Structuring Executive Compensation Contracts: The Impact of Industry Technological Intensity

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This study examines the relationship between CEO compensation packages and firm performance. We suggest the optimal compensation contract is partially dependent on the technological intensiveness of the industry in which the firm competes. We argue that firm performance will be stronger when CEO compensation is incentivized in line with CEO preferences. Our results indicate that firms in high-tech industries perform better with greater proportions of incentive-based compensation while firms in low-tech industries perform better when offering greater proportions of guaranteed pay. These findings suggest firms should evaluate the preferences of their CEOs prior to designing the compensation package, recognizing the relative risk aversion of low-tech CEOs and risk tolerance of high-tech CEOs.

INTRODUCTION

The relationship between CEO compensation and firm performance has been extensively studied (Jensen & Meckling, 1976; Jensen & Murphy, 1990; Sundaramurthy, Rhoades, & Rechner, 2005; Wright, Ferris, Sarin, & Awasthi, 1996). Research has been largely grounded in agency theory, which suggests that executives should be given equity stakes in their companies in order to properly align their interests with the interests of shareholders (Jensen & Meckling, 1976; Fama, 1980; Jensen & Murphy, 1990). This perspective assumes that CEOs and shareholders often have conflicting goals and interests. Accordingly, to ensure that CEOs pursue strategies in the best interest of the shareholders, executive compensation plans often include a large portion of stock options, hoping to assure that CEO decisions are focused on firm performance and value.

The idea of tying CEO pay to firm performance has received some empirical support in the literature. The impact of compensation packages on firm performance, however, is not clear. For example, Aupperle, Figler, & Lutz, (1991), Jensen & Murphy, (1990), and Murthy & Salter, (1975) found little to no relationship between CEO compensation and firm performance. Other studies, however, have found a significant relationship between CEO compensation and firm performance (Veliyath & Bishop; 1995). Crumley (2008) found a weak relationship between CEO compensation and return on equity and a strong relationship between sales and CEO compensation. Mehran (1995) and Finkelstein and Hambrick (1990) found a direct and positive relationship between executive ownership through CEO compensation and firm performance. These inconsistent results suggest additional research is necessary to better understand the relationship.

Some of the inconsistent findings of research on CEO compensation are likely due to the reliance on agency theory alone. A more complex relationship seems to be present, calling for research to examine other factors to help better understand optimal incentive contracts. Aaron et al. (2014) provide evidence that a moderate amount of incentive-based compensation leads to optimal firm performance, suggesting executive compensation is one of many applications of the Pierce and Aguinis (2011) *too-much-of-a-good-thing effect* (TMGT effect). Firms receive benefit from using incentive-based compensation but there exists an inflection point beyond which firm performance is hindered by additional incentive compensation.

Research on motivation has found that the use of different kinds of rewards has varying impacts on individual motivation (Pappas & Flaherty, 2006). The same holds true of CEOs. Hence, we believe that the CEO compensation to firm performance relationship will be stronger if the CEO is more highly motivated by the compensation structure. Thus, when the compensation package is well matched to the preferences of the CEO, the firm should perform better.

Total compensation for a CEO is comprised of performance-based compensation and fixed compensation. Performance-based compensation plans typically include equity interest such as stock purchase programs and stock options. Fixed compensation plans are primarily composed of annual salary and bonuses. Fixed compensation represents a guaranteed amount of money and therefore represents a lower risk for CEOs than performance-based plans which depend on firm performance and market value for their worth.

This study examines the impact of industry technological intensiveness on optimal incentive contracts. We argue that firm performance will be stronger when CEO compensation is incentivized in line with CEO preferences. We assume that firms in high-tech industries will have CEOs who are inherently more risk tolerant and will prefer more incentive-based compensation and that firms in low-tech industries will have CEOs who are inherently more risk averse and will prefer more guaranteed pay relative to incentive-based compensation. These preferences will then manifest themselves as improved firm performance when the compensation package is weighted accordingly.

LITERATURE REVIEW

Extant research suggests many factors influence the compensation of CEOs. Industry-level factors or external environmental factors have been found to influence CEO pay structure. Such factors influence both the amount and type of compensation firms offer CEOs. Milkovich (1982) indicated regulatory changes often cause significant alterations to a firm's compensation policies. Stroh et al. (1996) found top managers in higher turbulence industries receive a higher proportion of variable compensation. Chu et al. (2006) suggest the stage of industry life cycle is important. Specifically, businesses operating in early or rapidly changing stages of the industry life cycle will use more contingent compensation. Balkin and Gomez-Mejia (1987) find that high-tech companies in the United States tend to link more compensation to firm performance than non-high-tech companies, citing a pioneering culture and rapid development as causes.

