CEO Incentive Compensation and Stock Return Sensitivities

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Abstract

This paper explores the relationship between CEO incentive compensation and the resulting stock return sensitivities in response to firms' earnings announcements. Using Dow Jones Industrial data over the period from 1994 to 2001, I find that the stock returns are more sensitive to the higher CEO pay-performance ratios, regardless of earnings categories. This implies that CEOs whose incentive compensation are high are more (less) likely to be involved in overstatement when the firms' earnings are bad (good). This finding suggests not only that there exist overstatements in firms' earnings announcements, but also that the market is rational enough to consider CEO incentive compensation in discounting reported earnings.

Keywords: CEO incentive compensation, Earnings overstatement, Stock return sensitivities

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1. Introduction

Economists have largely welcomed strong performance-pay for managers, such as bonus, large grant of stocks and stock options, as a good corporate governance practice (Holmström 1982, Holmström and Milgrom 1987, Gibbons and Mulphy 1992). Empirically, for instance, higher levels of share of equity and share of equity-based managers' compensation added more value to firms (Mehran 1995).

However, recent corporate scandals (e.g. Enron, Worldcom) have demonstrated the potential cost of such strong performance-pay, that is, the managers may overstate their true performance to inflate the stock price.[1] For example, in Enron, the incentive compensation for the top five executives was extremely high (91.86% of total compensation in 1996, 96.65% in 2000).[2] This exceptional level doubtlessly contributed to the scandals that followed. Therefore, strong performance-pay might lead to mixed results of productive effort and overstatement effort to the firm's output. Thus, there has been an increasing number of theoretical and empirical studies on the relationship between earnings overstatement (or earnings management) and performance-pay, such as stock options (for empirical studies, see, e.g., Ke 2002, Gao and Shrieves 2002, Bergstresser and Philippon 2003; for theoretical studies, see, e.g., Dye 1988, Maggie and Rodriguez-Clare 1995, Crocker and Slemrod 2005).

Given that overstatement of performance is so widespread[3] and a serious problem in many aspects of the economy, a CEO's overstatement of her firm's earnings, in particular, could mislead not only investors but also other agents in the market. Thus the detection of firms' earnings overstatement and examination of this with CEOs' performance-pay is a topic of interest and importance to a wide variety of agents in the economy, such as

[1] In an article of *Business Week*, Byrne (2002) argues that "The tyranny of the daily stock price has led to borderline accounting and in some cases, outright fraud. And why not, when every upward tick of the stock means massive gains for option-rich executives?"

[2] *Source*: Forbes 3/22/2002

[3] "Fradulent accounting for earnings is to everyday business management what tax fraud, a rare practice, is to everyday tax chiseling." - Degeorge, Patel and Zeckhauser (2005)

investors, auditors and regulators.

This paper investigates the link between CEO incentive compensation and the resulting stock return sensitivities in response to firms' earnings announcements. In particular, we empirically analyze whether the stock market response to the announced earnings' depends on the CEOs performance-pay as predicted by the model. Theoretically, the model predicts that the sensitivity of stock returns to announced earnings should increase with the performance-pay, despite the increased level of overstatement.[4] We propose a new indicator for overstatement, earnings surprise (ES) sensitivities of stock returns (hereafter stock return sensitivities), which measures the responsiveness of stock returns with respect to earnings surprise.Since we cannot correctly measure an agent's overstatement or the effort, we empirically study whether stock market behaves as if it rationally expects CEOs to overstate their firms' earnings. Thus, by analyzing these sensitivities of stock return, the relative size of overstatement can be inferred.

An important advantage of this approach is that it does not require the direct measurement of overstatement of a firm's earnings. In contrast, many previous studies have used the discretionary accrual as a proxy of overstatement (or earnings manipulation in general), and studied how the monetary incentives of managers affect the earnings management (see, e.g., Ke (2002), Gao and Shrieves (2002), Bergstresser and Philippon (2003)). However, such an approach is subject to a criticism and debate whether the accrual (or which accrual) is a good proxy. For example, Krishnan et. al. (1999) criticize that the accrual is observable, not only to the econometricians, but also to the market. Therefore, if the accrual is indeed a good measure of overstatement or earnings management, CEOs cannot deceive the market and will not engage in costly earnings management (see also Schipper (1988)). Thus, they build their tests based on the skewness of the distribution of announced earnings. Similarly, McNichols and Wilson (1988) test earnings management based on the provision for bad debts. Even when the accrual is used as a proxy, Beneish

[4]For the detailed theoretical model, refer to a paper by Kwon and Yeo (2009)

(2001) shows that there exists wide variations/disagreements on which accrual (e.g. total accrual or discretionary accrual) should be used.

