.8}$	Repurchasing	2,595	23.48%	4.20%	-0.19%	4.18%	0.83%	-8.63%	0.62%	11.95%	2.78%	6.76%	-1.93%	1.07%
	Matching	2,595	13.01%	6.48%	-0.76%	4.37%	0.74%	4.30%	0.73%	13.01%	2.40%	7.44%	-3.39%	2.64%

(Continued)

Panel B: Mean Difference of Funding Source (Repurchasing – Matching)

Group	N	Earning	F.other	Invsale.net	Dlt.net	Sppe	Sstk.net	Dst.net	CapEx	Div	Acq	ϵ	Chech
Full Sample	2,754	10.48%***	-2.21%**	0.53%**	-0.19%	0.18%**	-12.72%***	-0.16%	-0.91%***	0.41%***	-0.76%**	1.45%***	-1.38%***
		(8.82)	(-2.06)	(2.11)	(-0.51)	(2.43)	(-21.84)	(-1.11)	(-3.41)	(2.86)	(-2.08)	(3.59)	(-3.96)
Z1-Low	55	12.76%**	-1.64%	1.35%	3.04%	1.20%	-6.87%*	-3.23%	1.23%	1.26%	-3.03%	-1.97%	5.20%*
		(2.38)	(-0.87)	(0.87)	(0.74)	(0.82)	(-1.94)	(-1.07)	(0.47)	(0.84)	(-1.26)	(-0.79)	(1.94)
Z1-Medium	73	9.11%***	1.45%	-0.57%	-3.85%*	2.81%***	-10.45%***	-0.50%	3.18%	0.74%***	-2.21%	3.60%**	-0.12%
		(2.77)	(1.07)	(-0.68)	(-1.77)	(3.31)	(-2.89)	(-0.80)	(1.37)	(3.35)	(-1.09)	(2.22)	(-0.05)
Z1-High	64	9.84%***	-2.38%**	1.08%	-1.03%	1.69%*	-7.05%***	-0.16%	-2.64%	0.43%	1.94%	-3.69%	-1.42%
		(3.11)	(-2.32)	(0.55)	(-0.26)	(1.90)	(-3.87)	(-0.11)	(-1.09)	(1.05)	(0.47)	(-1.49)	(-1.02)
Z1	192	10.40%***	-0.71%	0.53%	-0.93%	1.98%***	-8.29%***	-1.17%	0.68%	0.79%*	-1.06%	-0.42%	0.97%
		(4.66)	(-0.87)	(0.62)	(-0.48)	(3.26)	(-4.58)	(-1.16)	(0.48)	(1.72)	(-0.62)	(-0.33)	(0.77)
Z2~Z5	2,562	10.49%***	-2.32%**	0.53%**	-0.13%	0.05%	-13.05%***	-0.09%	-1.03%***	0.39%**	-0.74%**	1.59%***	-1.55%***
		(8.28)	(-2.01)	(2.02)	(-0.36)	(0.74)	(-21.37)	(-0.63)	(-3.86)	(2.55)	(-1.99)	(3.76)	(-4.29)
$Z_{<1.8}$	159	10.79%***	-0.97%	-0.11%	-0.18%	1.82%***	-9.31%***	-1.05%	1.55%	0.97%*	-2.02%	1.33%	1.82%
		(4.40)	(-1.01)	(-0.16)	(-0.10)	(2.75)	(-4.41)	(-0.96)	(0.98)	(1.80)	(-1.42)	(1.04)	(1.26)
$Z_{\geq 1.8}$	2,595	10.47%***	-2.29%**	0.57%**	-0.19%	0.08%	-12.93%***	-0.11%	-1.06%***	0.38%**	-0.69%*	1.45%***	-1.57%***
		(8.35)	(-2.01)	(2.16)	(-0.51)	(1.21)	(-21.40)	(-0.77)	(-3.99)	(2.54)	(-1.81)	(3.46)	(-4.39)

Table 7 Debt / Asset Before and After the Buyback

This table reports the Debt / Asset for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. Debt is calculated as the sum of current liability(dlcq) and long-term liabilities(dlttq). Debt / Asset is defined as $Debt_t/Asset_t$, where t denotes the end quarter of every consecutive four quarters. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1). Panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Debt-to-Asset Ratio										
Z1	Buyback	36.01%	36.77%	36.59%	34.65%	35.09%	35.80%	35.50%	35.54%	-0.84%*
	Matching	30.50%	32.01%	32.84%	32.55%	32.73%	32.51%	32.11%	31.98%	0.38%
Z2~Z5	Buyback	17.60%	17.02%	16.43%	16.22%	18.54%	19.49%	20.21%	20.81%	2.80%***
	Matching	18.53%	18.08%	17.43%	18.08%	19.29%	19.73%	20.11%	20.66%	1.97%***
Overall	Buyback	19.42%	18.99%	18.46%	18.08%	20.19%	21.08%	21.68%	22.20%	2.44%***
	Matching	19.72%	19.47%	18.98%	19.54%	20.64%	20.97%	21.26%	21.72%	1.81%***
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	5.48%***	4.74%***	3.73%***	2.06%***	2.33%***	3.26%***	3.38%***	3.55%***	
		(7.86)	(7.18)	(6.31)	(3.46)	(3.57)	(4.64)	(4.50)	(4.40)	
Z2~Z5	Difference	-0.93%***	-1.06%***	-0.99%***	-1.86%***	-0.75%***	-0.23%	0.11%	0.16%	
		(-5.36)	(-6.68)	(-7.03)	(-12.68)	(-4.33)	(-1.23)	(0.54)	(0.76)	
Overall	Difference	-0.29%*	-0.48%***	-0.52%***	-1.46%***	-0.44%***	0.11%	0.42%**	0.48%**	
		(-1.69)	(-3.03)	(-3.68)	(-10.06)	(-2.61)	(0.59)	(2.16)	(2.31)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	36.59%	37.97%	37.84%	36.02%	36.29%	36.99%	36.53%	36.38%	-0.77%
	Matching	30.38%	32.20%	33.14%	32.75%	32.88%	32.71%	32.38%	32.18%	0.52%*
$Z_{\geq 1.8}$	Buyback	17.80%	17.18%	16.60%	16.36%	18.66%	19.61%	20.34%	20.96%	2.74%***
	Matching	18.70%	18.26%	17.62%	18.27%	19.46%	19.89%	20.26%	20.81%	1.94%***
$Z_{<1.8}$	Difference	6.18%***	5.73%***	4.67%***	3.24%***	3.37%***	4.26%***	4.14%***	4.20%***	
		(8.25)	(8.11)	(7.32)	(4.97)	(4.77)	(5.62)	(5.13)	(4.74)	
$Z_{\geq 1.8}$	Difference	-0.90%***	-1.07%***	-1.02%***	-1.91%***	-0.81%***	-0.27%	0.09%	0.16%	
		(-5.25)	(-6.78)	(-7.23)	(-13.15)	(-4.68)	(-1.46)	(0.44)	(0.74)	

Table 8 Dividend / Asset Before and After the Buyback

This table reports the Dividend / Asset for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. Dividend / Asset is defined as $Dividend_{t-3\sim t}/Asset_t$, where t denotes the end quarter of every consecutive four quarters. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1). Panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Dividend-to-Asset Ratio										
Z1	Buyback	0.63%	0.63%	0.63%	0.67%	0.79%	0.74%	0.76%	0.84%	0.12%***
	Matching	0.66%	0.69%	0.65%	0.63%	0.69%	0.74%	0.76%	0.77%	0.07%***
Z2~Z5	Buyback	1.22%	1.25%	1.26%	1.28%	1.37%	1.42%	1.46%	1.51%	0.16%***
	Matching	1.21%	1.19%	1.16%	1.10%	1.15%	1.16%	1.17%	1.19%	-0.01%
Overall	Buyback	1.16%	1.19%	1.19%	1.22%	1.31%	1.36%	1.39%	1.45%	0.16%***
	Matching	1.15%	1.14%	1.11%	1.06%	1.10%	1.12%	1.14%	1.16%	0.00%
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	-0.03%	-0.06%	-0.02%	0.05%	0.10%*	0.00%	0.00%	0.07%	
		(-0.61)	(-1.18)	(-0.46)	(0.96)	(1.78)	(-0.01)	(0.01)	(1.03)	
		(0.69)	(2.70)	(3.48)	(5.72)	(6.30)	(7.05)	(7.62)	(8.15)	
Z2~Z5	Difference	0.01%	0.06%**	0.10%***	0.17%***	0.23%***	0.26%***	0.28%***	0.32%***	
		(0.41)	(2.39)	(4.26)	(7.66)	(9.65)	(10.50)	(10.84)	(11.36)	
Overall	Difference	0.01%	0.05%**	0.09%***	0.16%***	0.21%***	0.24%***	0.26%***	0.30%***	
		(0.28)	(2.08)	(4.07)	(7.67)	(9.79)	(10.25)	(10.55)	(11.27)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	0.59%	0.60%	0.60%	0.58%	0.73%	0.67%	0.69%	0.82%	0.13%***
	Matching	0.69%	0.72%	0.67%	0.64%	0.73%	0.76%	0.78%	0.80%	0.08%***
$Z_{\geq 1.8}$	Buyback	1.21%	1.24%	1.25%	1.28%	1.37%	1.42%	1.45%	1.50%	0.16%***
	Matching	1.20%	1.18%	1.15%	1.10%	1.13%	1.15%	1.17%	1.19%	-0.01%
$Z_{<1.8}$	Difference	-0.10%**	-0.13%**	-0.07%	-0.06%	0.01%	-0.09%	-0.09%	0.02%	
		(-2.06)	(-2.51)	(-1.41)	(-1.38)	(0.11)	(-1.60)	(-1.55)	(0.33)	
$Z_{\geq 1.8}$	Difference	0.02%	0.06%***	0.10%***	0.18%***	0.23%***	0.27%***	0.29%***	0.32%***	
		(0.68)	(2.62)	(4.43)	(8.04)	(10.01)	(10.76)	(11.09)	(11.50)	

Table 9 Z-score Change Before and After the Buyback across Z-Quintile Groups – Mean version