The above factors highlighted in prior research are said to influence the amount and/or type of compensation. In this study, we seek to determine the varying impact of incentive-based compensation for

CEOs in high-tech industries versus CEOs in low-tech industries. These are relevant factors because the CEOs themselves have self-selected into an industry that is either dynamic (high-tech) or static (low-tech) in nature. As such, those CEOs have given us some information regarding the extent to which they personally value risk and uncertainty with a large upside potential or they prefer a less risky, more certain and stable environment. It is logical to assume those preferences will manifest themselves in the optimal compensation packages for those CEOs as well.

Hypothesis Development

Industry Technological Innovativeness

Firms in high-technology industries usually exhibit highly volatile returns (Liu, 2006; Ciccone & Rocco, 2005). High-tech firms tend toward incentive-based compensation due to a variety of reasons. First, firms that operate in high-technology industries face a significant survival risk due to constantly changing technical standards and legal requirements (Horng et al., 2006). The firm cannot guarantee a large amount of compensation because the board simply does not know if the cash will be available or if the firm will survive.

Second, actions of the top executives can be expected to have a more significant impact on firm performance when volatility is high (Chu et al., 2006). Thus, these firms can adequately compensate quality CEO's by using a higher percentage of contingent compensation. As with small firms, the contingent compensation insulates the high-tech firm to some degree against the ebbs in firm returns. Chu et al. (2006) find that in large Taiwanese firms, technological intensity of the external environment is the best predictor of the use of incentive compensation.

Third, the volatility inherent in high-tech industries make high-tech firms riskier than firms operating in industries characterized by lower technological intensiveness (Chu et al., 2006). Thus, firms in high-tech industries would be assumed to attract more risk tolerant CEOs who accept, and are motivated by, the risk inherent in their industry along with risk inherent in their own compensation package.

Therefore, firms operating in high-technology industries should perform better with greater proportions of incentive-based compensation while firms in low-tech industries should perform better when offering greater proportions of guaranteed pay. We present the following hypotheses:

> *Hypothesis 1: Firms in low-tech industries will perform better when offering their CEOs a greater proportion of fixed compensation relative to incentive based compensation.*
> *Hypothesis 2: Firms in high-tech industries will perform better when offering their CEOs a greater proportion of incentive based compensation relative to fixed compensation.*

METHODOLOGY

We utilize a two-step methodology to test the impact of industry on the compensation package – firm performance relationship. The first step is to split the CEO dataset (containing 24,000 observations) into firms operating in high and low tech industries in order to run an event study and determine the pattern of the data. For each group, we sort the data by the focal variable (Percent Performance Compensation) to create quintiles. For example, LOW TECH Q1 represents the smallest proportion of performance-based compensation among the low-tech firms while HIGH TECH Q1 represents the smallest proportion of performance-based compensation for the high-tech firms.

The second step in the methodology is to conduct list-wise regressions for each group of CEOs in order to determine whether the compensation package – firm performance relationship is linear or curvilinear as well as the magnitude and importance of the relationship.

Measures and Analysis

Hypotheses are tested on 24,000 CEO observations from ExecuComp covering 1992-2004. Incentive pay was operationalized as the percent of performance-based compensation (i.e., Black-Scholes option value plus the value of the restricted stock grants.) relative to the overall compensation (i.e., includes performance-based compensation plus salary and bonus) for the CEO. Performance was measured as the CRSP equally weighted mean cumulative abnormal return and the buy and hold equally weighted mean cumulative abnormal return. Both models were accessed using the EVENTUS software to conduct an event study that ties the firms in the quintiles to the quintile-wide performance as measured by the two models. The use of the CRSP model to estimate abnormal performance allowed us to handle multiple and overlapping option grants for CEOs, aggregating them to one date. The fiscal year end for a firm served as the focal date because we did not have the option grant date and some CEOs have several grant dates in one year. We used mean cumulative abnormal returns to examine the performance around that date. Cumulative abnormal returns are the returns for a specific firm for one year, two years, etc. following the event over and above the return for the market as a whole. Thus, we have implicitly controlled for market returns and fluctuations.

The regressions use the same primary independent and dependent variables: percentage of performance-based compensation and cumulative abnormal returns. We enter the controls in Model 1: net sales, number of employees and total compensation of the CEO. In Model 2, we enter the focal variable of percentage performance compensation to obtain an r-square assuming a linear relationship. In Model 3, we enter the squared term of percentage performance compensation to see if the curvilinear assumption fits the data better and adds explanatory power.