Under the assumption of rational market expectation, the effect of good news/bad news of earnings determines the direction of movement in stock returns, while the effect of the size of overstatement relative to true earnings determines their sensitivities. For example, when a firm announces its earnings larger than the median of analysts' forecasts, the stock return will rise regardless of past efforts taken by the CEO. Since the market knows the level of each effort, the stock return will rise relatively less if the relative size of overstatement of earnings has been larger than it will if relative size of overstatement of earnings has been smaller. The unexpected terms in earnings movement are measured by the earnings surprise, the gap between actual *reported* earnings and the median forecasts by analysts when the earnings of a firm are announced. Thus, we suggest the measure of stock return sensitivities, which represents how the stock market responds more or less to the given level of earnings surprise. Theoretical predictions of stock return sensitivities is summarized in Table 1.

[Table 1 about here.]

Through examining stock return sensitivities in response to firm's earning announcements, the findings support the theoretical predictions that the size of overstatement by the CEO whose pay-performance ratio is high becomes smaller when the firm's performance is good. Namely, in this case, CEOs who have high pay-performance ratios are less likely involved in overstatement. The resulting stock return sensitivity is high. Similarly, when the firm's performance is bad, CEOs who have high pay-performance ratios are more likely to be involved in overstatement. Thus, the earning surprise sensitivity of stock returns is high.

This study contributes to our understanding of how CEO incentive compensation[5] affect stock return sensitivities for the various levels of earnings. This analysis sheds light

[5] In this study, pay-performance ratios are used as proxies.

on how CEOs effort levels (productive effort and overstatement effort) change with regard to firms' earnings through analyzing a new measure under the assumption of rational expectations of the market.

Using data from Compustat, IBES, CRSP, and Compustat executive Compensation, we measure stock return sensitivities and CEO's pay-performance ratio. We measure the pay-performance ratio by the ratio of all the performance-related components, such as bonus, net value of stock options exercised, and long-term incentive payouts to total compensation. Since the expected earnings per share would be already reflected in the stock price, we use the change in earnings surprise for the effect of the reported earnings. The earnings surprise represents by how much reported earnings in percentage terms differ from the analysts' median earnings. Moreover, to isolate the change in stock price due to the earnings surprise, we measure the percentage change in market performance, by the sum of abnormal stock returns between a day prior and a day after the announcement.

The remainder of the paper proceeds as follows. Section 2 presents predictions of the model where the CEO's incentive to overstate earnings depends on her performance-pay and her private information, leading to the proposal of hypotheses. Sections 3 and 4 set out the data and methodology on which the following analysis is based. Section 5 discusses the results. Section 6 concludes with a discussion of the implications of the results for future research.

2. Model prediction and Hypotheses

Consider an environment in which shareholders (principal) and a CEO (agent) have interests to improve a firm's earnings under rational expectation of the market.[6] Suppose risk-neutral owners of the firm or shareholders propose a contract consisting of a fixed amount of salary and performance-related terms determined by the stock return to a risk-

[6]For a detailed theoretical model, refer to a paper by Kwon and Yeo (2009)

neutral CEO. Due to this introduction of the stock market into the model, shareholders cannot fully commit to the amount of compensation to be given to the CEO. The CEO initially puts productive effort into improving the firm's earnings and this action is followed by the opportunity to overstate earnings with costs (overstatement effort). Note that the real earnings are scaled to be positive, at least 0 for theoretical simplicity.

Let us define earnings surprise sensitivities of stock returns with respect to the reported earnings per share and study how the stock return sensitivities respond to the change in a CEO's pay-performance ratio, β (or PPR in the empirical specification) in her compensation. It measures how much of the stock return would be changed in response to the (unexpected earnings) surprise. Unexpected portion for a firm's earnings depends on the reported earnings. However, stock returns associated with a firm's earnings announcement fully reflects any available information about earnings. Thus, for example, a small change in stock returns compared to large earnings surprise means they are not sensitive to the given change in earnings surprise. If there is no chance to overstate a firm's earnings, stock return sensitivity is more related to uncertainty of long-run performance of the firm or expected bad news that would be followed. However, in the model, the rational market expects that firms overstate their performance. In this situation, stock return sensitivity can be linked to the relative size of overstatement in true performance.

