CEO COMPENSATION AND FIRM PERFORMANCE: NON-LINEARITY AND ASYMMETRY

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ABSTRACT

The relationship between CEO compensation and firm performance is a field of intense theoretical and empirical research. The purpose of this study is to gain additional insights into the nature of this relationship by examining empirically the relatively unexplored areas of its non-linearity. The findings of this study show strong evidence that supports the view that the relationship between executive compensation and firm performance is non-linear and asymmetric. Additionally, the structure of asymmetry is found to be dependent upon the measure of performance. Convexity characterizes the asymmetry of the relationship between executive compensation and market returns, while concavity distinguishes the asymmetry of the relationship between executive compensation and accounting returns.

1. INTRODUCTION

The classic principal–agent problem is the consequence of separation of control from the firm's ownership associated with authorization of the

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managerial choice process. Expected to pursue the owner's goals, the manager enjoys know-how and information advantages, while the owner does not. The owner, as the principal, is thus confronted with the probability that the manager, as the agent, may not pursue the owner's goals, and designs ex ante mechanisms to solve the problem of efficient contracting in the presence of incomplete information. If incomplete information is about pre-contract agent's behavior, the principal faces a problem of adverse selection, which can be solved by self-selection mechanisms like signaling or screening. If, on the other hand, incomplete information is about post-contract agent's behavior, the principal encounters a moral hazard dilemma, which can be solved by designing specific incentives schemes to foster the agent's effort (Lambert, 2001; Bebchuk & Fried, 2003).

The relationship between executive incentives and firm performance has been the subject of intensive theoretical and empirical scrutiny by researchers from a variety of disciplines.[1] Despite the vast amount of research a number of issues still remain unresolved. The concern about the existence of asymmetries and non-linearities in the relationship between executive compensation and firm performance, in particular, appear to have been left relatively unexplored.

Conceptually, the existence of asymmetries in the relationship between compensation and performance measures does not invalidate the theoretical underpinning of the agency model. As a matter of fact, it is conceivable that symmetry may not be optimal, as no theoretical reason exists to justify the presence of symmetric responses in compensation contracts. On the contrary, asymmetric responses may be built into compensation contracts as a means to strengthen the incentive structure of compensation contracts. From this perspective, asymmetry may be consistent with agency theory and optimal contracting arrangements to the extent that encouraging a risk-taking behavior, while shielding the executive from downside risks aligns the incentives of the executive with those of the shareholders. In fact, symmetric responses do not necessarily induce efforts in an agency context.

The purpose of this study is to gain further insights into the nature of the relationship between chief executive officer (CEO) compensation and firm performance by empirically examining this relatively unexplored area of asymmetry, using a panel of 455 U.S. firms spanning a period of seven years, from 1996 to 2002.

The remainder of the study proceeds as follows. Section 2 briefly reviews the literature on the relationship between firm size, firm performance, and executive compensation. Section 3 specifies a non-linear and asymmetric relationship between executive compensation and firm performance. The data and their sources are described in Section 4, with Section 5 detailing the main empirical results. A brief conclusion and a summary of the empirical results appears in Section 6.

2. OVERVIEW OF THE LITERATURE

Early studies of executive compensation, such as Ciscel and Carroll (1980), Healy (1985), and Lewellen and Huntsman (1970), focused primarily on the linkages between executive compensation, firm size and profits. The relationship between executive compensation and firm size is one of the most consistent empirical results in the compensation literature, with most studies reporting a compensation elasticity with respect to size of about 0.30 (Rosen, 1992), implying that executive compensation increases by about a third as firm size doubles. Subsequent research has confirmed the positive relation between firm size and executive compensation (Conyon, Peck, & Sadler, 2000; Carpenter & Sanders, 2002; Cordeiro & Veliyath, 2003; Indjejikian & Nanda, 2002; Yermack, 1995).

