Compensation Structure Shifts: Rationale and Likelihood of Introducing 'New Components'

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Version 1.3: October 31, 2012

Abstract

Managerial compensation is persistent with respect to the components in the structure, but dynamic with regards to the weights of each component in a structure. Given the adoption of FAS 123R that required mandatory expensing of stock options, research has documented a significant decline in option grants. However, this decline has coexisted with contemporaneous introduction of new components in a compensation structure in the form of restricted stock and long-term incentive plans. We aggregate this information to ascertain the consequences of addition or substitution of new equity components in a manager's compensation structure and how that relates to pay-performance sensitivity and future firm risk. Our findings here corroborate the theory of efficient contracting, conditional on the nature of change undertaken in a compensation structure. Additionally, we also document the nature of firms that are likely to resort to new additions or substitutions, to find them differentiated by research orientation, leverage, number of operating segments, level of fixed assets and age of the CEO.

Keywords: Executive compensation, compensation structure.

JEL Classification: M12, M48, M52, G30

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† I am grateful to Shantanu Banerjee, Martin Conyon, Mark Shackleton and seminar participants at Lancaster University for their useful comments and suggestions.

1 Introduction

The objective behind compensating a firm's agent is to align their interest with that of the principal. The use of stock options, which have been historically thought to alleviate much of the agency problems that is apparent between the two sides, however has come under some objection in recent literature (Carpenter, 2000; Ross, 2004). Recent research by Hayes, Lemmon, and Qiu (2012) has attributed the decline in stock option grants, or, more specifically, the change in compensation structure to the adoption of FAS 123R[1]. In the discussion of the reasons to use or not use stock options, not much has been talked about how and why firms are substituting a majority of option grants with other equity components[2] and its implications on agency cost. We try and address these issues by examining the purpose and likelihood of addition and substitution of new incentive components in a compensation structure and how such a change might impact on pay-performance sensitivity and firm valuation.

Literature on executive compensation is dense with debate on issues pertaining to pay-performance sensitivity[3]. In light of the importance of compensation structure in the debate, Mehran (1995) empirically examines the impact of compensation structure on firm performance. Laying more structure to this issue, Lambert, Larcker, and Verrecchia (1991) theoretically evaluate this relationship to find that the value of a compensation contract is conditional on the structure of the package, and how components influence each other, rather than just the sum of all components. In their analysis of change in compensation components, the authors find that payoffs are consistent when new components are added to an existing compensation structure. However, most firms adjust existing structure for new components to keep a manager's expected utility unchanged[4]. In this context, Hayes et al. (2012) document a significant decline in option grants post FAS 123R adoption due to mandatory expensing of stock options. Their approach to identifying the adoption of FAS 123R as the 'exogenous' event inadvertently implies a change in compensation structure[5] as an ex post event. While it is expected that some firms would choose to change their compensation structure post FAS 123R adoption, there also exist firms that adjust their compensation structures prior to FAS 123R adoption. This is evident from the Figure I below, charting the cumulative number of firms

[1]The regulation came into effect in December 2005 for firms reporting after June 15, 2005, requiring all firms to mandatorily expense new option grants at 'fair value'.

[2]Some minor exceptions include Carter, Lynch, and Tuna (2007), Irving, Landsman, and Lindsey (2011) and Brown and Lee (2011).

[3]See Murphy (1999), Aggarwal (2007) and Frydman and Jenter (2010) for an overview of the literature.

[4]While the objective of Lambert et al. (1991) was to keep utility unchanged, this problem can be modelled by adjusting a manager's reservation utility as his expected utility prior to amendments in compensation structure. This adjusted reservation utility then feeds into the incentive feasibility set of a principal-agent problem.

[5]Henceforth, we imply as compensation structure that of the CEO alone.

that change their compensation structures by introducing new components through addition or substitution around the FAS 123R adoption. As is visible from the distribution of firms around the FAS 123R adoption, using a dummy variable to identify the event as exogenous would bias the results.

[FIGURE I GOES HERE]

In order to correct the bias, we need to first account for how compensation structure has changed in the last decade, and how this change in compensation structure impacts on the pay-performance sensitivity. Changes in compensation structure can be made in three different ways: addition, substitution or modification. If the board (or the firm) that contracts with the CEO feels the need to introduce a new component, either in the form of a restricted stock or long-term incentive plans (LTIPs), the contract between the CEO and the firm is renegotiated. Depending on contractual agreements, the new component could be introduced in a compensation structure in two different ways. First, there could be a contemporaneous increase in the value of new option grants when new components are introduced. This leads to an increase in the overall compensation. We define such firms as 'adding' firm. Second, the new components could be introduced while contemporaneously substituting with the value of new option grants. We define such firms as 'substituting' firm. While addition and substitution of new components are most likely to trigger contract renegotiation, modification of weights of existing components need not require any renegotiation. We define a firm as 'modifying' if only the weights of its existing components are changed and no new component is introduced in the compensation structure. Due to the increasing adoption of stock options in a CEO's incentive portfolio (Hall and Liebman, 1998; Murphy, 1999), we only consider cases where firms are adding or substituting components in lieu of stock options. As for modifying firms, these could include a range of firms with either cash-only components (salary and bonus) to all cash and equity components (salary, bonus, stock options, restricted stocks and LTIPs), without any change in the number of components.

We borrow from the intuition of Lambert et al. (1991) to differentiate between firms on the basis of their adjustment of compensation structure. We test our first hypothesis that addition of new components to a structure creates incentives different from instances where new components are introduced through substitution. As we verify the validity of this hypothesis, a corollary would be to identify if these differences in incentives are used to reduce agency cost or extract rent by opportunistic managers. Through changes in compensation structure, a firms seeks to maintain the objective of incentivising its manager while maintaining his reservation utility. In case of incentive substitution, there is risk that new components introduced in place of stock options might not provide the necessary incentive to take risk-increasing investments, as desired by risk-neutral investors. Furthermore, additions made to a structure directly increase the total compensation of a CEO, which has the implication of inefficiency in compensation. This inefficiency could be a cause or a consequence of new additions. What we mean by that is new additions could be made to align incentives or exhibit the ability of a CEO to extract rent. Hence, as our second hypothesis, we test the null argument that additions to a compensation structure are made to provide incentives that temporarily get misaligned in the short term, mainly due to the introduction of FAS 123R, while substitutions create inefficiencies as incentives are directed away from stock options, which are thought to reduce agency costs. Additionally, due to magnitude of change in total compensation, as will become apparent later, we add a maximum-likelihood framework to our study to determine the nature of firms that add or substitute new components to a manager's compensation structure.

Accounting for the endogenous nature of incentives in determining firm risk, our findings first reveal a significant difference between firms that either make new addition or substitution of new components. By way of our structural definition, new additions significantly increase a CEO's total compensation, while substitutions have no effect on the same. Equity substitutions are also found to be negatively associated with total values of delta, measured by the sensitivity of CEO's incentive to a firm's share price, and vega, measured by the sensitivity of a CEO's incentive to the standard deviation of a firm's stock return. Consequently, addition of new components is found to insignificantly affect our measure of delta, but marginally declining vega. We examine if these changes in compensation components and sensitivities are associated with incentive alignment or rent extraction. If the objective is to align principal-agent interest, we should expect to see a non-negative association between vega and firm volatility, our measure of firm risk, while if changes in compensation structure enable opportunistic managers to extract rent, then the same association will be negative. Using an instrument variable systems approach, our results exhibit that the association between incentive (vega) and forward-looking measure of firm risk is negative when firms add new components. These findings are consistent with the managerial-power argument for additions where additions can diverge pay-performance relationships. When firms substitute away from stock options, and in to other forms of equity compensation like restricted stock and LTIPs, the association is insignificant. This finding corroborates with the efficient bargaining argument that can help maintain a manager's utility without compromising on firm performance. Finally, we examine the likelihood of firms to add or substitute new components in a compensation structure. Our findings associate adding firms to be more research intensive, while substituting firms are found to be dividend paying firms, with relatively lower investment opportunity.