The effect of the CEO's productive effort is evaluated by the market based on stock returns. Once the CEO's productive effort is relatively greater than the falsification effort revealed ex-post, the resulting stock returns are more responsive when the announcements of earnings are considered good. Similar logic can be applied to the case of bad news of earnings.

Now we investigate the effect of the CEO's pay-performance ratios (PPR) in her compensation on the stock return sensitivities. The stock return sensitivities represent the relation between the relative size of overstatement and the firm's true performance. [7]

[7] A CEO's earnings report corresponds to the reported performance, $\widehat{y}$, in the model, and the stock price corresponds to the market performance, $\widetilde{y}$. Therefore, assuming overstatement in earnings reports

Moreover, the sign of the derivative of stock return sensitivities with respect to the pay-performance ratio is positive. It implies that stock returns sensitivities are positively responsive to the pay-performance ratio.

Proposition 1 *Under the rational market expectation and other assumptions made in the section, the relative size of overstatement of CEO decreases in the CEO's pay-performance ratio. Or, mathematically,*

$$\frac{\partial \eta}{\partial \beta} > 0 \tag{2}$$

Proof. See the Appendix. ■

From this relationship, we predict that the stock returns sensitivity increases with the pay-performance ratios regardless of category of earnings announcement. Thus the relative size of overstatement of the CEO is smaller when the firm's performance is good, while that is larger when the firm's performance is bad.

This result may seem counter-intuitive. The model predicts that as the pay-performance ratios increase, the CEO will overstate more. Thus one might think that the stock price would respond less sensitively to the announced earnings. However, because the market will rationally discount the announced earnings as the pay-performance ratios increase, the percentage change of stock price increases. Therefore, we estimate the sign of the derivative in the above to study whether the empirical patterns are consistent with the prediction of the model.

The resulting hypothesis to test is the following:

HYPOTHESIS 1 *Stock returns associated with a firm's earnings announcements are more(less) sensitive to the CEO's pay-performance ratio when the firm's performance are good(bad).*

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and rational market expectation, the stock return sensitivities can be defined as follows:

$$\eta = \frac{d\widetilde{y}}{d\widehat{y}}\frac{\widehat{y}}{\widetilde{y}} = (1 - \frac{\partial m^e(\widehat{y};\beta)}{\partial \widehat{y}})\frac{\widehat{y}}{\widehat{y} - m^e(\widehat{y};\beta)} = \frac{1 - \frac{\partial m^e(\widehat{y};\beta)}{\partial \widehat{y}}}{1 - \frac{m^e(\widehat{y};\beta)}{\widehat{y}}} \tag{1}$$

3. Data

Dow Jones Industrial companies are examined in this study. The total number of companies are 36, but only 30 companies are listed every year. Some companies have been replaced by others over the sample period. The total number of observations is 671. Quarterly earnings per share (EPS) data have been collected from the period, Jan. 1994 to Dec. 2001 for eight years. CEO compensation data have been extracted from Executive compensation in the COMPUSTAT Industrial database. Under the assumption that annual CEO compensation can be evenly spread through every quarter, quarterly CEO compensation is a quarter of the amount of the annual compensation for the corresponding CEO. Actual EPS and analysts' median forecasts are calculated based on the data from the I/B/E/S (Institutional Brokers' Estimate System). Daily stock returns and equally-weighted market return are from the CRSP (Center for Research in Security Prices), while reported earnings announcement dates have been taken from COMPUSTAT Industrial. Since there is no significant difference between actual EPS (data item 7) from the COMPUSTAT and actual EPS from the I/B/E/S, we use actual EPS from the I/B/E/S database.

Earnings surprise[8] measures the change of unexpected earnings in the announced earnings under the assumption that the analysts' forecasts are unbiased and the best expectation available for the actual earnings. Summary statistics for the important variables is presented in Table 2.

[Table 2 about here.]

4. Methodology

In this section, we explain how to test the model predictions in the previous section using data on the compensations of CEOs in Dow Jones Industrial database. We also calculate

[8]Earnings surprise is defined as the percentage change between actual earnings and the median value of analysts' forecasts.

abnormal stock returns (stock returns) associated with firms' earnings announcements. We use a modified event study in order to measure stock returns, which reflect how much stock returns gain or lose due to the impact of events, specifically, firms' earnings announcements.

