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Executive Compensation and Horizon Incentives: an Empirical Investigation of Corporate Cash Payout

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Abstract

The recent financial crisis has renewed the interest in executives' compensation-related horizon incentives. This paper examines how the short-termism in CEO compensation affects corporate cash payout through share repurchases using a new measure of compensation horizon incentive. In contrast to the conventional wisdom that firms buy back shares after poor stock performance, we find that CEOs with short compensation horizons are more likely to buy back shares after good performance. To bolster already high stock price, they have incentives to repurchase to boost up reported EPS towards analysts' expectations, and to cater to investors with short investment horizons. This short-termism is not related to corporate governance, but is more severe in firms that have less liquid stocks. While long-term shareholders do not benefit from such repurchases, short-termist CEOs benefit by selling their own holdings when firms are buying. Our findings suggest that some large cash payouts by firms with short managerial horizons during the repurchase binge in 2005-2008 may be premature, which portraits a striking contrast from the liquidity constraints that many firms experienced later during the crisis.

1. Introduction

The recent financial crisis has reinforced the interest in managerial horizon incentives. Pay arrangements that rewarded Wall Street bankers for short-term gains even when these gains were subsequently reversed gave many bankers strong incentive to "hit it big with one great year and then retire rich". This type of compensation structure has received wide criticism. Tying pay to long-term performance has been at the top of the regulator's reform agenda. More generally, all these highlight the importance of managerial horizon incentive on corporate decision making. Existing theories suggest that managers with short horizon incentive may involve in decisions that yield short-term gain at the expense of long-term firm value (e.g., Narayanan, 1985 and 1996; Stein, 1989; Thakor, 1990; Bebchuk and Stole, 1993). In this paper, we add to the literature by conducting an empirical test on how managerial horizon incentives arising from executive compensation structure may affect corporate decisions and firm value, in the context of corporate cash payout through share repurchases.

Cash payout in corporate liquidity management during the pre-crisis stock market boom provides an opportune setting in examining this issue. In light of the adverse and widespread impact of the recent financial crisis on corporate sectors, how firms manage internal and external sources of liquidity to weather negative financing shocks has attracted increasingly more attention.[1] Some latest studies have shown that corporate investment decline following the onset of the crisis, especially for firms that have low cash reserves (e.g., Duchin, Ozbas, and Sensoy, 2010; Campello, Graham, and Harvey, 2010). High pre-crisis cash reserves mitigated the adverse effect on post-crisis investment of the external financing supply shock.

On the other hand, S&P1500 non-financial firms distributed cash, typically through share repurchases, at an unprecedented level during the last market boom 2003-2007 before the crisis. The "buyback binge" (as the financial media then put it) portraits a striking contrast from the liquidity constraints that many

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[1] See, for example, Campello, Giambona, Graham, and Harvey (forthcoming) for how firms managed credit lines during the 2008-2009 financial crisis.

firms experienced later during the crisis.[2] Moreover, in contrast with the conventional wisdom that firms typically repurchase undervalued stocks, many firms bought back shares after good stock performance.[3] It is unclear why firms are buying back such a large volume of shares when the shares are not so cheap. Are these repurchases short-sighted and therefore do not benefit shareholders in the long run? How does the repurchase decision relate to managerial horizon incentives?

We hypothesize that managers with short-term horizon incentives tend to rely more on share repurchases to bolster already high stock price in a short run, and thus have more incentives to repurchase after good performance (*managerial horizon incentive hypothesis*). These repurchases, less likely to be motivated by undervaluation, are more likely to be undertaken to manage reported earnings-per-share (EPS) towards analysts' forecast consensus, or to cater to the demand of investors with short investment horizon for better short-run performance. Although those firms may be met with favorable market reaction in the short run, long-term shareholders would not benefit as much as from repurchases motivated out of the undervaluation concern.

We test an alternative hypothesis that managers may be overconfident and thus believe their equity is undervalued despite the current good performance (*managerial overconfidence hypothesis*). We distinguish the two hypotheses by looking at managers' own trading of the firms' stock when these firms are buying back their shares. Note that we focus on cash payout through repurchases but not dividends. This is because dividends are rather smooth over time, and the stickiness of dividends does not give managers as much leeway as repurchases in terms of the timing and magnitude of payout. Repurchases also have advantages that dividends do not have in facilitating EPS management and providing liquidity

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[2] In examining the share repurchase activities in the banking industry, Banyi, Porter, and Williams (2010) find that banks that received funds from the Troubled Asset Relief Program (TARP) returned a higher proportion of their available capital to shareholders in the periods leading up to the financial crisis than banks that did not.

[3] A recent study by Fu, Huang, and Lin (2011) finds that the open market repurchase anomalies, as reported by Ikenberry, Lakonishok, and Vermaelen (1995), disappeared for the period of 2003-2010 for all repurchasing firms covered in Compustat. This finding suggests that firms in that period on average might not buy back shares that were as undervalued as in earlier periods shown in Peyer and Vermaelen (2009).

and price floor support when investors and managers themselves are selling their holdings, both of which are related with managers' horizon incentives.

We measure the managerial horizon incentive induced by equity compensation using the idea of *pay duration* developed in Gopalan, Milbourn, Song, and Thakor (2010) and Cadman and Sunder (2010). This new measure is computed as the weighted average of the vesting periods of different pay components (salary, bonus, restricted stock and stock option). It thus explicitly captures the horizon incentives in the pay contract: the shorter the pay duration is, the shorter horizon incentive has a manager. As discussed in Gopalan et al. (2010), this measure has a number of advantages over some other compensation-related measures used in the prior literature to understand the extent to which compensation structure provides horizontal incentives to executives.

Using a sample of S&P 1500 non-financial firms which have equity components in CEO compensation from 2005 to 2008, we find strong empirical support for the *managerial horizon incentive hypothesis*.[4] More specifically, in contrast to the conventional wisdom that firms tend to buy back shares when they are undervalued, we find that CEOs with shorter pay duration are more likely to repurchase (and repurchase more) shares after good stock performance. However, the more these firms spend on their own shares at a high price, the more shares are sold contemporaneously by their CEOs themselves. This finding holds after controlling for CEOs' diversification and portfolio rebalancing incentives. It is not supportive of the *managerial overconfidence hypothesis*, which suggests CEOs in these firms will increase or hold (at least not sell) their own holdings. Instead, although we do not argue that repurchases at a high price serve the sole purpose to bolster stock price for self-interested CEOs' own trading needs, such repurchases have provided liquidity and price floor support to the CEOs' net selling. Consistent with this view, we show that the effect of CEO pay duration on repurchases after good performance is much stronger in firms with less liquid stocks traded. This is because, *ceteris paribus*, the positive (negative)

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[4] The data on the vesting schedules of restricted stocks and stock options are only available from 2005.

price impact of firm buybacks (CEO net selling) should be greater in these firms as opposed to in firms with highly liquid stocks.

We also examine how external market force and internal governance may have contributed to the seemingly short-termism in large cash payouts. We study two types of market forces: high expectations from analysts and short-term performance pressure from investors. We find that the incentive to repurchase after good performance appears to be stronger in the presence of these external forces. Specifically, the magnitudes of repurchases at high prices by CEOs with short pay durations increase when such repurchases boost up reported EPS towards analysts' forecast consensus which otherwise would fall short of it, and when more institutional investors have short investment horizons. On the other hand, we do not find evidence in support of the mis-governance view that short-termist CEOs are more likely to repurchase shares at high prices in poorly governed firms.

Next we ask how such repurchases affect firm value in the short and long run. These repurchases at high prices and their EPS inflation impact might meet the market's preference in the short run, typically the preference of investors with short-term investment horizon. This might be especially the case if, for example, repurchases are announced after a string of consecutive earnings increases or when stock prices have been experiencing a rising trend. Repurchases under those circumstances fuel investor optimism or even the illusion that the firms are undervalued despite the high present prices. Alternatively, the repurchase decisions might signal managerial commitment to distribute cash regardless of the market timing. All the above hypotheses suggest that such repurchases would benefit selling shareholders and other investors in the short run, but less likely those loyal (non-selling) investors in the long run. Our findings confirm this after examining the market reaction to the repurchases and tracking these firms for up to three years subsequently.

In sum, we find that CEOs with short pay horizon have more incentives to buy back shares after good stock performance. And they are more likely to do so to meet the market preference for better current

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performance than their counterparts with longer horizon incentives. Those repurchases would benefit selling shareholders (and the CEOs if they sell) and other short-termist investors, but not those loyal long-term investors. It is worth noting that our findings are robust even after controlling for CEO ownership, presumably another proxy for long-term incentives. And ownership itself does not seem to explain repurchases at high prices. Cheng, Hong, and Scheinkman (2010) and Fahlenbrach and Stulz (2011) find that ownership by bank CEOs does not explain their risk-takings and firm value. It suggests that CEOs may face other high-powered incentives like short-term performance expectation and pressure from the market and short-term profits from selling their holdings.

