Optimal Executive Compensation Contract under CEO Ownership and Corporate Governance: Theory and Empirical Illustration

Chung-Jen Fu
Department of Accounting, National Yunlin University of Science & Technology
123, Section 3, University Road, Touliu, Yunlin, Taiwan, R.O.C.
E-mail: fucj@yuntech.edu.tw
Fax：886-5-5345430
Tel：886-5-5342601#5341

Fu-Hsing Chang
Department of Accounting, National Yunlin University of Science & Technology
123, Section 3, University Road, Touliu, Yunlin, Taiwan, R.O.C.
E-mail: fschang@yuntech.edu.tw
Fax：886-5-5345430
Tel：886-5-5342601#5502

Mei-Lun Lin
Department of Accounting, Tainan Woman's College of Arts & Technology
529 Chung Cheng Rd, Yung Kang, Tainan, Taiwan, R.O.C.
E-mail: t20052@ms.twcat.edu.tw
Fax：886-6-2451787
Tel：886-6-2535649

Optimal Executive Compensation Contract under CEO Ownership and Corporate Governance: Theory and Empirical Illustration

ABSTRACT: This study theoretically and empirically examines the executive compensation to demonstrate that CEO ownership and corporate governance are explained by key variables in the contracting environment. There is good evidence to prove there exists a significant nonmonotonic relation. We find a U-shaped relation between the CEO compensation and CEO ownership; CEO compensation first decreases and then increases as CEO ownership increases. We also find that the CEOs earn greater compensation when proxies of corporate governance, the variables of board and ownership structure, are less effective. These findings suggest that when management controls enough of a firm's voting right, such managers are paying themselves more.

Keywords: CEO *compensation; CEO ownership; corporate governance; nonlinear ownership structure.*

I. INTRODUCTION

A great deal of effort has been made on the level of compensation and the extent of pay-for-performance for CEOs (chief executive officers) in the academic and business communities. What seems to be lacking, however, is the relation between ownership structure and the level of CEO compensation (Core et al. 1999). Numerous attempts have been made by scholars (e.g., Morck et al. 1988; McConnell and Servaes 1990) to show that agency problems and hence market valuation are nonmonotonic in managerial ownership. In addition to the importance of managerial ownership, Core et al. (1999) point out that measures of board and ownership structure explain a significant amount of cross-sectional variation in CEO compensation.

The level of CEO ownership not only affect the management effort but also has an influence on the firm's performance and stock price. Moreover, it has an effect on CEO compensation. Therefore, this study will discuss the CEO ownership in a CEO compensation model. A follow-up concern is whether CEO compensation is affected by corporate governance. This study will use the proxies of corporate governance, a comprehensive set of board and other ownership structure characteristics, to observe whether corporate governance has elasticity space to affect CEO compensation.

The purpose of this paper is to theoretically and empirically understand and thus examine the determinants of CEO compensation, with a special focus on the effect of CEO ownership and corporate governance on CEO compensation. Most of prior studies [1] generally interpret the positive relation at low levels of managerial ownership as evidence of incentive alignment, and the negative relation at high levels of managerial ownership. However, our findings in Taiwanese firms are different from

[1] For example, see Morck et al.(1988), McConnell and Servaes(1990), Hermalin and Weisbach(1991), Holderness et al.(1999).

others, but show the same trend that CEO compensation is affected by CEO ownership nonetheless. We find that when CEO ownership is at low levels, it exhibits a negative relation with the CEO compensation, and when CEO ownership is at high levels, it becomes a positive relation with the CEO compensation, resulting in a U-shape relation. Usually, a U-shape relation arises when the coefficient of first order term is negative and the coefficient of quadratic term is positive in quadratic equation. This captures an increasing effect of CEO ownership on CEO compensation.

With respect to the board-of-director variables, our finding is consistent with Core et. al. (1999). We find that CEO compensation is higher when the CEO is also the board chair, the CEO is also a director, and the board is larger. With respect to the other ownership variables, we find that CEO compensation is a decreasing function of the directors' ownership and the existence of a blockholder who owns at least 10% of the equity. As such, our results suggest that CEOs at firms with weaker governance structures have greater compensation.

This study contributes to the literature in three ways. First, this paper not only develops a theoretical model to clarify the roles of CEO ownership and various performance measures in the CEO compensation contracts, but also empirically examines the determinants of CEO compensation, with a special focus on the effect of CEO ownership and corporate governance. Secondly, it shows, by the empirical results, how we examine the nonlinearity impact of CEO ownership on CEO compensation. Prior studies focus on a nonmonotonic relation between firm performance and managerial ownership, or a linear relation between CEO compensation and ownership, but little examines whether a nonlinear relation exists between CEO compensation and CEO ownership. Thirdly, we find a U-shaped function relation between the CEO compensation and CEO ownership.

The remainder of this paper is organized as follows. In Section II, we propose and outline a model of CEO compensation. Section III discusses our research design, reviews the prior literature to find the measurement of the main variables, empirical model, and our sample selections. The empirical results are presented in Section IV. Section V contains sensitivity tests to determine the robustness of the results to alternative specifications. Section VI concludes the paper.

II. THE MODEL

Holmstrom (1979) points out that the "standard" agency model analyzes incentive problems. The principal must rely on imperfect measures of the agent's actions, such as his output and other information for both evaluation and motivation (Lambert and Larcker 1987). Fu et al. (2002) shows that the CEO compensation incentive scheme expressed in the following linear form:

$$B = \alpha_0 + \alpha_P P + \alpha_F F + \alpha_G G \tag{1}$$

where

$$P = \beta_0 + \beta_1 F + \beta_2 G + \varepsilon_p$$
$$F = f + \varepsilon_F$$
$$G = g + \varepsilon_g$$

B represents the level of CEO compensation, α_0 denotes the fixed salary, and α_P, α_F, α_G are the weights placed on market (P), financial (F) and nonfinancial (G) measures of performance, respectively. The respective sensitivity of total firm value to the financial and nonfinancial indicators of performance is captured by the coefficients β_1 and β_2.