Panel A of the table reports the mean Z-scores for different Z quintiles before and after the buyback event. The month of the buyback is indicated by 'T0'. "T+1" indicates one year after the event. The B panel reports the difference between buyback firms and matching firms in the same group and time period. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T0	T+1	T+2	T+3	T+4
Panel A: Mean of Z-Score										
Z1-Low	Buyback Firm	1.11	1.04	0.92	0.89	0.82	1.00	1.00	1.04	1.13
	Matching Firm	2.02	1.74	1.68	1.54	1.47	1.60	1.60	1.64	1.62
Z1-Med	Buyback Firm	1.54	1.48	1.48	1.39	1.43	1.55	1.63	1.58	1.61
	Matching Firm	2.11	1.98	1.92	1.82	1.75	1.79	1.88	1.86	1.94
Z1-High	Buyback Firm	1.93	1.87	1.71	1.70	1.82	1.99	2.01	1.95	2.08
	Matching Firm	2.41	2.29	2.31	2.16	2.07	2.11	2.08	2.11	2.18
Z1	Buyback Firm	1.59	1.53	1.42	1.37	1.43	1.57	1.66	1.60	1.68
	Matching Firm	2.23	2.06	2.01	1.88	1.82	1.89	1.91	1.92	2.01
Z2	Buyback Firm	2.52	2.45	2.45	2.40	2.43	2.55	2.48	2.52	2.55
	Matching Firm	2.73	2.68	2.58	2.54	2.49	2.52	2.51	2.50	2.52
Z3	Buyback Firm	3.22	3.17	3.18	3.21	3.27	3.36	3.33	3.32	3.23
	Matching Firm	3.35	3.34	3.24	3.25	3.23	3.15	3.12	3.13	3.07
Z4	Buyback Firm	4.29	4.27	4.24	4.28	4.40	4.42	4.28	4.19	4.01
	Matching Firm	4.34	4.41	4.33	4.29	4.33	4.14	3.98	3.92	3.91
Z5	Buyback Firm	6.76	7.00	7.26	7.57	7.75	7.18	6.53	6.17	5.93
	Matching Firm	6.08	6.38	6.64	7.00	7.44	6.54	5.88	5.59	5.40
Z2~Z5	Buyback Firm	6.11	6.21	6.27	6.38	6.52	6.13	5.62	5.46	5.36
	Matching Firm	6.07	6.14	6.31	6.47	6.53	5.93	5.44	5.28	5.17
Overall	Buyback Firm	5.73	5.80	5.83	5.90	6.00	5.69	5.26	5.13	5.05
	Matching Firm	5.77	5.82	5.94	6.04	6.05	5.55	5.12	4.98	4.89
Panel B: Difference between Buyback Firm and Matching Firm										
Z1-Low	Difference	-0.80**	-0.80**	-0.64*	-0.74***	-0.59***	-0.56***	-0.50***	-0.41*	-0.30
		(-2.19)	(-2.26)	(-1.92)	(-4.07)	(-3.60)	(-2.97)	(-2.80)	(-1.70)	(-1.08)
Z1-Med	Difference	-0.78***	-0.83***	-0.82***	-0.44***	-0.35***	-0.29***	-0.22**	-0.26*	-0.30**
		(-4.66)	(-4.27)	(-3.96)	(-2.69)	(-11.48)	(-4.33)	(-2.16)	(-1.95)	(-2.23)
Z1-High	Difference	-0.88***	-0.92***	-0.72***	-0.52***	-0.21***	-0.16**	-0.18*	-0.08	-0.05
		(-3.84)	(-4.37)	(-6.30)	(-7.41)	(-5.72)	(-2.10)	(-1.80)	(-0.70)	(-0.52)
Z1	Difference	-0.82***	-0.85***	-0.73***	-0.56***	-0.37***	-0.32***	-0.28***	-0.23***	-0.21**
		(-5.69)	(-5.95)	(-5.71)	(-6.76)	(-7.29)	(-4.94)	(-3.96)	(-2.58)	(-2.13)
Z2	Difference	-0.21***	-0.23***	-0.13***	-0.14***	-0.06***	0.03	-0.04	0.03	0.03
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.11)	(0.55)	(0.57)	(0.30)
Z3	Difference	-0.14**	-0.18***	-0.06**	-0.04	0.04**	0.20***	0.21***	0.19***	0.16***
		(0.03)	(0.00)	(0.04)	(0.40)	(0.04)	(0.00)	(0.00)	(0.00)	(0.00)
Z4	Difference	-0.05	-0.14***	-0.08	-0.01	0.08***	0.28***	0.30***	0.27***	0.10**
		(0.28)	(0.01)	(0.14)	(0.21)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)
Z5	Difference	0.67***	0.62***	0.63***	0.56***	0.31***	0.64***	0.66***	0.58***	0.53***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Z2~Z5	Difference	0.04	0.06	-0.04	-0.09*	-0.01	0.20***	0.18***	0.18***	0.19***
		(0.48)	(0.88)	(-0.57)	(-1.71)	(-0.27)	(3.94)	(3.56)	(3.22)	(3.17)
Overall	Difference	-0.05	-0.03	-0.10*	-0.14***	-0.05	0.15***	0.14***	0.14***	0.15***
		(-0.66)	(-0.38)	(-1.72)	(-2.77)	(-1.25)	(3.20)	(2.95)	(2.76)	(2.79)

Table 10 Median S&P Credit Ratings across Different Z-Quintile Groups

This table reports the median S&P credit ratings of buyback firms and their matching firms across different Z quintile groups at different time points relative to buyback events. "T0" denotes the month of repurchasing announcement. "T+1" represents one year following the announcement.

Group	Treatment	T-4	T-3	T-2	T-1	T0	T+1	T+2	T+3	T+4
Z1-Low	Buyback Firm	BB-	BB-	BB-	BB-	BB-	BB-	BB	BB	BB
	Matching Firm	BB-	BB-	BB-	BB-	BB-	BB-	BB-	BB	BB
Z1-Med	Buyback Firm	BB	BB+	BB+	BB+	BB+	BB+	BBB-	BBB-	BBB-
	Matching Firm	BB	BB	BB	BB-	BB-	BB	BB	BB	BB
Z1-High	Buyback Firm	BB+	BB+	BB+	BB+	BB+	BBB-	BBB-	BBB-	BBB-
	Matching Firm	BB+	BB	BB	BB	BB	BB	BB	BB+	BB+
Z1	Buyback Firm	BB	BB	BB	BB	BB	BB	BB+	BB+	BB+
	Matching Firm	BB	BB	BB	BB-	BB	BB	BB	BB	BB
Z2	Buyback Firm	BBB	BBB-	BBB-	BBB	BBB	BBB	BBB	BBB	BBB
	Matching Firm	BB+	BB+	BB+	BB+	BB+	BB+	BB+	BB+	BB+
Z3	Buyback Firm	BBB+	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB
	Matching Firm	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-
Z4	Buyback Firm	BBB+	BBB	BBB+	BBB+	BBB+	BBB+	BBB+	BBB+	BBB+
	Matching Firm	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB
Z5	Buyback Firm	A	A	A	A	A	A	A-	A-	A-
	Matching Firm	BBB+	BBB+	BBB+	BBB	BBB	BBB	BBB	BBB	BBB
Z2~Z5	Buyback Firm	BBB+	BBB	BBB	BBB	BBB+	BBB+	BBB+	BBB+	BBB+
	Matching Firm	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-
Overall	Buyback Firm	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB	BBB
	Matching Firm	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-	BBB-

Table 11 Comparative Analysis of Z-Score Changes Pre- and Post-Stock Repurchase Announcements Categorized by Quintiles of Outstanding Share Change (12-Month Window)

Panel A of the table presents the change in Z-Score before and after stock repurchase announcements, categorized by quintiles of outstanding share change over a 12-month period. These quintiles are based on the variation in outstanding shares of the repurchasing firms from the announcement day to 12 months later. Outstanding shares have been adjusted using CRSP cumulative factor to adjust shares (cfacshr). "Share Chg 1" denotes the quintile with the least share change, whereas "Share Chg 5" indicates the most. The month of the buyback is marked as 'T0', while 'T+1' denotes one-year post-announcement. $\Delta S_{t\to t+12}$ represents the mean share changes over a 12-month period. The B panel reports the difference in Z-Score between buyback firms and matching firms in the same category and timeframe. The Z-Scores are winsorized at the 1% and 99% levels. T-statistics are provided in parentheses. The symbols *, **, and *** denote significance levels at 10%, 5%, and 1%, respectively.

Share Change Quintile	Group	$\Delta S_{t\to t+12}$	T-4	T-3	T-2	T-1	T0	T+1	T+2	T+3	T+4
Panel A: Mean of Z-Score											
Share Chg 1 (Lowest)	Buyback	-10.65%	5.51	5.41	5.39	5.40	5.38	5.12	4.49	4.36	4.30
	Match	3.92%	5.34	5.30	5.41	5.55	5.46	5.02	4.61	4.51	4.52
Share Chg 2	Buyback	-4.28%	5.38	5.41	5.60	5.49	5.64	5.40	4.91	4.80	4.79
	Match	2.39%	5.59	5.58	5.69	5.69	5.74	5.39	4.97	4.91	4.78
Share Chg 3	Buyback	-1.87%	5.78	5.86	5.87	6.05	6.14	5.77	5.34	5.24	5.04
	Match	3.26%	5.92	6.12	6.13	6.13	6.18	5.70	5.16	5.00	4.96
Share Chg 4	Buyback	-0.09%	5.76	5.90	5.99	6.08	6.15	5.80	5.48	5.39	5.39
	Match	4.33%	5.82	5.90	6.06	6.15	6.15	5.63	5.28	5.09	5.05
Share Chg 5 (Highest)	Buyback	8.71%	6.35	6.47	6.41	6.48	6.72	6.39	6.06	5.85	5.73
	Match	4.73%	6.20	6.27	6.46	6.65	6.76	6.01	5.58	5.42	5.18
Overall	Buyback	-1.63%	5.74	5.80	5.84	5.90	6.01	5.70	5.26	5.13	5.05
	Match	3.73%	5.76	5.82	5.94	6.03	6.06	5.55	5.12	4.98	4.90
Panel B: Difference between Buyback Firm and Matching Firm											
Share Chg 1 (Lowest)	Difference		0.17	0.11	-0.02	-0.14	-0.07	0.09	-0.12	-0.15*	-0.22**
			(1.19)	(0.79)	(-0.14)	(-1.47)	(-1.05)	(1.17)	(-1.44)	(-1.70)	(-2.33)
Share Chg 2	Difference		-0.21	-0.17	-0.09	-0.21**	-0.10	0.01	-0.06	-0.10	0.01
			(-1.48)	(-1.33)	(-0.71)	(-2.14)	(-1.36)	(0.12)	(-0.74)	(-1.07)	(0.08)
Share Chg 3	Difference		-0.14	-0.26*	-0.26**	-0.08	-0.04	0.06	0.18*	0.24**	0.08
			(-0.99)	(-1.78)	(-2.06)	(-0.71)	(-0.45)	(0.64)	(1.87)	(2.23)	(0.70)
Share Chg 4	Difference		-0.06	0.01	-0.07	-0.07	0.00	0.17	0.20*	0.29**	0.34***
			(-0.37)	(0.04)	(-0.48)	(-0.57)	(0.04)	(1.53)	(1.83)	(2.41)	(2.68)
Share Chg 5 (Highest)	Difference		0.15	0.20	-0.05	-0.17	-0.04	0.38***	0.48***	0.43***	0.55***
			(0.73)	(1.05)	(-0.28)	(-1.23)	(-0.36)	(3.09)	(3.43)	(2.76)	(3.35)
Overall	Difference		-0.02	-0.03	-0.10	-0.13***	-0.05	0.14***	0.14***	0.14***	0.15***
			(-0.33)	(-0.40)	(-1.59)	(-2.63)	(-1.28)	(3.18)	(2.89)	(2.72)	(2.71)

Table 12 Matching Performance of Bankrupt Firms

This table presents the matching performance of firms that ultimately experienced bankruptcy. Variable BM was constructed using the book equity value for the last fiscal year-end in t-6 and the market capitalization at the end of December of the previous year. The Z-score was derived from the financial data available for the last fiscal year-end in t-6. Firm size (logarithm of market capitalization) was determined at the end of June in fiscal year t-5. The Fama French 12 Industry classification was perfectly matched between the treatment firms and their corresponding matching firms. "N" represents the number of 1-to-5 matching pairs. "B" represents bankrupt firms while "M" represents matching firms. The *t*-stats are reported in parentheses. All variables have been winsorized at the 1% and 99% level. The symbols *, **, *** represent 5%, 1%, and 0.1% significance level respectively. We compute the average of the variables for the five matched firms for each repurchasing firm.

