Strategic Flexibility and the Optimality of Pay for Luck

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September 7, 2007

Abstract

While standard contract theory suggests that a manager should be paid relative to a benchmark that removes the effects of forces beyond her control (i.e., luck), there is overwhelming evidence that CEO pay is strongly and positively related to luck. In this paper, we offer an explanation as to why the observed pay for luck can be optimal. We provide a simple model of CEO pay in an environment where the executive is charged with selecting and implementing the firm's strategy. For our purposes, strategy is interpreted as the choice of magnitude of the firm's exposure to sector or market factors. The idea we have in mind is that a firm's realized exposure to sector/market performance is at least partially under the CEO's control and not permanently fixed. Thus, a CEO needs to be incentivized to optimally choose her firm's exposure to sector forces. As a result, pay contracts will be both positively related to sector performance, and in some situations asymmetrically related to sector upswings and downswings. We find strong empirical support for our model.

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1 Introduction

One of the key predictions of the incentive theory is that optimal incentive-based pay should depend on variables under the manager's control and not those over which the manager has no control (see Weisbach (2007) for a summary). In light of this, the finding by Bertrand and Mullainathan (2001) that executives are paid for firm performance due to market factors potentially beyond their control (what they coin "luck") is *a priori* puzzling. This evidence is also at the crux of the managerial power hypothesis of CEO compensation. This hypothesis, most prominently put forth by Bebchuk and Fried (2003), argues that CEOs have captured the pay process and impose undue influence on it. However, an interesting and yet overlooked question is whether the empirically-measured luck is really something over which the executive has no control? In this paper we argue that the answer to this question is an emphatic *no*. In fact, while there are clearly market forces at work that are beyond the executive's control, the manager has at least some discretion over the firm's *exposure* to such forces through the choice of strategy. A similar observation is given by Holmstrom (2005) who is also somewhat skeptical of the argument attributing pay for luck to executive power over the compensation process, pointing out that filtering out luck from incentive pay may affect how the CEO reacts to those shocks and could influence her "risk choices."[1] In this spirit, we propose a simple model to formalize incentive contracts when a firm's exposure to the market movement is the CEO's strategic choice. Our model shows the optimality of "pay for luck" and also highlights the situations in which the reward for luck is more likely. We then take the predictions of the model to the CEO compensation data and find significant empirical support.

It is well known that both the level of executive pay and its sensitivity to stock prices have increased significantly since the 1980s (Hall and Liebman (1998)), with the bulk of the real increases coming in the past two decades (Frydman (2007)). For example, the average CEO pay in our sample (for all ExecuComp firms) has increased from \$2.3 million in 1992 to \$5.8 million in 2004. Stark criticism of such increases has come from both the academic and practitioner camps (see, for example, Bebchuk and Fried (2003), Bertrand and Mullainathan (2001), Crystal (1991), and Rappaport (1999)), calling these increases a windfall rather than performance-

[1] Quoting from Holmstrom (2005), "If John Browne's [CEO of British Petroleum] incentive pay were insulated from oil price shocks, it would affect the way he thinks about exploration and how he reacts to price shocks once they occur. Even comparisons with other oil companies or the overall stock market could influence his risk choices."

driven payouts. Consistent with this view, Bertrand and Mullainathan (2001) show that CEO pay is as sensitive to exogenous forces (luck), as it is to firm-specific performance (skill). A similar finding appears in the empirical literature on relative performance evaluation (e.g., Aggarwal and Samwick (1999a, 1999b), and Antle and Smith (1986)). Oyer (2004) suggests that pay for luck can be justified if one takes into account the fact that the CEO's outside opportunities may rise and fall with market levels, and thus firms that wish to retain their CEOs must pay for luck in order to insure that they are not hired away by other firms. While this explanation is plausible, it does not seem to explain the asymmetry in pay-for-luck exposures as documented by Garvey and Milbourn (2006). They show that when good luck manifests itself in the positive realization of, say, industry or broad market returns, executives' pay packages load positively on such movements, whereas when such external benchmarks are down, i.e., bad luck is realized, executives pay is significantly less sensitive to those benchmarks. Our model can also explain this asymmetric pay for luck relationship.

It is essential that any attempt to understand CEO pay must first clearly specify what CEOs actually do. The longstanding modeling choice in the compensation literature considers a standard agency setup, assuming that firm performance depends on the CEO's (personally) costly effort and some random factors over which the CEO has no control. The objective of the optimal contract is thereby to incentivize the CEO to exert effort to maximize firm value. In reality, most would argue that CEOs all work hard, and what really separates the winners from the losers is the CEO's chosen *strategy* for deploying a firm's assets. A CEO's primary responsibility is to put forth a vision for the firm and navigate its strategic initiatives. In doing this, the CEO is most concerned about the firm's strategic direction in lieu of its surrounding market environment: Where is the market or industry going? How does the firm fit into the marketplace? Going forward, what type of exposure to the market or industry is optimal for the firm, and how should one steer the company accordingly?

Such a situation forms the basis of our analysis to model the CEO's job as one of choosing the firm's strategy, which in turn affects the firm's exposure to sector and/or market movements.[2] In our model, facing uncertainty in regards to future sector movements, the CEO who is charged with choosing the firm's strategy, can put forth a (personally) costly effort

[2]For our purposes, one can think of a CEO choosing the firm's exposure to either industry sector or market movements. Empirically, we focus on sector movements, but our results are robust to using broader market returns as well.

to generate an informative signal about future sector returns. Pay for luck arises in the optimal contract as a mechanism to incentivize the CEO to exert effort to forecast the sector movements and choose the firm's optimal exposure to these movements accordingly. As our model shows, the absence of pay for luck will make firm investment decisions *insensitive* to sector movements, which is suboptimal if project payoffs depend on sector movements. An important contribution of our work is that the optimal contract rewards a risk-averse CEO more for good luck than punishes her for bad luck; that is, the optimal contract is asymmetrically sensitive to good and bad luck. Furthermore, given that CEOs actively change firm's exposure in response to sector movements, previous empirical tests looking at CEO incentive contracts are likely to be biased towards finding pay-for-luck asymmetry. Since these tests typically estimate one constant exposure for each firm, if CEOs actively engage in changing that exposure by choosing a higher exposure during bull markets and a lower one during bear markets, then even if the optimal contract is symmetrically sensitive to good luck and bad luck, the empirically-estimated loadings on luck are likely to be asymmetric. Our model also helps pin down situations in which pay for luck is more likely to be present. What we find is that pay for luck is more likely to be observed for a talented CEO possessing more valuable human capital in the labor market, and is also more likely to be prevalent in industries which offer greater strategic flexibility to the CEO, allowing her to change the firm's risk exposure to sector movements.

There is significant anecdotal support for our assumption that the CEO actively influences firm strategy. As Holmstrom (2005) points out, "[t]he reason CEOs and other people with business expertise sit on boards is that they are better placed to learn about the firm's strategy and understand how management thinks about it. This information is especially important when a CEO retires or when the firm runs into trouble and the board needs to figure out whether the current management has what it takes to get out of the trouble." In a recent paper, Bennedsen, Pérez-González and Wolfenzen (2007) demonstrate the impact of CEOs on firm value using a natural experiment involving CEO-family deaths. In sum, the findings of Bennedsen, Pérez-González and Wolfenzen (2007) sensibly suggest that the CEO is not an otherwise passive agent that only puts forth effort that affects a firm's output, but instead adds value through the host of actions and decisions she makes vis-a-vis the firm's strategic course. It is in this manner that we model the role of the CEO in the firm. Our model is also in the spirit of the recent work of Frydman (2007) and Murphy and Zábojník (2007) that suggest that over time, CEOs have become more highly valued for their general management skills, rather than firm-specific knowledge. This is akin to a world where CEO ability is linked explicitly to broader firm-level initiatives (such as the choice of firm strategy), rather than directed efforts only valuable to a single firm.

With the theory's empirically-testable predictions in hand, we turn to CEO compensation data spanning 1992 through 2004 and find strong empirical support for the model. Confirming previous studies, we first document that CEO compensation is dependent on luck (i.e., sector performance). To test whether the sensitivity of pay to luck is greater for more talented CEOs, we introduce two proxies for CEO talent. Our first proxy is derived from our model and to our knowledge has not been used in the literature. The motivation for this proxy is as follows. If a more talented CEO is better able to match a firm's exposure to market conditions, such firms are likely to have superior idiosyncratic performance, where idiosyncratic performance is measured based on historical loadings on sector returns. Thus, our first proxy for CEO talent is the level of idiosyncratic performance. We classify firm-CEO pairs into those that have positive and negative idiosyncratic performances and find that pay for luck is greater for CEOs with positive idiosyncratic performance. Our second proxy for CEO talent is CEO tenure. The idea here is that CEOs with longer tenures, such as Jack Welch, are likely to be more talented and hence in a position to make better strategic choices. Consistent with this, we find evidence of greater pay for luck for CEOs with longer tenures.

