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The Impact of CEO Compensation Structure on Firm Decisions

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The Impact of CEO Compensation Structure on Firm Decisions

**ABSTRACT:** We investigate the effect of CEO compensation structure (CS) on firm decisions, including internal decisions (financing, investing and operating decisions) and external decisions (financial analysts and stock-holders’ decisions.). Based on agency theory, we predict that the influence of CEO compensation on firm decisions varies according to its structure level. Consistent with our prediction, our results suggest that higher CS increases CEO’s incentive to manipulate reported earnings. We also find that higher CS is likely to encourage CEO’s to decrease debt to equity ratio by financing internally or issuing stock.

**Keywords:** CEO compensation structure; firm decisions; internal decisions; external decisions; incentives.

**Data Availability:** All data used for this study are from public sources.
The Impact of CEO Compensation Structure on Firm Decisions

1. INTRODUCTION

Two opposing perspectives appear to exist regarding the impact of executive stock options (hereafter ESOs) on CEO performance. On the one hand, the incentive alignment perspective states that ESOs are granted to mitigate the moral hazard that is often caused by senior managers not being financially vested in the firms they manage. Jensen and Meckling (1976) support this view when they suggest that granting options to CEOs align their incentives more closely with those of shareholders in that they both are concerned with the firm’s future profits. The results of Demsetz and Lehn (1985), Core and Guy (1999), Himmelberg et al. (1999) and Rajgopal and Shevlin (2002) are consistent with this perspective. On the other hand, the rent extraction perspective suggests that CEO’s frequently abuse ESOs for their own benefit. Yermack (1995; 1997), Aboody and Kasznik (2000), Carpenter and Remmers (2001) and Bens et al. (2002) provide evidence supporting this hypothesis.

A recent study by Hanlon et al. (2003) attempted to reconcile the above perspectives. Although their results supported the incentive alignment hypothesis, Larcker (2003, p. 92), commenting on these findings, notes that “the results from alternative specifications are so substantial that it is difficult to draw any conclusion about the impact of ESOs on firm performance.”

In view of these conflicting results, the present study seeks to examine whether and how a change in compensation structure (the proportion of stock-based to cash-based
compensation) impacts CEO decision-making. An increase in the proportion of stock-based pay can mitigate the potential limited horizon problem of CEOs by increasing their concern for the future financial health of the firm. As a result, CEOs can be expected to respond in specific ways to specific events. These are the kinds of issues we investigate in this study.

Many researchers (e.g. Antle & Smith 1986; Baker 1992; Bushman et. al. 1996, Banker et al. 2000, and Shrinivasan et al. 2002) have examined how incentive plans are constructed to motivate CEOs. Smith and Watts (1992) examined determinants of corporate financing, dividend, and compensation-policy choices. They also documented the empirical relations among corporate policy decisions and firm characteristics. Previous studies typically treated compensation structure (CS) as an independent variable, and little research has addressed the relation of CS to output (internal and external decisions) by treating CS as an endogenous variable. For example, higher R&D expenditures may lead to higher CS (Cheng 2004); on the other hand, higher CS may also encourage the CEO to over-invest in R&D. This paper attempts, in part, to address this issue.

The remainder of this paper is organized as follows. Section II develops hypotheses, Section III discusses research design, Section IV describes our sample and data, and Section V reports the results. The last section concludes.

II. HYPOTHESIS DEVELOPMENT

We view the compensation structure (CS) as another potential devise to reduce agency costs between shareholders and CEOs beyond a given composition of performance measures. Typical CEO compensation consists of two major components:
(1) Cash based: salary and bonus;

(2) Stock-price based: stock options and restricted stocks.

Based on agency theory, we develop hypotheses to relate CEO’s compensation to firm decisions influenced by the compensation contract.

**Operating Decisions**

Murphy (1999) suggests that option compensation and outright stock ownership by managers give rise to divergent incentives, with stock ownership focusing managers’ efforts on achieving higher total shareholder returns and options reward with share price appreciation relative to the exercise price. Therefore the influence of CS on discretionary accruals is difficult to predict since both stock basis and cash basis components give CEOs incentive to manipulate accounting numbers. Several empirical studies provide support for these predictions (e.g., Lambert et al. 1989, Lewellen et al. 1987). We conjecture that these divergent incentives could motivate managers to manipulate earnings up or down as a function of compensation structure and other factors. A large body of research has provided empirical evidence that managers often take advantage of discretionary accruals to manipulate earnings, motivated by bonus incentives, “income smoothing”, avoidance of losses and declines in earnings, political reasons and taxation considerations.\(^1\)

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\(^1\) See, e.g., Healy (1985); Dopuch and Pincus (1988); Jones (1991); Defond and Jiambalvo (1994); Guidry et al. (1999); Gaver, et al. (1995); Holthausen et al. (1995); Gaver and Gaver (1998).
Prior research (e.g., Gavor et al., 1995 and Reitenga et al., 2002) finds that firms use discretionary accruals to smooth earnings. We control for smoothing pressure. The variable for smoothing pressure (SMOOTH) is discussed in details in Section 4. The value of SMOOTH measures the gap between estimates of pre-managed earnings and an earnings target. If a firm fills this gap exactly with discretionary accruals, the measures of abnormal accounting accruals and SOOMTH would be equal. Reitenga et al. 2002 shows that, as the value of SMOOTH increases (decreases), the pressure to increase (decrease) earnings grows. We predict that the coefficient of SMOOTH is positive because we expect that firms would use discretionary accruals to fill the gap between target earnings and pre-managed earnings. Therefore, we propose the following hypothesis:

