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doi:10.6552/JOAR.2007.45.s.5

會計評論, (45_s), 2007

International Journal of Accounting Studies, (45_s), 2007

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頁數/Page： 121-149

出版日期/Publication Date：2007/05

The International Journal of Accounting Studies
2006 Special Issue
pp. 121-149

Performance Consequences of Pay Dispersion within Top Management Teams: The Impact of Firm Collaboration Needs

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ABSTRACT

According to tournament theory, the compensation gap between CEO and the top management team members provides incentives for lower-level executives to strive for promotion. However, equity theory argues that large pay dispersion leads to perceptions of inequity and has negative side effects on the firm's cooperative atmosphere and organizational performance. These two contradicting theories motivate us to investigate whether the incentive effect of pay dispersion among top management teams will be dependent on the degree of firm collaboration needs. In this paper, we employ two methods to measure pay dispersions among top management teams. One measure of pay dispersion is the coefficient of variation in compensation of top management teams, and the other is overpayment and underpayment of executives. Both measures show that the degree of firm collaboration needs has a negative impact on the incentive effect of pay dispersion. This result suggests that firms with higher collaboration needs should cautiously consider the negative impact of pay dispersion.

Keywords: *CEO compensation, Top management team, Pay dispersion, Firm performance.*

Data Availability: *Available from the sources identified in this paper.*

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The authors gratefully acknowledge the helpful comments and suggestions made by the guest editor, Jennifer Ho, and anonymous reviewers. National Science Council's generous financial support for this study is greatly appreciated (Project No. NSC 93-2416-H-194-029).
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1. INTRODUCTION

Agency theory has emerged to be the main framework in dealing with the problems of the divergent interests between managers and owners in the employment relationship (Baiman 1990). According to the agency theory, the basic agency problem is characterized in terms of the conflict of interest between top managers and owners. Agency research suggests that rewarding managers on the basis of the outcome of a decision would increase firm performance. However, the work by Jensen and Murphy (1990) showed low pay-performance sensitivity. In particular, they found that the wealth of a chief executive officer (CEO) changed by only $3.25 for every $1,000 change in shareholder wealth. Research by Attaway (2000) and Veliyath and Bishop (1995) also indicated that there was little relationship between top management compensation and firm performance. If the change of firm performance cannot be reflected in the outcome of the change of a manager's productivity or decisions, it would be difficult to obtain the expected results for pay-performance sensitivity.

The tournament theory proposed by Lazear and Rosen (1981) argues that setting managerial compensation should be based on an individual's ordinal rank in an organization rather than absolute performance. According to the theory, when monitoring managers becomes more costly and unreliable, paying top managers based on their marginal output would be less feasible because agents would be more likely to shirk their efforts and responsibilities (Henderson and Fredrickson 2001). In this situation, the large pay gap between CEO and other executives may induce managers to increase their efforts for competing for the very high pay and therefore improve firm performance. Lee (2006) found that the higher uncertainty and greater top management pay gaps enhance firm performance. However, a tournament-like incentive increases competition and may have a negative impact on the coordination between members in the top management team (TMT). Thus, such pay gaps may reduce a firm's performance when its tasks require high collaboration and cooperation (Shaw, Gupta and Delery 2002; Pfeffer 1995).

Research related to the effect of tournament compensation has yielded mixed results. In some cases, compensation gaps are positively related to the performance outcome, including a golfer's performance (Ehrenberg and Bognanno 1990) and firm performance (Eriksson 1999; Main, O'Reilly and Wade 1993). In other cases, greater compensation gaps instill a decrease in productivity, causing less collaboration and more turnover (Bloom and Michel 2002; Wade, O'Reilly and Pollock 2006; Pfeffer and Davis-Blake 1992; Pfeffer and Langton 1993).

Literature supporting tournament compensation structures asserts that larger compensation gaps in the top management teams are beneficial to individual and organizational performance, but this statement ignores the fact that many tasks require collaboration and involve interdependent situations (Carpenter and Sanders 2002; Hambrick 1995; Shaw et al. 2002). If worker compensations are determined solely on the basis of relative performance, competition among employees may dampen their cooperative efforts, which is harmful to the firm. For example, Drake, Haka and Ravenscroft (1999) found that, in Activity-Based-Costing (ABC) type of environment where significant cost reductions can be gained primarily from coordinated efforts of multiple workers, tournament incentive structures result in lower number of cooperative actions, which in turn, produce lower profits

According to equity theory, large pay gaps may give workers a feeling of inequity and produces negative firm performance (Dornstein 1989; Kabanoff 1991; Kulik and Ambrose 1992). Thus, the design of managerial incentive structures should take top management teams' perception of equity and procedural justice into consideration (Carpenter and Sanders 2002). This is particularly important for a decision environment with high innovation and interdependence. In such an environment, a great deal of collaboration and coordination within the top management teams is required to manage the innovative process and to cope with dynamics. Thus, large pay dispersion is likely to result in perceptions of inequity and dysfunctional decision outcomes for firms with high collaboration needs.

Based on the data of firms listed in Taiwan Stock Exchange, this paper examines the relationship between the pay dispersion of top management team and firm performance. Our focus is to investigate whether firm's coordination needs would moderate such relationship. We consider two factors as proxies to measure a firm's coordination needs: work interdependence and innovation. In addition, two alternative measures of pay dispersion are used in this study: overpayment versus underpayment of executives, and the coefficient of variation in compensation for all executives including the CEO.

This paper contributes to existing managerial compensation research in the following ways. First, this paper takes another stand and examines whether the effect of pay dispersion on firm performance may depend on the degree of firm collaboration needs. When firms are in a situation where firm performance depends on high degree of workers collaboration, we hypothesize that pay dispersion may have a negative impact on firm performance. Our study therefore jointly considers two theories and can explain why previous studies find mixed results regarding the direction of pay dispersion effect. Second, this study

provides two measures of management pay dispersion based on the executive overpayment (vs. underpayment) and the coefficient of variation in compensation for all executives of the firm. These measures based on actual compensations of top management team members can provide an objective measure of pay dispersion which are consistent with employees' perception of pay dispersion in the firm. Third, this study identifies two important factors that can reflect the degree of collaboration needs for a firm: innovation and interdependence. Innovative activities are the most important success factors in modern competitive environment (Wade et al. 2006). Organizational interdependence is identified as one of important contextual variables in management accounting system (Chenhall and Morris 1986). The dimensions of innovation and interdependence both demand high coordination effort. Finally, this paper investigates both contemporary and intertemporal relationships between pay dispersions and firm performance. Prior studies only focus on contemporary relationship (Henderson and Fredrickson 2001; Shaw et al. 2002; Lee 2006). After all, pay-dispersion observed by employees this period shall have an impact on firm performance mostly in the following period rather than in the same period.

The rest of this paper is organized as follows. Section 2 addresses the effect of pay dispersion among TMTs by combining tournament theory and equity theory and develops hypotheses. Section 3 describes the sample data and empirical models. The empirical results are analyzed and presented in the section 4. Conclusions are provided in the final section.