Variable	Full Sample (N=729)		
	Mean(B)	Mean(M)	Dif
Size	4.90	4.96	-0.05
			(-0.60)
BM	0.95	0.87	0.08
			(1.58)
Z-Score	3.70	3.78	-0.08
			(-0.22)
FF12 Industry	Perfectly Controlled		

Table 13 Comparative Analysis of Firm Characteristics Prior to Bankruptcy

This table presents the comparative analysis of firm characteristics for three groups: treatment firms, their matching firms, and the entire economy (including all firms in the market). The "Year" columns indicate the various fiscal years preceding the bankruptcy filing of treatment firms. The "dif" row represents the mean difference between treatment firms and matching firms. The significance levels are denoted by *, **, and *** indicating 10%, 5%, and 1% significance levels, respectively. Yearly sale growth is calculated as $(sale_t - sale_{t-1})/sale_{t-1}$, where t denotes the fiscal year. Asset growth is defined similarly as $(total\ asset_t - total\ asset_{t-1})/total\ asset_{t-1}$. Dividend/Asset is derived by dividing $dividend_t$ by $total\ asset_t$. Debt/Asset is derived by dividing $Debt_t$ by TA_t (Total Asset). ROA is defined as $coalesce(Oibdp_t, Sale_t - Xopr_t, Revt_t - Xopr_t)/((TA_{t-1} + TA_t)/2)$, where $Oibdp$ represents operating income before depreciation, $Xopr$ denotes total operating expenses, and $Revt$ represents total revenue. The $coalesce$ function retrieves the first non-missing value from the given parameters. ROE is defined as $coalesce(Oibdp_t, Sale_t - Xopr_t, Revt_t - Xopr_t)/((BE_{t-1} + BE_t)/2)$, where BE represents the book equity value. Total shareholder payout/Asset is defined as $(Dividend_t + Prstkc_t)/TA_t$, where $Prstkc$ denotes the purchase of common and preferred stocks. Panel B presents the results of total shareholder payout, dividend, and purchase of common and preferred.

Panel A

Variable	Group	Year					Variable	Group	Year				
		-5	-4	-3	-2	-1			-5	-4	-3	-2	-1
Z	Econ	5.07	5.10	4.99	4.90	4.81	Debt/Asset	Econ	20.79%	20.97%	21.18%	21.19%	21.50%
	Bankrupt	2.94	2.35	1.70	0.94	0.58		Bankrupt	30.12%	33.21%	37.22%	41.85%	50.48%
	Match	3.01	2.84	2.70	2.73	2.63		Match	25.30%	26.01%	26.29%	26.58%	28.54%
	Dif	-0.07	-0.49***	-1.00***	-1.79***	-2.04***		Dif	4.83%***	7.20%***	10.93%***	15.27%***	21.95%***
	t-stat	(-0.40)	(-2.99)	(-6.41)	(-11.97)	(-12.02)		t-stat	(4.89)	(7.00)	(10.15)	(13.45)	(15.98)
Sale Growth	Econ	19.85%	19.18%	18.23%	17.53%	16.39%	ROA	Econ	4.80%	4.28%	3.74%	3.11%	2.55%
	Bankrupt	16.11%	10.90%	8.14%	4.29%	-2.62%		Bankrupt	0.12%	-1.40%	-3.58%	-5.81%	-8.67%
	Match	13.58%	10.21%	9.71%	9.56%	7.52%		Match	2.79%	2.91%	2.83%	3.40%	4.31%
	Dif	2.53%	0.69%	-1.57%	-5.28%***	-10.14%***		Dif	-2.67%***	-4.31%***	-6.40%***	-9.21%***	-12.98%***
	t-stat	(1.61)	(0.45)	(-1.03)	(-3.40)	(-6.27)		t-stat	(-2.82)	(-4.55)	(-6.40)	(-9.13)	(-10.58)
Asset Growth	Econ	22.94%	21.14%	19.96%	19.51%	17.65%	ROE	Econ	16.67%	15.92%	15.16%	14.32%	13.61%
	Bankrupt	13.23%	9.05%	5.67%	1.97%	-10.83%		Bankrupt	12.71%	10.81%	8.20%	3.00%	-5.21%
	Match	9.91%	8.15%	8.03%	7.36%	5.62%		Match	14.30%	15.04%	16.29%	17.52%	18.95%
	Dif	3.33%**	0.90%	-2.36%	-5.39%***	-16.44%***		Dif	-1.60%	-4.23%**	-8.09%***	-14.51%***	-24.16%***
	t-stat	(2.08)	(0.59)	(-1.57)	(-3.56)	(-10.18)		t-stat	(-0.86)	(-2.16)	(-3.87)	(-6.44)	(-7.44)
Dividend/Asset	Econ	0.53%	0.53%	0.53%	0.53%	0.54%	Total Shareholder Payout/Asset	Econ	2.14%	2.25%	2.29%	2.35%	2.37%
	Bankrupt	0.29%	0.22%	0.19%	0.16%	0.11%		Bankrupt	1.07%	0.92%	0.84%	0.49%	0.31%
	Match	0.32%	0.31%	0.33%	0.34%	0.35%		Match	1.19%	1.27%	1.37%	1.41%	1.37%
	Dif	-0.03%	-0.09%***	-0.14%***	-0.19%***	-0.24%***		Dif	-0.12%	-0.35%***	-0.53%***	-0.91%***	-1.05%***
	t-stat	(-1.03)	(-3.66)	(-5.34)	(-7.45)	(-8.54)		t-stat	(-1.17)	(-3.63)	(-5.23)	(-10.24)	(-11.05)

(Continued)

Panel B						
Variable	**Group**	**Year Prior to Bankruptcy**				
		-5	**-4**	**-3**	**-2**	**-1**
Total Shareholder Pay-out/Asset	Econ	2.14%	2.25%	2.29%	2.35%	2.37%
	Bankrupt	1.07%	0.92%	0.84%	0.49%	0.31%
	Match	1.19%	1.27%	1.37%	1.41%	1.37%
	Dif	-0.12%	-0.35%***	-0.53%***	-0.91%***	-1.05%***
	t-stat	(-1.17)	(-3.63)	(-5.23)	(-10.24)	(-11.05)
Dividend/Asset	Econ	0.53%	0.53%	0.53%	0.53%	0.54%
	Bankrupt	0.29%	0.22%	0.19%	0.16%	0.11%
	Match	0.32%	0.31%	0.33%	0.34%	0.35%
	Dif	-0.03%	-0.09%***	-0.14%***	-0.19%***	-0.24%***
	t-stat	(-1.03)	(-3.66)	(-5.34)	(-7.45)	(-8.54)
Purchase of common and preferred stocks/Asset	Econ	1.34%	1.44%	1.48%	1.53%	1.53%
	Bankrupt	0.68%	0.64%	0.60%	0.32%	0.19%
	Match	0.72%	0.79%	0.86%	0.88%	0.87%
	Dif	-0.03%	-0.14%**	-0.27%***	-0.56%***	-0.68%***
	t-stat	(-0.48)	(-2.16)	(-3.93)	(-9.13)	(-9.99)

Table 14 Prevalence of Buyback amongst Bankrupt Firms

This table presents the time series of the incidence of buyback announcements and the purchase of stocks across three groups: treatment firms, their matching firms, and the entire economy (including all firms in the market). To calculate the incidence of buyback announcements, we align the bankruptcy filing date of all treatment firms and tally the number of buyback announcement events within each one-year time interval for five consecutive years preceding the filing date. "Dif" row represents the mean difference between treatment firms and matching firms. The significance levels are denoted by *, **, and *** indicating 10%, 5%, and 1% significance levels, respectively.

Variable	Group	Year				
		-5	-4	-3	-2	-1
Purchase of common and preferred stocks/Asset	Econ	1.34%	1.44%	1.48%	1.53%	1.53%
	Bankrupt	0.68%	0.64%	0.60%	0.32%	0.19%
	Match	0.72%	0.79%	0.86%	0.88%	0.87%
	Dif	-0.03%	-0.14%**	-0.27%***	-0.56%***	-0.68%***
	t-stat	(-0.48)	(-2.16)	(-3.93)	(-9.13)	(-9.99)
Incidence of Buyback	Econ	7.48%	7.37%	7.04%	6.76%	5.89%
	Bankrupt	4.39%	4.98%	3.21%	1.56%	0.08%
	Match	7.85%	6.64%	6.39%	5.35%	3.68%
	Dif	-3.46%***	-1.66%**	-3.19%***	-3.79%***	-3.59%***
	t-stat	(-4.74)	(-2.28)	(-5.11)	(-7.30)	(-10.55)

Table 15 Dollars Spent on Buybacks

This table reports the percentage of dollars (scaled by total assets in fiscal year T) used for open-market share repurchases following the buyback announcement over a four-year period. The dollars spent on buybacks are calculated by formula *prstkc – pstk_new.increase*, where $prstkc$ denotes purchase of common and preferred stock from Compustat Fundamentals Annual. The variable *pstk_new.increase* is determined by *pstk_new – pstk_new.L1*, with *pstk_new* being the result of *coalesce(pstkrv, pstkl, pstk)*. The variable *pstkrv* stands for preferred stock – redemption value, *pstkl* for preferred stock – liquidating value, and *pstk* for preferred/preference stock (capital) – total from the Compustat Fundamentals Annual. The *coalesce* function is used to select the first non-missing value among its parameters. "T" denotes the fiscal year end right before the buyback announcement while "T + 1" represents fiscal year end right after the buyback event. "T+1~T+4" refers to the cumulative dollars spent on buybacks over four years, scaled by total assets at the end of fiscal year "T". All variables have been winsorized at 1% and 99% level. The number of observations is reported below the percentage dollar values.

