Employee Compensation Still Impacts Payout Policy

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Abstract

Employee compensation may impact payout policy by (i) incentivizing managers with non-dividend-protected options to favor repurchases over dividends and (ii) diluting earnings, which firms can neutralize through share repurchases. Both the dividend-protection and dilution channels imply a positive relation between stock options and repurchases. Yet, recent studies and trends suggest repurchases do not decline when option usage falls around mandatory option expensing, casting doubt upon a causal relation between equity compensation and payout. We examine this relation in light of *the shift from options to restricted stock*. Our results strongly support a positive relation between compensation and share repurchases via the dilution channel; dividend protection has no first-order effect on payout. Difference-in-differences analyses using a shock to compensation around mandatory option expensing and an instrumental variable approach suggest that the relation between dilution and payout is likely causal. Further, as the dilution channel predicts, equity compensation positively relates to repurchase frequency and timing.

Option compensation may influence payout decisions through two non-mutually exclusive channels. First, options may incentivize managers to repurchase rather than pay dividends because dividends decrease the value of non-dividend-protected options (Fenn and Liang, 2001; Kahle, 2002). Second, firms may repurchase to offset earnings per share (EPS) or ownership dilution from employee stock options (Kahle, 2002; Bens, Nagar, Skinner, and Wong, 2003). Three-quarters of managers report that EPS management is a principle driver of payout policy and two-thirds state that dilution avoidance is important (Brav, Graham, Harvey, and Michaely, 2005). Both the dividend protection and dilution channels predict that repurchases will increase as options usage increases, and prior work confirms a positive relation.

Trends in stock-based compensation and payout policy indicate that share repurchases have increased in popularity while the use of employee stock options has declined, casting doubt upon the previously documented positive relation between options and share repurchases. The decline in option-based compensation is clear in Figure 1, which plots average stock-based compensation from 1994 to 2012 using hand-collected data on all employees, including both executives and rank and file. Option grants grow from 1.81% of total shares outstanding in 1994 to a peak of 2.99% in 2000, before falling to 0.64% in 2012. Meanwhile, Figure 2 shows that, although dividend yields remain relatively stable in our sample, share repurchases grow substantially, almost tripling from 1.01% of market capitalization in 1994 to 2.79% in 2012.[1] Moreover, Ferri and Li (2020) and Canil (2017) find no evidence that reductions in option-based executive compensation following FAS 123R, which requires firms to expense options at fair market value, result in increases in dividends or decreases in repurchases. They conclude that their findings are inconsistent with a causal relation between options and payout policy.

[Figure 1 here]

[Figure 2 here]

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[1] Although firms in our sample tend to have high repurchase and dividend yields, these trends also hold for the full sample of Compustat firms: The correlation coefficients of the time trends in our sample and in the full population of firms are 0.95 for both repurchase and dividend yields.

We reconcile these seemingly inconsistent trends with prior evidence by examining a potential missing link: restricted stock. Many firms replace option grants with restricted stock around the adoption of FAS 123R (Carter, Lynch, and Tuna, 2007; Hayes, Lemmon, and Qiu, 2012). Figure 1 shows that restricted stock grants hover between 0.04% and 0.17% of shares outstanding between 1994 and 2004, before increasing to 0.63% by 2012. Though the exact conversion rate is unobservable and likely varies across firms, anecdotal evidence suggests companies substitute restricted stock for options at a ratio of one share for every 3-4 options.[2] Because restricted stock is generally dividend-protected, it should be unrelated to payout decisions if dividend protection is the primary channel through which employee compensation relates to payout policy. In contrast, if *dilution* primarily motivates repurchases, then restricted stock should positively impact repurchase levels. Hence, it may be that repurchases do not decline with stock options because many firms replace options with restricted stock.[3] The impressive growth in restricted stock following FAS 123R coupled with its dilutive impact implies that incorporating restricted stock into our analyses is necessary to identify the channels through which compensation affects payout policy.

To analyze the dilution and dividend protection channels, we hand-collect data on options and restricted stock grants to ***all*** employees. This unique dataset is a substantial improvement over databases such as Execucomp or Incentive Lab, which cover only executive compensation, or Compustat, which provides sparse options coverage prior to 2004 and no restricted stock data during our sample period. Executive options, on average, comprise only one-quarter of all options in our sample, but this ratio varies substantially across firms, from 0.90% at the 10th percentile to 53.60% at the 90th percentile. Because stock-based compensation is dilutive regardless of whether it is given to executive or non-executive employees, collecting this data for all employees is essential to properly test the dilution channel.

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[2] Ruth Simon, The Guide to Restricted Stock, *The Wall Street Journal*, July 10, 2003.
[3] Not all stock-based compensation is dilutive because some grants are settled in cash. Because firms do not report settlement conditions for all employees, these observations may be included in our sample, which biases us against finding evidence consistent with the dilution channel. However, ISS reports that only 0.02% (2.62%) of option grants (restricted stock grants) in their sample are paid in cash. Phantom stock and stock appreciation rights (SARs), which are non-dilutive, cash-based stock awards are not included in our sample.

Our initial tests regress repurchases on equity compensation variables, standard controls, and firm and year fixed effects. The dividend protection channel predicts that only firms with high options usage—in particular options granted to *executives*, the decision makers of the firm—should favor repurchases over dividends. If dilution motivates repurchases, both options and restricted stock should positively impact repurchases. We find that total options outstanding and options exercised are positively related to repurchase, as both channels predict. Although executive options have an incremental effect on repurchases early in our sample, we find no evidence in recent years that executive options incrementally affect the dividend/repurchase choice, indicating that dividend protection no longer has a first-order effect on payout. These results suggest that as option grants decrease and thus have a smaller impact on executive wealth, the costs associated with altering payout policy exceed executives' benefits of protecting their options' value. As only the dilution channel predicts, restricted stock is positively related to repurchases. Further, the magnitudes of the effects of options and restricted stock on repurchases increases in recent years; this increase is consistent with dilution becoming a stronger motive for repurchases, perhaps due to companies learning over time how to counter dilution with repurchases or to stock-based compensation culminating to a "tipping point" above which companies can no longer ignore its effect on EPS and ownership dilution.

In addition to restricted stock, a second innovation in equity compensation is the rise in the prevalence and complexity of performance-based equity grants to top executives (Bettis, Bizjak, Coles, and Kalpathy, 2018). Because performance-vesting is usually linked to accounting metrics or stock price, an alternative interpretation of our findings is that executives use repurchases to manipulate specified performance targets. For example, targets are often linked to EPS or return on equity (ROE), which increase as shares outstanding and shareholder's equity fall due to stock repurchases. We use ISS Incentive Lab data to separate the performance-based restricted shares granted to executives from all non-performance-based restricted shares. Both types of shares are positively associated with repurchases, but we find no evidence that performance-based shares impact repurchases differently than non-performance-based shares. This result is inconsistent with executives' desire to meet performance targets driving the relation between

restricted stock and repurchases. Rather, these results are consistent with Armstrong et al. (2020), who find that executives' personal performance goals are secondary to market-based goals.

The dilution channel is agnostic about the relation between stock-based compensation and dividends. However, if firms establish fixed payout levels, then firms that repurchase more may have less money available to pay dividends, resulting in an indirect negative relation between stock-based compensation and dividend payout. Thus, we examine how compensation relates to payout choice. Our results indicate that firms are more likely to repurchase versus increase dividends when dilutive stock-based compensation is higher. Further, executive options do not increase the likelihood of avoiding dividends, inconsistent with the dividend protection channel. Overall, these results corroborate the dilution channel and indicate that dividend protection is not a first-order consideration in recent years.

The above results reveal a strong positive relation between the dilutive effect of stock-based employee compensation and share repurchases. If stock-based compensation is exogenous, one could interpret our findings as options and restricted stock *causing* firms to repurchase. However, endogeneity could cloud our interpretation through reverse causality, an omitted variables bias, or both. Reverse causality would suggest that repurchases affect stock-based compensation. The only potential channel of which we are aware is if repurchases exert positive price pressure (e.g., Zhang, 2005; McNally, Smith, and Barnes, 2006; Busch and Obernberger, 2016), thus causing employees to exercise more options. However, we control for stock returns in all models, and price pressure from repurchases should not affect restricted stock grants. An omitted variables problem would imply a failure to control for a firm characteristic that affects both repurchases and stock-based compensation. We control for size, past performance, investment opportunities, and capital structure as well as time-invariant firm characteristics and macro trends through firm and year fixed effects. We also use an econometric test developed by Oster (2019) to estimate how large the omitted variable bias would have to be to explain away our results. The results indicate that an omitted variable is unlikely to drive the relation between stock-based compensation and repurchases.

To provide additional support for a causal interpretation, we employ a difference-in-differences (DID) approach around a quasi-natural experiment representing a shock to the cost of option compensation.

Beginning in 2005, FAS 123R requires firms to expense options at fair market value. Many firms reduced option grants in response to mandatory option expensing (Hayes, Lemmon, and Qiu, 2012), and Ferri and Li (2020) use this shock to test whether firms with high implied option expense increase dividends or reduce repurchases more than firms with low implied option expense. While their analysis is appropriate for testing the dividend protection channel, it is not well suited to test the dilution channel because some firms replace options with restricted stock.[4] In fact, firms in the highest quartile of option expense increase restricted stock granted to all employees by more than twice as much as firms in the lowest quartile (0.39% of shares outstanding versus 0.18%, T-stat of difference = 4.54). If dilution drives repurchases, we would not expect repurchases to decrease in response to decreases in options granted if those options are replaced by restricted stock. Our unique approach allows us to examine whether repurchases differ substantially between firms that only reduce options and those that replace options with restricted stock.

A firm's decision to replace options with restricted stock is endogenous. Thus, in our DID we instrument for changes in dilution using an indicator variable for whether the firm employs a compensation consultant. Prior literature shows that compensation consultants encourage their clients to link pay to performance (Chu, Faasse, and Rau, 2018). Indeed, firms using compensation consultants increase restricted stock significantly more than firms without compensation consultants but reduce options similarly. Taken together, we can conclude that firms with a consultant experience relatively greater net changes in dilution, thereby meeting the relevance condition of an instrumental variable (IV). The use of a compensation consultant is a relatively stable firm characteristic that is likely unrelated to changes in payout policy apart from its effect on compensation—thus satisfying the exclusion restriction. Our analysis reveals that the change in repurchases around mandatory option expensing is significantly higher if firms exchange one dilution-inducing compensation mechanism (options) with another (restricted stock). These results hold

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[4] According to Louis Lavelle, "To curb option grants, companies are using a variety of strategies. Many, like Progress, are replacing some or all of their options with fewer shares of restricted stock. Others are simply reducing option grants, without offering a replacement." Kicking the Stock-Options Habit, *BusinessWeek*, February 16, 2005.

when we balance our covariates between treatment and control groups following Hainmueller (2012). This analysis provides plausibly causal support for the dilution channel.

Previous work demonstrates substantial heterogeneity in repurchase frequency and provides evidence that infrequent repurchases are motivated by misvaluation (e.g., Dittmar and Field, 2015; Ben-Rephael, Oded, and Wohl, 2014). While these studies speak to the motives of *infrequent* repurchases (market timing), our analysis provides a motive for *frequent* repurchasers: offsetting dilution from equity-based compensation. We find that frequent repurchasers have more options exercised and restricted stock grants compared to infrequent repurchasers, consistent with firms affected by dilution managing EPS throughout the year. Further, unlike infrequent repurchasers, frequent repurchasers do not repurchase after stock price decreases, consistent with the dilution channel. Thus, we make a novel contribution to the growing literature that relates repurchase motives to repurchase frequency, such as Dittmar and Field (2015) who find no evidence of market timing among frequent repurchasers. We show that frequent repurchasers proxies for firms that generally repurchase due to dilution.

Our unique setting also allows us to contribute to the literature examining the determinants of payout policy,[5] specifically how employee and executive compensation structures relate to repurchase activity. Previous studies document a positive association between stock options and share repurchases (Fenn and Liang, 2001; Kahle, 2002; Bens, Nagar, Skinner, and Wong, 2003).[6] However, since those studies were undertaken, the popularity of option-based compensation has declined while the popularity of repurchases has increased, and recent studies question a causal relation between options and payout policy (Ferri and Li, 2020; Canil, 2017). Our study incorporates hand-collected data on restricted stock to fully capture the equity compensation structure of the firm. We reconcile the findings of prior studies with the recent trends in equity compensation and payout policy by examining *all* equity compensation for *all*

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[5] For a more thorough discussion of the broader payout policy literature, see DeAngelo, DeAngelo, and Skinner (2009) and Farre-Mensa, Michaely, and Schmalz (2014).

[6] Moore (2020) and Edmans, Fang, and Huang (2020) find a link between the vesting schedules of executive equity grants and the likelihood and magnitude of share repurchases, concluding that short-term stock price concerns affect repurchases. Our work differs from these studies in that we use stock-based compensation for *all* employees to examine the dividend protection and dilution channels.

employees, thus including an increasingly important piece of the equation: restricted stock.[7] In fact, Ferri

and Li (2020) acknowledge that they "may not find a decrease in repurchases because a reduced need to

offset the dilutive effect of stock options was neutralized by an increased need to offset the dilutive effect

of restricted stock."

