 http://dx.doi.org/10.17287/kmr.2020.49.1.183

The Determinants of Pay-for-Performance Sensitivity and Convexity of CEO Bonus Contracts: Evidence from S&P 1500 Firms*

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Recent studies have suggested that CEO's annual bonus plans have an incentive effect comparable to stock compensation (Frydman and Jenter, 2010; Jensen and Murphy, 2011; Guay, Kepler, and Tsui, 2019). However, only a limited number of papers have addressed annual bonuses of CEOs. The aim of this paper is 1) to overview the comprehensive landscape of executive bonus plans 2) and to investigate the determinants of pay-for-performance sensitivity (hereafter, "PPS") and the convexity in annual bonuses. We find that the 80/120% rule for target setting for annual bonus plans holds on average, with some differences across industries. We also show that firms' growth opportunities are one of the key elements in determining bonus PPS and the convexity of bonus payouts after controlling for peer firm information and other economic factors.

Key words: annual bonus plans, pay-for-performance sensitivity, convexity, executive compensation

Ⅰ. Introduction

The annual bonus of the Chief Executive Officer is one of the most important elements of the CEO compensation package (Frydman and Jenter, 2010; Jensen and Murphy, 2011; Guay et al., 2019). Jensen and Murphy (2011) argue that annual bonuses are sometimes more effective in motivating executives than equity compensation because annual bonuses are paid annually by cash, whereas equity compensation is paid over multiple periods. Guay et al. (2019) similarly argue that the pay-for-performance sensitivity of cash compensation is steeper than that of the equity

최초투고일: 2019. 5. 22 수정일: (1차: 2019. 11. 27) 게재확정일: 2019. 12. 17
* This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF- 2018S1A5A2A02066328). Professor Jae Yong Shin acknowledges financial support from the Institute of Management Research at Seoul National University.

compensation *Delta*. Despite its importance, researchers have not paid much attention to executive bonus plans due to the lack of data availability.[1)] Research topics for bonus contracts have also been limited. Most prior studies have been centered around target setting (Indjejikian and Nanda, 2002; Leone and Rock, 2002; Aranda, Arellano, and Davila, 2014; Indjejikian, Matějka, Merchant, and Van der Stede, 2014; Bol and Lill, 2015) or performance measure selection (Banker and Datar, 1989; Lambert and Larcker, 1987; Sloan, 1993; Bushman, Indjejikian, and Smith, 1996; Ittner, Larcker, and Rajan, 1997).[2)]

In 2006, the U.S. Securities and Exchange Commission (SEC) adopted new executive compensation disclosure rules. The new disclosure rules require all listed U.S. firms to disclose detailed information on top executive compensation packages in the proxy statements.[3)] Recent research has taken advantage of these new executive disclosure rules. For example, Bennett, Bettis, Gopalan, and Milbourn (2015) use Incentive Lab data to revisit managers' earnings management behavior in order to beat compensation targets.[4)] Curtis, Li, and Patrick (2019) investigate the use of adjusted earnings in bonus contracts for S&P 500 firms. Kim and Shin (2017) study asymmetric target ratcheting. Following recent research, the aim of this paper is to overview the comprehensive features of executive annual bonus plans and investigate pay-for-performance sensitivity (hereafter, "PPS") of bonus plans using hand-collected data from the proxy statements of S&P 1500 firms.

We show that more than 60% of S&P 1500 firms use earnings measures to determine the annual bonus amount. The relative usage of performance measures varies across industries. For instance, industries in which managing margins is crucial to generating profits are more likely to select earnings measures. We also find a positive association between noise and the use of earnings measure (Lambert and Lacker, 1987; Banker and Datar, 1989). Furthermore, the 80/120% rule for performance standards holds for S&P 1500 firms. The average bonus cap is $ 2,351,020 and the average bonus floor is $ 376,732. The average bonus payout in the incentive zone is convex, that is, the slope above the bonus target is steeper than below the target.

Prior studies have found mixed results for

1) Prior studies in bonus compensation use data from a single firm with several divisions (Leone and Rock, 2002; Bouwens and Kroos, 2011; Aranda et al., 2014; Bol and Lill, 2015) or survey data (Bushman et al., 1996; Indjejikian and Nanda, 2002; Indjejikian, Matějka, Merchant, and Van der Stede, 2014; Lambert and Lacker, 1987).
2) Arnaiz and Salas-Fumás (2008) is an exception. This paper analytically investigates the relation between the volatility and kurtosis of performance and PPS of bonus plans.
3) See the SEC's final rule 33-8732a (https://www.sec.gov/rules/final/2006/33-8732a.pdf) for more detail.
4) Incentive Lab is a database that covers long-term and short-term compensation targets and goals of large U.S. firms (S&P 500 and a significant portion of S&P 400) from 1998.

the relation between growth opportunities of firms and the sensitivity of compensation to performance (Smith and Watts, 1992; Gaver and Gaver, 1993; Baber, Janakiraman, and Kang, 1996; Cadman, Klasa, and Matsunaga, 2010). Using hand-collected data on how firms estimate PPS, we find a positive association between firms' growth opportunities and the annual bonus PPS after controlling for peer firm information (Aranda et al., 2014) and other factors discussed in prior studies (Arnaiz and Salas-Fumás, 2008). We also find that growth firms are more likely to use convex bonus payouts for the executive annual incentive plan.

This paper has several contributions. Prior research investigates the relation between PPS of equity compensation and growth opportunities and find a positive association between these variables (Smith and Watts, 1992; Gaver and Gaver, 1993; Baber et al., 1996). Researchers have not paid much attention to the relation between cash compensation PPS and growth opportunities because the monetary incentives of annual bonus plans seem smaller compared to that of equity-based plans (Jensen and Murphy, 1990; Hall and Liebman, 1998; Core, Guay, and Verrecchia, 2003). Bonus compensation has generally been assumed to be less effective than equity-based plans in motivating executives. However, recent studies (e.g., Jensen and Murphy, 2011 and Guay et al., 2019) argue that short-term bonuses are as effective as equity compensation and the structure of annual incentives is altogether different from the structure of equity incentives. Therefore, it is important to study whether the findings for equity compensation can be applied to bonus compensation.

Second, this paper provides empirical results on the determinants of PPS of CEO annual bonus plans based on a large cross-sectional sample. Prior studies on the PPS of executive bonus contracts derive results from an analytic model (Arnaiz and Salas-Fumás, 2008) or compare equity compensation *Delta* and bonus PPS (Guay et al., 2019). The findings of this study may be more generalizable because we observe several important cross-sectional variables such as peer firm information. We define peer firms as the firms in the same two-digit sic code industry in the same year. Peer firm information is an important factor in designing compensation contracts (Albuquerque, 2009; Gong, Li, and Shin, 2011; Aranda et al., 2014; Indjejikian et al., 2014; Indjejikian, Matějka, and Schloetzer, 2014; Bol and Lill, 2015). However, peer firm information has not been examined in the context of annual bonus PPS.

Third, we find there is no association between bonus PPS or the convexity of annual bonus payoffs and equity compensation *Delta*. These findings implicitly indicate that designing annual bonus contracts can be different from designing equity compensation contracts. One of the reasons that bonus PPS has not been studied is that researchers have implicitly assumed that research on equity compensation *Delta* sheds light on annual bonus PPS as well. However, the boards' motivation in setting bonus PPS could be altogether different from that of setting equity compensation *Delta*. This paper addresses an important yet unexplored area of research.

The remainder of this paper is organized as follows. Section 2 summarizes prior literature and develops the hypotheses. The research design and sample selection are described in Section 3. Section 4 reports empirical results, and Section 5 concludes.