4.1 Earnings Surprise Sensitivity of Stock Returns

We use event studies repeatedly for every firm and every quarter in order to measure the change in stock returns due to earnings announcements. Event studies are the most commonly used methods in economics and finance for measuring the degree of impact of specific events. Events in this study are firms' quarterly earnings announcements. Each event window consists of 15 days before and after earnings announcement date and is preceded by estimation window, 250 day-period. The market model has been employed to calculate stock returns for firm i and quarter t:

$$R_{it} = \alpha_{0i} + \alpha_{1i} R_{mt} + \varepsilon_{it} \tag{3}$$

where R_{mt} is mean return during the normal period, and the noise, ε_{it} has the following properties: $E(\varepsilon_{it}) = 0$, $var(\varepsilon_{it}) = \sigma^2_{\varepsilon_{it}}$. The OLS gives us unbiased estimates since the size of samples is large enough. The resulting estimates of α and β are used to calculate abnormal returns, indicating how much the stock return rises (or falls) due to having the events compared to mean normal returns. Abnormal returns are the following:

$$AR_{it} = R_{it} - \widehat{\alpha}_{0i} - \widehat{\alpha}_{0i} R_{mt} \tag{4}$$

where AR_{it} is abnormal return associated with a firm's earnings announcement. Adding abnormal returns for each day of the event window provides cumulative abnormal returns (CAR). They represent patterns that either jump up, or down, or remain constant when news arrives.

For each event, we introduce earnings surprise (ES) sensitivity of stock returns. In response to the unexpected portion in actual reported earnings, the change in cumulative abnormal stock returns between the day prior and the day after the announcement date is calculated as follows:

$$\eta = \frac{\text{\% change in stock returns}}{\text{\% change in earnings surprise}} = \frac{\sum_{i=0}^{1} AR_i}{\frac{\text{act EPS-med fcsts}}{\text{abs(med fcsts)}}} \tag{5}$$

where the denominator measures the portion of announced earnings that are unexpected based on the information provided by the median analyst(s), while the numerator represents the change in stock returns for the three days around the announcement dates compared to the normal period.

4.2 CEO Pay-Performance Ratios

In order to define CEO pay-performance ratios, we use two different measures. One is the ratio of incentive-related terms in compensation to total compensation. This measure of ratios of performance-related terms ($PPR1$) in CEO compensations is defined as follows:

$$PPR1 = \frac{SOPTEXER}{SOPTEXER + BONUS + SALARY} \tag{6}$$

where $PPR1$ represents how much of value is realized from exercising options to the CEO compared to her total compensation, $SOPTEXER$ is the net value realized from exercising options[9], $BONUS$ is bonus paid to the CEO, and $SALARY$ is salary paid to the CEO. This relation is more focused on the dollar value increase in the CEO's wealth from exercising options.

As an alternative measure of CEO's pay-performance ratios, we can define $PPR2$ as follows:

$$PPR2 = \frac{BONUS + SOPTEXER + LTIP}{TDC2} \tag{7}$$

[9]This represents the difference in value between the exercise price of the options and the market price of the company's stock on the date of exercise

where $BONUS$ is bonus paid to the CEO, $SOPTEXER$ is the net value realized from exercising options, $LTIP$ is the long-term payouts, and $TDC2$ is total compensation including options exercised. This pay-performance ratio in CEO compensation explains how much performance-related terms consist of total compensation. This total compensation includes the net value of options exercised (TDC2 in Compustat), consisting of salary, bonus, other annuals, total value of restricted stock granted, net value of stock options exercised, long-term incentive payouts, and all other total. Since we focus on the degree of interrelationship in the performance-related terms in CEO compensation (pay-performance ratios), any compensation related to the CEO's performance will be taken into account to define these ratios, such as bonus, net value of stock options exercised, and long-term incentive payouts. We assume that CEO compensation is evenly spread throughout a year because only annual information of compensation is available. This assumption makes sense because each CEO makes a contract that lasts for a few years.

For the CEO's characteristics, we control for CEO tenure ($CEOtenure$) as well as how close one is to the end of her term measured by the number of years from the point of the earnings announcement date ($YEARS$).

