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ORIGINAL RESEARCH

Executive compensation and the credibility of share buyback announcements

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Abstract
The extant literature views open market share repurchase announcements as a signal of undervaluation, but these lack characteristics of a credible signal and hence can be misleading. In this paper we assess the credibility of the repurchase announcement signal by observing the underlying managerial wealth and repurchase incentives as measured by their compensation arrangements. We find that both short- and longer-term returns (actual repurchases) are positively (negatively) related to manager wealth sensitivity to changes in stock price (Delta and equity holdings) and negatively (positively) related to managerial incentives to increase firm risk (high Vega). These findings are particularly strong for firms with higher information asymmetry, or undervaluation. Our results add to the existing literature by showing that the market appears to be using executive remuneration arrangements to assess the credibility of a repurchase announcement signal and responds accordingly.

Keywords Open market share repurchases · Credibility · CEO remuneration · Incentives · Event study

JEL Classification G14 · G31 · G32 · G35 · J33

1 Introduction

The last couple of decades have witnessed a structural change in corporate payout policy with US firms now paying out more cash via share repurchases than traditional cash dividends (Zeng and Luk (2020). Though share buybacks can be carried out for a variety

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of motives, corporate executives cite stock undervaluation as the primary reason for their stock repurchase decisions (Brav et al. (2005). In line with this undervaluation argument, several studies report significant positive market reaction to repurchase announcements (e.g., Vermaelen (1981), Comment and Jarrell (1991) and Andreou et al. (2018)), together with a significant upward drift in their longer-term returns (e.g., Ikenberry et al. (1995), Ikenberry et al. (2000), Chang and Sullivan (2007) and Peyer and Vermaelen (2009)).

Recent studies, however, are more critical of this traditional signaling interpretation of Open Market Share Repurchase (OMSR) announcements. These argue that such announcements lack the characteristics of a credible signal,[1] and can potentially be used to mislead the market (e.g., Chan et al. (2010). In addition, share repurchases positively affect managerial compensation as these tend to improve firms' earnings per share (Murphy and Kester (2014), Cheng et al. (2015) and Almeida et al. (2016), and stock price ((Fried 2005) and Ahmed and Taffler (2021)). The absence of any downside penalty and the managerial incentives associated with share repurchase programs allow for their potential opportunistic use by firm management (see e.g., Fenn and Liang (2001), Massa et al. (2007), Louis and White (2007), Chan et al. (2010), Babenko et al. (2012), Almeida et al. (2016) and Ahmed and Taffler (2021). Buyback announcements can thus be value signaling or agency driven. As an ex-ante measure of true managerial intent does not exist, our main research question is how does the market perceive and react to a buyback announcement in the face of such executive compensation incentives?

In this paper, we examine how the market evaluates firm repurchase announcements by observing the underlying managerial wealth and repurchase incentives. The literature on agency theory suggests that compensation contracts that alleviate agency issues by aligning CEO and shareholder incentives will lead to investment and financing decisions that enhance firm value (see e.g., Coles et al. (2006) and Fenn and Liang (2001)). Therefore, we expect differences in executive compensation arrangements can help to explain variations in how the market *perceives* and reacts to the (repurchase announcement) signal. Specifically, we conjecture that investors view a repurchase announcement as a more credible signal of undervaluation when executives' incentives are better aligned with those of shareholders, and consequently react more positively.

We focus specifically on the share-based compensation component of the CEO's remuneration package because of its role in reducing agency issues (e.g., Jensen and Meckling (1976)). In particular, following Core and Guay (2001) and Coles et al. (2006), we employ Vega and Delta measures to assess CEO risk preferences and wealth incentives, respectively. Vega measures CEO wealth sensitivity to changes in stock return volatility. Executives with higher Vega have an incentive to increase firm risk as their stock options become more valuable. Shareholders, on the other hand, are risk neutral, at least in theory. They may not necessarily be risk averse as long as they are sufficiently compensated for bearing greater risk. However, excessive risk can potentially reduce firm value due to the higher discounting of future cash flows. Thus, investors may respond less favorably to a repurchase announcement from an executive with higher Vega.

Delta measures the sensitivity of CEO wealth to share price changes. Chava and Purnanandam (2010) argue that, in equilibrium, an optimal level of Delta aligns CEO and shareholder wealth incentives as the CEO shares gains and losses with shareholders. So, higher Delta, like managerial equity ownership, should reduce agency costs making signals

[1] Open market repurchase programs are not binding commitments on the part of firm management and offer managers financial flexibility both in timing and quantity of share repurchases. This is further facilitated by minimal reporting and disclosure requirements around the actual buyback transactions.

from such a manager more credible. We also use CEO equity holdings to capture the immediate effect of a repurchase announcement on managerial wealth in our models. The greater an executive's proportionate stake in firm value, the more likely the market will regard the repurchase announcement as value signaling.

We test our hypotheses using a sample of 6,403 unique share repurchase announcements between 1992 and 2019. Consistent with our expectations, we find that the market responds less favorably to buyback announcements where CEO wealth increases with firm risk. We also find higher CEO equity ownership adds credibility to their repurchase announcement, and observe its positive relationship with repurchase announcement returns, but not with Delta. However, when we split Delta into its constituents – option Delta and share Delta – we find that option Delta is, in fact, associated with a positive market reaction to repurchase announcement. Although share Delta is insignificant, albeit positive, the significance of the CEO share ownership variable suggests that the latter is partially capturing the effect of share Delta and the potential explanatory power of the combined Delta variable. It also highlights the fact that CEO shareholding more directly affects CEO wealth and is a better predictor of short-term repurchase announcement returns than option Delta which aligns incentives over the medium to long-term period. Our analysis shows that higher CEO wealth sensitivity to stock volatility (price) is negatively (positively) related to the longer-term returns of repurchase announcing firms. We speculate that the lack of recognition of the importance of executive compensation incentives by investors might be one factor helping to explain the longer-term drift in returns following the share buyback announcement.

Finally, we highlight the role of executive compensation arrangements in explaining firms' actual repurchase behavior. Interestingly, we find executive compensation arrangements that trigger a stronger market reaction to the repurchase signal are associated with fewer *actual* repurchases. Although this appears inconsistent in a signaling context, it is consistent with management adjusting their repurchase decisions conditional on the degree of stock price adjustment to their repurchase signal. Higher announcement and post-announcement returns following repurchase announcements not only make actual share repurchases more costly, but also eliminate the motive for repurchase programs initiated for undervaluation reasons, resulting in lower completion rates. Similarly, consistent with executive wealth incentives, we find executives with greater wealth sensitivity to firm risk (Vega) repurchase more shares to increase firms' financial risk.

We note that if compensation contracts are perfectly aligned, then the Vega and Delta/CEO holdings measures will be less useful in approximating the severity of agency problems. However, the executive compensation literature (Core et al. (2003) provide an excellent review) suggests that, as in practice, management-driven remuneration arrangements are suboptimal and the constraints they impose far from tight, substantial deviations from optimal contracting result (see e.g. Morck et al. (1988), Crystal (1991), Jensen (1993), Bebchuk et al. (2002) and Bebchuk and Fried (2003)).[2] Along with this issue, we also directly address potential endogeneity concerns (e.g., reverse causality, omitted variable bias, and potential correlation between our compensation variables and other firm characteristics) linked to compensation design in our empirical analysis using two stage least square methods.

Our research makes an original contribution to the literature on open market share repurchases. Although the empirical relationship between executive compensation design and stock repurchases has been explored before in the context of payout policy and

[2] Jensen (2005) also shows that executives with high wealth sensitivity to firm equity can end up destroying the core value of the business in defending overvaluation of their stock.

managerial repurchase incentives (e.g. Fenn and Liang (2001); Kahle (2002); Young and Yang (2011) and Almeida et al. (2016)), our study is concerned with *the perceived credibility* of the share buyback signal, and is distinct from these studies where repurchase completion rates are more important. Our paper adds to the recent literature on buybacks that attempts to assess the credibility of the share repurchase signal using different proxies (see e.g., Babenko et al. (2012), Bonaimé and Ryngaert (2013) and Cziraki et al. (2021) use insider trades; Chen and Wang (2012) financial constraints; Caton et al. (2016) governance and Huang et al. (2022) CEO trustworthiness). Closer to our paper, Chen et al. (2020) highlight the important role of executive equity compensation on unfavorable self-interested disclosures prior to a repurchase announcement. Different from these studies, we show more directly that investors estimate the credibility of, and react to, a repurchase announcement depending on executive compensation arrangements. In particular, our findings suggest that the credibility of the stock repurchase announcement itself, as proxied by executive compensation incentives, is important and these compensation measures are correlated with both the short- and longer-term returns of repurchase announcing firms, as well as actual repurchase completion rates.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the relevant literature and our hypotheses, and Sect. 3 describes our data. In Sect. 4, we discuss our research methodology and main results. In Sect. 5, we carry out robustness tests and further analysis, and we summarize our findings in Sect. 6.

2 Background and hypotheses

Zeng and Luk (2020) document that share repurchases are now the dominant choice for corporate payouts, with Skinner (2008) noting that dividend-only firms are largely extinct. A number of studies explore the motives for share repurchase programs.[3] For example, these can be used as a defense against hostile takeovers (Denis (1990), Brown and Ryngaert (1991)); to adjust capital structure (Lie (2002), Dittmar (2000)); to fund employee stock options (Fenn and Liang (2001), Kahle (2002)); and, to distribute excess cash to shareholders (Jensen (1986), Guay and Harford (2000), Jagannathan et al. (2000), Fatemi and Bildik (2012) and Gopal et al. (2024)) etc. In a survey of US corporate executives, Brav et al. (2005) document that managers rank stock undervaluation as the primary reason for their stock buyback decisions. The academic literature mainly draws on this signaling explanation to support the abnormal returns associated with repurchase announcements (e.g., Vermaelen (1981; Comment and Jarrell (1991), and Peyer and Vermaelen (2009)). However, such announcements lack the characteristics of a credible signal – which is the concern of this paper.

2.1 Buyback announcement as a market signal

A stock can deviate from its fundamental value due to information asymmetry in the marketplace. Managers, being particularly sensitive to stock undervaluation, often take action to correct it by signaling their private information to the market. Vermaelen (1981) argues

[3] Share repurchase motives are not mutually exclusive, and firms do not always disclose the(ir) repurchase motive(s) in their announcement. However, in theory, all repurchase motives suggested in the literature should have a positive effect on share price in different ways, save when opportunistic or cosmetic.

that repurchase announcements signal such managerial belief that their stock is undervalued. Several later studies build on this argument and show that undervalued firms that announce a repurchase program earn significant abnormal returns post-announcement (e.g., Ikenberry et al. (1995; 2000), Chan et al. (2004), Peyer and Vermaelen (2009) and Jakob and Valta (2023)).