Z Quintile	T+1	T+2	T+3	T+4	T+1~T+4
Full Sample	5.33%	4.77%	4.42%	4.19%	21.95%
	7,641	7,037	6,596	6,162	5,936
Z1-Low	3.82%	4.85%	3.29%	2.40%	15.69%
	214	189	173	154	146
Z1-Medium	2.86%	2.78%	2.77%	2.55%	12.71%
	266	245	227	202	198
Z1-High	2.65%	2.79%	2.92%	2.65%	12.22%
	271	237	224	208	199
Z1	3.06%	3.37%	2.97%	2.55%	13.33%
	751	671	624	564	543
Z2~Z5	5.57%	4.92%	4.57%	4.35%	22.82%
	6,890	6,366	5,972	5,598	5,393
$Z_{<1.8}$	3.30%	3.45%	3.07%	2.77%	14.13%
	656	583	541	481	465
$Z_{\geq 1.8}$	5.52%	4.89%	4.54%	4.31%	22.62%
	6,985	6,454	6,055	5,681	5,471

Table 16 Changes in Shares after Buyback Announcement within 48 Months

This table presents the changes in shares following a buyback announcement over a 48-month period. $\Delta S_{t\to t+48}$ represents the difference in shares 48 months post-announcement compared to the day of the announcement. Outstanding shares have been adjusted using CRSP cumulative factor to adjust shares (*cfacshr*). "Decrease Percentage" denotes the proportion of instances within specified percentage decline categories. $Z_{<1.8}$ and $Z_{\geq 1.8}$ refers to an alternative categorization of sample based on a Z-Score threshold of 1.8.

Z Quintile	Group	N	Mean $\Delta S_{t\to t+48}$	Median $\Delta S_{t\to t+48}$	Decease Percentage			
					Decrease	By -5% or more	By -10% or more	By -15% or more
Full Sample	Buyback Firm	6,469	0.58%	-3.58%	63.72%	44.64%	29.02%	17.14%
	Matching Firm	31,542	13.47%	3.10%	32.92%	18.45%	10.29%	5.69%
Z1-Low	Buyback Firm	159	16.01%	1.16%	45.28%	30.82%	23.90%	19.50%
	Matching Firm	855	31.86%	10.48%	22.34%	14.74%	8.07%	5.03%
Z1-Medium	Buyback Firm	213	5.22%	-2.46%	56.81%	43.66%	30.99%	19.72%
	Matching Firm	1,033	24.02%	6.02%	25.07%	14.04%	7.55%	3.29%
Z1-High	Buyback Firm	214	7.07%	-2.06%	55.14%	43.46%	29.91%	13.55%
	Matching Firm	1,063	18.92%	4.33%	29.63%	16.84%	9.22%	5.08%
Z1	Buyback Firm	586	8.82%	-1.14%	53.07%	40.10%	28.67%	17.41%
	Matching Firm	2,951	24.46%	6.03%	25.92%	15.25%	8.30%	4.44%
Z2	Buyback Firm	821	1.50%	-3.57%	64.80%	44.58%	29.48%	17.54%
	Matching Firm	4,002	15.27%	3.38%	31.68%	17.92%	9.85%	5.22%
Z3	Buyback Firm	1,098	-0.06%	-3.14%	63.21%	42.99%	27.78%	16.94%
	Matching Firm	5,363	11.93%	2.80%	33.06%	18.40%	10.11%	5.74%
Z4	Buyback Firm	1,392	-1.39%	-4.12%	66.67%	46.62%	29.38%	16.95%
	Matching Firm	6,655	9.85%	2.27%	36.75%	20.74%	12.23%	6.75%
Z5	Buyback Firm	2,572	-0.26%	-3.84%	64.42%	45.33%	29.28%	17.15%
	Matching Firm	12,571	12.89%	3.24%	32.86%	18.18%	9.94%	5.55%
Z2~Z5	Buyback Firm	5,883	-0.24%	-3.74%	64.78%	45.10%	29.05%	17.12%
	Matching Firm	28,591	12.34%	2.88%	33.64%	18.78%	10.49%	5.82%
$Z_{<1.8}$	Buyback Firm	500	8.05%	-2.07%	54.80%	41.40%	29.40%	18.80%
	Matching Firm	2,458	24.03%	5.77%	26.57%	15.50%	8.34%	4.43%
$Z_{\geq 1.8}$	Buyback Firm	5,969	-0.05%	-3.69%	64.47%	44.92%	28.98%	17.00%
	Matching Firm	29,084	12.58%	2.93%	33.45%	18.70%	10.45%	5.80%

Table 17 Number of Employees Following Repurchase Announcements Over Time (Median)

This table reports the median number of employees (in thousands) across different Z quintile groups, spanning four years before and after the repurchase announcement. The number of employees is sourced from Compustat Fundamentals Annual. "T+1" denotes one year forward, while "T-1" denotes one year backward. Panel A reports the median number of employees (in thousands). The last column in Panel A reports the Wilcoxon test estimates between post-announcements (from T+1 to T+4) sample and pre-announcements (from T-4 to T-1) sample, which corresponds to the difference of the location parameter. Panel B reports the Wilcoxon test estimates between buyback firms and matching firms, with the *p*-value reported in parentheses. The last column in Panel B details the median difference in difference, comparing the post-announcement period (from T+1 to T+4) to the pre-announcement period (from T-4 to T-1) for both buyback firms and their matched counterparts. The *p*-value for the aligned ranks transformation ANOVA is reported in the parentheses. The symbols ***, **, and * represent significance level of 1%, 5%, and 10%, respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Wilcoxon Test Estimate
Panel A: Median Number of Employees (in thousands)										
Z1-Low	Buyback Firm	2.16	2.21	2.50	2.61	2.76	2.50	2.86	3.13	0.19**
	Matching Firm	2.15	2.23	2.26	2.40	2.73	2.88	3.15	3.25	0.30***
Z1-Med	Buyback Firm	6.07	6.61	6.42	7.31	7.12	7.02	8.18	8.38	0.35
	Matching Firm	4.06	3.95	4.29	4.60	4.64	4.79	5.49	6.30	0.71***
Z1-High	Buyback Firm	6.80	6.80	6.55	6.80	6.90	7.30	8.00	8.14	0.31
	Matching Firm	4.78	4.85	5.00	5.60	6.00	6.10	6.31	6.78	0.83***
Z1	Buyback Firm	5.19	5.28	5.22	5.30	5.10	5.37	6.35	6.60	0.30***
	Matching Firm	3.60	3.67	3.91	4.20	4.38	4.53	5.00	5.62	0.63***
Z2	Buyback Firm	6.99	6.87	7.40	7.35	7.67	8.00	7.93	8.50	0.42***
	Matching Firm	4.77	5.07	5.20	5.70	5.79	6.10	6.60	7.10	0.78***
Z3	Buyback Firm	6.09	6.28	6.20	6.26	6.44	6.80	6.90	7.20	0.45***
	Matching Firm	4.21	4.14	4.17	4.51	5.10	5.57	6.10	6.40	0.90***
Z4	Buyback Firm	4.61	4.86	4.68	4.85	5.07	5.44	5.60	5.99	0.40***
	Matching Firm	3.22	3.22	3.25	3.51	3.94	4.34	4.60	4.90	0.70***
Z5	Buyback Firm	1.68	1.64	1.72	1.94	2.14	2.40	2.70	2.94	0.31***
	Matching Firm	1.43	1.37	1.40	1.59	1.81	2.16	2.41	2.71	0.44***
Z2~Z5	Buyback Firm	3.60	3.67	3.75	3.91	4.14	4.53	4.80	5.10	0.38***
	Matching Firm	2.73	2.70	2.80	3.04	3.32	3.73	4.15	4.50	0.60***
Overall	Buyback Firm	3.75	3.80	3.90	4.04	4.22	4.64	4.90	5.22	0.37***
	Matching Firm	2.84	2.80	2.90	3.14	3.43	3.85	4.24	4.62	0.61***

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif in Median
Panel B: Wilcoxon Test Estimates between Buyback Firm and Matching Firm										
Z1-Low	Difference	0.20	0.24	0.31*	0.32*	0.28	0.31	0.25	0.25	-0.46
		(0.18)	(0.10)	(0.07)	(0.08)	(0.15)	(0.14)	(0.29)	(0.35)	(0.62)
Z1-Med	Difference	1.95***	1.99***	1.92***	2.10***	1.80***	1.70***	1.80***	1.61**	0.02
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.02)	(0.30)
Z1-High	Difference	1.51***	1.71***	1.45***	1.40***	1.10**	1.00*	1.12*	1.24*	-0.26
		(0.00)	(0.00)	(0.00)	(0.01)	(0.03)	(0.07)	(0.07)	(0.07)	(0.69)
Z1	Difference	1.07***	1.18***	1.19***	1.20***	0.98***	0.96***	0.98***	0.95***	-0.60
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.62)
Z2	Difference	1.84***	1.93***	2.05***	1.94***	1.78***	1.85***	1.70***	1.87***	-0.16
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.65)
Z3	Difference	1.47***	1.58***	1.59***	1.46***	1.29***	1.30***	1.27***	1.30***	-0.94
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.53)
Z4	Difference	0.95***	1.02***	0.92***	0.88***	0.81***	0.87***	0.90***	0.84***	-0.31
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.19)
Z5	Difference	0.20***	0.21***	0.22***	0.23***	0.22***	0.22***	0.24***	0.24***	0.05***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Z2~Z5	Difference	0.62***	0.65***	0.66***	0.64***	0.61***	0.63***	0.64***	0.65***	-0.15***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Overall	Difference	0.65***	0.69***	0.70***	0.69***	0.64***	0.66***	0.67***	0.67***	-0.22***
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

Table 18 Employee Cumulative Growth Rate Following Repurchase Announcements

This table reports the mean cumulative growth rate of number of employees across different Z quintile groups. The number of employees is sourced from Compustat Fundamentals Annual. "T+i" (i=±1,±2,±3,±4) denotes the ith fiscal year end after(+)/before(-) the repurchase announcement. Panel A reports the mean cumulative growth rate. The column "T-1~T+1" represents the mean cumulative growth rate from last fiscal year prior to the repurchase announcement to the next fiscal year after the repurchase announcement. Panel B reports the mean difference in cumulative growth rate between buyback firms and matching firms. The symbols ***, **, and * represent significance level of 1%, 5%, and 10%, respectively.