Recall that the starting point of our thesis is that a firm's exposure to sector or market forces is not completely exogenous and beyond the CEO's control, but something that the CEO can alter if she has the strategic flexibility. To test this hypothesis, we identify industries that are likely to offer greater strategic flexibility to the CEO to see if pay for luck is more prevalent. We use the level of investment and R&D expenditure in an industry as proxies for the level of strategic flexibility in an industry. It is likely that industries with higher levels of investment or R&D expenditures may provide the CEO with greater strategic flexibility. In these industries, the CEO can scale up or down such expenditures and thereby change the firm's exposure to market conditions. This conjecture is also consistent with Bennedsen, Pérez-González and Wolfenzen (2007) who show that CEOs have a greater impact on firm value in industries with higher profits, greater R&D investments, etc. Our model predicts greater pay for luck in such industries. Consistent with this prediction, we find that the pay for luck is indeed significantly greater in industries with higher levels of investment or more R&D expenditures.

Finally, consistent with our model we document that in our sample there is evidence of asymmetric pay for luck as well, as in Garvey and Milbourn (2006). Also in line with our model, we find that the asymmetry between good luck and bad luck is present in industries with higher levels of investment or higher R&D expenditures that potentially yield the CEO more strategic flexibility in changing the firm's risk exposure to sector or market movements.

The remainder of the paper is organized as follows. In Section 2, we delineate the primitives of our model and derive the optimal compensation contract in a world where CEOs are entrusted with choosing the strategy by changing the firm's risk exposure to sector/market movements. Section 3 contains our empirical examination of the model's testable predictions and Section 4 concludes. All proofs are relegated to the Appendix.

2 The Model

In this section, we analyze a simple model that helps us characterize the optimal incentive contract when CEOs can change a firm's exposure to the firm's sector (or overall market) performance through their choice of an appropriate strategy.

2.1 Agents and Economic Environment

We consider a one-period economy with two dates ($t = 0$ and $t = 1$), in which an all-equity firm is owned by risk-neutral investors and managed by a risk-averse Chief Executive Officer (CEO). At $t = 0$, the CEO chooses a one-period investment project to be implemented. This project is a reflection of the firm's strategy, and henceforth we refer to this choice as such. The CEO can choose between two alternative strategies. One is a high-risk strategy denoted by subscript H, and the other is a low-risk strategy denoted by subscript L. The realized return from implementing either strategy, R_i with $i \in \{H, L\}$, is equal to $\beta_i R_m + \varepsilon$, where β_i is a measure of the riskiness of strategy i and R_m is the realized sector return. We have $\beta_H > \beta_L \geq 0$. Typically in the CEO compensation literature, $\beta_i R_m$ is referred to as the "luck" component of firm performance. Hereinafter, we refer to this as the systematic component of firm performance. The key assumption in our model is that by the choice of her strategy, the CEO affects the firm's exposure, β_i, to sector performance. The term ε represents the idiosyncratic component of firm performance, and is assumed to be common to the strategies and is independently distributed with respect to R_m on the support $(-\infty, \infty)$, with $\mathbf{E}(\varepsilon) = 0$ and $\mathbf{Var}(\varepsilon) = \sigma^2$.

The realized sector return at $t = 1$, R_m, can take on two possible values: $+r_m > 0$ (akin to a bull market) and $-r_m < 0$ (bear market). The common prior belief at $t = 0$ is that with probability $\theta \in (0, 1)$, $R_m = +r_m$, and with probability $1 - \theta$, $R_m = -r_m$. To maximize firm value, naturally it is optimal to choose the high-risk strategy (i.e., $\beta = \beta_H$) if the expectation is for a bull market and the low-risk strategy (i.e., $\beta = \beta_L$) if the expectation is for a bear market. At $t = 0$, the CEO can exert an effort k to generate information about the actual sector return. If the CEO exerts effort, denoted as $k = 1$, at a personal cost $\psi > 0$, then she generates a private signal S. The signal can take on two possible values, $S \in \{+s, -s\}$, and is fully revealing,[3] i.e.,

$$\Pr(S = +s | R_m = +r_m) = \Pr(S = -s | R_m = -r_m) = 1.$$

If the CEO shirks, i.e., $k = 0$, then no signal about sector return is generated and the CEO's information set contains only the prior belief θ.

At $t = 1$, both the investors and the CEO can observe and verify the realized return from the chosen strategy, R_i, and the realized sector return, R_m, whereas the investors do not observe the CEO's effort choice, the chosen strategy (the chosen β_i) and ε.[4] The problem confronting the investors is to design an appropriate compensation contract to incentivize the CEO to exert effort to uncover the sector return and choose the optimal strategy accordingly. Since the investors only observe R_i and R_m, any incentive contract can only be contingent on these two variables. We assume that the investors design an incentive contract of the form, $w = w_0 + \bar{w}R_i$ if $R_m = +r_m$ is realized, and $w = w_0 + \underline{w}R_i$ if $R_m = -r_m$ is realized. We place no other parametric restriction on w_0, $\underline{w}$, and $\bar{w}$.

[3] When we introduce heterogeneity along the dimension of CEO in Section 2.3, we allow this information structure to change such that more talented CEOs generate more informative signals.

[4] The CEO does not observe ε either. But since the CEO knows the chosen strategy, she can back out ε from the realized firm performance.

The CEO's utility is given by $V_M(w) - \psi \times 1_{\{k=1\}}$, where w is the CEO's total compensation, and $1_{\{k=1\}}$ is an indicator function that takes the value 1 if $k = 1$ and zero if $k = 0$. $V_M(w)$ is concave, i.e., $V_M' > 0$ and $V_M'' < 0$, and the CEO's reservation utility is given by a constant $V_{M0} > 0$.

2.2 Optimal Pay for Luck

If the CEO exerts effort to generate the signal, S, and optimally chooses the high-risk strategy (β_H) when $S = +s$ and the low-risk strategy (β_L) when $S = -s$, then the CEO's expected utility, given any compensation contract, is

$$V_M(w_0, \underline{w}, \bar{w}) = \theta \mathbf{E}\big(V(w_0 + \bar{w}[\beta_H r_m + \varepsilon])\big) + [1-\theta]\mathbf{E}\big(V(w_0 + \underline{w}[-\beta_L r_m + \varepsilon])\big) - \psi.$$

The first term is the CEO's expected payoff in the bull market, which occurs with probability θ, and the second term is the CEO's expected payoff in the bear market, which occurs with probability $1 - \theta$. Similarly, the investors' expected payoff when the CEO exerts effort and optimally chooses the strategy based on her privately-generated signal is

$$V_I(w_0, \underline{w}, \bar{w}) = \theta \mathbf{E}\big([1-\bar{w}][\beta_H r_m + \varepsilon] - w_0\big) + [1-\theta]\mathbf{E}\big([1-\underline{w}][-\beta_L r_m + \varepsilon] - w_0\big).$$

The investors' problem at $t = 0$ is to choose a contract, denoted as $(w_0, \underline{w}, \bar{w})$, to maximize their expected payoff given by $V_M(w_0, \underline{w}, \bar{w})$, subject to the CEO's incentive-compatibility and participation constraints. We now turn to the CEO's incentive-compatibility constraints. If the CEO shirks and does not exert effort, she can always choose either the high-risk or the low-risk strategy unconditionally. The CEO will exert effort to generate the signal and choose the right strategy only if her payoff in doing so, given by $V_M(w_0, \underline{w}, \bar{w})$, exceeds her expected payoff from choosing either the high- or low-risk strategy unconditionally. Thus, we have two incentive-compatibility constraints to satisfy. One ensures that the CEO's payoff with effort exertion is greater than her payoff with an unconditional choice of the high-risk strategy, and the other ensures that the CEO's payoff with effort exertion is greater than her payoff with an unconditional choice of the low-risk strategy. We now present the investors' full problem:

$$\max_{\{w_0,\underline{w},\bar{w}\}} \; V_I(w_0,\underline{w},\bar{w}), \tag{1}$$

$$\text{s.t. } V_M(w_0,\underline{w},\bar{w}) \geq V_{M0}, \tag{2}$$

$$V_M(w_0,\underline{w},\bar{w}) \geq \theta \mathbf{E}\big(V(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V(w_0+\underline{w}[-\beta_H r_m+\varepsilon])\big), \tag{3}$$

$$\text{and } V_M(w_0,\underline{w},\bar{w}) \geq \theta \mathbf{E}\big(V(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big). \tag{4}$$

In the above problem, (3) and (4) represent the CEO's incentive-compatibility constraints for effort exertion. The right-hand-side (RHS) of (3) is the CEO's expected payoff if she always selects the high-risk strategy ($\beta = \beta_H$). Constraint (3) ensures that this payoff is lower than the payoff with effort exertion. Similarly, constraint (4) ensures that the CEO's payoff with effort exertion, $V_M(w_0,\underline{w},\bar{w})$, is greater than her payoff if she shirks and always chooses the low-risk strategy ($\beta = \beta_L$). The CEO's participation constraint is stated in (2).