It is reasonable to assume that managers aim to correct any underpricing by sending "credible" signals to the market. However, there is a well-established signaling literature in finance beginning with Spence (1973) suggesting that the signal needs to be costly to be credible. In the absence of signaling costs, all firms, will have an incentive to mimic the signals of good firms. This results in a "pooling equilibrium", with the market unable to distinguish between good and bad firms.

A share repurchase announcement, however, only represents management *authorization* to repurchase shares, which is costless, unlike *actual* repurchases which are costly.[4] In addition, such authorizations are not binding commitments and, in fact, a large number of repurchase announcing firms do not complete their announced repurchase programs (see e.g., Stephens and Weisbach (1998) and Bhattacharya and Jacobsen (2016)).

2.2 Executive compensation and buyback announcements

OMSR programs not only provide financial flexibility to managers but also allow managers to make personal gains and manage earnings. Murphy and Kester (2014) claim that the primary reason managers repurchase shares is to improve their firm's Earnings Per Share (EPS) – a performance evaluation measure executive compensation is often tied to (e.g., Young and Yang (2011); Cheng et al. (2015); Almeida et al. (2016) and Kim and Ng (2018)).

Fried (2005) labels OMSR announcement a "false signaling device", arguing these are mainly driven by managerial incentives. Lee et al. (2020) document that buyback motives have changed in recent years from firm fundamentals, such as undervaluation driven, to those based on managerial self-interest. For example, Chan et al. (2018) show that controlling shareholders use repurchases to reduce the likelihood of margin calls on their pledged shares. Similarly, Lazonick et al. (2020) highlight that managers time their repurchase decisions in their self-interest. Edmans et al. (2018) show that managers strategically time the disclosure of discretionary positive news to coincide with months in which their equity vests, allowing them to sell their shares at a higher price. Ahmed and Taffler (2021) provide more direct evidence on this and find that insiders time the disclosure of, and their trades around, a repurchase announcement to maximize their wealth.

OMSR programs can therefore either signal firm undervaluation or be exploited opportunistically, or at least cosmetically by firm management. In an efficient market, one would expect market participants to differentiate value signaling repurchase announcements from agency driven or cosmetic ones.[5] However, managements' actual repurchase motives are

[4] The evidence on share buyback announcement signaling costs is mixed. Bonaimé (2012) shows that firms' prior record on actual repurchases (reputation) influences the market reaction to its subsequent repurchase program announcements. However, Chan et al. (2010) argue that there are no significant reputational penalties for managers who fail to repurchase the announced number of shares.

[5] It is important to note that agency theory, here, refers to the traditional agency conflict between shareholders and managers and not the agency cost of free cash flows. In our case, the former represents the possibility that repurchase programs can be used opportunistically against the interests of shareholders. In the

unobservable at the time of announcement; no true ex-ante measure of managerial intent exists (Chan et al. (2010)).

In this paper, we propose that executive compensation design can potentially be used to proxy for the "perceived" credibility of the open market repurchase announcement as a positive signal. Jensen and Meckling (1976) suggest that compensation contracts can be designed to alleviate agency problems by aligning management interests with those of shareholders, and a perfect compensation package should, in theory, eliminate all agency costs. However, unfortunately, such a compensation contract does not exist. So, in relative terms, a better compensation package is one that reduces agency costs and, at the same time, sufficiently compensates managers in order to attract and retain managerial talent (Coles et al. (2006)).

We argue that an executive compensation contract that aligns executives' interests with those of shareholders should result in more credible information disclosure and reduce information asymmetry. On the other hand, where shareholders' and executives' interests diverge, outside investors should view managers' buyback announcements more skeptically. We particularly focus on the share-based component of an executive's compensation package as this is likely to be far more effective in resolving agency issues than a fixed remuneration package (Jensen and Meckling (1976)).

We measure managerial wealth alignment and risk preferences by calculating Delta and Vega respectively from their own firm's stock and option holdings (see e.g., Core and Guay (2001), Coles et al. (2006) and Low (2009)). Chava and Purnanandam (2010) argue that in equilibrium an optimally chosen Delta aligns executives' incentives with those of shareholders. So, higher Delta should reduce agency costs and any signal from such a manager should be considered stronger (more credible) in relative terms. This expectation is formalized in the following hypothesis:

Hypothesis 1 There is a positive relationship between Delta (CEO wealth sensitivity to stock price) and market reaction to a share buyback announcement.

This relationship is likely to be stronger particularly in the case of longer-term returns as restricted stock grants and stock options typically have a vesting period. So, Delta measures incentive alignments over the medium to longer-term horizon. Similar to Delta, higher CEO Ownership also reduces agency issues as Fama (1980) notes from the classical economic literature. This is because as the CEO Ownership tends towards 100%, the owner-manager distinction disappears, eliminating the separation of ownership and control problem. Subsequently, the agency issue is mitigated (Jensen and Meckling (1976)), and the owner-manager runs the firm with the key objective to maximize profits (Fama (1980)). Therefore, the higher the CEO ownership of their firm, the lower the agency issue, and thus the more credible the signal from such a manager. Consequently, we expect the market to respond more positively to repurchase announcements from managers having a larger shareholding in their firm. However, unlike Delta, CEO shareholdings capture the immediate effect on CEO wealth and reduce the agency problem more directly. Therefore, we expect this relationship to be stronger in the short-run. Formally, we test this using the following hypothesis:

Footnote 5 (continued)

latter case the repurchase announcement is, in fact, good news for shareholders as actual repurchases reduce agency costs of free cash flows by limiting the amount of cash available at managers' discretion.

Hypothesis 2 There is a positive relationship between CEO Ownership and market reaction to a buyback announcement.

Agency issues can also arise due to differences in risk preferences between firm management and shareholders. We measure executives' incentives to take on more risk by Vega – the dollar change in managerial wealth for one percentage point change in stock return volatility. Amihud and Lev (1981), and Smith and Stulz (1985) argue that managers are undiversified as compared to shareholders due to their heavy investment in firm-specific wealth. Managers' concerns over job security and under-diversification may lead them to forgo risky but positive net present value (NPV) projects – the underinvestment problem as explained by Myers (1977). Coles et al. (2006) show that higher sensitivity of executives' pay to stock return volatility (Vega) is, in fact, related to riskier policy choices, such as investment in more risky projects, concentrated business lines, and higher debt to equity ratios.

Although higher Vega can help reduce risk-related agency issues, it can also increase other agency issues. For example, Ju et al. (2014) examine the effect of executive stock options on managerial risk-taking behavior and find that depending upon executive risk aversion and investment technology, a call option contract can induce either too little or too much risk taking. Since stock options are like call options on the firm's stock and have a convex payoff, managers are protected on the downside. Such downward protection can encourage them to take on risky projects and increase firm risk as their stock options become more valuable with higher volatility. Thus, managers with higher Vega have an incentive to increase firm risk.[6] As repurchases increase firms' financial risk, we expect the market to respond more circumspectly to a repurchase announcement made by an executive with higher Vega. Formally, we hypothesize:

Hypothesis 3 Market reacts less favorably i.e., negatively, to a buyback announcement when an executive has higher wealth sensitivity to stock return volatility (Vega).

3 Sample selection and variables

3.1 Data sample

We collect share repurchase announcement data from the Thomson Financial Security Data Company (SDC) Mergers and Acquisitions database. Our sample covers all 48,318 open market share repurchase programs announced by US firms between 1992 and 2019. We collect executive compensation data from ExecuComp available from 1992 onwards. As ExecuComp covers Standard & Poor's (S&P) 1,500 firms, merging SDC share repurchase announcement data with the ExecuComp dataset leaves us with 12,448 unique share repurchase announcements. We use data from CRSP to calculate returns for our event firms while financial statement data come from COMPUSTAT. Merging data from these datasets to our main dataset leaves us with 6,676 firm-year observations. We winsorize all variables at the 1st and 99th percentiles to mitigate the effect of outliers. Our final sample consists of

[6] Even though executives can potentially reduce firm value by taking on excessive risk, they can nonetheless potentially still gain personally.

6,403 firm-year observations across 2,147 unique firms with open market share repurchase announcements.

3.2 Variable construction and descriptive statistics

We calculate short-term market reaction to a repurchase announcement as the three-day (− 1,1) cumulative abnormal return (CAR) around the repurchase announcement (event) date (day 0) using CRSP value-weighted market return as the benchmark. We focus specifically on the share-based compensation component of the CEO's remuneration package because of its role in reducing agency issues (e.g., Jensen and Meckling (1976)). We follow Core and Guay (2002) and Coles et al. (2006) to employ Vega and Delta measures to assess CEO risk preferences and wealth incentives, respectively. Vega measures CEO wealth sensitivity to changes in stock return volatility. Executives with higher Vega have an incentive to increase firm risk as their stock options become more valuable. However, excessive risk can potentially reduce firm value due to the higher discounting of future cash flows. Thus, investors may respond less favorably to a repurchase announcement from an executive with higher Vega. Delta measures the change in the dollar value of an executive's wealth for a one percentage point change in stock price. For more detailed examination, we also decompose Delta into its two components, i.e., OptionDelta and ShareDelta. While OptionDelta focuses on the dollar change in the value of CEO options, ShareDelta measures the change in value of CEO stocks for one percentage point change in stock price. Vega is defined as the change in dollar value of an executive's wealth for a one percentage point change in annualized stock return volatility. In fact, Delta and Vega are the first derivatives of Merton's modified version of the Black and Scholes (1973) option valuation model with respect to price and volatility, respectively. Details for Delta and Vega are in Appendix I. CEO Ownership is the percentage of the firm owned by the CEO. We consider the actual identity of the CEO at the time of the share buyback announcement in constructing our test variables.

Following earlier studies such as Gong et al. (2008), Peyer and Vermaelen (2009), Chan et al. (2010), and Chen and Wang (2012), we control for various firm-level attributes that may influence share repurchase announcement returns. Size is the market value of the firm at the beginning of the fiscal year prior to the announcement. Book-to-market (B/M) is the ratio of book value of the firm's assets to its market value. Cashflow Ratio is the operating cash flow scaled by total assets. Prior BHR is measured as the 30-day buy-and-hold return starting from 2 to 32 days before the repurchase announcement (− 32, − 2). % Sought is the percentage of outstanding shares that the firm intends to buyback.[7] We also construct a Repurchase Dummy variable, equal to one if actual repurchases are higher than the sample median and zero otherwise. We also control for discretionary accruals (DA) with details in Appendix II. As financially-constrained firms experience lower share repurchase announcement returns, on average, compared to unconstrained firms (Chen and Wang (2012), we measure financial constraints using the KZ index (Kaplan and Zingales (1997). Variable definitions are also given in Table 10, in Appendix III.