We note the endogeneity concern that pay duration and repurchase decision might be co-determined. In selecting the optimal pay duration, shareholders will account for how share repurchases may affect managerial wealth through the structure of compensation scheme. To isolate causation, we utilize both GMM simultaneous equation estimation and firm fixed-effect regressions in our robustness checks. We find that, even after controlling for the effect of repurchase on pay duration, our main results hold that firms with short CEO pay duration are more likely to repurchase shares after good performance. In additional checks, we also show that our main results are robust after controlling for other potential motives of repurchase such as option dilution concerns documented in the previous literature.

The remainder of the paper is organized as follows. In Section 2, we outline the share repurchase binge before the recent financial crisis, develop testable hypotheses, and delineate our contribution to the related literature. We introduce the data, variable construction and empirical specifications in Section 3. Section 4 presents the main empirical results. In Section 5, we address the endogeneity concern and conduct robustness checks. We conclude in Section 6.

2. Hypotheses development and related literature

2.1. Background and hypotheses development

Grullon and Michaely (2002) and Skinner (2008) have documented the increase in share repurchase in a firm's payout mix over time. More recently, firms seemed to have paid out through repurchases not only transient earnings windfalls as suggested by the earlier literature (e.g., Guay and Harford, 2000; Jagannathan, Stephens, and Weisbach, 2000), but also permanent earnings (see a discussion in DeAngelo, DeAngelo, and Skinner (2008)).

The unprecedented level of repurchases was featured in the financial media as "the buyback binge". A news report cited some analyst's comments as follows: "This trend raises questions about corporate executives' priorities...... If they can't find anything to do with their money, it makes wonder what these guys are doing. You would think if you're that flush you would be pouring it into R&D and trying to come up with the next iPod." (by Marc Hogan, *Business Week*, August 28, 2006).[5] Practitioners expressed their concern too, as exampled by a comment in Schwab On Investing of Winter 2009: "Investors once rewarded the stocks of firms that used cash to buy back shares rather than capital investments. We believe this performance pattern on longer holds, however, as investors perhaps now believe firms deploying capital in this way are being short-sighted."

Viewed with hindsight, many firms bought back shares at much higher prices than prices obtained during and after the financial meltdown. Managers did not seem to have a rational expectation that large share repurchases at high prices may absorb the bulk of firm profits and leave firms snapped in tough time. Also cited in DeAngelo, DeAngelo, and Skinner (2008), the "Heard on the Street" column commented: "Warren Buffet knows a value stock when he sees it. Other executives can struggle with the concept – particularly when it comes to their own company's shares." (by Liam Denning, The Wall Street Journal, October 6, 2008). However, even viewed *ex ante*, share prices of many of those firms were not cheap. Many firms repurchased after a string of quarterly earnings increases which led to higher stock prices. Moreover, the more recent surge in repurchases seem not to be explained by the use of stock options in executive and employee compensation and the resulted dilution offsetting motivation (e.g., Fenn and Liang, 2001; Kahle, 2002; Bens, Nagar, Skinner, and Wong, 2003; Weisbenner, 2004; Babenko,

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[5] See also a report by Elizabeth MacDonald in *Forbes* on May 21, 2007.

2009). There is because there has been a decline in stock option grants in compensation since 2002 (Walker, forthcoming).

We think that both the "signal-jamming" explanation in managerial horizon literature (e.g., Stein, 1989) and the agency problem of overvalued equity hypothesis raised by Jensen (2005) are useful in understanding the above repurchase binge. Many firms experienced long strings of consecutive quarterly earnings increase during 2003-2006 which fueled market optimism, and these firms enjoyed high excess returns. These market premia and the rapidity with which they may disappear once the strings end provide managers incentives to maintain and extend the strings (Myers, Myers, and Skinner, 2006). The basic idea of "signal-jamming" is that higher earnings today will be correlated with higher earnings in the future, and the stock market uses the current earnings to make a forecast of firm value. Thus, managers may manipulate this signal by boosting up EPS through repurchases, typically when it becomes hard (or too costly) to improve on past good performance based on firm fundamentals. Jensen (2005) argues that when a firm's stock price is at such a level that cannot be easily justified by performance, then actions (such as repurchases) will be taken that at least appear to generate the market's expected performance in the short run. Both arguments suggest that this short-termism incentive is particularly stronger when managers' equity incentives are more tied to the short-run stock performance.

Furthermore, stock liquidity will affect short-termist CEOs' incentives to repurchase. Repurchases drive up stock prices in the short run, and the price impact of repurchases should be greater with less liquid stock, *ceteris paribus*. Therefore, short-termist CEOs who concern more about the short-run stock prices should have more incentives to buy back shares in firms with less liquid stocks. This generates our first testable hypothesis (*managerial horizon incentive hypothesis*):

Hypothesis 1: CEOs with short pay horizons have more incentives to buy back shares after good stock performance.

Hypothesis 1a: We expect that this relationship will be stronger in firms with less liquid stocks.

Alternatively, CEOs may be overconfident of the future firm performance and thus regard their firms' equity undervalued despite the current high prices. This is possible particularly if their firms have

experienced an increase in performance for some time, e.g., a sequence of quarterly earnings increase during a market boom. In this case, these firms may buy back shares to signal their CEOs' belief in the firms' equity value. Under this *managerial overconfidence hypothesis*, we would expect that CEOs will not sell their holdings when their firms are buying. Malmendier and Tate (2005) suggest that overconfident CEOs will even delay exercising their vested stock options.

But under the *managerial horizon incentive hypothesis*, CEOs care about the short-run stock prices because they can sell/exercise their vested stocks/options with more proceeds. Hall and Murphy (2002) suggest that underdiversified and risk-averse managers tend to cash out their stocks and options upon vesting. Cook, Krigman, and Leach (2004) and Grullon and Michaely (2004) find that open-market repurchases increase the market liquidity of repurchasing firms' stock. Thus, firm repurchases provide liquidity and price support for CEO selling to some extent. Moreover, as discussed below, repurchases after a string of good performance may fuel investor optimism which will bolster stock prices at least for the short run. CEOs can benefit from such price increase if they sell their holdings when their firms are buying. As such, we have the following two competing hypotheses:

Hypothesis 2a: CEOs with short horizon incentives are more likely to sell their holdings when firms are buying at high prices.

Hypothesis 2b: Short-termist CEOs who initiate repurchases at high prices are less likely to sell their own holdings.

Reflection of the recent financial crisis often points to the mis-governance in the failure to tying pay to long-term performance. The prior literature on corporate governance and firm cash policy also finds that weakly controlled managers dissipate cash quickly in ways that may destroy firm value (e.g., Dittmar and Mahrt-Smith, 2007; Harford, Mansi, and Maxwell, 2008). We hypothesize that poor corporate governance may have place less constraint on short-termist CEOs' decisions to repurchase at high prices. Thus, we will test:

Hypothesis 3: CEOs with short horizon incentives are more likely to repurchase after good performance in firms with poor corporate governance (as opposed to in firms with good governance).

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Aside from internal governance, managerial horizon is often related with investor horizon. There is an extensive literature on how myopic stock market may cause or aggravate managerial myopia. For instance, Shleifer and Vishny (1990) suggest that short horizons of smart investors lead to short horizons of managers. Short-termist investors tend to avoid investing in long-term assets that raise the cost of arbitrage because mispricing of claims to long-term assets can take a long time to disappear. As a result, mangers who are averse to the underpricing of their equity will avoid long-term projects. Brandenburger and Polak (1996) and Jensen (2005) suggest that short-termist managers tend to make decisions that the market wants to see. Polk and Sapienza (2009) and Asker, Ferra-Mensa, and Ljungqvist (2011) find consistent evidence that managers might distort investments in catering to the market.

Gaspar, Massa, Matos, Patgiri, and Rehman (2004) show that managers tend to buy back shares instead of paying dividends in responding to the preferred payout policy by short-term oriented institutional investors. We expect that when investors and managers are aligned in horizon incentives and both have short horizons, managerial myopia can be more severe. Specifically, high investor pressure for near-term performance can incentivize CEOs with short horizon to more actively repurchase either to boost up current EPS or to bolster the stock prices temporarily. This leads to:

Hypothesis 4: The relationship between CEOs' short horizon incentives and repurchases after good performance is stronger when the market pressure for short-term performance is more pronounced.

Dissipating cash through repurchases without timing the market might signal managerial commitment to payout, and thus mitigate the agency problem of free cash flow. Also, such repurchases after good performance may fuel investor optimism, because they meet the expectation of the market for better performance if they increase the reported EPS, or "signal" that the firms remain undervalued despite the high current prices, even though the market will not be fooled in the long run.[6] Either the payout

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[6] The prior literature suggests that, at repurchase announcements, the market does not seem to distinguish who will proceed, following repurchase announcements, with actual repurchases due to undervaluation from who will not (Lie, 2005). Bhattacharya and Dittmar (2008) find no difference in repurchase announcement returns between firms that repurchase shares and firms that do not repurchase shares during the quarter or the quarter following the repurchase announcement.

commitment or short-run investor optimism predicts a positive market reaction to the repurchase decisions and higher investor return at least for the short run.