2. THEORY AND HYPOTHESES

2.1 MANAGERRIAL COMPENSATION

According to agency theory, the design of compensation is concerned with the alignment between the interests of risk-and-effort-averse agents and those of shareholders (Indjejikian 1999). Many empirical studies examine the linkage between performance, e.g. shareholder value, accounting earnings & relative performance, and managerial compensation (Antle and Smith 1986; Core, Guay and Verrecchia 2003; Janakiraman, Lambert and Larcker 1992; Jensen and Murphy 1990; Gibbons and Murphy 1990; Natarajan 1996; Sloan 1993). An interesting problem is the association between incentives and subsequent firm performance since firm performance affects managerial compensation. Supporting evidences are provided by Abowd (1990) and Hayes and Schaefer (2000) who indicated that current CEO compensation was positively associated with future firm performance. In the case of intensive technology, linking executive compensation to accounting

measures or stock performance measures may induce managers to reduce R&D expenditures for the purpose of boosting current accounting earnings, which may not be an optimal decision to maximize firm value. Bushman, Indjejikian and Smith (1996) found that managerial performance can not be fairly reflected in accounting and stock-price-based performance measures when the firms exhibit higher information asymmetry. Innovation is one of proxy variables for information asymmetry. The issue of designing managerial compensation under innovative environment has been addressed by prior studies. Finkelstein and Hambrick (1996) concluded that when a CEO invests more resources on innovation, he/she should then obtain higher remuneration in order to be compensated for taking on a higher risk. Nevertheless, Bloom and Milkovich (1998) found that incentive pay was negatively related to firm performance among higher-risk firms. A possible reason is that the greater use of incentive pay for the firm with higher risk may make managers take actions which are harmful to firm performance. Thus, the link between performance and managerial compensation is less clear for firms with higher degree of innovation or risk.

Tournament theory by Lazear and Rosen (1981) and Rosen (1986) provides some explicit empirical predication about managerial positions and compensation structure. It is assumed that managers compete with one another at the n-th organizational level, and high performers based on their relative performance are promoted to the upper organizational level. Principals provide managers with large pay at an increasing rate and expect competition within top managers for winning the large prize. Thus, the difference in compensation level for the CEO relative to the next lower position in the firm should be large relative to changes in compensation levels observed at other management levels. A large prize in the higher ranks inherently motivates contestants in the lower ranks to compete for the large rewards at the top of the firm. This discourages shirking, and the requirement of cost monitoring is minimal (Rosen 1986). On the basis of tournament theory, Eriksson (1999) utilized the variability of sales to proxy for risk level in business environment, and there was a positive relationship between the variability of the sales of the firm and the intrafirm pay gaps. Naturally, the results imply that the reward difference is used to cope with production uncertainty. Henderson and Fredrickson (2001) considered how the R&D intensive level makes the rise in coordination needs within TMTs and find a positive association of R&D level and compensation gaps. The result supported tournament theory which argues that larger gaps better cope with the monitoring difficulties caused by such cooperative actions in R&D activities.

Main et al. (1993) studied TMTs and found the positive relationship of compensation gaps and the return rate on assets from 200 US firms. Eriksson (1999) tested the tournament models using executive data in Danish firms, and found a weak positive relationship between pay dispersion and firm performance. Ehrenberg and Bognanno (1990) indicated that a difference in prize influenced the outcomes of golfers in golf tournaments. However, some researches failed to find evidence supporting the positive relationship between compensation gap and firm performance. Conyon, Peck and Sadler (2001) failed to find a stable relationship between compensation pay and firm performance with UK data. Using Israeli firms listed on the Tel-Aviv Stock Exchange, Ang, Hauser and Lauterbach (1998) failed to find the significant and positive relationship between compensation gap and firm performance. One possible explanation provided by Ang et al. (1998) was that most Israeli firms were family-owned firms or partner-owned firms of centralized ownership. The mixed results documented in prior research motivate us to reexamine this issue by considering the equity and fairness of compensation within top management teams.

From the perspective of equity and social comparisons, it is likely that large pay dispersion may have negative impact on individual performance and firm performance because of the feeling of unfairness among top management team members. Top management team members including CEO represent the important labor forces in interdependent tasks. Executives will judge whether their efforts are comparable to their compensation as compared to their colleagues. If the ratio is consistent, it will be considered fair but if the ratio is inconsistent, a feeling of unfairness would occur (Lyne 1995). Those who feel that they are not treated fairly might adopt the following possible strategies: (1) through change of mindset, they will undertake actions that will cause their own and other's efforts or outcomes to change (e.g. Griffeth, Vecchio and Logan 1989); (2) they might change their target of comparison. (e.g. Gibbons, Benbow and Gerrard 1994); and (3) they might leave the organization. (e.g. Summers and Hendrix 1991). Wallace and Fay (1988) view equity as an important feature for a compensation system and suggest that pay determination should consider external equity, internal equity, individual equity, and process equity.

Related research has also indicated that social comparisons made by individuals are an important component of fair wage constitutions (Major and Testa 1989; O'Reilly, Main and Crystal 1988). The compensation gaps will affect the performance of the management level, resulting in less productivity, lower product quality and higher turnover of personnel (Hambrick and Finkelstein 1995). Large

compensation gaps among groups ruin cooperation (Levine 1991; Milgrom and Roberts 1988; Mitchell and Silver 1990) and make a behavioral segregation within the top management teams (Hambrick 1995). The social comparison research suggests that the feeling of inequity is driven by comparisons with others in the organization, which could deeply influence the integrated behaviors of members in the organization (Kulik and Ambrose 1992). If a manager who feels that he/she is underpaid, pay dispersion would not achieve the incentive effect.

Kahneman, Knetsch and Thaler (1986) indicate that economic theories largely fail to consider the notion of fairness. Combining the tournament theory and the argument of fairness, we could predict either positive, negative or even no relationship between pay dispersion within top management teams and firm performance. Thus, we construct the following hypothesis, stated in null form:

H1: There is no association between the pay dispersion within top management teams and firm performance.

2.2 PAY DISPERSION WITHIN THE TOP MANAGEMENT TEAM FOR FIRMS WITH HIGH AND LOW NEED OF COLLABORATION

Tournament theory asserts larger compensation gap in the higher ranks, which does suggest a rule of setting compensation for the top management teams to cope with monitoring difficulties in an uncertain environment. According to tournament theory, pay dispersion can resolve the monitoring difficulties for tasks with high needs of collaboration and joint decision making (Henderson and Fredrickson 2001). However, a large pay gap may also spoil the cooperative atmosphere. As argued by organization theorists, economic models sometimes are too restricted, the effect of noneconomic factors on the outcome of managerial compensation should also be considered. Since top management teams are deeply involved in the operation of the firm, CEO compensation should be aligned with the demand of firm operation and the compensation of other top management team members. When the tasks performed by the top management team involve high interdependence, the managers' feeling of unfairness in compensation may hamper the collaboration among them. Harder (1992) showed that those basketball players receiving a lower pay would be more selfish in their play while those highly-paid would play more as a team. Greater pay dispersion has resulted in poorer team performance in baseball (Bloom 1999). Deutsch (1985) claimed that pay dispersion lowered cooperation among workers and then diminished performance when their work is interdependent. Siegel and Hambrick (2005) argued that when there was a great need for interdependence among senior managers, the disadvantage of pay dispersion would be most significant.

Even though tournament theory and equity theory have opposite conclusion about the effect of pay dispersion on firm performance, each theory provide different aspects about the role played by firms' collaboration needs when discussing the pay dispersion effect. Tournament theory emphasizes on the monitoring difficulty in join-effort tasks which can be resolved through pay dispersion. Therefore, tournament theory suggests that pay dispersion shall have larger positive effect on firm performance for firms with higher collaboration needs. On the other hand, equity theory raises the issue of pay dispersion's negative effect on firm's collaboration atmosphere. Consequently, equity theory implies that pay dispersion have negative effect on firm performance for firms with higher collaboration needs. It is interesting to find out how the net effect of pay dispersion is affected by the degree of work interdependence of the firm. Thus, we construct the following hypothesis, stated in null form:

H2: There is no difference in the association between the pay dispersion of top management and firm performance for firms with higher and lower work interdependence.

