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高階經理人薪酬、生命週期與績效指標之價值攸關性

Compensation, Life Cycle, and the Value Relevance of Performance Measures

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摘要：代理理論認為提供高階經理人誘因報償具有強化績效指標的作用，有利於創造公司價值，故高階經理人薪酬及公司績效指標應是投資人評估公司價值的重要資訊。基於 Ittner and Larcker (2001)認為評估管理績效與公司評價的資訊不盡然相同的質疑，且在價值攸關性的系列文獻中，尚無充分的研究足以說明薪酬所扮演的角色。故本文研究目的乃強調公司價值、績效指標與高階經理人薪酬三者之間環環相扣的關係，以我國 1997 至 2006 年之資訊電子業為研究對象，驗證高階經理人薪酬對於績效指標與公司價值的關連性之影響。實證結果顯示：1.高階經理人薪酬對於財務績效指標(盈餘)和非財務績效指標(品質績效指標、顧客滿意度績效指標與創新績效指標)與公司價值之間的關連性具正向影響；2.尤其是相對於成熟期與衰退期公司，成長期公司之高階經理人薪酬對於非財務績效指標與公司價值之間關連性具有顯著正向影響。

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Abstract：In light of agency theory, this study examines the effect of contracting incentives on the value relevance of five performance measures, including earnings, product quality, market shares, patents and cycletime. We apply and extend the Ohlson (1995) valuation model based on a sample from periods 1997 to 2006 in the information electronic industry in Taiwan to examine the role of top manager's compensation in value-relevance research. Our findings indicate that top manager's compensation positively moderates the association between firm value and performance measures. We further find that compensation can enhance the value relevance of nonfinancial performance measures better for firms in the growth stage than firms in the mature and decline stages. This study contributes new insight going beyond the relations observed between top manager's compensation and the value relevance of nonfinancial performance measures.

Keywords：Top manager's compensation; Life cycle; Nonfinancial performance measures; Value relevance

1. Introduction

A sizable literature suggests that both financial and nonfinancial performance measures can provide value-relevant information for investors (Amir and Lev, 1996; Ittner and Larcker, 1998a; Hughes, 2000; Hand, 2005). Furthermore, agency theory suggests the performance measures included in compensation contracts should be linked with management effort and actions. The evidence of extant studies indicates that laying emphasis on multiple measures will improve the performance of firms and further increase firm values (Keating, 1997; Said, HassabElnaby and Wier, 2003; Ittner, Larcker and Randall, 2003). However, this does not imply that the performance measures which are included in compensation contracts should be the one with the highest association with stock prices (Lambert and Larcker, 1987). This raises a question about what the

role of top manager's compensation plays as investors use the performance measures to evaluate firms and make investments and related decisions.[2]

Holthausen and Watts (2001) indicate the most highly associated financial measures are not necessarily the most precise measures of firm value. Recently, increasing emphasis on the use of the combination of financial and nonfinancial performance measures has been proved to increase firm values (Ittner, Larcker and Rajan, 1997; Keating, 1997; Ittner and Larcker, 1998a, 2001; Said *et al.*, 2003). One of the primary motivations to using nonfinancial performance measures is the belief that only the integration of nonfinancial measures in performance measurement system allows managers to realize the relations among diverse strategic objectives, and efficiently allocate resources that promote value creation (Kaplan and Norton, 1996; Ittner and Larcker, 2001; Said *et al.*, 2003). As a result, nonfinancial performance measures are not only related to future financial performance (Ittner and Larcker, 1998a; Behn and Riley, 1999; Banker, Potter, and Srinivasan, 2000), but are also highly relevant in evaluating firm equity value (Amir and Lev, 1996; Maines *et al.*, 2002; Said, *et al.*, 2003).

Furthermore, incentive compensation contracts can encourage congruence between the actions desired by the principal and the actions taken by the agent (Holmstrom, 1979; Banker and Datar, 1989; Feltham and Xie, 1994; Lambert, 2001). Evidence in several studies indicates that performance-based compensation contracts give rise to performance improvements (Banker, Lee, Potter and Srinivasan, 2000) and thereby maximizes shareholders' value. However, Ittner *et al.* (2003) found that merely integrating the right performance measures (value drivers) in the compensation contract does not necessarily create more benefits to the firm. Thus, without a deep understanding of the performance measures and their interaction with compensation, managers will not allocate resources effectively and improve firm performance. Furthermore, stockholders may not evaluate the firm value appropriately.

Studies related to compensation confirm that investors conditionally explain nonfinancial information by considering firm-specifics, industry, environment,

[2] The definition of top manager in this study is CEO or president according to the disclosures of each company's annual report.

and regulatory factors (Maines *et al.*, 2002). The choice of which performance measures are relevant for firm valuation is also context dependent, including contexts such as operating strategies, investment opportunity, and business environment (Ittner and Larcker, 1998b; Maines *et al.*, 2002). This is especially true for firms in the different lifecycle stages (Schiehll and Morissette, 2000; Hand, 2005).

From a performance evaluation perspective, the impact of different lifecycle stages is an important contingency factor affecting firm performance (Pashley and Philippatos, 1990; Robinson and McDougall, 2001). Because lifecycle stages vary across firms, adopting appropriate nonfinancial performance measures determines performance consequences (Said, *et al.*, 2003) and influences firm value. Therefore, the use of nonfinancial performance measures should match the characteristics of the firm (Lambert and Larcker, 1987; Said *et al.*, 2003; HassabElnaby, Said, and Wier, 2005).

There have been numerous studies of the value relevance of nonfinancial measures; however, most prior research does not examine the effects of contracting incentives on the value relevance of performance measures (Kallapur and Kwan, 2004), particularly for firms in different lifecycle stages. This study extends the value relevance of performance measures, especially the nonfinancial performance measures, and examines the role of top manager's compensation to gain further insight into the association with stock prices.

The empirical results of this study show that the top manager's compensation positively moderates the association between firm value and performance measures, such as earnings, product quality, market shares and patents. We also find that compensation can enhance the value relevance of nonfinancial performance measures better for firms in the growth stage than those in the mature and decline stages.

Further, our results confirm prior studies which assert that the relationship between compensation levels and firm performance depends on whether earnings are positive (Gaver and Gaver, 1998; HassabElnaby *et al.*, 2005; Reitenga, 2006). The results also show that the moderating effect of compensation on the value relevance of nonfinancial performance measures is more significantly positive for

firms with positive earnings than firms with negative earnings, especially for firms in the growth stage compared with firms in the mature or decline stages.

This study contributes new insight going beyond the relations observed between top manager's compensation and the value relevance of performance measures. It implies that providing such information will be helpful to investors who attempt assess the firm stock prices more appropriately.

The remainder of this paper proceeds as follows. Section II discusses the literature review and develops the hypotheses. Section III discusses the research design and methodology, including the valuation model, definition and measurement of variables, and sample selection. Section IV discusses the empirical results. The conclusions and limitations are provided in the final section.

2. Literature Review and Hypotheses

According to agency theory, the owners of the firm usually enter into contracts with managers to monitor and reward manager's efforts to increase firm value (Holmstrom, 1979; Keating, 1997). Companies generally design performance evaluation systems and incentive compensation contracts that encourage managers focus efforts on the various performance measures, resulting in firm performance improvement (Ittner and Larcker, 2001; Said *et al.*, 2003; Bryant, Jones and Widener, 2004; Ramanan and Sridhar, 2006). Although the investors can not observe the actual valuation process, some research suggests that stock prices can reflect the conversion of all available information into predictions of firm's future cash flows given the firm's incentive plan (Liu, Nissim and Thomas, 2002; Dutta and Reichelstein, 2005). Further, in the accounting literature, evidence confirms a significantly positive relationship between motivation and performance (Kaplan and Atkinson, 1998; Schiehll and Morissette, 2000). Identifying these value drivers and their interrelations with manager's compensation is expected to improve firm value (Ittner and Larcker, 2001). Thus, it can be assumed that the firm performance measures play important roles in the process of value creation, compensation and motivation (Schiehll and

Morissette, 2000).

Financial measures are generally the key determinants for compensation and firm performance evaluation (Lambert and Larcker, 1987; Sloan, 1993; Holthausen, Larcker and Sloan, 1995; Bushman, Indejejikian and Smith, 1996; Keating, 1997). However, financial measures cannot completely reflect the expected future consequences of current actions in a timely manner. Keating (1997) asserts that earnings are a noisy measure of a manager's contribution to firm value. This is more likely to occur in firms whose values are derived more from future growth opportunity than from current assets in place (Smith and Watts, 1992). Because financial measures generally reflect past performance, nonfinancial measures usually can reflect actions that lead to future long-term performance (Banker, Potter, Srinivasan, 2000; Said *et al.*, 2003). Thus, nonfinancial performance measures can provide incremental information about management actions beyond that conveyed by financial performance measures and should be included in compensation contracts (Feltham and Xie, 1994; Hemmer, 1996; Kaplan and Norton, 1996, 2001; Said *et al.*, 2003).

Evidence from many studies implies that nonfinancial performance measures are relevant to investors and creditors (Barth and McNichols, 1994; Maines *et al.*, 2002). Ittner *et al.* (2003) found that firms that utilize a broader set of financial and (particularly) nonfinancial performance measures have higher stock returns. Ittner and Larcker (1998a) and HassabElnaby *et al.* (2005) have made the similar conclusions.