The value implication of those repurchases for the long-run investors is less clear *ex ante*. While investors are less concerned that managers may spend the free cash flow on value-destroying mergers and acquisitions or other negative NPV projects, surrendering the ability of timing the market in repurchasing shares may result in benefiting short-run investors at the expense of long-run investors. More importantly, managerial focus on short-run performance and the incentive to cater to the near-term market preference may otherwise distort the firms' financing and investment decisions. Long-term projects may be left insufficiently funded due to the large payout. This resource misallocation overall may not benefit shareholders in the long run. Polk and Sapienza (2009) show that firms earn lower subsequent returns following investments made to cater to the current investor preference. We have the fifth testable hypothesis as follows:

Hypothesis 5: repurchases made by CEOs with short horizion incentives after good performance benefit short-run but not long-run shareholders.

2.2. Related Literature

Our study contributes to the literature in several aspects. First, we show empirically that managerial preference and horizon incentive affects corporate decisions and firm value. There has been a rich set of theories, discussed earlier, on this issue. The growing empirical research is often constrained by the difficulty in measuring horizon incentive and having a good proxy for it. We tackle this issue by using the notion of pay duration. Prior literature suggests that equity-based compensation, typically the proportion of non-cash pay, mitigates managerial myopia (e.g., Jensen and Murphy, 1990; Bizjak, Brickley, and Coles, 1993; Holmstrom and Tilore, 1993; Kole, 1997). Our study differs in that we consider the time restrictions on stock/option vesting, and thus treat the horizon incentives of any stock/option grants with the same dollar values but different vesting schedules differently. Consistent with the idea that pay

duration captures managerial horizon incentive, Gopalan, Milbourn, Song, and Thakor (2010) find that managers with short pay duration are more likely to cut R&D and use more discretionary accruals. Other empirical studies suggest that managerial myopia may also arise from the threat of takeover (Stein, 1988), the influence of institutional investors (Bushee, 1998), or approaching retirement (Dechow and Sloan, 1991; Gibbons and Murphy, 1992; Gao, 2010).

Second, our study is related to the vast literature on cash holding and payout policy (see a review by DeAngelo, DeAngelo, and Skinner, 2008). We document that many S&P 1500 firms distributed cash substantially by buying back their shares after good stock performance. Managers in these firms surrendered their market timing ability in share repurchases of earlier periods (e.g., Dann, 1981; Vermaelen, 1981; Ikenberry, Lakonishok, and Vermaelen, 1995 and 2000; and Brockman and Chung, 2001) as well as in security issuance (e.g., Baker and Wurgler, 2002; and Jenter, Lewellen, and Warner, 2011). We show that these managers typically have short pay horizon incentives and place more weight on short-run performance. Although these repurchases benefit shareholders in the short run, they are not long-term value maximizing. In contrast, repurchases made by managers with longer horizon incentives create value beneficial to both short-term and long-term shareholders. In a similar vein, Massa, Rehman, and Vermaelen (2007) show that some repurchases are not motivated by taking advantage of a significantly undervalued stock price, but rather are chosen as a strategic reaction to other firms' repurchase decisions.

Our findings have implication for firms' cash holding policy and liquidity management in light of the fact that there is an overall increase in corporate cash holding. Bates, Kahle, and Stulz (2009) suggest that firms on average save more for precautionary motive as firms' cash flows become riskier. Other studies suggest that agency problem of free cash flow should be taken seriously and corporate governance matters in firms' cash management (e.g., Harford, 1999; Opler, Pinkowitz, Stulz, and Williamson, 1999; Pinkowitz, Stulz, and Williamson, 2006; Dittmar and Mahrt-Smith, 2007; and Harford, Mansi, and

Maxwell, 2008). We find that managerial horizon incentive, shown as being unrelated to corporate governance, can also affect how firms may make efficient use of their large cash holdings.

Third, we show some evidence of the impact of institutional shareholding on corporate payout policy. Specifically, we find that CEOs with short horizon incentives are even much less likely to time the market in their share repurchase decisions when there are more institutional investors with short investment horizon. Repurchases under this circumstance are more likely to be due to the pressure for short-term performance from short-term investors. Grinstein and Michaely (2005) find that payout policy affects institutional holding, but the relation does not hold in the other direction. Our finding differs possibly due to the following: 1) they look at an earlier sample period (up to 1996) when institutional ownership was not as prevalent as more recently; 2) unlike us, they focus on overall repurchases and do not distinguish those conducted with poor market timing from others.

Lastly, we add to the insider trading literature (e.g., Seyhun, 1986; Lakonishok and Lee, 2001; and Fidrmuc, Goergen, and Renneboog, 2006) in identifying an inconsistence between their private trades and firm-wide decisions for short-termist CEOs. They sell their holdings when their firms are buying at high prices. Their private trades are consistent with the view that executives have contrarian views on firm value as suggested in Jenter (2005) which are beneficial to themselves, but not long-run (non-selling) shareholders. In contrast, we find long-horizon CEOs' private trades are more consistent with their firm repurchase decisions. It highlights the importance of aligning managers' incentives with those of long-run shareholders', and also the potential cost to long-term investors of those firms which would prefer optimally a short executive pay duration as suggested by Bolton, Scheinkman, and Xiong (2006). Indeed, Babenko, Tserlukevich, and Vedrashko (2009) show that the undervaluation signal of a repurchase may be more credible if executives buy the firm's shares in their account too.

3. Data and Variable Construction

3.1. Data and sample construction

Our hypotheses relate CEOs' horizon incentives to affect stock prices in the short and long run, which in turn impact their compensations and incomes through their stock trading, so we start with a sample of S&P 1500 index firms with equity components in their CEO compensations.[7] The sizes and vesting schedules of restricted stocks and stock options granted to these CEOs for the period of 2005-2008 are from Equilar Consultants.[8] We obtain data on other components of CEO compensation (salary and bonus) and equity ownership from ExecuComp, stock returns from CRSP, firm financial data from Compustat, institutional ownership from CDA/Spectrum, and analysts' EPS forecasts from IBES. Firms in the financial sector (SIC 6000-6999) and utility sector (SIC 4900-4999) are excluded.[9] Finally, we require share repurchase data, data on size and vesting schedule of stocks/options, stock returns and all explanatory accounting items available for each firm year during the sample period 2005-2008.

3.2. CEO horizon incentive measure

We measure CEOs' horizon incentives induced by equity compensation using the idea of *pay duration* developed in Gopalan, Milbourn, Song, and Thakor (2010) and Cadman and Sunder (2010). This new measure of the duration of executive pay is in a similar spirit to the duration measure developed for bonds, and shows the extent to which overall pay provides shor-term incentives to managers. For each CEO-year, it is calculated following Gopalan et al. (2010) as the weighted average of the lengths of the vesting periods (the time it takes before the grant is vested) of the different pay components, with the weight for each component being the fraction of that component in the CEO's total compensation. Specifically,

$$Pay\ duration = \frac{(Salary + Bonus) \times 0 + \sum_{si=1}^{S} Stock_{si} \times t_{si} + \sum_{oi=1}^{O} Option_{oi} \times t_{oi}}{Salary + Bonus + \sum_{si=1}^{S} Stock_{si} + \sum_{oi=1}^{O} Option_{oi}} \tag{1}$$

when the stock and option grants vest entirely in t_{si} and t_{oi} years, respectively (cliff vesting). In case where the stock and option grants vest equally over the vesting periods (graded vesting), t_{si} (t_{oi}) is

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[7] For a study of how CEOs' non-equity incentives may affect their share repurchase decisions, see Cheng, Harford, and Zhang (2010).
[8] We thank Radha Gopalan for making the data available to us.
[9] Our results are not affected qualitatively if we include them in the sample.

replaced with $\frac{t_{si}+1}{2}$ ($\frac{t_{oi}+1}{2}$). $Salary$ and $Bonus$ are the dollar values of salary and bonus as of the year end, and thus have a vesting period of zero. $Stock_{si}$ and $Option_{oi}$ are the dollar value of restricted stock grant si and stock option grant oi which will vest in t_{si} and t_{oi} years, respectively. The value of restricted stock grant is estimated as the product of the stock price on the grant date and the number of stocks granted, while the value of stock option is estimated using Black-Scholes option pricing model. S and O, respectively, are the total number of stock and option grants in a year.