Technology intensity is a source of coordination needs (Henderson and Fredrickson 2001). Innovation processes usually involve with complicated and specialized technologies, which usually forces managers to look for cooperation with other managers to integrate their different specialties. Technological complementarities are one of the most important reasons for managers to cooperate in R&D activities (Hagedoorn 1993). As pointed out by Sakakibara (1997), risk sharing and skill sharing are two basic motives for co-operation in R&D activity. Therefore, the intensity of R&D activities is another source of a firm's collaboration needs. With similar line of logic in the last paragraph, tournament theory implies that for firm with more intensive R&D activities, pay dispersion shall have positive effect on firm performance. However, Siegel and Hambrick (2005) argued that innovative firms would require a high level of collaboration among executives and large pay dispersion may tend to impair collaboration. This line of argument implies that pay dispersion among the top management teams may have negative effect on firm performance for R&D-intensive firms. Thus, we construct the following hypothesis, stated in null form:

H3: There is no difference in the association between the pay dispersion of top management and firm performance for firms with higher and lower levels of R&D expenditures.

3. METHODS

3.1 SAMPLE AND DATA

The sample employed in this study includes firms listed on the Taiwan Stock Exchange (TSE) and the Over-The-Counter market (OTC). These firms are required to reveal compensation information of their top managers by mandatory regulation effective since 1995. Those compensation data are compiled by *Taiwan Economic Journal (TEJ)* in the *TEJ Database*. Since firms' disclosure was not so successful in the initial stage, the sample period for this study was from 1997 to 2003. Our initial sample includes all firms listed in the TSE and OTC from 1997 to 2003 with 4,479 firm-year observations. After dropping firms with missing financial data in the *TEJ Database*, our final sample consists of 3,417 firm-year observations. Table 1 shows the industry distribution of the sample. The biggest industry in Taiwan stock markets is the electronic industry, which accounts for 51.71 percent of the main sample. The electronic industry is the one that invests heavily in R&D activities and new product development. Accounting and other financial data are also retrieved from the *TEJ Database*. Data on variables related to other features of top managers are collected from firms' annual reports.

3.2 MEASURES: INDEPENDENT AND DEPENDENT VARIABLES

3.2.1 Pay dispersion within the top management teams

Following Siegel and Hambrick (2005), we define the Top-Management Teams (TMTs) as the executives (e.g., CEO, COOs, CFOs, division presidents) who are disclosed as management team members in corporate annual reports. The pay dispersion of TMTs is measured with two different proxies. The first proxy is the compensation variation (CV). The CV measure is the coefficient of variation in compensation for all top managers including the CEO of a firm (Bloom 1999; Eriksson 1999; Pfeffer and Langton 1993; Siegel and Hambrick 2005). The other proxy of pay dispersion is obtained by measuring the overpayment or underpayment within the top management teams by constructing a variable which captures the degree to which the average pay of top management team (excluding CEO) is mis-aligned with CEO pay and other managerial characteristics of the firm. The managerial compensation is affected by the level of management complexity. The proxies of firm size, product diversity and geographic diversification were used to measure management complexity (Carpenter and Sanders 2002; Henderson and Fredrickson 1996; Sanders and Carpenter 1998). Following these prior studies, the extent of pay dispersion of the top management team compensation is measured by first taking the residual from the regression of TMTs' average compensation on CEO pay and other managerial characteristics of the firm as indicated by equation

TABLE 1 Sample Firms by Industry (2-digit SIC Code) and Year

Year	1997		1998		1999		2000		2001		2002		2003		Total	
Category	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Cement	7	2.10	7	1.76	7	1.64	7	1.43	7	1.41	5	0.89	7	0.98	47	1.38
Foods	16	4.80	15	3.77	14	3.28	15	3.07	13	7.00	13	7.00	18	7.00	104	7.00
Plastics	12	3.60	12	3.02	10	2.34	11	2.25	12	2.42	11	1.96	17	2.38	85	2.49
Textile	35	10.51	35	8.79	41	9.60	40	8.18	36	7.26	34	6.07	41	5.74	262	7.67
Electric	23	6.91	29	7.29	25	5.85	26	5.32	26	5.24	28	5.00	40	5.60	197	5.77
Wire	12	3.60	13	3.27	13	3.04	12	2.45	12	2.42	8	1.43	13	1.82	83	2.43
Chemical	18	5.41	25	6.28	28	6.56	30	6.13	32	6.45	35	6.25	53	7.42	221	6.47
Glass	3	0.90	3	0.75	3	0.70	3	0.61	2	0.40	2	0.36	2	0.28	18	0.53
Paper	6	1.80	5	1.26	5	1.17	5	1.02	4	0.81	4	0.71	5	0.70	34	1.00
Steel	22	6.61	26	6.53	21	4.92	23	4.70	19	3.83	20	3.57	24	3.36	155	4.54
Rubber	7	2.10	7	1.76	7	1.64	8	1.64	7	1.41	8	1.43	8	1.12	52	1.52
Motor	4	1.20	4	1.01	4	0.94	4	0.82	3	0.60	4	0.71	4	0.56	27	0.79
Electronic	117	35.14	160	40.20	192	44.96	252	51.53	277	55.85	338	60.36	431	60.36	1767	51.71
Construction	26	7.81	27	6.78	26	6.09	26	5.32	22	4.44	22	3.93	27	3.78	176	5.15
Marine	12	3.60	15	3.77	15	3.51	13	2.66	10	2.02	11	1.96	14	1.96	90	2.63
Tourism	5	1.50	6	1.51	6	1.41	6	1.23	6	1.21	8	1.43	6	0.84	43	1.26
Department	8	2.40	9	2.26	10	2.34	8	1.64	8	1.61	9	1.61	4	0.56	56	1.64
Total	333	100%	398	100%	427	100%	489	100%	496	100%	560	100%	714	100%	3417	100%

(1) below[1]. Separate regressions are run for each industry which is defined according to the two-digit Standard Industrial Classification (SIC) code.

$$\begin{aligned} TMTPAY_{it} = {} & \beta_0 + \beta_1 CEOPAY_{it} + \beta_2 FIRM\_TENURE_{it} \\ & + \beta_3 PRO\_DIV_{it} + \beta_4 SIZE_{it} + \beta_5 PROFIT_{it-1} \\ & + \beta_6 NCEO\_DUALITY_{it} + \beta_7 CHG\_GDP_{it} + \Sigma\beta_t YEAR_t + \varepsilon_{TMTi} \end{aligned} \quad (1)$$

Where $TMTPAY_{it}$ is the average compensation for the top management teams (excluding CEO) in firm i in year t, $CEOPAY_{it}$ is the compensation for the CEO in firm i in year t, $FIRM\_TENURE_{it}$ is the firm age until year t, PRO_DIV_{it} is the diversity of products measured by the count of the product category from sales revenues listed for a firm in the annual report (Henderson and Fredrickson 2001), $SIZE_{it}$ is the size of firm i in year t and is measured using the logged value of the total assets, $PROFIT_{it-1}$ is the operating income divided by the total assets for firm i in year t-1, $NCEO\_DUALITY_{it}$ dummy variable takes a value of 1 for t year in which i firm's manager in the top management teams serves as the chairman or director of the board, (0 otherwise). CHG_GDP_{it} is the growth rate of real GDP in year t. This variable presents economy-wide conditions that would influence the level of managerial compensation (Chin, Lin and Lin 2000). $YEAR_t$ is a dummy variable to capture any yearly effects. ε_{TMTi} is the residual.