[7] Similar to Banyi et al. (2008), we subtract COMPUSTAT data item #56 (decrease in redeemable preferred stock) from data item #115 (purchase of common and preferred stock) and divide this by the quarter's closing price to yield the number of shares repurchased which is then scaled by the total number of shares outstanding to estimate the percentage of shares bought back in the quarter. These quarterly numbers are next summed over a one-year period (four quarters) following Chan et al. (2010) which gives us the percentage of Actual Shares Repurchased.

Table 1 presents the distribution of our open market share repurchase announcements by year from 1992 to 2019 (Panel A) and by industry (Panel B). The number of buyback announcements steadily increases from 23 in 1992 to 346 in 1998 before the dot-com bubble. The number of announcements then drops before peaking again at 405 by 2008. After the subprime mortgage crisis repurchase announcements fluctuate roughly between 250 and 350 a year until 2019. On average, sample firms state they intend to repurchase around 9.21% of their outstanding equity.

We identify industries using two-digit Standard Industrial Classification (SIC) codes. The majority i.e., 44%, of the repurchase programs are announced by manufacturing firms. Finance and services represent 16.2% and 15.4% of buyback announcements in our sample, respectively. Overall, statistics in Table 1 are in line with those reported in earlier studies.

In Table 2, we provide descriptive statistics on repurchase announcement returns, CEO compensation variables, and other firm characteristics for firms in our dataset. Average 3-day return (CAR) around the repurchase announcement event is 1.45%. While average Delta in the sample is about $0.756 million, the mean values for OptionDelta and ShareDelta are $0.284 million and $0.459 million, respectively. Mean Vega is about $0.145 million. The average CEO owns around 2.16% of their firm. Consistent with earlier studies, we note that repurchase announcing firms, on average, lose around 2.6% of their value in the 30-day period before the announcement, and repurchase about 5% of their outstanding shares in the year following the announcement.

4 Methodology and results

4.1 Empirical approach

Our data covers the period 1992–2019. We use the following fixed-effects (FE) OLS regression model to examine the association between CEO compensation structure and short-term market reaction to share repurchase announcements:

$$CAR_{i,t} = \propto + \beta_1\left(Delta_{i,t-1}\right) + \beta_2\left(Vega_{i,t-1}\right) + \beta_1\left(CEOOwnership_{i,t-1}\right) + \theta X_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where CAR_{it} is the three-day (-1,1) cumulative abnormal return of firm i during time t. $Delta_{i,t-1}$, $Vega_{i,t-1}$, and $CEO\ Ownership_{i,t-1}$ are the CEO compensation measures for firm i at time $t-1$. In additional models, $OptionDelta_{i,t-1}$ and $ShareDelta_{i,t-1}$ which make up $Delta_{i,t-1}$ are used separately.$X_{i,t-1}$ is a vector of control variables (i.e., *% Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, Repurchase Dummy,* and *DA*). To control for any unobserved, time-invariant industry-specific factors that may influence firm i's CAR, we include industry fixed effects in the model. Similarly, year fixed effects are used to control for any systematic variation in CAR related to macro-economic factors common to all firms. We lag all explanatory variables by one year and cluster standard errors at the industry level.

4.2 Main results

Table 3 presents the results of our main analyses. Following Coles et al. (2006), we include both Delta and Vega variables together in each regression model to isolate the effect of

Table 1 Distribution of share repurchases by year

Panel A: Yearly distribution of share repurchases

Year	N	Frequency (%)	Intended buyback ratio (%)
1992	23	0.36	9.66
1993	79	1.23	5.12
1994	154	2.41	6.76
1995	195	3.05	6.67
1996	258	4.03	6.52
1997	245	3.83	7.01
1998	346	5.40	8.63
1999	263	4.11	8.38
2000	211	3.30	8.58
2001	135	2.11	9.09
2002	115	1.80	10.24
2003	121	1.89	10.32
2004	191	2.98	10.03
2005	247	3.86	9.66
2006	244	3.81	8.67
2007	400	6.25	10.15
2008	405	6.33	10.41
2009	143	2.23	12.04
2010	246	3.84	11.72
2011	363	5.67	11.87
2012	277	4.33	11.86
2013	269	4.20	10.09
2014	312	4.87	8.62
2015	306	4.78	8.99
2016	241	3.76	8.61
2017	225	3.51	7.90
2018	288	4.50	7.66
2019	101	1.58	7.75
All	6403	100.00	9.21

Panel B: Industry distribution of share repurchases

Industry	Percentage (%)
Manufacturing	43.96
Finance, insurance, and real estate	16.24
Services	15.36
Retail	10.79
Transportation, communication, utilities	6.36
Wholesale	3.57
Mining	2.14
Construction	1.32
Agriculture	0.27

This table reports the distribution of repurchase announcements by year (Panel A) and industry (Panel B). Year represents the year of the announcement. N shows the number of announcements in that particular year for our sample. Frequency is the percentage to total announcements made in a given year. Intended

Table 1 (continued)

buyback ratio is the percentage of outstanding shares that management states it intends to buyback at the time of announcement. Two-digit SIC codes are used to identify the industries

Table 2 Descriptive statistics

	Mean	Std Dev	25th	Median	75th
CAR (%)	1.448	5.590	−1.064	1.188	3.909
Delta ($M)	0.756	1.580	0.099	0.262	0.688
OptionDelta ($M)	0.284	0.469	0.023	0.105	0.318
ShareDelta ($M)	0.459	1.326	0.030	0.089	0.278
Vega ($M)	0.145	0.226	0.012	0.054	0.172
CEO Ownership (%)	2.161	5.269	0.089	0.291	1.148
Size ($B)	10.953	27.257	0.804	2.305	7.702
B/M	1.605	2.347	0.496	0.854	1.549
Prior BHR	−0.026	0.136	−0.098	−0.011	0.058
Cashflow Ratio	0.128	0.096	0.065	0.115	0.176
KZ	1.773	1.553	1.070	1.766	2.511
DA	−0.061	0.383	−0.084	−0.032	0.004
Repurchase (%)	5.005	4.804	1.671	3.752	6.788

This table reports descriptive statistics for the main variables. The time span for this study is between 1992 and 2019. There are 6,403 firm-year observations across 2,147 firms. CAR is the three-day $(-1,1)$ cumulative abnormal return around the share buyback announcement date (day 0) using value-weighted market return as the benchmark. Delta is the dollar change in executive wealth for one percentage point change in stock price. Option(Share)Delta is the dollar change in executive option (share) wealth for one percentage point change in stock price. Vega is the dollar change in executive wealth for one percentage point change in annual volatility. CEO Ownership is the CEO's stock ownership as a fraction of total shares outstanding. Size is the market value of the firm in billions of USD. B/M is the ratio of book value of firm to its market value. Prior BHR is the buy and hold abnormal return of the firm for the 30-day window prior to the repurchase announcement and ending two days before the announcement $(-32,-2)$. Cashflow Ratio is the operating cash flow scaled by total assets. Financial constraints are measured by the KZ index. DA is the discretionary accruals of the firm following the Jones (1991) model. Actual Repurchase is the percentage of shares repurchased as a fraction of shares outstanding. For detailed definitions for these variables, see Table 10 in Appendix III

each of these incentive measures controlling for their effect on each other. Columns I, II, and III show the results of regressing repurchase announcement returns on Delta, Vega, and CEO Ownership without control variables. Although positive, contrary to hypothesis H1 the coefficient on Delta is statistically insignificant. However, we do observe a positive and significant coefficient for the CEO Ownership variable in line with hypothesis H2. Similarly, consistent with our third hypothesis, H3, Vega is negatively related with CAR suggesting that the market reaction to a repurchase announcement is weaker for firms where CEOs have a higher incentive to increase risk.

In Column IV of Table 3, we include control variables and find results that resonate with our findings in Columns I, II, and III. As with Column I, the coefficient on Delta is still statistically insignificant. A possible explanation for this result is that, compared to Delta, CEO Ownership captures the direct and immediate impact on executive wealth of a change in stock price. Hence, in the short-run, it is reasonable for the market to pay more attention to CEO Ownership as opposed to Delta.

In Columns V and VI, we separate Delta into its two constituent parts, OptionDelta and ShareDelta, respectively. The intuition is that CEO Ownership, by definition, can capture any potential association between the "share component" of Delta and CAR thus rendering this redundant in the model. Consequently, when CEO Ownership is included in the model, OptionDelta should provide a better explanation of the relationship between "delta" and CAR. Consistent with this reasoning, we find a significant and positive relationship between OptionDelta and repurchase announcement returns (CAR) in line with our hypothesis H1, although we do not observe a statistically significant relationship between ShareDelta and CAR. However, CEO Ownership remains positively related with CAR at conventional levels in Column V. In economic terms, we find that one-standard-deviation increases in OptionDelta and CEO Ownership lead to increases in CAR of approximately 0.24% ($=0.469\times0.503$) and 0.34% ($=5.269\times0.065$), respectively. Furthermore, in line with hypothesis H3 we find that the market reacts more circumspectly to a repurchase announcement when an executive has a higher incentive to increase firm risk (Vega). A one-standard-deviation increase in Vega leads to a decrease in CAR of around 0.36% ($=0.226\times-1.588$).[8] In addition, consistent with earlier studies such as Chen and Wang (2012), we find pre-announcement returns and financial constraints are negatively related to repurchase announcement returns, suggesting that the market reacts more positively to buyback announcements of undervalued firms but less favorably to those which are financially constrained.[9]

In further analyses, we test the cross-terms between stand-alone OptionDelta, Vega, and CEO Ownership. We use the White Test as a direct and robust test of the individual relevance of these measures as credibility signals. The results presented in Appendix III, Table 11 have high F-values, and are statistically significant at the 1% level, implying that heteroscedasticity is not an issue in our models, and our CEO compensation variables have credible and relevant coefficients.

Broadly speaking, these findings are in line with Babenko (2009) who proposes that repurchases increase pay-performance sensitivity and show that the announcement returns are typically higher for firms where managers have higher pay-performance sensitivity pre-announcement. However, similar in spirit to Huang et al. (2022) – who use a community-level survey-based measure of trust to assess credibility of managerial repurchase signal – we use more direct measures of managers' wealth and compensation to proxy for the

[8] Untabulated analyses of correlation and variance inflation factor (VIF) indicate potential multicollinearity between the right hand side variables is not an issue.