Finally, in contrast to Kahle (2002), whose evidence supports both dividend protection and dilution,

we only find strong evidence that dilution impacts repurchases. The compensation incentives of firms'

decision makers (i.e., executives) do not appear to motivate firms to favor repurchases over dividends in

recent years. These results hold even after considering the incentives provided by performance-vesting

restricted stock grants and addressing endogeneity concerns. In sum, the preponderance of our evidence

strongly supports dilution as the primary channel through which compensation affects payout policy.

2. Hypothesis development

2.1. Dilution, dividend protection, and payout policy

Stock-based compensation impacts payout policy through two distinct but non-mutually exclusive

channels: dilution and dividend protection. In this section, we develop hypotheses around these two

channels and outline the empirical predictions of each.

2.1.1. The dilution channel

Surveyed managers report that EPS management and dilution avoidance are important drivers of

payout policy (Brav, Graham, Harvey, and Michaely, 2005). Moreover, Hribar, Jenkins, and Johnson

(2006) and Almeida, Fos, and Kronlund (2016) show a discontinuity in repurchase likelihood around zero

earnings surprises, indicative of firms repurchasing to meet earnings expectations. Investors only partially

discount repurchase-driven increases in EPS (Hribar, Jenkins, and Johnson, 2006). In fact, meeting analyst

forecasts is associated with a value premium—even if the reported results are likely due to earnings

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[7] Burns, McTier, and Minnick (2015) also incorporate restricted stock into their analysis of compensation and payout policy. However, they do not focus on dilution and study only CEO compensation within firms in Europe, where they find options (restricted stock units) are more (less) likely to be dividend protected than in the US.

management (Bartov, Givoly, and Hayn, 2002; Hribar, Jenkins, and Johnson, 2006). Further, managerial compensation incentives may exacerbate management's desire to meet earnings targets (Cheng, Harford, and Zhang, 2015; Young and Yang, 2011), although recent work by Armstrong et al. (2020) suggests that market-based goals provide stronger incentives than internal EPS bonus thresholds.[8]

Both stock options and restricted stock contribute to dilution, i.e., increase share count.[9] Exercised options increase shares outstanding and therefore decrease basic EPS and to some extent diluted EPS. Unexercised options only impact diluted EPS. The dilutive effect of these outstanding options is increasing in both the number of in-the-money options and the extent of moneyness; at-the-money options have no dilutive effect. Time-vested restricted shares (shares that vest solely based on continued employment) increase the denominator of diluted EPS. Once vested, these shares are included in the denominator of basic EPS—even if the shares have not been issued. The dilutive effect of time-vested restricted stock is thus similar to an option with an exercise price of zero; one additional share of time-vested restricted stock increases share count by one. In contrast, diluted EPS does not incorporate performance-based shares until the performance goal is met.

The dilution hypothesis states that firms repurchase shares to neutralize the dilutive impact of stock-based compensation, which can be substantial.[10] This hypothesis has different implications for the level of repurchases and the decision to pay dividends versus repurchase; we summarize these hypotheses in Panel A of Figure 3. If dilution motivates repurchases, then repurchases will be positively related to both options

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[8] In addition, Gao and Kronlund (2020) use a regression discontinuity design around the stock price of executive options that are close to the money at expiration and find no association between executive option exercises and repurchases. However, shares outstanding do not necessarily increase by the number of options exercised due to net option exercises, which allow holders to surrender shares to the company to cover the exercise price of the options (see, e.g., https://www.naspp.com/Blog/February-2010/Why-Net-Exercise). Further, the dilutive effect of net option exercises is especially low if options are close to the money.

[9] ASC 260 governs how firms account for the dilutive impact of securities in the calculation of basic and diluted EPS. The dilutive effect of options and share-based awards is calculated using the treasury stock method. This method results in diluted shares outstanding increasing by the difference between the number of in-the-money options (which are dilutive and thus assumed to be exercised) and the number of shares that can be repurchased using the proceeds from exercise. For simplicity, this discussion ignores the impact of unrecognized compensation and windfall tax profits. For more details, refer to ASC 260.

[10] For example, Online Appendix Figure OA1 illustrates the impact of actual share repurchases on dilution and EPS management in Biogen Idec. By the end of the sample period, Biogen's EPS was 66% higher than it would have been in the absence of $7.7 billion in repurchases since 2004.

and restricted stock granted. The dilution hypothesis does not explicitly associate options or restricted stock to dividends. However, firms with high levels of employee stock options and/or restricted stock should repurchase more, leaving less money available for dividends. Prior literature (e.g., Guay and Harford, 2000; Jagannathan, Stephens, and Weisbach, 2000; Grullon and Michaely, 2002; Lie, 2005; Skinner, 2008) also notes that because managers are reluctant to cut dividends, they may funnel funds towards repurchases that they would have otherwise used for dividend *increases.* Hence, the decision to increase dividends (versus repurchase) should be negatively related to both options and restricted stock. Finally, because executive options are as dilutive as options granted to other employees, the dilution hypothesis predicts that executive options should have no incremental impact beyond that of total options.

[Figure 3 here]

2.1.2. The dividend protection channel

The second channel through which stock-based compensation could affect payout policy decisions is through variation in dividend protection. Most restricted stock is dividend-protected while most stock options are not: 91% of the firms in our sample that grant restricted stock offer dividend protection; in contrast, Zhang (2018) finds that fewer than 1% of S&P 500 firms provide dividend protection on option grants. Thus, options create an incentive to curtail dividends because dividends generally reduce the stock price by the after-tax dividend amount, thus decreasing options' value (Kahle, 2002).

The dividend protection hypothesis, whose predictions we outline in Panel B of Figure 3, states that firms favor repurchases over dividends to protect the value of non-dividend-protected options. Under this hypothesis, repurchase levels should be positively related to options, while the likelihood of increasing dividends (versus repurchasing) should be negatively related to options. Unlike the dilution hypothesis, the dividend protection hypothesis predicts that restricted stock is unrelated to dividend levels or payout choice. Another way in which we empirically disentangle the dilution hypothesis from the dividend protection hypothesis is by examining differences in the relation between payout and executive versus non-executive compensation. The dilution hypothesis predicts no difference between executive and non-executive options because they are equally dilutive. In contrast, the dividend protection hypothesis predicts the effect of

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options on payout choice should be stronger in firms with more executive options, because executives are the decision makers and have an incentive to protect their personal wealth while rank-and-file employees are not involved in payout policy decisions. Thus, the dividend protection hypothesis predicts executive options should have a positive incremental effect, beyond that of total options, on repurchases and a negative incremental effect on the likelihood of increasing dividends (versus repurchasing).

In summary, including restricted stock in our analyses allows us to further disentangle the impact of the dilution and dividend protection hypotheses on repurchase levels and payout choice. Both hypotheses predict a positive relation between options and repurchases, measured as either repurchase levels or a preference for repurchases over dividends. Only the dilution hypothesis predicts a positive relation between restricted stock and repurchases; the dividend protection hypothesis predicts that restricted stock should not affect payout decisions. Further, only the dividend protection channel predicts that executive options should incrementally affect payout decisions. We are the first study to our knowledge to take advantage of the growth in restricted stock usage to examine the effect of *all* equity compensation on payout policy.

The dilution and dividend protection hypotheses also yield testable predictions regarding mandatory stock option expensing. Option-based compensation received negative press in response to the accounting scandals of 2001-2002. In fact, Alan Greenspan testified that overly favorable accounting treatment contributed to excessive option-based compensation (Greenspan, 2002). This environment led to the introduction of FAS 123R, which requires firms to expense options at fair market value, effectively eliminating stock options' accounting advantages (e.g., Hall and Murphy, 2003). Mandatory expensing caused firms to significantly reduce option grants and increase restricted stock grants (Carter, Lynch, and Tuna, 2007; Hayes, Lemmon, and Qiu, 2012). Thus, FAS 123R serves as a quasi-natural experiment to examine whether stock options impact payout behavior. The dilution hypothesis predicts that the effect of option expensing on repurchase levels should differ based on whether a firm substituted restricted stock for options. Any negative impact of option expensing on repurchases should be concentrated in firms that reduced option grants but did not simultaneously increase restricted stock. Firms that replaced options with restricted stock should continue to experience compensation-induced dilution and thus should decrease

repurchases less (or increase them more) than firms that only cut options. In contrast, the dividend protection hypothesis suggests that the dividend protection motive weakens after FAS 123R, and thus dividends should increase and repurchases should decrease following FAS 123R.

2.2. Repurchase motives and the frequency of repurchases

Brav, Graham, Harvey, and Michaely (2005) find that 86.4% of executives state that undervaluation is a significant determinant of repurchases, and numerous studies corroborate their survey evidence (e.g., Ikenberry, Lakonishok, and Vermaelen, 1995; Dittmar, 2000; Peyer and Vermaelen, 2009). Figure 4, however, shows that the percent of firms repurchasing has increased over time. Less than one-third of firms repurchase each year through the turn of the century, but this increases to one-half by 2008. Even though fewer firms repurchase as the financial crisis lingers, close to half of all firms repurchase in each year since 2011. It is unlikely that undervaluation explains this upward trend. In fact, Fu and Huang (2015) document that long-run abnormal returns following share repurchases have weakened in recent years, consistent with motives other than undervaluation driving the average repurchase program.

[Figure 4 here]

Recent studies find evidence of market timing in firms that repurchase infrequently, but not in firms that repurchase regularly (Dittmar and Field, 2015; Ben-Rephael, Oded, and Wohl, 2014). Dittmar and Field (2015) conclude that "frequent repurchasers are likely repurchasing stock for reasons other than misvaluation." We agree that firms that repurchase infrequently are likely motivated by undervaluation and should time their purchases after stock price decreases. We propose that firms that repurchase frequently are likely motivated by dilution. Because EPS is based on the weighted average of shares outstanding over the quarter (year), to effectively offset dilution and maintain/increase EPS, firms should repurchase frequently. Dilution-motivated repurchases are also less likely to occur after stock price decreases; in fact, if options are exercised after stock price increases then frequent repurchases could coincide with stock price *increases*.

3. Data and summary statistics

3.1. Sample selection

We follow Kahle (2002) and construct our sample by identifying firms that announce an open market repurchase at least once during our sample period (1994-2012). Repurchase announcements are from Securities Data Corporation (SDC). Firms that announce a repurchase remain in our sample for the full time period, provided data is available on Compustat, CRSP, Execucomp, and electronic 10-Ks in Edgar. This procedure results in 6,197 repurchase announcements by 2,307 unique firms.

Our primary data on equity compensation come from a manual search of 10-Ks on Edgar.[11] We begin our hand-collection process by randomly selecting 1,000 of the above 2,307 firms. Figure OA2 verifies that both the number of repurchase announcements per firm and the number of years with positive actual repurchases are similarly distributed across our random sample and the full sample of SDC firms. For our sample we then hand-collect data on options (outstanding, granted, and exercised) and restricted stock grants to all employees for all available years between 1994 and 2012. In the early half of our sample, firms award restricted stock infrequently, and many firms do not mention restricted stock granted or outstanding in their 10-Ks. In these cases, we assume that restricted stock granted is equal to zero. Our final hand-collected sample covers 14,464 firm-years. All share-based compensation measures are expressed as a percentage of shares outstanding at the end of the fiscal year.

To verify the robustness of our results to controlling for performance-vesting shares, we merge our sample with ISS Incentive Lab data. ISS Incentive Lab provides detailed data on executive compensation contracts for the top 750 firms each year, backfilling as new firms are added to avoid survivorship bias. When we merge with our hand-collected data—which has the benefit of including data on compensation for *all* employees, not just executives—we have Incentive Lab data for 678 of our 1,000 firms.

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[11] Compustat and Execucomp also source compensation data from 10-K reports. However, Compustat does not provide restricted stock data, begins sparsely covering options in 2002, and more fully covers options only after 2004. Comparing our hand-collected options data to Compustat data indicates that Compustat is missing a significant percentage of option values (15% of options outstanding and 17% of options exercised and granted) during the reporting period. Missing data are most likely when they are not presented in tabular format in the 10-K. Execucomp only collects data for top executives (not all employees) and only within S&P 1500 firms.

Following Banyi, Dyl, and Kahle (2008), we measure repurchases as the purchase of common and preferred stock (Compustat *prstkc*) minus any reduction in the value of preferred stock (*pstk*), expressed as a fraction of market capitalization. Our measure approximates the change in shares outstanding due to repurchases. Other control variables, defined in the Appendix, include market capitalization, firm age, capital expenditures, prior one-year return, market-to-book ratio, operating income, cash holdings, leverage, institutional ownership, asset tangibility, sales growth, and return volatility. We winsorize all continuous variables at the 1st and 99th percentiles to mitigate the effect of outliers and potential data errors in Compustat.