OP and *UP* represent the executive overpayment and under-payment respectively. *OP* is computed by taking the absolute values of residuals ($|\varepsilon_{TMTi}|$) from equation (1) if the residuals are positive, and 0 otherwise. The greater the $|\varepsilon_{TMTi}|$ is, the greater the overpayment of top management team compensation will be. *UP* measure is computed by taking the absolute values of residuals ($|\varepsilon_{TMTi}|$) from equation (1) if the residuals are smaller than 0, and 0 otherwise. The greater the $|\varepsilon_{TMTi}|$ is, the greater the underpayment of top management team compensation will be. Based on the above definition, if a firm incurs executive overpayment in year *t*, OP_{it} will be positive and UP_{it} will be equal to zero. On the other hand, if a firm incurs executive under-payment in year *t*, OP_{it} will be equal to zero and UP_{it} will be positive.

The dependent variable in H1 to 3, the firm performance (FP), is measured with current firm performance (FP_{it}) or subsequent firm performance FP_{it+1}) in the next year. In addition, FP is calculated with two different methods: accounting-based (ROA) or market-based measures (SRET). ROA is the annual rate of return on assets which is a widely used measure of accounting performance to capture firm performance (Said, HassabElnaby and Wier 2003). It is derived from

[1] A similar regression model was employed by Henderson (1994) to assess the fit of compensation to market data and by Harder (1992) to assess pay distributions.

earnings before extraordinary items divided by average total assets. ROA_{it} andROA_{it+1} represent current (t year) and subsequent (t+1 year) accounting performance, respectively. The ROA is recommended as a main variable reflecting economic outcome (Said et al. 2003). On the other hand, stock returns (market-based measures) reflect not only historical financial performance but also expected future economic performance (Beaver, Lambert and Morse 1980). Therefore, the annualized market-adjusted stock returns (SRET) are also adopted as a proxy for firm performance. The current and subsequent firm performances are represented by $SRET_{it}$ and $SRET_{it+1}$ as well.

3.2.2 Interdependence

Organizational interdependence refers to the exchange of outcome that occurs within departments in an organization (Chenhall and Morris 1986). The top executives must jointly process information to resolve interdependence among different departments in the firm. The degree of diversity, the amount of capital spending, and the number of top managers in the firm are all contributing factors to the operational interdependencies that top management team must deal with. (Michel and Hambrick 1992; Henderson and Fredrickson 2001). To measure the degree of interdependence of the firms, we use a composite index based on these three contributing factors: diversification (SUMRATIO), capital spending rate (CAP), and top management group size (N_TMTs).

Firm diversification is measured by$1-\Sigma_{i=1}^{3}s_i^2$, where S_i equals the percentage of sales a firm received from its *i*th four-digit SIC segment within its primary two-digit industry. The larger the value is, the larger the firm's diversification will be. Capital spending rate is measured by dividing capital spending by market value plus long-term debt. The top management team size is defined as the total number of managers in top management teams. We rank these three indicators individually and calculate the sum of the three ranks to form a composite index for the measurement of firm interdependence. The higher the rank is, the more interdependent the firm will be[2]. We divide the high-interdependence and low-interdependence firms based on the measure of the sum of these three ranks. We use a dummy variable for the firm's interdependence (INTER). It is a dummy variable for interdependence that

[2] As the previous studies stated, the diversification, capital investment, and top management team size are the sources of interdependence. As the diversification increases, greater demands require top managers to coordinate interchanging resources (Michel and Hambrick 1992). Similarly, capital investment activity affects interdependence. The need for professional knowledge increases with the number of capital investment. No single executive who does not exchange other executives' knowledge can evaluate numerous investment projects (Siegel and Hambrick 2005). As the number of top managers increases, the single executive need to have more coordination with the other executives (Henderson and Fredrickson 2001). Thus, the greater composite index for SUMRATIO, CAP and N_TMTs , the higher degree of interdependence.

takes on the value of 1 if the sum of these three ranks for interdependence measures is greater than median, and 0 otherwise. When the firms have higher interdependence, the INTER is 1, and 0 when the firms have less interdependence.

3.2.3 R&D intensity

Firms with high R&D intensity are expected to have more coordination needs. Negative coefficients for the interactive terms of R&D intensity and pay dispersions would provide evidence that pay dispersion of the top management teams is more harmful to firm performance in higher RD intensive firms than in lower RD intensive firms. We measure a firm's R&D intensity using the ratios of R&D expenditures relative to total assets (Ho, Xu and Yap 2004).[3] The sample firms are grouped into either high RD intensive firms, whose R&D expenditure to total assets ratio is greater than the value of median, or low RD intensive firms whose R&D expenditure to total assets ratio is not greater than the value of median. A dummy variable (RDA) for the firm's R&D intensity takes on the value of 1 for high RD intensive firms, and 0 for low RD intensive firms.

3.3 CONTROL VARIABLES

Several variables that may affect firm performance are controlled in the analysis. Firm age generally has an effect on managerial compensation and firm performance (Wade et al. 2006). Firm age is measured as the number of years since the firm was established. Firm size is related to firm performance; the larger the firm is, the better the firm performance will be (Bryant, Jones and Widener 2004; Bloom and Milkovich 1998). This paper controls the effect of firm size using the logarithm of the total assets. As firms become larger, it is more difficult to manage the firms. Thus, they would employ more top managers because they expect to achieve better integration (Henderson and Fredrickson 2001).

The overall compensation level of top management team could affect firm performance. This effect is controlled in the analysis by including the natural logarithm of the average compensation of the top management teams as a control variable. The size of top management group could also affect pay inequality, which may affect firm performance (Siegel and Hambrick 2005). To control any time-related differences, the YEAR is coded as a dummy variable. Firm performance of previous year, $ROA_{t-1,}$ is also controlled.

[3] Lev and Sougiannis (1996) argue that R&D expenditures should be capitalized. To account for this view, we employ the relationship between R&D expenditures and total assets to measure R&D intensity.

3.4 EMPIRICAL MODELS

In order to test H1, we use the following model, which examines the relationship between pay dispersion and firm performance for a full sample. The following model is first used to test H1.

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 FIRM\_AGE_{it} + \beta_3 SIZE_{it} + \beta_4 LOG\_ALLTMT_{it} + \beta_5 N\_TMTs_{it} + \beta_6 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i \quad (2)$$

where:

FP_{it}	=	the firm's current performance (ROA_t or $SRET_t$)
$DISPERSION_{kit}$	=	presented by either OP_{it} and UP_{it} or CV_{it} of firm i in year t
$FIRM\_AGE_{it}$	=	the years of firm i being established up to year t
$SIZE_{it}$	=	the size of firm i in year t
LOG_ALLTMT_i	=	the natural logarithm of the average compensation of top management teams for firm i in year t
$TMTs_{it}$	=	the number of top management team members of firm i in year t
FP_{it-1}	=	the firm's performance in the previous period (ROA_{t-1} or $SRET_{t-1}$)
$YEAR_{it}$	=	the year dummy variable to control for possible yearly effect
FP_{it+1}	=	the firm's subsequent performance in the next year (ROA_{t+1} or $SRET_{t+1}$).