[9] In untabulated analyses, we test the robustness of our main findings by: (i) excluding financial firms from the sample; (ii) applying different model specifications including different time intervals (2-day, 3-day, 5-day), Fama-French factors, and equally-weighted market return as benchmark (iii) constructing alternative measures for Size, Prior BHR, and KZ – natural logarithm of market value, prior CAR, and KZ quintiles, respectively; (iv) using firm fixed effects and clustering, instead of industries; (v) adopting two-way clustering on year and industry following Petersen (2009); and (vi) by deleting repurchase announcements appearing more than once within a two-year period. All our results remain robust and similar to our original findings in each of these exercises.

Table 3 Effect of CEO Compensation on market reaction to repurchase announcement

	Repurchase announcement CAR					
	I	II	III	IV	V	VI
Delta	0.097		0.067	0.097		
	(0.073)		(0.079)	(0.087)		
OptionDelta					0.503**	
					(0.257)	
ShareDelta						0.091
						(0.121)
Vega	− 1.224***		− 1.171**	− 1.124**	− 1.588***	− 0.999*
	(0.470)		(0.493)	(0.539)	(0.608)	(0.510)
CEO		0.061**	0.052*	0.050*	0.065**	0.052
Ownership		(0.028)	(0.032)	(0.030)	(0.030)	(0.034)
% Sought				− 0.015	− 0.015	− 0.015
				(0.019)	(0.019)	(0.019)
Prior				− 3.163***	− 3.194***	− 3.158***
BHR				(0.784)	(0.784)	(0.784)
KZ				− 0.135**	− 0.141**	− 0.132**
				(0.066)	(0.068)	(0.066)
Size				− 0.001	− 0.001	− 0.001
				(0.004)	(0.004)	(0.004)
B/M				0.139	0.147	0.132
				(0.111)	(0.111)	(0.111)
Cashflow ratio				− 1.260	− 1.311	− 1.212
				(1.732)	(1.749)	(1.725)
Repurchase				0.073	0.071	0.070
Dummy				(0.183)	(0.183)	(0.183)
DA				0.263	0.268	0.261
				(0.210)	(0.209)	(0.210)
Fixed effects	YES	YES	YES	YES	YES	YES
Adj. R^2	0.012	0.012	0.013	0.021	0.021	0.021
Observations	6,254	6,260	6,117	5,565	5,565	5,565

This table presents the coefficients for Delta, OptionDelta, ShareDelta, Vega, and CEO Ownership, along with % Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, Repurchase Dummy, and DA as control variables. An intercept is included in the regression, but is not reported in this Table. Dependent variable is CAR, that is the three-day (-1,1) cumulative abnormal return around the share buyback announcement date (day 0) using value-weighted market return as the benchmark. Delta is the dollar change in executive wealth for one percentage point change in stock price. Option(Share)Delta is the dollar change in executive option (share) wealth for one percentage point change in stock price. Vega is the dollar change in executive wealth for one percentage point change in annual volatility. CEO Ownership is the CEO's stock ownership as a fraction of total shares outstanding. Variable definitions are given in Table 10, Appendix III. Explanatory variables are for the fiscal year prior to the announcement except Repurchase Dummy. Year and industry fixed effects are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

perceived credibility of a repurchase signal, and show that the strength of market reaction to a repurchase announcement signal is, in fact, dependent on our managerial wealth and compensation measures. In summary, we add to the literature by showing that CEO incentive measures have incremental explanatory power for repurchase announcement returns. After Prior BHR, Vega and OptionDelta have the highest economic impact on returns followed by financial constraints, and CEO Ownership.

4.3 Endogeneity concerns

In our main model, we use various control variables, lagged values of Vega, OptionDelta, and CEO Ownership, and include year and industry fixed effects to tackle reverse causation and omitted variables concerns. In this sub-section we also address any potential endogeneity concerns that our compensation variables might be correlated with other firm characteristics. First, we follow Coles et al. (2006) and use both predicted and residual values of OptionDelta, Vega, and CEO Ownership as CEO pay sensitivity measures.,[10][11] In particular, we regress the lagged values of OptionDelta, Vega, and CEO Ownership on their determinants to generate their predicted and residual values. To minimize the possible effect of other omitted variables, we include both year and four-digit SIC industry fixed effects in our regression specifications.

To test the robustness of our results and address potential endogeneity concerns, we also employ a simultaneous equation model approach as in Coles et al. (2006). Such an equation system is appropriate here because OptionDelta, Vega, and CEO Ownership variables can be jointly determined. In particular, we exploit the issuance of the Financial Accounting Standards Board (FASB) revised *Accounting for Stock Based Compensation Statement* SFAS 123R rule change requiring the mandatory expensing of employee stock options in 2005, as an exogenous shock. Nienhaus (2022) and Yun et al. (2023) argue that SFAS 123R directly impacts option-based compensation convexity while pay-performance sensitivity also changes. In line with these studies, we define a binary indicator variable "Post" for years from 2005 onwards. However, the shock will not have impacted all firms similarly. For example, firms that did not grant their CEOs any options prior to SFAS 123R (from 2002 to 2004) or firms that voluntarily opted for the fair value method before 2004 will not be affected. We identify such firms in our sample using ExecuComp and Bear Stearns Equity Research dated December 16, 2004 (McConnell et al. (2004) and categorize them as "control firms". We define "Treatment" as a binary indicator for non-control group firms which are affected by SFAS 123R and include the interaction variable Post × Treatment in our simultaneous equations models as another exogenous instrument when jointly estimating OptionDelta, Vega, and CEO Ownership. Post and Treatment comply with exclusion restrictions because, by definition, they should directly impact the CEO pay sensitivity measures but not repurchase announcement returns (CAR). The identifying restrictions we impose should be clear from the table. All right-hand-side (RHS) variables along with controls in Eq. (1), year and industry dummies are included in the simultaneous equations system. Standard errors are clustered by four-digit SIC industries.

[10] See their Table 2, p. 442.

[11] These variables are derived following Core and Guay (1999) and Guay (1999) although our actual regression model specifications of CAR differ slightly due to the need to impose identifying restrictions.

Table 4 presents the findings. Consistent with our original results, Column I shows that the market reacts circumspectly to repurchase announcements by firms where the CEO has a greater incentive to increase firm risk. Moreover, the market responds more positively to a repurchase announcement when the CEO has a greater ownership stake in the firm and their wealth is more sensitive to changes in stock price. Columns II – V report the simultaneous equations-based regression results. Column II estimates provide consistent interpretations and support our hypotheses. Buyback announcement returns are higher by 0.27% (=0.469×0.580) and 0.16% (=5.269×0.031) when OptionDelta and CEO Ownership increase by one-standard-deviation, respectively. In parallel, CAR drops by 0.38% (=0.226×1.697) with a one-standard-deviation increase in CEO Vega. As can also be observed, OptionDelta and Vega estimates in Columns III – V are consistent with Coles et al. (2006) while, similar to Nienhaus (2022) and Yun et al. (2023), treatment group firms' OptionDelta and CEO Ownership increase after the SFAS 123R rule change, but their Vega decreases.

5 Robustness tests and further analyses

Even though we control for a range of different factors in our main models, this section explores other, albeit seemingly less likely, explanations for our empirical results.

5.1 Additional controls

We consider open market share repurchases in our main analysis, however some buybacks are privately negotiated. Investors may react differently to such announcements because of potential information asymmetry concerns. We proxy this through a dummy variable, Private Negotiations. We argue that higher managerial equity ownership reduces agency costs, but it may also lead to managerial entrenchment as managers are less likely to be disciplined when engaging in activities that benefit themselves at the expenses of outside investors. To address this governance issue, we follow Feng et al. (2007) and Hu et al. (2022) and control for Institutional Ownership, CEO Duality, and Free Cash Flow in our analysis. Another possible empirical concern is the market's expectations, i.e., whether the stock market anticipates the buyback, and the extent to which such expectations are correlated with our compensation measures, Vega and Delta. Following Hsueh and Liu (1992), we use Analyst Dispersion to proxy market anticipation. Moreover, share ownership and option ownership can imply different holding horizons, depending on vesting schedules. Also, Delta and Vega measures can be mechanically related to holding horizons. To address these issues, we include a Remaining Vesting Period variable. Furthermore, one can argue firms that tend to have high Vega also are more likely to be those that undertake buybacks for financial flexibility reasons. Following Palmrose et al. (2004), Lei and Zhang (2016), DeAngelo et al. (2018), Evgeniou et al. (2018), and Kumar and Vergara-Alert (2020), we control for Leverage, Cash Ratio, Capex Ratio, Stock Return, Tangibility, Δ Net Income, and Dividend as proxies of financial flexibility. Definitions of all variables are provided in Table 10, in Appendix III. We find results similar to those of our main analysis even after controlling for all these additional factors. We tabulate these results in Appendix III, Table 12.

Table 4 Analyses addressing endogeneity concerns: CAR and CEO pay sensitivity measures

	(Coles et al. '06-T2)	Simultaneous Equations (Coles et al. 2006) with SFAS 123R Shock as the Instrument			
	CAR	CAR	OptionDelta	Vega	CEO Own
	I	II	III	IV	V
OptionDelta (predicted)	1.618*				
	(0.983)				
Vega (predicted)	−10.681**				
	(5.108)				
CEO Own. (predicted)	0.728***				
	(0.279)				
OptionDelta (residual)	−0.018				
	(0.113)				
Vega (residual)	−0.523				
	(0.393)				
CEO Own. (residual)	0.037				
	(0.023)				
OptionDelta		0.580*		0.553***	0.148
		(0.347)		(0.004)	(0.285)
Vega		−1.697***	1.677***		−3.240***
		(0.610)	(0.012)		(0.496)
CEO ownership		0.031**	0.001	−0.002***	
		(0.015)	(0.001)	(0.000)	
Post × Treatment			0.023*	−0.013*	0.447*
			(0.013)	(0.007)	(0.267)
Constant	−3.048*	−0.526	−0.050	0.046	4.252***
	(1.638)	(1.797)	(0.070)	(0.040)	(1.494)
RHS variables inc. Controls	YES	YES	YES	YES	YES
Fixed effects	YES	YES	YES	YES	YES
Adj. R^2	0.093	0.085	0.672	0.677	0.226
Observations	4,998	5,565	5,565	5,565	5,565