Analyzing this problem, we have our first result:

Proposition 1. *The optimal compensation contract, denoted as* $(w_0^*,\underline{w}^*,\bar{w}^*)$*, has the following properties: (1)* $\bar{w}^* > 0$ *and* $\underline{w}^* > 0$*; and (2) There exists a cutoff value for the prior probability of bull market,* $\theta^* > 0.5$*, such that for* $\theta < \theta^*$*,* $\bar{w}^* > \underline{w}^*$*.*

The intuition is as follows. The CEO's compensation is contingent on the firm's systematic performance (i.e., $\underline{w}^* > 0$ and $\bar{w}^* > 0$) to ensure that the CEO has sufficient incentive to exert effort to uncover the sector performance, R_m, and choose the optimal strategy accordingly. Lack of pay for systematic performance will result in the CEO choosing either the high- or the low-risk strategy unconditionally and hence the firm's exposure being insensitive to the sector performance.

Moreover, the two loadings on luck, $\underline{w}^*$ and $\bar{w}^*$, serve two slightly different incentive purposes. The loading on bad luck, $\underline{w}^* > 0$, ensures that the CEO does not shirk and unconditionally choose the high-risk strategy ($\beta = \beta_H$), whereas the loading on good luck, $\bar{w}^* > 0$, ensures that the CEO does not shirk and unconditionally choose the low-risk strategy ($\beta = \beta_L$). To see this, note that when $\underline{w}^* > 0$, the CEO suffers a loss if he chooses $\beta = \beta_H$ and $R_m = -r_m$. Similarly, when $\bar{w}^* > 0$, the CEO suffers an opportunity loss if he chooses $\beta = \beta_L$ and $R_m = r_m$. Given risk aversion, the CEO's incentive to avoid the loss when $R_m = -r_m$ is *ceteris paribus* stronger than her incentive to avoid forgoing her compensational gain when $R_m = r_m$. Hence, the investors rely to a lesser extent on the incentive contract to incentivize the CEO to not choose the high-risk strategy unconditionally. Thus, the optimal compensation contract for a risk-averse CEO exhibits asymmetry in pay for luck, i.e., $\bar{w}^* > \underline{w}^*$.

Of course, the above argument also depends on the prior likelihood of a bull or bear market. If a bear market is more likely a priori ($\theta < 1/2$), then the cost of unconditionally picking β_H is higher, which consequently reduces the reliance on the incentive contract (i.e. lowers $\underline{w}^*$), whereas if a bull market is more likely a priori ($\theta > 1/2$), then the cost of unconditionally picking β_L becomes higher, which again reduces the reliance on the incentive contract (i.e., lowers $\bar{w}^*$). Thus, as long as the prior likelihood for a bull market is not sufficiently high (i.e., θ is smaller than a cutoff value θ^*), we have $\bar{w}^* > \underline{w}^*$. We assume in subsequent analysis that $\theta < \theta^*$.

2.3 Pay for Luck and CEO Talent

Our analysis so far has shown that in a situation where CEOs can influence a firm's exposure to sector performance, the optimal incentive contract will reward the CEO for firm performance resulting from sector movement. That is, pay for luck arises in an optimal contract. We now extend our analysis to see how the optimal incentive contract varies with CEO talent. To do this, we add the following additional structure to the model. We introduce heterogeneity among CEOs by assuming that there are two types of CEOs: talented (T) and untalented (U). These two CEO types differ along two important dimensions. First, the talented CEO has greater ability to generate a signal about the sector return. Formally, the talented CEO obtains a perfect signal, whereas the untalented CEO's signal is noisy, i.e.,

$$\Pr(S = +s|R_m = +r_m, T) = \Pr(S = -s|R_m = -r_m, T) = 1, \tag{5}$$

$$\Pr(S = +s|R_m = +r_m, U) = \Pr(S = -s|R_m = -r_m, U) = \tau \in (0.5, 1). \tag{6}$$

The second difference between the CEO types is that the talented CEO also has the option of exerting effort to polish her resume. What we have in mind is that the talented CEO can undertake activities that publicize her talent and potentially her outside market value. Specifically, by polishing her resume the talented CEO can increase her outside market value by $d(k)$, where $k \in \{1, 0\}$. We assume that $d(0) = 0$ and $d(1) \equiv d > \psi$, so that it is profitable for the talented CEO to polish her resume. The talented CEO has in total one unit of effort that she can expend either in polishing her resume or in generating the signal about the sector performance. To streamline our main idea, we assume that the untalented CEO has no such option to polish her resume. This is not a crucial assumption and our results are valid even if the untalented CEO could polish her resume, provided her ability at polishing is lower than that of the talented CEO.

We assume that the investors can observe and verify the CEO's talent. This assumption is made for simplicity and does not affect our conclusions. Given observability of CEO type, the investors can offer potentially different contracts to the talented and the untalented CEOs. Our objective is to analyze the possible differences in the optimal contracts across the CEO types. We denote the contracts for the talented and the untalented CEOs by $(w_{0T}^*, \underline{w}_T^*, \bar{w}_T^*)$ and $(w_{0U}^*, \underline{w}_U^*, \bar{w}_U^*)$, respectively. An analysis of optimal contracts along the lines of the previous section yields the following result:

Proposition 2. *There exists a cutoff value for d, d^*, such that for $d > d^*$, we have $\bar{w}_T^* > \bar{w}_U^*$.*

The intuition is as follows. Since the talented CEO has a greater ability to divert her effort away from signal generation to resume polishing, the investors need to provide the talented CEO with greater incentives by more closely linking her pay to the firm's luck. What this result implies is that CEOs identified as being more talented are likely to be paid more handsomely for luck.

2.4 Empirical Predictions

In this section we list the main empirical predictions of our model. From Proposition 1 we know that the optimal incentive contract rewards the CEO for firm performance resulting from sector performance. Thus, the optimal contract does not remove the systematic component of firm performance. This forms our first prediction.

Prediction 1: *Optimal incentive contracts will reward CEOs for luck.*

Support for this prediction is provided by the results of Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006). One important aspect of testing *Prediction 1* is that our model is quite specific about the nature of sector performance that is likely to affect CEO compensation. It is reasonable to argue that CEOs, through their choice of strategy, will be able to shift the firm's exposure within a broad industry segment and not necessarily across industry segments. Thus, the luck that matters for CEO compensation according to our model, should be that resulting from industry returns. To test this prediction, we repeat the tests of Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006) for our extended sample period ensuring that the luck is measured using industry returns.

From Proposition 2 we know that the reward for luck will be greater for more talented CEOs. In our empirical tests, we use two proxies for CEO talent. Our first proxy arises quite naturally from our model. That is, if a more talented CEO is better able to match a firm's exposure to market conditions, such firms are also likely to have superior idiosyncratic performance, where idiosyncratic performance is measured based on past loading to the market return. Thus, our first proxy for CEO talent is the level of idiosyncratic performance, with positive idiosyncratic performance identifying more talented CEOs. Our second proxy for CEO talent is the tenure of the CEO. The intuition behind using CEO tenure as one proxy for CEO ability is that CEOs with longer tenure are more likely to be more talented and hence in a position to make better strategic choices. Furthermore, certain industries may offer CEOs greater strategic flexibility. For example, it is likely that industries with higher levels of investment or more R&D expenditures may offer a greater potential for CEOs to vary the firm's sector exposure. CEOs can alter the sensitivity of firm performance to sector performance by scaling up or down the level of investment. Similarly, by varying the level of R&D expenditure, CEOs can alter the speed of introducing new products and thus change the firm's exposure to sector performance. Consistent with this, Bennedsen, Pérez-González and Wolfenzen (2007) find that CEOs have a greater impact on firm performance in industries with higher levels of investment and R&D expenditures. Thus, we expect pay for luck to be greater in industries with higher levels of investment or R&D expenditures. Summarizing these, our second prediction is:

Prediction 2: *The reward for luck will be greater for CEOs with positive idiosyncratic performance and longer tenure, and for CEOs in industries with higher levels of investment and R&D expenditures.*

From Proposition 1, we know that in the optimal contract, $\bar{w}^* > \underline{w}^*$. This implies that the optimal contract rewards the CEO more for good luck than punishes her for bad luck, i.e., the optimal incentive contract is asymmetric on pay for luck. Our prediction is thus in line with the results of Garvey and Milbourn (2006). Interestingly, apart from the asymmetry built in the optimal contract, the CEO's ability to change firm exposures to sector performance implies that empirical tests that ignore this fact may be biased towards finding asymmetry in pay for luck. The reason for this is as follows. In estimating luck, these tests typically estimate one average β for every firm. However, if a CEO actively changes her firm's exposure to sector factors by increasing the risk of the firm's projects during bull markets and reducing the risk during bear markets, then such tests are likely to underestimate luck during bull markets and overestimate it during bear markets. Aggregating across all firms, the average β is likely to underestimate the actual β during bull markets and overestimate the actual β during bear markets. This in turn is likely to bias the estimates towards finding asymmetry in pay for luck. To see this more clearly, note that in the context of our model, $\bar{w}^*\beta_H$ and $\underline{w}^*\beta_L$ represent the optimal loadings on the sector return in bull and bear markets, respectively. Empirically, let $\bar{\beta}$ be the estimated firm's average exposure to sector movement, and let w^+ and w^- represent the loadings on good- and bad-luck, respectively. It is easy to show that we will have $w^+ = \bar{w}^*\beta_H/\bar{\beta}$ and $w^- = \underline{w}^*\beta_L/\bar{\beta}$. Thus even if $\bar{w}^* = \underline{w}^*$, we are likely to have $w^+ > w^-$ because $\beta_H > \bar{\beta} > \beta_L$. Thus, empirically we will observe asymmetry in the compensation contracts if we ignore the fact that CEOs can change the firm's risk exposure.

