An Investigation on Relationship between pay distribution and firm performance

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Abstract: Many analysis on management compensation focuses on the extent and structure of executives' pay. during this study, we tend to Investigation a compensation part that has not received to this point considerable analysis attention—the dispersion of compensation across managers—and its impact on firm performance.
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1. Introduction

Executive compensation has been a central research topic in economics and business during the past two decades, recently gaining impetus in the wake of corporate scandals that have exposed significant vulnerabilities in corporate governance and the subsequent far reaching regulatory changes (Sarbanes-Oxley). Prior research into executive compensation has primarily focused on issues related to the level and structural mix of compensation packages, and their sensitivity to firm performance (Lambert and Larcker (1987), Jensen and Murphy (1990), Yermack (1995), Hall and Liebman (1998), Core et al. (1999), Murphy (1999), and Bryan et al. (2000). Early compensation studies focused on the CEO, subsequently expanding the scope to the compensation of the entire managerial team. Thus, for example, Aggarwal and Samwick (2003) report that managers with divisional responsibilities have lower pay–performance sensitivities than do managers with broad oversight authority, who in turn have lower pay–performance sensitivities than does the CEO, concluding that pay–performance sensitivity increases with the span of authority. Similarly, Barron and Waddell (2003) examine the characteristics of compensation packages of the five highest paid executives and find that higher rank managers have a greater proportion of incentive-based compensation in pay packages than do lower ranked executives.

The issue of pay *dispersion* across managerial team members has received conceptual attention by labor economists and organization theorists, yet scant empirical research has been performed to date. In this study, we investigate empirically the effect of managerial compensation dispersion on firm performance. We draw on two competing models—the tournament theory and equity fairness arguments—to formulate our hypotheses: Tournament theory (Lazear and Rosen (1981)) views the advancement of executives in the corporate hierarchy as a tournament in which individuals compete for promotion and rewards. High-performing executives with considerable managerial potential win promotion and commensurate compensation. A large spread of compensation across corporate hierarchical levels attracts talented and venturesome participants to compete in the managerial tournament, providing extra incentives to exert effort. The winners' talent and the extra effort exerted will, according to the tournament model, translate to high firm performance.

The empirical evidence on the tournament theory is rather limited and results are mixed. Supporting evidence comes from studies of sport activities (Ehrenberg and Bognanno (1990), Becker and Huselid (1992) and by controlled experiments (Bull et al. (1987)). In business settings, Main et al. (1993), using survey data for top executives in 200 US firms, during 1980-1984, report that a greater spread of top-executive compensation is positively related to firm performance. Similarly, based on proprietary data of 210 Danish firms during 1992–1995, Eriksson (1999) provides somewhat weak evidence that higher pay dispersion is positively related to firm performance. In contrast, O'Reilly et al. (1988) do not find support for the tournament argument in a sample of 105 Fortune 500 firms, and Conyon et al. (2001) report that variation in executive compensation is not associated with enhanced firm performance in a sample of 100 UK firms in 1997.

In contrast with the tournament model, notions of equity fairness postulate that the quality of social relations in the workplace affect firm performance (Akerlof and Yellen (1988, 1990), Milgrom (1988), Milgrom and Roberts (1990)) and that large pay dispersion adversely affects employee relations and morale, leading to counterproductive organizational activities, which eventually reduce firm performance. Supporting evidence for the adverse effects of wage dispersion on performance is also limited. Using a sample of university faculty, Pfeffer and Langton (1993) report that greater wage dispersion within academic departments reduces

faculty satisfaction as well as research productivity and collaboration among colleagues. There is also some preliminary evidence in business settings (e.g., Drago and Garvey, 1998) that supports the argument for equity fairness.

2. Prior Research and Our Hypotheses
2.1 Tournament Theory

This theory (Lazear and Rosen (1981)) views the advancement of executives in a corporate hierarchy as a contest in which individuals compete for promotion and rewards. High-performing executives win promotions and receive prizes in the form of generous pay and perks in their new positions. The compensation spread across hierarchical levels (large "prizes" at the top) provides extra incentives to participate in the managerial "tournament" and exert considerable efforts to win the top prize. The main elements of the tournament theory are as follows: (i) Tournaments reward players with prizes based upon *relative* performance. The best performer receives the largest prize while the worst performer receives the smallest. (ii) Rewards are intrinsically nonlinear. (iii) The spread in prizes increases with the number of competitors. (iv) Participants with low ability will choose higher risk strategies to increase probability of winning. Thus, a participant's ability is negatively related to variability of his/her performance.