**H1**: CS is positively related to accruals (|AAC|).

**Financing Decisions**

CEO’s of firms with higher CS are more likely to finance by issuing bonds or finance internally rather than by issuing stock because according to signaling theory, capital structure has signaling properties. “The evidence shows that the market value of existing common shares falls when the firm issues new shares, because this will dilute existing stock-holders’ equity. Another explanation is the market’s concern that the new shares may be issued by a low-type firm, while a high type firm would be more likely to issue bonds or finance internally.” (Scott 1997). CEO with higher CS holds more stake in firm’s stock, therefore he is likely to finance by issuing bonds to avoid dilution and keep firm stock price and reputation stable. Additionally according to covenant contract theory (Dhaliwal 1980,
Deakin 1979, etc.) the debt–to-equity ratio is positively related with EPS. Myers (1977) argued the value of a firm’s potential investment opportunities such as call options whose values depend on the likelihood that management will exercise them. If the firm has risky debt outstanding, such situations arise in which exercising the option to undertake a positive net present value project potentially undermines share value because debt holders have a senior claim over shareholders on the project’s cash flows. Therefore firms with more investment opportunities such as higher RD are likely to finance growth options with equity rather than debt, that is such firms have lower DER to reduce the conflict between the debt holders and shareholders. Jensen (1986) suggested that firms with more free cash flow choose higher levels of debt in their capital structure as a credible pre-commitment to pay out the excess cash, hence there is positive relation between free cash flow and DER. The above analysis suggests the following hypothesis:

**H2:** CS is positively related to debt-equity ratio (DER).
Investment Decisions

According to earnings response coefficient theory (Collins et al. 1989; Easton et al. 1989; Lev et al., 1993), firms with higher advertising, R&D and capital expenditures have more growth opportunities, and investors therefore likely regard these expenditures as good news and respond positively---R&D, advertising expenses and capital expenditures provide firm informativeness of stock price. R&D and capital expenditures are positively related to stock returns (e.g. Lev and Sougiannis 1996, Sougiannis 1994). Hence, higher CS will encourage CEO to increase investment in advertising, R&D and capital expenditures to boost stock price. In addition, firms with more growth opportunities are likely to make more investments; therefore advertising expenses, R&D expenditure and capital expenditure will be larger. Moreover, because it is uncertain in determining the length of time over which benefits will endure and the magnitude of future benefits from R&D investment activity, firms with larger R&D investments are expected to be more risky. Furthermore, R&D is not evenly distributed across industries and firms. Expenditures by R&D-intensive firms will be much larger. Based on this discussion, we propose the following hypotheses:

H3: CS is positively related to advertising expenses (AE).

H4: CS is positively related to R&D expenses (RD).

H5: CS is positively related to investment in capital assets (CA).
External Decisions

Venky et al. (2003) suggests that “stock prices impound relevant information in managerial disclosures in light of the current contingencies. As a result, stock price-based incentives elicit both good news and bad news because it boosts the stock price.” Therefore CS will be positively related to stock price. Previous ERC research (Collins & Kothari, 1989) reveals that investors look optimistically at R&D expenditures and perceive them as growth opportunities. Moreover, EPS is positively related to PRICE because it has strong earning informativeness. (Ball & Brown, 1968). The change of EPS between two years could coarsely indicate the scenario of type of news. Ball & Brown (1968) measured the information content of earnings by whether reported earnings were greater than what the market had expected (GN) or less than expected (BN). Investors tend to take previous year EPS as one benchmark to measure current year EPS. The higher the positive change is, the better the news is which results in higher price reflecting market positive response to the good news. Hence EPS change between two years will be positively related to stock price. Furthermore higher market risk may have negative influence on stock price for risk-averse investors. The logic leads to the following hypothesis:

**H6:** CS is positively related to stock price (PRICE).

Nichols (1989) and Schipper (1991) suggest that analysts’ behavior gives more insight into the activities and beliefs of investors that cannot be observed directly. A greater presence of financial analysts is assumed to equate with a stronger firm information environment for external investors. Through their trading behavior, information acquisition
and dissemination activities, analysts can influence how and when financial information affects a firm’s stock price. Evidence suggests that analyst following in the US is positively related to corporate disclosure intensity, arguably due to the low cost of analysts’ information acquisition and processing activities (Chang, Khanna, and Palepu (2000). Therefore CEOs with higher CS have incentive to voluntarily disseminate more internal information to the outside and cause greater analyst following. Moreover, Mary E. Barth et al. (2001) found that more analysts following is presented for firms with more R&D expenditures because usually analysts will consider cost and benefit in covering firms. More R&D expenditures mean firms have more investment opportunities and its financial information has less prices informativeness. Therefore financial analysts have greater incentives to cover this kind of firm that will likely bring them profits. We also expect that higher CEO compensation structure will decrease the relation between analyst coverage and R&D expenditures because with higher CS level, CEO has more incentive to over invest in R&D to signal the market about its growth opportunity. Therefore it is relatively more difficult for analysts to undo the informativeness of R&D. Hence for the firms with higher CS level, the relation between R&D expenditures and analyst coverage decreases. In addition, considering other control variables, analysts coverage is positively related to firm risk since firms with higher market risk are likely to be under-valued by general risk-averse investors. Therefore, we propose the following hypothesis:

**H7:** There is positive relation between CS and the number of financial analysts following (NF).
III. RESEARCH DESIGN

We focus on estimating the following model:

\[ \ln(|AAC|) = \gamma_0 + \gamma_1 \times \text{SIZE} + \gamma_2 \times \ln(\text{CS}) + \gamma_3 \times \text{RISK} + \gamma_4 \times \text{DER} + \gamma_5 \times \ln(|\text{SMOOTH}|) + \varepsilon \]  

where

- \(|AAC|\) --- Abnormal accounting accruals; details of this measurement are provided in section IV;
- \(\text{CS}\) --- CEO compensation structure, defined as stock-based component value divided by cash-based component value;
- \(\text{SIZE}\) --- Firm size, equal to firm sales (COMPUSTAT item#12);
- \(\text{RISK}\) --- Firm systematic risk, measured by market model \(\beta\);
- \(\text{DER}\) --- Debt to equity ratio, equal to total debt book value divided by total book value of owner’s equity;
- \(\text{SMOOTH}\) --- target earnings – pre-managed earnings. Its detail measurement is discussed in section IV;
- \(\varepsilon\) --- Error term.

Furthermore, we also estimate the following model (2):

\[ \text{DER} = \beta_0 + \beta_1 \times \ln(\text{CS}) + \beta_2 \times \text{EPS} + \beta_3 \times \text{CF} + \beta_4 \times \text{RD} + \varepsilon \]  

(2)
DER--- Debt to equity ratio, equal to total debt book value divided by total book value of owner’s equity;

CS--- CEO compensation structure, defined as stock-based component value divided by cash-based component value;

EPS--- Earnings per share from operations (COMPUSTAT item#233);

CF--- Free Cash Flow as a measure of firm liquidity;

RD--- R&D expenses (COMPUSTAT item#46);

ε--- Error term.

**Measurement**

|AAC|

To measure abnormal accruals, we apply the research design used by Healy (1985), Deangelo (1986, 1988), Liberty and Zimmerman (1986), among others. Abnormal accounting accrual (AAC) is defined as the current-period accrual (AC) less the expected normal accrual (E(AC)), and standardized by the beginning-of-year stock price (P):

\[
AAC_{t,t} = \frac{[AC_{t,t} - E(AC_{t,t})]}{P_{t,t-1}}.
\]

The accounting accrual (AC) is defined as the change in noncash working capital (i.e., change in noncash current assets less current liabilities) less depreciation expense. The expected normal accrual [E(AC)] is estimated using a five year firm-specific average of prior periods’ accounting accruals (AC_{t-1}, …, AC_{t-5}) computed over the period under study. The hypothesis does not rely on the direction of the accrual, but the magnitude of the
accrual adjustments, since (according to Healy 1985), managers will shift earnings between years to maximize bonus. Test statistics are based on the absolute value of the abnormal accrual, i.e., $|AAC_{it}|$. The resulting absolute abnormal accrual measures the extent to which managers knowingly pursue certain techniques to adjust reported numbers.

[SMOOTH]

SMOOTH is computed as (target earnings – pre-managed earnings) (Baker et al. 2002). Details on each component of SMOOTH are given as follows:

Target earnings:

To estimate target earnings we use the following historical growth model:

Target earnings = if IBt-1 > IBt-4, then IBt-1 + (IBt-1 – IBt-4)/4,

or, if IBt-1 < IBt-4, then IBt-1.

where, IB = income before extraordinary items. (COMPUSTAT # A18)

We derive pre-managed earnings by removing an estimate of the effect of earnings management from income before extraordinary items. Our estimate of the effect of earnings management is based on the following financial statement relationships: (1) the change in the ratio of accounts receivable to revenue, (2) the change in the ratio of current liabilities less current maturities of long term debt to operating expenses, (3) and the change in the ratio of inventory to operating expenses. We assume that these relationships are constant over time for firm i. Therefore, changes in these relationships...
are interpreted as the effects of earnings management (see Kang and Sivaramakrishnan 1995). The formula for pre-managed earnings is as follows:

pre-managed earnings = IBt - REVt * (AR / REV)t + OPEXPt * ((CL-CM)/ OPEXP)t - OPEXPt * (INVENROTY/ OPEXP)t

where,

IB = income before extraordinary items (COMPSTAT #A18);
REV = Net sales (COMPSTAT #A12);
AR = Account receivable (COMPSTAT A#2);
OPEXP = cost of goods sold (COMPSTAT #A41) + selling and administrative expense (COMPSTAT #A189);
CL = current liabilities (COMPSTAT #A5);
CM = current maturities of long term debt (COMPSTAT #A44);
INVENTORY = (COMPSTAT #A3)

CEO Compensation Structure (CS)

We use the same measures for CS as those employed by Hwang (2002). The sum of annual stock option grants and restricted stock awards act as the proxy for CEO stock-based compensation. The value of CEO stock option awards is estimated for each year using the Black-Scholes option pricing model. The fair value of CEO restricted stock compensation is determined using the stock price on the grant date. For the earning-based compensation, we use salary plus bonus as a proxy, which is consistent with Sloan (1993). This measure excludes cash payments decided on the basis of long-term incentives.
INDUSTRY

An industry is classified as R&D-intensive if it is identified by any of the following four studies as R&D-intensive, or intangible-intensive firms: Collins et al.(1997), Dechow and Sloan (1991), Francis and Schipper (1999) and Lev and Sougiannis (1996). As telephone communication (SIC 481), drugs (SIC 283), computer and office equipment (SIC357) and aircraft and parts (SIC372) are higher in R&D expenditure and intangible assets, we assign variable INDUSTRY as 1 when three-digit SIC code is equal to 283, 357, 372 and 481; otherwise we assign the code as 0.