According to diverse objectives and strategies across firms, types of nonfinancial performance measures may differ. In recent years, many firms have placed greater emphasis on nonfinancial performance measures such as on time delivery, quality, patents, market penetration, and cycle time (Hauser, Simester, and Wernerfelt, 1994; Hemmer, 1996; Datar, Kulp and Lambert, 2001; Maines *et al.*, 2002). Mounting evidence supports customer satisfaction related measures, such as on time delivery and product quality. According to this view, these are not only the leading indicators of future financial performance (Behn and Riley, 1999; Ittner and Larcker, 1998a, 2001; Banker, Potter, Srinivasan, 2000; Said *et al.*, 2003), but they also have significantly positive relation with firm value (Anderson,

Fornell and Mazvancheryl, 2004).

Regarding another nonfinancial performance measures, Deng, Lev and Narin (1999) examined the relationship between patents and firm stock price. Hall, Jaffe, and Trajtenberg (2005) found that each citation per patent is positively associated with an increase of about 3-4 percent in market value. Taken together, the results of these related studies provide support for the belief that investors react directly to nonfinancial performance measures (Maines *et al.*, 2002).

In sum, the compensation which considers value drivers can motivate managers to exert more efforts and improve the organizations' performance (Zhou, 2000). The top manager will get more compensation as performance improves. Focusing on the identification of the value drivers that managers are motivated by compensation contracts lead to increased shareholder value. Given that firm stock price reflects value-relevant information, we expect that the market will evaluate firm value according to firm performance. Thus, the top manager's compensation has positive moderating effects on this relationship and we develop the following hypotheses:

H_1 : Top manager's compensation has a positive moderating effect on the relationship between firm value and performance measures.

Said *et al.* (2003) suggested that firms should connect the performance measures with the firm characteristics. Schiehll and Morissette (2000) further indicated that performance evaluation systems change dramatically throughout a firm's lifecycle stages. Nonfinancial performance measures are defined as firm-specific information that is correlated with future investment opportunities. As highlighted by Myers (1977), a firm's equity value can be decomposed into two components, one is assets-in-place as a result of past investments, and the other is future growth opportunities. The mix of assets-in-place and future growth opportunities affect firms' compensation contracts (Smith and Watts, 1992; Gaver and Gaver, 1993; Hand, 2005). Hand (2005) also found that the value relevance of nonfinancial performance measures decrease as firms mature over time.

From the lifecycle theory, in the start up stage, Anderson and Zeithamal (1984) suggested that products are unfamiliar for potential customers. There are

few assets-in-place and the largest fraction of a firm's value stems from its future growth opportunities (Hand, 2005).

In the growth stage, there are fewer assets-in-place and some income is being generated (Black, 1998). Firms need to expand their market shares and develop new products, patents and technology to create the future growth opportunities and generate higher income. Bushman *et al.* (1996) and Ittner *et al.* (1997) also found that compensation contracts which include nonfinancial performance measures are contingent on some factors such as future growth opportunity relative to assets-in-place. Therefore, firms have to emphasize nonfinancial performance measures in the growth stage.

In the mature stage, the firm's growth slows down substantially (Hand, 2005). Its unrecognized growth opportunity benefit is realized in financial statements. Therefore, the firm's assets-in-place generally dominate its valuation. However, to maintain the competitive advantage in the high technology market, in addition to financial performance measures, firms may need to place emphasis on nonfinancial performance measures.

At last, in the decline stage, the firm is either in a no-real-growth steady or liquidation situation (Smith, Mitchell and Summer, 1985; Hand, 2005). Financial performance measures are more important, and firms generally put less emphasis on nonfinancial performance measures in the decline stage than the earlier two lifecycle stages.[3]

In sum, future profitable growth opportunities increase firm value. From the evidence of prior research, nonfinancial performance measures are usually correlated with future growth opportunities. When a firm is in the earlier lifecycle stage, especially in the growth stage, most of its firm value is attributable to profitable expected future growth opportunities rather than assets-in-place. Thus, firms should reward top managers for these performance measures and generally place emphasis on nonfinancial performance measures in the earlier lifecycle stages. Firms will also benefit greatly from the improvement of performance and the market will reflect this in the stock prices. Thus, we develop the following

[3] Because of data limitation, we do not develop the hypothesis related to the start up stage.

hypotheses:

H_2 : The moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the earlier lifecycle stages than in the later lifecycle stages.

H_{2a} : The moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the growth stage than in the mature stage.

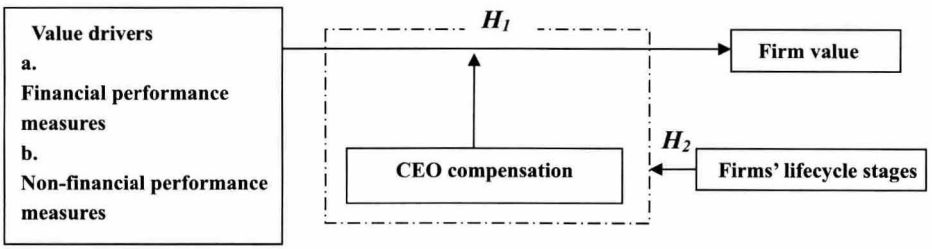
H_{2b} : The moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the growth stage than in the decline stage.

H_{2c} : The moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the mature stage than in the decline stage.

In order to express the hypotheses above more clearly, figure 1 show the conceptual framework of this study as follows.

Figure1

Conceptual Framework



3. Research Design and Methodology

This section presents the sample selection, definition of variables and measurements and the empirical model in accordance with the hypotheses.

3.1. Sample Selection

The sample consists of all firms in the electronic sector traded in the Taiwan Stock Exchange (TSE) and over the counter (OTC) exchange from 1997 to 2006.[4] The companies' financial data and the equity market value data are obtained from the Financial Data of Company Profile of the Taiwan Economic Journal (TEJ) Data Bank. Annual salary and bonuses are taken from the directors' salary and bonus data bank of the TEJ and firms' annual reports. The patent information is from the Patent database of the Learning-Tech Corporation.[5] Except for patent data, we compute and collect the other nonfinancial performance measures from the disclosures of firms' annual reports. The criteria of the samples are as follows: (1) companies with insufficient data are excluded; (2) companies subject to full-delivery settlement and de-listed companies are excluded;(3) companies that do not adopt calendar years are excluded.

The procedure of our sample selection is described as follows. Out of 8,244 initial firm-year observations over the 1997-2006 periods, 6,163 are missing data to measure our nonfinancial performance measures (QUALITY and PATENT), 280 observations are missing data for the compensation variables, 241 observations are missing data for the financial variables, and an additional 24 observations are missing data for the lifecycle classification variables, at last, 31 observations of extreme values data are removed. After eliminating observations due to lack of sufficient data, the sample size yields a total of 1,505 firm-year observations and the percentage of valid sample is about 18.26 percent of the sample (1,505/8,244).

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[4] Based on the modified rule in 1995, "Guidelines Governing the Preparation of Financial Reports by Securities Issuers", these firms are required to disclose top managers' compensation by mandatory regulation since 1996. Because the firms' disclosure was not so successful in the initial stage (Lee, Lin and Chuang, 2006), the research period for this study is from 1997 to 2006.

[5] The web address of Learning-Tech Corporation is as follows: http://www.twpat.com.

We focus on the information electronic industry in Taiwan for two reasons: (1) by focusing on a single industry, we hope to derive less noisy competitive structure variables (such as barrier-to-entry, and concentration) (Joos, 2002) and we can mitigate some cross-sectional problems (Ittner *et al.*, 2003),[6] and (2) the Taiwan Security Exchange Committee (2006) indicates that about 45 percent of firms in the Taiwan stock market belong to the information electronic industry, and this industry is the most important and competitive industry in Taiwan (Lee *et al.*, 2006; Jeng , Fok and Chang, 2009).

3.2. Variable Measurement

The definition and measurement of variables in the empirical models are as follows.

The dependent variable is firm value (MVE). As Holthausen and Watts (2001) points out, studies of value-relevance generally use stock prices to evaluate investors' use of information for valuations of the firms.

The control variables is book value (BV): the book value of the equity of firms; earnings (NI): the income before discontinued and extraordinary items of firms; product quality (QUALITY): the numbers of quality awards and ISO grant warrants can signify the excellent quality of firm's product (Liang and Yao, 2005); innovation productivity (PATENT): the numbers of patents have been used in many studies as measures of innovation productivity (Holthausen *et al.*, 1995);[7] market share (RMS): a firm's market share is divided by the market share for the top three firms in each sub-industry; [8] operation efficiency (CYCLE): cash-to-cash cycle or cycletime is used to measure firms' operational performance efficiency (Kaplan and Norton, 2004); compensation (COM): Balkin *et al.* (2000)

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[6] This study follows Ittner *et al.* (2003)'s suggestion that focusing on a single industry has substantially higher internal validity than a multi-industry analysis.

[7] Not all patents are equally valuable, but the numbers of patents have been shown to be significantly related changes in firm value, profitability, and sales growth (Balkin, Markman and Gomez-Mejia, 2000; Hand, 2005). Thus, this study uses the numbers of patents as the proxy variable for innovation productivity.