For our analysis around FAS 123R, we restrict our sample to 2003-2007 to isolate the effects of mandatory option expensing and study changes from the pre (2003-2004) to the post (2005-2007) period. We also require hand-collected data on compensation consultants, which we obtain for S&P 1500 firms from Cai, Kini, and Williams (2016).

3.2. Descriptive statistics

Table 1 summarizes the main variables used in this study. The first three columns of Panel A show statistics over the entire 1994 to 2012 period. Previous work shows that mandatory option expensing (FAS 123R) influenced compensation structure, and we are interested in the effect of compensation on payout policy. Hence, following Hayes, Lemmon, and Qiu (2012), Bakke, Mahmudi, Fernando, and Salas (2016), and Ferri and Li (2020), we define the post-option-expensing period as beginning in fiscal year 2005 and divide the sample into pre-option-expensing (1994-2004) and post-option-expensing (2005-2012) periods.

[Table 1 here]

We find that options outstanding, exercised, and granted average 7.9%, 1.1%, and 1.8% of shares outstanding, respectively, during our sample period. In an average year, employees exercise the equivalent of 14.3% (62.4%) of options outstanding (granted). About one quarter of total options outstanding belong to executives. Options outstanding and granted significantly decline following mandatory option expensing. Options granted, in particular, fall by more than 50%. While the median firm grants no restricted stock over our full sample period, the average firm grants the equivalent of 0.23% of shares outstanding; this amount

increases significantly from 0.07% before mandatory option expensing to 0.45% after. Hence, the decline

in options is counterbalanced by an increase in restricted stock grants. In untabulated results, we find that

only 24.8% of firms grant restricted stock and 96.2% grant options prior to mandatory option expensing,

whereas 80.7% of firms grant restricted stock and 83.1% grant options after mandatory expensing.

For the subsample of firm-years with available ISS data, we provide statistics on performance

vesting executive shares. Performance shares granted to executives grow from 0.03% of shares outstanding

in the first period to 0.11% in the second. In comparison, within this sample restricted stock grants increase

from 0.10% of shares outstanding to 0.48% (untabulated).

Repurchases average 1.9% of prior-year-end market capitalization, but their distribution is skewed:

The median is 0.2%, and one quarter of our firm-year observations have zero repurchases. Average

repurchases increase significantly from 1.5% during 1994-2004 to 2.5% during 2005-2012. Dividends as a

fraction of lagged market capitalization are roughly equal across the two periods.

The final rows in Panel A examine summary statistics of our control variables. We lag these

variables by one year relative to the dependent variable in the regressions. In the 2005-2012 period,

repurchasing firms are older and larger with lower prior returns and market-to-book ratios. Additionally,

the average repurchasing firm has lower asset tangibility, operating income, capital expenditures, leverage,

and sales growth. Institutional ownership and cash holdings in these firms have also increased over time.[12]

4. Stock-based compensation and payout policy

The trends in Figures 1 and 2 call into question the previously documented positive relation

between options and share repurchases. Consequently, we examine stock-based compensation and payout

policy in a multivariate setting by regressing several measures of payout on our hand-collected equity

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[12] Online Appendix Table OA1 shows the correlation between our compensation variables. Most are positively correlated, with an expected strong correlation between executive options outstanding and executive options exercisable and similarly between restricted stock granted and restricted stock outstanding. We observe a negative correlation between restricted stock and both options outstanding and executive options outstanding.

compensation variables, including total options outstanding, total options exercised, executive options outstanding, and restricted stock granted (all as a percent of shares outstanding).

4.1. Employee compensation and share repurchases

In order to examine whether employee compensation still impacts payout policy, we follow prior literature (e.g., Kahle, 2002) to ensure our results aren't driven by changes in methodology, and in Table 2 examine how stock-based compensation impacts share repurchases in a multivariate setting with standard controls and firm and year fixed effects. Standard errors are clustered by firm. Because repurchases are expressed as a percentage of market capitalization,[13] our dependent variable is bounded between zero and one. Consequently, we focus on Tobit regressions although we also report OLS results. It is important to note that repurchases are a flow variable and, when expressed as a percentage of market capitalization as we do, the level of repurchases approximates the change in shares outstanding. Our tests therefore reveal if firms actively reduce shares outstanding through repurchases in response to increases in shares outstanding (dilution) caused by stock-based compensation.

[Table 2 here]

Ideally, we would like to capture the dilutive impact of employee compensation. Options contribute to dilution in two ways. First, as discussed previously, exercised options increase share count and thus decrease basic EPS and to some extent diluted EPS. Second, depending on their number and their moneyness, unexercised options also decrease diluted EPS, and Bens, Nagar, Skinner, and Wong (2003) show firms manage diluted EPS. Unfortunately, firms do not report moneyness. We do, however, observe the number of options outstanding, which captures the accumulation of options over time. As more options accumulate, both their number and moneyness should increase, thereby increasing the dilutive impact. We do not separately examine options granted because options outstanding already implicitly capture them andmost options are granted at-the-money and thus have zero dilutive impact. In terms of restricted stock, we focus on shares granted. Because time-vested restricted shares decrease diluted EPS when granted and

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[13] We show similar results in Table OA2 when the dependent variable is expressed as a percentage of assets.

affect basic EPS once vested, the number of shares of restricted stock granted should proxy for the dilutive impact of restricted stock.[14] We also examine performance-based shares, which do not dilute EPS until the performance goal is met.

The inclusion of firm fixed effects in our models controls for unobservable firm-specific factors related to payout and compensation and allows us to interpret our coefficients as the impact of increases in our stock-based compensation variables on repurchase activity relative to within-firm averages. Furthermore, year fixed effects control for macroeconomic trends that could influence payout decisions, such as tax rates (e.g., as in Chetty and Saez (2005, 2006)). Nonetheless, though these models control for observable, known determinants of repurchase activity as well as time-invariant firm-specific unobservables and time-varying macroeconomic factors, we cannot yet rule out unobservable time-varying firm characteristics and therefore cautiously interpret our coefficients as motivating evidence.

Model (1) shows that over the full sample period, both employee options outstanding and options exercised are positively correlated with repurchase activity. A one standard deviation increase in options outstanding is associated with an increase in repurchases of 0.37%, a 19.4% increase relative to mean repurchases. Because we include firm fixed effects, we can interpret our options outstanding coefficients as follows: When options accumulate in such a way that they are *particularly high within that firm*, repurchases are higher than average. A one standard deviation increase in options exercised is associated with a 0.47% increase in repurchases, or a 24.9% increase relative to the mean.

In addition to controlling for total employee options, we also control for executive options outstanding. If non-dividend-protected options incentivize managers to substitute repurchases for dividends, then executive options should have an additional impact on repurchases above and beyond that of total employee options. The coefficient on executive options outstanding, which captures the differential

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[14] We favor restricted stock granted over restricted stock outstanding (or changes in restricted stock outstanding) due to data availability. Grants are available in almost 60% of the firm years in our sample (and we assume grants to be 0 if missing) while restricted stock outstanding is available in only 45% of the firm years. The two measures are highly correlated (0.82), but restricted stock granted should better capture dilution. Moreover, the impact of restricted stock on diluted EPS occurs at grant. There is no offsetting negative dilutive impact at disposition if shares are sold on the open market.

effect of executive options, is positive and significant at the 10% level, consistent with Kahle (2002).[15] This result suggests that executives protect their personal wealth by favoring repurchases over dividends. Our results so far find support for both the dilution and the dividend protection hypotheses.

Control variables take on expected signs. Consistent with Kahle (2002), Bens, Nagar, Skinner, and Wong (2003), and Dittmar (2000), firms repurchase more if they are older, are larger, or announced a repurchase program in the past year.[16] Firms also repurchase more if they have higher operating income or cash holdings, and lower growth opportunities, prior returns, debt, capital expenditures, sales growth, return volatility, or institutional ownership. It is important to note that including proxies for growth opportunities and prior performance helps alleviate concerns that these variables determine both compensation and payout. Moreover, the market-to-book ratio and past returns proxy for undervaluation.

Model (2) of Table 2 includes restricted stock as an explanatory variable. As noted earlier, if a firm reports no restricted stock data in their 10-K, we assume it grants no restricted stock that year. To capture any systematic bias, we create an indicator variable equal to one for these missing observations.[17] The restricted stock granted coefficient is positive and statistically significant; firms repurchase one additional share for approximately every two shares of restricted stock they grant. A one standard deviation increase in restricted stock grants is associated with a 0.25% increase in repurchases (a 13.1% increase relative to mean repurchases). The restricted stock indicator is not significant and including restricted stock does not significantly change the total options coefficients. Because restricted stock is generally dividend-protected but still contributes to dilution, a positive relation between restricted stock granted and share repurchases is consistent with the dilution channel but not the dividend substitution channel.

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[15] Table OA3 of the Online Appendix illustrates that the coefficient on executive options outstanding represents the incremental effect of executive compensation by separating options outstanding into non-executive and executive options outstanding. Note that the sum of the coefficients on *Options Outstanding* and *Executive Options Outstanding* in Table 2 is exactly equal to the coefficient on *Executive Options Outstanding* in Table OA3.

[16] Results are similar in Table OA4 when we exclude an indicator for repurchase announcements.

[17] In Table OA5 of the Online Appendix, we set these observations to missing and replicate Models (2)-(7). Doing so reduces our sample size by 41% (58% in the 1990s) but does not change our conclusions.

Next, we test whether the relation between compensation and repurchases changes over time. Prior literature shows that firms modified their compensation structure in response to mandatory option expensing in 2005. Therefore, in Models (3) and (4) we separate the sample into two periods, 1994-2004 and 2005-2012.[18] Options outstanding and exercised have positive and significant effects on repurchases in the 2005-2012 period (options exercised is positive and significant in the 1994-2004 period as well). Between 1994 and 2004, a one standard deviation increase in options outstanding (exercised) is associated with a 0.14% (0.36%) increase in repurchases. After 2004, a one standard deviation increase in options outstanding (exercised) is associated with a 0.83% (0.76%) increase in repurchases, a 33.5% (30.8%) increase relative to the mean value of repurchases during the same period. Restricted stock is not a significant determinant of repurchases in the earlier period, when restricted stock grants are rare, but the effect of restricted stock on repurchases is highly significant in the post-option-expensing period. After 2004, a one standard deviation increase in restricted stock is associated with a 0.39% increase in repurchases (a 15.8% increase relative to the mean). The large increases in the economic magnitudes of the effects of options and restricted stock on repurchases are consistent with dilution becoming a stronger motive for repurchases in recent years. Furthermore, in the 2005-2012 period, the coefficient on executive options outstanding becomes negative and loses significance, suggesting that dividend protection is not important in recent years when firms have fewer executive options outstanding and thus the benefit to protecting the value of options is lower.[19] OLS specifications in Models (5)-(7) continue to support the dilution, but not the dividend protection, channel. In sum, dilution is a significant determinant of repurchases and its impact has strengthened over time, consistent with firms using repurchases to counteract dilution more often in recent years. In contrast, we find that the dividend protection channel is not a first order concern.[20]

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[18] Our results are robust to including 2005 in the pre period. See Table OA6 of the Online Appendix.

[19] To test whether the effect on payout is significantly different between the pre- and post-periods, Table OA7 repeats the analysis for the full sample with the inclusion of a 2005-2012 indicator variable and the interaction of the indicator variable with all the right-hand side variables, including firm fixed effects. The coefficients on the interaction terms for options outstanding and exercised as well as restricted stock granted suggest the effects are significantly greater in the post-period.

[20] Table OA8 shows the robustness of our results to a measure of actual repurchases. With this measure, the coefficient on restricted stock is higher than in Table 2 and approximately equals one. Tables OA9-OA11 show robustness to

Although time-vested awards make up the majority of stock-based awards to executives during our sample period, recent trends in compensation reveal the growing popularity of performance-based restricted stock, which vests upon the attainment of specified goals, often related to EPS and ROE (Carter, Ittner, and Zechman, 2009; Bettis, Bizjak, Coles, and Kalpathy, 2010, 2018). Because these metrics could be manipulated by repurchases, which decrease shares outstanding and shareholder's equity, if an executive's compensation is directly linked to EPS or ROE, she has an additional personal incentive to minimize dilution through share repurchases. Consequently, we next test whether the impact of performance-based executive shares on repurchases is stronger than that of non-performance based shares.

We use ISS Incentive Lab data to identify performance-vesting restricted stock grants. ISS data is collected from proxy statements and is available from 1998 onwards for 678 firms (8,039 firm-years) of the 1,000 firms in our sample. We create a measure of *performance shares* that captures the total number of performance-based shares granted to executives, scaled by shares outstanding.[21] We then test whether performance shares have a differential effect on share repurchases relative to all non-performance shares (including those issued to non-executives).