Collectively, our findings make significant addition to the ever-growing debate on compensation policy and structure. We make contribution to the debate from a few ends. First, we provide empirical evidence on the hypothesis of 'new components' developed by Lambert et al. (1991) and Hall and Murphy (2002). Research on executive compensation has mainly been concerned with the sensitivity of incentives provided to executives to the performance or risk of the underlying firm. While the dynamics of compensation structure is implied in the changing incentives, it does not explicitly account for the new components introduced in a compensation structure and its impact on pay-performance sensitivity. We provide evidence with respect to the same.

Second, we are able to develop on the work of Carter et al. (2007) and Hayes et al. (2012) who use the adoption of FAS 123R as an exogenous shock to test pay-performance sensitivity. Our approach using the change in compensation structure is able to address the same question without the issue of true exogeneity of the FAS 123R adoption. Our sample selection procedure helps us incorporate the effect of FAS 123R as per the methodology of Carter et al. (2007)[6].

Third, our analysis enables us to differentiate between firms that change incentives while increasing overall compensation, as compared to firms that change incentives without any change in compensation. In addition, our analysis also enables us to understand the nature of firms that are likely to be of the former type, and what motivates them to be so. Increasing compensation is often perceived in the media with excess pay or entrenched CEO. The identification of firms adding or substituting new components helps shed light on this issue by associating the rise or consistency in pay with cause or consequence.

The rest of the paper is organised as follows: the next section discusses the literature in brief and develops the hypotheses tested; Section 3 describes the research design and methodology used in this study, Section 4 introduces the sample data and preliminary statistics on the data used for this study; Section 5 presents the empirical results and their implications; Section 6 concludes.

2 Literature review and hypothesis development

The agency problem between the principal (firm) and the agent (manager) has been widely discussed since the early work of Ross (1973), Jensen and Meckling (1976) and Holmstrom (1979), all of which propose the use of equity-linked pay to better align the interest of the principal and the agent. Even since, a lot of issues have been brought into the forefront of discussion in corporate finance in reference to executive compensation, including optimality of compensation contracts (Demsetz and Lehn, 1985), convexity of stock options (Jensen and Murphy, 1990), pay-performance sensitivity (Smith and Watts, 1992), design of compensation contracts (Kole, 1997), etc. The use of equity-based pay has certainly been the norm since Jensen and Murphy (1990) compared the pay of CEOs to be similar to those of bureaucrats. In the context of compensation components, the use of stock option has been the key driver for the increase in performance-related pay, at least till the mid-1990s (Hall and Liebman, 1998; Murphy, 1999). Stock options have been thought be provide the convexity essential to enable a manager to

[6] Carter et al. (2007) define the financial year 2002-03 as the year when firms began expensing stock option grants, although the same was not made mandatory until 2005.

undertake risk-increasing investments, as desired by risk-neutral investors. As such, grants of stock options are expected to be positively associated with future firm valuation[7].

Literature has verified two debatable issues with the above argument for stock options. The first relates to the endogenous relationship between firm valuation or performance and managerial incentives. Palia (2001) and Coles et al. (2006) take the initial steps in addressing the endogeneity issue, while others like Gormley, Matsa, and Milbourn (2012) have resorted to a natural experiments approach. The second issue relates to the validity of stock options to provide the necessary incentives to a manager to increase firm risk. Theoretical work by Carpenter (2000) and Ross (2004) find the absence of any incentive levels that can minimise the risk aversion of a utility maximising manager. The empirical findings of Hayes et al. (2012) lead in this direction.

From a technical standpoint, stock options also have issues with valuation and accounting treatment. Managers, as opposed to shareholders, are undiversified, risk-averse and are restricted from short-selling or hedging their equity holdings in their firm, all of which violate the standard assumptions of option valuation originally proposed by Black and Scholes (1973). The issue of executive stock option valuation using standard option pricing methods was also brought to the forefront as early as Lambert et al. (1991), with more extensive work by Hall and Murphy (2002). Although these papers make use of simulation procedures to model a CEO's private wealth, such forms of data are not easily obtainable. Additionally, accounting for stock option grants was not made mandatory until the adoption of FAS 123R, which required firms to expense the grants of stock options at fair value. In recent years, the impact of such a rule change has been examined to associate issues like accounting benefits and firm performance to incentives granted to a CEO (Carter et al., 2007; Irving et al., 2011; Hayes et al., 2012). They examine the impact of such a rule change, but remain silent on the substitution between different components in a compensation structure that might impact firm risk and, potentially, future firm performance. Specifically, Hayes et al. (2012) and Carter et al. (2007) link the additional cost of option grants to its decline in a compensation structure post FAS 123R.

In their critique of the optimal contracting view of Demsetz and Lehn (1985), Bebchuk, Fried, and Walker (2002) propose that managers hoping to maximise their rent extraction will continue to do so, but the process of rent extraction can be slow due to the sticky nature of boards and compensation committees to stick to the norms established. Sticky nature of managerial contracts offer limited deviations in pay even when business environment is continuously evolving. Theoretical work has been rife in the examination of dynamic optimal contracts, starting with the early work of Holmstrom and Milgrom (1987) but the empirical application has been limited, usually involving long time-series data (Boschen and Smith,

[7]This may not always hold true if the concavity, or risk aversion of a manager supersedes the convexity provided by option grants (Lambert et al., 1991).

1995; Frydman and Saks, 2010). The stickiness of compensation contracts can be understood if exogenous shocks force firms to change incentives provided to managers. In this respect, papers like Carter et al. (2007) and Hayes et al. (2012) use the adoption of FAS 123R as the exogenous event to ascertain pay-performance relationships. The problem with using regulatory events as exogenous shocks is that their effect is normally elongated over time, enabling firms to either make changes voluntarily before the adoption of the regulation or mandatorily when regulation comes into effect. Due to this, using dummies to separate the effect of regulation in a firm averages the effect of changes made in a firm, thus leading to inconsistent estimates. We hope to correct for this.

In understanding the effect of compensation on firm valuation in an endogenous framework, we take the approach of how the mix of compensation components changed in the last decade. Mehran (1995) and Bryan, Hwang, and Lilien (2000) provides an early empirical analysis of the importance of the structure of compensation contracts. Their work builds on the theoretical argument of Lambert et al. (1991) who suggest that the mix of components in a structure provides different incentives to different managers. More specifically, they relate the difference in incentives to the changing nature of components in a compensation structure. They propose that value of incentives of new components added to the structure will depend on how adjustments are made to the existing components. We use this conjecture to estimate the change in total incentives of firms that adjust their compensation structure and its association with future firm risk. As our first hypothesis, we provide a direct test of the theory proposed by Lambert et al. (1991). We state our first hypothesis (in alternative form) as follows:

H1: Firms that add new components to a CEO's compensation structure will create total incentives different to firms that substitute new components in lieu of stock options, both relative to firms that do not introduce new components in a compensation structure.