To test the relationship between the pay dispersion and subsequent firm performance, we replace FP_{it} with the subsequent firm performance in the next year (FP_{it+1}) in Equation (1). $DISPERSION_{it}$ is defined earlier in Equation (1). The control variables for FP_{it+1} are the control variables of year t+1. .

In H2, we test whether the negative relationship between pay dispersion and firm performance is stronger for firms with higher work interdependence. To examine this hypothesis, we use the following model.

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 INTER_{it} + \Sigma\beta_{3k} INTER_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it} + \beta_5 SIZE_{it} + \beta_6 LOG\_ALLTMT_{it} + \beta_7 N\_TMTs_{it} + \beta_8 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i \quad (3)$$

where INTER is a dummy variable for firm interdependence. INTER is equal to 1 for firms with higher interdependence, and 0 otherwise. The definitions of other variables are listed in the preceding section. Since we hypothesize that pay dispersion is less likely to have a positive impact on firm performance for firms with high interdependence, we predict that β_{3k} will be significantly negative. In addition to the current performance (FP_{it}), subsequent performance (FP_{it+1}) is also adopted as dependent variable in a separate regression analysis.

Firms with higher R&D intensity would also require higher degree of collaboration among the top management team members. The analysis based on

equation (3) above is also conducted with the dummy variable INTER replaced by RDA, which is also a dummy variable to indicate R&D intensity as discussed before, The model to test the relationship among R&D intensity, pay dispersion, and current performance is as follows:

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 RDA_{it} + \Sigma\beta_{3k} RDA_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it} + \beta_5 SIZE_{it} + \beta_6 LOG\_ALLTMT_{it} + \beta_7 N\_TMTs_{it} + \beta_8 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i \quad (4)$$

where RDA_{it} is a dummy variable that is 1 if the firm i's R&D intensity is high, and 0 otherwise. Similar to the analytical model in equation (3), subsequent performance (FP_{it+1}) is also adopted as dependent variable in a separate regression analysis. With similar arguments, we predict that β_{3k} will be significantly negative, indicating that the negative association between pay dispersion and firm performance is stronger for firms with higher R&D intensity.

3.5 DESRIPTIVE STATISTICS

A total of 3,417 firm-year observations are contained in the sample. Table 2 presents the descriptive statistics for this sample. The CEO total cash compensation on average equals NT$4,084.06 thousand. The mean for average compensation of the top management teams (not including CEO) is NT$2,375,231. Executives receive, on average, 58.15% of their CEO pay. The average value of total assets for our sample firms is NT$11.7 billion. The average overpayment for executives is NT$248,000, and the average underpayment for executives is NT$455,000. The average firm age is 21.4 years. R&D expenditure to total assets ratio is 1.84% on average. The average number of managers in the top management team is 3.7.

4. EMPIRICAL RESULTS

4.1 PAY DISPERSION WITHIN TOP MANAGEMENT TEAMS AND FIRM PERFORMANCE

The first objective is to test the relationship between pay dispersion within the top management teams and current firm performance. The results are presented in Table 3. The first column shows that when the dependent variable is ROA_t, the coefficient on OP is -0.68 (t=2.75, p<0.01) and the coefficient on UP is insignificant. The result indicates that the overpayment of the top management team compensation is significantly negatively associated with current firm performance, whereas its underpayment is not significantly associated with current

TABLE 2 Descriptive Statistics (N=3,417)

Variable	Mean	Std. Dev.	Max.	Min.	Median
CEOPAY (in thousands)	4084.060	4304.647	123141	131	3230
TMTPAY (in thousands)	2375.231	1692.751	30628	6	2014
ALL TMT (in thousands)	2914.409	2134.667	35023.4	113.5	2463
LOG ALLTMT (including CEO))	7.832	0.511	10.464	4.732	7.809
ASSETS (in millions)	11708.298	32935.859	480334.764	144.676	3062.828
OP (in millions)	0.248	0.598	10.212	0	0
UP (in millions)	0.455	1.029	34.381	0	0.159
CV	0.336	0.260	1.936	0	0.288
ROA (%)	4.936	8.183	57.390	-70.339	4.806
SRET (%)	11.558	67.625	700	-99.900	-2.200
FIRM AGE (in years)	21.366	11.812	58	1	20
PRO DIV	4.719	2.998	44	0	4
SIZE	15.135	1.339	19.990	11.882	14.935
PROFIT	0.055	0.074	0.470	-0.409	0.046
NCEO DUALITY	0.618	0.486	1	0	1
SUMRATIO	0.482	0.243	1	0	0.524
CAP (%)	4.593	10.856	149.789	-137.087	2.352
N TMTs	3.710	2.475	45	2	3
RD TA (%)	1.840	2.859	41.198	0	0.859
INTER	0.492	0.5	1	0	0
RDA	0.448	0.497	1	0	0

CEOPAY=CEO compensation; TMTPAY=average compensation of the top management teams (not including CEO); ALL_TMT=average compensation of the top management teams (including CEO); LOG_ALLTMT= the natural logarithm of average compensation of the top management teams; ASSETS=total assets; OP=overpayment of executives in top management teams; UP=underpayment of executives in the top management teams; CV= the coefficient of variation in compensation for all executives including CEO; ROA=return on assets; SRET=annualized stock return; FIRM_AGE= the years of firm i being established; PRO_DIV=the diversity of product; SIZE= log of asset size; PROFIT=operating income/total assets; NCEO_DUALITY= 1 if the top management team member is a director of the broad, 0 otherwise; RD_TA=R&D expenditures/ total assets; SUMRATIO=1-sum of squares of first three sales value; CAP=capital spending ratio; N_TMTs=the number of managers in the top management teams; INTER= a dummy variable of interdependence in the firm; RDA_{it} = a dummy variable of R&D intensity.

firm performance. The third column shows that, when current firm performance is measured using $SRET_t$, the coefficient on OP becomes insignificant but the coefficient on UP is significantly positive at the 5% level (coefficient=2.879). As to the second measure of pay dispersion, CV is negative and significant at 5% level (coefficient=-1.040) in the model of ROA_t, but not significantly different from 0 in the model of $SRET_t$. The results show that the greater the coefficient of variation in compensation for all top managers including CEO, the less favorable the current accounting performance. Overall, the results in Table 3 provide mixed evidence for H1.

TABLE 3 The Relationship between Pay Dispersion within Top Management Team and Current Firm Performance

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 FIRM\_AGE_{it} + \beta_3 SIZE_{it} + \beta_4 LOG\_ALLTMT_{it} + \beta_5 N\_TMTs_{it} + \beta_6 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i$$

Independent Variable	Dependent Variable			
	ROA_t		$SRET_t$	
	(1)	(2)	(3)	(4)
INTERCEPT	0.417	3.630*	22.070	5.213
	(0.20)	(1.85)	(0.91)	(0.23)
OP_t	-0.68***	-	2.292	-
	(-2.75)		(1.06)	
UP_t	-0.27	-	2.879**	-
	(-1.20)		(2.15)	
CV_t	-	-1.040**	-	0.087
		(-2.29)		(0.02)
$FIRM\_AGE_t$	-0.040***	-0.037***	-0.532***	-0.571***
	(-3.95)	(-3.82)	(-4.45)	(-4.82)
$SIZE_t$	-0.300**	-0.311***	4.185***	4.544***
	(-2.54)	(-2.85)	(2.95)	(3.24)
LOG_ALLTMT_t	0.976***	0.581**	-5.071	-3.296
	(3.48)	(2.19)	(-1.56)	(-1.06)
N_TMTs_t	0.025	0.023	-0.856*	-0.766*
	(0.53)	(0.50)	(-1.95)	(-1.75)
ROA_{t-1}	0.673***	0.672***	-	-
	(28.06)	(27.35)		
$SRET_{t-1}$	-	-	-0.088***	-0.087***
			(-4.77)	(-4.71)
Adj R^2	0.465	0.464	0.155	0.153
F	228.94	246.96	33.27	35.45
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,417	3,417	2,286	2,286

a.$DISPERSION_{kt}$is represented as OP_t & UP_t or CV_t , FP_t is represented as ROA_t and $SRET_t$.

b.White-adjusted t-statistics are in parentheses.

c.Regression coefficients for control variables of YEAR are omitted. Fixed effects models are based on a full sample of 3,417 and 2,286 firm-year observations in the current firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.

d.***p<0.01; **p<0.05; *p<0.1.