RESULTS AND DISCUSSION

In order to test Hypothesis 1, the observations were divided into low-tech and high-tech industries by SIC code to create two separate datasets. The low-tech dataset contains 16,260 (67.3%) observations. Next, the observations in the each dataset were sorted on the focal variable (percent incentive compensation) and then divided into five equal segments. Quintile 1 represents the bottom 20% of firms in terms of the percentage of incentive-based compensation they offer and quintile 5 represents the top 20% of firms. Each quintile in the low-tech dataset contains 3,252 observations. Then, the event study was performed in EVENTUS to match the firms in each quintile with their abnormal return. The results are displayed in Table 1 below.

TABLE 1
CEOS IN LOW TECH INDUSTRIES

	1 year	2 year	3 year	4 year	5 year
Q1	-0.09	1.30	2.74	2.94	2.42
Q2	1.32	2.13	2.36	2.43	1.86
Q3	1.32	1.55	-0.23	-0.74	-0.14
Q4	-2.45	-1.93	-2.43	-5.00	-8.59
Q5	-2.68	-7.98	-10.95	-11.66	-13.42

Hypothesis 1 asserted that firms in low-tech industries would perform better when offering their CEOs more guaranteed pay than incentive-based pay. Table 1 shows the peak (best performance) for the CEOs with the lowest amount of incentive-based compensation (Q1 & Q2). Additionally, the worst performance is for the firms offering CEOs the highest amount of incentive-based compensation (Q5). These results lend support to Hypothesis 1 and the assertion that firms in low-tech industries should use more guaranteed pay relative to incentive-based pay in their compensation structure.

In order to test Hypothesis 2, the high-tech firms were examined. The high-tech dataset contains 7,910 (32.7%) observations. Those observations were sorted on the focal variable (% incentive compensation) and then divided into five equal segments. Quintile 1 represents the bottom 20% of firms in terms of the percentage of incentive-based compensation they offer and quintile 5 represents the top 20% of firms. Each quintile in the high-tech dataset has 1,582 observations. Then, the event study was performed in EVENTUS to match the firms in each quintile with their abnormal return. The results are displayed in Table 2 below.

TABLE 2
CEOS IN HIGH TECH INDUSTRIES

	1 year	2 year	3 year	4 year	5 year
Q1	5.07	6.38	9.33	11.04	13.16
Q2	3.42	8.23	11.26	14.10	13.35
Q3	3.14	6.39	5.97	8.47	11.04
Q4	8.06	11.65	11.31	12.47	14.14
Q5	6.06	6.39	4.43	1.41	-2.11

Hypothesis 2 asserted that firms in high-tech industries would perform better when offering their CEOs more incentive-based pay relative to guaranteed pay. Table 2 shows the peak (best performance) for the firms generally occurs in Q4. This means high-tech firms perform optimally when offered relatively high amounts of incentive-based compensation. Hypothesis 2 is partially supported. It is not fully supported due to the dip in performance in Q5 suggesting the relationship is not linear. The results of Table 2 suggest firms in high-tech industries should use more incentive-based pay than their low-tech counterparts, but there is an inflection point, beyond which offering additional incentive-based pay produces detrimental results. In other words, firms in high-tech industries should use a moderate amount of incentive-based pay as a percentage of total compensation for their CEOs.

TABLE 3A
LOW-TECH FIRMS 1-YEAR

	Model (1)	Model (2)	Model (3)
Constant	.011	.028	.004
	.245	.640	.087
Control variables			
Net Sales	.013	.013	.010
	.975	1.024	.752
Number of Employees	.013	.014	.014
	1.027	1.099	1.073
Total Compensation	-.063***	-.049***	-.033**
	-6.900	-5.020	-3.188
Compensation variables			
Percent Performance Compensation		-.038***	.105***
		-3.985	3.712
Percent Performance Compensation ^ 2			-.157***
			-5.346
Model significance			
R-Squared	.006***	.007***	.010***
Adjusted R-Squared	.005***	.007***	.009***
Change in R-Squared		.001***	.002***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

While Tables 1 and 2 show the underlying pattern of the data, we need to determine the impact of our focal variable (incentive-based compensation) for each subset of CEOs. Recall that we examined the regression results for 3 models. Model 1 represents the control variables related to company size and the total compensation of the CEO. Model 2 introduces our focal variable (incentive compensation) to determine if this variable is meaningful in terms of explaining subsequent firm performance. Model 3 includes the squared term of our focal variable to assess whether underlying nature of the relationship between incentive compensation is best described as linear or nonlinear (concave). Tables 3A – 3E show the results for each of these models at various year milestones (one – five years respectively); Tables 4A – 4E provide this data for high-tech firms.