Models (8) and (9) of Table 2 show that performance-based shares do not incrementally impact share repurchases. We divide restricted shares into performance shares granted to executives and all other non-performance shares and regress repurchases on these two variables. We include an indicator variable equal to one if the CEO's bonus is a function of an EPS target (as in Cheng, Harford, and Zhang (2015)). In the Tobit regression in Model (8), the coefficients on performance and non-performance shares are similar: A one percentage point increase in non-performance shares is associated with an increase in repurchases of 0.70%, not statistically different from the 0.66% increase associated with performance shares. Model (9) uses OLS to confirm that performance and non-performance restricted stock both

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excluding non-dividend protected restricted stock, including industry-year fixed effects to control for competition for labor within an industry, and a subsample of firms least likely to be undervalued.

[21] We only measure performance shares because EPS targets can be defined in many ways, e.g., basic versus diluted EPS, EPS with or without extraordinary items. Our data do not allow us to distinguish among these different definitions of EPS, making it difficult to ascertain if/when firms actually reach these targets. See Armstrong et al. (2019) for more details.

significantly impact repurchases but not in a differential fashion. Performance-based stock may affect repurchases around the time it *vests*, as opposed to when the company *grants* it. Due to data limitations and the complexity of performance-based grants, we are unable to measure vesting of performance-based grants with accuracy. However, Armstrong et al. (2020) find that CEOs are more concerned with meeting analyst EPS expectations than with meeting internal incentive plan EPS goals. Overall, these results are inconsistent with executives' desire to meet performance criteria driving the strong, positive relation between restricted stock and repurchases.

4.2. Payout choice: Dividends versus share repurchases

In the previous section, we find no evidence that executive options have an incremental effect on repurchases in recent years. However, these results do not necessarily disprove the dividend protection hypothesis. While all stock options provide incentives to repurchase shares to counteract dilution, executive options create personal incentives for executives to avoid or decrease dividends even if repurchases remain constant. Thus, executive options could affect the choice of payout, even if they do not impact the level of repurchases. To further investigate the effect of stock-based compensation on payout method, we examine its relation to the dividend/repurchase choice.

Because firms are reluctant to cut dividends, they are unlikely to explicitly decrease dividends and substitute repurchases. Rather, they may funnel funds they would have otherwise used for dividend *increases* into repurchases instead. Thus, in Table 3 we follow prior studies (e.g., Guay and Harford, 2000; Jagannathan, Stephens, and Weisbach, 2000; Grullon and Michaely, 2002; Lie, 2005; Skinner, 2008) and condition on a payout increase, then use logistic regressions to model the decision to increase dividends versus repurchase, thus restricting our sample to firm-years with either a dividend increase or a repurchase. The dependent variable equals one if split-adjusted dividends per share increase from the prior to the current year, and zero if a firm does not increase dividends but instead repurchases stock. In Models (1)-(3) we define repurchases using repurchase announcements. Because repurchase announcements do not always result in actual repurchases and actual repurchases can occur for several years after an announcement, in Models (4)-(6) we define repurchases as positive actual shares repurchased. Finally, in Models (7)-(9) we

examine the decision to increase dividends versus increase repurchase yield. We classify firms that both increase dividends and repurchase as dividend increasers, with a dependent variable equal to one.[22] Using any of our dependent variables and regardless of the time period examined, we find either a weak or an insignificant relation between executive options and dividend increases. These results are inconsistent with dividend protection. We find some evidence consistent with dilution driving repurchases. Early in our sample period, firms are likely to repurchase rather than increase dividends as *total* options outstanding increase, while later, firms repurchase instead of increasing dividends as restricted stock granted increases. Overall, our analyses in Table 3 suggests that the dividend protection motive is not a first order concern.[23]

[Table 3 here]

4.3. Alleviating endogeneity concerns

As noted in Edmans, Gabaix, and Jenter (2017), "identifying the causal effect of compensation contracts on any interesting outcome variable is extraordinarily difficult" due to endogeneity. Despite the difficulties involved in establishing causality, we take two additional steps to alleviate endogeneity concerns. First, we estimate the relative size of the omitted variable bias necessary to explain away our results and show that omitted variables are unlikely to erase our main findings. Second, we conduct difference-in-differences analyses around a shock to compensation—mandatory option expensing—using an instrumental variable for stock-based compensation.

4.3.1. Omitted variables

Our results show a strong positive relation between the dilutive effect of stock-based employee compensation and share repurchases. If stock-based compensation were fully exogenous, then we could

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[22] In Online Appendix Table OA12, we exclude observations where the firm both increases its dividend and announces a repurchase program (or actually repurchases/increases repurchases) and find similar results. Additionally, Table OA13 shows these results are robust to excluding firms whose restricted stock is not dividend-protected.

[23] In Online Appendix Table OA14, we run a simultaneous equation model, where the dependent variables are repurchases and dividends, scaled by lagged market capitalization. We include dividends and repurchases as additional explanatory variables. In order to have identification, we exclude intangible assets as an explanatory variable when modeling repurchases, and asset tangibility when modeling dividends. We draw similar conclusions from this test: Restricted stock is positively correlated with repurchases and negatively correlated with dividends for the full sample period and only positively correlated with repurchases in the later period. Similar conclusions hold for the options variables. Additionally, repurchasing is negatively correlated with dividends for the full sample, but dividends have no effect on repurchases.

infer causality. However, our inferences may be flawed if compensation decisions are endogenous, i.e., if there is reverse causality, an omitted variables bias, or both. In our case, repurchases inciting changes in options and restricted stock grants would be consistent with reverse causality. Repurchases could potentially influence compensation decisions through their effect on stock prices (Zhang, 2005; McNally, Smith, and Barnes, 2006; Busch and Obernberger, 2016), but we control for stock returns in all specifications. The more critical concern is a failure to control for variables that drive both repurchases and stock-based compensation decisions resulting in a biased OLS coefficient. Because we include numerous firm characteristics as well as firm and year fixed effects when possible, an omitted variable would have to be a time-varying firm characteristic unrelated to our proxies for size, past performance, investment opportunities, or capital structure to drive our results. We are unaware of such a variable.

Nonetheless, to ensure that omitted variables are unlikely to drive the relation between stock-based compensation and payout policy, we use the econometric test proposed in Oster (2019) to estimate "Oster's δ," the relative size of the omitted variable bias necessary to explain away our results. A common cutoff is one, which implies that the omitted variables must be at least as important as the included variables to explain away the relation. A negative δ implies the correlation between the variable of interest and other observables differs in sign from the correlation between the variable of interest and unobservables. In other words, the coefficient associated with the variable of interest *increases* in magnitude when we augment the model with additional controls; hence, omitted variables are unlikely to erase the effect. We use Oster's proposed input of R-max = 1.3* $\tilde{R}$, where $\tilde{R}$ equals the largest empirically observed R^2.

Table 4 presents Oster's δ for relevant compensation variables from our Table 2 OLS specifications examining the relation between stock-based compensation and repurchases. All δs associated with statistically significant coefficients are either negative or greater than one. Any δs less than one are associated with coefficients that failed to achieve statistical significance in the original models. These results indicate that omitted variables are not likely to drive the positive relation between stock-based compensation and payout policy.

[Table 4 here]

4.3.2. Payout policy and option expensing: An instrumental variables approach

To further alleviate endogeneity concerns and strengthen identification, we study payout behavior around a plausibly exogenous shock to stock-based compensation: mandatory option expensing, or FAS 123R. As discussed earlier, mandatory expensing increased the cost of options, but not restricted stock. Subsequently, many firms decreased option grants, reducing the dividend protection motive. Prior studies show that firms with high implied option expense reduce options the most (e.g., Hayes, Lemmon, and Qui, 2012) but that these firms do not increase dividends or decrease repurchases more than other firms (Ferri and Li, 2020). We confirm prior findings that options granted indeed decrease more within firms with high versus low implied option expense (-1.41% versus -0.44%, T-*stat* of difference = 5.77). However, we also find that firms in the highest quartile of implied option expense increase restricted stock (as a percentage of shares outstanding) more than twice as much as low option expense firms (0.39% versus 0.18%, T-*stat* of difference = 4.54). For firms that replace options with restricted stock, the dilutive effect of compensation does not necessarily decrease in response to FAS 123R, even if the dividend protection incentive does.

To exploit the heterogeneity in firms' responses to mandatory option expensing and to disentangle the dilution versus dividend protection channels, we construct a difference-in-differences setting in which we compare changes in repurchases across "treated" and "control" firms from the pre (2003-2004) to post (2005-2007) period. We hypothesize that firms that hire compensation consultants are more likely to link compensation to shareholder value and thus will maintain a greater portion of equity-based compensation.[24] We define "treated" firms as firms with compensation consultants because they should be more likely to replace options with restricted stock rather than merely reduce options. Anecdotal evidence supports this claim.[25] Our instrument is uncorrelated with the implied option expense measure used in prior studies,

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[24] Heath, Ringgenberg, Samadi, and Werner (2020) raise a potential concern regarding the validity of studies reusing a natural experiment from prior research and suggest additional guidelines for proper inference. While prior studies have confirmed that mandatory option expensing through FAS123R indeed results in a decline in option compensation (e.g., Carter, Lynch, and Tuna, 2007; Hayes, Lemmon, and Qiu, 2012; Ferri and Li, 2020), we are the first to our knowledge to combine FAS123R with the use of compensation consultants as an instrument variable to study the effects of dilution on repurchases.

[25] For example, Coherent, Inc.'s 2005 proxy statement states: "Restricted stock grants are made following a report and recommendation of our outside compensation consultant based on current practices in the marketplace and after due consideration by the Compensation Committee."

which captures declines in options but not corresponding increases in restricted stock, and with changes in our options outstanding measure.[26] However, we show that firms with compensation consultants increase restricted stock significantly more than other firms. If employing a compensation consultant is positively related to increases in restricted stock but associated with similar declines in stock options, then firms with consultants should experience a greater increase in dilution than firms without consultants. Therefore, though we cannot *directly* measure the net dilutive impact due to option expensing within each firm, because the presence of a compensation consultant strongly predicts greater levels of stock-based compensation, it likely satisfies the relevance condition for a valid instrumental variable. If dilution concerns motivate repurchase activity, we expect this variable to take on a positive sign in a difference-in-differences model of repurchase changes around option expensing.

An instrumental variable must also meet the exclusion restriction, i.e., must only relate to payout through its relation to compensation (the change in restricted stock in our setting). One potential channel through which a compensation consultant could influence payout is by providing payout-related consulting services. Prior studies suggest that this channel does not hold (Cadman, Carter, and Hillegeist, 2010; Murphy and Sandino, 2010). Further, the use of a compensation consultant is "sticky;" for example, 90% of firms in our sample using a consultant in 2006 continue to use a consultant in 2007. This serial correlation reduces the likelihood that other time-varying firm characteristics simultaneously drive firms to hire a compensation consultant and increase repurchases. Thus, the presence of a compensation consultant likely meets the exclusion restriction.[27]

(https://www.sec.gov/Archives/edgar/data/21510/000114544306000414/d18515.htm)

[26] 71.25% of firms in the lowest quartile of implied option expense use a compensation consultant compared to 73.27% in the highest quartile. This difference is not significant (t-stat = 0.37). In Table OA15 the coefficients on compensation consultant in regressions of changes in options outstanding and options granted around FAS 123R are not significantly different from zero.

[27] Jochem, Ladika, and Sautner (2018) show that many firms exploited a regulatory exemption in FAS 123R that allowed firms to accelerate the vesting of previously granted, unvested options, which increased managerial short-termism for these firms. If firms with compensation consultants are more likely to accelerate option vesting, these firms may experience increased managerial short-termism and repurchase as a result. Hence, it is possible that our instrument violates the exclusion restriction within firms that accelerate vesting. To alleviate this concern, Online Appendix Table OA16 presents our IV analyses excluding the 111 firms in our sample that accelerated option vesting. Our findings are robust to excluding these firms.

We identify the presence of a compensation consultant using hand-collected data from Cai, Kini, and Williams (2016). Ideally, we would identify the use of a consultant prior to option expensing becoming mandatory in 2005. However, firms are not required to report compensation consultant details until 2006. Consequently, our indicator is based on whether the firm has a consultant in 2006 and relies on the usage of consultants being sticky over time. In our sample, 69.5% of firms use a compensation consultant.

A key identifying assumption of our identification strategy is that, in the absence of FAS 123R, firms with a compensation consultant (treated) and firms without a consultant (control) should experience parallel trends in repurchases. Although the parallel trends assumption is not directly testable, Figure 5 shows that treatment and control firms follow similar repurchase patterns in the pre-FAS 123R period.