4.3 Estimation Method

In order to estimate how much CEO's pay-performance ratios explain stock return sensitivities, we regress these stock return sensitivities on the pay-performance ratio in CEO compensation, CEO tenure, the interaction between pay-performance ratio and CEO tenure, and other control variables. Then the following OLS model can be estimated.

$$\begin{aligned} \eta_{it} &= \gamma_0 + \gamma_1 PPR_{it} + \gamma_2 CEOtenure_{it} \\ &+ \gamma_3 \{PPR \times CEOtenure\}_{it} + \gamma_4 ASSET_{it} + \gamma_5 SPRTRN_{it} \\ &+ \gamma_6 yrdum * + \gamma_7 inddum * + \epsilon_{it} \end{aligned} \tag{8}$$

where $SRsensitivity_{it}$ is earnings surprise sensitivity of stock returns for firm i in period t, specifically, the percentage change in stock returns from the normal period to the announcement period divided by the percentage change in earnings surprise for firm i in period t. PPR_{it} is the pay-performance ratios in CEO compensation, on which we focus throughout this paper; $CEOtenure_{it}$ is the number of years that the CEO has been in the position; $\{PPR_{it} \times CEOtenure_{it}\}$ is an interaction term, explaining the effect of CEO tenure combined with pay-performance ratios on stock return sensitivities. $ASSET_{it}$ is the logarithm of the total value of assets of firm i in period t, $SPRTRN_{it}$ is the S&P 500 index, and $yrdum*$, $inddum*$ are dummy variables for years and for different industries, which are categorized by the first 2-digit number of SIC (Standard Industrial Classification).

In addition to the above regression equation, we can add the number of years approaching the end of the term ($YEARS$), the interaction between pay-performance ratios and the number of years. The inclusion of the later variable is obvious because the moral hazard problem would be relatively more prevailing toward the end of CEOs' term. Due to data loss by including these items, we represent this regression separate from the above.

$$\begin{aligned} \eta_{it} &= \delta_0 + \delta_1 PPR_{it} + \delta_2 CEOtenure_{it} + \delta_3 YEARS_{it} \\ &+ \delta_4 \{PPR \times CEOtenure\}_{it} + \delta_5 \{PPR \times YEARS\}_{it} \\ &+ \delta_6 ASSET_{it} + \delta_7 SPRTRN_{it} + \delta_8 yrdum* + \delta_9 inddum* \\ &+ \epsilon_{it} \end{aligned} \tag{9}$$

where $YEARS_{it}$ is the number of years approaching the end of the CEO's term, and $\{PPR \times YEARS\}_{it}$ is interaction term between the CEO pay-performance ratios and the number of years approaching the end of her term.

In addition to the above OLS models, we also estimate the firm-fixed effect model for each case.

5. Results

5.1 OLS Analysis

We report regression results used by $PPR1$ in Table 3. Notice that $PPR1$ focuses on an increase in a CEO's wealth that results from exercising options. Table 3 depicts the estimated effect of CEO's pay-performance ratio on stock return sensitivities. Panel A represents regression analysis without including the CEO years variable. The estimated coefficient of pay-performance ratio (column 2) is 1.56 and is statistically significant at the 1% significance level. This finding implies that changes in stock returns associated with earnings announcements are more sensitive to higher pay-performance ratios. In other words, CEOs whose pay-performance ratios are higher are likely to make a relative more productive effort when their firms' earnings are good, while they are likely to involve relatively more overstatement when their firms' earnings are bad.

Panel B in Table 3 represents the estimated effects of not only pay-performance ratio, but also CEO years and their interaction terms. When we look at the regression results including the CEO years in Panel B, there are more significant estimated coefficients. Pay-performance ratio also significantly explains the sensitivity of stock returns.

Moreover, the sign of interaction terms between pay-performance ratios and CEO tenure, and CEO years is negative, respectively. The negative sign of interaction term between pay-performance ratios and CEO years implies that stock returns are less sensitive to the pay-performance ratios for the CEOs who have more years ahead. This finding is consistent with what the moral hazard problem might predict. For example, CEOs who are close to the end their terms have a higher incentive to involve overstatement of earnings than those who are far away from the end of their terms when the firm's performance is relatively bad. We have similar findings for the interaction between pay-performance ratios and tenure. Stock returns are less sensitive to pay-performance ratios of CEOs who have been in the position for a long time.

The regression results used by $PPR2$ are reported in Table 4. Notice that $PPR2$ includes in numerator any term that is related to the CEO's performance. Table 4 depicts the estimated effect of a CEO's pay-performance ratio on stock return sensitivities. The estimated coefficient of pay-performance ratio (column 2) is 2.10 and is statistically significant at the 1% significance level. This finding also implies that changes in stock returns associated with earnings announcements are more sensitive to higher pay-performance ratios. Thus, it is consistent with the prediction of the theoretical model. Therefore, using a different measure of CEOs' pay-performance ratios does not affect the main results of the empirical specification.