TABLE 3B
LOW-TECH FIRMS 2-YEAR

	Model (1)	Model (2)	Model (3)
Constant	.024	.057	.011
	.369	.867	.161
Control variables			
Net Sales	.022+	.023+	.018
	1.710	1.773	1.426
Number of Employees	.013	.014	.014
	1.047	1.138	1.105
Total Compensation	-0.80***	-.063***	-.042***
	-8.824	-6.447	-4.104
Compensation variables			
Percent Performance Compensation		-.047***	.135***
		-5.030	4.774
Percent Performance Compensation ^ 2			-.200***
			-6.844
Model significance			
R-Squared	.011***	.013***	.017***
Adjusted R-Squared	.010***	.012***	.016***
Change in R-Squared		.002***	.004***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 3C
LOW-TECH FIRMS 3-YEAR

	Model (1)	Model (2)	Model (3)
Constant	.048	.096	.030
	.571	1.131	.356
Control variables			
Net Sales	.022+	.023+	.018
	1.712	1.784	1.403
Number of Employees	.015	.017	.016
	1.205	1.308	1.271
Total Compensation	-.090***	-.071***	-.048***
	-9.920	-7.248	-4.672
Compensation variables			
Percent Performance Compensation		-.053***	.146***
		-5.659	5.193
Percent Performance Compensation ^ 2			-.219***
			-7.511
Model significance			
R-Squared	.014***	.017***	.021***
Adjusted R-Squared	.014***	.016***	.020***
Change in R-Squared		.002***	.004***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 3D
LOW-TECH FIRMS 4-YEAR

	Model (1)	Model (2)	Model (3)
Constant	.047	.014	.023
	.468	1.035	.223
Control variables			
Net Sales	.019	.020	.015
	1.521	1.593	1.194
Number of Employees	.015	.016	.016
	1.192	1.296	1.258
Total Compensation	-.095***	-.075***	-.051***
	-10.486	-7.753	-5.047
Compensation variables			
Percent Performance Compensation		-.054***	.155***
		-2.850	5.512
Percent Performance Compensation ^ 2			-.229***
			-7.874
Model significance			
R-Squared	.016***	.019***	.023***
Adjusted R-Squared	.015***	.018***	.022***
Change in R-Squared		.002***	.005***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 3E
LOW-TECH FIRMS 5-YEAR

	Model (1)	Model (2)	Model (3)
Constant	.031	.094	.002
	.268	.806	.021
Control variables			
Net Sales	.018	.019	.014
	1.397	1.465	1.079
Number of Employees	.012	.014	.013
	.971	1.070	1.032
Total Compensation	-.099***	-.080***	-.057***
	-10.859	-8.207	-5.559
Compensation variables			
Percent Performance Compensation		-.051***	.151***
		-5.428	5.363
Percent Performance Compensation ^ 2			-.221***
			-7.610
Model significance			
R-Squared	.018***	.020***	.024***
Adjusted R-Squared	.017***	.019***	.023***
Change in R-Squared		.002***	.004***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 4A
HIGH-TECH FIRMS 1-YEAR

	Model (1)	Model (2)	Model (3)
Constant	-.110***	-.075*	-.133***
	-4.539	-2.415	-4.111
Control variables			
Net Sales	-.025	-.019	.011
	-.517	-.392	.231
Number of Employees	.058	.054	.015
	1.226	1.133	.321
Total Compensation	-.124***	-.117***	-.089***
	-6.627	-6.050	-4.518
Compensation variables			
Percent Performance Compensation		-.034+	.354***
		-1.760	5.245
Percent Performance Compensation ^ 2			-.412***
			-5.988
Model significance			
R-Squared	.016***	.018***	.030***
Adjusted R-Squared	.015***	.015***	.027***
Change in R-Squared		.001+	.012***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 4B
HIGH-TECH FIRMS 2-YEAR

	Model (1)	Model (2)	Model (3)
Constant	-.248***	-.180***	-.296***
	-6.458	-3.646	-5.764
Control variables			
Net Sales	-.045	-.038	-.001
	-.950	-.796	-.016
Number of Employees	.092+	.087+	.039
	1.954	1.839	.825
Total Compensation	-.155***	-.145***	-.111***
	-8.299	-7.586	-5.688
Compensation variables			
Percent Performance Compensation		-.041*	.441***
		-2.173	6.596
Percent Performance Compensation ^ 2			-.512***
			-7.521
Model significance			
R-Squared	.027***	.028***	.047***
Adjusted R-Squared	.025***	.026***	.045***
Change in R-Squared		.002*	.019***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 4C
HIGH-TECH FIRMS 3-YEAR