When new additions are made to the compensation structure, they are bound to increase total compensation. Literature has often argued for the benefits of stock option grants and the convexity provided can enable managers to take the level of risk desired by risk-neutral investors. Alternatively, Hall and Murphy (2002) have also argued for the cost benefit of restricted stock and why they might be preferred when a company and its executive are allowed to bargain their contract. Their numerical analysis suggests that equity-based pay in the form of stock options provided as an add-on to a compensation creates inefficiencies, leading to overpaid executives. This might diverge the expected relationship between pay and performance. On the other hand, substitution can facilitate efficient bargaining leading to the use of other equity-based measure like restricted stock that can lower company cost, while still maintaining executive's utility. However, their substitution argument relates to the substitution of cash-based measures. The substitution of stock options for other equity-based measures will reduce the sensitivities, but if efficient bargaining is undertaken to maintain the CEO's expected utility, then firm valuation should be maintained or improved. Thus, we state our second hypothesis (again, in alternative form) in two parts, as follows:

H2a: Addition of new components to a CEO's compensation can diverge pay-performance relationship, leading to a non-positive relationship between incentives and future firm risk.

H2b: Substitution of new components in place of stock options can further increase alignment of pay with performance, leading to a non-negative relationship between incentives and future firm risk.

In the next section, we detail the research methodology we undertake to test the above hypotheses, and our definition of firms that add or substitute new components in a compensation structure.

3 Research design and methodology

3.1 New additions and substitutions

We categorise firms as adding, substituting or modifying firm depending on the nature of change in a compensation structure. In any given year, if firms introduce new components in a structure while also contemporaneously increasing or keeping fixed the value of current option grants, such firms are classified as those 'adding' new components. To ensure we are capturing firms that are strictly adding new components in the firm-year in question, we impose two further restriction. First, firms that add new components do not abandon stock options in the year before or after new component introduction. The reason for imposing this restriction helps us ensure that the firm-year identified by us as the year of new addition does not reflect a one-off grant, or is not a temporary adjustment in the current year only to abandon stock options in the year following the new addition. Second, it is likely that firms might have introduced new components in some years prior to the firm-year of introduction identified by us. To avoid this erroneous classification, we impose another restriction whereby only firms that have not introduced new components in at least 5 years prior to introduction can be classified as either addition or substitution.

As is the case with new equity addition, we define firms as substituting if they introduce new components in a CEO's compensation scheme while concurrently reducing the value of new option grants. We impose the same restriction of identifying new introductions as we did above for additions, although we do not require firms to not abandon stock options. It is very likely that firms that begin substituting stock options for other means try to eventually abandon new option grants. This is implied as part of the substitution argument.

While we test the theory of difference in incentives created due to either addition or substitution of ‘new components’, these incentives are measured against a basket case of firm that do not change their mix of components offered to a CEO. Incentive differential created through minor modifications in compensation will be be lower compared to the differentials when ‘new components’ are either added or substituted. Hence, we resort to a group of firms that do not introduce any new components in a CEO’s compensation structure. These firms continue to compensate the CEO using the same components, while only changing the weights of the components to adjust their incentives to the CEO. We define such firms are ‘modifying’ firms.

3.2 Methodology

The hypotheses defined in the previous section requires a mix of methodologies in our current study. In addressing the first hypothesis, which is a direct test of the theory proposed by Lambert et al. (1991), we need to control for unobserved heterogeneity that might be present between firms. Controlling for firm fixed-effects has been done consistently since the work of Himmelberg et al. (1999), and more recently in the the 2SLS framework by Armstrong and Vashishtha (2012). As a first step, we estimate the impact of new additions and substitutions on compensation components. In a framework similar to Hayes et al. (2012), we adopt the spell regression as follows:

$$CCOMP_{it} = \beta_0 + \beta_1 DUMMY_{it} + \beta_2 LTA_{it} + \beta_3 TENURE_{it} + \phi_i + \mu_t + \epsilon_{it} \tag{1}$$

In equation (1) above, the dependent variable ($CCOMP$) includes the proportion of all compensation components to total compensation, while also including the log-normalised measure of total compensation to assess the impact of addition and substitution on total compensation. The independent variables include a dummy ($DUMMY$) for either addition or substitution of new components, the log-normalised measure of a firm’s total assets (LTA) and the CEO’s tenure ($TENURE$). We also control for the unobserved firm fixed-effects (ϕ_i), while also controlling for the time effects (μ_t). ϵ_{it} captures the manager’s residual compensation.

Similar to the compensation component regression above, we evaluate the effect of addition and substitution on incentives in equation (2) below. The dependent variable ($CSENS$) now refers to our log-normalised measures of total delta and total vega sensitivities, while the independent variables in equation (2) are similar to (1), except for the new added variable of

CEO cash compensation ($CASHC$).

$$\begin{aligned} CSENS_{it} &= \gamma_0 + \gamma_1 DUMMY_{it} + \gamma_2 LTA_{it} + \gamma_3 CASHC_{it} + \gamma_{04} TENURE_{it} \\ &\qquad + \phi_i + \mu_t + \epsilon_{it} \end{aligned} \tag{2}$$

The debate on executive compensation is rife with instances of causality running in both directions between incentives and firm performance. Early research by Morck, Shleifer, and Vishny (1988) and McConnell and Servaes (1990) have shown incentives to affect performance, while Smith and Watts (1992), Yermack (1995), Core and Guay (1999) and others have found firm performance to determine managerial incentives. In this argument of causality, Palia (2001), and later Coles et al. (2006) utilise a systems approach to examining the effect of incentives on firm performance. Their systems approach using two-stage least square (2SLS) or generalised method of moments (GMM) has found popularity in recent work by Brockman, Martin, and Unlu (2010) and Armstrong and Vashishtha (2012). Using exogenous events, research by Gormley et al. (2012) and Low (2009) present intuitive findings that helps us better understand the causality of incentives and performance. Although using an exogenous event sounds appealing, its use in our research question is difficult as changes in compensation structure cannot be easily made due to contractual obligations of a firm. Hence, using the methodology of Palia (2001) and Coles et al. (2006), we adopt a 2SLS framework using instrument variables to address the endogenous nature between incentives and performance, while considering both measures of sensitivity, vega and delta, as endogenous[8]. We define the first-stage and second-stage regressions as follows:

$$CSENS_{it} = \eta_0 + \eta_1 SD_{it} + \boldsymbol{\tau Z_{it}} + \boldsymbol{\eta C_{it}} + \lambda_{it} + \phi_i + \mu_t + \epsilon_{1it} \tag{3}$$

$$SD_{i(t+1)} = \theta_0 + \theta_1 VEGA_{it} + \theta_2 DELTA_{it} + \boldsymbol{\theta C_{it}} + \lambda_{it} + \phi_i + \mu_t + \epsilon_{2it} \tag{4}$$

Equation (3) above is the first-stage regression with each sensitivity ($VEGA$ and $DELTA$) being regressed on our measure of firm risk (SD). The specification also includes a set of instruments, defined as $\boldsymbol{Z}$. $\boldsymbol{C}$ relates to different control variables used in both first and second-stage regressions, including log-normalised value of total assets, leverage, market-to-book, sales growth, cash compensation, property, plant and equipment, CEO tenure, price-to-strike ratio and proportion of stock options to total compensation. The estimated value of $VEGA$ and $DELTA$ are then used in the second-stage regression using the specification defined in equation (4). The same set of included instruments, defined by $\boldsymbol{C}$ are used in the second-stage as well. Additionally, we also include a control variable (λ_{it}) for the self-selection problem inherent in

[8]The endogenous nature of both vega and delta was considered by both Coles et al. (2006) and Armstrong and Vashishtha (2012).

our study. We use the procedure described by Wooldridge (1995) to compute the inverse Mill's ratio cross-sectionally for each year of our panel and then pool them by interacting the ratio with the year-specific dummies[9]. In both the specifications, we control for the firm fixed-effect (ϕ_i), while also controlling for time effects(μ_t).