Empirical evidence supporting the tournament theory was obtained in sport settings. For example, Ehrenberg and Bognanno (1990) examine the performance of golfers and conclude that as prize differentials increase, players' performance improves. Becker and Huselid (1992) examine the performance of drivers in professional auto racing, and report that pay dispersion has positive incentive effects on both individual performance and driver safety. In a business setting, Main et al. (1993) use survey data for 200 firms during 1980-1984 and report that pay differential increases substantially as one ascends the corporate hierarchy, consistent with tournament theory's prediction that extra weight on top-ranking prizes motivates participants to aspire to higher goals, and that the dispersion in top compensation increases with the number of contestants. The main finding of Main et al. (1993) is that firm performance is positively associated with executive pay dispersion. In a similar vein, Bognanno (2001) reports that the CEO pay rises with the number of vice presidents competing for the top position. However, he finds that inconsistent with the tournament prediction, firms do not maintain short-term promotion incentives, as longer time in position prior to promotion reduces the effect of pay increase from the promotion. Finally, Conyon et al. (2001) examine a sample of 100 large UK firms during 1997–1998 and find no evidence that larger pay dispersion is positively associated with

improved firm performance. O'Reilly et al. (1988) report similar findings for the US. Thus, the business-setting evidence on the tournament theory is mixed and somewhat dated.

2.2 Equity Fairness

Economic theory asserts that in equilibrium wages are equal to employees' marginal productivities. Such mainstream thinking has been challenged: Drawing on social exchange models, equity notions, and related work in sociology and psychology, Akerlof and Yellen (1988, 1990), Milgrom and Roberts (1988), and Levine (1991) argue that *low* pay dispersion may have a positive effect on employee efforts and productivity by creating harmonious and efficient labor relations thereby leading to higher output and productivity. In a similar vein, Levine (1991) develops a model showing that lowering pay dispersion can increase employee cohesiveness, which in turn will enhance productivity.

Further insight into the economic efficiency associated with a low pay dispersion is provided by Lazear (1989), and Milgrom and Roberts (1990): If promotion and salaries are based on relative rather than individual performance, as postulated by tournament theory, then employees will advance not only by performing well, but also by seeing to it that their rivals perform poorly. Consequently, employees have weaker incentives to cooperate, and in extreme cases may engage in outright sabotage of others' activities. To mitigate this, a firm may encourage cooperation by, among other things, reducing pay dispersion. Low dispersion may reduce effort, but at the same time increase cooperation. Thus, in general, it is optimal on productivity grounds to compress wage structure, to some extent, to promote cooperation (Lazear (1989). In a similar vein, Milgrom and Roberts (1990) use the principal-agent framework to suggest that employees may engage in rent-seeking activities to secure influence over organizational decision processes. Such influence-oriented activities arise when organizational decisions affect the distribution of wealth or other benefits among members or constituent groups. In their selfish interest, the affected individuals attempt to influence the decision process to their benefit. Furthermore, if firms cannot perfectly monitor output, workers may have incentives to exaggerate their output and lobby for higher wages. Thus, for example, the proponents of a project (e.g., R&D) may devote excessive effort to build the best possible case for investing in that project, hiding potential difficulties and focusing on the upside, while at the same time trying to denigrate competing proposals. Such arguments have led Milgrom and Roberts (1990) to promote wage compression under certain circumstances to alleviate these counterproductive activities.

Empirical tests of the above equity fairness arguments include the work of Pfeffer and Langton (1993), who report that the higher the wage dispersion of university faculty, the lower their satisfaction and research productivity and the less likely it is that faculty members will collaborate on research. Similarly, Cowherd and Levine (1992) report a positive relationship between product quality and various measures of interclass pay equity (low wage dispersion). Drago and Garvey (1998) report that strong promotion incentives are associated with reduced employee cooperation and individual efforts. Contradicting the equity fairness predictions, Hibbs and Locking (2000) report that compression of wage dispersion in Swedish companies depressed output and labor productivity.