[Figure 5 here]

Table 5 reports reduced-form ordinary least squares (OLS) and two-stage least squares (2SLS) regressions of the changes in average annual repurchases from 2003-2004 to 2005-2007 on changes in equity-based compensation, changes in our standards controls, and industry fixed effects. Prior literature finds that in response to the American Jobs Creation Act (AJCA) of 2004, firms used a portion of repatriated foreign earnings to repurchase shares from 2004 to 2006 (Blouin and Krull, 2009; Faulkender and Petersen, 2012). Though the effect of repatriation on repurchases was relatively small and spans our pre- and post-period, we include an additional variable, repatriation, to control for these potential tax-induced repurchases biases our findings. Model (1) shows the reduced form OLS relation between change in repurchases (standardized by lagged market capital) and the compensation consultant instrument. This reduced form test does not rely on the first stage regression, alleviating issues related to a weak instrument (Chernozhukov and Hansen, 2008; Angrist and Krueger, 2001). We find a positive and significant coefficient on our instrument; the presence of a compensation consultant results in firms increasing repurchases by 0.5% of market capitalization, a 34% increase relative to the mean change in repurchases over this period. Consistent with the dilution hypothesis, these results suggest that treated firms (with compensation consultants) increase repurchases by more than control firms (without compensation consultants).

[Table 5 here]

To address concerns of significant differences in covariates between our treatment and control groups, we follow Hainmueller (2012) and perform entropy balancing on the covariates. Table OA17 shows pre-balancing differences in covariates and that we successfully balance our covariates. Model (2) of Table 5 verifies that the compensation consultant coefficient remains positive and statistically significant in an entropy-balanced weighted regression. The compensation consultant coefficient in this entropy-balanced model implies changes in repurchases around mandatory option expensing are 0.4% of shares outstanding greater (a 28% increase relative to mean repurchase changes) if a compensation consultant advises the firm.

Next, we perform a 2SLS analyses in which the first stage estimates the change in restricted stock and the second stage estimates the repurchase change. For an instrumental variable model to be identified, the instrument must be relevant, i.e., correlated with the endogenous variable. Model (3) shows that the first-stage coefficient on our compensation consultant IV is positive and significant at the 1% level; the presence of a compensation consultant is associated with an increase in restricted stock of 0.1%, or 50% of the mean change in restricted stock. In addition, the Anderson LM statistic indicates that the excluded instrument is relevant and that our model is identified. However, to avoid any bias in the estimation of the change in restricted stock coefficient (the endogenous variable) in the second stage, the instrument must meet an additional hurdle: It must not be weakly correlated with the change in restricted stock. An F-test of the first stage regression yields a Cragg-Donald Wald F-statistic greater than both the general rule of thumb cutoff value of 10 as well as the Stock and Yogo (2005) critical values at the 15% maximal IV size assumption. Thus, combined with our reduced-form findings, we do not have a weak instrument by conventional definitions.

Model (4) presents the second-stage regression of change in repurchases. The coefficient on the instrumented change in restricted stock is positive and statistically significant, consistent with a greater increase in restricted stock being associated with a larger increase in repurchases. Our large IV coefficient estimate may indicate a weak instrument per Jiang (2017).[28] Therefore, to further alleviate concerns of a

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[28] The Durbin Wu Hausman test confirms endogeneity concerns, emphasizing the need for our IV approach.

weak instrument, we implement a second-stage weak instrument test put forth by Moreira (2003) that provides a confidence region and *p*-values for the endogenous variable in the second stage, based on the conditional likelihood ratio. We find the confidence set to be strictly greater than 0 with a *p*-value of 0.0132, suggesting that even after accounting for the potential weakness of the instrument, the coefficient on change in restricted stock remains significant.[29]

To test our ability to identify a plausibly causal relation between restricted stock and repurchases, we also conduct placebo tests around fictitious event years. Table 6 shows the results of replicating our analysis using several different pseudo pre- and post- periods. As expected, we find no significant effect of compensation consultant on changes in repurchases or changes in restricted stock around these fictitious years. This placebo test suggests it is unlikely that we have identified a spurious relation and provides additional support for a causal relation.

[Table 6 here]

Our IV analyses around mandatory option expensing show that repurchases grew more within firms that effectively exchange one dilution-inducing compensation mechanism (options) with another (restricted stock). We find no evidence of a dividend protection effect following mandatory option expensing, but our results provide causal support for dilution as the primary channel through which compensation affects payout policy in the post FAS 123R period. Overall, combining these results with our earlier results, the preponderance of our evidence strongly supports dilution as the primary channel through which compensation affects payout.

5. The frequency of repurchases

5.1. Determinants of repurchase frequency

Next, we explore whether firms that repurchase to avoid dilution exhibit a different repurchase "style" compared to firms that repurchase for undervaluation. Using our actual monthly repurchase data,

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[29] The 2SLS analysis assumes homoscedastic errors because the Pagan-Hall general test statistic fails to reject the null of homoscedastic errors.

which we hand-collected as described in Table OA8, we define repurchase style based on the frequency of repurchases. We follow Dittmar and Field (2015) and define firms that repurchase at least nine months per year as "frequent" repurchasers, five to eight months per year as "moderate" repurchasers, and one to four months per year as "infrequent" repurchasers.[30] Dittmar and Field (2015) find that infrequent repurchasers buy stock at a discount relative to average market prices, but frequent repurchasers do not. We examine both the determinants of repurchase frequency and whether the decision to repurchase after stock price decreases depends upon the frequency of repurchases.

If frequent repurchasers react to options and equity grants to avoid dilution, they should distribute repurchases more evenly across time rather than concentrate them in months with low stock prices. In contrast, repurchasing a block of shares infrequently in months when stock prices are low is consistent with undervaluation. We examine the determinants of repurchase frequency in Table 7. Model (1) shows an ordered logit model with the dependent variable equal to one, two, or three if the firm repurchases infrequently, moderately, or frequently, respectively. We find that the frequency of repurchases is consistently positively related to options outstanding, options exercised, and restricted stock granted. Odds ratios indicate that for a one standard deviation increase in options outstanding, options exercised, and restricted stock granted, the odds of being a more frequent versus less frequent repurchaser are 1.53, 1.22 and 1.25 times greater, all else equal. In addition, repurchase frequency is positively related to prior returns, consistent with frequent repurchases occurring at higher prices than infrequent repurchases.[31]

[Table 7 here]

To ensure that our results are not sensitive to the repurchase frequency definition, Model (2) redefines repurchase frequency as the number of quarters within a fiscal year in which the firm repurchases

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[30] Online Appendix Table OA18 examines the size of monthly repurchases (as a percent of shares outstanding) for frequent, moderate, and infrequent repurchasers. Frequent repurchasers buy an average of 0.51% of shares outstanding per month when they repurchase, significantly less than infrequent repurchasers who buy back an average 0.91% of shares outstanding in the months they repurchase. However, cumulative repurchases indicate that frequent repurchasers buy back almost twice as much as infrequent repurchasers (5.50% vs. 2.25%) on an annual basis. This difference is also statistically significant at the 1% level.

[31] In untabulated results, the average abnormal returns surrounding repurchase announcements decline from 2.8% in 1994-2004 to 1.5% in 2005-2012. If fewer companies are repurchasing due to undervaluation and more to avoid the dilution impact of options and restricted stock grants, then this trend is not surprising.

and finds similar results. Overall, the findings in Table 7 suggest that firms repurchase frequently to match the timing of repurchases with the exercise of options and grant of restricted stocks, which is consistent with firms repurchasing frequently to offset dilution, rather than exploit undervaluation.

5.2. The frequency of repurchases and the decision to repurchase

To provide further evidence that dilution drives frequent repurchases while undervaluation motivates infrequent repurchases, we examine the effect of repurchase frequency on the decision to repurchase. Table 8 reports a logit regression in which the dependent variable equals one if the firm repurchases during that month, and zero otherwise.[32] We regress this indicator variable on the prior three-month return, the concurrent month return, and the interaction of these returns with repurchase frequency indicators; the benchmark is moderate repurchasers. If dilution motivates frequent repurchases and undervaluation drives infrequent repurchases, then infrequent repurchases should be more likely to occur following decreases in stock prices. Further, frequent repurchases could be preceded by stock price increases if price increases result in more in-the-money or exercised stock options.

[Table 8 here]

Cross-sectional results in Model (1) indicate that firms are less likely to repurchase following positive stock returns. The interaction terms, however, indicate that the effect of prior returns on repurchase likelihood is mitigated for frequent repurchasers. Unreported *F*-tests indicate that the sum of the coefficients on prior returns and the interaction between prior returns and the frequent repurchase indicator do not significantly differ from zero. This finding is consistent with frequent repurchasers buying shares to counteract dilution rather than to "time the market." Model (2) includes firm fixed effects and shows that positive prior returns discourage infrequent repurchasers from buying back stock but encourage frequent repurchasers. Model (3) includes additional control variables and finds results consistent with Model (2). A 1% increase in prior three-month returns is associated with an 12.4% decline in repurchase likelihood for

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[32] For consistency across tables, we present results for the 1,000 firms for which we hand-collect data on stock-based compensation. Online Appendix Table OA19 replicates Table 8 for the full set of firms for which we have actual repurchase data.

infrequent repurchasers but a 18.2% *increase* in repurchase likelihood for frequent repurchasers, compared to moderate repurchasers.

In sum, the results are consistent with dilution driving frequent repurchases, as higher past returns increase the moneyness and hence the dilutive effect of options, but with undervaluation driving infrequent repurchases, which are more likely to follow negative stock returns. Our results are consistent with Fu and Huang (2016), who find that long-run abnormal returns following repurchases have disappeared in recent years, and provide an explanation for Dittmar and Field's (2015) finding that frequent repurchasers do not buy stock at a discount: Instead of attempting to time repurchases with low stock prices, frequent repurchasers match repurchases to option exercise and restricted stock grants.

6. Conclusion

As payouts reach record levels, how a firm determines their amount, form, and timing is an increasingly important question in corporate finance and one that has been the subject of much political debate. This study examines the link between payout policy and compensation in light of several significant innovations in the compensation landscape: the expensing of stock options, the ensuing growth in restricted stock, and the increasing popularity of performance-based executive compensation. Incorporating restricted stock into our analysis allows us to cleanly identify the dilution channel and show that it clearly dominates the dividend protection channel, especially in recent years when less executive wealth is tied to options and thus the benefit to protecting option value is lower. Further, our difference-in-differences analysis around mandatory option expensing suggests a causal relation between employee compensation and payout.

We also connect our findings to the nascent literature linking repurchase timing and frequency. We show that firms with more stock-based compensation repurchase more frequently, which potentially explains why frequent repurchasers do not time their purchases with low stock prices. Frequent repurchases coincide with employee option exercise and restricted stock grants, which generally do not occur when prices are low, to negate the dilutive effects of such compensation on earnings.

Our findings may help explain why investment has been weak in recent decades relative to Q and profitability (e.g., Lee, Shin, and Stulz, 2020; Gutierrez and Philippon, 2016). Dilution-driven repurchases are potentially consistent with firms using cash for repurchases that would otherwise have been used for investment, as in Almeida, Fos, and Kronlund (2016). While our finding that repurchase frequency is positively related to equity-based compensation appears inconsistent with firms repurchasing simply to meet earnings targets, we leave quantifying the value implications of dilution-motivated repurchases for future research.

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Appendix: Variable Definitions and Data Sources

Manually collected from 10-K annual reports

Options exercised: Total number of options exercised by all employees, as a fraction of shares outstanding.

Options granted: Total number of options granted to all employees, as a fraction of shares outstanding.

Options outstanding: Total number of options outstanding for all employees at the end of the prior year, as a fraction of shares outstanding.

Restricted stock granted: Number of restricted stock shares or restricted stock units granted to all employees, as a fraction of shares outstanding.

ΔRestricted stock: Change in average annual restricted stock granted, as a fraction of shares outstanding, around mandatory options expensing (FAS1234R) from 2003-2004 to 2005-2007.

Restricted stock indicator: An indicator variable equal to one if a firm reports no restricted stock data. (We assume the firm has zero restricted stock granted if restricted stock is missing.)

Execucomp

Executive options outstanding: Number of executive options outstanding at the end of the prior year, as a fraction of shares outstanding.

Compustat

Asset tangibility: Tangible assets (AT-INTAN), divided by total assets (AT).

Book to market: Book value of assets (AT) divided by market capitalization plus long-term debt (DLTT) plus debt in current liabilities (DLC) plus preferred stock (PSTK).

CAPEX: Capital expenditures (CAPX), divided by total assets (AT).

Cash holdings: Cash and short-term investments (CHE), divided by total assets (AT).

Dividend increase: Dummy variable equal to one if there is an increase in dividends per share (dvpsx_f), after adjusting for stock splits.

Dividends: Total common stock dividend (DVC), expressed as a fraction of firm's market capitalization at the end of the previous year.

Free cash flow: Operating cash flow (OANCF) minus capital expenditure (CAPX) divided by total assets (AT).

High option expense: An indicator variable equal to one if the firm's 2002 implied options expense, scaled by total assets, is above the median value.

Leverage: Sum of Long term debt (DLTT) and short term debt (DLC), divided by total assets (AT).

Loss indicator: An indicator variable equal to one if current net income is negative, and zero otherwise.

Market capitalization: Shares outstanding (CSHO) times stock price (PRCC_F).