Core et al. (1999) point out the importance of corporate governance on CEO compensation. Therefore, we include the proxies of corporate governance (C), the variables of board and ownership structure, into equation (1) to examine whether it has the same effect on CEO compensation. Hence, the optimal compensation incentive scheme expressed in the following form:

$$B = \alpha_0 + C + \alpha_P P + \alpha_F F + \alpha_G G \tag{1'}$$

A firm's total value is allocated first by paying the compensation (B) to the CEO, and the residual value (*P*-*B*) is shared by all of the stockholders. Hence, when the CEO owns δ $(0 \le \delta \le 1)$ percent of equity shares, his end of period wealth is the sum of $B + \delta(P\text{-}B)$ whereas the equity value owned by other stockholders is $(1 - \delta)(P\text{-}B)$. Under the linear form of compensation contracts specified in equation (1') and the assumption of a negative exponential utility function, the problem faced by outside shareholders who want to maximize the expected residual value given the individual rationality and incentive compatibility constraints can be formulated as:

$$\begin{aligned} &\underset{\alpha_0,\alpha_P,\alpha_F,\alpha_G}{Max} \; E[(1-\delta)(P-(\alpha_0 + C + \alpha_P P + \alpha_F F + \alpha_G G))] \\ &s.t. \quad E[-\exp\{-r\{(1-\delta)(\alpha_0 + C + \alpha_P P + \alpha_F F + \alpha_G G) + \delta P - \frac{f^2 + g^2}{2}\}\}] \ge u_0 \\ &(f, g) \in \arg\max_{f,g} \; E[-\exp\{-r\{(1-\delta)(\alpha_0 + C + \alpha_P P + \alpha_F F + \alpha_G G) + \delta P - \frac{f^2 + g^2}{2}\}\}] \end{aligned} \tag{2}$$

where *r* ($r > 0$) denotes the risk aversion coefficient of the management, *f* and *g* are the manager's efforts with respect to the financial and nonfinancial performance, respectively. We assume the manager has an increasing convex cost function, and without loss of generality, the function takes the form $(1/2)(f^2 + g^2)^2$. The noise therm ε (a common shock) is normally distributed with mean 0 and variance σ^2.

[2] In addition to the costs associated with *f* and *g*, there are other costs involved. We assume other costs to be constant and have negligible impact on managerial efforts.

By substituting management's response functions, the first order condition of the agent certainty equivalent [3], into total certainty equivalent [4] (see Appendix), shareholders' problem can be reduced to an unconstrained optimization:

$$\begin{aligned}\underset{\alpha_P,\alpha_F,\alpha_g}{Max}\ & \beta_0+(1-\delta)\beta_1\alpha_F+[(1-\delta)\alpha_P+\delta)\beta_1^2+(1-\delta)\beta_2\alpha_G+[(1-\delta)\alpha_P+\delta)\beta_2^2 \\ & -\frac{1}{2}[(1-\delta)(\alpha_F+\beta_1\alpha_P)+\beta_1\delta]^2-\frac{1}{2}[(1-\delta)(\alpha_G+\beta_2\alpha_P)+\beta_2\delta]^2 \\ & -\frac{r}{2}[(1-\delta)\alpha_P+\delta]^2\sigma_P^2-\frac{r}{2}[(1-\delta)\alpha_F]^2\sigma_F^2-\frac{r}{2}[(1-\delta)\alpha_G]^2\sigma_G^2\end{aligned} \tag{3}$$

Differentiating equation (3) with respect to α_P, α_F and α_G, and then solving the first order condition simultaneously, we can obtain the respective optimal weight placed on market, financial and nonfinancial measures of performance used in the compensation contracts:

$$\alpha_P^*=\frac{\beta_1^{\,2}(1-\frac{1}{1+r\sigma_F^2})+\beta_2^{\,2}(1-\frac{1}{1+r\sigma_G^2})-\frac{\delta}{1-\delta}r\sigma_P^2}{\beta_1^{\,2}+\beta_2^{\,2}+r\sigma_P^2-\frac{\beta_1^{\,2}}{1+r\sigma_F^2}-\frac{\beta_2^{\,2}}{1+r\sigma_G^2}}=\frac{1}{1-\delta}(\alpha_P^{'}-\delta) \tag{4}$$

$$\alpha_F^*=\frac{\beta_1}{1+r\sigma_F^2}\frac{1-\alpha_P^{'}}{1-\delta}\geq 0 \tag{5}$$

$$\alpha_G^*=\frac{\beta_2}{1+r\sigma_G^2}\frac{1-\alpha_P^{'}}{1-\delta}\geq 0 \tag{6}$$

where $\alpha_P^{'}=\dfrac{\beta_1^{\,2}+\beta_2^{\,2}-\dfrac{\beta_1^{\,2}}{(r\sigma_F^2+1)}-\dfrac{\beta_2^{\,2}}{(r\sigma_G^2+1)}}{\beta_1^{\,2}+\beta_2^{\,2}+r\sigma_P^2-\dfrac{\beta_1^{\,2}}{(r\sigma_F^2+1)}-\dfrac{\beta_2^{\,2}}{(r\sigma_G^2+1)}}$ (7)

[3] Agent certainty equivalent is calculated by subtracting the costs of efforts and risk premium from the expected compensation.

[4] Total certainty equivalent is the sum of management and shareholders' certainty equivalents.

Equation (7) indicates that $0 < \alpha_P^{'} < 1$. α_P^* in equation (4) is the derived optimal weight placed on firm value (market measure of performance), α_F^* in equation (5) is the one on financial measure of performance and α_G^* in equation (6) is the one on nonfinancial measure of performance.