The results based on subsequent firm performance appear in Table 4. For both ROA_{t+1} and $SRET_{t+1,}$ the coefficient of UP is significantly negative but the coefficient of OP is not significant. The regression results indicate that the overpayment of the top management team compensation is not associated with subsequent firm performance, but the underpayment of top management team compensation is negatively related to subsequent firm performance.

TABLE 4 The Relationship between Pay Dispersion within Top Management Team and Subsequent Firm Performance

$$FP_{it+1} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 FIRM\_AGE_{it+1} + \beta_3 SIZE_{it+1} + \beta_4 LOG\_ALLTMT_{it+1} + \beta_5 N\_TMTs_{it+1} + \beta_6 FP_{it} + \Sigma\theta_{t+1} YEAR_{it+1} + \varepsilon_i$$

Independent Variable	Dependent Variable ROA_{t+1}		$SRET_{t+1}$	
	(1)	(2)	(3)	(4)
INTERCEPT	-6.809***	-6.227***	-74.726***	-63.455***
	(-3.39)	(-3.22)	(-3.81)	(-3.33)
OP_t	0.136	-	-2.423	-
	(0.65)		(-1.47)	
UP_t	-0.270**	-	-2.015*	-
	(-2.00)		(-1.82)	
CV_t	-	-1.239***	-	-7.813*
		(-2.62)		(-1.70)
$FIRM\_AGE_{t+1}$	-0.024**	-0.022**	-0.291***	-0.266**
	(-2.22)	(-2.00)	(-2.68)	(-2.48)
$SIZE_{t+1}$	-0.063	-0.119	4.395***	4.006***
	(-0.52)	(-0.98)	(3.51)	(3.22)
LOG_ALLTMT_{t+1}	0.963***	1.034***	0.544	-0.066
	(3.66)	(4.04)	(0.23)	(-0.03)
N_TMTs_{t+1}	0.036	0.034	-0.663*	-0.736**
	(0.87)	(0.84)	(-1.94)	(-2.15)
ROA_t	0.670***	0.668***	-	-
	(23.30)	(23.20)		
$SRET_t$	-	-	-0.084***	-0.085***
			(-4.40)	(-4.45)
Adj R^2	0.456	0.456	0.142	0.142
F	202.10	219.11	31.84	34.40
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,123	3,123	2,432	2,432

a.$DISPERSION_{kt}$ is represented as OP_t & UP_t or CV_t, FP_{t+1} is represented as ROA_{t+1} and $SRET_{t+1}$.
b.White-adjusted t-statistics are in parentheses.
c.Regression coefficients for control variables of YEAR are omitted. Fixed effects models are based on a full sample of 3,123 and 2,432 firm-year observations in the subsequent firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.
d.***p<0.01; **p<0.05; *p<0.1.

Regarding CV, the other measure of pay dispersion within the top management teams, the results indicate that CV is significantly negative at 1% level (coefficient=-1.239) in the model of ROA_{t+1} and significantly negative at 10% level (coefficient=-7.813) in the model of $SRET_{t+1}$. The results show that the greater the coefficient of variation in compensation for all executives including CEO, the less favorable the subsequent firm performance. These results basically reject H 1, which states that pay dispersion is not associated with firm performance. In particular, our results tend to support the argument of equity theory that the pay

dispersion would have a negative effect on subsequent firm performance due to the perception of unfairness caused by comparison among team members.

Regarding the control variables, Tables 3 and 4 show that the ROA_{t-1} (ROA_t) is positively and significantly associated with ROA_t (ROA_{t+1}) in the accounting-based models. However, the association between $SRET_{t-1}$ and $SRET_t$ is negative and significant in market-based models. Generally, these results show that accounting earnings have persistence but stock market return does not have this feature. The negative significant coefficients of FIRM_AGE in both accounting-based and market-based models indicate that the older the firms, the less likely the firms are able to achieve higher accounting-based and market-based performance. SIZE is negatively associated with current accounting performance but positively associated with both current and subsequent market performances. The results indicate that firms with large size have lower accounting return rate, but attain higher level of market return. The coefficients on LOG_ALLTMT are positive in accounting performance models. The coefficients for N_TMTs are negatively associated with market performance. Here, we suggest one possible explanation. The greater number of TMT members represents the more complicated management in the firm. Investors have difficulty evaluating the complication of this type, as a result they devaluate such firm.

4.2 THE RALATIONSHIP BETWEEN INDEPENDENVE, PAY DISPERSION FIRM PERFORMANCE

H2 states that there is no difference in the association between the pay dispersion of top management and firm performance for firms with higher and lower work interdependence. The results for H2 are shown in Table 5. The main effect of pay dispersion (only OP and CV) is significant and negative in the current accounting performance model. On the contrary, UP is significant and positive in the current market performance model. Thus. there are no consistent relations between pay dispersion and current firm performance, which is consistent with the results in Table 3. The main effect of INTER on current firm performance is significant and negative. As Table 5 shows, the INTER*UP interaction term is significantly negative at 5% level in both ROA_t and $SRET_t$ models (the coefficients are -0.913 and -9.324, respectively). The results indicate that the underpayment of executives is negatively related to current firm performance for firms with higher work interdependence. The coefficient for the interaction effect of INTER and pay dispersion (measured by CV) shows the same results. The term of INTER*CV is significantly negative with current firm performance for both ROA_t and $SRET_t$ (the coefficients are -2.392 and -19.958, respectively). The significant interaction effect

indicates that higher-interdependence firms that create more pay dispersion have lower current accounting-based performance and market-based performance. The results indicate that H2 is rejected based on current firm performance.