5.2 FE analysis

In addition to OLS, firm-fixed effects models are used for robustness tests. Table 5 then presents the results with firm-fixed effects included. These estimates are almost identical to those without firm-fixed effects, suggesting that the estimated pay-performance ratios effects and other interaction terms' effects do not reflect omitted firm-fixed characteristics.

In Panel A, we report estimates of firm-fixed effects controlled without including the CEO years variable. The estimated coefficient of $PPR1$ is positive and significant at the 5% significance level. The interaction term between $PPR1$ and $CEOtenure$ also significantly explains the change in stock return sensitivities. For example, stock returns are more sensitive to the pay-performance ratios for CEOs who have been short in the duration of their positions. Thus, they are relatively less (more) likely to be involved with falsification when the firm's earnings are good (bad). In Panel B, we report firm-fixed effects controlled estimates that include the CEO years variable. These estimates are almost identical to the results without firm-fixed effects controlled.

Table 6 shows the regression results with firm-fixed effect controlled by using $PPR2$. These estimates are almost identical except that the estimated coefficient of the interaction term between $PPR2$ and $YEARS$ is not significant. However, the signs are still negative.

Thus all the implications in the OLS remain the same.

6. Conclusions

In this paper, we explore the effect of high incentive compensation for CEOs, proxied by high pay-performance ratios on the relative size of overstatement of firms' earnings with respect to firms' true performance. In order to analyze this relationship, we propose a new indicator for overstatement, earnings surprise sensitivity of stock returns, which measures how stock returns are responsive to the given size of earnings surprise. Based on the theoretical predictions, we test the relationship between CEOs' incentive compensation and the resulting stock returns sensitivities in response to the firm's earnings announcement.

Departing from the previous studies related to CEOs' incentive to overstate their firms' earnings, we shed light not only on the relation between CEO pay-performance ratios and the relative size of overstatement, but also on the relation between this size of overstatement and the firm's performance.

Under the assumption of rational market expectation, we find that stock returns to firms' earnings announcements are likely to be more sensitive to higher CEO performance-pay. This implies that CEOs whose pay-performance ratios are high are more (less) likely to be involved in overstatement when the firm's performance is bad (good). This supports theoretical predictions derived from the study of comparative statics. Moreover, CEOs who have been in the position for a shorter tenure have a higher (lower) incentive to overstate earnings when their firms' performance is bad (good). This finding suggests not only that there exist overstatements in firms' earnings announcements, but also that the market is rational enough to consider CEO's incentive compensation in discounting reported earnings.

Appendix

- Proof of proposition

Proof.

$$sign\{\frac{\partial\eta(\widehat{y};\beta)}{\partial\beta}\} = [-\frac{\partial^2 m^e(\widehat{y};\beta)}{\partial\beta\partial\widehat{y}}][1-\frac{m^e(\widehat{y};\beta)}{\widehat{y}}]-[1-\frac{\partial m^e(\widehat{y};\beta)}{\partial\widehat{y}}][-\frac{1}{\widehat{y}}\frac{\partial m^e(\widehat{y};\beta)}{\partial\beta}] \quad (10)$$

From the relation of $m^e(\widehat{y})$,

$$m^e(\widehat{y}) = \frac{\beta}{k_m}[1-\exp(-\frac{k_m}{\beta}\widehat{y})]. \quad (11)$$

$$\frac{\partial m^e(\widehat{y};\beta)}{\partial\widehat{y}} = \exp(-\frac{k_m}{\beta}\widehat{y}) \quad (12)$$

$$\frac{\partial^2 m^e(\widehat{y};\beta)}{\partial\beta\partial\widehat{y}} = \frac{k_m\widehat{y}}{\beta^2}\exp(-\frac{k_m}{\beta}\widehat{y}) \quad (13)$$

$$\frac{\partial m^e(\widehat{y};\beta)}{\partial\beta} = \frac{1}{k_m}[1-\exp(-\frac{k_m}{\beta}\widehat{y})] + \frac{\beta}{k_m}[-\frac{k_m\widehat{y}}{\beta^2}\exp(-\frac{k_m}{\beta}\widehat{y})] \quad (14)$$

Define $x = \frac{k_m}{\beta}\widehat{y}$.