[8] Following the procedures of defining market share in the marketing and management literature, Bryant *et al.* (2004) indicate this measure is preferable when cross-sectional data is pooled across industries.

suggest that top manager's efforts in high-technology firms need to be rewarded using short-term pay. Thus, we use the short-term compensation, consisting of cash annual salary and bonus in this study.[9]

The classification indicator variable is lifecycle stage (STAGE): we follow and revise the classification methods of Anthony and Ramesh (1992), Black (1998), Chin, Lin, and Chi (2004), Young and Huang (2004), Chin and Lin (2005), Wu and Cheng (2006), Lin, Wu and Wu (2008), and Taso, Lien and Liu (2010) to appropriately classify firm-years observations into three lifecycle stages using a multivariate classification method.[10]

First, we choose sales growth rate, capital expenditures, dividend payout, and firm age as classification indicators. Second, sales growth rate and capital expenditure are ranked from the highest to the lowest, while the dividend payout and firm age are ranked from the lowest to the highest. The indicators are given a score of 0, 1 or 2 based on their ranking, and the scores of the four indicators are summed together, resulting in a composite score ranging from zero to eight. Finally, firm-year observations with scores less than or equal to two (greater than or equal to six) are assigned to the growth stage (the decline stage). Firm-years with scores three, four or five are assigned to the mature stage. There are 314 firm-year observations in the growth stage, 859 firm-year observations in the

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[9] We thank the referee for the suggestion to use stock based bonus data to test our hypotheses. Ittner and Larcker (2001) suggested that high growth firms place larger weight on long-term components of compensation (option and stock holdings) than short-term components (salary and annual bonus). However, due to data limitation in Taiwan, Hung and Wang (2008) suggest that "if the financial report could disclose more details such as short-term and long-term incentive compensation and distinguish different management levels, investors would have a clear idea about the president (executive) compensation and be better able to monitor the strategy of compensation of the Board". In the reality of Taiwan, most firms do not adopt long-term compensation during the period (Tsai, 2003; Lee *et al.*, 2006). Lots of domestic research only use cash compensation data to examine top manager's compensation issues in Taiwan (e.g. Shi, 1996; Jiang, 2001; Tsai, 2003; Lin and Liu, 2003; Young and Wu, 2003; Lee *et al.*, 2006).Thus, this study uses short-term cash compensation data to test the hypotheses, too. However, we will include a sensitivity analysis to use the estimated stock based bonus of the top managers to retest our hypotheses.

[10] Although the multiple-indicators composite score classification method is limited, it does capture the distinctive economical and financial characteristics of the different lifecycle stages and reduce the probability of misclassification due to using single-factor classification methods.

mature stage and 332 firm-year observations in the decline stage.[11]

The independent variables for testing H_1 are as follows: NI *COM is the interaction term for NI and COM; QUALITY *COM is the interaction term for QUALITY and COM; PATENT *COM is the interaction term for PATENT and COM; RMS *COM is the interaction term for RMS and COM; CYCLE *COM is the interaction term for CYCLE and COM.

The independent variables for testing H_2 are as follows: QUALITY *COM*STAGE is the interaction term for QUALITY, COM and STAGE; PATENT * COM* STAGE is the interaction term for PATENT, COM and STAGE; RMS * COM* STAGE is the interaction term for RMS, COM and STAGE; CYCLE * COM* STAGE is the interaction term for CYCLE, COM and STAGE. The definition and measurement of variables see Table 1.

3.3. Empirical Model

To test the hypothesis, we use the cross-sectional regression model as originally developed by Ohlson (1995) and further extend the valuation model in two ways.[12] First, we add the interaction terms for each performance measure and compensation in model (1) to test H_1. Second, we add a new dummy variable (STAGE), and build the three-way interaction terms among nonfinancial variables, compensation, and STAGE, based on the lifecycle stage in model (2) to test H_2.

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[11] We thank the referee for suggestion to consider growth opportunity as a classification indicator and retest our hypotheses. Instead of lifecycle stage classification, the observations are classified according to proxy variable for growth opportunity, M/B ratio (e.g., Huang, Chen and Shieh, 2001; Liu, 2002; Hung and Wang, 2008; Chih, Lin, Chen and Chou, 2009).By ranking M/B ratios from the highest to the lowest, we distribute the observations into three groups (high growth opportunity, middle growth opportunity, and low growth opportunity). The empirical result weakly supports the conclusion that the moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the higher growth opportunity than firms in the lower growth opportunity.

[12] According to the suggestion of Bryant *et al.* (2004), there is no theoretical or empirical guidance as to the timing effects. Therefore, the examination of timing effects is beyond the scope of this study.

Table 1
Definition and Measurement of Variables

Variables	Measurement
Dependent variable	
Firm value (MVE_{it})	the market value of equity of firm i at time t / TA_{t-1};
Control variables	
Book value (BV_{it})	the book value of equity of firm i at time t-1 / TA_{t-1};
Earnings (NI_{it})	the income before discontinued and extraordinary items of firms i at time t / TA_{t-1};
Compensation (COM_{it})	Top manager's cash annual salary and bonus of firms i at time t / TA_{t-1};
Product quality ($QUALITY_{it}$)	The numbers of quality awards and ISO grant warrants of firm i at time t ;
Innovation productivity ($PATENT_{it}$)	The number of patents issued of firm i at time t;
Market share (RMS_{it})	The market share of firm i at time t divided by market share for the top three firms in each sub-industry at time t;
Operation efficiency ($CYCLE_{it}$)	365*(Inventory turnover + accounts receivable turnover – accounts payable turnover) of firms i at time t;
Independent variables for testing H_1	
NI_{it} *COM_{it}	Interaction term for NI and COM of firms i at time t;
$QUALITY_{it}$ *COM_{it}	Interaction term for QUALITY and COM of firms i at time t;
$PATENT_{it}$ *COM_{it}	Interaction term for PATENT and COM of firms i at time t;
RMS_{it} *COM_{it}	Interaction term for RMS and COM of firms i at time t;
$CYCLE_{it}$ *COM_{it}	Interaction term for CYCLE and COM of firms i at time t;
Independent variables for testing H_2	
$QUALITY_{it}$ *COM_{it} * $STAGE_{it}$	Interaction term for QUALITY, COM and STAGE of firms i at time t;
$PATENT_{it}$ *COM_{it} * $STAGE_{it}$	Interaction term for PATENT, COM and STAGE of firms i at time t;
RMS_{it} *COM_{it} * $STAGE_{it}$	Interaction term for RMS, COM and STAGE of firms i at time t;
$CYCLE_{it}$ *COM_{it} * $STAGE_{it}$	Interaction term for CYCLE, COM and STAGE of firms i at time t;
Classification indicator variable $STAGE_{it}$	Split the firm-observations by lifecycle classification indicators in three groups and take on the value of 1 if the firm is in the growth stage for testing H_{2a} and H_{2b} (or the firm is in the mature stage for testing H_{2c}) and 0 otherwise. Four lifecycle stage classification indicators are as follows: 1.SG_{it} (sales growth rate) = 100 * ($sales_t$- $sales_{t-1}$) / $sales_{t-1}$; 2.DP_{it} (Dividend payout) = 100*(annual cash dividend of common stock/annual earnings) ; 3.CE_{it} (Capital expenditure) = 100 * (purchase fixed assets – reevaluated fixed assets of firm i at time t) / AV_{t-1}; 4. AGE_{it} (Firm years) = the difference between the current year and the year which the firm was originally formed.

* To mitigate the impact of cross-sectional difference in firm size, the variables are scaled by the book value of total assets at the end of year t-1(TA_{t-1}) (thousand dollars).

** MVE = market value of equity(hundred million dollars or million dollars)/TA_{t-1}; BV = the book value of equity (thousand dollars)/TA_{t-1};COM = top manager's annual salary and bonus (thousand dollars)/TA_{t-1}; NI = earnings (thousand dollars)/TA_{t-1};QUALITY = the numbers of quality awards and ISO grant warrants; PATENT = the numbers of patents; RMS = firm's market share (%);CYCLE = cycle time (days).

The empirical models are as follows.

$$MVE_i = \alpha + \beta_1 BV_i + \beta_2 NI_i + \beta_3 COM_i + \beta_4 QUALITY_i + \beta_5 PATENT_i + \beta_6 RMS_i + \beta_7 CYCLE_i + \beta_{81} NI_i * COM_i + \beta_{82} QUALITY_i * COM_i + \beta_{83} PATENT_i * COM_i + \beta_{84} RMS_i * COM_i + \beta_{85} CYCLE_i * COM_i + \varepsilon_i \quad (1)$$

Variables definition:

MVE = market value of equity/TA_{t-1};

BV = the book value of equity/TA_{t-1};

NI = earnings /TA_{t-1};

COM = Top manager's annual cash salary and bonus/TA_{t-1};

QUALITY = the numbers of quality awards and ISO grant warrants;

PATENT = number of patents;

RMS = firm's market share;

CYCLE = cycle time;

NI *COM = interaction term for NI and COM;

QUALITY *COM = interaction term for QUALITY and COM;

PATENT*COM = interaction term for PATENT and COM;

RMS *COM = interaction term for RMS and COM;

CYCLE*COM = interaction term for CYCLE and COM.