Executive compensation increases with the size of the firm because of the higher level of skills and managerial talent required by the higher degree of complexity and diversity of activities within such organizations. In the more recent past, stimulated in part by theoretical developments in agency theory (Holmström, 1979), the emphasis has shifted to the investigation of direct linkages between executive compensation and firm performance. Agency theory suggests that CEO incentives can be aligned with the preferences of the shareholders through compensation arrangements that reward the CEO in accordance with firm performance. Although the empirical order of magnitude of the relationship between compensation and performance still remains highly controversial, most of the research conducted in the past two decades has produced a significant amount of evidence in support of the hypothesis that firm performance positively affects executive compensation, for example, Murphy (1985, 1986), Jensen and Murphy (1990), Abowd (1990), Ely (1991), Boschen and Smith (1995), and Kaplan (1994).

A related issue concerns the nature of firm performance measures. Researchers have examined the relationship between executive compensation and firm performance using accounting-based measures, such as profit, return on equity, and return on assets, as well as market-based performance measures, such as stock price and total shareholder return. At the same time, they have also recognized that each of these measures has drawbacks of its own. From the shareholder's perspective, return is generated from stock price changes and is not defined in accounting terms. In theory, market-based measures are ex ante, forward-looking measures of performance, as they reflect managerial decisions that induce future profitability. Conversely, accounting-based measures are ex-post, historical measures of performance, and are thus conceptually less relevant from the shareholder's perspective.

In practice, however, stock prices are a very noisy signal as they are frequently subject to significant market-wide fluctuations that mirror the determinants of the business cycle and the conditions of fiscal and monetary policy, and hence do not exclusively reflect executive performance (Bertrand & Mullainathan, 2000). In contrast, accounting-based measures shield executive performance from much of the noise and the accountability associated with stock market fluctuations. Nevertheless, several studies have found evidence that executive compensation responds more to the market-based than the accounting-based performance measures. Coughlan and Schmidt (1985), Rich and Larson (1984), Murphy (1985), and Conyon et al. (2000), among others, find significant empirical evidence that connects executive compensation to market-based returns. Baber, Janakiraman, and Kang (1996), on the other hand, report that such linkages are primarily associated with non-cash compensation. Additionally, Boschen, Duru, Gordon, and Smith (2003) present evidence that indicates that firms give less emphasis to accounting-based measures and increasingly rely on market-based measures. On the other hand, Lewellen and Huntsman (1970), Sloan (1993), and Carpenter and Sanders (2002), among others, find strong linkages between accounting-based measures of performance and executive compensation.

For the most part, executive compensation research has been confined to cash compensation as a proxy for total compensation, for example, Abowd (1990), Jensen and Murphy (1990), Lambert and Larker (1987), Mishra, Gobeli, and May (2000), Murphy (1985), and Sloan (1993), among others. Cash compensation comprises salary and bonuses, but does not include other forms of compensation, such as long-term incentives payouts and stock option grants. In earlier studies the use of cash compensation was for the most part justified on the basis of data availability and the relative magnitude of the cash component in total compensation. However, the changes that occurred in the last decade in the composition of compensation contracts, such as the enormous expansion of non-cash compensation, and the significant proliferation in the number of firms offering stock options to their executives and employees, together with the Securities and Exchange Commission (SEC) mandated disclosure regarding stock option grants issued to executives,[2] have resulted an increased attention to the relevance of non-cash compensation in pay-performance studies, notably Bertrand and

Mullainathan (2000), Core, Guay, and Verrecchia (2003), Cordeiro and Veliyath (2003), and Main, Bruce, and Buck (1996), among others.

Asymmetry of performance effects entails a non-linearity in the relationship between executive compensation and firm performance. As a result, failure to account for such non-linearity may result in model misspecifications and empirical analyses, which preclude a full assessment of the effects of performance on executive compensation. Yet, a striking feature of the most empirical work to date is that few systematic attempts have been made to evaluate the presence of asymmetric effects of firm performance measures on executive compensation. There is not much empirical evidence to date for the popular view (Crystal, 1991) that good performance is rewarded, while poor performance is ignored, or that compensation contracts are disproportionately more sensitive to positive than negative performance realizations (Joskow & Rose, 1994).

There is some evidence, however, that firms shield executive compensation from current charges against accounting performance that are not necessarily within the CEO's control (Gaver & Gaver, 1998), and from the contemporaneous effect on accounting performance of restructuring charges (Dechow, Huson, & Sloan, 1994). Gaver and Gaver (1998) use a sample of firms that reported 'Extraordinary Items' and/or 'Discontinued Operations' to demonstrate that nonrecurring losses on the income statement are not associated with CEO cash compensation, which suggests that compensation committees filter such losses from the determination of compensation. This action serves to reduce the riskiness of the CEO's compensation, since nonrecurring losses (e.g., those due to the adoption of new accounting standards) are often beyond the control of the CEO.