By substituting the three optimal weights α_P^*, α_F^* and α_G^* into equation (1'), we obtain the following form of the optimal compensation:

$$B = \alpha_0 + C + \frac{\alpha_P^{'} - \delta}{1-\delta} P + \gamma_F \frac{1-\alpha_P^{'}}{1-\delta} F + \gamma_G \frac{1-\alpha_p^{'}}{1-\delta} G \qquad (8)$$

where $\gamma_F = \frac{\beta_1}{r\sigma_F^2 + 1}$ and $\gamma_G = \frac{\beta_2}{r\sigma_G^2 + 1}$.

Under the assumptions of a negative exponential utility function, a specific cost function, and normally distributed stochastic errors, the optimal weights placed on market, financial and nonfinancial measures of performance are all positive when the CEO does not have any equity stake in the firm. With the increases in CEO's shareholdings, the optimal weight assigned to market measure of performance is decreasing and even becomes negative when $\delta > \alpha_P^{'}$. Conversely, the optimal weights assigned to financial and nonfinancial measures are increasing in CEO ownership. This theoretical finding is consistent with the empirical evidence of Allen (1981) and Lambert et al. (1993).

Individual rationality constraints in the equation (2) guarantees a CEO a

minimum expected utility (attained via a market or a negotiation process). Both CEO ownership and corporate governance may affect the CEO reserve utility. CEOs earn greater compensation when CEO ownership is higher or governance structures are less effective. The study of Core et al. (1999) focus on the economic income of CEO compensation, while this study will focus on the real income of CEO compensation, especially the effect of CEO ownership and corporate governance on the CEO compensation. As for the firm-specific optimal level of CEO compensation expressed in equation (8), its empirical test is beyond the scope of this study.

The disciplinary role of managerial ownership is a cornerstone in the principal-agent literature. Prior literature (Morck et al. 1988; McConnell and Servaes 1990; Morck et al. 2000) has noted a nonmonotonic relation between firm performance and managerial ownership. Pukthuanthong et al. (2004) find that the pay-for-performance relation appears to be curvilinear in CEO stock ownership, but they focus on the financial services sector only. However, Himmelberg et al. (1999) examine the observable determinants of managerial ownership, but they cannot conclude that changes in managerial ownership affect firm performance.

The impact of ownership structure on CEO compensation and firm performance is unclear given the mixed nature of the empirical results. This paper is to reexamine theoretical explanations of the empirical link between pay-for-performance, CEO ownership and corperate governance. To explore for a possible nonlinearity effect, we allow the pay-for-performance functional forms to be quadratic[5] (McConnell and Servaes 1990; Morck et al. 2000).

[5] Quadratic functions mentioned by Wooldridge(2003) in the book of "Introduction Econometrics" are also used quite often in applied economics to capture decreasing or increasing marginal effects.

III. RESEARCH DESIGN

Measurement of the Main Variables

CEO Compensation Determination

The empirical analysis of CEO compensation is based on cash compensation, including salary, bonus and traffic allowances. The results of standard agency models suggest that the level of pay is an increasing function of firm performance. Firm performance is measured by using market, financial and nonfinancial performance measures. Market performance is measured by using the annual stock return (e.g., Core et al. 1999; Cheng 2004). Financial performance is measured by using the return on equity (e.g., Craighead et al. 2004) and return on asset (e.g., Core et al. 1999). Nonfinancial performance is measured by the growth rate of sales revenue (e.g., Fu 2001; Fu et al. 2002), which is computed as the difference of net sales between year *t* and year *t*-1 divided by the net sales at year *t*-1.

Consistent with prior theory and empirical work (Core et al. 1999; Himmelberg et al. 1999), we expect that large firms are likely to employ more skilled managers with higher equilibrium wages. Company size provides an indication of managerial responsibility and job complexity. We use the total assets as a proxy for firm size and complexity. The regression model also contains two indicator variables that control for the year in which compensation was paid and industry differences in the demand for managerial talent (Murphy 1985; Core et al. 1999).

Board Structure

Core et al. (1999) find that a company's corporate governance practices affect its CEO compensation. Thus, we include some of their measures of board characteristic in this study to examine whether those board characteristics have the same effect on

CEO compensation. To measure how CEO is influencing his pay process, we use two proxies for that effect. One proxy is whether the CEO is a chairman of the board (Core et al. 1999) and the other proxy is whether the CEO is a director of the board. Fu (2001) provides justification for the use of the second proxy. He shows that the CEO compensation is higher when the CEO is also a director of the board.

Jensen (1993) expresses that large boards can be controlled more easily by CEOs. Core et al. (1999) find that CEO compensation is higher when the board is larger. Pukthuanthong et al. (2004) argue that board effectiveness may also be related to its size. It seems reasonable to conclude that the larger size of board is expected to be associated with less effective and more susceptible to the influence of the CEO. We expect the CEO compensation is an increasing function of the board structure variables.

Other Ownership Structure

In addition to board characteristics, ownership structure plays an important role in corporate governance. As measures for outside ownership influences, we use the ownership of directors and the existence of blockholder that owns at least 10% of the outstanding shares. We expect the CEO compensation is a decreasing function of the holdings of blockholder and the ownership of directors, respectively.

Empirical Model

To investigate the nonlinearity impact of CEO ownership on compensation, we use the quadratic function terms in the compensation regression, OWNCEO and $OWNCEO^2$ (as in McConnell and Servaes 1990; Morck et al. 2000). Following recent studies in this area (e.g., Core et al. 1999; Core and Guay 1999), the board and

ownership structure variables are treated as exogenous. In corporate finance literature (e.g., Morck et al. 1988), the agency problems and market valuation are nonmonotonic in CEO share ownership. Deducing from the model, we show that this leads to a nonlinearity in the pay-for-performance relation, and a comprehensive set of board and other ownership structure characteristics. The empirical model tested is:

$$\begin{aligned} Compensation_{i,t} = {} & \alpha + \beta_1 RET_{i,t} + \beta_2 FINANCIAL_{i,t-1} + \beta_3 NONFINANCIAL_{i,t-1} \\ & + \beta_4 SIZE_{i,t} + \beta_5 DUAL\_CHAIR_i + \beta_6 DUAL\_DIRECTOR_i \\ & + \beta_7 BOARDSIZE_i + \beta_8 OWN\_DIRECTOR_i + \beta_9 OWN\_BLOCK_i \\ & + \beta_{10} RET_{i,t} * OWNCEO_{i,t} + \beta_{11} RET_{i,t} * OWNCEO_{i,t}^2 + \varepsilon_i \end{aligned} \quad (8)$$

where *i* represent the firm. Table 1 summarizes our list of variables used in the subsequent analyses.