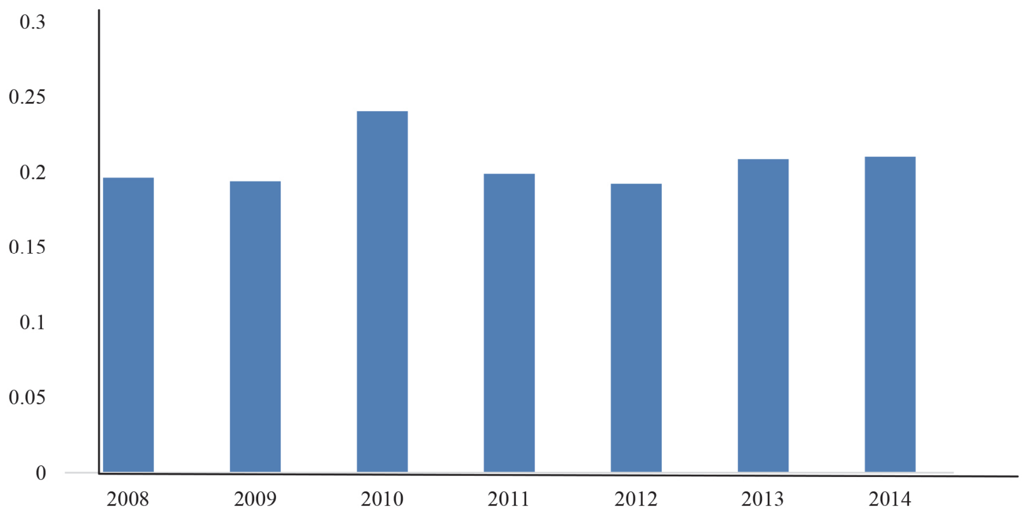
Ⅱ. Related Literature and Hypothesis Development

2.1 Annual Incentive Contract

Annual bonuses are one of the most important elements in the executive compensation package. Figure 1 illustrates the percentage of the annual bonus in the CEO total compensation from 2008 to 2014. The annual bonus is a substantial part of CEO compensation and the average percentage of the annual bonus in CEO compensation is approximately 20%. In addition, recent literature on annual bonus plans suggest that the magnitude of PPS of annual bonuses is comparable to that of equity compensation and that annual bonuses provide significant incentives for new CEOs (Guay et al., 2019).

Jensen and Murphy (2011) also point out several reasons why annual bonuses are effective in motivating managers. First, CEOs generally receive annual bonuses for their accounting performance. CEOs have a thorough understanding of the various factors related to increasing accounting performance, whereas there is still ambiguity regarding the factors related to increasing stock prices used for stock compensation. Second, immediate and tangible cash awards could easily motivate CEOs to increase effort. Third, performance measures for annual incentive contracts can be customized to each CEO. For example, CEO succession planning was a performance measure of the 2013 annual incentive plan for the CEO of Laboratory Corporation of America Holdings. To motivate CEOs to be involved in the succession planning, the compensation committee included this aspect in the bonus contracts. In sum, annual bonus is a key element of the CEO compensation package that provides direct and substantial motivation for CEOs.

As mentioned in Section 1, annual bonuses have not attracted much attention from accounting researchers due to data limitations. In 2006, details of executive bonus plans became available to researchers after the



〈Figure 1〉 The percentage of Annual Bonus in CEO Total Compensation from 2008 to 2014

SEC adopted new disclosure rules requiring firms to disclose their detailed executive compensation structures in the Compensation Discussion and Analysis (CD&A) section of proxy statements. Companies are required to document their performance measures, targets, and overall compensation structures for executive compensation contracts. Appendix A provides an example of the CD&A section for El Paso Electronic Company. El Paso Electronic Company not only discloses the performance measures used in CEO bonus contracts, but also provides the relative weights and standards for each performance measure. Thus, researchers can capitalize on this newly available data to understand the structure of annual bonus plans.

2.2 Pay-for-performance sensitivity (PPS)

CEO annual bonus plans typically consist of three factors (Murphy, 2001): 1) Pay-for-performance sensitivity (PPS), 2) performance targets or standards,[5] and 3) performance measures. Pay-for-performance sensitivity (PPS) is the relation between compensation and performance. PPS is an example of results control, that is, compensating employees for generating good results (Murphy, 2001). Well-designed PPS of bonus plans can motivate managers to generate positive results (Murphy, 2001). Early studies in PPS investigate the association between performance measured by ROA, ROE or stock returns and compensation (Baber et al., 1996). However,

5) Performance standards are typically composed of a target, a threshold, and a maximum.

other than the relation between stock returns and compensation,[6)] the relation between ROA/ROE and compensation may not be an appropriate proxy for PPS because performance measures in bonus plans frequently differ and can be customized to individual executives (Jensen and Murphy, 2011).

Core and Guay (2002) develop *Delta* and *Vega* as more sophisticated PPS measures for equity compensation. *Delta* is the sensitivity of the option portfolio value to the stock price and *Vega* is the sensitivity of the CEO's incentive portfolio value to stock return volatility (Core and Guay, 2002). Numerous studies have investigated the factors influencing *Delta* or *Vega* and the effect of *Delta* or *Vega* on managerial behavior. On the contrary, the PPS of annual bonuses has not received much attention because annual bonus data was not available until 2006 and researchers considered annual bonuses to have marginal importance in the total compensation.

Arnaiz and Salas-Fumás (2008) provide a rare study on bonus PPS. Arnaiz and Salas-Fumás (2008) analytically investigate the sources of factors affecting PPS and performance maximum of annual bonus plans. They find that the degree of PPS decreases and the performance maximum increases with performance volatility. The intuition behind these findings is that the performance volatility negatively affects the incentive power of risk averse agents. Thus, the pay-for-performance relationship of annual bonuses decreases as performance volatility increases. However, higher volatility of performance widens the informative area of performance measures, therefore, the bonus cap becomes higher. Arnaiz and Salas-Fumás (2008) also argue that PPS increases and the bonus cap decreases with the kurtosis of performance. They suggest that these results occur because higher kurtosis is a proxy for the narrower range of informative performance measures, and "a narrower zone of informative realizations of the performance variable" (Arnaiz and Salas-Fumás, 2008, p.144) makes the relation between performance and bonuses steeper.

Other than the volatility and kurtosis of performance, firms' growth opportunities could be a potential consideration when boards set executive bonus PPS. Firms with growth opportunities would increase their firm value by investing in positive NPV projects (Myers, 1977). Growth firms are more likely to obtain future economic rent from these investments because patents or firm specific knowledge that generate rent cannot be easily imitated by competitors (Tirole, 1988).

Several papers directly study the link be-

6) The magnitude of stock compensation increases as the stock returns increases. Hence, the relation between stock returns and the amount of stock compensation is directly tied to pay-for-performance sensitivity.

tween growth opportunities and PPS (Baber et al., 1996; Cadman et al., 2010). For example, Baber et al. (1996) investigate the cross-sectional association between the PPS of CEO compensation and a firm's investment opportunities. If boards cannot easily understand the nature of growth opportunities of the high growth firms, managers would have more room to manipulate their observable actions to their own benefit. Because the agency problem is more severe in growth firms (Smith and Watts, 1992; Gaver and Gaver, 1993), boards in growth firms would increase PPS to reduce agency conflicts. Indeed, Baber et al. (1996) find a significantly positive association between the compensation-stock return sensitivity and growth opportunities. However, they find an insignificant association between sensitivity of compensation to ROE and growth opportunities because accounting earnings are less informative than stock returns in capturing firms' growth (Smith and Watts, 1992; Gaver and Gaver, 1993). Hence, there can be no association between growth opportunities and bonus PPS.

On the contrary, it is also possible that misspecification issues drive the insignificant relation between the sensitivity of CEO compensation to accounting performance and investment opportunities in prior literature. Baber et al. (1996) and Cadman et al. (2010) use ROE as the accounting performance measure when they test the relation of PPS and growth opportunities because ROE is comparable to stock returns. However, in practice, ROE may not be the best proxy for accounting performance in bonus contracts. In our sample, only 3% of performance measures consist of ROE or ROA. The most widely used performance measure is EPS or unscaled earnings (Panel A, Table 3).

In addition, the assumption of prior studies (Baber et al., 1996; Cadman et al., 2010) that accounting performance is less informative than market performance for firms with investment opportunities may not be correct. We conjecture two reasons why accounting performance can be as informative as stock returns. First, compensation earnings and EPS are generally non-GAAP earnings (Curtis et al., 2019). If boards optimally adjust earnings to motivate managers, using adjusted earnings as performance measures can be also informative performance measures for growth firms. Second, compensation committees adjust accounting performance measures if necessary. Expenses related to acquisitions are generally excluded when adjusting compensation earnings (Curtis et al., 2019). Similarly, firm growth may be hurt because managers opportunistically reduce R&D expenditures to increase their cash compensation. However, Cheng (2004) argue that there is no association between R&D reduction and the amount of cash compensation, suggesting that compensation committees effectively respond to managers' opportunistic R&D reduction. In sum, accounting performance measures may be more informative than previously thought by researchers. Therefore, it may be possible to find a significantly positive association between bonus PPS and growth opportunities if appropriate performance measures are used when calculating PPS.