According to ***H1***, we expect the coefficients β_{81}, β_{82}, β_{83}, and β_{84}, which represent the moderating effect of top manager's compensation on the value relevance of various performance measures, such as NI, QUALITY, PATENT, and RMS respectively, to be positive, and expect the coefficient β_{85} of CYCLE*COM is negative.

$$MVE_i = \alpha + \beta_1 BV_i + \beta_2 NI_i + \beta_3 COM_i + \beta_4 QUALITY_i + \beta_5 PATENT_i + \beta_6 RMS_i + \beta_7 CYCLE_i + \beta_{81} QUALITY_i * COM_i + \beta_{82} PATENT_i * COM_i + \beta_{83} RMS_i * COM_i + \beta_{84} CYCLE_i * COM_i + \beta_{91} QUALITY_i * COM_i * STAGE_i + \beta_{92} PATENT_i * COM_i * STAGE_i + \beta_{93} RMS_i * COM_i * STAGE_i + \beta_{94} CYCLE_i * COM_i * STAGE_i + \beta_{10} STAGE_i + \varepsilon_i \quad (2)$$

Variables definition:

MVE = market value of equity/TA_{t-1};

BV = the book value of equity/TA_{t-1};

NI = earnings /TA_{t-1};

COM = Top manager's annual cash salary and bonus/TA_{t-1};

QUALITY = the numbers of quality awards and ISO grant warrants;

PATENT = number of patents;

RMS = firm's market share;

CYCLE = cycle time;

QUALITY *COM = interaction term for QUALITY and COM;

PATENT*COM = interaction term for PATENT and COM;

RMS *COM = interaction term for RMS and COM;

CYCLE*COM = interaction term for CYCLE and COM;

QUALITY *COM*STGAE = interaction term for QUALITY, COM and STAGE;

PATENT*COM*STGAE = interaction term for PATENT, COM and STAGE;

RMS *COM*STGAE = interaction term for RMS, COM and STAGE;

CYCLE*COM*STGAE = interaction term for CYCLE, COM and STAGE;

STAGE = lifecycle stage.

According to $\boldsymbol{H_2}$, relative to the later lifecycle stages, we expect the coefficients β_{91}, β_{92}, and β_{93} to be positive and the coefficient β_{94} is negative for firms in the earlier lifecycle stages.

4. Empirical Results and Analysis

4.1. Descriptive Statistics

In Table 2, we present the descriptive statistics for the full sample of firms. As we show in Panel A of Table 2, the mean (median) of MVE is 27,260 (5,136) million New Taiwan Dollars. The means of QUALITY, PATENT, RMS, and CYCLE are 0.76(units), 32.72(units), 6.45(%), and 81.23 (days) respectively. Additionally, the mean (or median) of the top manager's compensation (COM) is 4,373.52 (3,236.00) thousand New Taiwan Dollars.

Table 2
Summary Descriptive Statistics of Variables

Variable	MVE	COM	QUALITY	PATNET	RMS	CYCLE	NI	BV
Panel A: Full sample								
Mean	27,260.60	4,373.52	0.76	32.72	6.45	81.23	1,241.91	11,862.99
25%	2,261.00	2,344.00	0.00	0.00	0.78	34.40	66.45	1,526.01
Median	5,136.00	3,236.00	0.00	2.00	2.13	66.59	273.31	2,852.30
75%	14,026.00	4,896.00	1.00	14.00	7.31	107.39	728.28	6,638.16
Std. Dev.	95,361.65	4,240.24	1.64	127.51	10.93	100.31	5,416.75	34,987.19
Panel B: the growth stage								
Mean	40,615.26	4,620.31	0.89	42.57	7.56	80.78	1,778.30	15,815.45
25%	3,452.00	2,725.00	0.00	0.00	1.05	41.76	166.39	1,768.21
Median	9,184.50	3,537.00	0.00	2.00	2.82	67.03	420.90	3,343.59
75%	28,463.25	5,286.50	1.00	13.00	8.97	102.52	1,112.83	9,488.07
Std. Dev.	115,424.54	3,757.18	1.52	183.69	11.52	65.41	6,006.70	32,926.56
Panel C: the mature stage								
Mean	27,251.95	4,450.61	0.76	33.70	6.52	80.35	1,203.43	12,178.44
25%	2,279.00	2,329.00	0.00	0.00	0.78	34.02	32.18	1,530.15
Median	4,731.00	3,195.00	0.00	2.00	2.23	65.64	251.19	2,764.04
75%	14,503.00	4,899.00	1.00	15.00	7.42	107.48	691.47	6,625.80
Std. Dev.	99,017.19	4,315.92	1.74	120.63	11.06	71.85	5,307.98	35,153.19
Panel D: the decline stage								
Mean	14,652.35	3,940.64	0.61	20.90	5.22	83.91	834.18	9,200.211
25%	1,702.00	2,194.00	0.00	0.00	0.58	29.13	67.49	1,370.98
Median	3,455.00	3,093.00	0.00	2.00	1.53	68.52	187.93	2,585.24
75%	7,706.75	4,652.25	1.00	12.00	5.40	109.85	576.87	5,418.19
Std. Dev.	54,582.72	4,449.92	1.48	63.34	9.88	168.18	5,072.10	36,368.47

* MVE= market value of equity (million dollars); COM= top manager's annual salary and bonus (thousand dollars); QUALITY= the numbers of quality awards and ISO grant warrants; PATENT=the numbers of patents; RMS= firm's market share (%); CYCLE=cycle time (days); NI=earnings (million dollars); BV=book value of total equity (million dollars).

* The variables in the Table 2 are not deflated by the book value of total assets at the beginning of the year.

Table 3
Correlation Coefficients Among Variables

Variable	MVE	COM	QUALITY	PATENT	RMS	CYCLE	NI	BV
MVE	1	0.456***	0.151***	0.509***	0.589***	-0.360***	0.702***	0.794***
COM	0.453***	1	0.141***	0.280***	0.364***	-0.177***	0.386***	0.436***
QUALITY	0.047*	0.115***	1	0.178***	0.168***	-0.058**	0.103***	0.137***
PATENT	0.519***	0.250***	0.081***	1	0.261***	-0.206***	0.284***	0.523***
RMS	0.632***	0.336***	0.094***	0.501***	1	-0.309***	0.404***	0.606***
CYCLE	-0.097***	-0.110***	-0.059**	-0.085***	-0.163***	1	-0.422***	-0.233***
NI	0.787***	0.328***	0.056**	0.428***	0.604***	-0.120***	1	0.436***
BV	0.802***	0.338***	0.057**	0.447***	0.617***	-0.098***	0.732***	1

a: Right-up: Spearman Correlation; left-down: Pearson Correlation.
b: ***,**, * Statistically significant at the 1%, 5% ,and 10% levels, respectively (two-tailed).
c: MVE = market value of equity/ TA_{t-1}; COM = top manager's annual salary and bonus/ TA_{t-1}; QUALITY = the numbers of quality awards and ISO grant warrants; PATENT = the number of patents; RMS = firm's market share; CYCLE=cycle time; BV = the book value of equity of firm i at time t-1/ TA_{t-1}; NI = earnings/ TA_{t-1}; TA_{t-1}= the book value of total assets at the end of year t-1.

Panel B, Panel C, and Panel D in Table 2 present the descriptive statistics for the firms-observations in different lifecycle stages. The means (median) of MVE are 40,615.26(9,184.50); 27,251.95(4,731.00); 14,652.35(3,455.00) million New Taiwan Dollars. The means of QUALITY are 0.89, 0.76 and 0.61 in the different lifecycle stages; the means of PATENT are 42.57; 33.70 and 20.90; the means of RMS are 7.56%, 6.52% and 5.22%; finally, the means of CYCLE are 80.78, 80.35 and 83.91 days respectively. As Table 2 presents, the means of various performance measures are quite diverse; and it shows there are divergent characteristics among the firms. This result reflects the reality in Taiwan and implies that firms in the earlier lifecycle stage may place more emphasis on the nonfinancial performance measures. The means (median) of COM is 4,620.31 (3,537.00), 4,450.61 (3,195.00) and 3,940.64 (3,093.00) thousand New Taiwan Dollars. This is also consistent with our inference that firms may rewards the top managers based on their performance in different lifecycle stages.

Table 4
Empirical Results of the Moderating Effect of Compensation on the Relationship Between Firm Value and Performance Measures

$MVE_i = \alpha+\beta_1 BV_i+\beta_2 NI_i+ \beta_3 COM_i+\beta_4 QUALITY_i+\beta_5 PATENT_i+\beta_6 RMS_i+\beta_7 CYCLE_i+ \beta_{81} NI_i * COM_i +\beta_{82} QUALITY_i * COM_i+\beta_{83} PATENT_i * COM_i+\beta_{84} RMS_i * COM_i +\beta_{85} CYCLE_i * COM_i+ \varepsilon_i$ (1)

Variable	Expected sign	Estimated coefficient	*t*-statistic	VIF-value
Intercept	?	0.001	1.897*	
BV	+	0.002	6.024***	1.173
NI	+	0.004	10.058***	1.559
COM	+	-0.360	-4.220***	5.775
QUALITY	+	-0.001	-1.638	1.843
PATENT	+	-0.001	-0.057	1.642
RMS	+	0.001	1.945*	2.110
CYCLE	–	-0.001	-2.723***	3.331
NI*COM	+	3.365	10.436***	3.366
QUALITY*COM	+	0.066	3.213***	2.037
PATENT*COM	+	0.001	2.542**	1.168
RMS*COM	+	1.573	2.031**	1.592
CYCLE*COM	–	0.001	2.267**	5.241
Adj. R-squared	0.340			
F-statistic	65.466			
observations	1,505			

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b: MVE = market value of equity (hundred million dollars)/TA*t*-1(thousand dollars) ; BV = the book value of equity (thousand dollars) /TA *t*-1;NI = earnings (thousand dollars) /TA *t*-1; COM = Top manager's annual cash salary and bonus (thousand dollars)/TA *t*-1; QUALITY = the numbers of quality awards and ISO grant warrants; PATENT = number of patents; RMS = firm's market share ; CYCLE = cycle time; NI *COM = interaction term for NI and COM; QUALITY *COM = interaction term for QUALITY and COM; PATENT*COM = interaction term for PATENT and COM; RMS *COM = interaction term for RMS and COM; CYCLE*COM = interaction term for CYCLE and COM.