This table presents regression results from the models used by Coles et al. (2006). Column I gives the estimates for the predicted and residual values of OptionDelta, Vega, and CEO Ownership that are calculated by following Coles et al. (2006) and Core and Guay (1999). Columns II – V adopt the simultaneous equations system used by Coles et al. (2006) to reduce the likelihood of spurious results. To address the endogeneity issues further, we follow Nienhaus (2022) and Yun et al. (2023) and instrument OptionDelta, Vega, and CEO Ownership in the simultaneous equations system through Post × Treatment as the interaction of Post (an indicator for years from 2005) and Treatment variables. All right-hand-side (RHS) variables along with controls are included in regressions, but is not reported in this Table for brevity. Variable definitions are given in Table 11, Appendix III. Year and industry dummies are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, ** and * indicate statistical significance at the 1%, 5%, 10% levels, respectively

5.2 Other factors

Although we include various proxies in our model to further control for other components related to firm, governance, investors, and share repurchases, other externalities may still exist

that can influence the market's assessment of the repurchase decision. For instance, share buybacks occur in waves, and are more frequent in "hot market" periods. In such market conditions, it could be more challenging to filter the actual signal from noise, and thus, managerial compensation arrangements play a greater role in assessing the credibility of share buyback announcements. To test this conjecture, we identify hot markets as years with number of repurchases above the sample mean (as in Table 1) and test our main model only for these 16 hot market years: 1996–1999, 2005–2008, 2010–2016, and 2018. Statistically significant results for OptionDelta, Vega, and CEO Ownership in Column I of Table 5 are indeed stronger in economic terms as compared with our original results presented in Column V of Table 3. Specifically, we observe 58% (from 0.24 to 0.38%), 77% (from 0.34 to 0.60%), and 6% (from 0.36 to 0.38%) increase in economic significance for OptionDelta, CEO Ownership, and Vega, respectively. These new results confirm that the market relies more heavily on executive compensation variables in assessing the credibility of repurchase signal when markets are noisier.

The separate components of managerial remuneration structure i.e., OptionDelta and Vega, may potentially influence each other or even offset their individual impacts on investor assessment of the repurchase decision. To examine any such potential interaction effects, we construct two additional binary variables i.e., High Vega and High OptionDelta, equal to one if Vega (OptionDelta) is above the sample median in that year, and zero otherwise. We then run our main analyses with the following interactive terms: OptionDelta×High Vega and Vega×High OptionDelta. In Columns II–IV of Table 5, neither High Vega nor High OptionDelta offsets the effect of each other on CAR as indicated by the statistically significant coefficients for those managerial pay components, similar to our main findings. Results remain the same even when we include both interaction terms simultaneously in the model (see, Column IV). These findings suggest that the market differentiates between different the components of managerial compensation structure, and each component contributes separately to how the market views and reacts to the repurchase signal.

Another possible factor influencing the link between managerial pay structure and buyback announcement CAR could be the size of the repurchase itself. It is curious to know whether the size of the buyback is consequential as the repurchase itself. Thus, we create High Repurchase Size as a binary variable equals one if the size of the intended repurchase scaled by market value of equity is above the sample median for that particular year, and zero otherwise. We then interact High Repurchase Size with OptionDelta, Vega, and CEO Ownership separately and add these interaction terms to the main model in Column V of Table 5. While we obtain similar and robust results for our main compensation variables (OptionDelta, Vega, and CEO Ownership), we do not find any evidence these have an incremental effect for firms with larger repurchase size.

5.3 CEO incentive alignment and further conditions

We provide evidence of higher repurchase announcement returns when the perceived credibility of the repurchase announcement is greater as reflected in executive compensation arrangements and the firm also appears to be mispriced. We investigate this finding further, especially for firms with greater information asymmetry, by constructing a compensation dummy variable, Compensation Dummy. This proxies the "incentive alignment" between the executive and shareholders based on our three executive compensation sensitivity variables Delta, Vega and CEO Ownership, and takes the value of one when the firm's OptionDelta and CEO Ownership are above, and Vega is below the sample median, and zero otherwise.

Table 5 Effect of other factors on market reaction to repurchase announcements

	Repurchase snnouncement CAR				
	I	II	III	IV	V
OptionDelta × High RepSize					0.588
					(0.667)
Vega × High RepSize					−1.173
					(1.071)
CEO Ownership × High RepSize					0.018
					(0.059)
OptionDelta	0.918**		0.853**		0.773**
	(0.431)		(0.349)		(0.392)
Vega	−1.628**	−1.712***			−1.590**
	(0.826)	(0.586)			(0.696)
CEO Ownership	0.120**	0.065**	0.066**	0.066**	0.082*
	(0.048)	(0.030)	(0.030)	(0.030)	(0.045)
OptionDelta × High Vega		0.660*		0.595*	
		(0.365)		(0.358)	
Vega × High OptionDelta			−1.648***	−1.460***	
			(0.592)	(0.554)	
% Sought	−0.001	−0.015	−0.016	−0.016	−0.016
	(0.021)	(0.019)	(0.019)	(0.019)	(0.019)
Prior BHR	−2.932***	−3.209***	−3.213***	−3.199***	−3.200***
	(1.003)	(0.784)	(0.782)	(0.785)	(0.779)
KZ	−0.180*	−0.139**	−0.144**	−0.138**	−0.144**
	(0.095)	(0.067)	(0.068)	(0.067)	(0.068)
Size	−0.001	−0.001	−0.001	−0.001	−0.001
	(0.002)	(0.004)	(0.004)	(0.004)	(0.003)
B/M	−0.128	0.145	0.154	0.144	0.157
	(0.159)	(0.112)	(0.112)	(0.112)	(0.112)
Cashflow Ratio	−3.344	−1.247	−1.310	−1.205	−1.396
	(2.232)	(1.744)	(1.758)	(1.744)	(1.752)
Repurchase Dummy	0.308	0.067	0.065	0.064	0.066
	(0.247)	(0.182)	(0.182)	(0.182)	(0.183)
DA	0.350	0.268	0.272	0.266	0.279
	(0.225)	(0.209)	(0.209)	(0.209)	(0.209)
Fixed Effects	YES	YES	YES	YES	YES
Adj. R^2	0.017	0.021	0.021	0.021	0.022
Observations	3,983	5,565	5,565	5,565	5,565

This table presents regression estimates for Delta, OptionDelta, Vega, CEO Ownership and their interaction with High RepSize, High Vega and High OptionDelta, along with control variables. An intercept is included in the regression, but is not reported in this Table for brevity. Dependent variable is CAR, that is the three-day (-1,1) cumulative abnormal return around the share buyback announcement date (day 0) using value-weighted market return as the benchmark. Column I gives the results only for the years with hot markets i.e., 1996–1999, 2005–2008, 2010–2016, and 2018. Columns II to IV give the estimates for the effect of High Vega and High OptionDelta as binary variables equal to one if the Vega (OptionDelta) is above the sample median for that particular year, and zero otherwise. Column V presents the results for the effect of High Repurchase Size as a binary variable equals one if the size of the intended repurchase scaled by market value of equity is above the sample median for that particular year, and zero otherwise. Variable definitions are given in Table 10, Appendix III. Explanatory variables are for the fiscal year prior to the

Table 5 (continued)

announcement except Repurchase Dummy. Year and industry fixed effects are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

Lakonishok and Lee (2001) argue that greater information asymmetry leads to less efficiently-priced stocks in the market. Hence, the credibility of repurchase announcements will be a more important issue for firms with higher information asymmetry. Therefore, we expect the market to perceive a repurchase announcement as a more credible signal, and therefore react more positively to it, when executive wealth incentives are better aligned with those of shareholders – i.e., "aligned CEOs" – as proxied by our compensation dummy. Thus, we expect a stronger association between aligned CEOs and their buyback announcement returns. Drawing on Bryan and Tiras (2007) and Drobetz et al. (2010), we proxy greater information asymmetry by an Asymmetry Dummy, a binary variable that equals one when analyst forecast dispersion is greater than one standard deviation of the sample mean, and zero otherwise. Similarly, we anticipate that the market reacts more strongly to repurchase announcements of undervalued firms, especially when it comes from an aligned CEO. We proxy undervaluation using the 30-day return prior to repurchase announcement following Peyer and Vermaelen (2009) who argue that firms experiencing negative returns are more likely to be undervalued. We construct an Undervalue Dummy variable which takes the value of one for firms with 30-day BHR prior to the announcement below the sample median, and zero otherwise.

Overall, our analysis provides clear support for the proposition that CEO compensation design has value-relevant information for investors and the market reaction to a repurchase announcement is conditional on executive compensation design. The positive and statistically significant coefficient of the Compensation Dummy in Column I of Table 6 indicates better incentive alignment between executive and shareholders alleviates agency concerns and increases signal credibility, leading to a stronger market reaction to the repurchase announcement. This finding suggests that the market appears to understand CEOs' underlying wealth incentives and responds to their repurchase announcements accordingly.

In Column II of Table 6, a strongly positive coefficient on the interaction term between Compensation Dummy and information Asymmetry Dummy signifies that better incentive alignment between the CEO and shareholders adds credibility to the repurchase announcement, particularly for firms with high information asymmetry. Consequently, investors react more positively to repurchase announcements by such firms. Similarly, in Column III, the coefficient on the interaction term between Compensation Dummy and Undervalue Dummy is positive and significant at the 5% level. This result is consistent with our expectation that the market reacts more strongly to repurchase announcements of undervalued firms, especially, when CEO incentives are more aligned with shareholders, adding credibility to their repurchase signal.[12]

While we investigate the market reaction to share buyback decisions through the lens of CEO pay structure under information asymmetry and undervaluation, a natural extension of our study is an examination of any link between compensation structure and number of repurchases. We construct yearly number of repurchases and conduct a Poisson regression analysis in Appendix Table 13. The statistically significant and negative coefficient

[12] We test the cross-terms between Compensation Dummy, Asymmetry Dummy, and Undervalue Dummy using the White Test. The results in Appendix Table 11, have high *F*-values, and are statistically significant at the 1% level. These findings imply that heteroscedasticity is not an issue in our models, and our main explanatory variables have credible and relevant coefficients.

for Compensation Dummy in Column I suggests that companies with higher (lower) OptionDelta (Vega) and CEO Ownership tend to announce less buybacks as they consider the ramifications more carefully. Such hesitation in repurchase decisions is amplified for undervalued firms and firms that suffer from higher information asymmetry, as indicated by the greater negative coefficients for the interaction terms between the Compensation Dummy variable and proxies for information asymmetry and undervaluation in Columns II and III. These results reveal a further interesting insight into the relationship between managerial pay structure and share buybacks.