For our first set of instrument, we follow Armstrong and Vashishtha (2012) and use a firm's performance, measured by contemporaneous stock returns ($Return_t$) as instrument of log-normalised vega and delta. The overall compensation of a CEO is highly dependent on equity-based measures of stock options, restricted stock and LTIPs. These grants of equity-based components and their sensitivity to stock returns and volatility is correlated with the past performance of a firm, which will indirectly affect a firm's future valuation. Contemporaneous and past returns are not likely to be related a firm's future valuation.

As a second instrument for our endogenous incentive variables, we use the mean total compensation of firms incorporated in the same state as the underlying firm. Becker, Cronqvist, and Fahlenbrach (2010) adopt the approach to determine the effect of local wealthy individuals in attracting large blockholders. Proximity of local directors as an important determinant of board governance was recently documented by Knyazeva, Knyazeva, and Masulis (2011). We use the approach in similar context but with a different application. We expect the average compensation levels in any given state to have an effect on the compensation level of a CEO in that particular state, without any direct consequence on the risk-taking ability of a firm.

4 Variable measurement and sample selection

4.1 Measuring sensitivities

In order to make our analysis easily comparable to some of the recent empirical work, we follow the procedure described in Core and Guay (1999, 2002) to compute our measures of sensitivities. Prior to computations of sensitivities, we first construct a CEO's incentive portfolio, which included salary, bonus, stock options, restricted stock and LTIPs. Stock options are valued based on the methodology described by Core and Guay (2002) for past exercisable and unexerciseable grants, while current grants are valued using the formula proposed by Black and Scholes (1973), and as modified by Merton (1973) to include dividends. Since executive options are never really held till maturity, we follow Coles, Daniel, and Naveen (2006) and adjust the maturity downwards to 70% of its stated life. We aggregate the valuation of all components to compute delta[10], measured as the sensitivity of change in the value of

[9]The results on nine cross-sectional regressions are suppressed here for conciseness. Details on specification and results are available upon request.

[10]This is equivalent to the Total Delta computation by Hayes et al. (2012).

the CEO's incentive portfolio to a 1% change in the underlying stock's price. Similarly, we compute the option vega as the sensitivity of the change in the total option value to a 0.01 change in the standard deviation of the return of the underlying stock.

In addition to estimating the value of stock option grants, the components of restricted stock and LTIPs require valuation of both new grants as well as grants made earlier that may or may not have vested. In valuing these two components, we follow the computation procedure provided by Hayes et al. (2012) where restricted stocks are valued based on the fair value estimates, while LTIPs are estimated using both pre and post FAS 123R disclosures, as provided by Execucomp[11].

4.2 Measuring firm risk

Our second hypothesis requires us to examine the effect of incentive sensitivities on firm performance, while also taking into account the endogenous nature of relationship between the two variables. Recent empirical work has highlighted the importance of choosing the right performance measure to test its association with incentive measures. Coles et al. (2006) and Hayes et al. (2012) use specific measures of risk like research and development costs, capital expenditure, firm leverage, etc., while work by Low (2009) and more recently Armstrong and Vashishtha (2012) use aggregate measures of risk which is then segregated into systematic and idiosyncratic specific risks. To ease the demand on our computation, we follow Low (2009) and use the standard deviation of annualised daily returns from the following year. To facilitate comparison and robustness of our findings, we also use the specific measures of research and development costs, capital expenditure and firm leverage used by Coles et al. (2006).

4.3 Sample selection

In order to make our study most easily comparable to other empirical work in the field, we combine a range of different data sources which have become standard for studies on executive compensation. We first obtain annual compensation data of a CEO from Execucomp. As mentioned earlier, we merge the different tables provided in Execucomp as per the procedure detailed in Hayes et al. (2012) to arrive at computations of different components. Next, we combine this compensation data with firm fundamentals used in this study from Compustat. We also combine the CRSP dataset to compute the annualised daily stock return of the firms represented by the CEO. Finally, we compute certain governance measures from RiskMetrics and combine it with the merged dataset. Due to certain data definitions and restrictions, our

[11] As per Hayes et al. (2012), pre-FAS 123R estimates can be found in the Long Term Incentive Awards - 1992 Format file in Execucomp. For post-FAS 123R numbers, estimates are split between Plan Based Awards and Annual Compensation files for current and prior grants respectively.

data classification begins in the year 2002[12] until 2009, which encompasses 9,499 non-missing observations.

[TABLE I GOES HERE]

Table I above presents descriptive statistics of the variables used in our study. As described in the previous section, our definition of new component additions or substitutions accounts 5 years of compensation data prior to classification commencement. As we can see, most of our measures of firm characteristics are near identical to the ones used by Hayes et al. (2012). Our computations of vega and delta are also comparable to the descriptive results of Hayes et al. (2012), while they are marginally larger than the means and medians reported by Armstrong and Vashishtha (2012). This is likely due to our use of only recent data, while they use data beginning from 1992. As is the case with Armstrong and Vashishtha (2012) and Core and Guay (1999), our measures of vega and delta are also highly skewed, which we then log-normalise.

Table I above also presents the statistics for the sub-samples of firm adding and substituting new components. The statistics presented are for both pre and post new addition or substitution. We observe a big change in total compensation for firms adding new components, wherein the average total compensation increases from \$2.8 mln. to \$6.4 mln. post-addition. In similar context, average total compensation between firms substituting increase from \$4.7 mln. to \$6.7 mln. While the differences in compensation numbers are apparent between firms adding and substituting, post-introduction, the proportion of compensation components to total compensation are more aligned for the two groups of firms. Change in total compensation between the two groups of firms also leads to a change in the delta and vega. For adding firms, the sensitivities remain consistent in both the pre and post periods. However, firms substituting substantially reduce their delta and vega of compensation to a CEO. As for other variables, most variables are consistent, except for firm size, which exhibits that firms in both the groups in the post-introduction period are larger than their corresponding pre-introduction period. There is also a substantial decline in CEO tenure in the post-introduction period, while probably signifies a change in CEO, which we will explore further.

5 Empirical results

5.1 Impact of addition and substitution on compensation

In our first attempt to understand the impact of introducing 'new components' in a compensation structure, we analyse, seperately, the significance of adding and substituting compensation

[12] Classification beginning in 2002 utilises new equity introduction data from 1998 onwards.

components in a compensation structure. In both the cases of addition and substitution, the firm-year in which the 'new component' is introduced and subsequent firm-years are classified as adding or substituting firm-years. The control set includes both the firm-years prior to 'new component' introduction as well firm-years with modification in a spell-regression framework. We present the results in Table II below.

[TABLE II GOES HERE]

Panel A presents the results for firms making addition. As expected, we can see that adding new components increase a CEO's total compensation by USD 1.68 mln on average[13]. We can also deduce that most of the increase in compensation is due to introduction of either restricted stock or LTIPs. As for the fixed components of salary and bonus, we report a negative association with new additions. The decline in the proportion of cash components in total compensation could either be due to the overall increase in total compensation without much change in cash compensation, or an eventual decline in cash compensation. Similar intuition applies to the negative association observed for the proportion of stock options. These associations are similar to the findings of Hayes et al. (2012), albeit our setup reports significantly larger coefficients for overall compensation, restricted stock and LTIPs, while our coefficient for stock options is significantly lower.