		Model (1)		Model (2)	Model (3)
Constant		-.404***		-.283***	-.458***
		-7.897		-4.306	-6.727
	Control variables				
Net Sales		-.070		-.061	-.019
		-1.485		-1.279	-.396
Number of Employees		.123**		.116*	.062
		2.610		2.459	1.309
Total Compensation		-.161***		-.148***	-.109***
		-8.642		-7.758	-5.633
	Compensation variables				
Percent Performance Compensation				-.055**	.491***
				-2.905	7.393
Percent Performance Compensation ^ 2					-.580***
					-8.572
	Model significance				
R-Squared		.031***		.034***	.058***
Adjusted R-Squared		.029***		.032***	.056***
Change in R-Squared				.003**	.024***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 4D
HIGH-TECH FIRMS 4-YEAR

	Model (1)	Model (2)	Model (3)
Constant	-.531***	-.347***	-.581***
	-8.601	-4.372	-7.095
Control variables			
Net Sales	-.092+	-.070+	-.033
	-1.937	-1.678	-.701
Number of Employees	.141**	.132**	.072
	2.995	2.806	1.535
Total Compensation	-.163***	-.147***	-.104***
	-8.764	-7.707	-5.378
Compensation variables			
Percent Performance Compensation		-.070***	.536***
		-3.678	8.104
Percent Performance Compensation ^ 2			-.643***
			-9.546
Model significance			
R-Squared	.033***	.037***	.067***
Adjusted R-Squared	.031***	.035***	.065***
Change in R-Squared		.005***	.030***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

TABLE 4E
HIGH-TECH FIRMS 5-YEAR

	Model (1)	Model (2)	Model (3)
Constant	-.639***	-.413***	-.681***
	-9.065	-4.562	-7.289
Control variables			
Net Sales	-.111*	-.098*	-.051
	-2.334	-2.056	-1.080
Number of Employees	.154**	.144**	.084+
	3.264	3.062	1.789
Total Compensation	-.160***	-.143***	-.100***
	-8.609	-7.496	-5.163
Compensation variables			
Percent Performance Compensation		-.075***	.533***
		-3.952	8.056
Percent Performance Compensation ^ 2			-.645***
			-9.579
Model significance			
R-Squared	.032***	.038***	.068***
Adjusted R-Squared	.031***	.036***	.065***
Change in R-Squared		.005***	.030***

+significant at the .10 level
*significant at the .05 level
**significant at the .01 level
***significant at the .001 level

top line = standardized beta coefficients (constant is unstandardized)
bottom line = t-statistics

All regression models are significant for both low-tech and high-tech firms. The percentage of performance compensation is a more influential variable in the high-tech firms (r-square as high as 6.8%) than in low-tech firms (as high as 2.4%). The changes in r-square from Model 1 to 2 and 3 in low-tech firms are statistically significant but not very practically significant. For example, the changes in r-square for the one year returns are .001 and .002 respectively for Models 2 and 3. The changes in r-square for high-tech firms are also statistically significant. Here, the change from Model 1 to 2 is modest in practical terms, ranging from .001 to .005. However, the change in r-square when moving from Model 2 to Model 3 is both statistically and practically significant with a range of .012 to .030 and a mean change of .023.

Managerial Implications

There are many managerial implications from this study. The first is that one should not assume that more incentive-based compensation is necessarily better (agency theory). The results cited above show that firms in high-tech industries are performing better when giving higher proportions of incentive-based compensation to their CEOs while firms in low-tech industries are performing better when giving a relatively small percentage of incentive-based compensation to their CEOs. Additionally, we see incentive-based compensation is a more influential variable for CEOs in high-tech industries than for CEOs in low-tech industries. This makes it all the more important for high-tech firms to incentivize with substantial performance-based compensation, but also understand that *too-much-of-a-good-thing* can be bad (Pierce & Aguinis, 2011).

As a result, compensation committees should realize that CEOs respond differently to different compensation packages. The entire purpose of stock options and other incentive-based compensation is to properly align individual interests with firm interests and individual risk-preferences will play an instrumental role in proper alignment. Firms should evaluate the risk-preferences of their CEOs prior to designing the compensation package. CEOs in high-tech industries are likely attracted to those jobs because they are willing to take on more risk. It is not surprising that they thrive when given a compensation package that is riskier in nature but provides more upside potential. In addition, future research should directly examine the preferences espoused by CEOs across diverse industries. Doing so would provide more complete understanding of individual difference variables that influence preferences and therefore the motivational value associated with various compensation policies.

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