Group	Treatment	Cumulative Growth			
		T-1~T+1	T-1~T+2	T-1~T+3	T-1~T+4
Panel A: Mean Cumulative Growth Rate					
Z1-Low	Buyback Firm	3.60%	12.61%	20.30%	28.07%
	Matching Firm	7.03%	12.05%	17.39%	26.69%
Z1-Med	Buyback Firm	1.48%	5.89%	12.32%	15.34%
	Matching Firm	7.67%	12.92%	19.61%	28.34%
Z1-High	Buyback Firm	4.05%	6.62%	9.91%	17.23%
	Matching Firm	6.11%	11.81%	15.87%	20.95%
Z1	Buyback Firm	3.02%	8.05%	13.68%	19.52%
	Matching Firm	6.92%	12.27%	17.64%	25.17%
Z2	Buyback Firm	2.85%	6.26%	9.68%	13.83%
	Matching Firm	6.75%	11.27%	15.36%	20.35%
Z3	Buyback Firm	2.45%	6.84%	11.12%	15.86%
	Matching Firm	6.59%	12.58%	18.12%	23.30%
Z4	Buyback Firm	5.77%	11.90%	18.29%	23.96%
	Matching Firm	9.33%	16.88%	23.88%	31.89%
Z5	Buyback Firm	10.04%	19.93%	30.25%	37.12%
	Matching Firm	13.97%	25.40%	36.34%	46.90%
Z2~Z5	Buyback Firm	6.53%	13.56%	20.86%	26.70%
	Matching Firm	10.41%	18.90%	26.95%	35.14%
Overall	Buyback Firm	6.18%	13.02%	20.18%	26.03%
	Matching Firm	10.06%	18.25%	26.06%	34.21%
Panel B: Difference between Buyback Firms and Matching Firms					
Z1-Low	Difference	-3.43%	0.57%	2.92%	1.38%
		(-1.61)	(0.16)	(0.64)	(0.24)
Z1-Med	Difference	-6.19%***	-7.03%***	-7.28%**	-13.00%***
		(-3.93)	(-2.90)	(-2.10)	(-3.32)
Z1-High	Difference	-2.06%	-5.19%**	-5.95%*	-3.72%
		(-1.01)	(-1.97)	(-1.68)	(-0.86)
Z1	Difference	-3.90%***	-4.22%***	-3.96%*	-5.65%**
		(-3.53)	(-2.59)	(-1.80)	(-2.12)
Z2	Difference	-3.91%***	-5.00%***	-5.68%***	-6.52%***
		(-5.10)	(-4.25)	(-3.57)	(-3.21)
Z3	Difference	-4.14%***	-5.74%***	-7.00%***	-7.44%***
		(-6.78)	(-5.87)	(-5.40)	(-4.48)
Z4	Difference	-3.56%***	-4.97%***	-5.60%***	-7.93%***
		(-5.87)	(-5.44)	(-4.46)	(-5.06)
Z5	Difference	-3.93%***	-5.47%***	-6.09%***	-9.78%***
		(-7.57)	(-6.50)	(-5.30)	(-7.15)
Z2~Z5	Difference	-3.88%***	-5.34%***	-6.09%***	-8.44%***
		(-12.55)	(-10.88)	(-9.12)	(-10.31)
Overall	Difference	-3.88%***	-5.23%***	-5.88%***	-8.18%***
		(-12.97)	(-11.12)	(-9.20)	(-10.45)

Table 19 SGA / Asset Before and After the Buyback (Selling, General and Administrative Expense)

This table reports the SGA / Asset for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. SGA / Asset is defined as $SGA_{t-3\sim t}/Asset_t$, where t denotes the end quarter of every consecutive four quarters. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1). The panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Operating Performance										
Z1	Buyback	15.43%	14.65%	14.65%	14.30%	14.90%	14.94%	14.89%	14.38%	0.30%
	Matching	18.51%	18.04%	17.78%	17.68%	17.42%	17.75%	17.85%	17.33%	-0.07%
Z2~Z5	Buyback	31.46%	30.86%	30.09%	29.76%	30.24%	30.13%	29.81%	29.37%	-0.47%***
	Matching	31.43%	30.76%	29.64%	29.27%	29.43%	29.00%	28.71%	28.33%	-1.30%***
Overall	Buyback	30.04%	29.41%	28.69%	28.34%	28.83%	28.78%	28.50%	28.10%	-0.40%***
	Matching	30.28%	29.62%	28.56%	28.21%	28.32%	28.00%	27.76%	27.39%	-1.18%***
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	-3.06%***	-3.35%***	-3.09%***	-3.34%***	-2.47%***	-2.77%***	-2.94%***	-2.87%***	
		(-5.42)	(-6.55)	(-6.38)	(-6.45)	(-4.67)	(-4.68)	(-4.37)	(-3.94)	
Z2~Z5	Difference	0.04%	0.10%	0.45%*	0.48%**	0.81%***	1.12%***	1.09%***	1.04%***	
		(0.14)	(0.43)	(1.95)	(2.12)	(3.41)	(4.50)	(4.16)	(3.80)	
Overall	Difference	-0.24%	-0.21%	0.13%	0.13%	0.51%**	0.78%***	0.74%***	0.71%***	
		(-1.01)	(-0.93)	(0.59)	(0.62)	(2.29)	(3.32)	(3.00)	(2.74)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	14.93%	14.12%	14.17%	13.78%	14.00%	14.20%	14.09%	13.76%	0.03%
	Matching	18.27%	17.81%	17.53%	17.31%	17.00%	17.19%	17.49%	17.15%	-0.08%
$Z_{\geq 1.8}$	Buyback	31.30%	30.70%	29.94%	29.61%	30.13%	30.00%	29.68%	29.23%	-0.43%***
	Matching	31.28%	30.62%	29.52%	29.16%	29.31%	28.91%	28.60%	28.20%	-1.28%***
$Z_{<1.8}$	Difference	-3.31%***	-3.64%***	-3.31%***	-3.49%***	-2.95%***	-2.95%***	-3.36%***	-3.29%***	
		(-5.41)	(-6.66)	(-6.50)	(-6.44)	(-5.37)	(-4.86)	(-4.83)	(-4.30)	
$Z_{\geq 1.8}$	Difference	0.02%	0.08%	0.42%*	0.45%**	0.81%***	1.09%***	1.08%***	1.03%***	
		(0.07)	(0.35)	(1.86)	(1.98)	(3.44)	(4.40)	(4.13)	(3.76)	

Table 20 Sale / Asset Before and After the Buyback

This table reports the Sale / Asset for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. Sale / Asset is defined as $Sale_{t-3\sim t}/Asset_t$, where t denotes the end quarter of every consecutive four quarters. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1). The panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Operating Performance										
Z1	Buyback	0.66	0.65	0.64	0.67	0.69	0.68	0.70	0.70	0.04***
	Matching	0.77	0.76	0.75	0.76	0.78	0.78	0.79	0.78	0.03***
Z2~Z5	Buyback	1.31	1.30	1.29	1.27	1.27	1.26	1.25	1.24	-0.05***
	Matching	1.26	1.24	1.21	1.18	1.17	1.17	1.16	1.15	-0.06***
Over-all	Buyback	1.25	1.24	1.22	1.21	1.21	1.20	1.20	1.19	-0.04***
	Matching	1.21	1.19	1.16	1.14	1.14	1.13	1.12	1.12	-0.06***
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	-0.11***	-0.11***	-0.10***	-0.09***	-0.09***	-0.10***	-0.09***	-0.09***	
		(-7.04)	(-7.25)	(-7.99)	(-6.69)	(-5.79)	(-5.71)	(-5.01)	(-4.28)	
Z2~Z5	Difference	0.05***	0.06***	0.08***	0.09***	0.10***	0.09***	0.09***	0.09***	
		(6.63)	(8.29)	(10.31)	(11.72)	(12.61)	(11.51)	(10.56)	(9.81)	
Over-all	Difference	0.04***	0.05***	0.06***	0.07***	0.08***	0.07***	0.07***	0.07***	
		(5.09)	(6.65)	(8.64)	(10.08)	(10.96)	(9.97)	(9.13)	(8.51)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	0.63	0.62	0.60	0.63	0.65	0.65	0.65	0.65	0.03***
	Matching	0.74	0.73	0.72	0.73	0.76	0.76	0.77	0.76	0.03***
$Z_{\geq 1.8}$	Buyback	1.31	1.30	1.28	1.27	1.27	1.25	1.24	1.23	-0.05***
	Matching	1.26	1.23	1.20	1.18	1.17	1.16	1.16	1.15	-0.06***
$Z_{<1.8}$	Difference	-0.11***	-0.12***	-0.11***	-0.11***	-0.11***	-0.11***	-0.12***	-0.11***	
		(-7.10)	(-7.53)	(-8.19)	(-7.12)	(-6.43)	(-6.38)	(-6.30)	(-5.05)	
$Z_{\geq 1.8}$	Difference	0.05***	0.06***	0.08***	0.09***	0.10***	0.09***	0.09***	0.08***	
		(6.49)	(8.19)	(10.21)	(11.65)	(12.57)	(11.49)	(10.64)	(9.78)	

Table 21 ROA Before and After the Event

This table reports the ROA for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. ROA is defined as $(ibq_{t-3\sim t})/(\frac{at_{t-3}+at_t}{2})$, where t denotes the end quarter of every consecutive four quarters, ibq denotes the quarterly income before extraordinary items, and at represents total assets. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1). The panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

Group	Treatment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Operating Performance										
Z1	Buyback	-0.37%	-0.73%	0.36%	2.73%	2.13%	1.17%	1.86%	2.17%	1.22%***
	Matching	-0.98%	-1.61%	-1.25%	-0.43%	-0.90%	-0.53%	-0.27%	0.31%	0.49%***
Z2~Z5	Buyback	6.30%	6.79%	7.37%	7.52%	6.12%	5.60%	5.42%	5.38%	-1.49%***
	Matching	4.16%	4.34%	4.48%	3.80%	2.44%	2.36%	2.67%	2.82%	-1.71%***
Overall	Buyback	5.65%	6.05%	6.67%	7.04%	5.72%	5.18%	5.08%	5.08%	-1.22%***
	Matching	3.66%	3.76%	3.91%	3.38%	2.11%	2.08%	2.40%	2.59%	-1.50%***
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	0.59%	0.87%**	1.60%***	3.16%***	3.02%***	1.67%***	2.10%***	1.84%***	
		(1.37)	(2.33)	(4.90)	(9.37)	(7.73)	(4.29)	(4.86)	(4.24)	
Z2~Z5	Difference	2.13%***	2.45%***	2.89%***	3.72%***	3.68%***	3.25%***	2.74%***	2.56%***	
		(16.16)	(20.27)	(26.75)	(34.62)	(30.28)	(24.56)	(19.87)	(18.05)	
Overall	Difference	1.98%***	2.29%***	2.76%***	3.66%***	3.61%***	3.09%***	2.68%***	2.49%***	
		(15.68)	(19.94)	(26.91)	(35.78)	(31.13)	(24.70)	(20.40)	(18.49)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	-0.42%	-1.16%	-0.27%	2.39%	2.20%	1.09%	1.80%	2.05%	1.58%***
	Matching	-1.00%	-1.95%	-1.65%	-0.58%	-0.76%	-0.55%	-0.30%	0.17%	0.68%***
$Z_{\geq 1.8}$	Buyback	6.21%	6.73%	7.33%	7.49%	6.05%	5.55%	5.37%	5.35%	-1.49%***
	Matching	4.09%	4.29%	4.44%	3.75%	2.38%	2.32%	2.63%	2.80%	-1.70%***
$Z_{<1.8}$	Difference	0.57%	0.79%*	1.38%***	2.96%***	2.96%***	1.61%***	2.06%***	1.85%***	
		(1.21)	(1.94)	(3.86)	(7.85)	(6.97)	(3.74)	(4.38)	(3.92)	
$Z_{\geq 1.8}$	Difference	2.12%***	2.43%***	2.89%***	3.73%***	3.67%***	3.23%***	2.74%***	2.55%***	
		(16.14)	(20.32)	(27.02)	(35.12)	(30.49)	(24.68)	(19.99)	(18.11)	