Results for substituting firms, as shown in Panel B, differ with both Hayes et al. (2012) and our findings for firms adding 'new components'. Total compensation, although increasing, does not change significantly when firms substitute new components in place of stock options. In this regard, the coefficient for the proportion of stock option grants is significantly negative, and is lower than one reported by Hayes et al. (2012). Our coefficients in regressions of restricted stock and LTIPs also remain positive, although the coefficient is greater for restricted stock when firms substitute than when firms add. It goes to show that restricted stock, as a proportion to total compensation, play an equivalent, if not more important role when firms substitute when compared to adding firms. Substituting firms are also found to make insignificant changes to a CEO's salary, while the proportion of bonus to total compensation is found to be lower by 6%.

5.2 Impact of addition and substitution on sensitivity

The use of stock options have been primarily motivated as a way to increase the convexity of a manager's pay so as to enable him to undertake risk-increasing investments (Jensen and Meckling, 1976; Jensen and Murphy, 1990). However, our primary argument relates to impact of 'new component' introduction on sensitivities, and not the direct ability of

[13]As the total compensation variable is log-normalised, the coefficient on the new addition variable is exponentiated.

stock options to increase convexity, and its coexistence with a manager's concave utility function. Hence, a decline in stock option grants can invariably lead a reduction in the sensitivities of delta and vega. We present out findings in Table III below.

[TABLE III GOES HERE]

We observed from Table II earlier the impact of new additions and substitution on the components of a compensation structure. We find new additions to significantly increase total compensation while marginally reducing the proportion of new option grants in the overall compensation of a CEO. Similarly, substitution leads to an insignificant increase in total compensation, while significantly reducing the proportion of new option grants in the overall compensation. This significant decline in the proportion of stock option grants and its impact on sensitivity is clearly visible in our findings in Table III above. When 'new components' are introduced in a compensation structure through substitution of stock options, we observe a significant decline in both the sensitivities of delta and vega. However, such is not the case when new additions are made to the compensation components. The delta sensitivity remains unchanged when either restricted stocks or LTIPs or both components are introduced in a CEO's compensation structure through addition, but leads to a marginally significant decline in vega. This finding is in line with the theory proposed by Lambert et al. (1991), highlighting the difference in incentives created between new addition and substitutions. Lambert et al. (1991) evidences that when new components are added, the result can be similar to a standard contract trying to induce convexity while balancing with the risk-averse nature of a manager. However, when components are introduced through substitution, 'the partial derivative [of manager's utility to stock return volatility] will be more negative than the corresponding derivative' when new additions are made. This evidence is clear from our findings above, thus corroborating with our first hypothesis.

5.3 Changes in firm risk with endogenous incentive contracts

We have seen above the difference in total compensation, compensation components and compensation sensitivities when new components are introduced either through addition or substitution. In case of new additions, the function of partial derivative of a manager's expected utility on the standard deviation of stock return might increase the convexity of a manager if existing options are out of the money. However, excessive addition can make a manager risk averse as the options get deep in the money (Lambert et al., 1991). This consequence of new addition was also observed in the theory of 'managerial power' proposed by Bebchuk et al. (2002), citing the ability of managers to extract rent from their company when its most opportunistic for them to do so. We provide empirical evidence on this matter to ascertain if addition of new components lead to a deviation away from proposed alignment of interest between the principal and the agent, leading to a non-positive association between incentives and firm risk. Results are presented in Table IV below.

[TABLE IV GOES HERE]

The columns of *Total Vega (Log)* and *Total Delta (Log)* correspond to first stage regression in a two-stage least square (2SLS) regression framework, using instrument variables. A description of the instruments have been provided in an earlier section. The last column of *Firm Risk* provide the coefficient estimates from the second-stage regression. Results here exhibit a significant negative relationship between both the incentive measures of vega and delta, and future firm risk. This finding falls in line with our expectation that entrenched managers will want to extract rent when it is most opportunistic for them, thus creating a divergence between firm risk and the incentives provided. Other control measures that are statistically significant include firm size, investment opportunity, CEO tenure, CEO age and capital expenditure. Including the inverse Mill's ratio for the self-selection correction also shows significance at 1%, highlighting the importance of selection in our setup. Other control measures are not found to be statistically different from zero.

As suggested by Lambert et al. (1991), substituting new components can alter the slope of the function, depending on the moneyness of the option. The theoretical work of Hall and Murphy (2002) suggests that efficient bargaining between the firm and its managers can lead to optimal substitution with the manager able to maintain his expected utility without the firm having to sacrifice on firm performance. Hence, if substitution can lead to decline in the incentives (as shown in Table III above), then the relationship between such incentives and future firm risk ought to be either positive or insignificant from zero. Results shown below in Table V proves the same when future firm risk and incentives are regressed in an endogenous framework. Corroborating with our hypothesis on substitution, we maintain that efficient bargaining can lead to insignificant changes in pay-performance relationship, although granting fewer stock options can lower firm cost by minimising future liability. In our specification, similar variables hold significance, excluding firm size and CEO age. The coefficient on the self-selection correction term is also significant at 1%.

[TABLE V GOES HERE]

Our findings above for both addition and substitution are robust to additional dummies for industry and time periods that have been included in prior literature (Palia, 2001; Armstrong and Vashishtha, 2012), albeit with some sacrifice in efficiency. Findings are also robust to different dependent variables used by Coles et al. (2006) and Hayes et al. (2012). Additionally, while our specification here is testing the average effect of the firms that introduce new components, the findings are robust to testing on firm-years when new components are added or substituted.

5.4 Nature of firms introducing 'new components'

The discussion, until now, has been centred around the level and sensitivity of compensation components, and its association with firm risk. Due to the sticky nature of compensation committee members to stock to the norm, and the rapid standardisation of stock option grants in the last decade or two, not much has been discussed about the nature of firms that resort to alternative forms of pay, or firms that change the structure of their compensation contracts. The research design of our study enables us to use a maximum-likelihood approach in a panel-data setup to determine the nature of firms that add or substitute new components to a compensation contract. Table VI below presents our findings.

[TABLE VI GOES HERE]

The findings above show that firms that add or substitute are very alike in some respect to their firm size, investment opportunity, option moneyness and tenure of the CEO. However, they differ a lot in other aspects. Firms that add are highly research oriented, operating in fewer business segments, while also being highly under-levered. The odds of total compensation is also very high amongst adding firms, relative to substituting firms. Compared to firms adding new components, substituting firms are over-leveraged and have younger CEO's. Substituting firms are also found to have larger fixed assets and higher stock returns to shareholders. Most other variables remain statistically insignificant.

6 Conclusion

The discussion of pay-performance sensitivity in the compensation literature has been prolonged since the early works of Jensen and Meckling (1976) and Holmstrom (1979) proposing the use of equity-based methods to compensate a manager to undertake risk-increasing activities. In this light, researchers have take different approaches to analysing the pay-performance sensitivity, including the design of compensation contracts (Kole, 1997), structure of compensation contracts (Lambert et al., 1991; Mehran, 1995), etc. As part of the numerical analysis undertaken, Lambert et al. (1991) exhibit that the incentives created when compensation structures are adjusted to add new components will be different from incentives when similar adjustments are made through substitution. We borrow from the intuition of Lambert et al. (1991) to differentiate between firms on the basis of their adjustment of compensation structure in our analysis of pay-performance sensitivity.

In our analysis of the impact of addition and substitution of new components on compensation structure, we find that firms that add new components significantly increase total compensation, mainly through increases in restricted stocks and LTIPs. While additions are made by contemporaneously adding or keeping fixed the number of option grants, our analysis reveals that, over time, the proportion of options to total compensation declines when firms add new components. Similarly, when firms substitute, new components are introduced by making insignificant changes in total compensation, but significant reductions in stock option grants. When considering the sensitivities of delta and vega, we find additions make insignificant adjustments to both sensitivities. This result is expected as option grants are only adjusted marginally. However, substitution significantly reduces the values of both delta and vega. This is mainly due to the significant reduction in option grants when alternatives like restricted stocks or LTIPs are used.