2.3 Hypothesis

In summary, the tournament theory predicts a positive association between firm performance and pay dispersion whereas the equity fairness notions predict a negative association. While the tournament and the equity fairness arguments concerning the impact of pay dispersion on performance provide distinguishable predictions, the empirical evidence—particularly in business settings—is limited and often mixed. Ultimately, it is important to consider whether the motivational benefits from larger pay dispersion under the tournament theory exceed the costs from envy and dysfunctional behavior associated with larger pay dispersion under the equity-fairness theory. We posit that in business settings where relative performance is a better incentive mechanism than absolute performance, the net benefits associated with tournament incentives are likely to exceed the costs from envy and dysfunctional behavior associated with larger pay dispersion. Thus, we predict that:

H: Firm performance is positively associated with dispersion of managerial compensation.

3.1. Sample

Our sample is drawn from all firms listed in the Execucomp database during 2003-2010. We exclude utility and financial services companies due to concerns that government regulations of these industries might affect the structure of executive compensation and its impact on performance. We obtain financial statement data from Compustat and stock returns from CRSP. Compact Disclosure provides the information on managerial equity ownership and board structure. Compensation data are derived from the Execucomp database.

3.2. Model Specification

The central hypothesis examined in this study is that firm performance is positively associated with managerial pay dispersion. Following prior studies (Morck et al. (1988), Hermalin and Weisbach (1991), and Himmelberg et al. (1999)), we measure firm performance by Tobin's Q, and regress it on pay dispersion and a set of control variables. The dependent variable, TOBINQ, is measured as the market value of common equity plus book value of liabilities, divided by the book value of total assets of the firm at the end of the fiscal year. Following prior studies (Aggrawal and Samwick (2003), Barron and Waddell (2003)), we define the top management team as the five highest paid executives whose compensation is disclosed in the Execucomp database. Compensation dispersion is measured by the coefficient of variation of total pay (comprising of salary, bonus, stock options granted, long-term incentive pay, restricted stock grants, and other compensation), across the top managerial team, namely the standard deviation of compensation divided by the mean. Pay dispersion is denoted by DISPAY. Under hypothesis H, we expect the coefficient of DISPAY to have a positive sign in the TOBINQ regression. In addition to our focus variables DISPAY and the various interaction terms discussed above, we include in the regression the following control variables, reflecting firm attributes and governance indicators, which were shown in previous research (Morck et. Al (1988), Lang and Stulz (1994), Berger and Ofek (1995), Yermack (1996), Shleifer and Vishny (1997), Chen and Steiner (2000)) to be associated with Tobin's Q: capital expenditure divided by sales (CAPSALE), firm size (SIZE), number of business segments (SEGNUM), insider equity ownership (INSIDEQ), squared of insider equity ownership (INSIDEQSQ), proportion of outside directors on the board (OUTDIR), number of directors (BOARDSIZE) and CEO-chairman duality (CEODUAL). Our cross-sectional regression model is the following (model 1) where subscripts denote firm i in year t (t = 2003–2010). All variables are defined in Table 1.

4. Results

4.1 Descriptive Statistics

Table 1 reports on the sample descriptive statistics. The mean and median TOBINQ are 2.12 and 1.64 respectively. The mean dispersion (coefficient of variation) of management compensation (DISPAY) is 0.62 with an interquartile range of 0.33, suggesting considerable sample cross-sectional variability of pay dispersion. We also compute the mean and standard deviation of the compensation of the top five executives. This mean ($1,980 million), along with the standard deviation ($4,104 million), and interquartile range ($1,481 million) further indicate substantial sample variation of compensation. The data in Table 1 also show that, on average, the sample firms are profitable (mean ROA is 10.35%):