Sample

We restrict ourselves to firms that have no missing data. Stock prices and accounting data are collected from Taiwan Economic Journal. Data on board and ownership structure variables are collected from annual reports. Because the listed companies started to reveal the CEO compensation only after it was made mandatory on November 7, 1995 by Securities and Futures Committee in Taiwan, and this research needs to have compensation of the previous year, hence, our sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. Finally, all monetary items are restated to constant 2003 NT dollars using the fiscal year-end Consumer Price Index.

IV. RESULTS

Descriptive Statistics

The amount of stock a CEO needs to own in order to control his firm personally is an even more contentious issue, as it will depend on the distribution of shareholdings in his firm. To obtain interpretable results, after examining the distribution of CEO ownership in our sample firms, we limit ourselves to fairly tightly parameterized specifications as shown in Figure 1. Different from the existing studies typically indicating a reverse U-shaped function relation between the pay-for-performance and CEO ownership, Figure 1 depicts a trend of a U-shaped function relation. The relation between ownership and compensation might be nonlinear, it also highlights the need of controlling for some sources of heterogeneity across firms, particularly industries.

Table 2 summarizes the mean values of compensation, grouped by level of CEO ownership. Note that the percentage of shares owned by CEOs for no more than 5% of outstanding equity is high enough to 63.90% of the size distribution of firms with an average of compensation NT$3,920 thousand. The amount of average compensation gradually declines by increasing the percentage of CEO ownership. The average compensation is the lowest when the percentage of ownership is 15~25%. And then, there is an increase of the average compensation by increasing the percentage of CEO ownership. It is the highest average compensation NT$5,508 thousand when the ownership is over 45%.

Table 3 summarizes the descriptive statistics of the sample. The statistics in this table show that the mean of CEO compensation is equal to NT$3,790 thousand, with the median of NT$3,051 thousand. The variable annual stock return (RET), a proxy

for the market measure of performance, has a mean of 7.28% and a median of –6.10%. ROE and ROA, proxies for the financial measures of performance, and their means are 6.07%and 8.07%, respectively. As the proxy for the nonfinancial measure of performance, the growth rate of sales revenue has a mean of 17.36%. As for firm size, the mean of total assets is equal to NT$17,044 millions.

Consistent with prior studies (Morck et. al. 1988; McConnell and Servaes 1990; Core et al. 1999; Morck et al. 2000), we find that the distribution of CEO ownership is skewed, with the mean CEO ownership of approximately 6.20%, and the median of 2.76%. The CEO is also chairman of the board accounts for 27.84% of the sample. The CEO is also director is about 60.09% of the sample. Board size has a mean of 8 directors. The percentage of director ownership approximately has a mean of 25.47% of the outstanding equity. Finally, the mean of blockholders' ownership is 2.69%.

A possible concern in studies that use a large number of explanatory variables is multicollinearity, where the independent variables are strongly correlated with each other, resulting in inflated standard errors and a higher likelihood of accepting the null hypothesis that the coefficients are not significantly different than zero (Pukthuanthong et al. 2004). To test for more complex multicollinearity relations between linear combinations of variables, we compute variance inflation factors (VIFs). Although no definitive cutoff value of a VIF exists to rule out multicollinearity is not a problem, a common cutoff value of 10 is often used. It empirically shows that the values of VIF are less than 10, so there is no multicollinearity in this study.

The regression equation includes as a dependent variable CEO compensation and includes independent variables defined in Table 1 as proxies for the determinants of

CEO compensation. The regression model also contains two indicator variables that control for the year in which compensation was paid and industry membership (e.g., Core et al., 1999).

Our empirical analysis of the effects of CEO ownership and corporate governance on CEO compensation is summarized in Table 4, using the pooled data of firms over the period 1997-2003. Table 4 reports estimated coefficients for cases in which CEO ownership is represented by OWNCEO and OWNCEO ^{2}. We report estimated coefficients for financial performance measures to be ROA and ROE. The coefficients for the year and industry-indicator variables are not reported in the table as they are not of direct interests in this study.

Models 1 and 2 of Table 4 are different in terms of the selections of a proxy for financial performance measure. Model 1 includes ROA and Model 2 includes ROE. Consistent with the previous literature, financial performance, and firm size have a strong positive effect on CEO compensation, whereas the coefficient on the market performance and nonfinancial performance is not significant.

Next, we consider the board structure variables. Model 1 of Table 4 shows that the significant coefficient on the dummy variable for dual CEO/board chair indicates that a CEO who also serves as board chair receives additional compensation of NT$400 thousand, whereas a CEO who also serves as board director receives additional compensation of NT$586 thousand. It is possibly because dual CEO/board chair accounts for only 27.84% of the sample, but dual CEO/director accounts for 60.09% of the sample. Board size is significant; it implies that one member increase in the size of the board is associated with an increase of NT$64 thousand in CEO compensation.

By considering the other ownership variables used in Model 1 of Table 4, the significant coefficients of director ownership indicates that a 1% increase in the variable leads to a NT$3,264 thousand decrease in CEO compensation. The percentage of bolckholder ownership also has a significantly negative coefficient, with a 1% increase in the variable leading to a NT$1,487 thousand decrease in CEO compensation.