Table 22 Operating Profit Margin Before Depreciation Before and After the Buyback

This table reports the Operating Profit Margin Before Depreciation for buyback firms and their matching firms across different Z quintile groups and across four years before and after the event. "T+1" denotes one year forward, while "T-1" denotes one year backward. Accounting variables are calculated using Compustat quarterly data, with the quarter in which the event occurs being skipped. The T+1 variable is calculated by utilizing the four consecutive quarters following the event quarter. The variable is defined as $(Oibdpq_{t-3\sim t})/(Sale_{t-3\sim t})$, where t denotes the end quarter of every consecutive four quarters, and $Oibdp$ denotes the quarterly operating profit before depreciation. $Oibdp$ is calculated by $coalesce(oibdpq,\ saleq - xoprq,\ revtq - xoprq)$, where $coalesce$ function means if the first term is missing then taking the second term. $oibdpq$ denotes operating income before depreciation quarterly, $saleq$ sale quarterly, $xoprq$ operating expense quarterly, $revtq$ revenue quarterly. "Dif" column reports the mean difference between the average post-announcements performance (T+1~T+4) and the average prior-announcements performance (T-4~T-1).). The panel B reports the difference between buyback firms and matching firms in the same group and time period. Panel C shows the results of categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. All variables are winsorized at 5% and 95% level. *, **, *** represents 10%, 5%, and 1% significance level respectively. (Note: we winsorize at 5% and 95% compared to 1% and 99% in other tables, the reason for this is due to the very long tails of the distribution making for a noisy table.)

Group	Treat-ment	T-4	T-3	T-2	T-1	T+1	T+2	T+3	T+4	Dif
Panel A: Operating Performance										
Z1	Buyback	17.49%	17.40%	18.34%	20.04%	19.29%	18.59%	18.80%	18.78%	0.67%**
	Matching	14.79%	14.71%	14.66%	15.65%	15.60%	15.44%	15.68%	15.89%	0.71%***
Z2~Z5	Buyback	14.14%	14.54%	15.10%	15.35%	14.57%	14.32%	14.30%	14.27%	-0.40%***
	Matching	12.34%	12.55%	12.86%	12.75%	12.17%	12.24%	12.57%	12.75%	-0.30%***
Overall	Buyback	14.46%	14.82%	15.42%	15.81%	15.03%	14.73%	14.72%	14.68%	-0.29%***
	Matching	12.57%	12.76%	13.03%	13.04%	12.50%	12.55%	12.87%	13.04%	-0.20%***
Panel B: Difference between Buyback Firm and Matching Firm										
Z1	Difference	2.68%***	2.68%***	3.65%***	4.38%***	3.68%***	3.12%***	3.10%***	2.88%***	
		(6.07)	(6.88)	(10.19)	(12.42)	(9.58)	(7.33)	(6.64)	(5.77)	
Z2~Z5	Difference	1.80%***	2.00%***	2.24%***	2.60%***	2.40%***	2.09%***	1.73%***	1.53%***	
		(14.93)	(17.27)	(19.99)	(23.17)	(20.53)	(16.80)	(13.50)	(11.37)	
Overall	Difference	1.88%***	2.07%***	2.38%***	2.78%***	2.53%***	2.18%***	1.86%***	1.65%***	
		(16.11)	(18.58)	(22.21)	(25.92)	(22.54)	(18.29)	(14.97)	(12.66)	
Panel C: Categorization with Z < 1.8 and Z ≥ 1.8										
$Z_{<1.8}$	Buyback	18.00%	17.75%	18.68%	20.57%	19.98%	19.22%	19.29%	19.42%	0.82%***
	Matching	15.07%	14.87%	14.74%	15.92%	15.96%	15.75%	15.84%	16.00%	0.72%***
$Z_{\geq 1.8}$	Buyback	14.13%	14.55%	15.11%	15.36%	14.57%	14.32%	14.32%	14.28%	-0.40%***
	Matching	12.35%	12.56%	12.87%	12.76%	12.18%	12.26%	12.60%	12.78%	-0.29%***
$Z_{<1.8}$	Difference	2.91%***	2.87%***	3.93%***	4.63%***	4.01%***	3.45%***	3.42%***	3.40%***	
		(6.21)	(6.95)	(10.28)	(12.14)	(9.75)	(7.56)	(6.74)	(6.39)	
$Z_{\geq 1.8}$	Difference	1.79%***	1.99%***	2.24%***	2.60%***	2.39%***	2.07%***	1.72%***	1.50%***	
		(14.90)	(17.27)	(20.04)	(23.35)	(20.53)	(16.77)	(13.51)	(11.22)	

Table 23 Probability of SEOs Following Buyback Announcement

This table reports the probability of observing share issuance (SEOs) after the buyback event over a 48-month period. $Z_{<1.8}$ and $Z_{\geq 1.8}$ refers to an alternative categorization of sample based on a Z-Score threshold of 1.8.

Z Quintile	Group	Months					
		3	6	12	24	36	48
Full Sample	Buyback Firms	0.32%	0.70%	1.65%	3.68%	5.72%	7.40%
	Matching Firms	4.96%	9.77%	17.05%	29.61%	37.66%	43.52%
Z1-Low	Buyback Firms	0.82%	1.23%	4.51%	7.79%	10.66%	11.89%
	Matching Firms	10.25%	17.62%	25.82%	41.80%	52.05%	59.84%
Z1-Medium	Buyback Firms	1.36%	3.05%	4.41%	8.81%	12.20%	14.24%
	Matching Firms	8.14%	14.24%	22.71%	38.31%	46.10%	52.54%
Z1-High	Buyback Firms	0.33%	1.34%	2.34%	6.02%	8.70%	11.37%
	Matching Firms	9.36%	15.72%	25.08%	35.12%	45.15%	51.17%
Z1	Buyback Firms	0.84%	1.91%	3.70%	7.52%	10.50%	12.53%
	Matching Firms	9.19%	15.75%	24.46%	38.19%	47.49%	54.18%
Z2	Buyback Firms	0.72%	1.36%	2.81%	5.61%	9.23%	11.58%
	Matching Firms	6.24%	12.40%	20.81%	33.85%	40.63%	47.42%
Z3	Buyback Firms	0.34%	0.55%	1.38%	3.44%	5.58%	7.30%
	Matching Firms	5.79%	9.92%	15.84%	30.30%	38.43%	45.39%
Z4	Buyback Firms	0.23%	0.63%	1.37%	2.80%	4.40%	6.00%
	Matching Firms	3.43%	7.03%	14.47%	25.16%	33.50%	38.82%
Z5	Buyback Firms	0.09%	0.28%	0.99%	2.60%	4.05%	5.44%
	Matching Firms	3.89%	8.75%	15.79%	28.03%	36.00%	41.13%
Z2~Z5	Buyback Firms	0.27%	0.57%	1.42%	3.25%	5.18%	6.83%
	Matching Firms	4.49%	9.11%	16.23%	28.65%	36.57%	42.34%
$Z_{<1.8}$	Buyback Firms	1.10%	2.20%	4.26%	7.83%	10.99%	12.77%
	Matching Firms	9.89%	16.48%	25.41%	38.74%	46.98%	53.43%
$Z_{\geq 1.8}$	Buyback Firms	0.25%	0.56%	1.40%	3.28%	5.21%	6.89%
	Matching Firms	4.50%	9.13%	16.26%	28.74%	36.77%	42.58%

Appendix

Table A1 BHAR across Different Z Groups and Time Periods (1990 ~ 1999)

This table reports buy-and-hold abnormal returns across different quintile groups of Z and various holding periods. The data pertains to instances where buybacks took place between 1990 and 1999. Z1 is equally divided into three subgroups based on Z-Score: low, medium, and high. If a control firm announces a buyback or is delisted during a specified calculation period, such as a 6-month return, its missing values are substituted by the market value-weighted return (VWRETD). That firm will be excluded from the portfolio in the next holding period. Z2~Z5 represents the aggregate of Z quintile group 2 to 5. Mean Dif ($Z1 - Z2{\sim}Z5$) denotes the mean difference of BHAR between Z1 and the aggregate of Z2 to Z5. Panel A delineates the categories based on Z-Quintile distinctions. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. Mean Dif ($Z_{<1.8} - Z_{\geq 1.8}$) denotes the mean difference of BHAR between groups with Z-Score below 1.8 and those 1.8 or above. Before portfolio formation, returns are winsorized at the 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Buy-and-Hold Abnormal Return					
	3-month	**6-month**	**1-year**	**2-year**	**3-year**	**4-year**
Panel A: Categorization using Z-Quintile						
	0.90%**	1.20%**	0.57%	0.05%	0.50%	9.65%***
Full Sample	(2.31)	(2.05)	(0.55)	(0.02)	(0.21)	(3.12)
	3,368	3,362	3,319	3,211	2,988	2,776
	6.02%**	7.31%*	14.63%**	23.16%**	28.81%	37.49%
Z1-Low	(2.15)	(1.88)	(2.18)	(2.18)	(1.60)	(1.48)
	90	89	89	83	74	63
	-1.09%	-0.23%	-4.58%	-4.39%	-5.79%	-2.09%
Z1-Medium	(-0.70)	(-0.09)	(-1.15)	(-0.62)	(-0.58)	(-0.14)
	118	118	116	113	106	98
	-1.59%	-4.01%	-6.19%	-6.89%	5.62%	33.58%
Z1-High	(-0.71)	(-1.42)	(-1.33)	(-1.05)	(0.52)	(1.18)
	92	91	91	88	79	76
	0.83%	0.80%	0.65%	2.82%	7.13%	19.25%
Z1	(0.66)	(0.46)	(0.22)	(0.60)	(0.97)	(1.51)
	300	298	296	284	259	237
	1.02%	1.21%	1.06%	1.64%	-1.37%	2.53%
Z2	(1.07)	(0.81)	(0.42)	(0.32)	(-0.25)	(0.38)
	395	393	386	366	337	318
	1.64%**	3.11%***	1.77%	3.14%	-0.64%	6.36%
Z3	(2.12)	(2.59)	(0.85)	(0.87)	(-0.14)	(1.19)
	593	593	581	563	517	465
	0.30%	-0.06%	2.77%	4.52%	9.62%**	16.27%***
Z4	(0.40)	(-0.05)	(1.26)	(1.27)	(2.04)	(2.73)
	737	736	731	710	675	637
	0.86%	1.15%	-1.49%	-4.94%	-5.08%	7.00%
Z5	(1.21)	(1.07)	(-0.80)	(-1.15)	(-1.14)	(1.25)
	1,343	1,342	1,325	1,288	1,200	1,119
	0.90%**	1.24%**	0.55%	-0.20%	-0.13%	8.68%***
Z2~Z5	(2.20)	(2.00)	(0.50)	(-0.09)	(-0.05)	(2.75)
	3,068	3,064	3,023	2,927	2,729	2,539
Mean Dif	-0.10%	-0.46%	0.03%	2.58%	7.11%	10.71%
($Z1 - Z2{\sim}Z5$)	(-0.07)	(-0.25)	(0.01)	(0.49)	(0.91)	(0.81)
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8						
	2.16%	2.78%	2.63%	5.74%	7.47%	9.12%
$Z_{<1.8}$	(1.48)	(1.30)	(0.73)	(0.95)	(0.80)	(0.71)
	219	218	216	206	192	174
Mean Dif	1.34%	1.65%	2.30%	5.88%	7.51%	-0.41%
($Z_{<1.8} - Z_{\geq 1.8}$)	(0.88)	(0.74)	(0.61)	(0.92)	(0.78)	(-0.03)