IV. SAMPLE SELECTION AND DATA

Our empirical tests employ data from three sources. Financial statement data and average annual stock price are obtained from the COMPUSTAT annual database (2002 version) for the period 1987--2001. A firm systematic risk-Beta is calculated for a 5-year time period in COMPUSTAT ending in current month. We retrieve Beta of the years between 1992-2001 from COMPUSTAT 1997 and 2002 versions respectively. After December 31, 1992 information about the components of executives’ total compensation is available for 1992 and later years, whereas it is not available or is difficult to retrieve for earlier years. Therefore the data on CEO stock option awards (the number of options granted and exercise prices), restricted stock awards (the fair value on the grant date) and cash compensation (salary plus bonus) are from Standard & Poor’s (S&P) EXECUCOMP database for the period 1992-2001. Due to the data availability, we retrieved the data for the variable –NF from IBES for the period from 1992 to 2001. The test period is 1992-2001 and qualified firms enter the samples as early as the availability of data allows (typically in
the first year, abnormal accruals can be computed). The samples are restricted to those firms that maintain the same fiscal year-end for six adjacent years, since calculating \( E(AAC) \) relates to six years. The sample firms also must have data on the determinants and on the parameters of the Black-Scholes option pricing model available from COMPUSTAT databases.

Consistent with prior studies (e.g., Dechow and Sloan 1991, Gaver and Gaver 1998, Murphy and Zimmerman 1993, Yermack 1995, 1996), we focus on firms in S&P 500 that are larger in size (current market value(2002) is over 439 million dollars). The sample selection procedure favors larger, more established and actively traded firms, which is likely to reduce the power of the empirical tests and results in survivor bias. Furthermore, the larger firms are worth examining for at least two reasons. First, larger firms usually have more severe agency problems. This implies that issues of managerial incentive are likely to be more important for larger firms. Second, the S&P 500 firms play an important role in the U.S economy (Sloan 1993).

The sample firms are pooled cross-section from wide range of industries, market capitalization, and stock exchanges, in order to reduce the concern with sample clustering.

**Descriptive Statistics**

Table 1 summarizes the descriptive statistics of the sample. The table shows that CS ranges from 0.02 to 6.00E+8, with a mean of 749502. This suggests that stock-price-based compensation is much larger than cash-based compensation in our sample. The average of PE is 28.21, ranging from –1448.18 to 7280.20. The average of abnormal accruals (\(|AAC|\)) is 48, ranging from 0.00 to 6588.96. Its distribution is significantly
different from 0. It shows that abnormal accruals are common in our sample. The average of Debt to Equity ratio (DER) is 39.63, ranging from .00 to 307.13, which indicates that our sample firms finance more by issuing bond than by issuing stock. The average of CF is 338.40, ranging from –5460 to 8072, which indicates that on average our sample firms are not likely to suffer short term liquidity problem. The average of Research & Development expenditures (RD) is 427.57, ranging from 0 to 5227. The average Advertising Expenses (AE) is 423.97 ranging from 1.00 to 3757.00. The average Capital Expenditure (CA) is 732.10, ranging from 6.70 to 15524. The average of SIZE is 8846 ranging from 333 to 117958. The average of EPS is 1.28, ranging from –8.63 to 10.65 and one sample t-test is significant from 0 which means on average sample firm are profitable. The average of risk is 1.05, ranging from –0.04 to 2.69. It suggests that on average our sample firms have normal risk. The average analyst coverage (NF) is 18.24, ranging from 4.58 to 45.58. The average stock price (PRICE) is 30.57, ranging from .71 to 96.77. The average EPSC is .54, ranging from .000 to 9.31. It indicates that a significant variance exists for EPS between two consecutive years of our sample firms. The average of IDUSTRY is 0.17, ranging from 0 to 1. The average of SMOOTH is 656, ranging from 0.3 to 28111.
V. Empirical Results

Tests of H1:

Table 2 reports the results for the tests of our first hypothesis. H1 predicts that CS is positively related to accruals, $\gamma_1$ (the coefficient of firm size) is positive and $\gamma_2$ (the coefficient of Ln(CS)) is unknown. $\gamma_3$ (the coefficient of firm systematic risk), $\gamma_4$ (the coefficient of debt to equity ratio) and $\gamma_5$ (the coefficient of smoothing effect) are expected to be all positive.