Finally, the coefficients of the ownership-performance product terms are significant in all of the two regressions, the coefficient of first order term is negative and the sign of quadratic term is significantly positive, indicating a U-shaped function relation between the pay-for-performance and CEO ownership. A U-shape arise in equation (8) when the coefficient on RET*OWNCEO is negative and the coefficient on RET*OWNCEO^2 is positive, capturing an increasing effect of RET*ONWCEO on CEO compensation. Prior studies (e.g., Morck et al. 1988; McConnell and Servaes 1990) generally interpret the positive relation at low levels of CEO ownership as evidence of incentive alignment, and the negative relation at high levels of managerial ownership. However, the results of our finding in Taiwanese firms are different from those of prior studies.

The empirical results show that when management controls enough of a firm's voting rights, the CEO may be paid more, or at least different from other CEOs. Such evidence supports the "skimming" view of CEO compensation as it suggests that such managers are paying themselves more (Wan 2004). In accord with the study of Jensen and Meckling (1976), when CEO ownership falls, it will tend to encourage CEO to appropriate large amounts of the corporate resources in the form of perquisites because of decline in CEO's fractional claim on the outcomes. If a wholly owned firm is managed by the owner, he will make operating decisions which maximize his

utility.

As consistency checks on our Model 1 results, we also use other financial performances in regression model 2. The Model 2 of Table 4 uses ROE as the financial performance measure. These results are virtually identical to those using ROE. The adjusted R^2 of Models 1 and 2 regressions are 14.88% and 13.96%, respectively.

In accord with the Core et al. (1999), the signs of the coefficients of CEO duality, board size, ownership of director, and ownership of blockholder are consistent with the interpretation that when corporate governance is weak, the CEO is able to extract additional compensation from the firm. However, different from those studies on managerial ownership and Tobin'Q, the pay-for-performance relation appears to be curvilinear in CEO ownership but in a U-shaped function relation.

V. SENSITIVITY TESTS

In this section, we test the sensitivity of the results to number of alternative specifications: (1) change CEO compensation relation from RET to financial performance, ROA; (2) only including the ownership of CEOs without interaction terms. Table 5 reports the results of the alternative specifications on the performance equation with quadratic specification.

CEO Compensation Relation with Financial Performance

The Model 1 of Table 5 contains the estimated coefficients of the compensation

model including the CEO compensation relation with financial performance by using the quadratic specification. Regardless of measures of financial performances being ROA or ROE, these results indicate that most of the variables still remain the same significance as the ones in Table 4. The results were represented by the financial performance ROA in Table 5.

Interestingly, note that the interactive variables specific to each set of regressions are found to be highly significant, and the market and financial specifications lead to very similar results. Importantly, it indicates a similar role in both the market and financial measures of performance as a base for compensation.

No Interaction Term

The Model 2 of Table 5 contains the estimated coefficients of the compensation model including only the CEO ownership without interaction by using the quadratic specification. The results were represented by the financial performance ROA. It is clear that these results are almost identical to those by using interaction terms on the CEO compensation.

Summary of Sensitivity Analysis

Overall these sensitivity results reinforce our findings that the CEO ownership plays a nonlinear role on CEO compensation. All of this amount to say that the CEO compensation relation appears to be curvilinear in CEO ownership and shows a U-shaped relation. The results lead to the conclusion that our empirical results are proved to be robust to a battery of specification checks.

V. CONCLUSION

This paper develops a theoretical model to clarify the roles of CEO ownership and various performance measures in the CEO compensation contracts. The prediction of the model is tested with CEO compensation data over the period 1997-2003 of the publicly listed firms in Taiwan. The theoretical model indicates that the optimum weights placed on market, financial and nonfinancial measures of performance are all positive when a CEO has a very low equity stake in the firm. With the increase in CEO ownership, the optimum weight placed on market measure of performance is decreasing. The analysis reveals that CEO ownership affects CEO compensation through its influence on the optimum weight placed on the market measure of performance instead of being a direct explanatory variable of CEO compensation.

The sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. With respect to the board-of-director structure, our results indicate that CEO compensation is higher when board is large, the CEO is also the board chair, and the CEO is also the board director. With respect to the ownership structure, we find that CEO compensation is lower when there exists an external blockholder who owns at least 10% of the shares, and CEO compensation is a decreasing function of the directors' ownership. These results suggest that firms with weaker governance structures have greater CEO compensation.

Prior literature has noted a nonmonotonic relation between firm performance and CEO ownership. We explore this phenomenon in our sample and find a U-shaped function relation between the CEO compensation and CEO ownership. Finally, our robustness checks suggest that these sensitivity results reinforce our findings.

Appendix

We use the compensation incentive scheme of Fu et al. (2002) to create a principal-agent model that incorporates the proxies of corporate governance (C), the variables of board and ownership structure.

However, a professional manager's personal income or wealth is closely connected with the level of compensation. By considering his equity ownership (δ), a manager's end-of-period wealth is the sum of $B+\delta P$, whereas the residual value $(1-\delta)P-B$ is owned by outside shareholders. Under the linear form of compensation contracts and the assumption of a negative exponential utility function, the problem faced by outside, the agent's certainty equivalent is

$$\begin{aligned} ACE &= E[(1-\delta)(\alpha_0 + C + \alpha_P P + \alpha_F F + \alpha_G G) + \delta P] - \frac{f^2+g^2}{2} \\ &\quad - \frac{r}{2}[(1-\delta)\alpha_F]^2\sigma_F^2 - \frac{r}{2}[(1-\delta)\alpha_G]^2\sigma_G^2 - \frac{r}{2}[(1-\delta)\alpha_P + \delta]^2\sigma_P^2 \\ &= (1-\delta)(\alpha_0 + \alpha_F f + \alpha_g g) + [(1-\delta)\alpha_P + \delta](\beta_0 + \beta_1 f + \beta_2 g) - \frac{f^2+g^2}{2} \\ &\quad - \frac{r}{2}[(1-\delta)\alpha_F]^2\sigma_F^2 - \frac{r}{2}[(1-\delta)\alpha_G]^2\sigma_G^2 - \frac{r}{2}[(1-\delta)\alpha_P + \delta]^2\sigma_P^2 \end{aligned} \tag{A-1}$$

where $E[\ ]$ denotes the expected operator.