Table A2 BHAR across Different Z Groups and Time Periods (2000 ~ 2009)

This table reports buy-and-hold abnormal returns across different quintile groups of Z and various holding periods. The data pertains to instances where buybacks took place between 2000 and 2009. Z1 is equally divided into three subgroups based on Z-Score: low, medium, and high. If a control firm announces a buyback or is delisted during a specified calculation period, such as a 6-month return, its missing values are substituted by the market value-weighted return (VWRETD). That firm will be excluded from the portfolio in the next holding period. Z2~Z5 represents the aggregate of Z quintile group 2 to 5. Mean Dif ($Z1 - Z2{\sim}Z5$) denotes the mean difference of BHAR between Z1 and the aggregate of Z2 to Z5. Panel A delineates the categories based on Z-Quintile distinctions. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. Mean Dif ($Z_{<1.8} - Z_{\geq 1.8}$) denotes the mean difference of BHAR between groups with Z-Score below 1.8 and those 1.8 or above. Before portfolio formation, returns are winsorized at the 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Buy-and-Hold Abnormal Return					
	3-month	**6-month**	**1-year**	**2-year**	**3-year**	**4-year**
Panel A: Categorization using Z-Quintile						
	1.25%***	1.59%***	3.78%***	5.14%***	6.74%***	10.17%***
Full Sample	(3.08)	(2.73)	(4.16)	(3.42)	(3.39)	(3.68)
	2,443	2,440	2,427	2,358	2,234	2,131
	1.48%	-0.33%	6.07%	7.18%	23.22%*	35.80%*
Z1-Low	(0.58)	(-0.10)	(1.17)	(0.84)	(1.80)	(1.81)
	96	96	95	92	80	73
	5.31%*	1.76%	6.25%	10.82%	26.91%**	51.96%*
Z1-Medium	(1.94)	(0.50)	(1.15)	(1.26)	(2.06)	(1.73)
	66	66	65	64	60	57
	2.83%*	5.05%**	8.89%**	13.77%**	16.74%	24.60%
Z1-High	(1.72)	(2.22)	(2.40)	(2.09)	(1.63)	(1.63)
	80	80	80	79	70	66
	3.00%**	2.12%	7.14%**	10.75%**	22.36%***	36.84%***
Z1	(2.20)	(1.18)	(2.59)	(2.34)	(3.21)	(2.99)
	242	242	240	235	210	196
	-0.04%	-0.53%	0.36%	-0.69%	-3.31%	-0.37%
Z2	(-0.03)	(-0.35)	(0.15)	(-0.19)	(-0.66)	(-0.06)
	299	298	296	288	275	260
	1.52%	1.21%	4.92%*	3.25%	3.91%	4.50%
Z3	(1.46)	(0.86)	(1.80)	(0.85)	(0.80)	(0.73)
	378	378	374	364	345	332
	1.16%	1.63%	3.65%*	4.56%	3.63%	12.78%**
Z4	(1.41)	(1.34)	(1.91)	(1.42)	(0.98)	(2.07)
	460	460	458	440	415	396
	1.15%*	2.26%**	3.61%***	6.28%**	8.47%***	8.30%**
Z5	(1.81)	(2.37)	(2.68)	(2.57)	(2.60)	(2.02)
	1,064	1,062	1,059	1,031	989	947
	1.06%**	1.53%**	3.40%***	4.46%***	5.02%**	7.28%***
Z2~Z5	(2.49)	(2.49)	(3.53)	(2.81)	(2.43)	(2.64)
	2,201	2,198	2,187	2,123	2,024	1,935
Mean Dif	1.93%	0.56%	3.88%	6.89%	18.37%**	31.54%**
($Z1 - Z2{\sim}Z5$)	(1.34)	(0.30)	(1.35)	(1.44)	(2.56)	(2.50)
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8						
	3.09%*	1.42%	5.90%*	7.91%	20.74%**	36.55%**
$Z_{<1.8}$	(1.87)	(0.65)	(1.75)	(1.39)	(2.51)	(2.47)
	193	193	191	186	170	159
Mean Dif	1.99%	-0.05%	2.67%	4.17%	16.89%**	31.19%**
($Z_{<1.8} - Z_{\geq 1.8}$)	(1.17)	(-0.02)	(0.79)	(0.72)	(2.02)	(2.09)

Table A3 BHAR across Different Z Groups and Time Periods (2010 ~ 2021)

This table reports buy-and-hold abnormal returns across different quintile groups of Z and various holding periods. The data pertains to instances where buybacks took place between 2010 and 2021. Z1 is equally divided into three subgroups based on Z-Score: low, medium, and high. If a control firm announces a buyback or is delisted during a specified calculation period, such as a 6-month return, its missing values are substituted by the market value-weighted return (VWRETD). That firm will be excluded from the portfolio in the next holding period. Z2~Z5 represents the aggregate of Z quintile group 2 to 5. Mean Dif ($Z1 - Z2{\sim}Z5$) denotes the mean difference of BHAR between Z1 and the aggregate of Z2 to Z5. Panel A delineates the categories based on Z-Quintile distinctions. Panel B shows the categorization based on Z-Scores, specifically those below 1.8 and those 1.8 or above. Mean Dif ($Z_{<1.8} - Z_{\geq 1.8}$) denotes the mean difference of BHAR between groups with Z-Score below 1.8 and those 1.8 or above. Before portfolio formation, returns are winsorized at the 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Buy-and-Hold Abnormal Return					
	3-month	**6-month**	**1-year**	**2-year**	**3-year**	**4-year**
Panel A: Categorization using Z-Quintile						
	1.58%***	2.50%***	4.56%***	6.01%***	8.89%***	12.16%***
Full Sample	(5.19)	(5.52)	(6.46)	(4.92)	(5.20)	(5.18)
	2,566	2,549	2,506	2,281	2,060	1,807
	3.16%	3.06%	2.04%	-8.99%	-9.65%	-5.65%
Z1-Low	(1.42)	(0.77)	(0.33)	(-1.12)	(-0.64)	(-0.36)
	58	58	55	51	42	34
	2.05%	0.99%	2.61%	2.91%	6.62%	16.00%
Z1-Medium	(1.13)	(0.39)	(0.64)	(0.45)	(0.65)	(1.27)
	110	110	108	99	83	73
	1.58%	1.60%	4.54%	5.84%	26.03%**	36.43%***
Z1-High	(1.25)	(0.83)	(1.50)	(1.02)	(2.56)	(2.70)
	127	124	122	111	96	80
	2.11%**	1.68%	3.33%	1.54%	12.33%*	21.48%***
Z1	(2.17)	(1.14)	(1.43)	(0.40)	(1.89)	(2.62)
	295	292	285	261	221	187
	1.36%*	2.65%**	4.56%**	3.47%	5.76%	15.48%***
Z2	(1.96)	(2.26)	(2.57)	(1.17)	(1.50)	(2.86)
	411	407	397	366	326	277
	1.70%**	2.49%**	6.27%***	7.78%***	13.46%***	11.61%**
Z3	(2.49)	(2.51)	(4.09)	(2.99)	(3.30)	(2.46)
	480	477	467	423	382	337
	1.91%***	3.45%***	5.15%***	10.21%***	10.36%***	13.65%***
Z4	(2.75)	(3.62)	(3.22)	(3.43)	(3.07)	(2.75)
	552	549	541	485	445	396
	1.19%**	2.12%***	3.57%***	4.91%**	5.45%*	7.20%*
Z5	(2.28)	(2.70)	(3.02)	(2.42)	(1.81)	(1.65)
	828	823	814	745	686	608
	1.52%***	2.62%***	4.71%***	6.57%***	8.40%***	11.15%***
Z2~Z5	(4.77)	(5.53)	(6.38)	(5.10)	(4.76)	(4.56)
	2,271	2,257	2,221	2,020	1,839	1,620
Mean Dif	0.48%	-1.03%	-1.39%	-4.61%	5.28%	10.14%
($Z1 - Z2{\sim}Z5$)	(0.48)	(-0.68)	(-0.58)	(-1.17)	(0.83)	(1.22)
Panel B: Categorization with Z < 1.8 and Z ≥ 1.8						
	2.38%**	2.13%	3.01%	0.37%	9.42%	17.08%**
$Z_{<1.8}$	(2.55)	(1.43)	(1.29)	(0.10)	(1.51)	(2.15)
	315	311	299	266	225	186
Mean Dif	0.79%	-0.44%	-1.48%	-5.64%	2.35%	5.67%
($Z_{<1.8} - Z_{\geq 1.8}$)	(0.82)	(-0.29)	(-0.62)	(-1.41)	(0.38)	(0.70)

Table A4 Changes in Median Shares after Buyback Announcement by Quarter

This table presents the changes in median shares following a buyback announcement over a 16-quarter period. It reports the median percentage change in outstanding shares at the end of each quarter relative to the shares on the day of the announcement are reported. Outstanding shares have been adjusted using CRSP cumulative factor to adjust shares (*cfac-shr*). $Z_{<1.8}$ and $Z_{\geq 1.8}$ refers to an alternative categorization of sample based on a Z-Score threshold of 1.8.