While the issue of valuing executive stock options is ever-present (Core and Guay, 2002), the endogeneity of the relationship between pay sensitivity and firm performance makes the analysis more complex. Recent literature on executive compensation has been rife with discussion on pay-performance sensitivity, using a multitude of approaches including system equations (Palia, 2001; Armstrong and Vashishtha, 2012), natural experiments (Gormley et al., 2012), potentially exogenous events (Carter et al., 2007; Hayes et al., 2012), etc. We use the systems approach used by Palia (2001) to determine the relationship between incentives and firm risk. Our findings suggest that firms that add new components do so at the cost of firm performance as the relationship deviates between incentives and firm risk. When firms substitute, the new components introduced have insignificant effect on the risk-taking ability of the manager, leading to a non-negative statistically insignificant association between the two measures.

Our findings have implications for the optimal-contracting theory proposed by Demsetz and Lehn (1985), conditional on the nature of adjustment undertaken in a compensation contract. The differences in incentives through addition or substitution and their alignment with agency issues were also discussed by Hall and Murphy (2002), wherein adding to compensation contracts can create inefficiencies while substitution can stem from efficient bargaining between the principal and the agent. We provide empirical evidence with regard to both the views.

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Appendix A

Figure 1: Cumulative Number of Firms Introducing 'New Components'
This figure illustrates the cumulative number of firms introducing 'new components' in a compensation structure of a CEO. 'New Components' here is defined as new additions or substitutions of either restricted stock or LTIPs, or both in place of stock options in a CEOs portfolio.

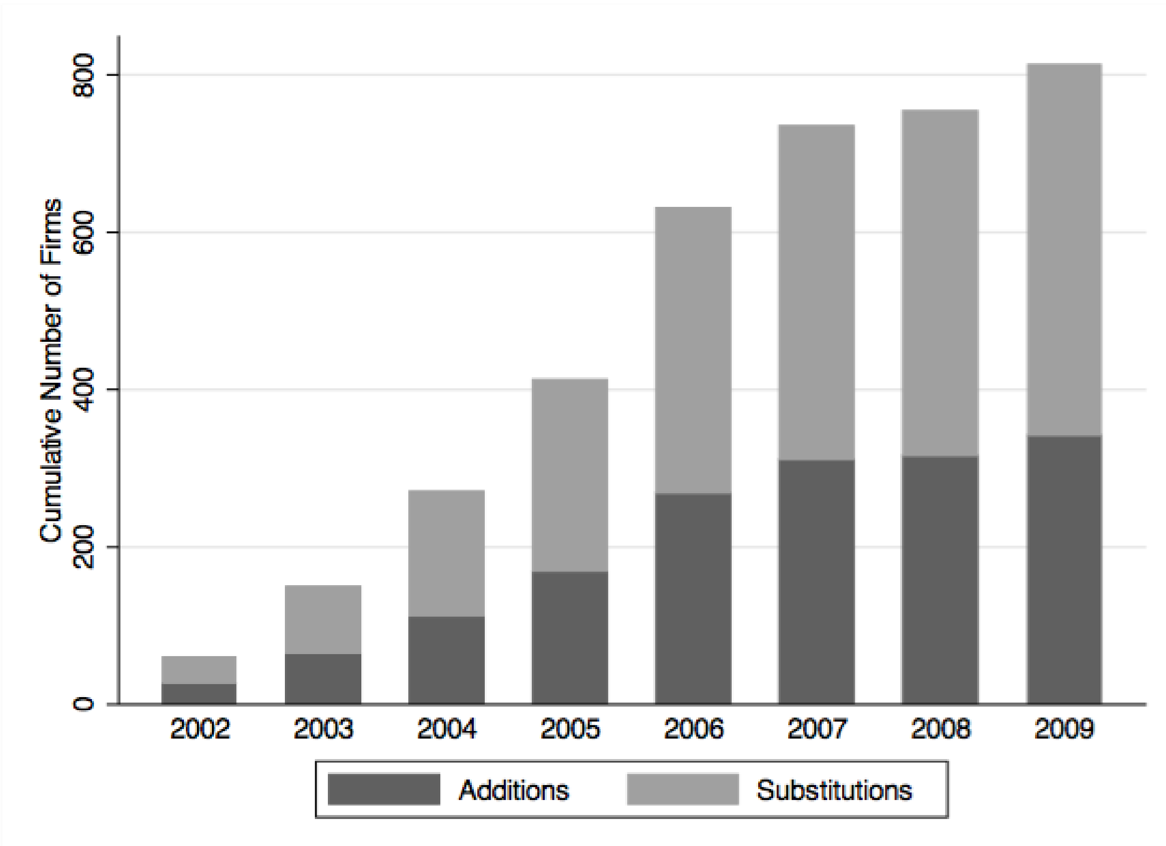

Table I: Descriptive Statistics

This table presents the primary variables used in our study, grouped by *Level of Compensation Components*, *Proportion of Compensation Components*, *Compensation Sensitivities* and *Other Variables*. The sample contains non-missing observations collected from Execucomp, Compustat and CRSP from 2002 to 2009. Definition of variables and their computations are defined in Appendix B. Summary statistics are presented for the overall sample (9,499 observations) as well as sub-samples of pre-addition (1,510 observations), post-addition (1,590 observations), pre-substitution (1,770 observations) and post-substitutions (2,209 observations).

	Overall (N = 9,499)		Pre-Add (N = 1,510)		Post-Add (N = 1,590)		Pre-Sub (N = 1,770)		Post-Sub (N = 2,209)	
Variable	Mean	Median	Mean	Median	Mean	Median	Mean	Median	Mean	Median
Level of Compensation Components										
Salary ($000s)	707.28	653.85	581.79	530.00	763.10	700.00	637.01	600.00	797.90	745.83
Bonus ($000s)	587.67	88.82	611.60	216.24	440.85	0.00	771.73	344.18	568.84	0.00
Option Grants ($000s)	1,634.08	527.78	1,128.38	55.33	1,232.06	407.40	2,797.33	1,166.58	1,356.64	501.91
Restricted Stock ($000s)	1,096.56	0.00	439.12	0.00	1,757.10	581.75	434.54	0.00	1,826.60	726.36
LTIPs ($000s)	2,143.29	0.00	145.87	0.00	3,824.61	0.00	134.62	0.00	3,632.08	209.64
Total Compensation ($000s)	5,189.05	2,518.27	2,818.88	1,420.11	6,439.90	2,902.71	4,697.76	2,591.76	6,721.93	3,319.63
Cash Compensation ($000s)	1,294.95	900.00	1,193.40	798.35	1,203.96	875.00	1,408.74	950.00	1,366.74	916.67
Proportion of Compensation Components										
Salary/Total	0.34	0.24	0.43	0.35	0.32	0.23	0.29	0.22	0.30	0.21
Bonus/Total	0.14	0.05	0.21	0.15	0.09	0.00	0.17	0.13	0.10	0.00
Options/Total	0.29	0.23	0.28	0.18	0.21	0.13	0.48	0.53	0.21	0.14
Restricted Stock/Total	0.16	0.00	0.07	0.00	0.25	0.22	0.05	0.00	0.26	0.24
LTIP/Total	0.08	0.00	0.01	0.00	0.12	0.00	0.01	0.00	0.14	0.00
Compensation Sensitivities										
Delta (Total) ($000s)	748.83	233.85	570.96	191.42	557.55	214.90	775.75	248.37	599.36	232.90
Vega (Total) ($000s)	128.22	46.48	98.21	29.03	98.65	39.37	157.60	67.30	139.47	59.25
Other Variables										
Market-to-Book	2.02	1.64	2.12	1.72	1.84	1.52	2.21	1.79	1.78	1.53
Research & Development	0.03	0.00	0.03	0.00	0.03	0.00	0.04	0.01	0.03	0.00
Capital Expenditure	0.05	0.03	0.05	0.03	0.05	0.03	0.05	0.04	0.05	0.03
Leverage	0.21	0.19	0.19	0.16	0.21	0.19	0.19	0.18	0.23	0.21
Cash	0.17	0.11	0.18	0.12	0.15	0.10	0.19	0.12	0.16	0.10
Total Assets (Log)	7.32	7.16	6.95	6.78	7.40	7.22	7.19	7.05	7.67	7.50
Volatility (Firm)	0.39	0.33	0.39	0.33	0.40	0.35	0.36	0.32	0.39	0.33
Volatility (Market)	0.16	0.13	0.14	0.13	0.18	0.13	0.14	0.13	0.18	0.13
CEO Tenure (years)	7.78	5.50	8.31	6.00	7.38	5.26	7.50	5.00	7.01	5.00
Price-to-Strike Ratio	1.28	1.00	1.28	1.00	1.23	1.00	1.38	1.03	1.22	1.00