5.4 Compensation structure of other executives

Our paper mainly focuses on the relation between share buyback announcement returns and the CEO's compensation structure. However, firms have other powerful executives, including the Chief Financial Officer (CFO) and the Chief Operating Officer (COO), and other board members, too, who can influence decision making in a firm. Although their compensation and firm ownership percentage may not be as high as in the case of the CEO, investors may also consider their remuneration structure in their reaction to repurchase announcements. To examine this, we construct parallel ownership and sensitivity measures for other executives, as well as all executives, including the CEO. Using these new samples, we calculate OptionDelta in two ways: (1) by taking the average of executives' option Delta per firm per year, and (2) by taking the weighted average of executives' option Delta per firm per year, where the weights are constructed relative to total compensation of those executives. Vega is calculated similarly for these new samples. We define Exec Ownership as the sum of executives' share ownership over total shares outstanding. We repeat the main analyses in Table 3 with these measures for executives.

Column I in Table 7 provides the results with the CEO compensation measures for comparison. In Columns II and IV (III and V) we regress repurchase announcement returns on the simple (weighted) average values of our compensation measures (Delta, Vega and ownership) calculated for executives in a firm. Considering other executives only (Columns II and III), the results indicate that the effect of compensation measures on repurchase announcement returns is weaker than the ones with only CEO measures (Column I), with only Vega having a negative and statistically significant coefficient at the 5% level for these models. However, findings for all executives including the CEO, in Columns IV and V, confirm that compensation variables play an important role in explaining repurchase announcement returns. Specifically, we find that OptionDelta (Vega) is positively (negatively) related with CAR at the 5% significance level. Overall, we provide evidence that investors incorporate the pay structure of other executives in their reaction to share repurchase announcements, but not as much as they do for the CEO. More importantly, we note that investors' response to the repurchase announcement is more sensitive to changes in executives' risk preferences as compared to changes in their wealth incentives.

5.5 Longer-term returns

The earlier literature documents a significant positive drift in longer-term returns of repurchase announcing firms. Chang and Sullivan (2007), however, argue that longer-term returns are conditional on repurchase motive and mainly non-control related repurchases generate higher returns. More recent studies, on the other hand, find no evidence of abnormal returns for repurchasing firms (e.g., Fu and Huang (2015) and Bargeron et al. (2017)).

Table 6 Effect of CEO alignment on market reaction to repurchase announcements

	Repurchase Announcement CAR		
	I	II	III
Compensation dummy ×		5.729***	
Asymmetry dummy		(2.134)	
Asymmetry dummy		−1.858	
		(1.406)	
Compensation dummy ×			1.542**
Undervalue dummy			(0.674)
Undervalue dummy			−0.408
			(0.256)
Compensation dummy	1.026***	1.168***	0.176
	(0.377)	(0.406)	(0.437)
% Sought	−0.013	−0.013	−0.014
	(0.019)	(0.019)	(0.019)
KZ	−0.137**	−0.173***	−0.141**
	(0.063)	(0.067)	(0.062)
Size	−0.001	−0.001	−0.001
	(0.002)	(0.002)	(0.002)
B/M	0.145	0.171	0.149
	(0.109)	(0.140)	(0.111)
Cashflow ratio	−0.882	−0.212	−0.893
	(1.634)	(1.858)	(1.609)
Repurchase dummy	0.053	−0.029	0.059
	(0.180)	(0.189)	(0.179)
DA	0.217	0.200	0.209
	(0.207)	(0.204)	(0.205)
Prior BHR	−2.936***	−2.897***	−3.780***
	(0.758)	(0.793)	(1.054)
Fixed Effects	YES	YES	YES
Adj. R^2	0.020	0.023	0.021
Observations	5,687	5,203	5,687

This table presents the coefficients for Compensation Dummy, Asymmetry Dummy, and Undervalue Dummy, as well as their interactions, along with % Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, Repurchase Dummy, and DA as control variables. An intercept is included in the regression, but is not reported in this table. Dependent variable is CAR, that is the three-day (-1,1) cumulative abnormal return around the share buyback announcement date (day 0) using value-weighted market return as the benchmark. Compensation Dummy proxies for wealth alignment between the CEO and shareholders. It takes the value of one when delta (vega) is above (below) sample median and CEO Ownership is above median, and zero otherwise. Asymmetry Dummy represents high information asymmetry. It is a dummy variable equal to one if analyst forecast dispersion for that firm is more than one standard deviation from the sample mean of analyst forecast dispersion, and zero otherwise. Undervalue Dummy is a proxy for undervalued firms. It is a dummy equal to one for firms with buy-and-hold returns prior to the share repurchase announcement below the sample median, and zero otherwise. Variable definitions are given in Table 10, Appendix III. Explanatory variables are for the fiscal year prior to the announcement except Repurchase Dummy. Year and industry fixed effects are included. Standard errors are clustered

Table 6 (continued) by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

Given these disparate findings, we examine longer-term returns of firms in our sample. We argue that firms' longer-term returns are reflective of firms' operating and investment decisions, which are directly influenced by managerial incentives. Coles et al. (2006) empirically demonstrate that executive compensation arrangements influence their operating and investment choices which are reflected in firms' operating performance, i.e., profitability. Since a firms' operating performance is linked to its stock price performance, we expect repurchase announcing firms with better aligned managerial incentives to outperform those with less aligned incentives.

We test this line of argument more directly and report results in Table 14, in Appendix III. Consistent with our expectations, we find that firms with better aligned CEOs generally invest more and generate higher operating profits as compared to firms with less aligned CEOs. This difference in operating performance, as expected, is also reflected in longer-term returns earned by firms in these two subgroups, with better aligned firms generating higher abnormal returns in the one-year period following the repurchase announcement.[13] In line with Fu and Huang (2015) and Bargeron et al. (2017), we note that these returns have decreased in recent periods and are much lower than in earlier studies such as Ikenberry et al. (1995).

Table 8 tests the relationship between our incentive alignment proxies (OptionDelta, Vega, CEO Ownership, and Compensation Dummy) and the longer-term returns of repurchase announcing firms controlling for other factors that are potentially correlated with longer-term returns. The significant coefficients on our main executive compensation variables and their signs are consistent with our expectations and suggest that they may partially explain variations in the longer-term returns experienced by repurchasing firms. Our findings in this section are generally in line with Caton et al. (2016) who also show repurchasing firms with better governance show better operating results and higher longer-term returns following the repurchase announcement. However, unlike Caton et al. (2016), we use executive compensation arrangements to approximate the market's assessment of the credibility of repurchase signal. Additional tests reveal that our results are robust to inclusion of additional governance controls.

5.6 Actual repurchases

Finally, we investigate the association between CEO compensation arrangements and firms' actual repurchase behavior. Though managers cite stock undervaluation as the prime motive for initiating a stock repurchase program (Brav et al. (2005)), many firms repurchase shares

[13] We calculate longer-term returns using the market model and Carhart's four-factor model as benchmarks to approximate normal returns for our sample firms. Longer-term return is defined as the cumulative abnormal return over the one-year window (252 trading days) commencing two days following the repurchase announcement. To generate benchmark model estimates we use daily return data for the one-year period (252 trading days) prior to repurchase announcement starting − 32 days before the repurchase announcement date.

Table 7 Analyses with CEO and other executives' compensation measures

Samples:	Repurchase announcement CAR				
	CEO	Other executives		All executives	
	I	II	III	IV	V
OptionDelta	0.503*	0.0022	0.0018*	0.0018**	0.001**
	(0.260)	(0.0014)	(0.0010)	(0.0008)	(0.000)
Vega	−1.588***	−0.006**	−0.005**	−0.005***	−0.003**
	(0.608)	(0.003)	(0.002)	(0.002)	(0.001)
Exec ownership	0.065**	−0.004	−0.003	0.027	0.025
	(0.030)	(0.040)	(0.040)	(0.023)	(0.022)
% Sought	−0.015	−0.015	−0.012	−0.013	−0.012
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Prior BHR	−3.194***	−3.263***	−3.061***	-3.210***	−3.021***
	(0.784)	(0.738)	(0.738)	(0.735)	(0.732)
KZ	−0.141**	−0.136**	−0.123*	-0.139**	−0.129**
	(0.068)	(0.065)	(0.063)	(0.065)	(0.063)
Size	−0.001	−0.001	−0.001	-0.001	−0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
B/M	0.147	0.186	0.166	0.187*	0.172
	(0.111)	(0.113)	(0.109)	(0.112)	(0.107)
Cashflow ratio	−1.311	−0.890	−0.805	−0.975	−0.866
	(1.749)	(1.619)	(1.603)	(1.618)	(1.610)
Repurchase dummy	0.071	0.019	0.021	0.040	0.026
	(0.183)	(0.173)	(0.172)	(0.174)	(0.173)
DA	0.268	0.189	0.220	0.238	0.234
	(0.209)	(0.202)	(0.205)	(0.206)	(0.205)
Fixed effects	YES	YES	YES	YES	YES
Adj. R^2	0.021	0.019	0.018	0.019	0.019
Observations	5,565	5,784	5,823	5,784	5,823

This table presents the coefficients for OptionDelta, Vega, and Exec Ownership, along with % Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, Repurchase Dummy, and DA as control variables. An intercept is included in the regression, but is not reported in this table. Compensation measures are constructed for three different samples, i.e., the CEO, other executives, and all executives including the CEO. For the second and the third samples, OptionDelta is calculated two ways: 1) by taking the average of executives' option delta per firm per year, and 2) by taking the weighted average of executives' option delta per firm per year, where the weights are constructed through the total compensation of those executives. The same process is used for the Vega variable. Exec Ownership is the sum of executives' shares over total shares outstanding. Columns II and IV (III and V) give results using a simple (weighted) average method. Dependent variable is CAR. Variable definitions are given in Table 10, Appendix III. Explanatory variables are for the fiscal year prior to the announcement except Repurchase Dummy. Year and industry fixed effects are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

for other corporate reasons. However, repurchase announcements are not legally binding commitments. Bhattacharya and Jacobsen (2016) note that 27% of repurchase announcing firms do not repurchase a single share in the fiscal year following the announcement. It is also important to note that non-completion of an announced repurchase program does not

necessarily represent opportunistic management behavior. For example, repurchase programs motivated by firm undervaluation should not be completed if the market subsequently corrects for any mispricing, post-announcement. Therefore, it is reasonable to expect lower completion rates for firms that experience higher announcement and post-announcement returns, making actual repurchases more costly for such firms.[14] As post-announcement returns are negatively correlated with actual repurchases, we expect our compensation variables to have the opposite effect on actual repurchases as compared to their effect on returns.