Market to book: Market capitalization plus long-term debt (DLTT) plus debt in current liabilities (DLC) plus preferred stock (PSTK), divided by the book value of assets (AT).

Operating income: Operating income (OIBDP), divided by book value of assets (AT).

Repurchases: The expenditure on the repurchase of common and preferred stock (PRSTKC) minus any reduction in the value of preferred stock outstanding (PSTK), expressed as a fraction of firm's market capitalization at the end of the previous year.

ΔRepurchases: Change in average annual repurchases a fraction of firm's market capitalization at the end of the previous year, around mandatory option expensing (FAS1234R) from 2003-2004 to 2005-2007.

ROA volatility: The standard deviation of returns on assets (operating income before tax divided by lagged total assets) in the past five fiscal years.

Sales growth: The growth rate of sales (SALE) from the prior year.

Total payout: The sum of repurchases and dividends (DVC), expressed as a fraction of firm's market capitalization at the end of the previous year.

CRSP

Age: Years since the firm appears for the first time on CRSP database.

Announcement return: CAPM abnormal returns during the 5-day window around repurchase announcement.

Concurrent return: Buy-and-hold return during the month.

Institutional ownership: Shares held by institutional investors as a percentage of total shares outstanding. This is the sum of stakes held by all institutional investors as reported in their quarterly 13(f) reports. The data were purchased from Thomson Financial. All institutions with at least $100 million under management are required to report equity positions (greater than 10,000 shares or $200,000) to the SEC each quarter. Managers with stale reports (i.e., report date unequal to quarter-end date) are excluded for the quarter. The data are also cleaned of obvious reporting errors (e.g., lags in adjustment for stock splits).

Prior return: Buy-and-hold return over the prior year.

Prior 3-month return: Buy-and-hold return over the prior three months.

Return Volatility: Standard deviation of daily returns over prior year.

SDC

Announcement indicator: An indicator variable equal to one if the firm announced a repurchase during the current or prior year.

Monthly Repurchase Data

Frequent repurchaser: An indicator variable equal to one if a firm repurchases during 9-12 months in a year.

Infrequent repurchaser: An indicator variable equal to one if a firm repurchases during 1-4 months in a year.

ISS

CEO bonus indicator: An indicator variable equal to one if the CEO's bonus is based on an EPS target.

Performance shares: Number of performance vesting shares granted to executives during the fiscal year measured at the target performance level, divided by the number of shares outstanding.
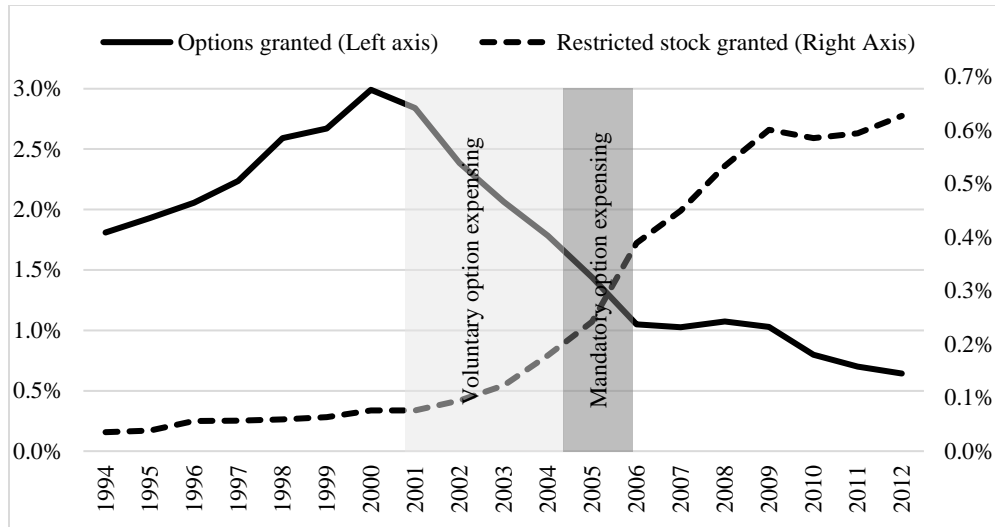
Figure 1. Trends in Stock-based Compensation

Description: This figure shows annual average restricted stock and option grants, scaled by the number of shares outstanding, from 1994 to 2012 for our sample of 1,000 firms. Our sample selection process is described in Section 3. Light shading from 2001 to 2004 denotes the years during which many firms began to voluntarily expense stock options. Dark shading in 2005 denotes the adoption of mandatory option expensing.

Interpretation: Option grants began falling when option expensing became voluntary and continue falling during the mandatory expensing phase-in. Restricted stock grants increased during these periods, suggesting that restricted stock replaced options.
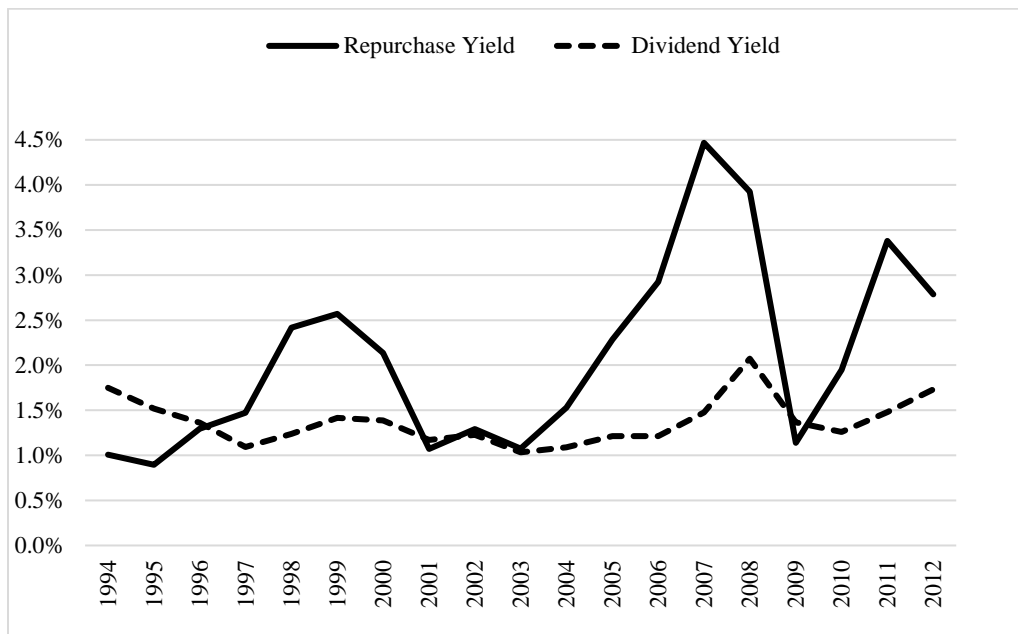
Figure 2. Trends in Payout Policy

Description: This figure shows annual average repurchase and dividend values, scaled by market capitalization, from 1994 to 2012 for our sample of 1,000 firms. Our sample selection process is described in Section 3.

Interpretation: Dividend yields are fairly constant during the sample period. Repurchase yields are more variable but are particularly high after mandatory option expensing.

Panel A: Predictions of Dilution Hypothesis

| | Variables of Interest | | |
Outcome	Options	Executive Options (Incremental effect)	Restricted Stock
Repurchase levels	+	0	+
Dividend increase instead of repurchase	–	0	–

Panel B: Predictions of Dividend Protection Hypothesis

| | Variables of Interest | | |
Outcome	Options	Executive Options (Incremental effect)	Restricted Stock
Repurchase levels	+	+	0
Dividend increase instead of repurchase	–	–	0

Figure 3. Hypotheses Predictions

Description: The above figure outlines the empirical predictions of the dilution hypothesis (Panel A) and the dividend protection hypothesis (Panel B). We show the expected sign of coefficients on total options, executive options, and restricted stock in regressions modeling repurchase levels and the likelihood of increasing dividends instead of repurchasing.

Interpretation: Though both hypotheses share similar predictions regarding the relation between stock options and payout, their predictions regarding executive options and restricted stock differ. These differences allow us to empirically disentangle the dilution and dividend protection hypotheses.
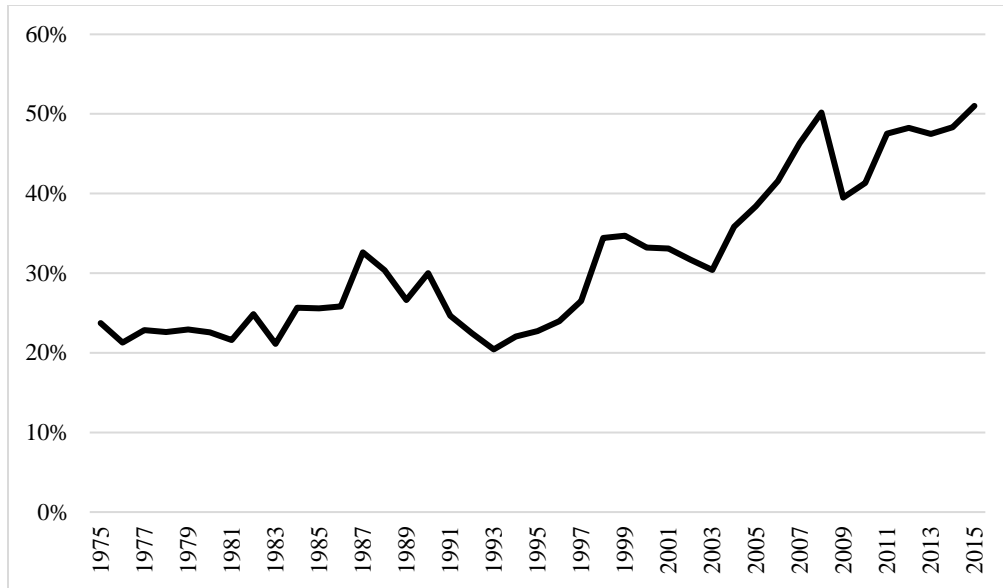
Figure 4. Fraction of Firms Repurchasing

Description: This figure shows the fraction of firms repurchasing each year for the full sample of listed CRSP/Compustat firms from 1975 to 2015. Repurchases are measured as the expenditure on the repurchase of common and preferred stock minus any reduction in the value of preferred stock outstanding.

Interpretation: The fraction of firms that repurchase increases substantially over time. Because close to half of all firms repurchase towards the end of the sample period, it is unlikely that undervaluation explains this upward trend.
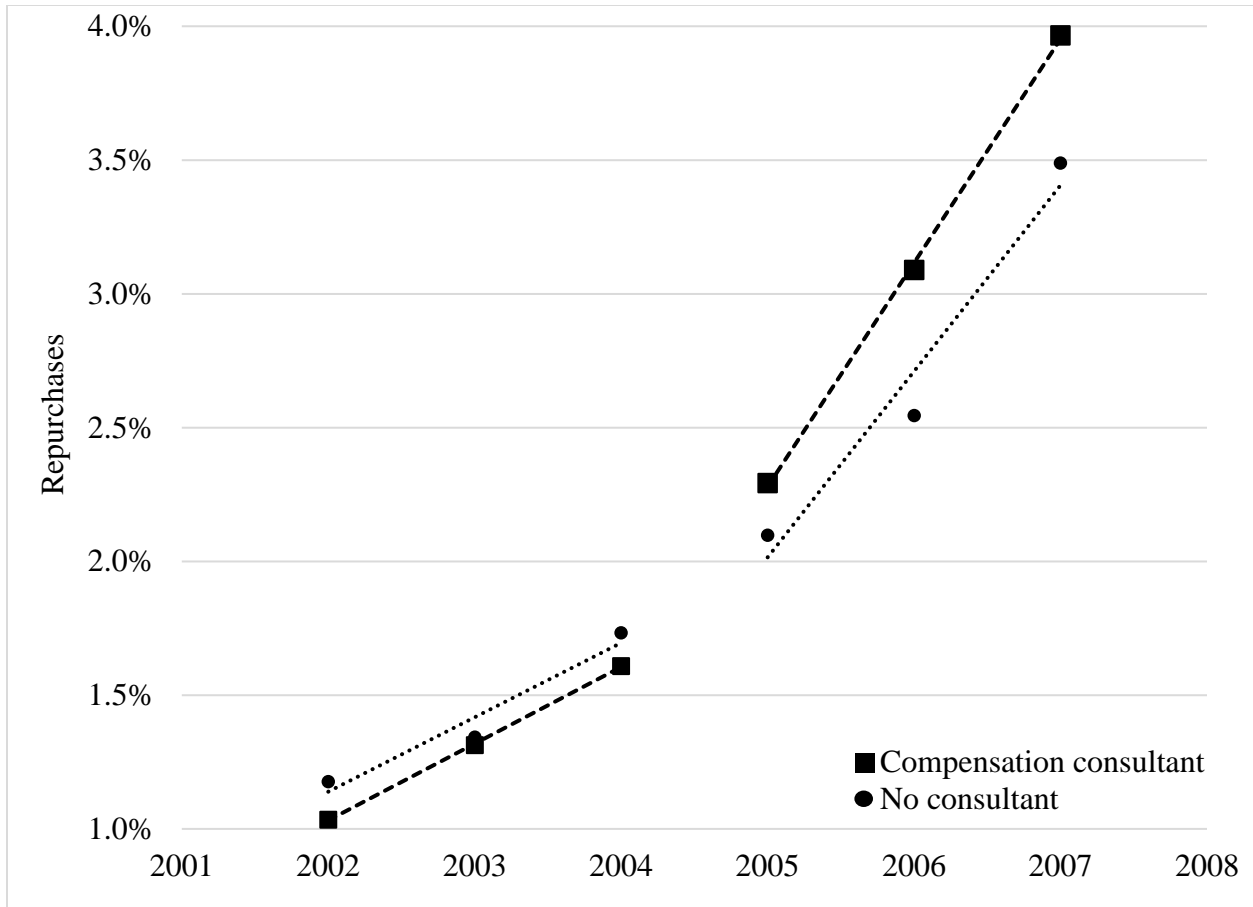
Figure 5. Parallel Trends

Description: The above figure displays the average repurchase trends for firms with a compensation consultant (square) and firms without a compensation consultant (circle). The dotted and dashed lines represent linear trends in the pre (2002-2004) and the post (2005-2007) FAS 123R periods.