As noted above, such actions do not undermine the predictions of agency theory. Dechow et al. (1994) argue that since restructuring charges are typically associated with permanent reductions in costs (e.g., layoffs) and/or increased operational synergy, such charges tend to increase firm value and it is in the firm's best interest to encourage the CEO to take such actions. Eliminating the restructuring charge, which decreases current accounting measures, from the determination of compensation removes a disincentive for the CEO to take the steps necessary to maximize firm value.

3. MODEL SPECIFICATION AND RELEVANT HYPOTHESES

In this section, I outline a model of executive compensation that postulates a non-linear, asymmetric relationship between performance and executive compensation, where positive and negative performance realizations of equal magnitude elicit an unequal compensation response.

Specifically, it is assumed that executive compensation is a semi-log-linear function of performance and a log-linear function of size:

$$\ln COMP_{it} = \alpha + \beta \ \ln z_{it} + \delta\pi_{it} + \varepsilon_{it} \quad \text{(i)}$$

where $COMP_{it}$ is the executive compensation in firm i at time t, z_{it} represents the firm size and π_{it} denotes the performance measure. The term ε_{it} is a stochastic error, which is assumed to be serially uncorrelated with zero mean and constant variance, and independently distributed across firms. In Eq. (i), the parameters β and δ represent the short-run elasticity of executive compensation with respect to the firm size, z_{it}, and the short-run semi-elasticity with respect to performance, π_{it}, respectively.[3]

Eq. (i) is derived on the stylized assumption that the relationship between (the logarithm of) executive compensation and firm performance is linear. The effects of performance on executive compensation are assumed symmetric, i.e., whether $\pi_{it} > 0$ or $\pi_{it} < 0$, they are equal in magnitude and opposite in sign. On the other hand, asymmetry in performance effects requires that when $\pi_{it} > 0$ or $\pi_{it} < 0$, the effects on executive compensation are not just opposite in sign, but also different in magnitude. Eq. (ii) removes the symmetry assumption, and models the asymmetric effects in the compensation equation using, as an approximation, specification of the performance measure with threshold at $\pi_{it} = 0$:

$$\ln COMP_{it} = \alpha + \beta \ \ln z_{it} + \delta_1 \, pos(\pi_{it}) + \delta_2 \, neg(\pi_{it}) + \varepsilon_{it} \quad \text{(ii)}$$

where $pos(\pi_{it})$ and $neg(\pi_{it})$ denote the positive and negative values of performance measure, π_{it}.

Eq. (ii) implies that the effect of performance on executive compensation depends upon whether π_{it} is positive or negative. When $\pi_{it} > 0$ is true, the short-run effect of performance on executive compensation is captured by the point estimate of δ_1. Conversely, when $\pi_{it} < 0$ is true the short-run effect is δ_2. This asymmetric pattern of performance effects indicates that an improvement or a worsening of a positive performance is not necessarily equivalent to an improvement or a worsening of a negative performance. Thus, for example, the effect on executive compensation of an increase of 10 percentage points in π_{it}, when π_{it} is positive (say, from 20 to 30) is not the same as that of an increase of 10 percentage points in π_{it} when π_{it} is negative (say, from -30 to -20).

Eq. (ii) incorporates the relevant empirical hypotheses underlying this study, which can be summarized as follows. First, the effects of firm performance measures on executive compensation are asymmetric. This hypothesis is rejected if the coefficient on the positive and negative values of the performance variable, δ_1 and δ_2, in Eq. (ii) are not significantly different from each other, i.e., $\delta_1 - \delta_2 = 0$. Second, alternative performance measures display different patterns of asymmetry. This hypothesis is rejected if, given two alternative measures of performance, say, π_{1it} and π_{2it}, the differences $\delta_{11it} - \delta_{12it}$ and $\delta_{21it} - \delta_{22it}$ are jointly not significantly different from zero, where δ_{11it} and δ_{21it} are the coefficient estimates of $pos(\pi_{1it})$ and $pos(\pi_{2it})$, δ_{12it} and δ_{22it} are the coefficient estimates of $neg(\pi_{1it})$ and $neg(\pi_{2it})$, respectively. Noticeably, the rejection of the asymmetry hypotheses provides evidence that supports the conventional representation of the executive compensation model.