There is another argument for the relation between growth opportunities and bonus PPS. Several papers in psychology find that the existence of target-based pay can demotivate managers to think outside the box (Humphreys and Revelle, 1984; Wood, Mento, Locke, 1987). This is because executives would narrowly focus on beating given performance targets (Shapira, 1976; Pittman, Emery, and Boggiano, 1982). Thus, executives do not allocate their resources on risky projects but on foreseeable projects (Amabile, 1996). Similarly, Webb, Williamson, and Zhang (2013) find that the participants of an experiment that are given target-based pay implement a lower number of production efficiencies than those with a fixed wage. If executives are pressured by the higher PPS of bonus plans and become fixated on narrow horizon accounting numbers or are motivated to cut important investment for the future profits ("managerial short-termism"), boards of growth firms would not set high PPS for their executive bonus plans.[7)8)]

In sum, growth firms would have higher PPS for executive bonus plans to reduce agency problems. However, higher PPS could adversely affect growth firms. Whether growth firms prefer higher PPS of bonus plans is thus an empirical question. Therefore, we state our first hypothesis as follows:

Hypothesis 1: The steepness of pay-for-performance sensitivity of executive annual bonus contracts is not associated with the firm's growth opportunities.

2.3 Pay convexity

Unlike risk neutral investors, risk averse managers do not prefer risky projects. The reason why boards set convex compensation

7) The problems from using of target-based pay would be more severe for annual bonuses than for stock options. Prior studies show that long-term compensation effectively alleviates managerial short-termism (Dechow and Sloan 1991; Cheng, 2004).

8) 518 measure-years of the sample in this paper were EPS measures. About 80% of the EPS measures are non- GAAP EPS measures, suggesting compensation committees "adjust compensation to prevent executives from engaging in opportunistic behavior." (Dechow, Huson and Sloan, 1994). Curtis, Li, and Patrick (2019) also show similar results in that of the 1,083 earnings measure-years in their sample, 757 measure-years are non-GAAP earnings. However, it is impossible to eliminate managerial short-term behavior by adjusting earnings targets. For example, CEOs can manage real earnings to meet analyst forecasts (Roychowdhury, 2006) or to control their future compensation targets (Bouwens and Kroos, 2011). These activities can eventually negatively influence the firms' growth opportunities.

payouts for their executives is to motivate managers to invest in risky projects. Prior studies show that the convex payout of the stock options could motivate managers to bear risk because they are not penalized by negative compensation from losses (Smith and Stulz, 1985; Smith and Watts, 1992; Guay, 1999; Gormley, Matsa, and Milbourn, 2013). Smith and Stulz (1985) analytically suggest that managers with a convex utility function would bear risk when the manager's wealth is a convex function of firm value, that is, when managers receive stock options. Gormley et al. (2013) find that managers cut R&D expenses, reduce leverage, and stockpile cash when they receive compensation with less convex payoffs. Therefore, typical growth firms are more likely to provide stock-based executive compensation to add convexity to the compensation package (Gaver and Gaver, 1993; Anderson, Banker, and Ravindran, 2000; Ittner, Lambert, and Lacker, 2003). Following the intuition of this line of research, annual bonus payoff could be more convex for growth firms.

On the other hand, growth firms could have less convex annual bonus compensation because high convex payoffs could affect earnings management incentives of CEOs. Laux (2014) finds that convex pay plans give CEOs incentive to manipulate earnings even when the boards award optimal long-term compensation plans. Boards make business decisions based on the accounting numbers generated by CEOs. A more convex compensation payout would affect the incentives of the CEO to manage earnings and distort board decisions in her favor.[9] Prior research finds that firms with growth opportunities are more likely to engage in earnings management (McNichols, 2000; Lee, Li, and Yue, 2006). Manipulated earnings in growth firms would lead to suboptimal investment decisions (Laux, 2014) that might be more problematic than earnings management in value firms because poor investment decisions would hurt the firms' growth potential. This phenomenon would be more severe for bonus compensation because short-term bonuses are determined based on accounting numbers. Therefore, boards in growth firms could reduce the convexity in executive bonus plans to mitigate the investment distortion created by earnings manipulation. If this is the case, there would be a negative

9) Empirical papers show the mixed evidence for the relation between equity compensation (convex compensation payouts) and earnings manipulation. For example, Bergstresser and Philippon (2006) and Burns and Kedia (2006) find a positive relation, however, Erickson, Hanlon, and Maydew (2006) and Armstrong, Jagolinzer, and Lacker (2010) report that there is no concrete evidence that CEO equity compensation is positively associated with accounting fraud. Laux (2014) suggests that prior studies have missed the link between accounting manipulation and boards' investment decisions. When managers manipulate earnings, these earnings may also induce boards to continue poor investments that might be desirable for managers.

association between a firm's growth opportunities and the convexity of annual bonus plans.

Based on these competing predictions, we state the hypothesis on the relation between growth opportunities and the convexity of executive annual bonus plans in the null form:

Hypothesis 2: The convexity of executive annual bonus payouts is not associated with the firm's growth opportunities.

Ⅲ. Research Design and Sample

3.1 Research Design

We estimate the following regression to test Hypothesis 1:

$$\begin{aligned} Ch\_LogPPS_{i,j,t+1} = {} & \lambda_0 + \lambda_1 Ch\_MTB_{i,t} \\ & + \lambda_2 TAR\_DEV_{i,j,t} + \lambda_3 Ch\_STD\_ROA_{i,t} \\ & + \lambda_4 Ch\_KURT\_ROA_{i,t} \\ & + \lambda_5 Relative\_To\_PeerLogPPS_{i,t} \\ & + \lambda_6 Ch\_ROA_{i,t} + \lambda_7 LogAT_{i,t} \\ & + \lambda_8 Ch\_LogDelta_{i,t+1} \\ & + \text{Year and Industry fixed effects} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

The dependent variable is $Ch\_LogPPS_{i,j,t+1}$, which is the difference between $LogPPS_{i,j,t+1}$ and $LogPPS_{i,j,t}$. $LogPPS_{i,j,t}$ is the natural logarithm of the pay-for-performance sensitivity of a performance measure j for year t. We only use earnings measures in our test. We classify earnings measures as follows: earnings per share, operating earnings per share, net income, operating income, EBIT, EBITDA, income before extraordinary items, income before taxes. Pay-for-performance sensitivity (PPS) is estimated as the change in the dollar value of the CEO's annual bonus compensation divided by actual performance change amounting to 1% of targets. The amount of CEO's annual bonus compensation is estimated by multiplying the weight of each performance measure in the annual bonus plan with the total bonus amount. We provide an example of the bonus PPS estimation in Appendix B. Our main variable of interest is $Ch\_MTB_{i,t}$, which captures a firm's growth opportunities,[10] and is defined as the difference between $MTB_{i,t}$ and $MTB_{i,t-1}$. $MTB_{i,t}$ is the market to book ratio estimated as the market value of equity over the book value of total assets.

Prior target setting literature argues that future bonus targets are revised based on past performance (Indjejikian and Nanda, 2002; Leone and Rock, 2002; Aranda et al.,

10) We do not use research and development expense (xrd) to capture firm's growth opportunities because earnings and R&D expenses are endogenously related.

2014; Indjejikian et al., 2014; Bol and Lill, 2015; Kim and Shin, 2017). If the "80%/120%" rule[11] is the norm of performance plans, past performance should affect the PPS because past performance would be associated with the performance maximum and the performance threshold through the performance target. The performance maximum, target, and threshold are all elements in estimating the PPS. Thus, we control for $TAR\_DEV_{i,t}$, which is the difference between current actual performance and current performance targets divided by current performance targets. Following the findings of Arnaiz and Salas-Fumás (2008), we control for the volatility and kurtosis of ROA. We predict that the PPS is negatively related with the volatility of ROA and positively related with the kurtosis of ROA. $Ch\_STD\_ROA_{i,t}$ is estimated as $STD\_ROA_{i,t}$ minus $STD\_ROA_{i,t-1}$. $STD\_ROA_{i,t}$ is the standard deviation of $ROA_{i,t}$ over the past five years. $Ch\_KURT\_ROA_{i,t}$ is estimated as $KURT\_ROA_{i,t}$ minus $KURT\_ROA_{i,t-1}$. $KURT\_ROA_{i,t}$ is the kurtosis of $ROA_{i,t}$ over the past five years. $ROA_{i,t}$ is defined as income before extraordinary items of firm i for year t scaled by the average total assets of firm i for year t.

Peer firm information is an important factor in designing compensation contracts (Albuquerque, 2009; Gong et al., 2011; Aranda et al., 2014; Indjejikian et al., 2014; Indjejikian et al., 2014; Bol and Lill, 2015). In addition, Park and Vrettos (2015) find that RPE features in compensation contracts are significantly associated with the sensitivity of the CEO's incentives to stock return volatility (*Vega*). Thus we control for $Relative\_To\_PeerLogPPS_{i,t}$, which is the difference between the mean value of peer firm $LogPPS_t$ and firm's own $LogPPS_{i,j,t}$.[12] We define peer firms as the firms in the same two-digit sic code industry in the same year. To control for the firm's fundamental characteristics, we include $Ch\_ROA_{i,t}$ and $LogAT_{i,t}$. $Ch\_ROA_{i,t}$ is estimated as ROA $_{i,t}$ minus ROA $_{i,t-1}$. $LogAT_{i,t}$ is the natural logarithm of total assets. Because PPS of equity compensation can be associated with bonus PPS, we additionally control for $Ch\_LogDelta_{i,t+1}$, which is defined as the difference between $LogDelta_{i,t+1}$ and $LogDelta_{i,t}$. $LogDelta_{i,t}$ is the natural logarithm of stock option *Delta*, which is the dollar change in the executive's wealth for a 1% change in stock price (Core and Guay, 2002; Coles, Daniel, and Naveen, 2006).