Assume further that shareholders are risk neutral, which implies outside shareholders' certainty equivalent is equal to the residual value. It follows that total certainty equivalent (TCE), the sum of management's and outside shareholders' certainty equivalents, can be expressed as

$$\begin{aligned} TCE &= \beta_0 + \beta_1 f + \beta_2 g - \frac{f^2+g^2}{2} - \frac{r}{2}[(1-\delta)\alpha_P + \delta]^2\alpha_P^2 \\ &\quad - \frac{r}{2}[(1-\delta)\alpha_F]^2\alpha_F^2 - \frac{r}{2}[(1-\delta)\alpha_G]^2\alpha_G^2 \end{aligned} \tag{A-2}$$

From the first order condition of ACE,

$$\frac{\partial ACE}{\partial f} = (1-\delta)\alpha_F + \left[(1-\delta)\alpha_P + \delta\right]\beta_1 - f = 0$$

$$\frac{\partial ACE}{\partial g} = (1-\delta)\alpha_G + \left[(1-\delta)\alpha_P + \delta\right]\beta_2 - g = 0$$

the respective optimal amount of effort into financial and nonfinancial performance can be obtained:

$$\begin{aligned} f^* &= (1-\delta)(\alpha_F + \beta_1\alpha_P) + \beta_1\delta \\ &= (1-\delta)\alpha_F + \beta_1\left[(1-\delta)\alpha_P + \delta\right] \end{aligned} \tag{A-3}$$

$$g^* = (1-\delta)(\alpha_G + \beta_2\alpha_P) + \beta_2\delta \tag{A-4}$$

By substituting management's response functions (A-3) and (A-4) into TCE, outside shareholders' problem can be reduced to an unconstrained optimization:

$$\begin{aligned} \underset{\alpha_P,\alpha_F,\alpha_g}{Max}\ & \beta_0 + (1-\delta)\beta_1\alpha_F + [(1-\delta)\alpha_P + \delta)\beta_1^2 + (1-\delta)\beta_2\alpha_G + [(1-\delta)\alpha_P + \delta)\beta_2^2 \\ & -\frac{1}{2}[(1-\delta)(\alpha_F + \beta_1\alpha_P) + \beta_1\delta]^2 - \frac{1}{2}[(1-\delta)(\alpha_G + \beta_2\alpha_P) + \beta_2\delta]^2 \\ & -\frac{r}{2}[(1-\delta)\alpha_P + \delta]^2\sigma_P^2 - \frac{r}{2}[(1-\delta)\alpha_F]^2\sigma_F^2 - \frac{r}{2}[(1-\delta)\alpha_G]^2\sigma_G^2 \end{aligned} \tag{A-5}$$

Differentiating equation (A-5) with respect to α_P, α_F, and α_G,

$$\begin{aligned} \frac{\partial(A-5)}{\partial\alpha_P} &= (1-\delta)\beta_1^2 + (1-\delta)\beta_2^2 - \left[(1-\delta)(\alpha_F + \beta_1\alpha_P) + \beta_1\delta\right](1-\delta)\beta_1 \\ &\quad - \left[(1-\delta)(\alpha_G + \beta_2\alpha_P) + \beta_2\delta\right](1-\delta)\beta_2 - r\left[(1-\delta)\alpha_P + \delta\right](1-\delta)\sigma_P^2 = 0 \\ \frac{\partial(A-5)}{\partial\alpha_F} &= (1-\delta)\beta_1 - \left[(1-\delta)(\alpha_F + \beta_1\alpha_P) + \beta_1\delta\right](1-\delta) - r\left[(1-\delta)\alpha_F\right](1-\delta)\sigma_F^2 = 0 \\ \frac{\partial(A-5)}{\partial\alpha_G} &= (1-\delta)\beta_2 - \left[(1-\delta)(\alpha_G + \beta_2\alpha_P) + \beta_2\delta\right](1-\delta) - r\left[(1-\delta)\alpha_G\right](1-\delta)\sigma_G^2 = 0 \end{aligned}$$

the first order condition yields

$$\alpha_P = \frac{\beta_1^2 + \beta_2^2 - \beta_1\alpha_F - \beta_2\alpha_G}{\beta_1^2 + \beta_2^2 + r\sigma_p^2} - \frac{\delta r\sigma_P^2}{(1-\delta)(\beta_1^2 + \beta_2^2 + r\sigma_P^2)} \tag{A-6}$$

$$\alpha_F = \frac{\beta_1}{1 + r\sigma_F^2}(1 - \alpha_P) \tag{A-7}$$

$$\alpha_G = \frac{\beta_2}{1 + r\sigma_G^2}(1 - \alpha_P) \tag{A-8}$$

By solving equations (A-6), (A-7) and (A-8) simultaneously, we can obtain the respective optimal weight placed on market, financial and nonfinancial measures of performance used in the compensation contracts:

$$\alpha_P^* = \frac{\beta_1^2(1 - \frac{1}{1+r\sigma_F^2}) + \beta_2^2(1 - \frac{1}{1+r\sigma_G^2}) - \frac{\delta}{1-\delta}r\sigma_P^2}{\beta_1^2 + \beta_2^2 + r\sigma_P^2 - \frac{\beta_1^2}{1+r\sigma_F^2} - \frac{\beta_2^2}{1+r\sigma_G^2}} = \frac{1}{1-\delta}(\alpha_P^{'} - \delta) \tag{A-9}$$

$$\alpha_F^* = \frac{\beta_1}{1+r\sigma_F^2}\frac{1-\alpha_P^{'}}{1-\delta} \geq 0 \tag{A-10}$$

$$\alpha_G^* = \frac{\beta_2}{1+r\sigma_G^2}\frac{1-\alpha_P^{'}}{1-\delta} \geq 0 \tag{A-11}$$

where $\alpha_P^{'} = \dfrac{\beta_1^2 + \beta_2^2 - \dfrac{\beta_1^2}{(r\sigma_F^2+1)} - \dfrac{\beta_2^2}{(r\sigma_G^2+1)}}{\beta_1^2 + \beta_2^2 + r\sigma_P^2 - \dfrac{\beta_1^2}{(r\sigma_F^2+1)} - \dfrac{\beta_2^2}{(r\sigma_G^2+1)}}$ (A-12)

REFERENCES

Allen, M. 1981. Power and privilege in the large corporation: Corporate control and managerial compensation. *American Journal of Sociology* 86: 1112-1123.