Prior literature has long argued that CEOs' stock-based compensation can better align their incentives with long-term shareholders' value than cash compensation (e.g., Jensen and Murphy, 1990; Bizjak, Brickley, and Coles, 1993; Holmstrom and Tilore, 1993; Kole, 1997). But it treats the horizon incentives of any stock (and/or option) grants of equal dollar values equally without taking into account the length of the vesting schedules of the grants. Intuitively, for two stock (and/or option) grants with identical grant-date dollar values, the grant with longer vesting periods will provide longer incentive horizons. Thus the pay duration measure has the advantage of better capturing CEO's horizon incentives than the conventional equity incentive measure.[10] We show later that the relationship between pay duration and repurchase decisions remains robust after controlling for the proportion of equity pay in the total compensation. Gopalan et al. (2010) also discuss the advantages of this pay duration measure over some other compensation measures developed in the prior literature like the delta and vega of executive's stock and option grants and holdings (Coles, Daniel, and Naveen, 2006) and the extent of correlation of executive pay to stock returns and accounting earnings (Sloan, 1993).

3.3. Empirical specifications and key variables

We have three sets of tests in our empirical analysis. The first includes tests of Hypothesis 1, 3 and 4, which concerns how CEOs' horizon incentives may impact their repurchase decisions after good stock performance, and how stock liquidity, corporate governance and market pressure may affect the relation

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[10] Using the examples of Bear Stearns and Lehman Brother, Bebchuk, Cohen, and Spamann (2010) argue that equity-based compensation do not necessarily result in an alignment of executives' interest with long-term shareholder value.

of CEO's horizon incentives and repurchase decisions. We employ two models – Logit and Tobit – for these tests based on the following specification for Hypothesis 1:

$$\text{Repurchase}_{it} = \alpha + \beta_1 \text{Duration}_{it} + \beta_2 \text{Excess retrun}_{it-1} + \beta_3 \text{Duration}_{it} * \text{Excess return}_{it-1}$$
$$+ \beta_4 \text{Controls}_{it-1} + \varepsilon_{it} \qquad (2)$$

and the following specification for Hypothesis 1a, 3, and 4:

$$\text{Repurchase}_{it} = \alpha + \beta_1 \text{Duration}_{it} + \beta_2 \text{Excess retrun}_{it-1} + \beta_3 \text{Factor}_{it-1} + \beta_4 \text{Duration}_{it}$$
$$* \text{Excess return}_{it-1} + \beta_5 \text{Excess retrun}_{it-1} * \text{Factor}_{it-1} + \beta_6 \text{Duration}_{it} * \text{Factor}_{it-1}$$
$$+ \beta_7 \text{Duration}_{it} * \text{Excess retrun}_{it-1} * \text{Factor}_{it-1} + \beta_8 \text{Controls}_{it-1}$$
$$+ \varepsilon_{it} \qquad (3)$$

where the subscript i indicates the firm and t time in years. We employ two measures of repurchase: a dummy in the Logit model and the ratio of repurchase expense to the firm's prior-year-end market value of equity. We follow the prior repurchase literature and measure a firm's stock performance using its annual stock return over the fiscal year in excess of the contemporaneous market return (value-weighted CRSP stock return). Peyer and Vermaelen (2009) suggest that prior stock returns are the best predictor of future returns for repurchases. We also use other measures of benchmark return such as Fama-French 48 industry return for robustness. The results are similar, so we choose not to report them for brevity. In our analysis, all explanatory variables in the interaction terms are demeaned to facilitate the interpretation of the estimated coefficients of the variables. Detailed variable definitions for all variables in the empirical analysis can be found in Appendix 1. Controls$_{it-1}$ refers to a set of firm characteristics variables the literature has identified that may affect a firm's repurchase decision (e.g., Dittmar, 2000; Jagannathan, Stephens, and Weisbach, 2000; and Huang and Thakor, 2011).

Factor$_{it-1}$ refers to the stock liquidity, corporate governance, and market pressure, respectively. We use two measures of stock liquidity: the bid-ask spread (*Spread*) and the average daily stock turnover

(*Turnover*). We include three commonly used measures of corporate governance: the Gompers, Ishii, and Metrick (2003) index (*GIM-index*), the number of directors in the board (*Board size*), and the collective equity ownership by all non-executive directors in the board (*Non-exe director ownership*).

We measure market pressure from two sources. The first is the pressure to meet or beat the consensus analyst forecast. Skinner and Sloan (2002) show that stock price drops significantly if a firm's EPS misses its expectation by even a small amount. This pressure should be more pronounced after a string of good performance and investors' expectation becomes higher during a market boom. Hribar, Jenkins, and Johnson (2006) suggest that not all repurchases will necessarily inflate EPS. So we construct an annual observation which is the proportion (or the number) of quarters within a year that repurchases actually inflate the reported EPS towards the analysts forecast consensus (*Accretive repurchase*). The second market pressure measure we use the proportion of institutional investors with short-investment horizon, controlling for institutional ownership in a firm-year (*Short-term institutions*). The institutional investor horizon is derived based on Gaspar, Massa and Matos (2005).[11] It is intuitive that the more institutional investors with short-term horizon, the higher pressure for short-term performance, because those investors may "vote with their feet" which creates stock price down pressure if firms cannot show satisfying performance in the short run.

Our second test is to examine how CEOs conduct their private trades of the firms' shares when the firms are buying (Hypothesis 2). We conduct an OLS regression based on the following specification:

$\text{CEO Net Purchase}_{it}$

$$
\begin{aligned}
&= \alpha + \beta_1 \text{Duration}_{it} + \beta_2 \text{Excess retrun}_{it-1} + \beta_3 \text{Repurchase}_{it} + \beta_4 \text{Duration}_{it} \\
&\quad * \text{Excess return}_{it-1} + \beta_5 \text{Excess retrun}_{it-1} * \text{Repurchase}_{it} + \beta_6 \text{Duration}_{it} \\
&\quad * \text{Repurchase}_{it} + \beta_7 \text{Duration}_{it} * \text{Excess retrun}_{it-1} * \text{Repurchase}_{it} + \beta_8 \text{Controls}_i \\
&\quad + \varepsilon_{it}
\end{aligned}
\tag{4}
$$

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[11] We thank Joe Zhang for the data on institutional investor horizon.

where the subscript *i* indicates the firm and *t* time in years. We define the dependent variable CEO Net Purchase$_{it}$ as the dollar value of net open market purchases following Jenter (2005), which is calculated as the product of the net number of shares bought or sold during a year by the stock price at the end of the fiscal year. The number of shares bought or sold on the open market during a year is the annual change in stock holdings minus the number of shares acquired through option exercises and stock grants.

We also follow Jenter (2005) in including a number of controls to capture CEOs' diversification and portfolio rebalancing incentives in their private trades. The dollar value of restricted stocks (*Stock grant value*) and the Black-Scholes value of options (*Option grant value*) granted in the current year are included to control for the effect of contemporaneous equity-based compensation. To account for the effect of prior exposure to company stock, we include the value of stock ownership (*Stock ownership*) and the intrinsic value of unexercised exercisable (*Unexercised exercisable options*) and unexercised unexercisable (*Unexercised unexercisable options*) stock options measured as of the prior fiscal year end. To control for the effect of current and lagged price changes on the value of stock holdings, we also include a product of stock ownership as of the prior year end and the stock price change in the prior year (*Stock ownership change (year -2 to -1)*) and a product of stock ownership as of the prior year end and the stock price change in the current year (*Stock ownership change (year -1 to 0)*). To capture the effect of risk and changes in risk on trading incentives, we include the idiosyncratic stock return volatility (*Idiosyncratic volatility*), the change in volatility as of the prior year end and the current year end (*Change in idiosyncratic volatility (year -2 to -1)* and *Change in idiosyncratic volatility (year -2 to -1)*).

Our third set of tests involves examining the short-run and long-run firm value of repurchases (Hypothesis 5). To capture the different value implications of repurchases out of different motivations, we form two portfolios of sample firms as follows. One portfolio is composed of firms with above-median excess stock returns (raw returns in excess of the contemporaneous market returns) and below-median pay duration. This portfolio should capture repurchases made after good performance by CEOs with short horizon incentives. The other portfolio contains the rest of sample firms.

For both portfolios, we estimate abnormal returns around the repurchase announcements in a three-day window (-1, 1) using the market model. The announcement dates are collected from SDC. Banyi, Dyl, and Kahle (2008) find that repurchase announcements provided in SDC are incomplete in that many firms' announcements are left missed out. Therefore, in conducting our long-run studies, we follow Cheng, Harford, and Zhang (2010) to use the fiscal year end date of the repurchasing year as the event date. And to reduce the impact of the repurchase measure noise discussed in Banyi, Dyl, and Kahle (2008), we require that for a repurchasing firm to be included in this long-run study, its repurchase expense be at least 1% of the firm's market value of equity as of the prior fiscal year end. The results are not affected if we use the 0.1% cutoff. Following the prior literature (e.g., Peyer and Vermaelen, 2009), we employ two estimation approaches in computing the long-run abnormal stock returns: the Fama-French three-factor model combined with Ibbotson's RATS (1975) methodology and the Fama-French calendar-time portfolio approach. We examine the abnormal stock returns for 12, 24, and 36 months for both portfolios.