$$\begin{aligned} sign\{\frac{\partial\eta(\widehat{y};\beta)}{\partial\beta}\} &= [-\frac{x}{\beta}e^{-x}][1-\frac{1}{x}(1-e^{-x})] - \frac{1}{\beta}[1-e^{-x}][-\frac{1}{x}(1-e^{-x})-e^{-x})] \\ &= \frac{1}{x\beta}(e^{-2x}-2e^{-x}+2xe^{-x}-2xe^{-2x}-x^2e^{-x}+1) > 0 \quad (15) \end{aligned}$$

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Table 1: Theoretical Predictions of Stock Return Sensitivities

PPR[1]	Stock Return Sensitivities[2]	Relative Size of Overstatement
	Firm's Performance ($y \uparrow$)	
$PPR \uparrow$	$\uparrow\uparrow$ (more sensitive)	$\frac{m}{y} \downarrow$
$PPR \uparrow$	$\uparrow$ (less sensitive)	$\frac{m}{y} \uparrow$

Notes: This table represents theoretical predictions for earnings surprise sensitivity of stock returns. For example, suppose we observe that stock return sensitivities are more responsive to the earnings announcement when the firm's earnings surprise is positive. This implies that the relative size of overstatement by the CEOs whose pay-performance ratios are high is smaller.

1. Pay-performance ratios represent the portion of CEO compensation tied with her performance out of total compensation.

2. Earning surprise sensitivity of stock returns represents the change in stock returns divided by the earnings surprise. It is only observable ex-post.

Table 2: Summary Statistics

Panel A: Summary statistics for the stock return sensitivity					
	Mean	Std. dev	Bottom 5%	Median	Top 5%
$CAR(-1,1)^1(\%)$	0.334	5.175	-7.836	0.350	9.590
$CAR(-2,2)(\%)$	0.358	5.819	-8.450	0.295	10.29
Estimated EPS	0.676	0.600	0.17	0.4925	2.105
Actual EPS	0.694	0.622	0.173	0.4850	2.238
Earnings surprise (%)	4.442	15.42	-12.55	1.951	24.94
Median_forecast	0.669	0.590	0.168	0.4783	2.200
Price(t+1)	64.08	25.91	30	59.44	111.3

Panel B: Summary statistics for CEO compensation					
	Mean	Std. dev	Bottom 5%	Median	Top 5%
$SALARY$	1205.3	479.50	618.46	1080.0	2000
$BONUS$	2232.3	2660.3	0	1405.3	8000
$SOPTEXER^2$	10741.5	45668.26	0	1633.5	37117
$PPR1$	0.6337	0.2442	0.1537	0.6685	0.9514
$PPR2$	0.380	0.3328	0	0.3953	0.8945
AGE	60.34	5.678	48.35	61	70
$YEARS^3$	4.150	2.128	1	4	8
$TENURE$	5.856	4.232	0	5	14
$SPRTRN^4$	0.0011	0.0107	-0.0174	0.00081	0.1843
$LASST^4$	10.70	1.052	9.484	10.47	12.81

Notes: This table represents summary statistics for selected variables. Panel A shows variables used for earnings surprise sensitivity of stock returns. Panel B represents items in CEO compensation and the corresponding CEO and firm characteristics.

1. CAR represents the cumulative abnormal returns for the specific period due to earnings announcement for a firm-quarter.
2. $SOPTEXER$ is the net value realized from exercising options.
3. $YEARS$ represents how many years are left for a CEO to end her term.
4. $SPRTRN$ refers to S&P 500 index returns and $LASST$ is log of total value of asset for a firm.

Table 3: Regression Analysis used by $PPR1$

Panel A: Regression analysis I (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR1$[1]	1.563***	0.5418	2.88	0.004
$TENURE$	0.0865**	0.0434	1.99	0.047
$PPR1 \times TENURE$	-0.1833**	0.074	-2.48	0.013
No. of obs	671			
R^2	0.07			

Panel B: Regression analysis II (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR1$	7.630***	1.773	4.30	0.000
$TENURE$	0.2776*	0.1500	1.85	0.065
$YEARS^2$	0.3480	0.2281	1.53	0.128
$PPR1 \times TENURE$	-0.6992***	0.1768	-3.95	0.000
$PPR1 \times YEARS$	-0.6278**	0.2739	-2.29	0.023
$TENURE \times YEARS$	0.0095	0.0210	0.45	0.652
No. of obs	263			
R^2	0.20			

Notes: This table represents OLS results used by $PPR1$. $LASST$, $SPRTRN$, and year and industry dummies are omitted in the table.