4. SAMPLE SELECTION, VARIABLE MEASUREMENTS, AND DESCRIPTIVE STATISTICS

This section describes the sample, data sources and variable measurement. All data for this study are drawn from Standard and Poor's (2004) *ExecuComp* database. The sample consists of panel data from 455 U.S. firms covering the period 1996–2002. This sample is obtained from an initial sample of 2,394 U.S. firms after imposing the condition that CEO tenure extend over the entire period 1996 to 2002, with full years of tenure during 1997–2002, and at least 6 months tenure in 1996. This condition is imposed to guarantee homogeneity in the pay-performance relationship and to control to some degree for human capital heterogeneity within firms. Panel A of Table 1 presents the sample selection process.

Detailed information about industry composition of the sample is presented in Panel B of Table 1. The sample encompasses 25 industries, with 2-digit SIC ranging from 01 to 99. The largest sample representation is the electrical equipment industry, with 42 firms or about 9.2 percent of the sample, followed by insurance and other financial services, and services, each with 32 firms or about 7 percent of the sample, and the chemical industry with 31 firms or about 6.8 percent of the sample. The industries with the smallest sample representation are mining with 4 firms, about 0.9 percent, and toy manufacturing and construction, each with 5 firms, accounting for approximately 1.1 percent of the sample.

This sample has at least two advantages over other samples. First, it is random and utilizes the most recent available information. Not only does it include newer firms, but also large firms are not overly represented[4] as in the studies that use common data sources such as *Forbes* or *Fortune*. The sample

Table 1. Sample Selection & Industry Composition.

	Number of Firms	CEO-Year
Panel A: Sample selection		
Initial sample 1996–2002	2,394	11,766
Less: no starting date as CEO	163	769
Less: CEO left position prior to 1996	82	256
Less: CEO did not serve during the 7-year study period	1,140	5,636
Less: lack data for study period	542	1,836
Less: omitted due to missing data	12	84
Final sample	455	3,185

Industries	2-Digit SIC	Number of Firms	Percentage
Panel B: Industry composition			
Mining	10, 12, 14	4	0.9
Gas & oil and petroleum refining	13, 29	21	4.6
Construction	15–17,19	5	1.1
Food	1, 20–21, 54, 58	28	6.2
Clothing & footwear	22–23, 31, 56	19	4.2
Forest product, paper	24, 26	11	2.4
Furniture	25, 57	7	1.5
Printing & publishing	27	13	2.9
Chemicals	28	31	6.8
Rubber, plastic, stone, clay, & glass	30, 32	10	2.2
Primary & fabricated metal	33–34	18	4.0
Industrial machinery	35	22	4.8
Electrical equipment	36	42	9.2
Transportation equipment	37	11	2.4
Instruments	38	16	3.5
Toy manufacturing	39	5	1.1
Transportation	40, 42–47	19	4.2
Telecommunication	48	8	1.8
Utilities	49	26	5.7
Wholesale trade	50–51, 99	14	3.1
Retail trade	52–53, 55, 59	17	3.7
Banks	60	29	6.4
Insurance, other financial services	61–64, 67,69	32	7.0
Services	70–79	32	7.0
Healthcare & professional services	80, 82, 83, 87	15	3.3

contains data from a wide variety of firms: those in the Standard and Poor's 500, Standard and Poor's Mid-Cap 400, and Standard and Poor's Small-Cap 600, which provide considerable variation in firm size.[5] The sample is taken over a period of time and follows SEC regulations on disclosure requirements, as well as the FASB debate on accounting for stock options, which ultimately produced SFAS 123 "Accounting for Stock-based Compensation." Thus, the sample corresponds to a period during which firms made compensation decisions in accord with current disclosure requirements, and this adds to the generalizability of the findings.