To test our second hypothesis, we construct

11) The 80%/120% rule indicates the practice of setting the performance maximum as 120% of the performance target and setting the performance threshold at 80% of the performance target.

12) To increase sample size, we construct peer firm portfolios based on industry and year. Results remain very similar to analyses using peer firm portfolios based on industry, performance measure, and year (the sample size is reduced to 796 measure-years.)

the following model:

$$Ch\_LogConvex_{i,j,t+1} = \lambda_0 + \lambda_1 Ch\_MTB_{i,t} + \lambda_2 Ch\_STD\_CFO_{i,t} + \lambda_3 Ch\_LogPPS_{i,j,t+1} + \lambda_4 Relative\_To\_PeerLogConvex_{i,t} + \lambda_5 Ch\_ROA_{i,t} + \lambda_6 LogAT_{i,t} + \lambda_7 Ch\_LogDelta_{i,t+1} + \textit{Year and Industry fixed effects} + \varepsilon_{i,t} \quad (2)$$

The dependent variable is $Ch\_LogConvex_{i,j,t+1}$, which is the difference between $LogConvex_{i,j,t+1}$ and $LogConvex_{i,j,t}$. $LogConvex_{i,j,t}$ is the natural logarithm of $Convex_{i,j,t}$. $Convex_{i,j,t}$ is defined as the PPS estimated between the performance maximum and the performance target divided by the PPS =estimated between the performance target and the performance threshold. Prior studies argue that firm risk is positively associated with the convex payout of CEO compensation (Smith and Stulz, 1985; Smith and Watts, 1992; Gaver and Gaver, 1993; Guay, 1999; Gormley et al., 2013). We use $Ch\_STD\_CFO_{i,t}$ to capture firm risk. $Ch\_STD\_CFO_{i,t}$ is the difference between $STD\_CFO_{i,t}$ and $STD\_CFO_{i,t-1}$. $STD\_CFO_{i,t}$ is the standard deviation of $CFO_{i,t}$ over the past five years. The reason why we do no control for the volatility of ROA in equation (2) is that $Ch\_STD\_ROA_{i,t}$ could be interpreted as the noise in performance measure. Thus, we use cash flows as a proxy for the firm's fundamental performance. $CFO_{i,t}$ is the operating cash flows (OANCF) over average total assets. $Relative\_To\_PeerConvex_{i,t}$ is estimated as the mean value of peer firm $LogConvex_{i,t}$ minus firm's own $LogConvex_{i,j,t}$. Peer firm portfolios are constructed based on two-digit SIC code industry and year.

3.2 Sample Selection and Descriptive Statistics

Our sample consists of S&P 1500 firms from 2008 to 2014, that uses earnings as their performance measure in annual bonus contracts. We classify earnings measures as follows: earnings per share, operating earnings per share, net income, operating income, EBIT, EBITDA, income before extraordinary items, income before taxes. We hand-collect bonus cap, target bonus, bonus floor, performance maximum, performance target, and performance minimum of each performance measure from the proxy statement. We obtain stock return data from CRSP and financial data from Compustat. We also use Execucomp to estimate *Delta*.

Table 1 summarizes the sample selection procedure. Among S&P 1500 firms from 2008 to 2014, we collect 16,503 measures (6,674 firm-years). The sample is restricted to measures that are based on earnings. We exclude measure-years that lack measure threshold, target, and maximum information, as well as those with missing control variables and peer firm information. Because our research model

〈Table 1〉 Sample Selection

The performance measure-years of S&P 1500 firms with executive annual bonus contracts from 2008 to 2014	16,503
Less measure-years that are not earnings measures for executive bonus contracts	(9,028)
Sample earnings measure-years	7,475
Less measure-years that lack measure threshold/ target /maximum and pay floor/target/cap	(4,354)
Sample measure-years that have earnings target information	3,121
Less measure-years that lack control variables and peer firm information	(1,544)
Sample measure-years that have target information and control variables	1,577
Less measure-years of firms in the finance industry	(60)
Sample measure-years that have target information and control variables	1,518
Less measure-years that lack two consecutive years of data	(137)
Final Sample (measures)	1,381

This table presents our sample selection procedure.

requires lagged measure information, we further exclude measure-years that lack two consecutive years of data. The final sample for testing H1 and H2 consists of 1,381 measure-year observations (1,176 firm-years).

Table 2 presents shows the descriptive statistics by firm. The mean (median) values of $ROA_{i,t}$ is 6.4% (5.4%) of average total assets. The means of standard deviation and kurtosis of $ROA_{i,t}$ are 0.032 and 0.563, respectively. The means and medians of $MTB_{i,t}$ are 1.209 and 0.904, respectively. The average $Log\ Delta_{i,t}$ is 5.499, which is comparable to the descriptive statistics ($LogDelta_{i,t}$: 5.456) of Kim and Shin (2017).

Ⅳ. Empirical Results

4.1 Performance Measures Used in Executive Bonus Contracts

Panel A of Table 3 and Figure 2 shows the relative percentage of the use of performance measures in CEO annual bonus plans. Among 16,503 performance measures, the most widely used performance measures are earnings measures.[13] Sales measures are second most frequently used (11%), followed by non-financial measures (10%) and cash flows (5%). Typical non-financial measures are customer relations management, strategic goals, and CSR

13) Measures are classified as earnings measures if the performance measures are determined based on earnings per share, operating earnings per share, net income, operating income, EBIT, EBITDA, income before extraordinary items, or income before taxes.

〈Table 2〉 Descriptive Statistics by Firms

Panel A: Descriptive Statistics of Final Sample (1,381 measure-years)

Measure	N	Mean	Median	Q1	Q3	Std. Dev.
ROA	1,176	0.065	0.055	0.032	0.093	0.057
LOGAT	1,176	8.248	8.192	7.297	9.157	1.376
STD_ROA	1,176	0.033	0.021	0.011	0.039	0.036
KURT_ROA	1,176	0.532	0.432	-1.390	2.309	2.293
MTB	1,176	1.209	0.904	0.542	1.510	0.990
LOGDELTA	1,176	5.499	5.528	4.637	6.360	1.308

Table 2 describes the descriptive statistics for our sample. The sample is 1,176 firm-year observations. The final sample of 1,381 measure-year observations is from 1,176 firm-year observations.

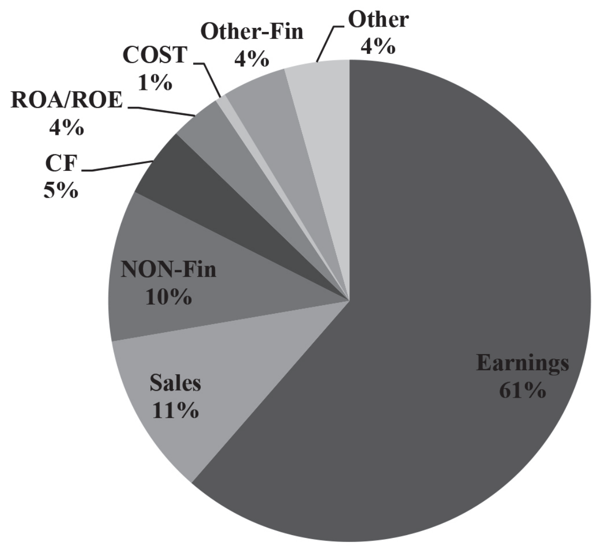
Panel B: Comparison of Initial Sample and Final Sample

	Initial Sample - Final Sample (N=15,122)*			Final Sample (N=1,381)				
Measure	N	Mean	STD	N	Mean	STD	Diff	T-Stat
ROA	14,338	0.05	0.07	1,381	0.07	0.06	-0.01	-7.02
LOGAT	14,338	8.15	1.57	1,381	8.21	1.38	-0.06	-1.37
STD_ROA	14,127	0.04	0.05	1,381	0.03	0.04	0.01	6.55
KURT_ROA	13,519	0.54	2.35	1,381	0.48	2.29	0.05	0.8
MTB	13,962	1.20	1.04	1,381	1.20	0.98	0.00	0.13
LOGDELTA	12,855	5.29	1.35	1,381	5.49	1.30	-0.20	-5.24
Bonus to Total Pay	14,286	0.22	0.17	1,381	0.23	0.15	-0.01	-3.16

*Deleted observations that are excluded from the final sample (16,503 - 1,381 = 15,122 measure-years). Bonus to Total Pay is defined as bonus compensation divided by total compensation.

activities such as environmental protection.