Moreover, similar to *Prediction 2*, we should observe asymmetry between good luck and bad luck in incentive contracts for CEOs in industries that offer them greater strategic flexibility in changing the firm's exposure. Summarizing all these leads to our third prediction:

Prediction 3: *Incentive contracts will reward CEOs more for good luck than punish them for bad luck. The asymmetric reward for luck will be present for CEOs in industries with greater strategic flexibility, as proxied by higher levels of investment and more R&D expenditures.*

3 Empirical Analysis

In this section, we describe our data, lay out our empirical methodology, and provide our main results stemming from the tests of our model's predictions.

3.1 Data and Descriptive Statistics

The data for testing our predictions are drawn from two standard sources. Stock returns and estimates of return volatility come from the Center for Research in Security Prices (CRSP), and compensation data are from Standard and Poor's ExecuComp. Our sample period covers the years 1992 - 2004. The compensation data are for the firm's executive identified by ExecuComp as the CEO. To obtain a sample suitable for testing, we modify this overall sample in the following ways. First, we drop firms with fiscal years ending in any month other than December. We do this to ensure that the period we use to measure firm performance coincides with the period used to measure industry performance, which we use as the benchmark. Second, to ensure that we have a full year's compensation data, we drop firm-years in which the CEO changed. In Section 3.3, we compare the overall ExecuComp sample to our sample to ensure that the selection does not bias our conclusions. For robustness, we repeat all our tests with the full sample and obtain results similar to the ones reported.

3.2 Empirical Specification and Key Variables

In testing our predictions, we are broadly interested in examining how CEO compensation is related to the systematic component of firm performance. To do this, we follow the approach used in Bertrand and Mullainathan (2001) and Garvey and Milbourn (2006) and break the test into two stages. In the first stage, we calculate the systematic component (the component referred to as "luck" in the previous studies) and idiosyncratic component of firm's dollar return. We achieve this using the following specification:

$$y_{it} = \beta \mathrm{X}_m + \mu_t \mathrm{T} + \epsilon_{it}, \tag{E1}$$

where the subscript i indicates the firm, m indicates the market, and the subscript t refers to time in years and T refers to a matrix of time dummies. The dependent variable y is the annual stock return and X represents the return on a set of sector indices. We scale both firm stock return and the sector return by each firm's market capitalization at the beginning of the year. In the baseline specification, the sector indices include the equal- and value-weighted industry returns, where industry is identified at the level of two-digit SIC code. As discussed earlier, industry returns are most relevant for testing our model implications. For robustness, we repeat our tests later on by including equal- and value-weighted portfolio returns of all NYSE/AMEX/NASDAQ stocks, return on the S&P 500 index and the return on the firm's size decile portfolio. Since many of these indices are highly correlated with industry returns, we obtain similar results with these as well. Furthermore, since all of these are imperfect measures of the sector return that is likely to be relevant for choosing a firm's strategy, we may misclassify some systematic and idiosyncratic portion of firm performance. Because our tests are based on how CEO pay is related to the systematic component of firm performance in the cross section, measurement error is unlikely to bias our conclusions. One important difference between our specification and that of previous studies is that we estimate the above equation individually for each two-digit SIC code industry. This allows the loadings to be different across industries. Note that even our tests are likely to be biased towards finding asymmetry in the pay for luck relationship because we only estimate one average loading for a firm. Due to the noise in short-term return measures and the lack of sufficient observations, we are unable to estimate time varying loadings for a firm. Taking into account the potential bias, we rely less on our tests documenting asymmetry and more on the tests identifying cross sectional variation in the asymmetry. Based on the estimation of the above equation, we estimate the systematic component of firm performance as:

$$\text{Systematic}_{it} = \widehat{\beta}\text{X}_m + \widehat{\mu_t}\text{T}, \tag{E2}$$

where $\widehat{\beta}$ and $\widehat{\mu_t}$ represent the coefficient estimates from (E1). The difference between firm stock return and the systematic component is referred to as the idiosyncratic component.

Having estimated the systematic and idiosyncratic components of firm performance, in the next stage we estimate how CEO compensation varies with the systematic and idiosyncratic components of performance. To do this, we follow the approach of Aggarwal and Samwick (1999a) and Garvey and Milbourn (2006) on the pay for performance relationship and estimate the following model:

$$z_{it} = \beta_1\text{Systematic}_{it} + \beta_2\text{Idiosyncratic}_{it} + \gamma\text{X}_{it} + \mu_e\text{E} + \mu_t\text{T}, \tag{E3}$$

where the dependent variable z is the level of compensation. We use three alternative measures of CEO compensation. Our first measure is the executive's total direct compensation, *Total*

Compensation, which is a sum of the CEO's yearly salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and Black and Scholes value of stock option awards in the year. The other two measures of compensation are *Bonus*, which is a measure of the CEO's bonus for the year, and *Option Grants*, which is the Black and Scholes value of option grants during a year. Following Garvey and Milbourn (2006), we do not fix the sensitivity of pay to either systematic or idiosyncratic components to be the same for all firms. Instead, we let the loadings vary with the riskiness of the components of firm performance by including interaction terms between the components of firm performance and the cumulative distribution function (CDF) of their own respective variances. We also include the level of the cdf as an additional control. Thus, our set of controls X_{it} include interaction terms between *Systematic* and *Idiosyncratic* and the CDF of their variances, the level of the CDF of the two variances and the tenure of the CEO (*Tenure*). We calculate the tenure for a CEO in any year as the difference in years between the fiscal year end of that year and the date at which the executive became CEO. μ_e refers to executive fixed effects and μ_t refers to time fixed effects. Our predictions are about how β_1 varies in the cross section of CEOs. We now present our empirical results, starting with the summary statistics.

3.3 Summary Statistics

In Panel A & Panel B of Table I, we compare the summary statistics for compensation and firm-specific variables for executives identified as the CEO (given by the CEOANN field in ExecuComp) from the full ExecuComp sample (Panel A), and our sub-sample that excludes firms with fiscal year ending other than December and also firm-years in which the CEO was changed (Panel B). These summary statistics show that our sub-sample is comparable to the full sample in terms of average market value and CEO pay. Focusing on Panel B, the average salary and bonus for a CEO in our sample are approximately, \$641,203 and \$749,512, respectively, while option grants in the year average about \$1.9 million. The standard deviation of stock returns are the volatilities provided in the Execucomp database that are used to calculate the Black and Scholes value of options. The more important feature of both the full sample and the sub-sample is the enormous right skewness in the data. For instance, the maximum value of option grants is about \$600 million in the full ExecuComp sample, and the median value is approximately one-fourth of the mean. To reduce the effects of such outliers, our variables of empirical interest are all winsorized at the 1% level and we estimate robust standard errors.

[Table I goes here]

Critical to our ability to test the hypothesis that managers change firm exposures to market returns is the fact that the benchmark can take both positive and negative values. Table II summarizes the percentage of the observations for each benchmark that are positive, as given in the column denoted as percent positive. Not surprisingly for our sample period, a large proportion of our sample contains positive benchmark returns.

[Table II goes here]

3.4 Empirical Results

We begin our empirical analysis by testing *Prediction 1* to see if there is evidence of pay for luck. These tests are similar to those in Bertrand and Mullainathan (2001) with the one important difference being that our sample period is longer than theirs. We repeat the tests to ensure that the results hold in our sample as well. The results are reported in Table III. In Column (1), the dependent variable is *Total Compensation*. The positive coefficient on *Systematic* confirms pay for luck. In Columns (2) & (3) we repeat the estimation with *Bonus* and *Option Grants* as measures of compensation, respectively, and find the existence of reward for luck for bonus payments, whereas it is statistically insignificant for option grants. Our point estimates are also consistent with earlier papers. The point estimates in Column (1) imply that for a CEO of a firm with median risk, an additional $1,000 in firm value arising from market movements will increase total compensation by $1.068, bonus payouts by just under 36 cents, and new option grants by 10 cents.