Our major results for H1 are as follows: the coefficient Ln(CS) is positive and statistically significant at the level of 0.005. The results indicate that stock-basis compensation outweighs cash-basis compensation in encouraging CEOs to manipulate accounting numbers through technical accounting choices. The coefficient of SIZE is positive and statistically significant (p<.005). The coefficients of RISK is positive and statistically significant (p<.005). The coefficient of DER is positive and statistically significant at .01 level. These are consistent with our expectation. The coefficient of Ln(|SMOOTH|) is positive and has a significance level of 0.000 indicating that firms do manage to fill the gap between the target earnings and pre-managed earnings (earning smoothing ) by using discretionary accounting accruals. This result provides strong evidence both theoretically and empirically that CEO compensation structure does affect CEO in making operating decisions through accounting procedures.
**Tests of H2**

H2 predicts the relation between debt to equity ratio and CEO compensation structure. Table 3 reports results for this relation. Specifically, Hypothesis 2 predicts that $\beta_1$ (the coefficient of Ln(CS)) is positive. The coefficients of EPS, $\beta_2$, and free cash flow, $\beta_3$, are predicted to be positive, and the coefficient of research & development expenditures, $\beta_4$, is predicted to be negative.

Our results for H2 show that the coefficient of Ln(CS) is negative and statistically significant at the 0.005 level. This finding provides empirical evidence that signaling theory cannot explain the CEO’s financing decisions. Explanations can be drawn from contracting theory. C.W. Smith et al. (1992) suggest that, in the relation between principal and agent, if the principal can observe the agent’s actions, the optimal contract pays the agent a fixed wage in the form of cash and bonus and penalizes him for taking suboptimal actions. In this situation, the principal has more power over the firm and is likely to draw debt contractors in and share firm risk with them. In this scenario, DER is relatively higher. However, if the principal cannot observe the agent’s actions, the optimal contract gives the agent a share in the outcome of his actions—stock option or restricted stock awards, hence CS level will be higher. In this situation, principal cannot exert much power on firm decisions. The agent-CEOs will balance the relation between the two sides of capital contributors—principal and debt holders, hence one would expect DER to be lower. Furthermore, to avoid dividend restriction imposed by debt holders, CEOs are more likely to reduce DER rate. CEOs may have two choices to achieve a lower DER. One is to finance by issuing stock. The other is to finance internally. The strong negative relation between CS and DER in this study is therefore consistent with agency theory.
The coefficient of EPS is insignificant. The coefficient of free cash flow is significant at 0.005 level and that of research and development expenditures is negative and statistically significant at .01 level. Our results for EPS are inconsistent with those in Dhaliwal’s (1980) study. After we partition EPS into two groups (one group’s EPS is positive and the other one is negative), we get different results. For the positive EPS group, the coefficient of EPS is positive and statistically significant at the 0.001 level. For the negative EPS group, the coefficient of EPS is negative and statistically significant at the 0.05 level. The reason is that negative EPS indicates bad firm performance. When EPS becomes negative but is close to zero, the firm shows the tendency to have a default problem and will be under critical supervision by covenants, therefore debt contractors would impose severe limits on the firm including debt negotiating or restricting dividend payments resulting in debt stability or possible reduction. At the same time when EPS is getting progressively worse, firms lose ability to issue stock. Therefore the higher EPS is, the lower is the DER. However, when EPS is positive, the higher the EPS, the more profitable the firm is and the more flexible with the types of covenants placed on it. Therefore the higher will be the DER.

The coefficient of RD is negative and statistically significant at the 0.01 level. Such result indicates that managers tend to finance high growth firms by issuing stock as investors look positively at the growth opportunity. At the same time, higher growth firms tend to be in need of cash flows to support investing activities. They avoid borrowing loans because fixed interest and principal payment may be a heavy burden to these firms. Whereas by issuing stock firms can enjoy the use of cash without worrying about fixed periodic repayment of loans.
Tests of H3

H3 predicts the relation between Advertising Expenses and CEO compensation structure. It predicts that $\zeta_1$ (the coefficient of Ln(CS)), $\zeta_2$ (the coefficient of Ln(PE)) and $\zeta_3$ (the coefficient of SIZE) are all positive.

Table 4 shows the results of OLS model on the relation between CS and AE. It suggests that Ln(CS) has no significant effect on AE. SIZE is positively related to AD and statistically significant ($p<.001$). The coefficient of Ln(PE) is positive and statistically significant at the .05 level.

Table 5 presents summary statistics of two stage least squares model from estimating Ln(CS) and AD as jointly determined endogenous variables. It presents the summary statistics from the second stage estimation where the independent variable, Ln(CS), is replaced by its proxy, which is predicted Ln(CS) based on a first-stage regression of Ln(CS) on instrumental variables (PRICE, EPS,SIZE and PE).

The table reveals that correcting for potential simultaneity bias has a dramatic effect on the inferences regarding advertising expenses. The coefficient of Ln(CS) is positive and significantly different from zero ($p=0.005$) which is consistent with prediction. The simultaneous equation regression test provides evidence that CEO with higher stock option compensation has greater motivation to invest in advertising. Moreover, this test suggests that there is a simultaneous effect relation between compensation structure and advertising expenditure since the higher the CS, the more likely the CEO is to over invest in advertisement. On the other hand, if the compensation committee plans to encourage CEO to invest more in advertisement, they may increase the CEO compensation structure.
Tests of H4

H4 predicts the relation between Research and Development expenditures and CEO compensation structure. In H4, it is predicted that $\theta_1$ (the coefficient of Ln(CS)) is positive; $\theta_2$ (the coefficient of Ln(PE)), $\theta_3$ (the coefficient of SIZE), $\theta_4$ (the coefficient of RISK) and $\theta_5$ (the coefficient of INDUSTRY) are also positive. Table 6 showing the result of OLS model indicates that Ln(CS) has no significant effect on RD. SIZE, RISK and INDUSTRY have significant effects on RD at significant level of 0.001. Ln(PE) has significant effect on R&D expenditures at the level of 0.01.