$$TOBINQ_{it} = \beta_0 + \beta_1 DISPAY_{it} + \beta_2 DISPAY_{it} * RDSALE_{it} + \beta_3 DISPAY_{it} * ADVSALE_{it}$$
$$+ \beta_4 DISPAY_{it} * OUTDIR_{it} + \beta_5 DISPAY_{it} * CEODUAL_{it}$$
$$+ \beta_6 DISPAY_{it} * INSIDEQ_{it} + \beta_7 DISPAY_{it} * INSTEQ_{it}$$
$$+ \beta_8 RDSALE_{it} + \beta_9 ADVSALE_{it} + \beta_{10} SIZE_{it} + \beta_{11} CAPSALE_{it}$$
$$+ \beta_{12} SEGNUM_{it} + \beta_{13} INSIDEQ_{it} + \beta_{14} INSIDEQSQ_{it}$$
$$+ \beta_{15} INSTEQ_{it} + \beta_{16} OUTDIR_{it} + \beta_{17} CEODUAL_{it} + \beta_{18} BOARDSIZE_{it} + \varepsilon_{it}, \quad (1)$$

Relatively large (mean and median annual sales of \$3,642 million and \$960 million, respectively), and operate on average in 3.7 business segments or divisions (mean SEGNUM is 3.7). The mean and median of BOARDSIZE indicate 9 directors per firm. The mean proportion of independent directors on the board (OUTDIR) is 62%, and 60% of the sample firms had CEOs who also chaired the board of directors. At the mean, insiders own 12% of equity (median = 4%), and institutional investors own 57% of equity.

4.2 The Association between Pay Dispersion And Firm Performance

Table 2, presents a pooled ordinary-least-squares regression estimates of the model in Equation (1): TOBIN's Q regressed on the dispersion of management compensation (DISPAY) along with control variables. The t-statistics are based on Huber-White robust standard error, a generalization of White (1980) standard error, which is robust to both serial correlation and heteroscedasticity. Column (1) presents the pooled regression results with year and industry dummies, but without the interaction terms. The coefficient of pay dispersion, DISPAY, is positive and significant at the 1% level (*t*-statistic 3.56), supporting hypothesis H1 which predicts that firm performance is positively associated with the dispersion of management compensation. An implication of the positive relationship between Tobin's Q and pay dispersion is that the tournament incentives and motivational benefits from larger pay dispersion under the tournament theory exceed the costs from envy and dysfunctional behavior associated with larger pay dispersion under the equity-fairness theory. To assess the economic significance of the association between pay dispersion and firm performance, we focus on the pay dispersion coefficient, 0.2793. Thus, if a firm's pay dispersion increases from the 25th sample percentile (0.4248 in Table 1) to the sample median (0.5687), the increase in TOBINQ is 0.0402 (0.2793 × (0.5687 – 0.4248)). Based on the sample mean book value of assets of \$4,175 million, the consequent increase in firm market value is \$168 million (0.0402 × 4,175). Similarly, if a firm's DISPAY increases from the median to the 75th percentile of the sample, the associated increase in market value is \$207 million. Thus, variation in pay dispersion of top management is associated with economically substantial changes in the market value of companies.

Table 1
Descriptive Statistics

The sample consists of 12,197 annual observations for 1,855 companies compiled for 2003–2010. TOBINQ is the book value of total assets less book value of equity plus market value of common equity divided by book value of total assets. DISPAY is the coefficient of variation of total compensation (composed of salary, bonus, stock options granted, long-term incentive pay, restricted stock granted, and other compensation) paid to the top five executives in the management team during the fiscal year. RDSALE is the sum of research and development costs divided by sales for the prior five years. ADVSALE is the sum of advertising costs divided by sales for the prior five years. ROA is operating profit over total assets. CAPSALE is capital expenditure over sales. SIZE is natural logarithm of sales. SALES is the dollar value of sales. SEGNUM is number of business segments in the firm. INSIDEQ is percentage of common equity owned by officers and directors. INSIDEQSQ is the squared term of INSIDEQ. INSTEQ is the percentage of common equity owned by institutional shareholders. OUTDIR is the proportion of outside directors (defined as directors who are neither current nor former officers of the firm) on the board. CEODUAL equals one if the CEO is the chairman of the board of directors, and zero otherwise. BOARDSIZE is the natural logarithm of the number of directors sitting on each company's board as of the annual general meeting date in the given year.