Table 3 reports the Spearman and Pearson correlations among selected variables. As expected, the performance measures, such as QUALITY (Pearson ρ = 0.047; Spearman ρ = 0.151), PATENT (Pearson ρ = 0.519; Spearman ρ = 0.509), RMS (Pearson ρ = 0.632; Spearman ρ = 0.589), and CYCLE (Pearson ρ = -0.097; Spearman ρ = -0.360) show significant relations with MVE. This implies that firms generally have more market value as firms with better performance. Further, the various performance measures, such as NI (Pearson ρ = 0.328; Spearman ρ = 0.386), QUALITY (Pearson ρ = 0.115; Spearman ρ = 0.141), PATENT (Pearson ρ = 0.250; Spearman ρ = 0.280), RMS (Pearson ρ = 0.336; Spearman ρ = 0.364),

and CYCLE (Pearson ρ = -0.110; Spearman ρ = -0.177) also show significant relations with COM. In general, observed relations among variables are consistent with our expectations. This is consistent with our inference and encourages us to examine whether firms pay higher compensation to managers with higher performance and thereafter increase the firm value. However, there are high correlations among independent variables. To further test for the existence of multicollinearity, we utilize the Variance Inflation Factor (VIF) in later analysis.

4.2. Hypothesis Testing

Table 4 presents the results for testing $\boldsymbol{H_1}$ and shows that NI is significantly positively associated with firm value (MVE) (β_2 = 0.004, $p < 0.01$), and the coefficient of interaction term for NI *COM is also significantly positive (β_{81}= 3.365, $p < 0.01$). This result is consistent with the expectation that financial measure (NI) generally is an important value-relevant performance measure and the compensation (COM) has a positive moderating effect on the relationship between firm value and NI. The coefficients of the interaction term for QUALITY*COM, PATENT*COM and RMS*COM are also significantly positive (β_{82} = 0.066, $p < 0.01$; β_{83} = 0.001, $p < 0.05$; β_{84} = 1.573, $p < 0.05$). This result suggests that compensation also has significant and positive moderating effect on the association between nonfinancial performance measures and firm value. The results conform to the inference made by this study and $\boldsymbol{H_1}$ is supported. However, the coefficients of the interaction term for CYCLE*COM are also significantly positive (β_{85} = 0.001, $p < 0.05$). We will examine it in the later sections.

In a knowledge based economy, the new rule for companies to build wealth is innovation productivity. Innovation plays a critical role in determining a firm's success or failure in intensely competitive industry. Looking at Patents, as one of the indicators of innovation productivity, we can find more and more firms developing patents in the information electronics industry in Taiwan. For example, Taiwan Semiconductor Manufacturing (TSMC) received 331 patents in 2005 and 463 patents in 2006; QUANTA Computer Inc. (QCI) received 735 patents in

2005 and 934 patents in 2006; CHI MEI Optoelectronics Corporation (CMO) received 183 patents in 2005 and 142 patents in 2006. Further, in the international marketplace, firms focus on improving product quality and extending their market shares as the key success factors of their competitive strategies to generate more benefits. Thus, firms should pay higher compensation to managers with higher performance and thereafter increase the firm value. Our empirical results shown in Table 4 reflect the reality in Taiwan and support this assertion.

Table 5 presents the results of testing $\boldsymbol{H_2}$. We test the three-way interaction among nonfinancial performance measures, compensation, and a dummy variable (STAGE) based on the lifecycle stages. Panel A of Table 5 shows the model reaches a significant level (F value = 44.766, $p < 0.01$), and the adjusted R^2 is 0.374, implying the explanatory power of the regression model is good. The results of comparison between firms in the growth stage and the mature stage indicate that the coefficients of interaction terms for QUALITY *COM *STAGE, RMS *COM *STAGE and CYCLE *COM *STAGE are significant ($\beta_{91} = 0.085$, $p < 0.05$; $\beta_{93} = 7.533$, $p < 0.01$; $\beta_{94} = -0.001$, $p < 0.05$). This result supports $\boldsymbol{H_{2a}}$.

Panel B of Table 5 shows the results of comparing firms in the growth stage with firms in the decline stage. The coefficients of RMS*COM*STAGE are also positive and significant ($\beta_{93} = 9.050$, $p < 0.01$). This result supports $\boldsymbol{H_{2b}}$ weakly. Panel C of Table 5 shows results between firms in the mature stage and the decline stage. The coefficient of the three-way interaction term for CYCLE *COM *STAGE is negatively significant ($\beta_{94} = -0.001$, $p < 0.05$). $\boldsymbol{H_{2c}}$ is also supported weakly.

The result of Table 5 implies the moderating effect of top manager's compensation on the relationship between firm value and nonfinancial performance measures is more positive for firms in the growth stage than in the mature and decline stages.

In hyper-competitive markets, future profitable growth opportunities will greatly add to the firm value. Firms have to pursue future growth opportunities in order to survive (Balkin *et al.*, 2000). When a firm is in the growth stage, most of its firm value is attributable to profitable expected future growth opportunities rather than assets-in-place. Nonfinancial performance measures are defined as

firm-specific information that is correlated with future growth opportunities. Thus, in the growth stage, firms generally tend to place great emphasis on nonfinancial performance measures in reward system and investors positively evaluate firms particularly with better nonfinancial performance in this early lifecycle stage.

The results of Table 4 and Table 5 indicate that top manager's compensation enhances the relation between firm value and performance measures. Our results also imply that firms in the information electronic industry in Taiwan competes with other firms through various nonfinancial performance measures, such as product quality (QUALITY), innovation productivity (PATENT), market shares (RMS), and operation efficiency (CYCLE) and rewarding managers for doing well for these performance measures, it appears that firms will benefit more and the market will reflect the reality.

4.3. Sensitivity Analysis

We checked the robustness of our results using several alternative specifications described below.

4.3.1. Re-classify Life Cycle Stage

Some researchers suggest that dividend payout is not appropriate as the classification indicator in Taiwan. This study uses sales growth rate, capital expenditures, and firm age as the classification indicators and reclassifies firm-year observations based on trisection of the composite scores without dividend payout as the classification indicator. Among the total 1,505 firm-years observations, there are 297 observations in the growth stage, 901 observations in the mature stage and 307 observations in the decline stage. We retest $\boldsymbol{H_2}$ and the results are shown in Table 6.

The Panel A of Table 6 shows, compared with the mature stage, the coefficients of QUALITY*COM*STAGE and RMS*COM *STAGE are significantly positive (β_{91} =0.065, $p < 0.10$; β_{93}= 7.844, $p < 0.01$) for firms in the growth stage, and Panel B of Table 6 shows the results of comparing firms in the growth stage and the decline stage. The coefficients of QUALITY *COM *STAGE, and RMS*COM* STAGE are significantly positive (β_{91} = 0.134, $p <$

0.10; β_{93} = 11.539, $p < 0.01$). Finally, Panel C of Table 6 shows the results of comparing firms in the mature stage and the decline stage. Only the coefficients of CYCLE*COM* STAGE are significantly negative (β_{94}= -0.001, $p < 0.05$). In sum, the results support the previous conclusions.

4.3.2. Splitting the Sample into Firms with Positive Earnings or Firms with Negative Earnings

Gaver and Gaver (1998), HassabElnaby *et al.* (2005) and Reitenga (2006) suggest that the relation between compensation levels and firm performance depends on earnings levels. To test our research hypotheses more deeply, we partition our sample into two sub-samples according to whether the firm's earnings are positive or negative. Table 7 presents the results of testing $\boldsymbol{H_1}$ and Table 8 presents the results of testing $\boldsymbol{H_2}$.

The results of Panel A in Table 7 show the coefficients of interaction term of NI*COM, QUALITY*COM, RMS*COM, and CYCLE*COM are significantly associated with firm values (β_{81} = 1.550, $p < 0.01$, β_{82} = 0.080, $p < 0.01$, β_{84} = 1.525, $p < 0.05$, and β_{85} = -0.002, $p < 0.05$, respectively) for firms with positive earnings. On the contrary, the results of Panel B in Table 7, only the coefficient of the interaction term of QUALITY*COM is significantly positively associated with firm values (β_{82} = 0.035, $p < 0.10$) for firms with negative earnings.