3.4. Summary statistics

Our final sample covers 884 firms and 1744 firm-years from 2005 to 2008. Panel A of *Table 1* presents a summary statistic for the main variables in our empirical analysis. Overall, share repurchases take place in about two-thirds of sample firm-years, indicating a period of extensive buybacks. On average, a firm spends $358 million, or about 3.2% of its lagged market value of equity, on the repurchase. The median of repurchase size is much smaller, which suggests that the distribution of repurchase size is rather skewed in the sample. The average pay duration for the sample CEOs is around 1.87 years, which is longer than that reported in Gopalan et al. (2010), due to the fact that our sample focuses on firms with equity component in CEO compensation. The average (median) CEO stock ownership is 1.4% (0.3%), while the fraction of non-cash pay in total compensation exceeds 70%.

The average (median) market-to-book ratio is 3.35 (2.7), which is considerably high as our sample tilts towards large firms with substantial cash payout. On average, our sample firms beat the market by

4.8% in stock returns, but the median firm underperforms the market by 1.7%. The median firm has about 8.5% and 14.3% of the book value of total assets in cash and cash flows, respectively. And it invests about 3.8% of the book value of total assets, and finance 15% of them using long-term debt. The median firm pays few dividends, although on average, sample firms pay out 14.7% of the net income in dividends. Our sample firms have on average 0.8% of the book value of total assets in non-operation income. Overall, the summary statistic suggests that our sample firms are profitable and experience a period of high valuation with substantial cross-sectional variations. We winsorize all continuous variables (except the pay duration) to reduce the impact of outliers.

In Panel B, we conduct a univariate test of how a firm's repurchase decision relates to its prior excess return in firms with different pay durations. We compare the excess returns of repurchasing firms with below median duration with that of non-repurchasing firms with below median duration. We also perform the same comparison for firms with above median duration. We find that for firms with below median duration, repurchasing firms have even higher excess returns than non-repurchasing firms, although the difference is insignificant. In contrast, for firms with above median duration, repurchasing firms experience significantly lower excess returns than non-repurchasing firms. This finding suggests that, unlike firms with longer pay duration, firms with shorter duration are less likely to time the market in their repurchase decision.

4. Empirical results

4.1. Tests of Hypothesis 1

In this section, we examine how CEOs' horizon incentives may affect their repurchase decisions while controlling for factors that have been documented in the prior literature in explaining repurchase. *Table 2* presents the consistent baseline results for both models: Logit (*Panel A*) and Tobit (*Panel B*). Overall, consistent with market timing, firms are more likely to repurchase after poor stock returns. Yet, the coefficients of the interaction term between pay duration and abnormal stock returns suggest that it

may only be the case for firms with relatively long CEO pay duration. Instead, CEOs with short pay duration are more likely to repurchase after good performance. To the extent that CEO stock ownership may proxy for long horizon incentive, we control for it in all of our multivariate regressions. It is statistically insignificant in explaining repurchases. In untabulated results, we also include an additional interaction term between CEO ownership and abnormal stock returns, and do not find it is statistically significant either.

Firms with shorter pay duration may need to buy back shares more frequently to offset the dilution from stock option granting and exercising, as suggested in the prior literature (e.g., Fenn and Liang, 2001; Kahle, 2002; and Weisbenner, 2004). To capture the effect of stock options on repurchases, we include a set of variables related with managerial stock options in Column (2) of both models. We find that coefficients on all of them are positive, but only those on unexercised exercisable options and exercised options are statistically significant in the Tobit model. It suggests that exercised or exercisable stock options during the sample period are significantly related with the repurchase magnitude but not the repurchase likelihood. Nevertheless, the main finding on pay duration and repurchase is robust after controlling for stock options.

To see if our pay duration measure has incremental explanatory power to the equity incentive in the compensation, we control for the non-cash pay proportion in the total compensation of the CEOs. Note that the pay duration variable will then capture the difference in horizons of two pays with the same proportion of equity pay. We find that our main finding of pay duration is virtually unaffected. The coefficients on the non-cash pay itself are positive but only significant in the Tobit model, a finding reminiscent of the results on stock options in CEO pay as shown above.

Results on most of the explanatory variables are consistent with those in the prior literature. For instance, large firms and firms with more cash, better operating performance, and lower leverage are more likely to repurchase and repurchase more. Also, those repurchasing firms are less likely those that pay

large dividends or have large investments (capital expenditures), which suggest that repurchases during 2005-2008 are not dominated by those large firms who are also big dividend payers. One noteworthy finding, which departs from the previous literature, is that firms do not seem to take share repurchase as such a payout mode to dissipate temporary cash flows any longer compared to the earlier time: coefficients on the temporary cash flow item (*Non-operation income*) are insignificant and coefficients on cash flow volatility (*Volatility of ROA*) become significantly negative. Rather, firms tend to also pay out permanent cash flows as well.

Table 3 presents test results of Hypothesis 1a. We find strong support for it. The coefficients of the triple interaction term are significantly negative. Further, we find that the coefficients of the interaction term, *Duration * Excess return*, are no longer significant with only one exception in the Tobit model with the bid-ask spread being the liquidity measure. It thus suggests that the above documented relationship between CEO horizon incentive and repurchase is mainly driven by firms with less liquid stocks. This evidence strengthens our main hypothesis that CEOs with short pay horizon have more incentives to repurchase after good performance in order to bolster stock prices higher at least in the short run. This is because the stock price impact of share repurchase should be greater with less liquid stocks. Note that other explanatory variables are also included in all the regressions, but we choose not to report them to conserve space.

4.2. Tests of Hypothesis 2

We have shown that CEOs with short pay duration have more incentives to repurchase after good performance. In this section, we test Hypothesis 2 to distinguish this managerial myopia hypothesis (Hypothesis 2a) from an alternative managerial overconfidence hypothesis (Hypothesis 2b) by examining repurchasing CEOs' contemporaneous private trades. Results shown in *Table 4* support the managerial myopia hypothesis. The significantly positive coefficient on the interaction term, *Duration * Excess return*, suggests that CEOs with higher pay duration typically buy more after good stock performance.

And as the significantly positive coefficient on the triple interaction term – *Repurchase * Duration * Excess return* – indicates, their private purchases increase with the amount of share repurchases, if any, by their firms. In contrast, CEOs with shorter pay duration sell more if more repurchases are conducted after good performance, suggested by the coefficient on the above triple interaction term and the significantly negative coefficient on the interaction term, *Repurchase * Excess return*.

Overall, we show that it is unlikely that short-horizon CEOs do not have a clear estimation of (as the media suggested) or are overconfident with their firms' valuation before deciding on buying back shares after good performance. In addition, we find that CEOs' prior exposure to equity incentive (unexercised exercisable options) and contemporaneous equity compensation (current stock and option grants) as well as higher trading risk (higher idiosyncratic volatility compared with the previous year) also propel them to sell more of their own holdings. Our finding in support of the managerial myopia hypothesis holds even after controlling for these intuitive factors in explaining a CEO's private trading incentive.

4.3. Tests of Hypothesis 3 and 4

The above sections have suggested that short-termist CEOs may ignore their private signal about the firms' valuation and repurchase shares at high prices. Next we investigate whether this myopia may be due to failure of corporate governance, and how market pressure may aggravate managerial myopia.

Table 5 show results of testing Hypothesis 3. We do not find any evidence in suggesting that this managerial myopia in cash payout is related to mis-governance. In both models, the coefficients on the triple interaction term, *Duration * Excess return * Poor corporate governance*, are insignificant across all three governance measures. Nonetheless, the coefficients on the interaction term, *Duration * Excess return*, remain significantly negative with similar economic magnitudes as in the baseline regressions, except when we use *GIM-index* as the governance measure. In sum, Hypothesis 3 is not supported empirically.

Table 6 and *Table 7* present results of the effect of external pressure. We find some weak evidence in support of Hypothesis 4. The estimated coefficients on the market pressure variables interacted with *Duration * Excess return* are statistically significant in the Tobit model but not in the Logit model. Short-horizon CEOs tend to repurchase more after good performance if such repurchases can boost up reported EPS towards the analysts' forecast consensus, and when there are more investors with short-term investment horizons in the investor base. The coefficients on the term *Duration * Excess return* remain significantly negative in all model specifications, indicating the robustness of our main findings.

4.4. Tests of Hypothesis 5

This section presents the results of firm value implication for repurchasing firms in both the short run and the long run, reported in *Table 8*. We find that the market responds positively to the repurchase announcements by the sample firms overall, with the mean (median) three-day CAR being 1.8% (1.47%). The magnitude is slightly lower compared to those found in the prior literature. Furthermore, we do not find a significant difference of market reactions to repurchase announcements between firms in the portfolio of high (above-median) excess returns and short (below-median) pay duration and all other firms.