Table 7 presents summary statistics of two stage least squares model from estimating Ln(CS) and RD as jointly determined endogenous variables. It presents summary statistics from the second stage estimation where the independent variable Ln(CS) is replaced by its proxy, which is predicted Ln(CS) based on a first-stage regression of Ln(CS) on instrumental variables (PRICE, EPS, RISK, SIZE, PE and INDUSTRY).

The result is different from that of Table 6 in that Ln(CS) is positively related to RD at the significant level of .005. Whereas Ln(PE) and RISK have no significant effect on RD. The table reveals that correcting for potential simultaneity bias has a dramatic effect on the inferences regarding R&D expenditures that means there is simultaneous effect relation between research expenditure and CEO compensation structure. On the one hand, when CS is higher, CEO is likely to over invest in research expenditures, on the other hand, if compensation committees value firm R&D expenditures as long term growth opportunity and intend to promote CEO to focus on this perspective, compensation committees would like to increase CS. Our results are also consistent with the findings by Cheng (2004).
Tests of H5

H5 predicts the relation between Capital investment and CEO compensation structure. It predicts that $\lambda_1$ (the coefficient of Ln(CS)) is positive; $\lambda_2$ (the coefficient of Ln(PE)) and $\lambda_3$ (the coefficient of SIZE) are positive too. Table 8 shows that both Ln(CS) and Ln(PE) have no relation with CA. SIZE is positively related to R&D (p<.005).

Table 9 presents summary statistics of two stage least squares from estimating Ln(CS) and CA as jointly determined endogenous variables. It presents summary statistics from the second stage estimation where the independent variable Ln(CS) is replaced by its proxy, which is predicted Ln(CS) based on a first-stage regression of Ln(CS) on instrumental variables (PRICE, EPS,SIZE and PE).

The table reveals that correcting for potential simultaneity bias has no dramatic effect on the inferences regarding R&D expenditures. The coefficients of Ln(CS) and SIZE are not significantly different from that in Table 8. Therefore, the result suggests that CEO compensation structure does not have significant effect on CEO decision to make investment in capital assets. Firm size plays an important role in this procedure.

Tests of H6

H6 predicts the relation between PRICE and CEO compensation structure. It predicts that $\delta_1$ (the coefficient of Ln(CS)) is positive; $\lambda_2$ (the coefficient of RD), $\lambda_3$ (the coefficient of EPS) and $\lambda_4$ (the coefficient of EPSC) are all positive. $\lambda_5$ (the coefficient of RISK) is expected to be negative. Table 10 shows the result of OLS model that the coefficient of Ln(CS) is positive and statistically significant (p<.005); The coefficients of EPS and EPSC are positive and statistically significant (p<.005); the coefficient of RD is
positive and statistically significant (p<.05). The coefficient of RISK is negative and statistically significant at the level of 0.005. These results are all consistent with predictions.

Table 11 presents summary statistics of two stage least squares from estimating Ln(CS) and PRICE as jointly determined endogenous variables. It presents summary statistics from the second stage estimation where the independent variable, Ln(CS), is replaced by its proxy, which is predicted Ln(CS) based on a first-stage regression of Ln(CS) on instrumental variables (RD, EPS EPSC RISK and the lag of Ln(CS)--Ln(CS t-1)). we use natural logarithms of lag CS as one of instrumental variables in the two stage least square regression as SPSS Regression Models 10.0 states “... the lagged value of an endogenous variable is very often used as an instrument because it is frequently a good predictor of the current value.” The table reveals that there is potential simultaneity bias between PRICE and CS.

The two-stage least squares regression test suggests that CEOs with higher stock option compensation have more incentive to boost stock price and induce investors to value stock price high. At the same time higher stock price indicates that investors perceive firms positively and compensation committees are likely to put more weight on the stock component in designing compensation. Our conclusion is consistent with the findings of Venky et al. (2003): “Our results suggest that stock price-based compensation itself plays a role in this process by providing managers with an incentive to improve price informativeness through disclosure.” This process he refers to is the stock price formation process through which prices become informative about managerial actions.
Tests of H7

H7 predicts the relation between financial analysts coverage and CEO compensation. Table 12 shows the result about the relation. It is expected that the $\eta_1$ (the coefficient of Ln(CS)) is positive, $\eta_2$ (the coefficient of R&D expenditure) and $\eta_4$ (the coefficient of firm systematic risk) are positive, $\eta_3$ (the coefficient of interaction between Ln(CS) and R&D expenditures) is negative.

Our result is consistent with prediction. The coefficient of Ln(CS) is positive and statistically significant ($p=0.01$); the coefficient of R&D expenditures is positive and statistically significant ($p<.001$); The coefficient of the interaction between Ln(CS) and R&D expenditures is negative and statistically significant ($p<.05$). The coefficient of firm systematic risk is positive and statistically significant ($p<.001$).