Panel B of Table 3 represents the relative use of performance measures in annual bonus contracts by industry. Industries where profit margins are important prefer earnings measures. For example, over 75% of bonus rewards are determined based on earnings in the wholesale trade and retail trade industry. Firms in the construction industry are also more likely to use earnings measures (70%) in CEO annual bonus plans. In the service industry, sales measures are important (21%) because profit is directly tied to sales. Production growth (*other financial*) or developing new mines (*non-financial*) would be a core element for future profits in the mining industry. Thus, other financial and nonfinancial measures are widely used in the mining industry.



This figure is based on the sample of 16,503 measure-years. For each measure-year observation, we count the bonus weight on each measure, based on the detailed disclosures about CEO annual bonus plan. Each entry of Panel B indicates how much proportion of CEO annual bonus is based on each performance metric.

〈Figure 2〉 Performance Measures Used in CEO Annual Bonus Plans from 2008 to 2014

Panel C of Table 3 tests the factors considered by boards when earnings measures are used in CEO annual bonus plans. We do not make a specific hypothesis regarding this test. The following regression is estimated to investigate the determinants of earnings measure use in annual bonus plans:

$$\begin{aligned} Earnings\_Ratio_{i,t+1} &= \lambda_0 \\ &+ \lambda_1\, Earnings\_Ratio_{i,t} \\ &+ \lambda_2\, STD\_ROA\_Quartile_{i,t} \\ &+ \lambda_3\, Earnings\_Ratio_{i,t} * STD\_ROA\_Quartile_{i,t} \\ &+ \lambda_4\, ROA_{i,t} + \lambda_5\, LogAT_{i,t} \\ &+ \lambda_6\, Ret_{i,t} + \lambda_7\, MTB_{i,t} \\ &+ Year\ and\ Industry\ fixed\ effects + \varepsilon_{i,t} \end{aligned} \tag{3}$$

$Earnings\_Ratio_{i,t}$ is defined as a firm i's weight of earnings measure used in CEO annual bonus plan for fiscal year t. Prior studies argue that the noise in performance measures is negatively associated with the use of those measures in the compensation package (Banker and Datar, 1989; Lambert and Larcker, 1987; Bushman et al., 1996; Ittner et al., 1997). Therefore we control for $STD\_ROA\_Quartile_{i,t}$, which is the quartile rank of $STD\_ROA_{i,t}$. $Ret_{i,t}$ is the stock return of a firm *i* over the twelve months ending at the end of the fiscal year *t*. We exclude measure-years that lack control variables. The final sample size is 4,589 measure-years in Panel C.

Column (1) provides the result without the interaction term of a firm's own $Earnings\_Ratio_{i,t}$ and $STD\_ROA\_Quartile_{i,t}$. $Earnings\_Ratio_{i,t}$ has a significantly positive coefficient, suggesting that there is a serial correlation

〈Table 3〉 Performance Measures Used in CEO Annual Bonus Plans

Panel A: The Distribution of Performance Measures Used in CEO Annual Bonus Plans

	Earnings	Sales	CF	ROA/ ROE	COST	Other Fin	Non-Fin	other
All firms	61%	11%	5%	3%	1%	4%	10%	4%

This table is based on the sample of 16,503 measure-years. For each measure-year observation, we count the bonus weight on each measure, based on the detailed disclosures about CEO annual bonus plan. For example, a firm can give 50% of bonus based on earnings and 50% on sales. Each entry of Panel A indicates how much proportion of CEO annual bonus is based on each performance metric. If we take the weight into account, our initial sample shows that 61% of CEO annual bonus is on average granted based on earnings. Likewise, 11%, 5%, 3%, 1%, 4%, 10%, and 4% of CEO annual bonus is granted on sales, CF, ROA (ROE), costs, other financial, non-financial, and other metrics, respectively.

Panel B: The Distribution of Performance Measures Used in CEO Annual Bonus Plans across Industries

Industry	Earnings	Sales	CF	ROA/ ROE	COST	Other Fin	Non-Fin	other
Agriculture, Forestry and Fishing	59%	8%	31%	0%	0%	2%	0%	0%
Construction	70%	3%	5%	9%	2%	1%	6%	5%
Finance, Insurance and Real Estate	56%	5%	0%	10%	1%	11%	10%	7%
Manufacturing	61%	13%	7%	3%	0%	3%	10%	3%
Mining	40%	3%	5%	3%	4%	17%	16%	11%
Retail Trade	76%	10%	2%	1%	0%	2%	7%	2%
Services	62%	21%	3%	1%	0%	1%	9%	3%
Transportation, Communications, Electric, Gas and Sanitary Service	60%	4%	7%	3%	1%	5%	14%	6%
Wholesale Trade	79%	6%	1%	6%	0%	1%	4%	3%

This table is based on the sample of 16,503 measure-years. For each measure-year observation, we count the bonus weight on each measure, based on the detailed disclosures about CEO annual bonus plan. Each entry of Panel B indicates how much proportion of CEO annual bonus is based on each performance metric.

〈Table 3〉 Performance Measures Used in CEO Annual Bonus Plans (continue)

Panel C: Earnings Selection Test

$$Earnings\ Ratio_{i,t+1} = \lambda_0 + \lambda_1\ Earnings\ Ratio_{i,t} + \lambda_2\ STD\ ROA\ Quartile_{i,t} + \lambda_3\ Earnings\ Ratio_{i,t} * STD\ ROA\ Quartile_{i,t} + \lambda_4\ ROA_{i,t} + \lambda_5\ LogAT_{i,t} + \lambda_6\ Ret_{i,t} + \lambda_7\ MTB_{i,t} + Year\ and\ Industry\ fixed\ effects + \varepsilon_{i,t} \quad (3)$$

Dependent Variable:		$Earnings\_Ratio_{i,t+1}$	
Independent Variables:	Pred.	(1)	(2)
Intercept		0.098***	0.087***
		(4.65)	(4.18)
$Earnings\ Ratio_{i,t}$	+	0.853***	0.880***
		(83.29)	(57.95)
$STD\ ROA\ Quartile_{i,t}$	-	-0.003	0.007
		(-1.58)	(1.26)
$Earnings\ Ratio_{i,t}{}^*\ STD\ ROA\ Quartile_{i,t}$	-		-0.017**
			(-2.03)
$ROA_{i,t}$	+	0.075*	0.082*
		(1.72)	(1.86)
$LogAT_{i,t}$	?	-0.005***	-0.005***
		(-3.41)	(-3.32)
$Ret_{i,t}$	?	0.025***	0.025***
		(3.47)	(3.46)
$MTB_{i,t}$	-	-0.007**	-0.007***
		(-2.48)	(-2.59)
Year fixed effects		YES	YES
Industry fixed effects		YES	YES
Number of observations (firm years)		4,589	4,589
Adjusted R^2		79.23%	79.26%

Panel A, Table 3 reports the performance measures used in CEO annual bonus plans of the U.S. firms. Panel B, Table 3 presents the distribution of performance measure usage by industry. The sample for Panel A and Panel B consists of 16,503 measures from 2008 to 2014. Panel C, Table 3 reports the results of estimating equation (3). The sample for Panel C is 4,589 measure-year observations for the 2008-2014 period. The 16,503 measure-year observations in Panel B reduced to 6,674 firm-year observations since our earnings selection model is to examine how firms choose to use earnings metric for CEO annual bonus. We further delete the observations with missing values for explanatory variables, which reduced the sample to 4,589 firm-year observations.

See Appendix B for the variable definitions. All variables are winsorized at the top and bottom 1 percentiles. Year and industry fixed effects are included. Industry fixed effects are constructed based on the two-digit SIC codes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

for the use of earnings measures in bonus contracts. When the interaction term is included in column (2), the coefficient of $Earnings\_Ratio_{i,t}*STD\_ROA\_Quartile_{i,t}$ is significantly negative (-0.017, t-value : -2.03). This means that boards place less weight on past *Earnings_Ratio* when earnings are noisy. This result is in line with prior studies that find that the relative use of performance measures are negatively associated with the noise in the measures (Banker and Datar, 1989; Lambert and Larcker, 1987; Bushman et al., 1996; Ittner et al., 1997).