In the long run, there is some evidence that firms in the "high return – short duration" portfolio are able to reap a significantly positive abnormal stock returns for the first 12 months following repurchases. However, this good performance seems reversed during the next two years, as the abnormal returns of this portfolio become insignificantly different from zero for holding periods of 24 and 36 months. Investors indeed incur a loss in return for the next 12 and 24 months. In comparison, the abnormal returns of the other portfolio are significantly positive and at greater magnitudes for holding periods of 12, 24, and 36 months, and they appear to increase over time. The results for the second portfolio are reminiscent of the findings in earlier research.

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Overall, we show that repurchases after good performance by short-horizon CEOs may benefit short-term investors, but not those in the long run. Other repurchases consistently create value beneficial to shareholders both in the short term but also in the long term.

5. Robustness Tests: Endogeneity of Pay Duration and Repurchase

Note that our study is not to argue that it is always optimal for firms to tie their executive compensation to long-term firm performance. The optimal pay duration will likely depend on a firm's specific circumstance, market friction, and their interaction. In practice, there's a rich cross-sectional variation of the mixture of short-term and long-term pay. While there are horizon-induced costs (like what we document in this study), boards weigh the benefits of such a pay structure against the costs, and in equilibrium we observe that some firms adopt short pay horizon. For example, Bolton, Scheinkman, and Xiong (2006) suggest that in a speculative market where stock prices may deviate from fundamentals, the optimal compensation contract may put more weight on short-term stock price performance than on long-term fundamental value.[12] Gopalan, Milbourn, Song, and Thakor (2010) conduct a systemic analysis on the trade-off between short-term and long-term pay. As such, endogeneity concern arises from the supposition that pay duration and repurchase decision may be co-determined. Short pay duration may make managers less likely to time the market in repurchasing shares. In turn, in selecting optimal pay duration, shareholders will account for the effect of repurchase on managerial wealth through the structure of compensation scheme.

To isolate causation, we estimate a simultaneous equation system based on Generalized Method of Moments (GMM) that models pay duration and repurchase decision as jointly endogenous. The first equation in our two-equation system is the baseline specification in testing Hypothesis 1 (Column (1) of *Table 2*). The second equation is specified as follows:

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[12] See also, for instances, Core, Holthausen, and Larcker (1999) and Dutta and Reichelstein (2003) on the determinants of compensation contracts.

$$\text{Duration}_{it} = \alpha + \beta_1 \text{Repurchase}_{it} + \beta_2 \text{Excess retrun}_{it-1} + \beta_3 \text{Controls}_{it-1} + \varepsilon_{it} \qquad (5)$$

where the control variables include firm size (total assets), market-to-book ratio, R&D, bid-ask spread, corporate governance, and idiosyncratic volatility. We select the control variables based on Gopalan, Milbourn, Song, and Thakor (2010). They find that optimal pay duration decreases in the extent of the mispricing of the firm's stock and in the quality of corporate governance.

In *Table 9*, we report the results for both equations. In the equation explaining repurchase, the coefficient of the interaction term, *Duration * Excess return*, remains significantly negative in both cases when the dependent variable is either the repurchase dummy or the repurchase ratio. Thus, we confirm that, even after controlling for the effect of repurchase on pay duration, our main finding continues to hold that firms with short pay durations are more likely to repurchase and repurchase more after good stock performance. In the equation explaining duration, we find that repurchase decision affects pay duration positively. And the coefficients of other variables are consistent with those in Gopalan et al. (2010), except that the coefficient of *GIM-index* is not significant possibly because our sample is smaller than theirs.

To address the concern that both pay duration and repurchase decision may be driven by some time-invariant omitted variable, we also run a firm fixed-effect regression based on Equation (2). In untabulated results (for brevity), we find that the main finding still holds.

6. Conclusion

Amid the renewed interest in executive compensation-related horizons after the financial crisis in 2007-2009, our study presents new empirical evidence that managerial preference and horizon incentives matter for corporate decisions and firm value. In contrast to the liquidity constraints faced by many firms at the onset of the crisis which are shown to have largely dampened corporate investment, we document a share buyback binge by many firms during 2005-2008. Those firms paid high prices for their shares then

and only found their shares prices later dropped significantly to a much lower level during the crisis. Using a new measure of managerial horizon incentive based on the duration of pay, we show that many of those expensive repurchases, even viewed *ex ante*, were made by managers with short horizons who used repurchases to bolster current stock prices. Unlike repurchases motivated to take advantage of stock undervaluation, repurchases after good performance by short-horizon managers benefited selling investors but not those loyal (non-selling) shareholders in the long run. It appears that this short-termism in large cash payout is not related to corporate governance. There is some evidence that market pressure from both analysts' EPS expectation and short-term institutional investors' preference for short-term performance may have aggravated managerial myopia.

We also find that managers behave in a strikingly different way in their private trades. When their firms repurchase shares after good stock performance, CEOs with long horizon incentives increase their private purchases with the magnitude of firm buybacks, but CEOs with short horizon do the opposite. It highlights the importance of aligning managerial incentives with the interest of those long-term shareholders.

Appendix 1: Empirical Variable Definitions

- *Accretive repurchase* is the number of quarters in which repurchases inflate reported EPS towards the analysts' forecast consensus, divided by four.
- *Assets (log)* is the natural logarithm of the book value of total assets.
- *Board size* is the number of directors on the board.
- *Cash* is the ratio of cash plus liquid investments to lagged value of total assets.
- *CAPX* is the ratio of capital expenditure to lagged value of total assets.
- *Change in idiosyncratic volatility (year -2 to -1)* is the change of *Idiosyncratic volatility* from year -2 to year -1.
- *Change in idiosyncratic volatility (year -1 to 0)* is the change of *Idiosyncratic volatility* from year -1 to year 0.
- *Debt ratio* is the ratio of long-term debt to lagged value of total assets.
- *Dividend* is the ratio of dollar amount of dividends to lagged net income available to common shareholders.
- *Duration* is the pay duration defined in (1).
- *Excess return* is the annual stock return in excess of the contemporaneous value-weighted CRSP stock return.
- *Exercised options* is the dollar of exercised options in a year.
- *Fraction of non-cash pay* is the ratio of non-cash component of CEO pay (sum of restricted stock and stock option) to the CEO's total compensation.
- *GIM-index* is measured on the same principle as Gompers, Ishii, and Metrick (2003).
- *Idiosyncratic volatility* is the standard deviation of residuals obtained from regressing the firm's raw daily stock return on the contemporaneous value-weighted CRSP stock return in a year.
- *Illiquidity* is a dummy variable which equals one if *Spread* is in its top tercile of the sample, or *Turnover* is in its bottom tercile of the sample.
- *MB* is the market-to-book ratio.
- *Non-operating income* is the ratio of non-operating income (Compustat item *nopi*) to lagged value of total assets.
- *Option grant value* is the Black-Scholes value of stock options grant in the current year.
- *Overall institutional ownership* is the ratio of total shares owned by institutional investors to the number of shares outstanding.

- *Ownership of non-exe directors* is the collective stock ownership by all non-executive directors on the board.
- *Poor governance* is a dummy variable which equals one if *GIM-index* is in its top tercile of the sample, or *Board size* is in its top tercile of the sample, or *Ownership of non-exe directors* is in its bottom tercile of the sample.
- *R&D* is the ratio of research and development to total assets.
- *Repurchase* is the dollar amount of share repurchase, defined based on Grullon and Michaely (2002).
- *Repurchase dummy* is a dummy variable which equals one if *Repurchase ratio* is no less than 0.1% and zero otherwise.
- *Repurchase ratio* is the ratio of *Repurchase* to lagged market value of equity.
- *ROA* is the return on assets, defined as the ratio of operation income before depreciation to lagged value of total assets.
- *Short-term institutions* is the proportion of institutional investors with short-investment horizon. The institutional investor horizon is defined based on Gaspar, Massa and Matos (2005).
- *Spread* is the monthly average stock bid-ask spread in the past three years.
- *Stock grant value* is the dollar value of restricted stocks granted in the current year.
- *Stock ownership* is shares owned by the CEO divided by the number of shares outstanding.
- *Stock ownership change(year -2 to -1)* is the product of the number of shares owned as of the year -1 and the stock price change from year-end -2 to year-end -1.
- *Stock ownership change (year -1 to 0))* us the product of the number of shares owned as of the year -1 and the stock price change from year-end -1 to year-end 0.
- *Turnover* equals 1000 times the monthly average ratio of the trading volume to shares outstanding in the past three years.
- *Unexercised exercisable options* is the intrinsic value of unexercised but exercisable stock options reported in ExecuComp.
- *Unexercised unexercisable options* is the intrinsic value of unexercised and non-exercisable stock options reported in ExecuComp.
- *Volatility of ROA* is the standard deviation of the annual ROA for the last five years.