In different model specifications in Table 9 we regress actual repurchase completion rates on executive compensation sensitivity variables along with other control variables using a Tobit model as actual repurchases are truncated at the 100% of announced repurchase program size (Percentage Sought). Following Stephens and Weisbach (1998), we explicitly control for announcement and post-announcement returns as these directly affect the cost of repurchases. Similar to Stephens and Weisbach (1998), we find that firms experiencing higher returns following the repurchase announcement repurchase fewer shares. Also, unsurprisingly, undervalued (high B/M) firms have higher repurchase completion rates. More importantly, and incremental to the literature, we empirically document that executive compensation structure can marginally explain firms repurchase completion rates. For example, in line with their incentives to increase firm risk, executives with higher wealth sensitivity to firm risk (Vega) repurchase more shares. Similarly, we find that both CEO Ownership and OptionDelta are negatively related to actual repurchases as the two variables have a positive association with post-announcement returns, making actual repurchases costlier. Equally, we confirm that repurchase and post-repurchase announcement returns are negatively related to actual repurchases, also as expected.

6 Conclusion

The recent literature suggests that though traditionally viewed as value signaling, OMSR announcements can potentially be agency driven. Chan et al. (2010) and Babenko et al. (2012) raise questions on the credibility of an OMSR signal. Lee et al. (2020) suggest that executive compensation arrangements have become an important factor in assessing the motive of repurchase programs. Chen et al. (2020) find that executive equity compensation is associated with managerial self-serving disclosures before a repurchase announcement. We add to this strand of literature and provide empirical evidence that the market appears to evaluate the credibility of a share buyback announcement as value signaling by observing the underlying executive wealth and repurchase incentives as proxied by their compensation arrangements. More specifically, we show that executives' equity ownership and compensation variables (Delta and Vega) are correlated with repurchase announcement and post-announcement returns as well actual repurchase completion rates of repurchase announcing firms. The market reacts more (less) strongly to a repurchase announcement when CEO wealth is more sensitive to changes in stock price (risk). We find this relationship between executive compensation arrangements and repurchase announcement returns to be particularly strong for undervalued firms (high B/M), and those that suffer from higher information asymmetry.

[14] Also note, if undervaluation was the underlying motive behind a repurchase announcement, an appropriate market adjustment on repurchase signal eliminates the need for actual repurchases.

Table 8 Effect of CEO compensation on longer-term returns of repurchase announcing firms

	CAR			
	I	II	III	IV
OptionDelta	0.032***		0.033***	
	(0.012)		(0.012)	
Vega	−0.109***		−0.117***	
	(0.024)		(0.024)	
CEO Ownership		0.003*	0.003*	
		(0.001)	(0.001)	
Compensation dummy				0.031**
				(0.013)
% Sought	0.001	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Prior BHR	−0.038	−0.015	−0.031	−0.015
	(0.050)	(0.051)	(0.050)	(0.051)
KZ	0.002	0.002	0.002	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
Size	−0.001***	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
B/M	0.015*	0.015**	0.015*	0.015**
	(0.008)	(0.007)	(0.008)	(0.007)
Cashflow ratio	−0.190***	−0.186***	−0.210***	−0.189***
	(0.058)	(0.060)	(0.060)	(0.059)
Repurchase dummy	−0.032***	−0.030***	−0.030***	−0.029***
	(0.009)	(0.010)	(0.010)	(0.010)
DA	−0.014	−0.015*	−0.011	−0.016*
	(0.009)	(0.009)	(0.009)	(0.009)
Fixed effects	YES	YES	YES	YES
Adj. R^2	0.059	0.056	0.061	0.057
Observations	5,698	5,688	5,566	5,688

This table presents the coefficients for OptionDelta, Vega, CEO Ownership, and Compensation Dummy along with % Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, Repurchase Dummy, and DA as control variables. An intercept is included in the regression, but is not reported in this table. CAR represents the cumulative abnormal return over a one year period (252 trading days) starting from two days following the repurchase announcement. Abnormal return is defined as the difference between the actual return of firm i on day t and the market return on day t. $CAR_{i,t+n} = \sum_{t=1}^{n}(R_{i,t} - R_{m,t})$.Variable definitions are given in Table 10 in Appendix III. Year and industry fixed effects are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

We also provide evidence that firms with better aligned incentives between the CEO and shareholders invest more and generate higher operating income. Such firms also earn slightly higher abnormal longer-term returns in the year following the repurchase announcement as compared to other repurchase announcing firms where CEO incentives are weakly aligned with those of shareholders. Results are robust to alternative model specifications and free from potential endogeneity concerns which we explicitly address in this study.

Table 9 Effect of CEO compensation on actual share repurchases

	Actual share repurchase		
	I	II	III
OptionDelta	−0.486***		−0.479***
	(0.158)		(0.163)
Vega	1.567***		1.442***
	(0.375)		(0.374)
CEO Ownership		−0.057***	−0.057***
		(0.010)	(0.010)
Percentage Sought	0.065***	0.066***	0.064***
	(0.010)	(0.010)	(0.010)
Prior BHR	0.410	0.299	0.302
	(0.368)	(0.372)	(0.385)
KZ	−0.010	0.003	0.001
	(0.035)	(0.033)	(0.034)
Size	−0.001***	−0.001***	−0.001***
	(0.000)	(0.000)	(0.000)
B/M	0.194***	0.202***	0.201***
	(0.059)	(0.057)	(0.059)
Cashflow ratio	0.170	0.190	0.365
	(0.683)	(0.698)	(0.685)
DA	−0.215	−0.169	−0.221*
	(0.131)	(0.128)	(0.131)
Leverage	0.420	0.300	0.272
	(0.342)	(0.336)	(0.347)
Cash ratio	0.112	0.332	0.296
	(0.560)	(0.527)	(0.563)
Past stock return	−0.170	−0.243*	−0.168
	(0.126)	(0.130)	(0.127)
Current stock return	−0.620***	−0.676***	−0.613***
	(0.162)	(0.158)	(0.162)
Future stock return	−0.370**	−0.360**	−0.333**
	(0.145)	(0.146)	(0.148)
Year and industry dummies	YES	YES	YES
Pseudo R^2	0.038	0.039	0.039
Observations	5,442	5,437	5,320

In this table we regress actual repurchase completion rates on executive compensation sensitivity measures, i.e., OptionDelta, Vega, and CEO Ownership, along with control variables (% Sought, Prior BHR, KZ, Size, B/M, Cashflow Ratio, DA, Leverage, Cash Ratio, Past Stock Return, Current Stock Return, and Future Stock Return). An intercept is included in the regression, but is not reported in this table. A Tobit model is used as actual repurchases are truncated at 100% of the intended size of the repurchase program. Dependent variable is Actual Share Repurchase, that is firms' actual share re-acquisitions in the first four quarters from the quarter of OMSR announcement. Variable definitions are given in Table 10, in Appendix III. Year and industry dummies are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

This paper makes a novel contribution to the share repurchase literature – with a particular focus on how the market views, and reacts to, a share repurchase announcement conditional on executive compensation arrangements at the time of repurchase announcement. The findings highlight that executive compensation design has value-relevant information in relation to news events such as OMSR announcements. Our paper makes an original contribution by showing that the market appears to understand underlying managerial wealth and repurchase incentives and responds accordingly to OMSR announcements. Our findings more generally demonstrate the importance of managerial reward mechanisms in driving firm corporate policy choices and which, our results suggest, the market appears to recognize.

Appendix I

The value of the executive's stock option is calculated using Black and Scholes European option price formula as modified by Merton (1973) that takes into account dividend payments. Options value is defined by the following formula:

$$Se^{-dT}N\left(d_1\right) - Xe^{-rT}N(d_2)$$

where

$$d_1 = \frac{\ln(S/X) + (r - d + \sigma^2/2)/T}{\sigma\sqrt{T}}$$

$$d_2 = \frac{\ln(S/X) + (r - d - \sigma^2/2)/T}{\sigma\sqrt{T}}$$

S = Price of the underlying stock.
X = Strike price of the option.
T = Time to maturity of the stock option.
r = Risk free rate.
d = Dividend rate.
σ = Volatility of the stock returns.
N = Cumulative normal distribution function.

Since Delta is defined as the first derivative of option value with respect to price. In order to obtain the percentage change in option value the following equation is used:

$$Delta(\Delta) = \frac{\partial(optionvalue)}{\partial(stock\ price)} \times (stock\ price/100)$$

$$= e^{-dT}N\left(d_1\right) \times (S/100)$$

Vega is defined as the first derivative of option value with respect to stock return volatility.

$$Vega = \frac{\partial(option\ value)}{\partial(stock\ volatility)} \times (1/100)$$

$$= S\sqrt{T} \times e^{-dT}N\left(d_1\right) \times 0.01$$

In order to estimate the dollar changes in the value of the executive's wealth the estimated value of Delta and Vega is multiplied by the total number of options held by the executive. Delta of the executive's portfolio of stocks and options is computed by adding the Delta of restricted stock and shares held by the CEO to the Delta of the options portfolio.

Appendix II

Accruals are measured at the fiscal year-end prior to a repurchase announcement to avoid look-ahead bias using the following equation:

$$\text{Accruals} = (\Delta\text{CA} - \Delta\text{Cash} - \Delta\text{CL} + \Delta\text{STD} - \text{DEP}) / \text{TA}$$

where.

ΔCA = change in current assets.

ΔCash = change in cash.

ΔCL = change in current liabilities.

ΔSTD = change in debt included in current liabilities.

DEP = depreciation and amortization expense.

TA = Total Assets.

Accruals calculated using the above formula are then decomposed into discretionary and non-discretionary accruals using the Jones (1991) model:

$$\frac{\text{Accrual}_i}{\text{TA}_i} = \propto_0 \frac{1}{\text{TA}_\text{i}} + \propto_1 \frac{\Delta\text{Sales}_\text{i}}{\text{TA}_\text{i}} + \propto_2 \frac{\Delta\text{PPE}_\text{i}}{\text{TA}_\text{i}} + \epsilon_\text{i}$$

where.

ΔSales = change in sales.

ΔPPE = change in Plant Property and Equipment (PPE).

Non-discretionary accruals are defined as the fitted value from the above model for a particular firm and discretionary accruals are then defined as the residual value which is the difference between the total accruals and the expected or fitted value scaled by total assets of the firm. In the above model, regression coefficients are estimated every year using the Fama and French (1997) 48 industries classification for all stocks listed on NASDAQ/AMEX/NYSE. Non-discretionary and discretionary accruals are then calculated as follows:

$$\text{NDA}_\text{i} = \propto_0 \frac{1}{\text{TA}_\text{i}} + \propto_1 \frac{\Delta\text{Sales}_\text{i}}{\text{TA}_\text{i}} + \propto_2 \frac{\Delta\text{PPE}_\text{i}}{\text{TA}_\text{i}} \rightarrow \text{DA}_\text{i} = \frac{\text{Accrual}_i}{\text{TA}_i} - \text{NDA}_\text{i}$$

Appendix III

See Tables 10, 11, 12, 13, 14.