Interpretation: Treated and control firms follow similar repurchase trends in the pre-mandatory option expensing period, but the difference widens in the post period.

Table 1. Descriptive Statistics for Our Random Sample of Repurchasing Firms

Description: This table reports summary statistics for our random sample of 1,000 firms that announce a repurchase in SDC between 1994-2012 and have data available on Compustat, CRSP, Execucomp, and electronic 10-Ks in Edgar. The sample consists of 14,464 firm-years between 1994 and 2012, 9,183 firm-years between 1994 and 2004, and 5,281 firm-years between 2005 and 2012. *Performance shares* are reported for the subsample with ISS Incentive Lab data, which comprises 5,093 firm-years between 1998 and 2012, 1,426 firm-years between 1998 and 2004 and 3,667 firm-years between 2005 and 2012. All compensation variables are expressed as a percentage of shares outstanding. Repurchases and dividends are expressed as a percentage of lagged market capitalization, and asset tangibility, CAPEX, cash holdings, leverage, and operating income are expressed as a percentage of total assets. Please refer to the Appendix for detailed variable definitions and Online Appendix Table OA1 for correlation coefficients.

Interpretation: Options outstanding and granted decline significantly following mandatory option expensing. In contrast, restricted stock granted increases significantly. Hence, the decline in options is counterbalanced by an increase in restricted stock grants. Repurchases increase following mandatory expensing despite the decrease in options outstanding and granted.

	All periods			1994-2004			2005-2012			P-value for Difference	
	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation	Mean	Median	Standard Deviation	Mean	Median
Options outstanding (%)	7.89	6.63	5.73	8.64	7.30	6.09	6.86	5.85	5.02	0.000	0.000
Options exercised (%)	1.13	0.72	1.28	1.11	0.68	1.29	1.17	0.79	1.26	0.016	0.000
Options granted (%)	1.81	1.18	2.12	2.33	1.59	2.40	1.10	0.76	1.33	0.000	0.000
Executive options outstanding (%)	2.08	1.42	2.16	2.21	1.52	2.30	1.89	1.32	1.90	0.000	0.000
Restricted stock granted (%)	0.23	0.00	0.45	0.07	0.00	0.24	0.45	0.26	0.56	0.000	0.000
Performance shares (%)	0.07	0.00	0.32	0.03	0.00	0.23	0.11	0.00	0.39	0.000	0.000
Repurchases (%)	1.89	0.20	3.14	1.47	0.01	2.80	2.47	0.84	3.49	0.000	0.000
Dividends (%)	1.40	1.01	1.55	1.42	1.01	1.56	1.38	1.00	1.52	0.120	0.920
Dividends/Total payout (%)	53.08	52.51	40.98	58.34	67.46	40.98	46.27	38.95	39.97	0.000	0.000
Asset tangibility (%)	87.43	94.71	16.17	90.74	97.43	13.64	81.62	87.60	18.46	0.000	0.000
Capex (%)	4.89	3.66	4.73	5.47	4.35	4.99	4.08	2.87	4.22	0.000	0.000
Cash holding (%)	13.27	6.85	15.58	12.08	5.49	15.51	14.93	9.04	15.53	0.000	0.000
Leverage (%)	21.38	19.75	17.50	21.88	20.15	17.96	20.67	19.15	16.98	0.000	0.011
Market capitalization (2012 $s)	11,561	2,453	37,073	10,493	2,012	36,649	13,054	3,054	37,609	0.000	0.000
Market to book	1.60	1.22	1.31	1.70	1.24	1.44	1.47	1.18	1.08	0.000	0.000
Operating Income (%)	14.80	14.50	10.83	15.30	15.39	11.82	14.13	13.46	9.24	0.000	0.000
Age	29.20	27.00	18.92	26.40	24.00	18.16	33.12	33.00	19.28	0.000	0.000
Institutional ownership (%)	65.32	67.80	21.43	57.76	60.20	20.33	75.89	78.17	18.20	0.000	0.000
Prior return (%)	8.03	10.20	40.40	10.60	12.05	41.69	4.43	8.27	38.22	0.000	0.000
Return volatility (%)	2.59	2.27	1.27	2.66	2.33	1.30	2.47	2.17	1.22	0.000	0.000
Sales growth (%)	12.72	9.59	24.85	14.30	10.24	26.83	9.96	8.53	20.63	0.000	0.000

Table 2. Share Repurchases and Employee Compensation

Description: This table presents Tobit and ordinary least squares (OLS) regressions of repurchases on employee stock-based compensation, control variables, and firm and year fixed effects for our random sample of 1,000 firms that announce a repurchase in SDC between 1994-2012 and have data available on Compustat, CRSP, Execucomp, and electronic 10-Ks in Edgar. We show the estimation for the full 1994-2012 sample period, 1994-2004 only, or 2005-2012 only, as noted. Models (8) and (9) use the ISS Incentive Lab data on performance-vesting shares, which is available for 678 firms from 1998 to 2012. *Restricted Stock Granted* in these two specifications is all non-performance restricted stock granted. The dependent variable repurchases are estimated from Compustat as the purchase of common and preferred stock minus any reduction in the value of preferred stock outstanding, scaled by lagged market capital. All independent variables are defined in the Appendix. All specifications include both firm and year fixed effects. OLS standard errors are clustered by firm. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: Repurchases are positively related to options outstanding and options granted in all periods. Executive options granted positively relate to repurchases in the pre-mandatory expensing period only, indicating that dividend protection is not a motive for repurchases following mandatory expensing. Restricted stock granted is strongly positively related to repurchases following mandatory expensing, consistent with the dilution channel but not the dividend substitution channel. Performance-based shares do not incrementally impact share repurchases, inconsistent with executives' desire to meet performance criteria driving the strong, positive relation between restricted stock and repurchases. In conclusion, this table shows that the dilution effect is present across the full sample period while the divided substitution channel is present only in the pre-option expensing period.

	Tobit				OLS			Tobit	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8) 1998-2012 (ISS)	(9) 1998-2012 (ISS)
	Full	Full	1994-2004	2005-2012	Full	1994-2004	2005-2012		
Options outstanding	0.064***	0.073***	0.023	0.165***	0.045***	0.022*	0.131***	0.106***	0.064***
	(5.32)	(6.06)	(1.48)	(6.08)	(4.28)	(1.96)	(4.40)	(6.60)	(4.01)
Options exercised	0.367***	0.369***	0.278***	0.606***	0.305***	0.199***	0.514***	0.402***	0.368***
	(11.13)	(11.20)	(6.80)	(10.77)	(8.76)	(5.51)	(8.19)	(9.67)	(8.01)
Executive options outstanding	0.049*	0.046*	0.093***	-0.016	0.025	0.047*	-0.018	0.040	0.045
	(1.85)	(1.72)	(2.71)	(-0.28)	(1.06)	(1.70)	(-0.36)	(1.06)	(1.27)
Restricted stock granted		0.556***	0.019	0.697***	0.365***	0.030	0.473***		
		(5.04)	(0.08)	(4.65)	(3.59)	(0.19)	(3.44)		
Non-performance shares								0.700***	0.490***
								(5.28)	(3.90)
Performance shares								0.661***	0.466***
								(4.81)	(3.60)
Restricted stock indicator		-0.000	-0.000	0.001	-0.001	-0.001	0.001	0.001	-0.000
		(-0.26)	(-0.29)	(0.29)	(-0.68)	(-0.70)	(0.44)	(0.70)	(-0.05)
Announcement indicator	0.025***	0.025***	0.023***	0.024***	0.014***	0.012***	0.017***	0.022***	0.014***
	(29.54)	(29.46)	(21.87)	(18.63)	(18.75)	(13.56)	(13.16)	(21.05)	(14.25)
Asset tangibility	0.004	0.005	0.007	0.014	-0.000	0.003	0.008	0.006	0.003
	(0.91)	(1.09)	(1.13)	(1.40)	(-0.04)	(0.47)	(0.80)	(1.01)	(0.55)
Capex	-0.046***	-0.045***	-0.040***	-0.050*	-0.027**	-0.018**	-0.033	-0.087***	-0.038***
	(-4.06)	(-3.98)	(-2.83)	(-1.88)	(-2.57)	(-2.23)	(-1.55)	(-5.07)	(-3.17)
Cash holding	0.035***	0.035***	0.054***	0.043***	0.018***	0.021***	0.031***	0.030***	0.015***
	(7.37)	(7.38)	(8.28)	(4.73)	(4.37)	(4.52)	(3.68)	(4.85)	(2.60)
Leverage	-0.051***	-0.051***	-0.042***	-0.101***	-0.026***	-0.023***	-0.061***	-0.061***	-0.030***
	(-13.64)	(-13.70)	(-8.49)	(-13.26)	(-7.71)	(-5.82)	(-7.61)	(-12.58)	(-6.31)
Log(Market capitalization)	0.007***	0.007***	0.008***	0.011***	0.001**	0.001	0.005***	0.007***	0.002***
	(9.16)	(9.68)	(8.02)	(5.95)	(2.37)	(1.59)	(3.29)	(7.82)	(2.82)
Market to book	-0.010***	-0.009***	-0.010***	-0.009***	-0.004***	-0.004***	-0.005***	-0.008***	-0.004***
	(-16.48)	(-16.32)	(-13.76)	(-6.95)	(-8.59)	(-7.50)	(-5.53)	(-12.24)	(-6.87)
Operating income	0.101***	0.102***	0.094***	0.079***	0.032***	0.020***	0.048***	0.111***	0.030***
	(14.93)	(15.08)	(10.38)	(6.47)	(4.26)	(3.19)	(4.21)	(13.05)	(2.93)
Log(age)	0.013***	0.012***	0.012***	0.008**	0.006***	0.006***	0.005	0.009***	0.006***
	(9.33)	(8.95)	(5.52)	(2.32)	(4.77)	(3.13)	(1.41)	(5.07)	(3.14)
Institutional ownership	-0.011***	-0.012***	-0.009*	-0.006	-0.011***	-0.002	-0.009	-0.023***	-0.018***
	(-3.19)	(-3.45)	(-1.90)	(-0.87)	(-3.93)	(-0.63)	(-1.51)	(-4.88)	(-4.42)
Prior returns	-0.005***	-0.005***	-0.005***	-0.004*	-0.003***	-0.003***	-0.002	-0.006***	-0.004***
	(-4.32)	(-4.27)	(-3.62)	(-1.87)	(-3.63)	(-3.64)	(-1.58)	(-4.19)	(-3.56)
Return volatility	-0.540***	-0.514***	-0.431***	-0.314***	-0.284***	-0.159***	-0.121*	-0.613***	-0.332***
	(-10.56)	(-10.01)	(-5.77)	(-3.62)	(-7.35)	(-3.42)	(-1.85)	(-9.60)	(-6.51)
Sales growth	-0.011***	-0.011***	-0.009***	-0.010***	-0.006***	-0.003**	-0.009***	-0.012***	-0.006***
	(-6.31)	(-6.28)	(-4.44)	(-3.31)	(-4.62)	(-2.26)	(-3.11)	(-5.47)	(-3.50)
CEO bonus indicator								0.001	0.001
								(0.28)	(0.59)
Observations	14,286	14,286	9,083	5,203	14,286	9,083	5,203	8,019	8,019
Log likelihood/ Adjusted R^2	8440***	8468***	5970***	4252***	0.184	0.116	0.200	9057***	0.205

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Table 3. The Dividend/Repurchase Choice and Employee Compensation

Description: For our random sample of 1,000 firms in those years in which payout increases, this table presents logistic regressions of the likelihood of increasing dividends versus repurchasing on employee stock-based compensation and control variables, including year fixed effects. The dependent variable equals one if split-adjusted dividends per share increase from the prior to the current year, and zero if a firm announces a repurchase program (Models (1)-(3)), actually repurchases (Models (4)-(6)), or increases repurchase yield (Models (7)-(9)), but does not increase dividends. Estimation periods span the full 1994-2012 sample period, 1994-2004 only, or 2005-2012 only, as noted. Control variables from Table 2 are included but coefficients are omitted for brevity. Standard errors are clustered by firm. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: This table provides additional support for dilution as a primary channel driving the relation between compensation and repurchases. Regardless of the dependent variable and time period examined, there is a weak or an insignificant relation between executive options and dividend increases, which is inconsistent with dividend protection. There is evidence consistent with the dilution hypothesis. Specifically, in the early sample period, firms are likely to repurchase rather than increase dividends as total options outstanding increase, while in the late period, firms repurchase instead of increasing dividends as restricted stock granted increases.