Table 4 reports the statistics regarding the threshold and maximum of performance measures used in annual bonus contracts. From 16,503 measure-years, we exclude measure-years that lack target information. The sample size is reduced to 3,121 measure-years. In Panel A, we show the overall firms' performance threshold and maximum. The mean performance threshold is 82.46% and the mean

〈Table 4〉 Threshold and Maximum of Performance Measures Used in CEO Annual Bonus Plans

Panel A: Threshold and Maximum of Performance Measures Used in CEO Annual Bonus Plans (3,121 measure-years)

	PM Threshold	PM Maximum
All firms	82.46%	120.94%

Panel B: Threshold and Maximum of Performance Measures Used in CEO Annual Bonus Plan across Industries (3,121 measure-years)

	PM Threshold	PM Maximum
Agriculture, Forestry and Fishing	89.59%	104.72%
Construction	71.18%	145.01%
Finance, Insurance and Real Estate	84.90%	117.28%
Manufacturing	79.99%	122.22%
Mining	77.62%	125.38%
Retail Trade	87.12%	118.61%
Services	84.19%	117.76%
Transportation, Communications, Electric, Gas, and Sanitary Service	85.37%	121.82%
Wholesale Trade	81.44%	119.90%

Table 4 Panel A reports the average performance threshold and performance maximum of the sample. Panel B shows the average performance threshold and performance maximum by industry. The sample for Panel A and Panel B consists of 3,121 measure-years from 2008 to 2014. The initial sample of 16,503 measure-year observations reduced to 7,475 observations if we limit our sample to earnings metrics. We further delete the observations with missing values for any one of performance threshold, target, and maximum. Observations with performance target set to zero or with negative performance threshold are also excluded since those observations are rare and unique cases, which reduced the sample to 3,121 measure-year observations.

performance maximum is 120.94%, suggesting that the 80/120 rule holds in the sample. However, the 80/120 rule is not supported in some industries. Panel B presents the results by industry. For example, in the agriculture, forestry and fishing industry, the gap between the performance maximum and threshold is only 15% (104.72%-89.59%). On the contrary, the gap is over 70% (145.01%-71.18%) in the construction industry.

Table 5 provides the descriptive statistics of the bonus cap and floor used in annual bonus contracts. The sample size is 2,581 firm-years, which is equal to that of Table 4. Panel A of Table 5 shows that the average bonus floor is 374,123 U.S. dollars and the average bonus cap is 2,315,801 U.S. dollars, which is approximately 6 times larger than the average bonus floor. Panel B presents statistics by industry. The bonus floor in the agriculture, forestry and fishing industry has the lowest value (0), whereas the industry's bonus cap is similar to the average of entire sample. The bonus floor (453,335 U.S. dollars) is the highest in the transportation, communications, electric, gas, and sanitary service industry. The results in Table 3 and Table 4 indicate that the relative use of earnings

〈Table 5〉 Floor and Cap of CEO Annual Bonus Plans

Panel A: Floor and Cap of CEO Annual Bonus Plans (2,581 firm-years)

	Bonus Floor	Bonus Cap
All firms	$ 374,123	$ 2,315,801

Panel B: Floor and Cap of Performance Measures Used in CEO Annual Bonus Plans across Industries (2,581 firm-years)

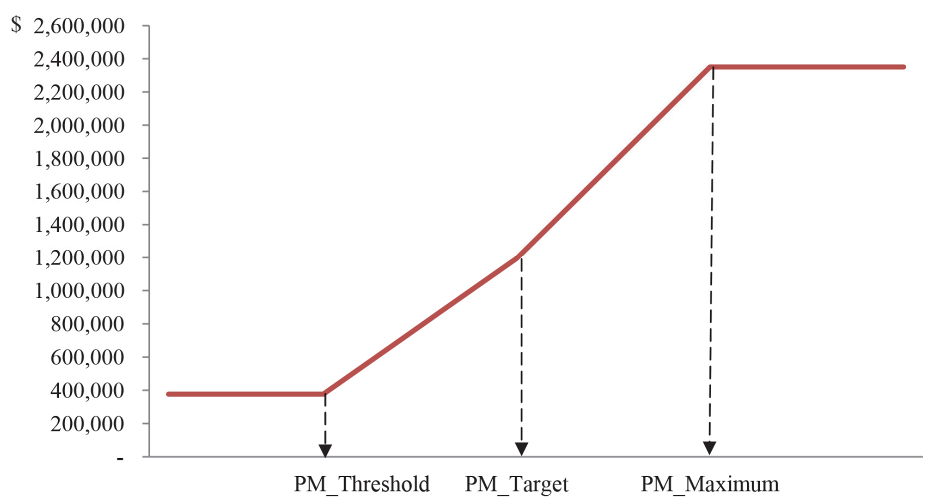
	Bonus Floor	Bonus Cap
Agriculture, Forestry and Fishing	$ 0	$ 2,295,750
Construction	300,287	2,339,061
Finance, Insurance and Real Estate	418,797	2,231,651
Manufacturing	358,085	2,419,424
Mining	313,877	2,009,860
Retail Trade	442,349	2,682,983
Services	297,159	1,902,553
Transportation, Communications, Electric, Gas, and Sanitary Service	453,335	2,521,269
Wholesale Trade	325,917	1,788,622

Table 5 Panel A reports the average bonus cap and bonus floor of the sample. Panel B shows the average bonus cap and bonus floor by industry. The sample for Panel A and Panel B consists of 2,581 firm-years from 2008 to 2014. The sample used in Table 4, Panel B (3,121 measure-years) is converted to 2,581 firm-years since we examine the total bonus cap and floor, which takes unique value for each CEO every year.

measures in annual bonus plans and the performance maximum/threshold in the wholesale industry is very similar to that of the retail industry. However, the bonus cap in the retail industry (2,682,983 U.S. dollars) is much greater than bonus cap in the wholesale industry (1,788,622 U.S. dollars), which is different from the findings in Table 3 and Table 4.

Table 6 describes the pay-for-performance sensitivity of CEO bonus contracts. Panel A provides the descriptive statistics for the pay-for-performance sensitivity. The average pay-for-performance sensitivity is around $47,102, suggesting that if CEOs increase their earnings performance by 1% of their performance targets, they can earn an additional $47,102 as bonuses.[14] The agriculture, forestry and fishing industry and the retail industry have the highest bonus PPS. On the other hand, the average bonus PPS in the Construction industry is below one fourth of the bonus PPS in the Retail industry.

Panel B shows that PPS in the incentive zone is often convex. Over 63% of performance measures use convex compensation functions, which is different from the findings of Murphy (1999).[15] Only 6% of the performance meas-



〈Figure 3〉 The "Incentive zone" of CEO Annual Bonus Plan Using S&P 1500 Firms from 2008 to 2014

14) For example, the average EPS target in the sample is 2.76. This means that when CEOs increase their EPS by 0.28, he or she receives an additional $47,102 in bonuses.

15) In Table 4 of Murphy (1999), 27% of industrial firms use a convex compensation function in the incentive zone, followed by 14% in Finance and Insurance and 13% in utilities.

ures are linear in the incentive zone. Figure 3 depicts the incentive zone of our sample firms. The pay-for-performance relationship is convex; the slope between the bonus cap and the target bonus is greater than the slope between the target bonus and the bonus floor.

Panel C of Table 6 shows the relative percentage of linear/convex/concave bonus payouts in the incentive zone by industry. There is a substantial difference between the wholesale industry and the retail industry. In the retail industry, bonus payouts are more likely to be concave (42.96%), whereas concave bonus payouts are less frequent in the wholesale industry (24.84%). Firms in the wholesale and the manufacturing industry mostly prefer a convex compensation function (69.57% and 67.39%, respectively).

Panel D reports the estimation results for equation (1). The coefficient for $Ch\_MTB_{i,t}$ is positively significant (0.128, t-value : 3.10) and supports the agency theory-based explanation. Boards of growth firms increase annual bonus plan PPS to mitigate agency problems that arise due to the difficulty of comprehending growth opportunities. Both $Ch\_STD\_ROA_{i,t}$ and $Ch\_KURT\_ROA_{i,t}$ do not have significant coefficients. These results may be driven by the fact that ROA may not be the best proxy for earnings measures. The coefficient of $Relative\_To\_PeerPPS_{i,t}$ is positive and significant, implying that boards adjust annual bonus PPS using peer firm PPS as a benchmark.[16] Boards increase PPS when the previous year's peer firm PPS is higher than the firm's own PPS. Large firms are more visible and under higher scrutiny,[17] therefore, larger firms tend to have higher annual bonus PPS. $Ch\_Logdelta_{i,t+1}$ does not have a significant coefficient, providing evidence that bonus PPS differs from equity compensation *Delta*.