Table II: Fixed-Effects Regression of CEO Compensation and Compensation Components when 'New Components' are Introduced
This table presents the fixed-effects regression of compensation components, including total compensation on dummies of new additon and substitution. The sample consists of 5,790 and 6,799 observations for new additions and substitutions, respectively. Both samples include as controls observations of firms modifying their compensation structure without adding new components. The fixed-effects controlled are unobserved firm effects. The specification of the regression in both Panel A and B are similar to equation (1) defined earlier. Cluster-robust t-statistics are reported in parenthesis. Statistical significance (two-sided) at the 10%, 5%, and 1% level is denoted by *, ** and ***, respectively.

Panel A: New Equity Additions

	Total Compensation (Log)	Salary/Total	Bonus/Total	Options/Total	Restricted Stock/Total	LTIP/Total
New Equity Addition	0.4917***	-0.1035***	-0.1292***	-0.0693***	0.1784***	0.1236***
	(8.48)	(-7.55)	(-13.08)	(-5.45)	(16.08)	(13.08)
Total Assets (Log)	0.1243*	0.0399***	-0.0610***	-0.0326**	0.0519***	0.0017
	(1.94)	(2.93)	(-6.13)	(-2.40)	(4.55)	(0.23)
CEO Tenure	-0.0058*	0.0035***	0.0004	-0.0029***	-0.0021***	0.0012***
	(-1.66)	(3.25)	(0.36)	(-2.96)	(-2.85)	(2.78)
Observations	5790	5790	5790	5790	5790	5790
Adjusted-R^2	0.5790	0.4231	0.2770	0.3722	0.4121	0.4293

Panel B: New Equity Substitutions

	Total Compensation (Log)	Salary/Total	Bonus/Total	Options/Total	Restricted Stock/Total	LTIP/Total
New Equity Substitution	0.0646	0.0080	-0.0783***	-0.2731***	0.2031***	0.1402***
	(1.60)	(0.89)	(-10.39)	(-23.84)	(22.22)	(18.89)
Total Assets (Log)	0.0693	0.0308***	-0.0656***	-0.0148	0.0423***	0.0074
	(0.90)	(2.77)	(-7.34)	(-1.20)	(4.04)	(1.06)
CEO Tenure	-0.0042	0.0041***	0.0012	-0.0040***	-0.0017**	0.0004
	(-1.28)	(3.83)	(1.47)	(-4.03)	(-2.51)	(0.81)
Observations	6799	6799	6799	6799	6799	6799
Adjusted-R^2	0.5469	0.3912	0.2301	0.4121	0.3736	0.3823

Table III: Fixed-Effects Regression of CEO Incentives (Delta and Vega) when 'New Components' are Introduced

This table presents the fixed-effects regression of compensation sensitivities on dummies of new additon and substitution. The sample consists of 5,790 and 6,799 observations for new additions and substitutions, respectively. The decline in observations represent the absence of stock option valuations for a few observations. Both samples include as controls observations of firms modifying their compensation structure without adding new components. The fixed-effects controlled are unobserved firm effects. The specification of the regression in both Panel A and B are similar to equation (2) defined earlier. Cluster-robust t-statistics are reported in parenthesis. Statistical significance (two-sided) at the 10%, 5%, and 1% level is denoted by *, ** and ***, respectively.

	Total Delta (Log)	Total Vega (Log)	Total Delta (Log)	Total Vega (Log)
New Equity Addition	-0.0540	-0.1300*		
	(-0.96)	(-1.96)		
New Equity Substitution			-0.2218***	-0.3424***
			(-5.15)	(-7.67)
Total Assets (Log)	0.2618***	0.3075***	0.2684***	0.2912***
	(4.67)	(4.98)	(5.98)	(5.37)
Cash Compensation	0.0000	0.0001***	0.0000*	0.0000**
	(0.65)	(3.07)	(1.93)	(2.09)
CEO Tenure	0.0721***	0.0160***	0.0745***	0.0222***
	(12.72)	(2.74)	(10.50)	(4.19)
Observations	5790	4980	6799	6146
Adjusted-R^2	0.7103	0.7093	0.6895	0.6589

Table IV: 2SLS-IV Regression of Compensation Sensitivities on Firm Risk: Additions
This table presents the 2SLS-IV regression of endogenous compensation sensitivities and firm risk variables when new additions are made. The specification of the regression, including instrument, is similar to equations (3) and (4) for first and second stages, respectively. Angrist-Pischke multivariate F-statistics along with their respective p-values are included for first-stage regressions. Sargan statistics and its respective p-value is included for second-stage regressions. Cluster-robust t-statistics and z-statistics are reported in parenthesis for first-stage and second-stage regressions, respectively. Statistical significance (two-sided) at the 10%, 5%, and 1% level is denoted by *, ** and ***, respectively.

	Total Vega (Log)	Total Delta (Log)	Firm Risk
Total Vega (Log)			-0.0940*
			(-1.83)
Total Delta (Log)			-0.2219***
			(-4.81)
Total Assets (Log)	0.1670	0.5496***	0.1478***
	(1.17)	(6.89)	(4.06)
Leverage	0.0811	-0.8179***	-0.0324
	(0.23)	(-3.45)	(-0.30)
Market-to-Book	-0.0443	0.3988***	0.0900***
	(-0.78)	(8.78)	(4.07)
Sales Growth (Lagged)	0.1086	0.2259**	0.0387
	(1.20)	(2.13)	(1.14)
Research & Development	0.6897	-1.7240***	-0.1129
	(1.43)	(-2.79)	(-0.44)
R&D Dummy	-0.3957	-0.1010	-0.0548
	(-1.76)	(-0.42)	(-0.75)
Capital Expenditure	0.6371	0.0840	0.6376**
	(1.21)	(1.49)	(2.38)
Property, Plant & Equipment	-1.4509**	-0.6992	-0.2136
	(-2.20)	(-1.65)	(-1.02)
Cash Compensation	0.0001	0.0001	-0.0001**
	(0.36)	(0.17)	(-2.36)
CEO Tenure	0.0087	0.0735***	0.0200***
	(0.95)	(7.57)	(5.17)
CEO Age	-0.0020	-0.0104	-0.0069**
	(-0.19)	(-1.25)	(-2.51)
Count of Segments	0.0584	0.0212	0.0003
	(1.57)	(0.79)	(0.03)
Inverse Mill's Ratio	0.3050	0.1429	-0.3308***
	(0.85)	(0.73)	(-4.07)
Stock Return	-0.0531*	0.1094***	
	(-1.81)	(4.38)	
Mean State Compensation	0.3822***	0.2062**	
	(3.55)	(2.60)	
Observations	1966	1966	1966
Partial R^2	0.02	0.32	
Angrist-Pischke F-statistic	12.11	36.27	
p-value	0.01	0.01	
Hausman Test for Endogneity			12.59
p-value			0.01