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Table 1 Summary Statistic

Panel A of this table presents the summary statistic of the 884 sample S&P 1500 index firms (excluding financial/utility firms) from 2005 to 2008. All variables are defined in Appendix 1. Panel B reports results of a univariate test of difference in prior-year excess returns between non-repurchase firms and repurchase firms. The sample is divided into two subsamples depending on whether a firm's pay duration is above or below the sample median. The t-test and Wilcoxon rank sum test are conducted to test the difference between means (*t-stat*) and between the distributions (*z-stat*) of excess returns. *** and ** denote significance at the 0.01 and 0.05 levels, respectively.

Panel A: Summary statistics of the overall sample

Variable	Mean	Median	Std	N
Repurchase dummy	0.682	1	0.466	1744
Repurchase ratio	0.032	0.018	0.04	1744
Repurchase ($ MM)	358.4	39.45	952.8	1744
Duration	1.866	1.891	0.692	1744
Fraction of non-cash pay	0.713	0.757	0.189	1744
Stock ownership	0.014	0.003	0.032	1744
Excess return	0.048	-0.017	0.354	1744
Assets (log)	7.672	7.549	1.526	1744
Cash	0.148	0.085	0.158	1744
MB	3.347	2.712	2.482	1744
Debt ratio	0.164	0.15	0.14	1744
ROA	0.155	0.143	0.073	1744
CAPX	0.057	0.038	0.058	1744
Non-operating income	0.008	0.006	0.01	1744
Dividend	0.147	2E-04	0.295	1744
Volatility of ROA	0.035	0.025	0.031	1744
Idiosyncratic volatility	0.018	0.017	0.006	1744

Panel B: Univariate test of difference in prior-year excess returns between non-repurchase firms and repurchase firms

	Low Pay Duration			High Pay Duration		
	Non-repurchase	Repurchase	Difference *t/z-stat*	Non-repurchase	Repurchase	Difference *t/z-stat*
Mean	0.035	0.040	-0.193	0.136	0.032	3.809***
Median	-0.044	-0.009	-1.132	0.055	-0.027	2.437**
N	333	539		222	650	

Table 2 CEO Horizon Incentive and Decision to Repurchase: Baseline Analysis

This table reports regression results of how CEO horizon incentive affects firm repurchase decisions. Panel A employs a Logit model, where the dependent variable is *Repurchase dummy*. Panel B employs a Tobit model where the dependent variable is *Repurchase ratio*. All variables are defined in Appendix 1. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

	Panel A: Logit Model		
	(1)	(2)	(3)
Duration	0.094	0.066	0.040
	(0.358)	(0.521)	(0.762)
Excess return	-0.585***	-0.566***	-0.585***
	(0.001)	(0.001)	(0.001)
Duration * Excess return	-0.696***	-0.669**	-0.694***
	(0.005)	(0.010)	(0.006)
Stock ownership	-1.840	-2.489	-1.634
	(0.431)	(0.294)	(0.485)
Unexercised exercisable options		5.682	
		(0.367)	
Unexercised unexercisable options		3.742	
		(0.725)	
Exercised options		20.233	
		(0.181)	
Fraction of non-cash pay			0.315
			(0.521)
Assets (log)	0.392***	0.439***	0.381***
	(0.000)	(0.000)	(0.000)
Cash	1.681***	1.631***	1.649***
	(0.006)	(0.009)	(0.007)
MB	0.059*	0.060*	0.057
	(0.084)	(0.088)	(0.101)
Debt ratio	-2.388***	-2.506***	-2.396***
	(0.000)	(0.000)	(0.000)
ROA	7.559***	7.678***	7.573***
	(0.000)	(0.000)	(0.000)
CAPX	-5.786***	-5.735***	-5.753***
	(0.000)	(0.000)	(0.000)
Non-operating income	2.858	2.092	2.610
	(0.718)	(0.793)	(0.741)
Dividend	-0.495**	-0.498**	-0.480**
	(0.016)	(0.017)	(0.020)
Volatility of ROA	-4.940**	-4.867**	-5.007**
	(0.036)	(0.042)	(0.034)

Idiosyncratic volatility	-72.153***	-71.213***	-72.265***
	(0.000)	(0.000)	(0.000)
Constant	-1.597**	-2.158**	-1.706**
	(0.046)	(0.019)	(0.035)
Obs.	1744	1698	1744
R-square	0.176	0.179	0.176

Panel B: Tobit Model			
	(1)	(2)	(3)
Duration	0.001	0.000	-0.003
	(0.575)	(0.986)	(0.438)
Excess return	-0.012***	-0.013***	-0.013***
	(0.001)	(0.001)	(0.001)
Duration * Excess return	-0.017***	-0.015***	-0.017***
	(0.003)	(0.007)	(0.003)
Stock ownership	-0.035	-0.056	-0.018
	(0.507)	(0.302)	(0.737)
Unexercised exercisable options		0.261*	
		(0.087)	
Unexercised unexercisable options		0.301	
		(0.228)	
Exercised options		1.319***	
		(0.001)	
Fraction of non-cash pay			0.025**
			(0.038)
Assets (log)	0.006***	0.009***	0.005***
	(0.000)	(0.000)	(0.000)
Cash	0.060***	0.060***	0.058***
	(0.000)	(0.000)	(0.000)
MB	0.000	0.000	0.000
	(0.674)	(0.723)	(0.855)
Debt ratio	-0.040***	-0.042***	-0.040***
	(0.002)	(0.001)	(0.002)
ROA	0.131***	0.138***	0.132***
	(0.000)	(0.000)	(0.000)
CAPX	-0.132***	-0.123***	-0.130***
	(0.000)	(0.000)	(0.000)
Non-operating income	0.019	-0.027	0.005
	(0.907)	(0.868)	(0.976)
Dividend	-0.023***	-0.021***	-0.021***

		(0.000)	(0.000)	(0.000)
Volatility of ROA		-0.161***	-0.158***	-0.164***
		(0.002)	(0.002)	(0.001)
Idiosyncratic volatility		-1.680***	-1.578***	-1.692***
		(0.000)	(0.000)	(0.000)
Constant		-0.007	-0.039**	-0.017
		(0.689)	(0.031)	(0.322)
Obs.		1744	1698	1744
R-square		0.12	0.132	0.122

Table 3 CEO Horizon Incentive and Decision to Repurchase: Effect of Stock Liquidity

This table reports regression results of how the relationship between CEO horizon incentive and firm repurchase decisions varies with stock liquidity. In the Logit model, the dependent variable is *Repurchase dummy*. In the Tobit model, the dependent variable is *Repurchase ratio*. Also, two measures of stock liquidity are used: *Spread* and *Turnover*. All variables are defined in Appendix 1. Other control variables in *Table 2* are included here but not reported. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Model	Logit		Tobit	
Liquidity measure	Spread	Turnover	Spread	Turnover
Duration	0.118	0.117	0.002	0.002
	(0.296)	(0.319)	(0.353)	(0.544)
Excess return	-0.388**	-0.536***	-0.011***	-0.014***
	(0.026)	(0.002)	(0.006)	(0.000)
Duration * Excess return	-0.367	-0.450	-0.010*	-0.009
	(0.216)	(0.120)	(0.098)	(0.130)
Illiquidity dummy	-0.388**	-0.120	-0.011***	-0.010***
	(0.042)	(0.482)	(0.001)	(0.004)
Duration * Illiquidity	-0.109	-0.074	-0.007	-0.002
	(0.604)	(0.725)	(0.134)	(0.546)
Excess return * Illiquidity	-0.436	0.057	-0.003	0.013
	(0.334)	(0.911)	(0.717)	(0.175)
Duration * Excess return * Illiquidity	-1.431**	-1.153*	-0.029**	-0.030***
	(0.016)	(0.089)	(0.030)	(0.008)
Other controls	YES	YES	YES	YES
Obs.	1744	1744	1744	1744
R-square	0.181	0.176	0.126	0.126

Table 4 CEOs' Private Trades When Firms Are Buying Back Shares

This table reports the OLS regression result of how CEOs conduct their private trades when their firms are buying back shares. The dependent variable is *Net CEO Purchase*, defined as the dollar value of net open market purchases following Jenter (2005). It is calculated as the product of the net number of shares bought or sold during a year by the stock price at the end of the fiscal year. The number of shares bought or sold on the open market during a year is the annual change in stock holdings minus the number of shares acquired through option exercises and stock grants. All other variables are defined in Appendix 1. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Repurchase	-0.002
	(0.130)
Duration	-0.266
	(0.813)
Repurchase * Duration	0.002
	(0.279)
Excess return	-6.850**
	(0.024)
Repurchase * Excess return	-0.023***
	(0.003)
Duration * Excess return	10.878**
	(0.046)
Repurchase * Duration * Excess return	0.035**
	(0.021)
Stock grant value	-1.158***
	(0.004)
Option grant value	-1.091*
	(0.064)
Unexercised exercisable options	-0.229***
	(0.000)
Unexercised unexercisable options	0.389
	(0.109)
Stock ownership change (year -1 to 0)	-0.078
	(0.294)
Stock ownership change (year -2 to -1)	-0.024
	(0.671)
Stock ownership	-0.031
	(0.113)
Idiosyncratic volatility	-145.077
	(0.289)
Change in idiosyncratic volatility (year -2 to -1)	62.230
	(0.630)
Change in idiosyncratic volatility (year -1 to 0)	355.761
	(0.047)**