Z Quintile	Group	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Full Sample	Buyback	-0.23%	-0.96%	-1.44%	-1.86%	-2.12%	-2.35%	-2.53%	-2.75%	-2.83%	-2.96%	-3.10%	-3.28%	-3.33%	-3.48%	-3.53%	-3.58%
	Matching	0.09%	0.28%	0.46%	0.65%	0.84%	1.04%	1.26%	1.46%	1.67%	1.86%	2.06%	2.27%	2.48%	2.68%	2.86%	3.10%
Z1-Low	Buyback	-0.14%	-0.73%	-0.75%	-0.60%	-0.39%	-0.46%	-0.28%	-0.15%	0.30%	-0.01%	0.05%	-0.29%	-0.15%	0.24%	1.14%	1.16%
	Matching	0.11%	0.38%	0.62%	0.91%	1.28%	1.59%	2.06%	2.59%	3.19%	3.64%	4.40%	5.24%	5.98%	7.25%	9.33%	10.48%
Z1-Medium	Buyback	-0.13%	-0.97%	-1.63%	-1.95%	-2.24%	-2.36%	-2.47%	-2.93%	-2.97%	-3.15%	-3.32%	-3.01%	-2.82%	-2.96%	-2.85%	-2.46%
	Matching	0.08%	0.28%	0.49%	0.69%	1.02%	1.36%	1.68%	2.03%	2.36%	2.74%	3.32%	3.82%	4.39%	5.05%	5.77%	6.02%
Z1-High	Buyback	-0.25%	-1.08%	-1.60%	-1.99%	-2.08%	-2.32%	-2.23%	-2.46%	-2.49%	-2.40%	-2.62%	-3.31%	-2.71%	-2.54%	-2.39%	-2.06%
	Matching	0.10%	0.31%	0.48%	0.69%	0.85%	1.04%	1.28%	1.46%	1.80%	1.98%	2.22%	2.65%	3.00%	3.56%	3.95%	4.33%
Z1	Buyback	-0.18%	-0.95%	-1.27%	-1.55%	-1.69%	-1.92%	-1.93%	-2.18%	-2.02%	-1.88%	-1.87%	-2.05%	-2.28%	-2.34%	-1.70%	-1.14%
	Matching	0.09%	0.31%	0.53%	0.75%	1.03%	1.27%	1.60%	1.89%	2.28%	2.63%	3.18%	3.66%	4.17%	4.81%	5.48%	6.03%
Z2	Buyback	-0.23%	-0.98%	-1.46%	-2.05%	-2.31%	-2.44%	-2.57%	-2.78%	-2.87%	-2.96%	-3.08%	-3.30%	-3.34%	-3.32%	-3.30%	-3.57%
	Matching	0.08%	0.27%	0.47%	0.68%	0.85%	1.06%	1.25%	1.50%	1.70%	1.88%	2.18%	2.40%	2.63%	2.79%	3.18%	3.38%
Z3	Buyback	-0.21%	-1.05%	-1.65%	-2.24%	-2.57%	-2.84%	-2.92%	-3.25%	-3.31%	-3.39%	-3.38%	-3.52%	-3.44%	-3.44%	-3.19%	-3.14%
	Matching	0.07%	0.24%	0.40%	0.56%	0.71%	0.88%	1.09%	1.30%	1.51%	1.69%	1.89%	2.08%	2.26%	2.46%	2.61%	2.80%
Z4	Buyback	-0.34%	-1.16%	-1.67%	-2.06%	-2.30%	-2.53%	-2.88%	-3.02%	-3.24%	-3.43%	-3.53%	-3.70%	-3.86%	-4.08%	-4.12%	-4.12%
	Matching	0.06%	0.23%	0.38%	0.52%	0.65%	0.82%	0.96%	1.10%	1.23%	1.37%	1.53%	1.67%	1.81%	1.96%	2.11%	2.27%
Z5	Buyback	-0.20%	-0.81%	-1.26%	-1.66%	-1.88%	-2.05%	-2.24%	-2.50%	-2.59%	-2.73%	-2.97%	-3.17%	-3.23%	-3.48%	-3.67%	-3.84%
	Matching	0.11%	0.32%	0.53%	0.76%	0.97%	1.20%	1.43%	1.65%	1.86%	2.04%	2.24%	2.42%	2.64%	2.80%	3.02%	3.24%
Z2~Z5	Buyback	-0.23%	-0.96%	-1.46%	-1.87%	-2.16%	-2.39%	-2.58%	-2.81%	-2.91%	-3.05%	-3.23%	-3.39%	-3.44%	-3.62%	-3.68%	-3.74%
	Matching	0.08%	0.27%	0.46%	0.64%	0.82%	1.02%	1.22%	1.41%	1.62%	1.79%	1.97%	2.15%	2.35%	2.53%	2.69%	2.88%
$Z_{<1.8}$	Buyback	-0.19%	-0.96%	-1.30%	-1.65%	-1.74%	-1.99%	-2.21%	-2.34%	-2.22%	-1.95%	-1.99%	-2.37%	-2.43%	-2.53%	-2.35%	-2.07%
	Matching	0.09%	0.31%	0.51%	0.71%	1.01%	1.28%	1.60%	1.90%	2.27%	2.59%	3.10%	3.51%	4.00%	4.62%	5.33%	5.77%
$Z_{\geq 1.8}$	Buyback	-0.23%	-0.96%	-1.46%	-1.87%	-2.16%	-2.37%	-2.56%	-2.79%	-2.89%	-3.04%	-3.19%	-3.38%	-3.42%	-3.58%	-3.63%	-3.69%
	Matching	0.09%	0.28%	0.46%	0.65%	0.83%	1.03%	1.22%	1.42%	1.63%	1.80%	1.99%	2.17%	2.39%	2.56%	2.72%	2.93%

Table A5 Matching Performance Including ICR

This table presents the matching performance by adding ICR. Variable Size denotes the log of market capitalization (in million), variable BM stands for the book-to-market ratio, and variable prior return is the raw returns in the six months prior to firms repurchase announcement, ending five days before the announcement day. ICR_MA3 is three-year moving average of ICR (interest rate coverage ratio). To assess the quality of this matching, we compute the average of the variables for the five matched firms for each repurchasing firm. "N" represents the number of 1-to-5 matching pairs. "B" represents buyback firms while "M" represents matching firms. The *t*-stats are reported in parentheses.

	Full Sample (N=6,568)		
Variable	**Mean(B)**	**Mean(M)**	**Dif**
Size	7.22	6.82	0.40***
			(12.81)
B/M	0.51	0.54	-0.03***
			(-4.96)
Prior Return	-0.01	0.00	-0.01**
			(-2.21)
Z-Score	4.99	4.97	0.01
			(0.18)
ICR_MA3	43.40	37.45	5.95***
			(3.14)
FF12 Industry	Perfectly Controlled		

Table A6 Five-Day Abnormal Returns Following Repurchase Announcements Over Time

This table reports the 5-day abnormal return of repurchase announcements over different time periods. The 5-day time window includes two days before, two days after, and the announcement day. The table provides the abnormal returns of the repurchasing firms over their matching firms along with their t-stats and the number of observations. "Zombie" is defined as firms classified in Z1 group and with a three-year moving average interest coverage ratio less than one. "Viable" is all firms other than "Zombie". ***, **, and * indicate that abnormal returns are significant at the 1%, 5%, and 10% significance levels, respectively.

	Full Sample	**Different Time Periods**				
		1990~1999	**2000~2004**	**2005~2009**	**2010~2014**	**2015~2021**
Zombie	2.20%**	1.91%	4.14%	3.59%**	-3.19%	2.24%
	(2.37)	(1.34)	(1.33)	(2.36)	(-0.77)	(0.93)
	154	60	16	36	12	30
Viable	1.59%***	1.84%***	1.63%***	1.83%***	0.64%***	1.72%***
	(15.40)	(10.02)	(4.99)	(7.69)	(3.15)	(7.23)
	6,414	2,427	704	1,119	1,118	1,046
Overall	0.61%	0.06%	2.51%	1.76%	-3.83%	0.52%
	(0.66)	(0.04)	(0.80)	(1.15)	(-0.92)	(0.21)
Mean Difference (Z - V)	1.60%***	1.84%***	1.69%***	1.88%***	0.60%***	1.74%***
	(15.55)	(10.09)	(5.16)	(8.01)	(2.92)	(7.21)

Table A7 BHAR across Different Time Periods

This table reports buy-and-hold abnormal returns across various holding periods. “Zombie” is defined as firms classified in Z1 group and with a three-year moving average interest coverage ratio less than one. “Viable” is all firms other than “Zombie”. If a control firm announces a buyback or is delisted during a specified calculation period, such as a 6-month return, its missing values are substituted by the market value-weighted return (VWRETD). That firm will be excluded from the portfolio in the next holding period. Should there be missing values for the 'treat' firm during a calculation period, for instance, a 6-month return, these missing values are replaced by market returns. In subsequent return calculations, such as a 12-month return, both this 'treat' firm and its corresponding control firms are excluded from the sample. Observations nearing the end of the sample period are omitted if their projected return timeframe extends beyond the sample's end date. Mean Difference (Z - V) denotes the mean difference of BHAR between zombie firms and other firms in the sample. Before portfolio formation, returns are winsorized at the 1% and 99% level. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Buy-and-Hold Abnormal Return					
	3-month	**6-month**	**1-year**	**2-year**	**3-year**	**4-year**
Zombie	3.99%*	2.29%	-0.75%	1.82%	11.36%	30.39%*
	(1.84)	(0.80)	(-0.18)	(0.25)	(1.03)	(1.71)
	154	154	152	142	122	109
Viable	1.21%***	1.68%***	2.96%***	3.37%***	3.64%***	7.63%***
	(5.32)	(5.02)	(5.36)	(3.46)	(2.82)	(4.25)
	6,413	6,404	6,357	6,074	5,659	5,229
Full Sample	1.27%***	1.71%***	2.91%***	3.38%***	3.84%***	8.11%***
	(5.61)	(5.12)	(5.29)	(3.49)	(2.99)	(4.51)
	6,567	6,558	6,509	6,216	5,781	5,338
Mean Difference (Z – V)	2.90%	1.42%	-2.13%	1.34%	10.56%	24.79%
	(1.42)	(0.51)	(-0.51)	(0.19)	(0.99)	(1.41)

Table A8 Fama-French IRATS

This table reports IRATS alphas across various holding periods. For every event month, denoted as j, where j=0 represents the month when the open market repurchase is announced, a cross-sectional regression is conducted. The regression involves analyzing the monthly excess returns of buyback firms in the corresponding calendar month, t, for event month j, over the FF5-factors for the same month. The resulting alpha j represents the abnormal returns for each event month j, within a specified time period of (+1, +12). The intercepts obtained from these alpha j values are then summed up to derive the cumulative abnormal return (CAR) figures. The standard error for a given event window is determined by taking the square root of the sum of the squares of the monthly standard errors. "Zombie" is defined as firms classified in Z1 group and with a three-year moving average interest coverage ratio less than one. "Viable" is all firms other than "Zombie". Mean Difference (Z - V) denotes the mean difference of alpha j between zombie firms and other firms in the sample. *, **, *** represents 10%, 5%, and 1% significance level respectively.

	Months			
	(+1, +12)	**(+1, +24)**	**(+1, +36)**	**(+1, +48)**
Zombie	6.36%	12.83%	25.63%**	38.71%***
	(1.01)	(1.58)	(2.53)	(3.40)
Viable	1.85%***	5.72%***	8.35%***	11.59%***
	(3.67)	(7.40)	(8.69)	(10.18)
Full	1.85%***	5.71%***	8.48%***	11.90%***
	(3.66)	(7.39)	(8.83)	(10.48)
Mean Difference	0.38%	0.30%	0.48%*	0.57%**
Z - V	(0.79)	(1.07)	(1.74)	(2.46)