$TAR\_DEV_{i,j,t}$ has a positive and significant coefficient (0.169, t-value : 2.92). Prior studies find that well-performing managers are compensated for receiving targets that are not based on past good performance (Aranda et al., 2014; Indjejikian, et al., 2014). In line with these studies' intuition, well-performing managers are compensated for the higher PPS combined with easier targets that can increase their future bonus amount. Under the assumption that the 80/120 rule holds, easier targets imply a narrower zone between the performance maximum and performance threshold, which leads to a sharper slope in the incentive zone.

The results in Table 7 show that boards in-

16) The intuition behind this finding is similar to that of Aranda et al. (2014). Aranda et al. (2014) suggest that the relative target difficulty using peer firm information negatively affects the following year's target revision.

17) Hyun, Kim, Kwon, and Shin (2014) show that large firms try to hide the specific amount of executive compensation to reduce the political costs of disclosing higher executive pay.

〈Table 6〉 Pay-for-Performance Sensitivity of CEO Annual Bonus Plans

Panel A: Pay-for-Performance Sensitivity in the "Incentive Zone" (3,121 measure-years)

	PPS
Agriculture, Forestry and Fishing	$ 75,879
Construction	18,426
Finance, Insurance and Real Estate	46,584
Manufacturing	45,125
Mining	21,487
Retail Trade	75,624
Services	37,730
Transportation, Communications, Electric, Gas, and Sanitary Service	56,496
Wholesale Trade	41,923
Average	$ 47,102

Panel B: Shape of Pay-for-Performance Sensitivity in the "Incentive Zone" (3,121 measure-years)

	Linear	Convex	Concave
Shape of PPS in "Incentive Zone"	6.38%	63.35%	30.28%

Panel C: Shape of Pay-for-Performance Sensitivity in the "Incentive Zone" across Industries (3,121 measure-years)

	N	Linear	Convex	Concave
Agriculture, Forestry and Fishing	1	0.00%	100.00%	0.00%
Construction	42	2.38%	57.14%	40.48%
Finance, Insurance and Real Estate	364	9.89%	61.54%	28.57%
Manufacturing	1,236	5.83%	67.39%	26.78%
Mining	126	3.97%	61.11%	34.92%
Retail Trade	270	2.96%	54.07%	42.96%
Services	452	6.42%	59.51%	34.07%
Transportation, Communications, Electric, Gas, and Sanitary Service	469	8.32%	62.05%	29.64%
Wholesale Trade	161	5.59%	69.57%	24.84%

The initial sample of 16,503 measure-year observations reduced to 7,475 observations if we limit our sample to earnings metrics. We further delete the observations with missing values for any one of performance threshold, target, and maximum. Observations with performance target set to zero or with negative performance threshold are also excluded since those observations are rare and unique cases, which reduced the sample to 3,121 measure-year observations.

〈Table 6〉 Pay-for-Performance Sensitivity of CEO Annual Bonus Plans (continue)

Panel D: Test for the Determinants of Pay-for-Performance Sensitivity

$$Ch\_LogPPS_{i,j,t+1} = \lambda_0 + \lambda_1 Ch\_MTB_{i,t} + \lambda_2 TAR\_DEV_{i,j,t} + \lambda_3 Ch\_STD\_ROA_{i,t} + \lambda_4 Ch\_KURT\_ROA_{i,t} + \lambda_5 Relative\_To\_PeerLogPPS_{i,t} + \lambda_6 Ch\_ROA_{i,t} + \lambda_7 LogAT_{i,t} + \lambda_8 Ch\_LogDelta_{i,t+1} + \text{Year and Industry fixed effects} + \varepsilon_{i,t} \quad (1)$$

Dependent Variable:		$CH\_LogPPS_{i,j,t+1}$
Independent Variables:	Pred.	(1)
Intercept		-0.381***
		(-3.33)
$Ch\_MTB_{i,t}$	+	0.128***
		(3.10)
$TAR\_DEV_{i,j,t}$	+	0.169***
		(2.92)
$Ch\_STD\_ROA_{i,t}$	-	-0.608
		(-0.51)
$Ch\_KURT\_ROA_{i,t}$	+	-0.001
		(-0.15)
$Relative\_To\_PeerLogPPS_{i,t}$	+	0.128***
		(8.53)
$Ch\_ROA_{i,t}$	?	0.521
		(1.31)
$LogAT_{i,t}$	?	0.057***
		(4.55)
$Ch\_LogDelta_{i,t+1}$	+	0.004
		(0.13)
Year fixed effects		YES
Industry fixed effects		YES
Number of observations (measure years)		1,381
Adjusted R^2		11.78%

Table 6 Panel A shows the average pay-for-performance sensitivity for all firms and for each industry. Panel B reports the shape of the pay-for-performance sensitivity for CEO annual bonus plans. Panel C shows the shape of the pay-for-performance sensitivity by industry. The sample for Panel A, Panel B, and Panel C consists of 3,121 measure-years from 2008 to 2014. Panel D, Table 5 presents the test results of estimating equation (1). The sample for Panel D is 1,381 measure-year observations for the 2008-2014 period. See Appendix B for the variable definitions. All variables are winsorized at the top and bottom 1 percentiles. Year and industry fixed effects are included. Industry fixed effects are constructed based on the two-digit SIC codes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

〈Table 7〉 Determinants of the Pay-for-Performance Sensitivity Convexity

$$Ch\_LogConvex_{i,j,t+1} = \lambda_0 + \lambda_1 Ch\_MTB_{i,t} + \lambda_2 CH\_STD\_CFO_{i,t} + \lambda_3 Ch\_LogPPS_{i,j,t+1} + \lambda_4 Relative\_To\_PeerLogConvex_{i,t} + \lambda_5 Ch\_ROA_{i,t} + \lambda_6 LogAT_{i,t} + \lambda_7 Ch\_LogDelta_{i,t+1} + Year\ and\ Industry\ fixed\ effects + \varepsilon_{i,t} \quad (2)$$

Dependent Variable:		$Ch\_LogConvex_{i,j,t+1}$
Independent Variables:	Pred.	(1)
Intercept		0.001
		(0.02)
$Ch\_MTB_{i,t}$	+	0.044**
		(2.17)
$Ch\_STD\_CFO_{i,t}$	+	1.654**
		(2.36)
$Ch\_LogPPS_{i,j,t+1}$	?	1.606**
		(2.28)
$Relative\_To\_PeerLogConvex_{i,t}$	+	0.033
		(1.26)
$Ch\_ROA_{i,t}$	?	0.286***
		(10.73)
$LogAT_{i,t}$	?	-0.382
		(-1.50)
$Ch\_LogDelta_{i,t+1}$	+	0.006
		(1.01)
Year fixed effects		YES
Industry fixed effects		YES
Number of observations (measure years)		1,381
Adjusted R^2		14.35%

Table 7 presents the test results of estimating equation (2). The sample for Table 7 is 1,381 measure-year observations for the 2008-2014 period. See Appendix B for the variable definitions. All variables are winsorized at the top and bottom 1 percentiles. Year and industry fixed effects are included. Industry fixed effects are constructed based on the two-digit SIC codes. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

crease convexity of the pay-for-performance sensitivity of annual bonus plans when growth opportunities increase, suggesting that boards place greater importance on motivating CEOs to invest in risky projects. The coefficient of $Ch\_MTB_{i,t}$ is positively significant at the 5% level (0.044, *t*-value : 2.17). $Ch\_STD\_CFO_{i,t}$ also has a significant and positive coefficient (1.654, *t*-value : 2.36), suggesting that boards increase the convexity to motivate risk averse managers to pursue more risky investments when the firms' past performance is more volatile. As in Table 6, λ_4 is significantly positive. If peer firm bonus plans are more convex than that of the focal firm, boards increase the convexity of their annual bonus plans.

Ⅴ. Conclusion

In this paper, we overview the annual bonus contracts of CEOs using hand-collected data. Although annual bonus plans are one of the most important elements of the executive compensation package, prior to 2006, we were not able to directly observe the details of the executive compensation contracts due to lack of data. After 2006, the executive compensation disclosure requirements have permitted researchers to understand and analyze the specific details of all executive compensation contracts. Before compensation data was available, researchers had to rely on proprietary survey data obtained by a limited number of compensation consultant firms. For example, in terms of performance measures, researchers have not been able to clearly designate the frequency of performance measures used by firms to determine executive compensation because of the prevalence of nonfinancial measures and multiple financial measures. This paper documents that earnings are the most widely used performance measure in bonus plans for S&P1500 firms, with more than 60% of S&) 1500 firms using earnings measures to determine the annual bonus amount. We observe the degree of industry variations in terms of the 80/120 rule and the relative usage of performance measures. We find that industries in which profit generation is more important are more likely to select earnings measures.