	Dividend increase vs. repurchase announcement			Dividend increase vs. actual repurchase			Dividend increase vs. repurchase increase		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Full	1994-2004	2005-2012	Full	1994-2004	2005-2012	Full	1994-2004	2005-2012
Options outstanding	-7.003***	-8.193***	-4.001	-7.143***	-8.433***	-4.354*	-6.605***	-8.134***	-2.570
	(-4.68)	(-5.31)	(-1.49)	(-5.58)	(-6.12)	(-1.95)	(-5.38)	(-6.27)	(-1.15)
Options exercised	-5.285	-5.838	-3.553	-2.517	-4.867	1.978	-3.829	-4.273	-1.703
	(-1.21)	(-0.99)	(-0.54)	(-0.83)	(-1.20)	(0.42)	(-1.13)	(-0.95)	(-0.30)
Executive options outstanding	-4.163	-5.146	-5.188	-4.842*	-5.563*	-4.444	-3.447	-3.387	-6.406
	(-1.20)	(-1.27)	(-0.74)	(-1.67)	(-1.68)	(-0.83)	(-1.25)	(-1.07)	(-1.17)
Restricted stock granted	-45.557***	11.595	-60.584***	-42.852***	0.469	-56.049***	-32.949***	19.489	-49.845***
	(-3.42)	(0.46)	(-3.99)	(-3.98)	(0.02)	(-4.62)	(-2.90)	(0.83)	(-4.01)
Number of observations	7,677	4,814	2,863	10,399	6,344	4,055	9,351	5,949	3,402
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pseudo R^2	0.312	0.330	0.310	0.303	0.321	0.294	0.320	0.345	0.302

Table 4. Omitted Variables Do Not Drive the Relation between Share Repurchases and Payout

Description: This table reports the importance of omitted variable bias, measured using Oster (2019)'s δ, for the linear regressions in Table 2. δ represents the ratio of the explanatory power of omitted variables relative to the included variable of interest necessary to erase the impact of the variable of interest. A common cutoff is one, which implies that the omitted variables must be at least as important as the non-omitted variables to explain away our results. A negative δ shows that the effect of the dependent variable increases on adding the controls and hence omitted variables are unlikely to make the effect disappear. We use Oster's proposed input of R-max = 1.3* $\tilde{R}$, where $\tilde{R}$ equals the largest empirically observed R^2.

Interpretation: All δs associated with statistically significant coefficients in Table 2 are either negative or greater than one, indicating that omitted variables are not likely to drive the positive relation between stock-based compensation and payout policy.

Corresponding columns from Table 2	(5)	(6)	(7)
Options outstanding	-2.5	3.6	-6.2
Options exercised	17.5	24.4	6.8
Executive options outstanding	1.7	2.8	-0.6
Restricted stock granted	1.0	1.4	-11.7

Table 5. Payout Policy and Mandatory Option Expensing: An IV Approach

Description: This table reports OLS and 2SLS regression estimates of changes in repurchases around mandatory option expensing on equity-based compensation. This analysis includes all firm-years in our sample between 2003 and 2007. The dependent variable is the change in repurchases from pre-FAS 123R (2003-2004) to post-FAS 123R (2005-2007). We create an indicator variable (Compensation consultant) equal to one if the firm hires a compensation consultant in 2006, the first year in which firms report compensation consultants. We then use this indicator to instrument for change in restricted stock granted from pre- to post-FAS 123R. Model (1) presents reduced form OLS regression estimates. Model (2) presents an OLS model using an entropy-balanced control sample. Table OA17 shows the covariate balance using entropy weights. Model (3) presents the first stage estimates of a regression of change in restricted stock on the consultant indicator. Model (4) presents the second stage IV estimates. All models include Fama-French 48 industry fixed effects and changes in our standard control variables. We also include an indicator equal to one if the firm repatriated funds under the AJCA in that year. The standard errors assume homoscedasticity as the Pagan-Hall test fails to reject the null of homoscedasticity. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: The positive and significant coefficient on our instrument supports the dilution hypothesis; it suggests that treated firms (with compensation consultants) increase repurchases more than control firms (without compensation consultants).

	Reduced Form: Δ Repurchases		Two-stage Least Squares	
	OLS	Entropy balanced OLS	1st stage: Δ Restricted stock	2nd stage: Δ Repurchases
	(1)	(2)	(3)	(4)
Compensation Consultant	0.005**	0.004*	0.001***	
	(2.48)	(1.72)	(3.19)	
Δ Restricted stock				6.106**
				(2.03)
Number of observations	744	744	744	744
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.198	0.153	0.210	
Cragg-Donald Wald F statistic			10.19	
Anderson LM statistic			10.886	
P-value			0.001	
Confidence interval				1.21-18.55
P-value				0.0132

Table 6. Payout Policy and Mandatory Option Expensing: A Placebo Test

Description: This table reports the results of a placebo test where we repeat the analysis in Table 5 after moving the mandatory option expensing "treatment" year forward to a non-event year. The dependent variable is the change in repurchases from pre-period (two years prior to the placebo event year) to post-period (the placebo event year and the next two years). We create an indicator variable (Compensation consultant) equal to one if the firm hires a compensation consultant in 2006, the first year in which firms report compensation consultants. We use this indicator to instrument for change in restricted stock granted from pre- to post-period. Panel A presents reduced form OLS regression estimates. Odd-numbered models in Panel B present first stage regressions of change in restricted stock on the consultant indicator. Even-numbered models in Panel B present second stage IV estimates. All models include Fama-French 48 industry fixed effects and changes in our standard control variables. The standard errors assume homoscedasticity as the Pagan-Hall test fails to reject the null of homoscedasticity. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: This placebo test suggests it is unlikely that we have identified a spurious relation and provides additional support for a causal relation. There is no significant effect of compensation consultant on changes in repurchases or changes in restricted stock around other years.

Panel A: Reduced Form OLS

Dependent variable:	Δ Repurchases			
Placebo event year:	2007	2008	2009	2010
	(1)	(2)	(3)	(4)
Compensation Consultant	-0.001	-0.005	-0.002	0.000
	(-0.59)	(-1.61)	(-0.69)	(0.18)
Number of observations	684	654	641	623
Controls	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.208	0.197	0.211	0.204

Panel B: Two-stage Least Squares

Dependent variables:	Δ Restricted stock (1st stage) and Δ Repurchases (2nd stage)							
Placebo event year:	2007		2008		2009		2010	
	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage	1st stage	2nd stage
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Compensation Consultant	-0.000		-0.000		-0.000		-0.000	
	(-0.17)		(-0.77)		(-0.97)		(-0.40)	
Δ Restricted stock		26.461		17.011		5.276		-3.198
		(0.18)		(0.72)		(0.61)		(-0.15)
Number of observations	684	684	654	654	641	641	623	623
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.209		0.136		0.165		0.165	

Table 7. Share Repurchase Frequency and Equity-based Compensation

Description: This table presents ordered logit models of repurchase frequency on employee stock-based compensation, controls, and firm and year fixed effects. Monthly repurchase data are available beginning in 2004, and our estimation period spans 2004-2012. Model (1) estimates repurchase frequency with values of one, two, and three assigned to infrequent, moderate, and frequent repurchases. We categorize firms as infrequent, moderate, and frequent repurchasers if they repurchase in one to four months, five to eight months, or nine or more months during the year, respectively. Model (2) defines repurchase frequency as the number of quarters during a fiscal year the firm repurchases. Odds ratios are based on one standard deviation changes in independent variables. All variables are defined in the Appendix. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: The frequency of repurchases is consistently positively related to options outstanding, options exercised, and restricted stock granted. These results suggest that firms repurchase frequently to match the timing of repurchases with the exercise of options and grant of restricted stocks, which is consistent with firms repurchasing frequently to offset dilution, rather than exploit undervaluation.

	Repurchase frequency		Repurchase quarters per year	
	(1)		(2)	
	Coefficients	Odds Ratio	Coefficients	Odds Ratio
Options outstanding	8.563***	1.53	5.760**	1.33
	(2.76)		(2.06)	
Options exercised	15.861***	1.22	12.875**	1.17
	(2.68)		(2.37)	
Executive options outstanding	-3.104	0.94	-0.143	1.00
	(-0.54)		(-0.03)	
Restricted stock granted	40.477**	1.25	37.954***	1.23
	(2.46)		(2.70)	
Restricted stock indicator	0.262	1.09	0.250	1.08
	(0.84)		(0.88)	
CAPEX	-8.243**	0.75	-6.620*	0.79
	(-2.16)		(-1.73)	
Cash holding	-0.739	0.89	-0.460	0.93
	(-0.82)		(-0.52)	
Leverage	-5.230***	0.44	-4.560***	0.49
	(-6.75)		(-5.51)	
Log(Market capitalization)	1.377***	7.63	1.307***	6.88
	(5.46)		(5.93)	
Market to book	-0.341**	0.68	-0.305**	0.71
	(-2.35)		(-2.30)	
Operating income	5.716***	1.70	4.831***	1.57
	(4.41)		(4.14)	
Log(Age)	0.780	1.70	0.442	1.35
	(1.40)		(0.94)	
Institutional ownership	-3.366***	0.56	-3.186***	0.58
	(-3.89)		(-3.89)	
Prior return	0.595***	1.22	0.469**	1.17
	(2.68)		(2.24)	
Number of observations	3,279		3,279	
Firm and year fixed effects	Yes		Yes	
Pseudo R^2	0.364		0.305	

Table 8. Monthly Repurchase Likelihood

Description: This table presents logistic regressions predicting monthly repurchase likelihood as a function of repurchase frequency and prior returns. The sample consists of the 715 firms for which we have both hand-collected stock-based compensation data and hand-collected actual monthly repurchase data from quarterly (10-Q) and annual (10-K) filings between 2004 and 2012. The dependent variable equals one if the firm repurchases during the month. We categorize firms as infrequent, moderate, and frequent repurchasers if they repurchase in one to four, five to eight, or nine or more months during the year, respectively. Marginal effects are calculated at the mean. We include firm fixed effects in Models (2) and (3) and standard controls in Model (3). All independent variables, with the exception of returns variables, are measured at the end of the prior fiscal quarter and defined in the Appendix. Standard errors are clustered by firm. T-statistics are in parentheses; ***, **, and * denote significance at 1%, 5%, and 10% respectively.

Interpretation: Firms are less likely to repurchase following positive stock returns. The interaction terms indicate that the effect of prior returns on repurchase likelihood is mitigated for frequent repurchasers, such that prior returns do not significantly impact repurchase likelihood for frequent repurchasers. The results are consistent with frequent repurchasers buying shares to counteract dilution rather than to time the market.

	(1)		(2)		(3)	
	Coefficient	Marginal effect	Coefficient	Marginal effect	Coefficient	Marginal effect
Frequent	1.767***	0.403	1.556***	0.363	1.526***	0.051
	(32.68)		(33.79)		(32.83)	
Infrequent	-1.441***	-0.344	-1.419***	-0.329	-1.371***	-0.066
	(-57.98)		(-52.15)		(-49.98)	
Prior 3-month return	-0.823***	-0.206	-0.920***	-0.224	-0.998***	-0.041
	(-5.17)		(-5.25)		(-5.73)	
Concurrent return	-1.432***	-0.358	-1.550***	-0.377	-1.483***	-0.060
	(-6.48)		(-6.71)		(-6.32)	
Prior 3-month return *Frequent	0.727**	0.182	0.766***	0.187	0.794***	0.033
	(2.57)		(2.64)		(2.79)	
Prior 3-month return * Infrequent	-0.497**	-0.124	-0.569***	-0.139	-0.642***	-0.027
	(-2.49)		(-2.59)		(-2.89)	
Concurrent return *Frequent	0.526	0.131	0.565	0.136	0.619	0.025
	(1.30)		(1.38)		(1.53)	
Concurrent return * Infrequent	0.076	0.019	0.025	0.006	0.075	0.003
	(0.26)		(0.08)		(0.24)	
Number of observations	41,243		40,906		40,541	
Firm fixed effect	No		Yes		Yes	
Controls	No		No		Yes	
Pseudo R^2	0.241		0.258		0.262	