This test suggests that CEO with higher stock options in compensation are highly motivated to take action portfolios to attract financial analysts. In addition, the results indicate that higher CS likely increases the difficulty for financial analysts to interpret research and development expenditures.
VI. CONCLUSION

The accounting literature extensively examines the influence of bonuses on managerial decisions and the formation of managerial incentives. We study the influence of CEO compensation structure on firms’ decisions. It is important for compensation committees to know in what respects and the extent to which CS influences managerial behaviors in the presence of agency problem. Such knowledge can allow them to take appropriate measures impounded in compensation to mitigate such agency problems. It is also important for investors to know how to interpret the information of managerial compensation structure to make wise investment decision. At the same time, this study can also offer insight into the financial information formation process involved by CEO to accounting standard bodies.

We hypothesize that CEO compensation structure (CS) has influence on firms’ financing, operating and investment decisions and through CEO’s opportunistic behavior CS has influence on firm external decisions. Specifically Higher CS will encourage CEO to over invest in R&D, advertisement and capital expenditures which signal the firm’s growth opportunities leading investors to boost stock price. Moreover, there are more analysts to follow firms with higher CS. Another major finding is that Higher CS can give CEO more incentive to take opportunistic action to manipulate financial reporting process which is also the major channel for CEO to influence firm external decisions. Finally higher CS will encourage CEO to finance internally or by issuing stocks that can protect his own stake in the firm.
Our findings expand prior literature in the following ways: First, few prior researches associate the managerial compensation structure with firm decisions with the exception of Venky et al. (2003) who study the relation between managerial compensation structure and firm discretionary disclosure decisions and Aboody and Kasznik (2000) who study whether managers manipulate the time of release of voluntary disclosures around award dates. This study is the first to provide evidence on the influence of managerial compensation structure on more comprehensive firm decisions covering operating, financing and investment decisions. Second, our study may also offer insights to compensation committees into the influence of managerial compensation structure and guide them in constructing incentive plans to mitigate agency problems. For example, compensation committee offers stock option to CEO seeking to minimize CEO’s short-term action and encourage him to focus on long-term perspective. However, our findings offer the evidence that higher stock proportion compensation may give CEO encouragement to take opportunistic action to manipulate accounting earnings even more greatly. Compensation committees may revise their objectives and take corresponding actions accordingly. Third, our study may be of interest to investors seeking to make wise investment decisions through a more informed understanding of CS. Finally our study may contribute to firm theory literature by showing the formation process of firm decisions.
REFERENCES


Table 1
Descriptive Statistics on Cash-based and Stock-price-based CEO Compensation and Performance Measures Using Annual Data for 1987-2110

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<th>Minimum</th>
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<td>.08</td>
<td>.39</td>
<td>.17</td>
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*DER denotes debt to equity ratio, measured as total debt book value divided by total book value of owner’s equity. RD denotes R&D expenses. CA denotes investment in capital assets. SIZE denotes firm size, measured as firm annual sales. EPS denotes earnings per share. NF denotes number of financial analysts issuing earning forecasts for the firm, measured as the number of analysts with earning forecasts for the current fiscal year. RISK denotes firm systematic risk, defined as \( \beta \) in the market model. AE denotes selling expenses. BA denotes dummy variable to proxy big five as auditors; 1 for firms with a Big Five as auditor, and 0 otherwise. CS denotes CEO compensation structure, defined as stock-price-based component value divided by cash-based component value. LN(CS) denotes natural logarithms of CS. Price denotes average annual stock price, measured by calculating the average monthly stock price. [AAC] denotes abnormal accounting accruals; its measurement was discussed in section III. PE denotes price to earning ratio, which is used to measure growth opportunity. CF denotes free cash flow; for measuring firm’s liquidation situation. EPSC denotes the change of EPS for consecutive two years, that is, EPS in current year t minus EPS in year t-1. INDUSTRY= 1 if belongs to R&D-intensive industry, and 0 otherwise; its measurement was discussed in Section III.
Table 2  OLS Regression of Abnormal accruals on SIZE, Ln(CS), RISK, DER and Ln (|SMOOTH|).

\[ \text{Ln}(|AAC|) = \gamma_0 + \gamma_1 \times \text{SIZE} + \gamma_2 \times \text{Ln}(\text{CS}) + \gamma_3 \times \text{RISK} + \gamma_4 \times \text{DER} + \gamma_5 \times \text{Ln}(|\text{SMOOTH}|) + \varepsilon \]

<table>
<thead>
<tr>
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<th>estimated</th>
<th>p-value</th>
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<td>.000**</td>
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<tr>
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<td>.004**</td>
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<td>.006*</td>
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<td>5.79E-03</td>
<td>.006*</td>
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<td>Ln(</td>
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<td>Adjusted R²</td>
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* Significant at the 0.01 level (2-tail test)
** Significant at the 0.005 level (2-tail test)
Variables are defined in Table 1.
Table 3  OLS Regression of Debt to equity ratio on Ln(CS), EPS, CF and RD.

\[ \text{DER} = \beta_0 + \beta_1 \times \text{Ln(CS)} + \beta_2 \times \text{EPS} + \beta_3 \times \text{CF} + \beta_4 \times \text{RD} + \varepsilon \]

<table>
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<th>p-value</th>
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<tr>
<td>Intercept</td>
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<td>.000**</td>
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<td>EPS</td>
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<td>.275</td>
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<tr>
<td>CF</td>
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<tr>
<td>RD</td>
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Sample Size 800
Adjusted R\(^2\) .037