TABLE 5 The Relationship between Interdependence, Pay Dispersion and Current Firm Performance

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 INTER_{it} + \Sigma\beta_{3k} INTER_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it} + \beta_5 SIZE_{it} + \beta_6 LOG\_ALLTMT_{it} + \beta_7 N\_TMTs_{it} + \beta_8 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i$$

Independent Variable	Dependent Variable			
	ROA_t		$SRET_t$	
	(1)	(2)	(3)	(4)
INTERCEPT	0.825 (0.41)	3.680* (1.91)	34.222 (1.42)	13.699 (0.60)
OP_t	-0.591** (-2.26)	-	3.825 (1.30)	-
UP_t	0.032 (0.15)	-	6.473*** (3.42)	-
CV_t	-	-0.993** (-2.23)	-	2.392 (0.46)
$INTER_t$	-2.226*** (-9.20)	-2.156*** (-9.13)	-14.504*** (-4.86)	-14.100*** (-4.72)
$INTER_t$*OP_t	-0.198 (-0.43)	-	-5.636 (-1.02)	-
$INTER_t$*UP_t	-0.913** (-2.32)	-	-9.324** (-2.58)	-
$INTER_t$*CV_t	-	-2.392*** (-2.69)	-	-19.958* (-1.90)
$FIRM\_AGE_t$	-0.030*** (-3.04)	-0.029*** (-2.98)	-0.478*** (-4.01)	-0.537*** (-4.57)
$SIZE_t$	-0.298** (-2.52)	-0.277** (-2.55)	3.920*** (2.74)	4.501*** (3.22)
LOG_ALLTMT_t	0.956*** (3.40)	0.559** (2.13)	-5.808* (-1.78)	-3.814 (-1.23)
N_TMTs_t	0.210*** (3.94)	0.194*** (3.86)	0.263 (0.58)	0.229 (0.50)
ROA_{t-1}	0.649*** (26.57)	0.651*** (26.48)	-	-
$SRET_{t-1}$	-	-	-0.095*** (-5.06)	-0.092*** (-4.82)
Adj R^2	0.480	0.479	0.166	0.163
F	198.23	224.92	29.51	32.81
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,417	3,417	2,286	2,286

a.$DISPERSION_{kt}$ is represented as OP_t & UP_t or CV_t, FP_t is represented as ROA_t and $SRET_t$.
b.White-adjusted t-statistics are in parentheses.
c.Regression coefficients for control variables of YEAR are omitted. Fixed effects models are based on a full sample of 3,417 and 2,286 firm-year observations in the current firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.
d.***p<0.01; **p<0.05; *p<0.1.

Moreover, we analyzed the effect of the association between pay dispersion and the degree of firm interdependence on subsequent firm performance by including the interaction term of pay dispersion and interdependence. The results

are listed in Table 6. The coefficients on the terms of INTER*OP and INTER*UP are insignificant in both the models of subsequent firm performance (ROA_{t+1} and $SRET_{t+1}$). However, the term of INTER*CV is significant and negative with subsequent firm performance for both ROA_{t+1} and $SRET_{t+1}$ at 10% level (the coefficients on INTER*CV are -1.657 and -5.496, respectively). Using the coefficient of variation in compensation for all executives, the findings support the view that the relationship between pay dispersion and firm performance is significantly negative for firms with higher work interdependence.

TABLE 6 The Relationship between Interdependence, Pay Dispersion and Subsequent Firm Performance

$$FP_{it+1} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 INTER_{it} + \beta_{3k} INTER_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it+1} + \beta_5 SIZE_{it+1} + \beta_6 LOG\_ALLTMT_{it+1} + \beta_7 N\_TMTs_{it+1} + \beta_8 FP_{it} + \Sigma\theta_{t+1} YEAR_{it+1} + \varepsilon_i$$

Independent Variable	Dependent Variable			
	ROA_{t+1}		$SRET_{t+1}$	
	(1)	(2)	(3)	(4)
INTERCEPT	-7.099***	-6.586***	-77.277***	-64.466***
	(-3.55)	(-3.45)	(-3.90)	(-3.37)
OP_t	0.164	-	-2.438	-
	(0.79)		(-1.27)	
UP_t	-0.152	-	-3.264**	-
	(-1.01)		(-2.48)	
CV_t	-	-1.167**	-	-8.354*
		(-2.49)		(-1.85)
$INTER_t$	-1.661***	-1.640***	1.694	1.912
	(-6.93)	(-6.90)	(0.68)	(0.76)
$INTER_t$*OP_t	-0.387	-	-1.116	-
	(-1.04)		(-0.31)	
$INTER_t$*UP_t	-0.335	-	3.414	-
	(-1.17)		(1.38)	
$INTER_t$*CV_t	-	-1.657*	-	-5.496*
		(-1.79)		(-1.78)
$FIRM\_AGE_{t+1}$	-0.019*	-0.017	-0.302***	-0.270**
	(-1.74)	(-1.57)	(-2.76)	(-2.51)
$SIZE_{t+1}$	-0.024	-0.073	4.476***	3.995***
	(-0.20)	(-0.61)	(3.51)	(3.15)
LOG_ALLTMT_{t+1}	0.992***	1.062***	0.670	-0.005
	(3.82)	(4.19)	(0.29)	(0.002)
N_TMTs_{t+1}	0.120***	0.113***	-0.755**	-0.824**
	(2.65)	(2.59)	(-2.14)	(-2.36)
ROA_t	0.646***	0.644***	-	-
	(22.48)	(22.46)		
$SRET_t$	-	-	-0.082***	-0.084***
			(-4.28)	(-4.35)
Adj R^2	0.464	0.464	0.141	0.141
F	169.64	194.27	25.99	29.53
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,123	3,123	2,432	2,432

a.$DISPERSION_{kt}$ is represented as OP_t & UP_t or CV_t, FP_{t+1} is represented as ROA_{t+1} and $SRET_{t+1}$.

b.White-adjusted t-statistics are in parentheses.

c.Regression coefficients for control variables of YEAR omitted. Fixed effects models are based on a full sample of 3,123 and 2,432 firm-year observations in the subsequent firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.

d.***p<0.01; **p<0.05; *p<0.1.

4.3 THE RELATIONSHIP BETWEEN R&D INTENSITY, PAY DIPERSION AND FIRM PERFORMANCE

H3 states that there is no difference in the association between the pay dispersion of top management and firm performance for firms with higher and lower levels of R&D expenditures. As shown in Table 7, the coefficients on OP and CV are significant and negative in the ROA_t model, and the coefficient on UP is significant and negative in the $SRET_t$ model. The main effect of RDA is insignificant for current accounting performance and market performance. However, the interaction term of RDA*UP is significantly negatively associated with ROA_t (coefficient=-0.391, $p<0.1$). The interaction term of RDA*CV is significantly negatively associated with $SRET_t$ (coefficient = -17.746, $p<0.1$). There is no significant association between the term of RDA*CV and current accounting-based performance. The effectiveness of R&D activity is the leading indicator of firm performance. The accounting-based returns may largely reflect short-term performance (Said et al. 2003). One alternative explanation is that the negative impact of pay dispersion (measured by CV) on firms with higher level of R&D intensity is less pronounced in terms of accounting-based performance.

The results of the relation between pay dispersion, R&D intensity, and subsequent firm performance are presented in Table 8. Consistent with the expectation of H3, the terms of RDA*UP and RDA*OP are not significantly associated with subsequent firm performance. However, the coefficient on the interaction term of RDA*CV is significant and negative at 10% level by using subsequent firm performance ROA_{t+1} and $SRET_{t+1}$ (the coefficients on RDA*CV are -1.757 and -16.218 respectively). The results show that the association between pay dispersion and subsequent firm performance is significantly negative for firms with high RD intensiveness. Based on the results, H3 is partly supported for subsequent firm performance when the pay dispersion is measured by overpayment and underpayment.