Two measures of executive compensation are used in this study: cash compensation and total (cash and non-cash) compensation. Cash compensation (*CASHCOMP*) is defined as the sum of salary and bonus. Total compensation (*TOTALCOMP*), includes both cash and non-cash compensation. Non-cash compensation is composed of long-term incentive payouts, the value of restricted stock grants, the value of stock option grants, and any other compensation item for the year. Stock options are valued at the grant-date using *ExecuComp*'s modified Black and Scholes (1973) methodology.[6] Firm performance is modeled using both accounting-based and market-based measures. Market-based performance is measured as total one-year shareholder return on common stock (*TRS*), defined as the closing price at fiscal year-end plus dividends divided by the closing price of the prior fiscal year-end. Accounting-based performance is measured by return on assets (*ROA*), defined as income before tax, extraordinary items, and discontinued operations divided by average total assets. Finally, firm size is proxied by net annual sales (*SALES*).

Table 2 (Panel A) presents descriptive statistics of the relevant variables in the sample panels. The average cash compensation and total compensation over the seven-year period are $1.2788 and $4.453 million, respectively, and are much higher than the corresponding median values of $0.929 and $2.031 million. The mean of accounting returns is 3.66%, while the mean of stock market returns is 20.12%, and the average amount of sales is $3.537 billion. Consistent with prior literature, accounting returns have lower volatility, as measured by the overall standard deviation, than stock market returns. This is generally consistent with the smoothing effects of accruals.

The pair-wise correlation matrix of the variables is reported in Panel B of Table 2. The highest correlation, as expected, is between *CASHCOMP* and *TOTALCOMP* (0.50). The correlation between *SALES* and *CASHCOMP* (0.41) is also strong and significant, as is that between *SALES* and *TOTALCOMP* (0.28). Both measures of performance, *TRS* and *ROA*, also have a small significant positive univariate association with both measures

Table 2. Descriptive Statistics, and Correlations.

Variables	Mean	S D.	25th Percentile	Median	75th Percentile	Skewness	Kurtosis
Panel A: Descriptive statistics							
CASHCOMP	1.27877	1.26352	0.56300	0.92900	1.52500	3.93	27.11
TOTALCOMP	4.45280	8.68068	1.04129	2.03050	4.58405	9.32	148.43
SALES	3536.78	9777.32	419.61	1020.99	2719.78	10.71	172.02
TRS	20.12	66.52	−15.28	9.07	38.84	4.04	38.14
ROA	3.66	17.00	1.49	4.73	8.81	−11.01	188.82
SALARY%	32.85	23.97	15.23	27.12	44.04	1.11	3.76
BONUS%	19.55	17.37	5.42	16.83	28.67	1.12	4.37
OTHER%	1.18	4.35	0.00	0.00	0.22	6.60	57.94
STOCK%	46.41	28.61	23.83	49.50	69.72	−0.20	1.92

Variables	*CASHCOMP*	*TOTALCOMP*	*SALES*	*TRS*	*ROA*
Panel B: Pair-wise correlations					
CASHCOMP	1.0000				
TOTALCOMP	0.4951	1.0000			
	(0.0000)				
SALES	0.4074	0.2779	1.0000		
	(0.0000)	(0.0000)			
TRS	0.0322	0.0796	−0.0403	1.0000	
	(0.0695)	(0.0000)	(0.0230)		
ROA	0.0841	0.0514	0.0334	0.1161	1.0000
	(0.0000)	(0.0037)	(0.0595)	(0.0000)	

Note: All data are from Standard and Poor's *ExecuComp* database. *CASHCOMP* is cash compensation, in millions of dollars, defined as the sum of salary and bonus. *TOTALCOMP* is cash and non-cash compensation, in millions of dollars. Non-cash compensation includes composed of long-term incentive payouts, the value of restricted stock grants, the value of stock option grants and any other compensation item for the year. *TOTALCOMP* pay includes stock grants (valued at the grant-date market price) and stock options (valued using *ExecuComp*'s modified Black–Scholes formula–*ExecuComp* values options using an ''expected life'' equal to 70% of the actual term. In addition, *ExecuComp* sets volatilities below the 5th percentile or above the 95th percentile to the 5th and 95th percentile volatilities, respectively; similarly, dividend yields above the 95th percentile are reduced to the 95th percentile.) *SALES* is net annual sales, in millions of dollars. *ROA* is return on assets, defined as income before tax, extraordinary items and discontinued operations divided by average total assets. *TRS* is total one-year shareholder return on common stock, defined as the closing price at fiscal year-end plus dividends divided by the closing price of the prior fiscal year-end. *ROA* and *TRS* are deciles. *SALARY%*, *BONUS%*, *OTHER%* and *STOCK%* are the salary, bonus, other, and stock-based compensations as a percentage of total compensation. In a normal distribution, skewness is zero, and excess kurtosis is 3. Correlation coefficients' *p*-values are in parenthesis beneath the estimated correlation coefficients.