We also empirically investigate the economic factors influencing boards' decision for setting pay-for-performance sensitivity and for increasing the convexity of executive annual bonus plans. We borrow from prior literature and incorporate peer firm information into our regression models. After controlling for peer firm information, we find that growth opportunities of a firm are one of the key elements in designing annual bonus plans. Growth firms are more likely to have executive bonus plans that have higher PPS and more convexity.

This paper's main caveat is that we restrict our sample to firms that use earnings measures in CEO bonus contracts to maintain cross-sectional comparability. However, there are different characteristics among earnings, revenue, and other measures in bonus contracts. This implies that our results might not fully explain the features of other performance measures. Econometrically, this could be problematic because we risk a sample selection bias in our sample firms when we limit our sample to firms that use earnings measures. Nonetheless, we do not find any intuitive or economic logic for substantial differences between firms that use earnings measures and other types of measures. Therefore, we believe that although they may be some limitations to generalizability, our findings shed light on the annual bonus plans in general.

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〈Appendix A〉 2014 Proxy Statement of El Paso Electronic Company 2014 ANNUAL CASH BONUS PLAN

Metric	Weighting (%)	Performance Goals			Performance Result		
						Final Payout (as % of Target Bonus)	
		Threshold	Target	Maximum	Actual Result	CEO	Other NEOs (averaged)
EPS	50	$2.20	$2.30	$2.45	$2.27	39.7	38.2
Customer Satisfaction							
3rd Party Customer Survey	10	75	78	81	81	20	17.9
Call Center Performance (%)	10	70%	80%	90%	86%	16	14.7
Reliability (SAIDI) (min)	15	45.6 min	41.9 min	39.9 min	46.6 min	0	0
Safety							
DART (measure of injuries)	3.75	1.5	1.2	0.9	1.73	0	0
Vehicle accident	3.75	3.6	2.6	1.6	1.55	7.5	6.7
Leading Indicator activities	2.5	4 points	6 points	8 points	Maximum	5	3.7
Compliance	5	N/A	Fully Compliant	N/A	Target	5	5
Total	100					93.2	86.2

Bonuses are paid in late February or early March after the Compensation Committee reviews the audited financial results and operational performance for the previous year. As reported in the Annual Report on Form 10-K for the year ended December 31, 2014, and as shown in the above table, the Company's net income was $2.27 per basic share, which includes an accrual for the cost of the bonus pool. The table also shows that the Company met (or failed to meet) its customer satisfaction goals, its reliability goal, its three safety goals and its compliance goal. As a result, each NEO received a bonus, as set forth in the table below and also in the Summary Compensation Table later in this proxy statement. The total bonus paid to Company employees for 2014 was approximately $7.4 million, of which approximately $1.9 million was paid to the NEOs and other executive officers.

〈Appendix B〉 The example of Estimating Bonus Pay-for-performance Sensitivity using data from Monsanto Company

Year: 2014

Performance measure: EPS
The weight of EPS measure in bonus contracts: 50%

Bonus Floor (A)	Target Bonus (B)	Bonus Cap (C)	C-A
0	$803,513	$2,295,750	$2,295,750
PM Threshold (D)	PM Target (E)	PM Maximum (F)	F-D
$4.56	$5.09	$5.33	$0.77

Pay-for-performance Sensitivity
= {[(Bonus Cap - Bonus Floor) * PM weight] / (PM Max - PM Thr)} * 1% of PM Tar
= {[($2,295,750 - $0) * 50%] / ($5.33-$4.56)} * 1% of $5.09
= $1,490,747 * 0.0509 = $75,879

〈Appendix C〉 Variable Definitions

Variable		Definition
$LogPPS_{i,j,t}$	=	The natural logarithm of pay-for-performance sensitivity of a performance measure *j* for year *t*. We only use earnings measures in our test. We classify earnings measures as follows: earnings per share, operating earnings per share, net income, operating income, EBIT, EBITDA, income before extraordinary items, or income before taxes. Pay-for-performance sensitivity is estimated as the change in the dollar value of the CEO's annual bonus compensation divided by the actual performance change amounting to 1% of targets. The amount of CEO's annual bonus compensation is estimated by multiplying the weight of each performance measure in bonus contracts with the total bonus amount.
$LogConvex_{i,j,t}$	=	The natural logarithm of $Convex_{i,j,t}$. $Convex_{i,j,t}$ is the pay-for-performance sensitivity estimated between the performance maximum and the performance target divided by the pay-for-performance sensitivity estimated between the performance target and the performance threshold.
$MTB_{i,t}$	=	The market to book ratio estimated as the market value of equity over the book value of total assets.
$TAR\_DEV_{i,t}$	=	The difference between the current actual performance and the current performance target divided by the current performance target.
$STD\_ROA_{i,t}$	=	The standard deviation of $ROA_{i,t}$ over the past five years.
$KURT\_ROA_{i,t}$	=	The kurtosis of $ROA_{i,t}$ over the past five years.
$ROA_{i,t}$	=	The income before extraordinary items of firm *i* for year *t* scaled by the average total assets of firm *i* for year *t*.
$STD\_CFO_{i,t}$	=	The standard deviation of $CFO_{i,t}$ over the past five years. $CFO_{i,t}$ is the operating cash flows (OANCF) over average total assets.
$Relative\_To\_PeerLogPPS_{i,t}$	=	The difference between the mean value of peer firm $LogPPS_t$ and firm's own $LogPPS_{i,j,t}$. We define peer firms as the firms in the same two-digit sic code in the same year.
$Relative\_To\_PeerLogConvex_{i,t}$	=	The difference between the mean value of peer $LogConvex_t$ and firm's own $LogConvex_{i,j,t}$. We define peer firms as the firms in the same two-digit sic code in the same year.
$LogAT_{i,t}$	=	The natural logarithm of total assets.
$LogDelta_{i,t}$	=	The natural logarithm of stock option *Delta*, which is the dollar change in the executive's wealth for a 1% change in stock price (Core and Guay, 2002; Coles et al., 2006).
$Earnings\_Ratio_{i,t}$	=	A firm *i*'s weight of earnings measure used in CEO annual bonus plan for fiscal year *t*.
$Ret_{i,t}$	=	The stock return of a firm *i* over the twelve months ending the end of the fiscal year *t*.
$STD\_ROA\_Quartile_{i,t}$		The quartile rank of $STD\_ROA_{i,t}$

최고경영자 성과급의 성과-보수 민감도 결정요인에 대한 연구: 미국 S&P 1500기업을 중심으로

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요 약

본 연구는 최고경영자 성과급에 대한 전반적인 특성을 분석하고 그 중에서 성과-보수 민감도(Pay-for-Performance Sensitivity, "PPS")의 결정 요인을 집중적으로 살펴보고자 한다. 최근 연구에 따르면 최고경영자의 성과급은 주식기준 보상에 준하는 유인 효과를 지닌 것으로 나타났다(Frydman and Jenter, 2010; Jensen and Murphy, 2011; Guay, Kepler, and Tsui, 2019). 그럼에도 불구하고 최고경영자의 성과급에 대한 연구가 부족한 실정이다. 미국 S&P 1500기업의 2008년부터 2014년까지 경영자 성과급 보수계약을 분석한 결과, 산업별로 차이는 있지만, 기업들이 대체로 성과급 목표 설정에 80/120% 원칙을 사용하는 것으로 나타났다. 아울러 인접 기업(peer firms)들과 기타 경제적 요인들을 통제한 후에는 기업의 성장성이 성과급의 성과-보수 민감도(pay-for-performance sensitivity)와 성과-보수 민감도의 볼록성(convexity)의 핵심적인 결정요인으로 나타났다.

주제어: 경영자 성과급, 성과-보수 민감도, 볼록성, 최고경영자 보상

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- 저자 권세원은 현재 세종대학교 경영대학 회계학 전공 조교수로 재직 중이다. 서울대학교 경영학과를 졸업하고, 동 대학원에서 경영학 석사 및 박사를 취득하였으며, 공인회계사 자격 취득 후 삼일회계법인에서 약 4년가량 회계감사를 담당하였다. 주요연구분야는 경영진의 성과보상, 기업지배구조, Accrual anomaly 등이다.
- 저자 김경원은 현재 서울대학교 경영대학 경영학과 회계학 박사과정에 재학 중이다. 서울대학교 경영학과 및 동 대학원에서 경영학 석사를 취득하였으며, LG전자에서 4년 근무하였다. 주요연구분야는 경영진의 성과보상, 기업지배구조, 보상철학 등이다.
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- 저자 정선문은 현재 서울대학교 경영대학 경영학과 회계학 박사과정에 재학중이다. 고려대학교에서 미술학사 및 경영학사를 취득하였으며, 서울대학교 경영학과에서 경영학 석사를 취득하였다. 주요 연구분야는 성과측정, 인센티브계약, 기업지배구조, 경영자보상, 정부예산 등이다.