Cheng, S. 2004. R&D expenditures and CEO compensation. *The Accounting Review* 79 (2): 305-328.

Core, J. E., R. W. Holthausen, and D. F. Larcker. 1999. Corporate governance, chief executive officer compensation, and firm performance. *Journal of Financial Economics* 51 (3): 371-406.

Core, J., and W. Guay. 1999. The use of equity grants to manage optimal equity incentive levels. *Journal of Accounting and Economics* 28 (2): 151-184.

Craighead, J. A., M. L. Magana, and L. Thorne. 2004. The impact of mandated disclosure on performance-based CEO compensation. *Contemporary Accounting Research* 21 (2): 369-398.

Fu, C. J. 2001. Executive compensation, ownership, and firm performance. *Sun Yat-Sen Management Review* 9: 95-116.

Fu, C. J., S. J. You, and M. Koo. 2002. The impacts of managerial ownership on CEO compensation design. AAA 2002 Annual Meeting.

Hermalin, B. E., and M. S. Weisbach. 1991. The effects of board compensation and direct incentives on firm performance. *Financial Management* 20 (4): 101-112.

Himmelberg, C. P., R. G. Hubbard, and D. Palia. 1999. Understanding the determinants of managerial ownership and the link between ownership and performance. *Journal of Financial Economics* 53 (3): 353-384.

Holderness, C. G., R. S. Kroszner, and D. Sheehan. 1999. Were the gold old days that good? Change in managerial stock ownership since the great depression. *Journal of Finance* 54 (2): 435-469.

Holmstrom, B. 1979. Moral hazard and observability. *Bell Journal of Economics* 10: 74-91.

Jensen, M. C. 1993. The modern industrial revolution, exit, and the failure of internal control systems. *Journal of Finance* 48 (3): 831-880.

Jensen, M. C., and W. H. Meckling. 1976. Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics* 3: 305-360.

Lambert, R. A. and D. F. Larcker. 1987. An analysis of the use of accounting and market measures of performance in executive compensation contracts. *Journal of Accounting Research* 25 (3): 85-125.

Lambert, R., D. Larcker, and K. Weigelt. 1993. The structure of organizational incentives. *Administrative Science Quarterly* 38 (3): 438-461.

McConnell, J. J., and H. Servaes. 1990. Additional evidence on equity ownership and corporate value. *Journal of Financial Economics* 27 (2): 595-612.

Morck R., M. Nakamura, and A. Shivdasani. 2000. Banks, ownership structure, and firm value in Japan. *Journal of Business* 73 (4): 539-567.

Morck, R., A. Shleifer, and R. W. Vishny. 1988. Management ownership and market valuation: An empirical analysis. *Journal of Financial Economics* 20: 293-315.

Murphy, K. J. 1985. Corporate performance and managerial remuneration: An empirical analysis. *Journal of Accounting and Economics* 7: 11-42.

Pukthuanthong, K., E. Talmor, and J. S. Wallace. 2004. Corporate governance and theories of executives pay. *Corporate Ownership and Control* 1 (2), 94-105.

Wan, K. M. 2004. Managerial compensation when managers are principals. Corporate Ownership & Control 1 (2): 106-201.

Wooldridge, J. M. 2003. *Introductory Econometrics: A Modern Approach*. 2nd Edition. U.S.A.: South-Western.