of compensation, *CASHCOMP* and *TOTALCOMP*. The pair-wise correlations between *SALES*, *ROA*, and *TRS* are below 0.10, which does not raise multicollinearity concerns. Consistent with previous studies, there is also a positive and significant correlation between stock market returns, *TRS*, and accounting returns, *ROA*, as well as an inconclusive association between *SALES* and both measures of performance.

5. EMPIRICAL RESULTS

This section summarizes the main empirical results of the study. I examined the pay-performance relationship using four alternative models. Two models employ the stock market measure of performance (*TRS*) and the other model use the accounting measure (*ROA*). I also included firm net sales as the proxy for size in all models.

As a starting point, and for comparison purposes, I performed a fixed-effects estimation of cross-section time-series regressions based on *symmetric* specifications of the relationship. Time-specific effects, in the form of yearly dummy variables are included in all the estimated models.

The estimates were obtained using the Within-Group (WG) estimator with cash compensation (*CASHCOMP*) or total compensation (*TOTALCOMP*) as the dependent variable as shown below in models 1–4:[7]

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{1}$$

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{2}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{3}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{4}$$

The results in Table 3 suggest that the statistical performance of the symmetric model is quite satisfactory. The WG estimator yields significant estimated coefficients with correct signs in all cases. The results with respect to size indicate that the relationship between executive compensation (both cash and total) and size is positive and significant, regardless of the measure of performance used.

Table 3. Within-Group Estimates of the Symmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (1)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (2)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta TRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (3)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ \ln(SALES_{it}) + \delta ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (4)

Dependent /Variable Independent Variables	ln $CASHCOMP_{it}$		ln $TOTALCOMP_{it}$	
	Model 1	Model 2	Model 3	Model 4
Constant	5.52170	5.69784	5.52162	5.82190
	(44.11)	(43.60)	(25.97)	(26.60)
ln $SALES_{it}$	0.21012	0.17174	0.33374	0.29092
	(12.25)	(9.58)	(11.46)	(9.69)
TRS_{it}	0.11645		0.11285	
	(11.91)		(6.80)	
ROA_{it}		0.35609		0.42706
		(3.80)		(4.22)
R^2				
within	0.242	0.212	0.226	0.218
overall	0.410	0.387	0.344	0.314
between	0.367	0.339	0.308	0.285
F test (1)	108.27	91.50	99.35	94.84
p-value	0.0000	0.0000	0.0000	0.0000
F test (2)	14.70	14.15	10.16	10.18
p-value	0.0000	0.0000	0.0000	0.0000
Number of observations	3183	3183	3183	3183

Note: Variables are defined as in Table 2, except that the values of *ROA* and *TRS* are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. *t*-statistics are in parenthesis beneath the estimated coefficients. *F* test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. *F* test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

Table 3 reports two *F* tests. The first concerns the null hypothesis that all coefficients except the constant are zero; the second refers to the null hypothesis that the fixed effects are not significantly different from zero. In both cases, and for all the four estimated models, the null hypothesis is soundly rejected. The elasticity of cash compensation with respect to size is approximately 0.21 in Model 1, 0.17 in Model 2, and about 0.29 or higher in the case of total compensation. These estimates are generally in accord with the findings of previous studies. Similarly, the results with respect to performance indicate that the relationship between executive compensation (both cash and total) and performance is also positive and statistically strong. The estimated coefficients of *TRS* and *ROA* are significantly different from zero at any conventional level. The coefficient estimate of *ROA*, however, is more than three times the magnitude of the coefficient estimate of *TRS*. This outcome suggests that in the determination of executive compensation a greater weight is placed on accounting returns than market performance. This result is not uncommon to the literature, and is consistent with risk-sharing concerns, since stock returns are more volatile in the short-run than return on assets. Stock returns vary owing to factors outside the control of the CEO, and hence their use in the compensation contract increases the risk imposed on the executive. Lambert and Larker (1987) demonstrate that firms with less volatile stock returns place greater weight on stock returns when determining compensation.