[Table III goes here]

One of the main advantages of our theory is that it identifies the specific situations in which pay for luck should be more prevalent. As mentioned in *Prediction 2*, we expect greater pay for luck for more talented CEOs and in industries that offer greater strategic flexibility to the CEO. We now test the first part of *Prediction 2*, which indicates greater pay for luck for more talented CEOs. We use two proxies for CEO talent. In Panel A of Table IV, we use the average idiosyncratic performance during a CEO's tenure as a measure of CEO talent and test *Prediction 2*. If a CEO is talented in changing firm exposure to sector movements, then firm performance should be better than that can be achieved by passively retaining the same exposure to the sector as in the past. Thus, in the first stage we identify the systematic and idiosyncratic components of firm performance for year t using the loading estimated with data till year $t-1$. Then we estimate the average idiosyncratic return for each CEO-firm pair and divide our sample into two sub-samples: CEO-firm pairs with positive average idiosyncratic performance and CEO-firm pairs with negative average idiosyncratic performance. We then repeat our tests separately for the two sub-samples. The results of this estimation are reported in Panel A of Table IV. The results clearly show that when CEO compensation is measured using *Total Compensation*, evidence of pay for luck is only found in the sub-sample with positive idiosyncratic return. This provides strong evidence in support of our theory. When we repeat the tests using *Bonus* as a measure of compensation, we obtain results inconsistent with our theory. In the case of option grants, while the coefficient for CEOs with positive idiosyncratic return is positive and that for CEOs with negative idiosyncratic return is negative, both the loadings are insignificant. Overall, the results in Panel A of Table IV support the prediction of greater pay for luck for more talented CEOs.

In Panel B we use CEO tenure as an alternate proxy for CEO talent to test *Prediction 2*. The idea is that CEOs with longer tenure are likely to be more talented (e.g., Milbourn (2003)). To test for greater pay for luck for more talented CEOs, we divide our sample into two sub-samples: CEOs with tenure above the median tenure of the sample and CEOs with tenure below the median tenure of the sample. We then repeat the estimation in both the sub-samples. The results reported in Panel B of Table IV show that there is strong evidence that CEO pay is related to luck for more talented CEOs. Specifically, both *Total Compensation* and *Bonus* load significantly on luck only for CEOs with long tenure. This offers significant support for our theory. Note that some of the prior literature also uses CEO tenure as a proxy for the degree of CEO entrenchment. Thus, our results in Panel B can also be interpreted as indicating greater pay for "luck" for more entrenched CEOs. We try to distinguish our theory from this alternate explanation by doing further cross sectional tests to investigate whether, consistent with our model, we observe greater pay for luck in industries that offer more strategic flexibility to the CEO; this is the second part of *Prediction 2*.

In Panel C & Panel D of Table IV, we test the second part of *Prediction 2* to see if pay for luck is more prevalent in industries that offer greater strategic flexibility. As mentioned earlier, we use two proxies to identify industries that offer such flexibility. First, we use the level of capital expenditure in an industry and classify industries with higher than median capital expenditure as offering greater flexibility for the CEO to change firm exposure. We define a firm's industry at the level of four-digit SIC code and measure the industry capital expenditure every year as the median ratio of *Capital Expenditure* over *Total Assets* of all firms in the industry. We repeat our tests in sub-samples with above and below median industry capital expenditure levels. As can be seen from Column (1) in Panel C, the pay for luck is significantly greater (1.975 in comparison to 1.07) for firms in industries with higher levels of capital expenditure. In unreported tests we find that the coefficients are statistically different from each other. The results also show that *Bonus* also loads to a greater extent on luck for firms in industries with higher capital expenditure. This offers further support for our theory.

In Panel D we use the level of R&D expenditure in an industry to identify flexible industries. We classify industries with non-zero R&D expenditure in the median firm as offering greater strategic flexibility to the CEO. The idea here is that by scaling up or down R&D expenditure, CEOs can alter the speed of new product introduction and hence the sensitivity of firm performance to sector movements. The evidence in Panel D again shows that when pay is measured using *Total Compensation*, pay for luck is present only in firms with higher R&D expenditure. This offers further evidence in support for our theory and shows that at least for some firms, pay for luck may be optimal and is aimed at providing incentives for the CEO to choose the appropriate strategy.

[Table IV goes here]

3.5 Asymmetric Pay for luck

In this section we test *Prediction 3*, which predicts asymmetry in the optimal pay for performance relationship. In Panel A of Table V, we test if there is evidence of asymmetry in the over all pay for luck relationship. The tests in this sub-section are similar to those in Garvey and Milbourn (2006) with the main difference being the different sample period we use. In Panel A of Table V, we repeat the estimation of (E3) after replacing *Systematic* with two interaction terms, namely *Systematic* × *+ve Systematic* and *Systematic* × *-ve Systematic*, where *+ve Systematic* (*-ve Systematic*) is a dummy variable that takes a value 1 when *Systematic* is positive (negative). The results in Panel A show that there is significantly greater reward for positive systematic return than for negative return. These results are consistent with Garvey and Milbourn (2006) and also in line with our predictions. In Panels B and C we repeat our estimation to see if the asymmetry in pay for luck is present in industries that offer greater strategic flexibility to the CEO. In Panel B, we divide the sample into firms in industries with high and low capital expenditures. As mentioned earlier, industries with higher capital expenditures are likely to offer greater strategic flexibility to the CEO. Note that while our theory predicts that we should observe asymmetry in the pay for luck relationship for the sub-sample with high capital expenditure, we do not have any specific prediction on the pay for luck relationship in the low capital expenditure sub-sample. But for providing a overall picture, in Panel B, we repeat the estimation of (E3) in both the sub-samples with high and low capital expenditure. Consistent with our prediction, we do find asymmetry in the pay for luck relationship in the sub-sample with high capital expenditure. Although the coefficient on *Systematic* × *+ve Systematic* is larger than the coefficient on *Systematic* × *-ve Systematic* we find that the two are statistically indistinguishable. In Panel C, we use the extent of R&D expenditure in the industry as a measure of strategic flexibility and find that there is asymmetry in the pay for luck in firms in high R&D industries. This again offers evidence consistent with our theory.

[Table V goes here]

4 Conclusion

The compensation packages of top CEOs have most assuredly skyrocketed in the past fifteen years. And while less work has been put forth to explain the increase in levels, there is an abundance of research related to the structure of pay. A popular theme that has emerged is the managerial power approach in which CEOs control their boards and the pay process, owing to weak corporate governance and shareholder rights. Bebchuk and Fried (2003) argue that shoring up such weaknesses is a necessary and overdue step. Our work certainly doesn't take issue with such a charge. In fact, it seems quite reasonable that significant improvements could be made in many firms in regards to the efficacy of their corporate governance. However, our paper seeks to provide an optimal contracting explanation for at least one aspect of the empirical regularities leading to the managerial power explanation through the apparent pay for luck. Our simple model captures the idea that CEOs are hired to select the firm's strategy, and that this strategy manifests itself in realized exposures to sector and market factors. Optimal compensation necessarily accommodates such a setting, and can justify the positive relationship uncovered empirically between CEO pay and luck.

Appendix

Proof of Proposition 1: Denote the non-negative Lagrangian multipliers associated with the constraints (2), (3) and (4) as λ, γ_H and γ_L, respectively. The first-order-conditions of this program with respect to $w_0, \underline{w}$ and $\bar{w}$, respectively, can be expressed as:[5]

$$\begin{aligned}
0 &= -1+\lambda\big[\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)\big] \\
&\quad +\gamma_H[1-\theta]\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])-V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon])\big) \\
&\quad +\gamma_L\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])-V_M'(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big), \qquad \text{(A1)}\\
0 &= -\beta_L+\lambda\beta_L\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big) \\
&\quad +\gamma_H\big[\beta_L\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)-\beta_H\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon])\big)\big], \qquad \text{(A2)}\\
0 &= -\beta_H+\lambda\beta_H\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big) \\
&\quad +\gamma_L\big[\beta_H\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)-\beta_L\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big)\big]. \qquad \text{(A3)}
\end{aligned}$$

First, we claim that the CEO's incentive compatibility constraint (4) must be binding in the optimal contract. We prove it by contradiction. Suppose (4) is not binding, then we must have $\gamma_H = 0$. Substituting $\gamma_H = 0$ into (A2) yields $\lambda = \frac{1}{\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))} > 0$. Then, we can rewrite (A1) as

$$\begin{aligned}
0 &= -1+\frac{\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)}{\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))} \\
&\quad +\gamma_L\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])-V_M'(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big).
\end{aligned}$$

Note that $\gamma_L\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])-V_M'(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big)\leq 0$, since $\gamma_L \geq 0$ and $\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])-V_M'(w_0+\bar{w}[\beta_L r_m+\varepsilon])\big)<0$ (note that $V(\cdot)$ is concave). Thus, we must have

$$\frac{\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)}{\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))}\geq 1,$$

i.e., $\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)\geq\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]\big)$, which cannot hold. Thus, we must have $\gamma_H > 0$. Hence, the CEO's incentive compatibility constraint (4) must be binding.