In testing $\boldsymbol{H_2}$, the results of Panel A in Table 8 present that compared with firms with positive earnings in the mature stage, the coefficients of QUALITY* COM* STAGE, RMS* COM* STAGE, and CYCLE* COM*STAGE are significantly associated with firm value (β_{91} = 0.116, $p < 0.01$, β_{93} = 6.142, $p <$ 0.01, and β_{94}= -0.002, $p < 0.01$, respectively) for firms with positive earnings in the growth stage. The results of Panel B in Table 8 present that compared with firms with positive earnings in the decline stage, the coefficients for QUALITY * COM* STAGE, RMS* COM* STAGE, and CYCLE* COM* STAGE are significant (β_{91} = 0.137, $p < 0.05$, β_{93} = 5.597, $p < 0.01$, and β_{94} = -0.003, $p < 0.05$, respectively) for firms with positive earnings in the growth stage.

Table 5
The Empirical Results of the Firms in Different Lifecycle Stages

$$MVE_i=\alpha+\beta_1 BV_i+\beta_2 NI_i+\beta_3 COM_i+\beta_4 QUALITY_i+\beta_5 PATENT_i+\beta_6 RMS_i+\beta_7 CYCLE_i+\beta_{81} QUALITY_i * COM+\beta_{82} PATENT_i * COM+\beta_{83} RMS_i * COM+\beta_{84} CYCLE_i * COM+\beta_{91} QUALITY_i * COM_i * STAGE+\beta_{92} PATENT_i * COM_i * STAGE+\beta_{93} RMS_i * COM_i * STAGE+\beta_{94} CYCLE_i * COM_i * STAGE+\beta_{10} STAGE+\varepsilon_i \quad (2)$$

	Panel A: the growth stage (STAGE =1) relative to the mature stage			**Panel B: the growth stage (STAGE =1) relative to the decline stage**			**Panel C: the mature stage (STAGE =1) relative to the decline stage**		
Variable	**Expected sign**	**Estimated coefficient**	***t*-value**		**Estimated coefficient**	***t*-value**		**Estimated coefficient**	***t*-value**
Intercept	?	-0.001	-0.953		-0.001	-1.927*		-0.001	-1.531
BV	+	0.002	6.987***		0.002	3.315***		0.002	7.054***
NI	+	0.005	13.560***		0.010	12.635***		0.004	15.159***
COM	+	0.301	4.234***		0.250	2.805***		0.097	1.627
QUALITY	+	-0.001	-0.257		-0.001	-0.258		-0.001	-0.119
PATENT	+	-0.001	-1.507		-0.001	-2.135**		0.001	2.313**
RMS	+	0.002	3.367***		0.002	2.802***		0.001	0.105
CYCLE	-	-0.001	-2.964***		0.001	0.653		-0.001	-2.442**
QUALITY*COM	+	-0.029	-0.818		-0.033	-0.452		0.016	0.359
PATENT* COM	+	0.001	0.882		0.003	2.865***		0.001	0.884
RMS* COM	+	-3.175	-2.750***		-4.911	-2.252**		-1.740	-1.163
CYCLE* COM	-	-0.001	-0.485		-0.001	-0.831		0.001	1.610
QUALITY*COM* STAGE	+	0.085	2.324**		0.101	1.520		0.024	0.557
PATENT*COM* STAGE	+	0.001	0.001		-0.002	-1.572		-0.001	-0.517
RMS*COM* STAGE	+	7.533	5.349***		9.050	3.987***		1.492	0.952
CYCLE*COM* STAGE	-	-0.001	-1.993**		-0.001	-1.138		-0.001	-2.308**
STAGE	+	0.001	5.209***		0.001	5.673***		0.001	5.384***
Adj. R-squared	0.374			Adj. R-squared	0.454		Adj. R-squared	0.299	
F-statistic	44.766			*F*-statistics	34.515		*F*-statistics	32.673	
observations	1,173			observations	646		observations	1,191	

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b: MVE=market value of equity (hundred million dollars)/TA*t*-1(thousand dollars) ; BV=the book value of equity (thousand dollars)/TA *t*-1;NI= earnings (thousand dollars)/TA *t*-1; COM=Top manager's annual cash salary and bonus (thousand dollars)/TA *t*-1; QUALITY=the numbers of quality awards and ISO grant warrants; PATENT=number of patents; RMS=firm's market share; CYCLE=cycle time; QUALITY *COM=interaction term for QUALITY and COM; PATENT*COM=interaction term for PATENT and COM; RMS *COM=interaction term for RMS and COM; CYCLE*COM=interaction term for CYCLE and COM; QUALITY *COM*STGAE =interaction term for QUALITY,COM and STAGE; PATENT*COM*STGAE =interaction term for PATENT ,COM and STAGE; RMS *COM*STGAE =interaction term for RMS,COM and STAGE; CYCLE*COM*STGAE=interaction term for CYCLE, COM and STAGE; STAGE=lifecycle stage.

Table 6

The Empirical Results of the Firms in Different Lifecycle Stages-without Dividend Payout as the Classification Indicator

$$MVE_i=\alpha+\beta_1 BV_i+\beta_2 NI_i+\beta_3 COM_i+\beta_4 QUALITY_i+\beta_5 PATENT_i+\beta_6 RMS_i+\beta_7 CYCLE_i+\beta_{81} QUALITY_i * COM+\beta_{82} PATENT_i * COM+\beta_{83} RMS_i * COM+\beta_{84} CYCLE_i * COM+\beta_{91} QUALITY_i * COM_i * STAGE+\beta_{92} PATENT_i * COM_i * STAGE+\beta_{93} RMS_i * COM_i * STAGE+\beta_{94} CYCLE_i * COM_i * STAGE+\beta_{10} STAGE+\varepsilon_i \quad (2)$$

	Panel A: the growth stage (STAGE =1) relative to the mature stage			**Panel B: the growth stage (STAGE =1) relative to the decline stage**			**Panel C: the mature stage (STAGE =1) relative to the decline stage**		
Variable	**Expected sign**	**Estimated coefficient**	***t*-value**		**Estimated coefficient**	***t*-value**		**Estimated coefficient**	***t*-value**
Intercept	?	-0.001	-0.931		-0.001	-1.697*		-0.001	-0.779
BV	+	0.002	6.676***		0.002	3.714***		0.002	6.323***
NI	+	0.005	12.383***		0.008	10.759***		0.004	13.354***
COM	+	0.267	3.885***		0.316	3.203***		0.130	2.174**
QUALITY	+	0.001	0.033		0.001	0.617		-0.001	-0.030
PATENT	+	-0.001	-0.858		-0.001	-2.228**		0.001	1.765*
RMS	+	0.002	2.659***		0.004	3.304***		0.001	0.925
CYCLE	-	-0.001	-2.075**		-0.001	-0.108		-0.001	-1.801*
QUALITY*COM	+	-0.024	-0.670		-0.086	-1.040		-0.040	-0.815
PATENT* COM	+	0.001	0.665		0.003	2.274**		0.001	0.695
RMS* COM	+	-2.204	-2.052**		-7.257	-2.952***		-3.168	-1.956*
CYCLE* COM	-	-0.001	-0.852		-0.001	-0.115		0.001	1.194
QUALITY*COM* STAGE	+	0.065	1.805*		0.134	1.772*		0.034	0.702
PATENT*COM* STAGE	+	0.001	0.242		-0.002	-1.070		-0.001	-0.449
RMS*COM* STAGE	+	7.844	5.518***		11.539	4.584***		2.631	1.562
CYCLE*COM* STAGE	-	-0.001	-1.331		-0.001	-1.506		-0.001	-2.194**
STAGE	+	0.001	4.818***		0.001	3.024***		0.001	4.329***
Adj. R-squared	0.346			Adj. R-squared	0.466		Adj. R-squared	0.263	
F-statistic	40.615			*F*-statistics	33.939		*F*-statistics	27.926	
observations	1,198			observations	604		observations	1,208	

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b: MVE=market value of equity (hundred million dollars)/TA*t*-1(thousand dollars) ; BV=the book value of equity (thousand dollars)/TA *t*-1;NI= earnings (thousand dollars)/TA *t*-1; COM=Top manager's annual cash salary and bonus (thousand dollars)/TA *t*-1; QUALITY=the numbers of quality awards and ISO grant warrants; PATENT=number of patents; RMS=firm's market share; CYCLE=cycle time; QUALITY *COM=interaction term for QUALITY and COM; PATENT*COM=interaction term for PATENT and COM; RMS *COM=interaction term for RMS and COM; CYCLE*COM=interaction term for CYCLE and COM; QUALITY *COM*STGAE =interaction term for QUALITY,COM and STAGE; PATENT*COM*STGAE =interaction term for PATENT ,COM and STAGE; RMS *COM*STGAE =interaction term for RMS,COM and STAGE; CYCLE*COM*STGAE=interaction term for CYCLE, COM and STAGE; STAGE=lifecycle stage.