5. SUMMARY AND CONCLUSION

Incentives and a sense of equity are two essential ingredients when designing the compensation structure for the top management teams in a team-work environment. This study analyzes the relationship between the pay dispersion of top management teams and current & subsequent firm performance for firms with different degrees of collaborating needs. The results are related to two streams of prior research, which have not been jointly considered together: tournament theory and equity theory. According to the tournament theory, when a firm faces high

TABLE7 The Relationship between R&D Intensity, Pay Dispersion and Current Firm Performance

$$FP_{it} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 RDA_{it} + \Sigma\beta_{3k} RDA_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it} + \beta_5 SIZE_{it} + \beta_6 LOG\_ALLTMT_{it} + \beta_7 N\_TMTs_{it} + \beta_8 FP_{it-1} + \Sigma\theta_t YEAR_{it} + \varepsilon_i$$

Independent Variable	Dependent Variable			
	ROA_t		$SRET_t$	
	(1)	(2)	(3)	(4)
INTERCEPT	0.450 (0.23)	3.497* (1.78)	22.157 (0.91)	5.518 (0.24)
OP_t	-0.575*** (-2.77)	-	2.031 (0.85)	-
UP_t	-0.188 (-1.63)	-	2.855** (2.03)	-
CV_t	-	-1.022** (-2.19)	-	-1.520 (-0.30)
RDA_t	0.216 (1.03)	0.182 (0.84)	-0.496 (-0.19)	-0.707 (-0.27)
RDA_t *OP_t	-0.576 (-1.62)	-	1.904 (0.44)	-
RDA_t *UP_t	-0.391* (-1.86)	-	-0.020 (-0.01)	-
RDA_t *CV_t	-	-0.165 (-0.17)	-	-17.746* (-1.72)
$FIRM\_AGE_t$	-0.039*** (-4.05)	-0.037*** (-3.80)	-0.532*** (-4.41)	-0.570*** (-4.76)
$SIZE_t$	-0.296*** (-2.91)	-0.300*** (-2.73)	4.148*** (2.93)	4.478*** (3.43)
LOG_ALLTMT_t	0.948*** (3.55)	0.568** (2.14)	-4.970 (-1.54)	-3.134 (-1.13)
N_TMTs_t	0.018 (0.38)	0.019 (0.42)	-0.850* (-1.95)	-0.750 (-1.42)
ROA_{t-1}	0.672*** (46.64)	0.671*** (27.31)	-	-
$SRET_{t-1}$	-	-	-0.088*** (-4.75)	-0.087*** (-4.47)
Adj R^2	0.465	0.463	0.154	0.154
F	186.57	211.66	27.01	30.62
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,417	3,417	2,286	2,286

a.$DISPERSION_{kt}$ is represented as OP_t & UP_t or CV_t, FP_t is represented as ROA_t and $SRET_t$.
b.White-adjusted t-statistics are in parentheses.
c.Regression coefficients for control variables of YEAR are omitted. Fixed effects models are based on a full sample of 3,417 and 2,286 firm-year observations in current firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.
d.***p<0.01; **p<0.05; *p<0.1.

degree of collaboration needs, such as interdependent and high innovative environments, pay dispersion can effectively resolves the monitoring and evaluation difficulty in a collaborative environment and provide incentives for employees to strive for promotion. On the other hand, equity theory suggests that pay dispersion may negatively affect the collaborative atmosphere among employees. Therefore, pay dispersion will hurt the firm the most when the firm requires high degree of collaboration. Thus, it will be interesting to test the effect of pay dispersion for firms with different levels of collaboration needs.

TABLE 8 The Relationship between R&D Intensity, Pay Dispersion and Subsequent Firm Performance

$$FP_{it+1} = \beta_0 + \Sigma\beta_{1k} DISPERSION_{kit} + \beta_2 RDA_{it} + \Sigma\beta_{3k} RDA_{it} \times DISPERSION_{kit} + \beta_4 FIRM\_AGE_{it+1} + \beta_5 SIZE_{it+1} + \beta_6 LOG\_ALLTMT_{it+1} + \beta_7 N\_TMTs_{it+1} + \beta_8 FP_{it} + \Sigma\theta_{t+1} YEAR_{it+1} + \varepsilon_i$$

Independent Variable	Dependent Variable			
	ROA_{t+1}		$SRET_{t+1}$	
	(1)	(2)	(3)	(4)
INTERCEPT	-6.916***	-6.398***	-76.495***	-64.137***
	(-3.44)	(-3.31)	(-3.90)	(-3.35)
OP_t	0.125	-	-2.875*	-
	(0.63)		(-1.70)	
UP_t	-0.241*	-	-2.368***	-
	(-1.89)		(-2.63)	
CV_t	-	-1.293***	-	-8.539*
		(-2.61)		(-1.84)
RDA_t	0.247	0.207	2.463	2.240
	(1.07)	(0.88)	(1.04)	(0.95)
RDA_t *OP_t	0.092	-	1.997	-
	(0.25)		(0.63)	
RDA_t *UP_t	-0.137	-	1.786	-
	(-0.54)		(1.06)	
RDA_t *CV_t	-	-1.757*	-	-16.218*
		(-1.73)		(-1.75)
$FIRM\_AGE_{t+1}$	-0.023**	-0.021*	-0.291***	-0.261**
	(-2.16)	(-1.94)	(-2.67)	(-2.44)
$SIZE_{t+1}$	-0.058	-0.110	4.504***	4.071***
	(-0.48)	(-0.91)	(3.60)	(3.30)
LOG_ALLTMT_{t+1}	0.955***	1.029***	0.430	-0.211
	(3.64)	(4.03)	(0.19)	(-0.09)
N_TMTs_{t+1}	0.033	0.031	-0.647*	-0.765**
	(0.79)	(0.77)	(-1.89)	(-2.23)
ROA_t	0.669***	0.668***	-	-
	(23.10)	(23.11)		
$SRET_t$	-	-	-0.084***	-0.087***
			(-4.38)	(-4.46)
Adj R^2	0.456	0.457	0.141	0.142
F	164.25	188.34	25.98	29.78
(p value)	(<.0001)	(<.0001)	(<.0001)	(<.0001)
N	3,123	3,123	2,432	2,432

a.$DISPERSION_{kt}$ is represented as OP_t & UP_t or CV_t, FP_{t+1} is represented as ROA_{t+1} and $SRET_{t+1}$.
b.White-adjusted t-statistics are in parentheses.
c.Regression coefficients for control variables of YEAR omitted. Fixed effects models are based on a full sample of 3,123 and 2,432 firm-year observations in the subsequent firm performance model covering the period 1997-2003 when dependent variables are ROA and SRET, respectively.
d.***p<0.01; **p<0.05; *p<0.1.

Several important findings emerge from this study. First, pay dispersion does not seem to work well to improve firm performance. The incremental effect of pay dispersion on firm performance in our analysis seems to be mostly negative. Second, for firms with higher interdependence or high R&D intensity, the pay dispersion will even have larger negative impact on firm performance.

Even though tournament theory suggests pay dispersion as an efficient tool to resolve monitoring difficulty in a collaborative environment, our analysis shows

that the negative effect of pay dispersion on collaborative atmosphere and employees' perception of fairness appears so overwhelmingly dominant over the benefit of pay-dispersion in resolving monitoring difficulty. In an era with high level of technology complexity, collaboration among workers appers to be necessary. It is important not to over-emphasize the pay-dispersion among employees because the dispersion may seriously spoil the firms' cooperative atmosphere and employees' perception of fairness. The main limitations of this study is that the data of long term pay, e.g. stock options and stock dividends are not available in the annual statements of Taiwanese listed firm. Future research can focus on the long term pay issue for Taiwan listed firms. Using the compensation surveys and TEJ data to test the impact of long term pay dispersion on firm performance or sub-unit performance is suggested.

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