Next, we claim that the CEO's incentive compatibility constraint (3) must be also binding in the optimal contract. Again, we prove it by contradiction. Suppose (3) is not binding, then we must have $\gamma_L = 0$. Substituting $\gamma_L = 0$ into (A3) yields $\lambda = \frac{1}{\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon]))} > 0$. Substituting this into (A2) yields $\gamma_H = \frac{\beta_L[\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon]))-\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))]}{\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon]))[\beta_L\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))-\beta_H\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon]))]} > 0$. Substituting all these into (A1) yields

$$\begin{aligned}
0 &= -1+\frac{\theta\mathbf{E}\big(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])\big)+[1-\theta]\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)}{\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon]))} \\
&\quad +\frac{\begin{array}{c}[1-\theta]\beta_L\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon])-V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])) \\ \times\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])-V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon]))\end{array}}{\mathbf{E}(V_M'(w_0+\bar{w}[\beta_H r_m+\varepsilon]))[\beta_L\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon]))-\beta_H\mathbf{E}(V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon]))]},
\end{aligned}$$

[5] We assume technical conditions are satisfied so that we can exchange the order of differentiation and expectation.

which is equivalent to

$$\frac{\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)\beta_L-\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon])\big)\beta_L}{\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_L r_m+\varepsilon])\big)\beta_L-\mathbf{E}\big(V_M'(w_0+\underline{w}[-\beta_H r_m+\varepsilon])\big)\beta_H}=1,$$

i.e., $\beta_L=\beta_H$, which cannot be true. So, we must have $\gamma_L>0$, and hence (3) must be binding.

Thus, in equilibrium we have

$$\begin{aligned}&[1-\theta]\mathbf{E}\big(V_M(w_0^*+\underline{w}^*[-\beta_L r_m+\varepsilon])-V_M(w_0^*+\underline{w}^*[-\beta_H r_m+\varepsilon])\big)\\&=\theta\mathbf{E}\big(V_M(w_0^*+\bar{w}^*[\beta_H r_m+\varepsilon])-V_M(w_0^*+\bar{w}^*[\beta_L r_m+\varepsilon])\big)=\psi.\end{aligned}\tag{A4}$$

Note that if $\theta=0.5$, we must have $\bar{w}^*>\underline{w}^*$ in order for (A4) to hold because $V_M(\cdot)$ is concave. As $\theta\uparrow 1$, $\bar{w}^*$ must approach to zero in order for the equality $[1-\theta]\mathbf{E}\big(V_M(w_0^*+\underline{w}^*[-\beta_L r_m+\varepsilon])-V_M(w_0^*+\underline{w}^*[-\beta_H r_m+\varepsilon])\big)=\theta\mathbf{E}\big(V_M(w_0^*+\bar{w}^*[\beta_H r_m+\varepsilon])-V_M(w_0^*+\bar{w}^*[\beta_L r_m+\varepsilon])\big)$ to hold. Thus, by continuity there must exists a cutoff $\theta^*>0.5$ such that for $\theta<\theta^*$, we have $\bar{w}^*>\underline{w}^*$. □

Proof of Proposition 2: For better illustration and analytical tractability, we assume that $V_M(w)=\log(A+w)$, where $A>0$ is sufficiently large so that we are not constrained by the condition $A+w>0$. We also suppress the idiosyncratic term ε to simplify the algebra without changing the main intuition.

The talented CEO's incentive compatibility constraints to allocate her effort to signal generation instead of resume polishing are

$$\begin{aligned}[1-\theta]\big[V_M(w_{0T}-\underline{w}_T\beta_L r_m)-V_M(w_{0T}-\underline{w}_T\beta_H r_m)\big]&\geq d,\\ \theta\big[V_M(w_{0T}+\bar{w}_T\beta_H r_m)-V_M(w_{0T}+\bar{w}_T\beta_L r_m)\big]&\geq d,\end{aligned}$$

which can be simplified as

$$\frac{A+w_{0T}-\underline{w}_T\beta_L r_m}{A+w_{0T}-\underline{w}_T\beta_H r_m}\geq e^{\frac{d}{1-\theta}},\tag{A5}$$

$$\frac{A+w_{0T}+\bar{w}_T\beta_H r_m}{A+w_{0T}+\bar{w}_T\beta_L r_m}\geq e^{\frac{d}{\theta}},\tag{A6}$$

The talented CEO's participation constraint is

$$\theta V_M(w_{0T}+\bar{w}_T\beta_H r_m)+[1-\theta]V_M(w_{0T}-\bar{w}_T\beta_L r_m)-\psi\geq V_{M0},$$

i.e.,

$$(A+w_{0T}+\bar{w}_T\beta_H r_m)^\theta(A+w_{0T}-\underline{w}_T\beta_L r_m)^{1-\theta}\geq e^{V_{M0}+\psi}.\tag{A7}$$

It is clear that (A5) – (A7) must be binding in the optimal contract (see the proof of Proposition 1).

Similarly, the untalented CEO's incentive compatibility constraints are

$$[1-\theta]\tau\big[V_M(w_{0U}-\underline{w}_U\beta_L r_m)-V_M(w_{0U}-\underline{w}_U\beta_H r_m)\big]-\theta[1-\tau]\big[V_M(w_{0U}+\bar{w}_U\beta_H r_m)-V_M(w_{0U}+\bar{w}_U\beta_L r_m)\big]\geq\psi,$$

$$\theta\tau\big[V_M(w_{0U}+\bar{w}_U\beta_H r_m)-V_M(w_{0U}+\bar{w}_U\beta_L r_m)\big]-[1-\theta][1-\tau]\big[V_M(w_{0U}-\underline{w}_U\beta_L r_m)-V_M(w_{0U}-\underline{w}_U\beta_H r_m)\big]\geq\psi,$$

and her participation constraint is

$$\tau\left[\theta V_M(w_{0U}+\bar{w}_U\beta_H r_m)+[1-\theta]V_M(w_{0U}-\underline{w}_U\beta_L r_m)\right]$$
$$+[1-\tau][\theta V_M(w_{0U}+\bar{w}_U\beta_L r_m)+[1-\theta]V_M(w_{0U}-\underline{w}_U\beta_H r_m)]-\psi\geq V_{M0}.$$

It is clear that the untalented CEOs' participation and incentive-compatibility constraints are binding in the optimal contract (the proof is similar to that in Proposition 1). From the untalented CEOs' two binding incentive-compatibility constraints, we have

$$\begin{aligned}
V_M(w_{0U}-\underline{w}_U\beta_L r_m)-V_M(w_{0U}-\underline{w}_U\beta_H r_m) &= \frac{\psi}{[1-\theta][2\tau-1]},\\
V_M(w_{0U}+\bar{w}_U\beta_H r_m)-V_M(w_{0U}+\bar{w}_U\beta_L r_m) &= \frac{\psi}{\theta[2\tau-1]},\\
\theta V_M(w_{0U}+\bar{w}_U\beta_L r_m)+[1-\theta]V_M(w_{0U}-\underline{w}_U\beta_H r_m) &= V_{M0}-\frac{\psi}{2\tau-1},
\end{aligned}$$

i.e.,

$$\frac{A+w_{0U}-\underline{w}_U\beta_L r_m}{A+w_{0U}-\underline{w}_U\beta_H r_m} = e^{\frac{\psi}{[1-\theta][2\tau-1]}}, \tag{A8}$$

$$\frac{A+w_{0U}+\bar{w}_U\beta_H r_m}{A+w_{0U}+\bar{w}_U\beta_L r_m} = e^{\frac{\psi}{\theta[2\tau-1]}}, \tag{A9}$$

$$(A+w_{0U}+\bar{w}_U\beta_L r_m)^{\theta}(A+w_{0U}-\underline{w}_U\beta_H r_m)^{1-\theta} = e^{V_{M0}-\frac{\psi}{2\tau-1}}. \tag{A10}$$

The solutions to (A5) – (A10) are

$$\bar{w}_T^* = \frac{e^{V_{M0}+\psi}\left[1-e^{-\frac{d}{1-\theta}}\right]}{[\beta_H-\beta_L]r_m}\left[\frac{\beta_H e^{\frac{d}{1-\theta}}-\beta_L}{\beta_H-\beta_L e^{\frac{d}{1-\theta}}}\right]^{1-\theta}, \tag{A11}$$

$$\underline{w}_T^* = \frac{e^{V_{M0}+\psi}\left[1-e^{-\frac{d}{1-\theta}}\right]}{[\beta_H-\beta_L]r_m}\left[\frac{\beta_H-\beta_L e^{\frac{d}{1-\theta}}}{\beta_H e^{\frac{d}{1-\theta}}-\beta_L}\right]^{\theta}, \tag{A12}$$

$$\bar{w}_U^* = \frac{e^{V_{M0}+\psi+\frac{\psi}{2\tau-1}[\frac{1}{1-\theta}-2\tau]}\left[1-e^{-\frac{\psi}{[1-\theta][2\tau-1]}}\right]}{[\beta_H-\beta_L]r_m}\left[\frac{\beta_H e^{\frac{\psi}{[1-\theta][2\tau-1]}}-\beta_L}{\beta_H-\beta_L e^{\frac{\psi}{[1-\theta][2\tau-1]}}}\right]^{1-\theta}, \tag{A13}$$

$$\underline{w}_U^* = \frac{e^{V_{M0}+\psi+\frac{\psi}{2\tau-1}[\frac{1}{1-\theta}-2\tau]}\left[1-e^{-\frac{\psi}{[1-\theta][2\tau-1]}}\right]}{[\beta_H-\beta_L]r_m}\left[\frac{\beta_H-\beta_L e^{\frac{\psi}{[1-\theta][2\tau-1]}}}{\beta_H e^{\frac{\psi}{[1-\theta][2\tau-1]}}-\beta_L}\right]^{\theta}. \tag{A14}$$