1. $PPR1$ represents CEO's pay-performance ratio defined as the ratio of net value from exercising options to total compensation for a firm-quarter.

2. $YEARS$ represents how many years are left for a CEO to end her term.

***: significant at 1 % level, **: significant at 5 % level, and *: significant at 10 % level, respectively.

Table 4: Regression Analysis used by $PPR2$

Panel A: Regression analysis I (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR2$[1]	2.104***	0.7257	2.90	0.004
$TENURE$	0.1966**	0.0792	2.48	0.013
$PPR2 \times TENURE$	-0.2911***	0.1087	-2.68	0.008
No. of obs	671			
R^2	0.07			

Panel B: Regression analysis II (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR2$	3.723*	2.094	1.78	0.077
$TENURE$	0.1782	0.1850	0.96	0.336
$YEARS^2$	0.0039	0.2433	0.02	0.987
$PPR1 \times TENURE$	-0.4535**	0.2016	-2.25	0.025
$PPR1 \times YEARS$	-0.1523	0.2971	-0.51	0.609
$TENURE \times YEARS$	0.0194	0.022	0.90	0.368
No. of obs	263			
R^2	0.13			

Notes: This table represents OLS results used by $PPR1$. $LASST$, $SPRTRN$, and year and industry dummies are omitted in the table.

1. $PPR2$ represents CEO's pay-performance ratio defined as the ratio of the all the performance related terms to total compensation(TDC2) for a firm-quarter.

2. $YEARS$ represents how many years are left for a CEO to end her term.

***: significant at 1 % level, **: significant at 5 % level, and *: significant at 10 % level, respectively.

Table 5: Regression Analysis used by $PPR1$ (Firm fixed effects controlled)

Panel A: Regression analysis I (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR1$[1]	1.347**	0.5679	2.37	0.018
$TENURE$	0.0671	.046543	1.44	0.150
$PPR1 \times TENURE$	-0.1793**	0.0760	-2.36	0.019
No. of obs	671			

Panel B: Regression analysis II (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR1$	7.112***	1.913	3.72	0.000
$TENURE$	0.2595	0.1754	1.48	0.141
$YEARS$	0.3524	0.2697	1.31	0.193
$PPR1 \times TENURE$	-0.6246***	0.1906	-3.28	0.001
$PPR1 \times YEARS$	-0.6010**	0.2985	-2.01	0.045
$TENURE \times YEARS$	0.0147	0.0224	0.65	0.513
No. of obs	263			
R^2	0.14			

Notes: This table represents OLS results used by $PPR1$. $LASST$, $SPRTRN$, and year and industry dummies are omitted in the table.

1. $PPR1$ represents CEO's pay-performance ratio defined as the ratio of net value from exercising options to total compensation for a firm-quarter.

2. $YEARS$ represents how many years are left for a CEO to end her term.

***: significant at 1 % level, **: significant at 5 % level, and *: significant at 10 % level, respectively.

Table 6: Regression Analysis used by $PPR2$ (Firm fixed effects controlled)

Panel A: Regression analysis I (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR2$[1]	2.331***	0.7991	2.92	0.004
$TENURE$	0.1986**	0.0841	2.36	0.019
$PPR2 \times TENURE$	-0.3265***	0.1166	-2.80	0.005
No. of obs	671			

Panel B: Regression analysis II (dep. var.: ES sensitivity of stock returns)				
Variable	Coef.	Std. Err.	t	$P > \|t\|$
$PPR2$	6.410***	2.153	2.98	0.003
$TENURE$	0.4195**	0.2002	2.10	0.037
$YEARS$	0.3760	0.2737	1.37	0.171
$PPR1 \times TENURE$	-0.6754***	0.2018	-3.35	0.001
$PPR1 \times YEARS$	-0.3710	0.2995	-1.24	0.217
$TENURE \times YEARS$	0.0160	0.0214	0.75	0.455
No. of obs	263			
R^2	0.13			

Notes: This table represents regression results controlled firm fixed effects used by $PPR2$. $LASST$, $SPRTRN$, and year and industry dummies are omitted in the table.

1. $PPR2$ represents CEO's pay-performance ratio defined as the ratio of the all the performance related terms to total compensation(TDC2) for a firm-quarter.

2. $YEARS$ represents how many years are left for a CEO to end her term.

***: significant at 1 % level, **: significant at 5 % level, and *: significant at 10 % level, respectively.