Table 7
Empirical Results of Firms with Positive Earnings and Negative Earnings

$$MVE_i = \alpha + \beta_1 BV_i + \beta_2 NI_i + \beta_3\, COM_i + \beta_4\, QUALITY_i + \beta_5 PATENT_i + \beta_6\, RMS_i + \beta_7\, CYCLE_i + \beta_{81} NI_i{*}COM_i + \beta_{82} QUALITY_i{*}COM_i + \beta_{83} PATENT_i{*}COM_i + \beta_{84} RMS_i{*}COM_i + \beta_{85} CYCLE_i{*}COM_i + \varepsilon_i \quad (1)$$

		Panel A: Firms with positive earnings		**Panel B:** Firms with negative earnings	
Variable	**Expected sign**	**Estimated coefficient (*t*-statistic)**	**VIF-value**	**Estimated coefficient (*t*-statistic)**	**VIF-value**
Intercept	?	-0.001		0.001	
		(-2.432**)		(1.124)	
BV	+	0.001	1.238	0.001	1.110
		(2.529***)		(5.158***)	
NI	+	0.018	2.008	0.001	1.421
		(20.701***)		(1.787*)	
COM	+	-0.101	8.059	0.103	6.140
		(-1.024)		(1.855*)	
QUALITY	+	-0.001	1.925	-0.001	1.867
		(-2.179**)		(-1.275)	
PATENT	+	-0.001	1.638	0.001	1.948
		(-0.361)		(4.737***)	
RMS	+	0.001	2.197	0.002	2.027
		(2.256**)		(4.767***)	
CYCLE	-	0.001	3.192	0.001	4.665
		(2.252**)		(0.818)	
NI*COM	+	1.550	5.441	0.314	2.902
		(3.660***)		(1.571)	
QUALITY*	+	0.080	2.129	0.035	2.160
COM		(3.975***)		(1.726*)	
PATENT*COM	+	0.001	1.118	-0.001	1.700
		(1.174)		(-1.147)	
RMS*COM	+	1.525	1.617	-2.232	1.576
		(2.066**)		(-1.891*)	
CYCLE*COM	-	-0.002	4.956	-0.001	8.865
		(-2.343**)		(-0.780)	
Adj. R-squared		0.487		0.335	
F-statistic		99.379		11.882	
observations		1,245		260	

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b: MVE=market value of equity (hundred million dollars)/TA_{t-1}(thousand dollars) ; BV= the book value of equity (thousand dollars)/TA_{t-1}; NI= earnings (thousand dollars) /TA_{t-1}; COM= Top manager's annual cash salary and bonus (thousand dollars) /TA_{t-1}; QUALITY= the numbers of quality awards and ISO grant warrants; PATENT= number of patents; RMS=firm's market share; CYCLE=cycle time; NI *COM=interaction term for NI and COM;QUALITY *COM=interaction term for QUALITY and COM; PATENT*COM=interaction term for PATENT and COM;RMS *COM=interaction term for RMS and COM; CYCLE*COM=interaction term for CYCLE and COM.

The numbers of patents have been shown to be significantly related to

changes in firm value, profitability, and sales growth (Balkin *et al.*, 2000; Hand 2005). However, we find the results of Table 8 are interesting. Compared with the mature and decline stages, the coefficients of PATENT * COM* STAGE are significant ($\beta_{92} = 0.013$, $p < 0.01$) for firms with negative earnings in the growth stage. This implies that in the growth stage, the firm having the ability to develop more patents, even with negative earnings, may create more competitive advantage for survival and increase firm value. In this case, the firm will benefit more than in the later lifecycle stages in the Taiwan information industry.

The results in Table 7 and Table 8 imply that the moderating effect of compensation on the relationship between nonfinancial performance measures and firm value is stronger for firms with positive earnings than firms with negative earnings.

4.3.3. Sub-industry

The firms in the information electronic industry in Taiwan have different core products, operating strategies, and business environment. Thus, the usefulness of information about performance measures may vary according to the changes in the production function and activities of firms. The Taiwan Stock Exchange (TSE) classifies firms into eight different sub-industries from year 2007 to reflect the real conditions in the Taiwanese information electronic industry. Therefore, we follow the categories of TSE and re-examine the hypotheses. From the empirical results in Table 9, we find the relationship between firm values and the interactions of these performance measures with compensation are obviously different among these eight sub-industries. This shows that the importance and meanings of the moderating effect of compensation upon the eight sub-industries are different. In particular, we find that the coefficients of NI*COM are significant for six sub-industries (e.g., Semiconductor, Photodiode, Electronic components, Electronic channel, Information service and other electronic industry). This evidence confirms the suggestion of many studies that financial measures are generally the key determinants for compensation and firm performance evaluation (Sloan, 1993; Holthausen *et al.*, 1995; Bushman *et al.*,

Table 8
Empirical Results of Firms with Positive Earnings and Negative Earnings in the Different Lifecycle Stages

$$MVE_i=\alpha + \beta_1 BV_i + \beta_2 NI_i + \beta_3 COM_i + \beta_4 QUALITY_i + \beta_5 PATENT_i + \beta_6 RMS_i + \beta_7 CYCLE_i + \beta_{81} QUALITY_i * COM + \beta_{82} PATENT_i * COM + \beta_{83} RMS_i * COM + \beta_{84} CYCLE_i * COM + \beta_{91} QUALITY_i * COM_i * STAGE + \beta_{92} PATENT_i * COM_i * STAGE + \beta_{93} RMS_i * COM_i * STAGE + \beta_{94} CYCLE_i * COM_i * STAGE + \beta_{10} STAGE + \varepsilon_i \quad (2)$$

PANEL A: testing H_{2a} the growth stage (STAGE =1) relative to the mature stage

Variables	Expected sign	Estimated coefficient (*t*-statistic) (Firms with positive earnings)	Estimated coefficient (*t*-statistic) (Firms with negative earnings)
Intercept	?	-0.001 (-3.010***)	0.001 (0.791)
BV	+	0.001 (2.186**)	0.001 (4.727***)
NI	+	0.020 (23.854***)	0.001 (2.872***)
COM	+	0.215 (2.901***)	0.045 (0.848)
QUALITY	+	-0.001 (-0.732)	-0.001 (-1.001)
PATENT	+	-0.001 (-1.621)	0.001 (3.468***)
RMS	+	0.002 (3.126***)	0.002 (3.522***)
CYCLE	-	0.001 (1.368)	0.001 (1.443)
QUALITY* COM	+	-0.018 (-0.532)	0.031 (1.412)
PATENT* COM	+	0.001 (1.119)	-0.001 (-0.458)

PANEL B: testing H_{2b} the growth stage (STAGE =1) relative to the decline stage

Variables	Expected sign	Estimated coefficient (*t*-statistic) (Firms with positive earnings)	Estimated coefficient (*t*-statistic) (Firms with negative earnings)
Intercept	?	-0.002 (-4.217***)	0.001 (0.545)
BV	+	0.001 (2.152**)	0.001 (3.886***)
NI	+	0.022 (18.159***)	0.001 (0.717)
COM	+	0.194 (2.247**)	-0.068 (-0.663)
QUALITY	+	-0.001 (-0.124)	-0.001 (-2.033**)
PATENT	+	-0.001 (-1.955*)	0.001 (1.629)
RMS	+	0.002 (2.348**)	0.001 (1.133)
CYCLE	-	0.001 (1.487)	-0.001 (-0.846)
QUALITY* COM	+	-0.043 (-0.620)	0.216 (3.108***)
PATENT* COM	+	0.001 (0.238)	-0.001 (-1.731*)

Variables	Expected sign	Estimated coefficient (*t*-statistic) (Firms with positive earnings)	Estimated coefficient (*t*-statistic) (Firms with negative earnings)	Variables	Expected sign	Estimated coefficient (*t*-statistic) (Firms with positive earnings)	Estimated coefficient (*t*-statistic) (Firms with negative earnings)
RMS* COM	+	-2.290 (-2.118**)	-2.338 (-1.684*)	RMS* COM	+	-1.682 (-0.818)	-2.172 (-1.110)
QUALITY*COM* STAGE	+	0.116 (3.302***)	-0.057 (-0.581)	QUALITY*COM * STAGE	+	0.137 (2.142**)	-0.139 (-1.407)
PATENT*COM* STAGE	+	-0.001 (-0.518)	0.013 (2.569***)	PATENT*COM * STAGE	+	-0.001 (-0.127)	0.016 (2.582**)
RMS*COM * STAGE	+	6.142 (4.715***)	5.484 (1.423)	RMS*COM* STAGE	+	5.597 (2.623***)	7.811 (2.187**)
CYCLE*COM* STAGE	-	-0.002 (-2.694***)	0.001 (0.952)	CYCLE*COM* STAGE	-	-0.003 (-2.337**)	-0.001 (-0.427)
STAGE		0.001 (5.286***)	-0.001 (-0.294)	STAGE		0.001 (5.846***)	0.001 (0.359)
Adj. R-squared		0.530	0.390	Adj. R-squared		0.576	0.550
F-statistic		68.845	9.348	*F*-statistic		49.025	6.948
observations		963	210	observations		567	79

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b : MVE=market value of equity (hundred million dollars)/TA_{t-1}(thousand dollars) ; BV= the book value of equity (thousand dollars)/TA_{t-1}; NI= earnings (thousand dollars) /TA_{t-1}; COM= Top manager's annual cash salary and bonus (thousand dollars)/TA_{t-1}; QUALITY= the numbers of quality awards and ISO grant warrants; PATENT= number of patents; RMS=firm's market share; CYCLE=cycle time; QUALITY *COM=interaction term for QUALITY and COM; PATENT*COM=interaction term for PATENT and COM; RMS *COM=interaction term for RMS and COM; CYCLE*COM=interaction term for CYCLE and COM; QUALITY *COM*STGAE =interaction term for QUALITY, COM and STAGE;PATENT*COM*STGAE =interaction term for PATENT, COM and STAGE; RMS *COM*STGAE =interaction term for RMS , COM and STAGE; CYCLE*COM*STGAE=interaction term for CYCLE, COM and STAGE; STAGE=lifecycle stage.