Table 2. Regressions of Tobin's *Q* on Pay Dispersion and Control Variables

Variable	Mean	Q1	Median	Q3	Standard Deviation
TOBINQ	2.1172	1.2445	1.6385	2.3757	1.5442
DISPAY	0.6174	0.4248	0.5687	0.7467	0.2806
ROA	0.1035	0.0588	0.1019	0.1491	0.0899
CAPSALE	0.0800	0.0286	0.0478	0.0834	0.0899
RDSALE	0.2015	0	0.02126	0.2577	0.3381
ADVSALE	0.0648	0	0	0.0626	0.1507
SIZE	6.9876	5.9331	6.8673	7.9522	1.4951
SALES (millions of dollars)	3,642	377	960	2,842	9,618
SEGNUM	3.682	1	3	5	3.3757
INSIDEQ (%)	11.61	1.02	4.03	15.76	16.32
INSTEQ (%)	57.06	43.98	59.81	72.79	20.89
OUTDIR	0.6226	0.482	0.70	0.8461	0.1909
CEODUAL	0.5990	0	1	1	0.48
BOARDSIZE	8.9341	7	9	11	3.09

In all cases, the dependent variable is TOBINQ, computed as the book value of total assets less book value of equity plus market value of common equity divided by book value of total assets. The sample consists of 12,197 annual observations for 1,855 companies compiled for 2003–2010. DISPAY is the coefficient of variation of total compensation (composed of salary, bonus, stock options granted, long-term incentive pay, restricted stock granted, and other compensation) paid to the top five executives in the management team during the fiscal year. RDSALE is the sum of research and development costs divided by sales for the prior five years. ADVSALE is the sum of advertising costs divided by sales for the prior five years. ROA is operating profit over total assets. CAPSALE is capital expenditure over sales. SIZE is natural logarithm of sales. SALES is the dollar value of sales. SEGNUM is number of business segments in the firm. INSIDEQ is percentage of common equity owned by officers and directors. INSIDEQSQ is the squared term of INSIDEQ. INSTEQ is the percentage of common equity owned by institutional shareholders. OUTDIR is the proportion of outside directors (defined as directors who are neither current nor former officers of the firm) on the board. CEODUAL equals one if the CEO is the chairman of the board of directors, and zero otherwise. BOARDSIZE is the natural logarithm of the number of directors sitting on each company's board as of the annual general meeting date in the given year. t-statistics (reported in parentheses) are based on Huber-White robust standard error, which is a generalization of White (1980) standard error that is robust to both serial correlation and heteroscedasticity. Coefficients on the year indicators and industry indicators are included in all models but are not shown. Panel A presents ordinary least squares regression estimates. Panel B presents regression estimates from a fixed effects model that assigns a unique intercept to each firm and includes dummy variables for years.

Ordinary Least Squares Regression Estimates

Variable	Predicted Sign	(1)	(2)	(3)
Intercept		1.9667 (7.47)***	2.0225 (7.71)***	2.1091 (6.42)***
DISPAY	+	0.2793 (3.56)***	0.1954 (2.18)**	0.0491 (2.06)**
DISPAY * RDSALE	+		0.3075 (2.73)***	0.2711 (2.73)***
DISPAY * ADVSALE	+		0.1425 (2.15)**	0.2146 (2.02)**
DISPAY *OUTDIR	+			0.0027 (2.14)**
DISPAY *CEODUAL	-			-0.3726 (-2.79)***
DISPAY *INSIDEQ	+			0.1249 (0.27)
DISPAY *INSTEQ	+			0.5643 (1.55)

***, **, and * denote significance at the 1%, 5% and 10% levels (two-tailed) respectively.

5. Summary

This study examines the association between the dispersion of top-management compensation and firm performance. According to the tournament theory, higher pay dispersion attracts exceptionally talented executives thereby enhancing firm performance. In contrast, considerations of equity fairness suggest that greater pay dispersion reduces employee motivation and cooperation, leading to lower firm performance.

Consistent with tournament theory, we find that firm performance, measured either by Tobin's Q or by the firm's stock return, is positively associated with the pay dispersion of top management.

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