* Significant at the 0.01 level (2-tail test)
** Significant at the 0.005 level (2-tail test)
Variables are defined in Table 1.
Table 4  OLS Regression of Advertising expenses on Ln(CS), firm growth and SIZE

\[ AE = \zeta_0 + \zeta_1 \times \text{Ln(CS)} + \zeta_2 \times \text{Ln(PE)} + \zeta_3 \times \text{SIZE} + \epsilon \]

<table>
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<td>Ln(PE)</td>
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<td>SIZE</td>
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<td>2.862E-02</td>
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Sample Size: 397
Adjusted R\(^2\): .418

* Significant at the 0.05 level (2-tail test)
** Significant at the 0.001 level (2-tail test)
Variables are defined in Table 1.
Table 5   Two Stage Least Squares Regression of Advertising Expenses on Ln(CS), Firm Growth and SIZE

\[ AE = \zeta_0 + \zeta_1 \times \text{Ln(CS)} + \zeta_2 \times \text{Ln(PE)} + \zeta_3 \times \text{SIZE} + \epsilon \]

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<td>Ln(CS)</td>
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<tr>
<td>Ln(PE)</td>
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* Significant at the 0.005 level (2-tail test)
Variables are defined in Table 1.
Table 6  OLS Regression of R&D expenditures on Ln(CS), firm growth, SIZE, RISK and INDUSTRY

\[
\text{RD} = \theta_0 + \theta_1 \times \text{Ln(CS)} + \theta_2 \times \text{Ln(PE)} + \theta_3 \times \text{SIZE} + \theta_4 \times \text{RISK} + \theta_5 \times \text{INDUSTRY} + \varepsilon
\]

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* Significant at the 0.01 level (2-tail test)
** Significant at the 0.001 level (2-tail test)
Variables are defined in Table 1.
Table 7  Two stage least square regression of R&D expenditures on Ln(CS), firm growth, SIZE, RISK and INDUSTRY

\[ RD = \theta_0 + \theta_1 \cdot \text{Ln(CS)} + \theta_2 \cdot \text{Ln(PE)} + \theta_3 \cdot \text{SIZE} + \theta_4 \cdot \text{RISK} + \theta_5 \cdot \text{INDUSTRY} + \varepsilon \]

(+) (+) (+) (+) (+)

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<td>RISK</td>
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* Significant at the 0.005 level (2-tail test)
** Significant at the 0.001 level (2-tail test)
Variables are defined in Table 1.
Table 8  OLS Regression of capital expenditures on Ln(CS), firm growth and SIZE

\[ CA = \lambda_0 + \lambda_1 \times \text{Ln}(CS) + \lambda_2 \times \text{Ln}(PE) + \lambda_3 \times \text{SIZE} + \epsilon \]

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* Significant at the 0.001 level (2-tail test)

Variables are defined in Table 1.
Table 9 Two stage least regression of capital expenditures on Ln(CS), firm growth and SIZE

\[ CA = \lambda_0 + \lambda_1 \times \text{Ln(CS)} + \lambda_2 \times \text{Ln(PE)} + \lambda_3 \times \text{SIZE} + \varepsilon \]

* Significant at the 0.001 level (2-tail test)
Variables are defined in Table 1.

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Table 10  OLS Regression of stock price on Ln(CS), RD, EPS, EPSC and RISK.

\[
\text{Price} = \delta_0 + \delta_1 \text{Ln(CS)} + \delta_2 \text{RD} + \delta_3 \text{EPS} + \delta_4 \text{EPSC} + \delta_5 \text{RISK} + \epsilon
\]

(+ )  (+)  (+)  (+)  (-)

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<td>RISK</td>
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<td>-6.431</td>
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<tr>
<td>Adjusted R$^2$</td>
<td></td>
<td>.41</td>
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* Significant at the 0.05 level (2-tail test)
** Significant at the 0.005 level (2-tail test)

Variables are defined in Table 1.
Table 11  Two stage least squares on regression of stock price on Ln(CS), RD, EPS, EPSC and RISK.

\[
\text{Price} = \delta_0 + \delta_1 \text{Ln(CS)} + \delta_2 \text{RD} + \delta_3 \text{EPS} + \delta_4 \text{EPSC} + \delta_5 \text{RISK} + \varepsilon
\]

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predicted sign</th>
<th>estimated</th>
<th>p-value</th>
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<tr>
<td>Intercept</td>
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<tr>
<td>RD</td>
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<td>.0024</td>
<td>.013*</td>
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<td>-</td>
<td>-6.597</td>
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Sample Size 645
Adjusted R\(^2\) .38

Significant at the 0.05 level (2-tail test)
Significant at the 0.005 level (2-tail test)
Variables are defined in Table 1.
Table 12  OLS Regression of financial analysts coverage on Ln(CS), RD, interaction between Ln(CS) and RD, RISK and PRICE.

\[ NF = \eta_0 + \eta_1 \cdot \text{Ln}(CS) + \eta_2 \cdot RD + \eta_3 \cdot \text{Ln}(CS) \cdot RD + \eta_4 \cdot \text{RISK} + \eta_5 \cdot \text{PRICE} + \varepsilon \]

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Predicted sign</th>
<th>estimated</th>
<th>p-value</th>
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<td>Adjusted R²</td>
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* Significant at the 0.05 level (2-tail test)  
** Significant at the 0.001 level (2-tail test)  
Variables are defined in Table 1.