Table 10 Variable definitions

CAR	The three-day (-1,1) cumulative abnormal return around the share buyback announcement date (day 0) using value-weighted market return as the benchmark
Delta	The dollar change in executive wealth for one percentage point change in stock price. See Appendix I
OptionDelta	The dollar change in executive options value for one percentage point change in stock price. See Appendix I
ShareDelta	The dollar change in value of executive stock grants for one percentage point change in stock price
Vega	The dollar change in executive wealth for one percentage point change in annual volatility. See Appendix I
CEO Ownership	The CEO's ownership stake in the firm as a fraction of total shares outstanding
Percent (%) Sought	The percentage of outstanding shares that the management intends to repurchase at the time of repurchase announcement
Size	The market value of the firm in billions of USD
B/M	The ratio of book value of firm to its market value
Prior BHR	The buy and hold return of the firm for the 30-day window prior to the repurchase announcement and ending two days before the announcement (-32,-2)
Cashflow ratio	The operating cash flow scaled by total assets
KZ	The KZ index as a proxy for financial constraints
Repurchase dummy	Dummy variable equal to one if actual repurchases are higher than the sample median, and zero otherwise
DA	The discretionary accruals of the firm following Jones (1991) model
Actual share repurchase (%)	The percentage of shares repurchased as a fraction of total outstanding shares
Leverage	The ratio of total debt to total assets of the firm
Cash ratio	The cash level of the firm scaled by total assets
Private negotiations	Dummy variable equal to one if repurchases are privately negotiated, and zero otherwise
Analyst dispersion	Dispersion of analyst forecasts
Remaining vesting period	Remaining period in years before vesting of CEO share options
Capex ratio	Proxy for "investment". Capital expenditures over total assets
(Past/future) stock return	Annual stock returns of previous, current, or next year
Tangibility	Gross plant, property, equipment over total assets
Δ net income	Change in net income from last fiscal year over total assets
Dividend	Dividend payments over market value of the firm
Institutional ownership	Proportion of institutional ownership
CEO duality	Dummy variable equal to one if the CEO is also the chair of the board, and zero otherwise
Free cash flow	Derived as (Operating income before depreciation—taxes expenses—interest expenses—dividends—capital expenditures)/total assets
Compensation dummy	Proxy for "aligned CEOs". The dummy takes the value of one if delta (vega) is above (below) sample median and CEO Ownership is above median, and zero otherwise
Asymmetry dummy	Dummy that is equal to one if analyst forecast dispersion for that firm is more than one standard deviation from the sample mean of analyst forecast dispersion, and zero otherwise
Undervalue dummy	Dummy that is equal to one for firms with buy-and-hold returns prior to the share repurchase announcement below the sample median, and zero otherwise
Exec ownership	The sum of executives' shares over total shares outstanding
Profitability	Earnings before interest and depreciation over net sales

Table 11 White test for heteroscedasticity

Models	Dependent variable	Variables for cross-term test			F-value	p-value
1	CAR	OptionDelta	Vega		28.430	0.000
2	CAR	CEO Ownership			27.410	0.000
3	CAR	OptionDelta	Vega	CEO Ownership	37.100	0.000
4	CAR	Compensation Dummy			20.630	0.000
5	CAR	Compensation Dummy × Asymmetry Dummy	Asymmetry Dummy	Compensation Dummy	14.320	0.000
6	CAR	Compensation Dummy × Undervalue Dummy	Undervalue Dummy	Compensation Dummy	29.700	0.000

This table presents the *F*-values and p-values from the tests for cross-terms between delta, optionDelta, shareDelta, vega, and CEO ownership compensation dummy, asymmetry dummy, and undervalue dummy, compensation dummy × asymmetry dummy, and compensation dummy × undervalue dummy. The White Test analyses are conducted using these explanatory variables from the main models in Tables 4 and 7

Table 12 Regression analysis with additional controls

	CAR		
	I	II	III
OptionDelta	0.513*		0.518*
	(0.279)		(0.289)
Vega	−1.854***		−1.873***
	(0.630)		(0.660)
CEO ownership		0.074**	0.083***
		(0.030)	(0.031)
Private negotiations	0.142	0.083	0.098
	(0.190)	(0.190)	(0.193)
Analyst dispersion	0.163	0.076	0.236
	(1.545)	(1.688)	(1.679)
Remaining vesting	0.591	0.655	0.478
Period	(0.760)	(0.780)	(0.770)
Capex ratio	−4.122	−6.225	−5.185
	(6.227)	(5.453)	(5.638)
Leverage	−0.282	−0.478	−0.571
	(1.149)	(1.164)	(1.191)
Cash ratio	−0.595	−0.528	−0.549
	(1.509)	(1.544)	(1.539)
Stock return	−0.457	−0.457	−0.493
	(0.340)	(0.344)	(0.349)
Tangibility	1.573**	2.074***	1.771**
	(0.782)	(0.788)	(0.790)
Δ net income	5.410*	5.452**	5.823**
	(2.871)	(2.745)	(2.866)
Dividend	−13.703	−10.773	−9.334
	(13.234)	(13.547)	(13.875)
Institutional ownership	−0.518	−0.645	−0.163
	(0.917)	(0.984)	(0.981)
Free cash flow	−5.068*	−5.112*	−4.996*
	(2.630)	(2.705)	(2.702)
CEO duality	−0.705*	−0.886**	−0.910**
	(0.371)	(0.383)	(0.386)
Original controls	YES	YES	YES
Fixed effects	YES	YES	YES
Adj. R^2	0.025	0.026	0.028
Observations	5,228	5,204	5,094

This table presents the results for OptionDelta, Vega, and CEO ownership, along with private negotiations, analyst dispersion, remaining vesting period, capex ratio, leverage, cash ratio, stock return, tangibility, Δ net income, dividend, institutional ownership, free cash flow, and CEO duality as additional control variables. An intercept and original control variables are included in the regressions, but not reported in this table. Variable definitions are provided in Appendix III, Table 10. Year and industry fixed effects are included. Standard errors are clustered by industry using four-digit SIC codes and given in parentheses. ***, **, * indicate significance at the 1%, 5%, 10% levels, respectively

Table 13 Effect of CEO alignment on number of repurchases

	Number of repurchases		
	I	II	III
Compensation dummy ×		−0.303**	
Asymmetry dummy		(0.154)	
Asymmetry dummy		0.013	
		(0.056)	
Compensation dummy ×			−0.057**
Undervalue dummy			(0.029)
Undervalue dummy			−0.047***
			(0.013)
Compensation dummy	−0.048***	−0.055***	−0.015
	(0.017)	(0.018)	(0.024)
% Sought	−0.003***	−0.002***	−0.003***
	(0.001)	(0.001)	(0.001)
Prior BHR	−0.102***	−0.107***	−0.234***
	(0.035)	(0.038)	(0.044)
KZ	−0.000	−0.001	−0.001
	(0.004)	(0.004)	(0.004)
Size	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)
B/M	−0.024***	−0.020***	−0.024***
	(0.006)	(0.007)	(0.006)
Cashflow ratio	−0.262***	−0.218***	−0.263***
	(0.062)	(0.071)	(0.062)
Repurchase dummy	0.092***	0.088***	0.092***
	(0.012)	(0.012)	(0.012)
DA	0.009	0.006	0.009
	(0.019)	(0.019)	(0.019)
Fixed effects	YES	YES	YES
Pseudo R^2	0.063	0.065	0.065
Observations	5,687	5,203	5,687

This table presents Poisson regression results for compensation dummy, asymmetry dummy, and undervalue dummy, as well as their interactions, along with control variables. An intercept is included in the regression, but is not reported in this table for brevity. Dependent variable is yearly number of repurchases. Compensation Dummy proxies for wealth alignment between the CEO and shareholders. It takes the value of one when delta (vega) is above (below) sample median and CEO Ownership is above median, and zero otherwise. Asymmetry Dummy represents high information asymmetry. It is a dummy variable equal to one if analyst forecast dispersion for that firm is more than one standard deviation from the sample mean of analyst forecast dispersion, and zero otherwise. Undervalue Dummy is a proxy for undervalued firms. It is a dummy equal to one for firms with buy-and-hold returns prior to the share repurchase announcement below the sample median, and zero otherwise. Variable definitions are given in Table 10, Appendix III. Explanatory variables are for the fiscal year prior to the announcement except Repurchase Dummy. Industry fixed effects are included. Standard errors are clustered by industries using four-digit SIC codes and given in parentheses. The ***, **, * indicate statistical significance at the 1%, 5%, 10% levels, respectively

Table 14 T-Tests for future investment, profitability, and CAR

	Firms with aligned CEO	Firms without aligned CEO	Difference	p-value
Investment_{t+1}	0.051	0.043	0.008*	0.073
$\text{Profitability}_{t+1}$	0.214	0.168	0.046***	0.002
CAR_{mm}	0.034	0.027	0.007**	0.044
CAR(4-Factor)	0.024	0.009	0.015*	0.066

This table presents t-test mean comparison results for future investment, profitability, and CAR. All future measures refer to one year after that particular repurchase announcement per firm. Investment is measured by capital expenditures over total assets. Profitability is measured by earnings before interest and depreciation over net sales. CAR represents cumulative abnormal return over a one-year period (252 trading days) starting from two days following the repurchase announcement. Abnormal return is defined as the difference between actual return of firm i on day t and the market return on day t. $CAR_{i,t+n} = \sum_{t=1}^{n}(\text{R}_{\text{i,t}} - \text{R}_{\text{m,t}})$. CAR (4-Factor) represents cumulative abnormal return above the expected return calculated using Carhart's four-factor model over a one-year period (252 trading days) starting from two days following the repurchase announcement. Where abnormal return is defined as the difference between actual return of firm i on day t and the expected return calculated using the Carhart four-factor model on day t. $CAR_{i,t+n} = \sum_{t=1}^{n}(R_{i,t} - (\alpha + \beta_{i,m}(R_m - R_f) + \beta_{i,smb}(R_{smb}) + \beta_{i,hml}(R_{hml}) + \beta_{i,mom}(R_{mom}))$. Two groups in comparison are firms with and without aligned CEO incentives. The difference between the two groups is given along with the associated p-value

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