Denote $[2\tau-1]d/\psi\equiv y$. We assume $\tau\leq\frac{0.5}{1-\theta}$, i.e., the untalented CEO's signal precision is sufficiently low. It is clear that $\bar{w}_U^*$ is decreasing in y. Note that if $y=1$, then $\bar{w}_T^*/\bar{w}_U^*=e^{\frac{\psi}{2\tau-1}\left[2\tau-\frac{1}{1-\theta}\right]}<1$, whereas as $y\uparrow\infty$, we have $\bar{w}_T^*>\bar{w}_U^*$. Thus, there exists a cutoff value for d, denoted as $d^*>\psi/[2\tau-1]$, such that for $d>d^*$, we have $\bar{w}_T^*>\bar{w}_U^*$. □

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Table I: Summary Statistics

Descriptive statistics of chief executive officers (CEOs) and firms. The data are collected for every CEO in the ExecuComp database for the period 1992–2004. Panel A summarizes the full ExecuComp sample, and Panel B summarizes the sub-sample that only includes firms with fiscal year ending in December and excludes the firm-years with CEO transition. *Market Value* is the firm's equity market capitalization at the end of the firm's fiscal year. *Salary* and *Bonus* represent the CEO's yearly salary and bonus values, respectively. *Option Grants* represents the Black and Scholes value of the options granted to the CEO in the year. *Total Compensation* is the sum of salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and stock option awards. *Age* is the CEO's age in the data year, and *Tenure* for any year is calculated as the difference between the fiscal year-end of that year and the date at which the CEO became CEO as given by the BecameCEO field in ExecuComp. *Stock return* is the one-year percentage return for the firm over its fiscal year. The standard deviation of stock returns, *Volatility*, is computed using the five years of monthly data preceding the data year. Compensation data are in thousands, and market values are in millions of yearly dollars.

Panel A: Summary Statistics for Full ExecuComp Sample

Variable	N	Mean	Min	Median	Max	Std. Dev.
Salary ($ thousand)	21019	609.66	0.00	550.00	5,806.65	339.88
Bonus ($ thousand)	21019	700.99	0.00	341.54	102,000.00	1,600.04
Option Grants ($ thousand)	20822	2,175.33	0.00	530.99	600,000.00	8,797.18
Total Compensation ($ thousand)	20822	4,350.78	0.00	2,017.60	655,000.00	11,000.00
Tenure (Years)	18919	7.53	0.00	5.25	49.94	7.06
Age (Years)	8978	58.20	37.00	58.00	92.00	7.84
Stock Return	20983	0.19	-0.98	0.11	26.19	0.65
Volatility	20162	0.43	0.10	0.36	4.21	0.25
Market Value ($ million)	20941	6,072.41	1.94	1,291.79	602,432.90	20,407.72
Log(Assets)	21009	7.39	1.23	7.22	14.22	1.76

Panel B: Summary Statistics for Our Sub-sample

Variable	N	Mean	Min	Median	Max	Std. Dev.
Salary ($ thousand)	13025	641.20	0.00	589.40	5,806.65	353.63
Bonus ($ thousand)	13025	749.51	0.00	380.16	102,000.00	1,710.13
Option Grants ($ thousand)	12956	1,974.48	0.00	534.83	291,000.00	6,634.04
Total Compensation ($ thousand)	12956	4,292.33	0.00	2,128.86	293,000.00	8,294.89
Tenure (Years)	11867	7.97	0.99	5.91	45.02	6.81
Age (Years)	5504	58.72	38.00	59.00	91.00	7.76
Stock Return	13005	0.19	-0.98	0.12	14.94	0.61
Volatility	12524	0.41	0.10	0.34	4.21	0.24
Market Value ($ million)	12981	6,683.11	1.94	1,534.74	507,216.70	20,977.15
Log(Assets)	13018	7.66	1.23	7.54	14.22	1.83

Table II: Market Indices

This table reports the summary statistics of the two market indices that we use in our baseline specification to estimate the systematic and idiosyncratic components of firm performance: equal-weighted industry return and value-weighted industry return. We define the firm's industry at the level of two-digit SIC code. The data are collected for every firm in which a chief executive officer (CEO) in ExecuComp is identified as defined by the CEOANN field for each year 1992-2004. The percent positive (negative) represents the proportion of the sample for which the relative benchmark return is positive (negative).

Variable	Percent positive	Percent negative	Min	Median	Max	Std. Dev.
Equal-Weighted Industry Return	70%	30%	-96%	12%	942%	43%
Value-Weighted Industry Return	78%	22%	-96%	20%	485%	147%

Table III: Pay for Systematic Return

This table reports the results of the regression relating CEO compensation to the systematic and idiosyncratic components of firm performance. Specifically, we estimate the panel corrected OLS regression: $z_{it} = \beta_1 \text{Systematic}_{it} + \beta_2 \text{Idiosyncratic}_{it} + \gamma \text{X}_{it} + \mu_e \text{E} + \mu_t \text{T}$, where z is *Total Compensation* in Column (1), *Bonus* in Column (2) and *Option Grants* in Column (3). *Total Compensation* is the sum of salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and stock option awards, *Bonus* is the bonus award during a year and *Option Grants* is the Black and Scholes value of option grants during a year. *Systematic* is the systematic component of firm performance estimated using the equal- and value-weighted industry returns, where industry is defined at the two-digit SIC code level. *Idiosyncratic* is the residual firm performance and is estimated as the difference between firm return and the systematic component of firm return. Robust standard errors are reported in parentheses, and the coefficients on the intercept, the CDF of the dollar variance return, and the year and executive fixed effects are suppressed for convenience. The compensation data are from ExecuComp, and stock returns are from CRSP. The sample includes all CEO-firm year data from ExecuComp after excluding CEO transition years and firms with fiscal year ending other than December for the years 1992-2004. The standard errors are clustered at individual executive level. Asterisks denote statistical significance at the 1% (∗∗∗), 5% (∗∗) and 10% (∗) levels.

	Total Compensation	Bonus	Option Grants
	(1)	(2)	(3)
Systematic	1.068	.364	.106
	(.352)***	(.125)***	(.242)
Idiosyncratic	.748	.311	-.132
	(.310)**	(.068)***	(.189)
Systematic × CDF of Var of Systematic	-.971	-.326	-.053
	(.385)**	(.129)**	(.270)
Idiosyncratic × CDF of Var of Idiosyncratic	-.690	-.304	.212
	(.360)*	(.073)***	(.240)
Obs.	11778	11845	11778
R^2	.513	.66	.42

Table IV: CEO Talent, Strategic Flexibility, and Pay for Systematic Return

This table reports the results of the regression relating CEO compensation to the systematic and idiosyncratic components of firm performance. Specifically, we estimate the panel corrected OLS regression: $z_{it} = \beta_1 \text{Systematic}_{it} + \beta_2 \text{Idiosyncratic}_{it} + \gamma \text{X}_{it} + \mu_e \text{E} + \mu_t \text{T}$, where z is *Total Compensation* in Columns (1) & (2), *Bonus* in Columns (3) & (4) and *Option Grants* in Columns (5) & (6). *Total Compensation* is the sum of salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and stock option awards, *Bonus* is the bonus award during a year and *Option Grants* is the Black and Scholes value of option grants during a year. *Systematic* is the systematic component of firm performance estimated using the equal- and value-weighted industry returns, where industry is defined at the two-digit SIC code level. *Idiosyncratic* is the residual firm performance and is estimated as the difference between firm return and the systematic component of firm return. Robust standard errors are reported in parentheses, and the coefficients on the intercept, the CDF of the dollar variance return, and the year and executive fixed effects are suppressed for convenience. In Panel A we report results for sub-samples of firms with +ve and -ve average idiosyncratic performance, in Panel B we report results for sub-samples of firms with CEOs with above and below median tenure, in Panel C we report results for firms in industries with above and below median capital expenditure, and in Panel D we report results for firms in industries with above and below median R&D expenditures. The compensation data are from ExecuComp, and stock returns are from CRSP. The sample includes all CEO-firm year data from ExecuComp after excluding CEO transition years and firms with fiscal year ending other than December for the years 1992-2004. The standard errors are clustered at individual executive level. The standard errors are clustered at individual executive level. Asterisks denote statistical significance at the 1% (∗∗∗), 5% (∗∗) and 10% (∗) levels.

This panel reports the results of the regression relating CEO compensation to systematic and idiosyncratic components of firm performance after dividing the sample into firm years with CEOs with positive and negative idiosyncratic performance.