1996). In contrast with financial performance measures, the coefficients of RMS*COM are significant for Semiconductor, Computer and Peripheral devices, Photodiode, Telecommunication internet and other electronic industries. The coefficients of PATENT*COM are also significant for Computer and Peripheral devices, Photodiode, and Information service. Our empirical results suggest that nonfinancial measures are also essential for compensation and firm's value evaluation.

4.3.4. Variables Are Scaled by Shares

To mitigate the impact of cross-sectional difference in firm size, we also scale the variables by shares of common stocks outstanding of the end of the year and re-estimate the regression. The results (not tabled) are consistent with the prior results of Table 4 and Table 5. In addition, the coefficients of CYCLE*COM*STAGE are significantly negative when testing $\boldsymbol{H_{2a}}$ (β_{94} = -0.004, $p < 0.01$), and support the previous conclusions.

4.3.5. Stock-based Bonus

Except for cash compensation, stock-based bonus is also an important payment form for top manager's compensation. Similar to Lin and Hu (2003) and Hung and Wang (2008), this study uses the public data of the top manager's stock holdings to estimate top manager's stock-based bonus to re-examine the hypotheses[13].

Instead of cash compensation (COM) only, we use another forms of top manager's compensation to re-test $\boldsymbol{H_1}$. The empirical results shows (not tabled), the coefficients of interaction term of NI*STOCK, RMS*STOCK, and

[13] We thank the referee for suggestion to consider stock-based bonus data as another variable for top manager's compensation to retest our hypotheses. This study follows and modifies the method of Hung and Wang (2008)'s to estimate top manager's stock-based bonus. The procedure is as follows. First, we calculate per-year change of the top manager's stock holdings. After adjusting the stock dividends, we can get the amounts which are possibly due to stock bonus granted. Second, by multiplying estimated stock bonus granted by the assumed ex-rights price, we get the market value of the top manager's stock-based bonus as the variable (STOCK). After eliminating observations due to lack of sufficient data, the sample size yields a total of 1,031 firm-year observations, there are 171 observations in the growth stage, 614 observations in the mature stage and 246 observations in the decline stage.

CYCLE*STOCK are significantly associated with firm values (β_{81} = 14.688, p < 0.01, β_{84} = 3.536, p < 0.10, β_{85} = -0.005, p < 0.10) by stock-based bonus (STOCK) only. Then we use both variables (STOCK) and (COM) to test $\boldsymbol{H_1}$. The coefficients of interaction term of PATENT*COM, NI*STOCK, RMS*STOCK, and CYCLE*STOCK are also significantly associated with firm values (t-value = 4.561, 8.274, 2.686, -2.134, respectively). Thus, $\boldsymbol{H_1}$ is supported and the results are robust.

In testing $\boldsymbol{H_2}$, compared with firms in the mature stage, we use variables (STOCK) and (COM) as top manager's compensation to test $\boldsymbol{H_{2a}}$, the coefficients of interaction term for QUALITY*COM*STAGE and RMS*COM*STAGE are significant for firms in the growth stage (β_{91} = 1.113, p < 0.05, β_{93} = 61.586, p < 0.01 respectively) (not tabled). $\boldsymbol{H_{2a}}$ is supported. The results of comparing firms in the growth stage with the decline stage show the coefficients of PATENT* COM*STAGE (β_{92} = 0.146, p < 0.05), the coefficient of RMS*STOCK*STAGE is 35.224 (p < 0.05) and the coefficient of CYCLE*STOCK*STAGE is -0.020 (p < 0.05). $\boldsymbol{H_{2b}}$ is supported. Finally, the results of comparing firms in the mature stage and the decline stage shows the coefficient of RMS*STOCK*STAGE is 54.097 (p < 0.01), and CYCLE* STOCK*STAGE is -0.015 (p < 0.10), respectively. $\boldsymbol{H_{2c}}$ is supported, too. The results are consistent with the prior results of Table 4 and Table 5 and support the previous conclusion, even using different measures of top manager's compensation.

In sum, the results of sensitivity analysis provide detailed evidence of the moderating effect of compensation on the value relevance of performance measures, and the results are consistent with our prior conclusions.

5.Conclusion and Limitation

Maines *et al.* (2002) asserted that investors can perceive nonfinancial performance measures because stock prices appear to reflect these measures. With regard to the research on the nonfinancial information in valuation, this study mainly examines the role of compensation on the relationship between nonfinancial performance measures and stock prices, especially for firms in

Table 9
Partial Empirical Results of Firms among Eight Sub-industries

$$MVE_i=\alpha+\beta_1 BV_i+\beta_2 NI_i+\beta_3 COM_i+\beta_4 QUALITY_i+\beta_5 PATENT_i+\beta_6 RMS_i+\beta_7 CYCLE_i+\beta_{81} NI_i * COM+\beta_{82} QUALITY_i * COM+\beta_{83} PATENT_i * COM+\beta_{84} RMS_i * COM+\beta_{85} CYCLE_i * COM+\varepsilon_i \quad (1)$$

Industries	semiconductor	computer and peripheral devices	photodiode	telecommunication internet	electronic components	electronic channel	information service	other electronic industry
Variables	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**	**Estimated coefficient (*t*-statistic)**
NI*COM	3.933	1.052	6.089	0.925	2.047	2.224	3.900	3.941
	(3.104***)	(1.361)	(4.074***)	(1.403)	(1.814*)	(2.190**)	(4.564***)	(3.274***)
QUALITY*COM	-0.258	0.051	0.020	-0.001	0.108	0.098	0.097	0.136
	(-1.165)	(2.118**)	(0.199)	(-0.003)	(1.332)	(0.955)	(0.595)	(1.500)
PATENT*COM	-0.006	0.001	0.021	0.015	-0.002	-0.022	0.110	0.004
	(-0.736)	(2.133**)	(1.656*)	(0.924)	(-0.461)	(-0.424)	(2.385**)	(0.365)
RMS*COM	40.670	46.602	17.721	10.048	-1.982	0.587	-0.645	10.214
	(3.535***)	(11.276***)	(2.935***)	(2.028**)	(-1.222)	(0.468)	(-0.404)	(1.978**)
CYCLE*COM	0.002	0.002	-0.001	0.001	0.001	0.002	0.005	0.002
	(0.766)	(0.844)	(-0.487)	(0.515)	(1.096)	(1.551)	(1.284)	(0.956)
Adj. R-squared	0.434	0.525	0.399	0.407	0.328	0.396	0.926	0.469
F-statistic	15.782	32.419	11.291	9.761	12.813	6.835	52.392	13.371
observations	232	314	187	154	291	108	50	169

a : *, **, *** Statistically significant at the 10%, 5%, and 1% levels, respectively (two-tailed).

b: MVE=market value of equity (hundred million dollars)/TA*t*-1(thousand dollars) ; BV= the book value of equity (thousand dollars)/TA*t*-1; NI= earnings (thousand dollars) /TA *t*-1; COM= Top manager's annual cash salary and bonus (thousand dollars)/TA *t*-1; QUALITY= the numbers of quality awards and ISO grant warrants; PATENT= number of patents; RMS=firm's market share; CYCLE=cycle time; NI *COM=interaction term for NI and COM; QUALITY *COM=interaction term for QUALITY and COM; PATENT*COM=interaction term for PATENT and COM; RMS *COM=interaction term for RMS and COM; CYCLE*COM=interaction term for CYCLE and COM.

different life cycle stages. The empirical results of this study show that a significant portion of firm value can be explained by the moderating effect of compensation across various performance measures. Compensation plan have proven to be effective devices to motivate manager's performance (Schiehll and Morissette, 2000). Our findings also support that assertion that firm value increases as investors' perceived greater firm performance improvement at the compensation level. This implication indicates that top manager's compensation improves the relationship between firm value and performance measures. These evidences further suggest that firms that reward managers based on financial performance measures alone cannot recognize the complete benefits of future growth opportunities. This is especially true for firms in the growth stage.

Our results have important implications for firm's management and decision planning. In the informational electronic industry, which is the most important and competitive industry in Taiwan, our findings suggest that firms can succeed by means of appropriate selection of performance measures, such as earnings (NI), market shares (RMS), product quality (QUALITY), innovation productivity (PATENT), and operation efficiency (CYCLE). In particular, firms will benefit more by putting emphasis on nonfinancial performance measures and rewarding top manager for improvement of these performance measures in the early lifecycle stages and the market will reflect this in the stock prices.

The results of this study support that the moderating effect of compensation on performance measures can convey more information to help shareholders evaluate the value of firms, even in different lifecycle stages. The results of this study contribute to the value relevance literature and we believe that adding such information to a valuation model will provide investors with a way to appraise firm value more appropriately and to decide stock price.

The limitations of this study include: (1) there are a lot of difficulties of obtaining accurate and detailed data on exactly how firms measure performance and the compensation schemes employed by the sample firms; (2) the public data of the Taiwan's managers' compensation has been condensed to one number (Hung and Wang, 2008), which does not separately each manager's listed cash-based and stock-based figures since year 2007. Thus, we have limited

understanding concerning more details about cash compensation data and cannot extend our research period to year 2009; (3) the analysis is restricted to firms in the information electronic industry and this may diminish generalization that apply to other industries; (4) we use archival measures available to proxy for nonfinancial performance measures, which are supported in the related studies. However, there is obviously unwanted noise. Further research may use more precise nonfinancial performance measures employed by the compensation plans of firms to re-examine the conclusion.

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