FIGURE 1

Frequency Distribution of CEO Ownership and CEO Compensation

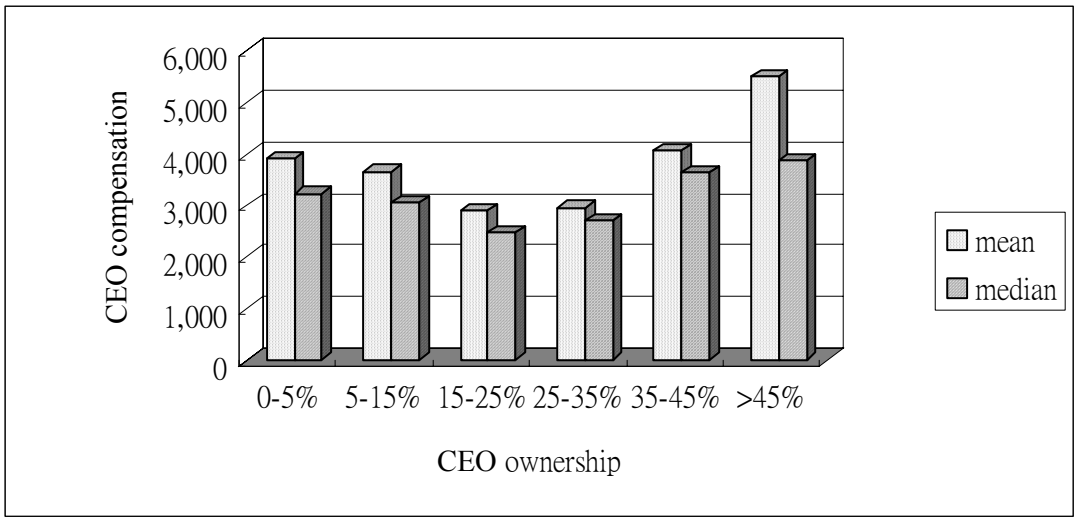

TABLE 1
Variable Descriptions

Variable	Description
Compensation	CEO compensation, including salary, bonus and traffic allowances, in NT$ thousands.
RET	Market measure of performance, measured by annual stock return.
FINANCIAL	Financial measure of performance, measured by ROE or ROA for the prior year.
ROE	Financial measure of performance, measured by the percentage corporate return on equity for the prior year.
ROA	Financial measure of performance, measured by the percentage corporate return on assets for the prior year.
NONFINANCIAL	Nonfinancial measure of performance, measured by the growth rate of sales revenue for the prior year.
SIZE	Measured by the total assets for the prior year in NT$ millions.
OWNCEO	CEO ownership, measured by the percentage of equity shares held by a firms' CEO.
$OWNCEO^2$	The square of OWNCEO, included to allow for nonlinearity
DUAL_CHAIR	A dummy variable, equal to 1 if the CEO is also a board chair; 0 otherwise
DUAL_DIRECTOR	A dummy variable, equal to 1 if the CEO is also a director; 0 otherwise
BOARDSIZE	The board size, defined as the total number of directors on the board.
OWN_DIRECTOR	The percentage of outstanding shares owned by the directors.
OWN_BLOCK	The percentage of outstanding shares owned by the blockholders that owns at least 10% of the outstanding shares.

TABLE 2

Mean Value of Compensation, Grouped by Level of CEO Ownership

CEO Ownership	Number of Observations	Mean Compensation	Median Compensation	Standard Error of Mean Compensation
0-5%	2,483	3,920	3,241	3,521
5-15%	976	3,659	3,059	2,936
15-25%	217	2,908	2,470	1,771
25-35%	114	2,962	2,711	1,717
35-45%	51	4,075	3,643	1,874
>45%	45	5,508	3,873	5,968
Total	3,886			

The sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. All monetary items are expressed in 2003 NT dollars using the fiscal year-end Consumer Price Index.

TABLE 3
Descriptive Statistics

Variables	Unit	Mean	Median	Maximum	Minimum	Standard Deviation
Compensation	Thousand	3,790	3,051	53,625	0	3,303
RET	%	7.28%	-6.10%	700.00%	-92.84%	65.34%
ROE	%	6.07%	6.54%	79.86%	-171.79%	15.37%
ROA	%	8.07%	7.28%	62.86%	-37.14%	9.08%
NONFINANCIAL	%	17.36%	6.55%	5824.74%	-95.83%	124.88%
SIZE	Million	17,044	4,206	1,157,683	305	56,891
OWNCEO	%	6.20%	2.76%	97.13%	0.00%	9.52%
DUAL_CHAIR	Dummy Variable	27.84%	0	1	0	44.83%
DUAL_DIRECTOR	Dummy Variable	60.09%	1	1	0	48.98%
BOARD_SIZE	Person	7.54	7.00	30.00	2.00	3.71
OWN_DIRECTOR	%	25.47%	23.16%	97.13%	0.13%	14.03%
OWN_BLOCK	%	2.69%	0.00%	67.03%	0.00%	7.06%

The sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. All monetary items are expressed in 2003 NT dollars using the fiscal year-end Consumer Price Index.
See Table 1 for variable descriptions.

TABLE 4

Determinants of Compensation, Quadratic Specification

	Financial Performance Measure			
	Model 1 ROA		Model 2 ROE	
Variable	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Intercept	1,922.414	4.61***	2,074.935	4.95***
RET	52.719	0.49	71.825	0.67
ROA	10,411.890	17.52***		
ROE			5,623.942	16.19***
NONFINANCIAL	-5.005	-0.12	-6.443	-0.16
SIZE	0.012	11.33***	0.012	11.12***
DUAL_CHAIR	399.520	2.34**	376.018	2.19**
DUAL_DIRECTOR	585.868	3.77***	605.424	3.88***
BOARD_SIZE	63.754	4.33***	59.288	4.01***
OWN_DIRECTOR	-3,264.429	-8.98***	-3,088.830	-8.47***
OWN_BLOCK	-1,487.122	-2.11**	-1,609.844	-2.27**
RET*OWNCEO	-5,975.314	-3.08***	-5,768.191	-2.95***
RET*OWNCEO^2	2,0146.230	4.18***	19,342.520	3.99***
Adjusted R^2	14.88%		13.96%	

,*p<0.05 and p<0.01, respectively.

See Table 1 for variable descriptions.

The sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. All monetary items are expressed in 2003 NT dollars using the fiscal year-end Consumer Price Index.

For brevity, the year-specific and industry-specific intercepts are not reported.

TABLE 5

Sensitivity Analysis of Compensation Model, Quadratic Specification

	Model 1 Financial Performance		Model 2 No Interaction Term	
Variable	**Coefficient**	**t-value**	**Coefficient**	**t-value**
Intercept	1,996.655	4.72***	2,151.755	5.09***
RET	-75.992	-0.93	-76.852	-0.94
ROA	12,106.010	16.61***	10,472.140	17.60***
NONFINANCIAL	21.344	0.54	19.332	0.49
SIZE	0.011	9.98***	0.011	9.93***
DUAL_CHAIR	602.256	3.38***	651.195	3.48***
DUAL_DIRECTOR	667.189	4.26***	709.536	4.43***
BOARD_SIZE	62.192	4.22***	57.165	3.85***
OWN_DIRECTOR	-3,014.246	-7.79***	-3,070.603	-7.33***
OWN_BLOCK	-1,541.433	-2.18**	-1,437.184	-2.03**
ROA*OWNCEO	-37,864.970	-4.39***		
ROA*OWNCEO^2	65,188.570	4.00***		
OWNCEO			-4,923.115	-3.99***
OWNCEO^2			10,343.660	4.36***
Adjusted R^2	14.88%		14.87%	

,*p<0.05 and p<0.01, respectively.

See Table 1 for variable descriptions.

The sample consists of 3,886 annual observations of 914 firms over the period 1997-2003. All monetary items are expressed in 2003 NT dollars using the fiscal year-end Consumer Price Index.

For brevity, the year-specific and industry-specific intercepts are not reported.