Panel A: Pay for Systematic Return: +ve versus -ve Idiosyncratic Return

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	+ve Idiosync	-ve Idiosync	+ve Idiosync	-ve Idiosync	+ve Idiosync	-ve Idiosync
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic	1.331	1.035	.253	.530	.374	-.239
	(.542)**	(.651)	(.175)	(.194)***	(.527)	(.485)
Idiosyncratic	.184	-.140	.198	.530	-.630	-.888
	(.709)	(.563)	(.080)**	(.221)**	(.608)	(.436)**
Systematic × CDF of Var of Systematic	-1.284	-1.088	-.225	-.508	-.331	.189
	(.577)**	(.664)	(.197)	(.198)**	(.570)	(.489)
Idiosyncratic × CDF of Var of Idiosyncratic	.086	.089	-.166	-.531	.895	.850
	(.913)	(.578)	(.091)*	(.224)**	(.804)	(.441)*
Obs.	4165	5170	4189	5205	4165	5170
R^2	.498	.604	.651	.635	.433	.49

This panel reports the results of the regression relating CEO compensation to systematic and idiosyncratic components of firm performance after dividing the sample into firm years with CEOs with above and below median tenure.

Panel B: Pay for Systematic Return: Long versus Short Tenure

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	Long Tenure	Short Tenure	Long Tenure	Short Tenure	Long Tenure	Short Tenure
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic	1.632	-.492	.311	-.018	.520	-.468
	(.641)**	(.739)	(.146)**	(.057)	(.474)	(.685)
Idiosyncratic	1.562	-.296	.343	.044	-.110	-.399
	(.827)*	(.539)	(.087)***	(.035)	(.339)	(.513)
Systematic × CDF of Var of Systematic	-1.644	.621	-.258	.042	-.640	.555
	(.700)**	(.782)	(.153)*	(.061)	(.560)	(.734)
Idiosyncratic × CDF of Var of Idiosyncratic	-1.906	.214	-.328	-.025	.188	.308
	(1.187)	(.711)	(.093)***	(.042)	(.405)	(.683)
Obs.	9815	8906	9887	9005	9815	8906
R^2	.514	.464	.697	.769	.539	.376

This panel reports the results of the regression relating CEO compensation to systematic and idiosyncratic components of firm performance after dividing the sample into firm in industries with above and below median capital expenditure.

Panel C: Pay for Systematic Return: High versus Low Capital Expenditure

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	High Capex	Low Capex	High Capex	Low Capex	High Capex	Low Capex
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic	1.975	1.070	.514	.370	.512	.170
	(.652)***	(.541)**	(.253)**	(.146)**	(.396)	(.405)
Idiosyncratic	.931	.716	.346	.317	-.015	-.246
	(.504)*	(.498)	(.122)***	(.098)***	(.341)	(.290)
Systematic × CDF of Var of Systematic	-2.112	-.895	-.504	-.321	-.616	-.030
	(.704)***	(.606)	(.254)**	(.158)**	(.435)	(.453)
Idiosyncratic × CDF of Var of Idiosyncratic	-.983	-.709	-.365	-.298	-.090	.310
	(.525)*	(.573)	(.138)***	(.104)***	(.351)	(.358)
Obs.	4171	5982	4195	6018	4171	5982
R^2	.647	.551	.632	.699	.636	.447

This panel reports the results of the regression relating CEO compensation to systematic and idiosyncratic components of firm performance after dividing the sample into firms in industries with above and below median R&D expenditure.

Panel D: Pay for Systematic Return: High versus Low R&D Expenditure

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	High R&D	Low R&D	High R&D	Low R&D	High R&D	Low R&D
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic	1.481	.747	.288	.577	.333	.046
	(.430)***	(.676)	(.100)***	(.329)*	(.317)	(.418)
Idiosyncratic	.744	.695	.247	.437	-.198	-.072
	(.396)*	(.422)*	(.070)***	(.151)***	(.244)	(.287)
Systematic × CDF of Var of Systematic	-1.438	-.848	-.262	-.539	-.284	-.172
	(.487)***	(.787)	(.110)**	(.330)	(.363)	(.496)
Idiosyncratic × CDF of Var of Idiosyncratic	-.661	-.802	-.243	-.403	.318	-.031
	(.459)	(.486)*	(.077)***	(.161)**	(.306)	(.355)
Obs.	7704	2449	7748	2465	7704	2449
R^2	.52	.596	.706	.663	.435	.434

Table V: Asymmetric Pay for Systematic Return

This table reports the results of the regression relating CEO compensation to systematic and idiosyncratic components of firm performance. Specifically, we estimate the panel corrected OLS regression: $z_{it} = \beta_1\text{Systematic} \times (\text{+ve Systematic})_{it} + \beta_2\text{Systematic} \times (\text{-ve Systematic})_{it} + \beta_3\text{Idiosyncratic}_{\ it} + \gamma \text{X}_{it} + \mu_e\text{E} + \mu_t\text{T}$, where z is *Total Compensation* in Columns (1) & (2), *Bonus* in Columns (3) & (4) and *Option Grants* in Columns (5) & (6). *Total Compensation* is the sum of salary, bonus, other annual compensation, long-term incentive payouts, other cash payouts, and the value of restricted stock and stock option awards, *Bonus* is the bonus award during a year and *Option Grants* is the Black and Scholes value of option grants during a year. *Systematic* is the systematic component of firm performance estimated using the equal- and value-weighted industry returns, where industry is defined at the two-digit SIC code level. *Idiosyncratic* is the residual firm performance and is estimated as the difference between firm return and the systematic component of firm return. Robust standard errors are reported in parentheses, and the coefficients on the intercept, the CDF of the dollar variance return, and the year and executive fixed effects are suppressed for convenience. In Panel A we report results for the full sample, in Panel B we report results for firms in industries with above and below median capital expenditure, and in Panel C we report results for firms in industries with above and below median R&D expenditures. The compensation data are from ExecuComp, and stock returns are from CRSP. The sample includes all CEO-firm year data from ExecuComp after excluding CEO transition years and firms with fiscal year ending other than December for the years 1992-2004. The standard errors are clustered at individual executive level. Asterisks denote statistical significance at the 1% (∗∗∗), 5% (∗∗) and 10% (∗) levels.

Panel A: Asymmetric Pay for Systematic Return

	Total Compensation	Bonus	Option Grants
	(1)	(2)	(3)
Systematic × +ve Systematic	1.345	.369	.438
	(.385)***	(.132)***	(.283)
Systematic × -ve Systematic	-.203	.340	-1.421
	(.721)	(.130)***	(.581)**
Idiosyncratic	.660	.310	-.238
	(.316)**	(.066)***	(.193)
Systematic × CDF of Var of Systematic	-1.190	-.331	-.316
	(.409)***	(.135)**	(.301)
Idiosyncratic × CDF of Var of Idiosyncratic	-.602	-.302	.317
	(.368)	(.071)***	(.249)
Obs.	11778	11845	11778
R^2	.514	.66	.423

Panel B: Asymmetric Pay for Systematic Return: High versus Low Capital Expenditure

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	High Capex	Low Capex	High Capex	Low Capex	High Capex	Low Capex
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic × +ve Systematic	2.059	1.209	.583	.339	.635	.402
	(.666)***	(.549)**	(.282)**	(.146)**	(.425)	(.415)
Systematic × -ve Systematic	1.721	.048	.303	.593	.139	-1.536
	(.814)**	(1.151)	(.210)	(.195)***	(.497)	(.881)*
Idiosyncratic	.907	.661	.326	.329	-.050	-.337
	(.502)*	(.506)	(.113)***	(.099)***	(.341)	(.293)
Systematic × CDF of Var of Systematic	-2.182	-.979	-.562	-.303	-.718	-.171
	(.710)***	(.614)	(.278)**	(.157)*	(.456)	(.461)
Idiosyncratic × CDF of Var of Idiosyncratic	-.958	-.658	-.345	-.309	-.053	.395
	(.521)*	(.580)	(.127)***	(.105)***	(.350)	(.361)
Obs.	4171	5982	4195	6018	4171	5982
R^2	.647	.552	.633	.699	.636	.449

Panel C: Asymmetric Pay for Systematic Return: High versus Low R&D Expenditure

	Total Compensation	Total Compensation	Bonus	Bonus	Option Grants	Option Grants
	High R&D	Low R&D	High R&D	Low R&D	High R&D	Low R&D
	(1)	(2)	(3)	(4)	(5)	(6)
Systematic × +ve Systematic	1.624	1.301	.271	.577	.566	.653
	(.455)***	(.715)*	(.105)***	(.353)	(.347)	(.553)
Systematic × -ve Systematic	.673	-1.437	.389	.576	-.993	-2.350
	(.791)	(1.648)	(.138)***	(.267)**	(.666)	(1.472)
Idiosyncratic	.688	.578	.254	.437	-.290	-.200
	(.400)*	(.452)	(.069)***	(.147)***	(.246)	(.318)
Systematic × CDF of Var of Systematic	-1.535	-1.348	-.250	-.539	-.443	-.720
	(.501)***	(.818)*	(.113)**	(.351)	(.379)	(.617)
Idiosyncratic × CDF of Var of Idiosyncratic	-.608	-.673	-.250	-.403	.406	.111
	(.469)	(.514)	(.075)***	(.157)**	(.316)	(.381)
Obs.	7704	2449	7748	2465	7704	2449
R^2	.52	.6	.706	.663	.436	.443