Assets (log)	0.067
	(0.932)
MB	-0.052
	(0.876)
Obs.	1627
R-square	0.155

Table 5 CEO Horizon Incentive and Decision to Repurchase: Impact of Corporate Governance

This table reports regression results of how the relationship between CEO horizon incentive and firm repurchase decisions varies with corporate governance. In the Logit model, the dependent variable is *Repurchase dummy*. In the Tobit model, the dependent variable is *Repurchase ratio*. Three measures of corporate governance are used: *GIM-index*, *Board size*, and *Non-exe director ownership*. All variables are defined in Appendix 1. Other control variables in *Table 2* are included here but not reported. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Corporate governance measures	Logit			Tobit		
	GIM-index	Board size	Non-exe director ownership	GIM-index	Board size	Non-exe director ownership
Duration	0.077	-0.014	-0.012	0.002	0.004	0.001
	(0.619)	(0.922)	(0.930)	(0.507)	(0.277)	(0.778)
Excess return	-0.564**	-0.608***	-0.303	-0.014***	-0.010**	-0.009*
	(0.013)	(0.004)	(0.188)	(0.004)	(0.027)	(0.087)
Duration * Excess return	-0.399	-0.765**	-0.689**	-0.009	-0.017**	-0.015**
	(0.284)	(0.016)	(0.047)	(0.231)	(0.015)	(0.050)
Poor governance	0.081	-0.082	0.046	0.001	0.001	0.002
	(0.632)	(0.665)	(0.795)	(0.874)	(0.871)	(0.530)
Duration * Poor governance	0.157	0.173	0.094	-0.000	-0.009*	0.001
	(0.521)	(0.476)	(0.722)	(0.946)	(0.099)	(0.869)
Excess return * Poor governance	0.200	0.894*	-0.419	0.013	0.008	0.005
	(0.651)	(0.091)	(0.365)	(0.138)	(0.401)	(0.640)
Duration * Excess return * Poor governance	-0.681	0.566	0.159	-0.010	0.012	-0.002
	(0.371)	(0.521)	(0.800)	(0.478)	(0.397)	(0.878)
Obs.	1521	1434	1433	1521	1434	1433
R-square	0.16	0.167	0.168	0.096	0.108	0.107

Table 6 CEO Horizon Incentive and Decision to Repurchase: Effect of EPS Management

This table reports regression results of how the relationship between CEO horizon incentive and firm repurchase decisions varies with the incentive to inflate reported EPS towards the analysts' forecast consensus. In the Logit model, the dependent variable is *Repurchase dummy*. In the Tobit model, the dependent variable is *Repurchase ratio*. All variables are defined in Appendix 1. Other control variables in *Table 2* are included here but not reported. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

	Logit	Tobit
Duration	0.046	0.002
	(0.765)	(0.353)
Excess return	-0.495	-0.013***
	(0.200)	(0.000)
Duration * Excess return	-0.996*	-0.017***
	(0.055)	(0.003)
Proportion of accretive repurchase quarters	14.658***	0.116***
	(0.000)	(0.000)
Duration * Accretive repurchase	-2.819	-0.024
	(0.388)	(0.210)
Excess return * Accretive repurchase	-1.235	-0.009
	(0.898)	(0.731)
Duration * Excess return * Accretive repurchase	-11.603	-0.078**
	(0.369)	(0.021)
Other controls	YES	YES
Obs.	1646	1646
R-square	0.217	0.155

Table 7 CEO Horizon Incentive and Decision to Repurchase: Effect of Investor Horizon

This table reports regression results of how the relationship between CEO horizon incentive and firm repurchase decisions varies with the pressure for short-run perform from investors with short-term investment horizon. In the Logit model, the dependent variable is *Repurchase dummy*. In the Tobit model, the dependent variable is *Repurchase ratio*. All variables are defined in Appendix 1. Other control variables in *Table 2* are included here but not reported. Robust standard errors are clustered by firm and p-values are reported in parentheses. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

	Logit	Tobit
Duration	0.113	0.002
	(0.286)	(0.445)
Excess return	-0.471**	-0.012***
	(0.015)	(0.002)
Duration * Excess return	-0.707**	-0.019***
	(0.015)	(0.002)
Proportion of short-term institutions	-0.687	0.017
	(0.386)	(0.359)
Duration * Short-term institutions	1.336	0.055**
	(0.177)	(0.021)
Excess return * Short-term institutions	-0.039	-0.045
	(0.980)	(0.137)
Duration * Excess return * Short-term institutions	-1.943	-0.086**
	(0.211)	(0.017)
Overall institutional ownership	-0.249	0.004
	(0.570)	(0.658)
Other controls	YES	YES
Obs.	1741	1741
R-square	0.176	0.124

Table 8 Short-run and Long-run Abnormal Stock Returns of Repurchases

This table reports the short-run and long-run abnormal stock returns of repurchases for sample firms. Sample firms with above-median excess return and below-median CEO duration are formed in a portfolio named "High return * Short duration". All other sample firms are included in a portfolio named "All Others". Panel A reports the three-day (-1, 1) cumulative abnormal returns (CAR) around repurchase announcement for the overall sample and the two portfolios. Panel B reports the long run abnormal returns for the overall sample and the two portfolios for three portfolio holding periods: 12, 24, and 36 months, respectively. Two estimation approaches are used in the long-run study. IRATS is the Fama-French three-factor model combined with Ibbotson's RATS (1975) methodology. Calendar-time is the Fama-French calendar time portfolio approach. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

Panel A: Announcement Three-day CAR

	Mean	Median	N
Overall	1.8%***	1.47%***	455
High return * Short duration	1.6%***	1.4%***	104
All Others	1.85%***	1.47%***	351

Panel B: Long-run abnormal returns

	Holding 12 months		Holding 24 months		Holding 36 months		
	IRATS	Calendar-time	IRATS	Calendar-time	IRATS	Calendar-time	N
Overall	5.05%***	0.77%**	5.89%***	0.64%**	6.54%***	0.68%**	1001
High return * Short duration	4.54%*	0.46%**	2.24%	0.26%	3.66%	0.30%	229
All Others	5.33%***	0.77%**	7.42%***	0.67%**	8.45%***	0.70%***	772

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Table 9   CEO Horizon Incentive and Decision to Repurchase: Simultaneous Equations

This table reports GMM estimation results of two simultaneous equations of pay duration and repurchase decision. In Panel A, the dependent variables are *Repurchase dummy* and *Duration*. In Panel B, the dependent variables are *Repurchase ratio* and *Duration*. All variables are defined in Appendix 1. *, ** and *** indicate significance at 10%, 5% and 1%, respectively.

	Panel A		Panel B	
	Repurchase dummy	Pay Duration	Repurchase ratio	Pay Duration
Duration	0.170		-0.017	
	(0.527)		(0.605)	
Excess return	6.220*	0.063	0.808**	0.047
	(0.062)	(0.177)	(0.041)	(0.291)
Duration * Excess return	-3.390*		-0.440**	
	(0.057)		(0.037)	
Stock ownership	-0.605		-0.053	
	(0.332)		(0.491)	
Assets (log)	0.048	0.172***	0.008	0.185***
	(0.390)	(0.000)	(0.219)	(0.000)
Cash	0.178		0.052**	
	(0.395)		(0.049)	
MB	0.005	0.015**	0.001	0.020***
	(0.564)	(0.034)	(0.358)	(0.005)
Debt ratio	-0.436***		-0.029	
	(0.009)		(0.171)	
ROA	1.336***		0.069	
	(0.003)		(0.237)	
CAPX	-1.310**		-0.096	
	(0.018)		(0.146)	
Non-operating income	3.536		0.456	
	(0.260)		(0.241)	
Dividend	-0.130		-0.024**	
	(0.160)		(0.040)	
Volatility of ROA	-1.387		-0.174	
	(0.186)		(0.168)	
Repurchase dummy / Repurchase ratio		0.353***		4.059***
		(0.003)		(0.009)
Idiosyncratic volatility		4.569**		3.664*
		(0.037)		(0.087)
R&D		1.623***		1.737***
		(0.000)		(0.000)
Spread		0.524		1.369*
		(0.429)		(0.051)
GIM-index		0.008		0.006
		(0.142)		(0.238)
Obs.	1521	1521	1521	1521