Table V: 2SLS-IV Regression of Compensation Sensitivities on Firm Risk: Substitutions
This table presents the 2SLS-IV regression of endogenous compensation sensitivities and firm risk variableswhen new substitutions are made. The specification of the regression, including instrument, is similar to equations (3) and (4) for first and second stages, respectively. Angrist-Pischke multivariate F-statistics along with their respective p-values are included for first-stage regressions. Sargan statistics and its respective p-value is included for second-stage regressions. Cluster-robust t-statistics and z-statistics are reported in parenthesis for first-stage and second-stage regressions, respectively. Statistical significance (two-sided) at the 10%, 5%, and 1% level is denoted by *, ** and ***, respectively.

	Total Vega (Log)	Total Delta (Log)	Firm Risk
Total Vega (Log)			0.0792
			(0.96)
Total Delta (Log)			-0.2599***
			(-6.48)
Total Assets (Log)	0.3525***	0.5068***	0.0647
	(3.02)	(8.08)	(1.38)
Leverage	-0.3950	-0.7725***	-0.0170
	(-1.44)	(-4.06)	(-0.22)
Market-to-Book	0.0095	0.3646***	0.0926***
	(0.17)	(10.11)	(4.16)
Sales Growth (Lagged)	0.0389	0.1228*	-0.0061
	(0.39)	(1.69)	(-0.25)
Research & Development	-0.3599	-0.3213	-0.0809
	(-0.29)	(-0.47)	(-0.44)
R&D Dummy	0.2009	-0.1420	-0.0153
	(0.96)	(-0.87)	(-0.28)
Capital Expenditure	-0.8272	0.8636*	0.7334***
	(-1.39)	(1.89)	(3.22)
Property, Plant & Equipment	-0.1911	-0.2695	-0.0220
	(-0.30)	(-0.61)	(-0.22)
Cash Compensation	0.0001	0.0001	-0.0001
	(1.62)	(0.71)	(-0.80)
CEO Tenure	0.0184*	0.0681***	0.0194***
	(1.96)	(6.89)	(6.68)
CEO Age	0.0026	0.0153*	0.0016
	(0.29)	(1.98)	(0.49)
Count of Segments	0.0270	0.0051	-0.0122
	(0.71)	(0.16)	(0.73)
Inverse Mill's Ratio	0.9580***	0.2341	-0.4667***
	(3.57)	(1.49)	(-2.55)
Stock Return	-0.0705***	0.1067***	
	(-3.75)	(5.25)	
Mean State Compensation	0.3930***	0.2416***	
	(3.03)	(3.16)	
Observations	3139	3139	3139
Partial R^2	0.05	0.34	
Angrist-Pischke F-statistic	12.85	34.80	
p-value	0.01	0.01	
Hausman Test for Endogneity			12.59
p-value			0.01

Table VI: Maximum-Likelihood Regression of 'New Components' Introduced in a Compensation Structure

This table presents the maximum-likelihood, fixed-effects regression of dummies of new addition and substitution. The sample consists of 1,754 and 2,999 observations for new additions and substitutions, respectively. The coefficients reported are odd ratios. The fixed-effects controlled are unobserved firm effects. The specification of the regression is similar to equation (5) defined earlier. Cluster-robust z-statistics are reported in parenthesis. Statistical significance (two-sided) at the 10%, 5%, and 1% level is denoted by *, ** and ***, respectively.

	New Equity Addition (Dummy)	New Equity Substitution (Dummy)
Total Assets (Log)	170.2942***	85.6240***
	(12.96)	(17.16)
Leverage	0.0980***	3.1840**
	(-2.73)	(2.10)
Market-to-Book	0.4196***	0.5366***
	(-5.06)	(-5.56)
Sales Growth (Lagged)	0.5256	0.8039
	(-1.55)	(-0.88)
Research & Development	1.324e+10***	16865.9232***
	(5.27)	(4.14)
R&D Dummy	118.3251***	0.4291*
	(3.29)	(-1.91)
Capital Expenditure	32.6888	9.6642
	(1.44)	(1.09)
Property, Plant & Equipment	0.5856	0.0098***
	(-0.29)	(-3.31)
Cash Compensation	0.9994***	0.9999***
	(-6.62)	(-3.16)
CEO Tenure	0.9838	1.0133
	(-0.76)	(0.83)
CEO Age	0.9662	0.9524***
	(-1.60)	(-3.25)
Count of Segments	0.7402***	0.9891
	(-2.76)	(-0.13)
Price-to-Strike Ratio	0.5752***	0.8392*
	(-3.06)	(-1.67)
Total Compensation (Log)	3.0189***	1.2298***
	(9.49)	(3.23)
Stock Return	1.0047	1.1732***
	(0.06)	(2.61)
Mean State Compensation	1.7477	0.8381
	(1.53)	(-0.80)
Observations	1754	2999
chi2	631.7818	790.7046
p-value	0.0000	0.0000

Appendix B

Variable Definitions

Salary - Total dollar value of salary as provided by Execucomp.

Bonus - Calculated as bonus plus the the value of non-equity target shares provided Hayes et al. (2012).

Option Grants - Computations based on the method provided by Core and Guay (2002).

Restricted Stock - Sum of current restricted stock grants made that are unexercisable.

LTIPs - Target and unearned value of equity grants made in the current year (Hayes et al., 2012).

Total Compensation - Sum of salary, bonus, options grants, restricted stocks and LTIPs.

Cash Compensation - Sum of salary and bonus.

Salary/Total - Dollar value of salary scaled by total compensation.

Bonus/Total - Dollar value of bonus scaled by total compensation.

Options/Total - Dollar value of option grants scaled by total compensation.

Restricted Stock/Total - Dollar value of restricted stock scaled by total compensation.

LTIP/Total - Dollar value of LTIPs scaled by total compensation.

Delta (Total) - Sum of Black-Scholes delta of current and prior option grants, 1% of value of current and prior restricted stock grants and 1% of value of current and prior LTIP grants.

Vega (Total) - 1% of the sum of current Black-Scholes vega of current and prior option grants.

Market-to-Book - Market value of assets plus book value of long-term debt scaled by total assets.

Research & Development - Research and development expenditures to total assets.

Capital Expenditure - Value of capital expenditure scaled by total assets.

Leverage - Value of current and long-term liabilities scaled by total assets.

Cash - Value of cash and cash equivalent scaled by total assets.

Total Assets (Log) - Log-normalised value of total assets.

Volatility (Firm) - Standard deviation of the last 252 trading day returns of a firm, annualised.

Volatility (Market) - Standard deviation of the last 252 trading day returns of S&P500, annualised.

CEO Tenure - Time difference, in years, between the data date and the date the executive was appointed as CEO.

Price-to-Strike Ratio - Computed as the ratio of market price to the avergae strike price of the underlying stock option.