To avoid potential biases inherent in using either measure alone, I included both measures as explanatory variable. Models 5 and 6 represent such formulation:

$$\ln(CASHCOMP_{it}) = \alpha + \beta\ \ln(SALES_{it}) + \delta_1 TRS_{it} + \delta_2 ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{5}$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta\ \ln(SALES_{it}) + \delta_1 TRS_{it} + \delta_2 ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \tag{6}$$

The estimation results of Models 5 and 6 are reported in Table 4. The estimated coefficients of *TRS* and *ROA* are, again, significantly different from zero at any conventional level, regardless of the fact that the performance measures enter the compensation equation together. As in the earlier results, the coefficient estimate of *ROA* is much larger in magnitude than the coefficient estimate of *TRS*.

Overall, then, the estimation results in Tables 3 and 4 suggest that the symmetric version of the model performs relatively well. What is arguable, however, is whether the estimated coefficients are significant and relevant from the economic viewpoint. In particular, based on the estimates of Models 5 and 6, a one percentage point change in *TRS* results in a change of \$6,985 and \$16,177, respectively, while a similar change in *ROA* shifts the cash and total compensation of the median CEO by \$16,583 and \$52,407, respectively. Sloan (1993) provides evidence consistent with the prediction that firms whose stock prices respond more strongly to non-firm-specific factors place greater weight on accounting earnings in order to shield executives from undue compensation risk.

Table 4. Within-Group Estimates of the Symmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1\ TRS_{it} + \delta_2\ ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (5)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1\ TRS_{it} + \delta_2\ ROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (6)

Dependent Variable (Model)/ Independent Variables	ln $CASHCOMP_{it}$ (Model 5)	ln $TOTALCOMP_{it}$ (Model 6)
Constant	5.65268	5.52162
	(44.04)	(26.07)
ln $SALES_{it}$	0.19156	0.30976
	(10.87)	(10.34)
TRS_{it}	0.11026	0.10485
	(11.20)	(6.26)
ROA_{it}	0.25954	0.33524
	(4.35)	(3.30)
R^2		
within	0.247	0.229
between	0.394	0.328
overall	0.355	0.298
F test (1)	98.98	89.84
p-value	0.0000	0.0000
F test (2)	14.83	10.19
p-value	0.0000	0.0000
Number of observations	3183	3183

Note: Variables are defined as in Table 2, except that the values of *ROA* and *TRS* are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. t-statistics are in parentheses beneath the estimated coefficients. F test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. F test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

The validity of these results relies critically on the maintained hypotheses of symmetry and no adjustment costs. In order to test the symmetry hypothesis, I revised estimation models to include a variable equal to π_{it}, representing *positive* measure of performance, if 1 and zero otherwise. Similarly, I included another variable to represent *negative* measure of performance when $\pi_{it} < 0$. Models (1a)–(4a) represent the changes in specification discussed earlier.

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (1a)$$

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (2a)$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (3a)$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (4a)$$

Both measures of performance are included in Models 5 and 6 while testing the null hypothesis of symmetry. Models (5a) and (6a) are presented below:

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSTRS_{it} + \delta_{22} NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (5a)$$

$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSTRS_{it} + \delta_{22} NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (6a)$$

The results of WG estimates are presented in Table 5. The findings indicate the estimation results of the asymmetric specifications are highly at variance with those presented in Tables 3 and 4.

As in earlier results, the F tests reported in Table 5 soundly reject the null hypotheses that all coefficients except the constant are zero and that the fixed effects are not significantly different from zero. Further, the three R^2 are also not too different from those reported in Tables 3 and 4, with the exception of the R^2 within, which are significantly higher in all the estimated models. This is particularly evident in Models (1a), (2a) and (5a). Since the WG estimator maximizes the R^2 within, this finding alone is an indication of the greater explanatory power of the asymmetric specification. The findings with respect to size are reasonably close, and in some cases almost identical, to those obtained under the symmetry assumption. The results with respect to performance, on the other hand, indicate that there is strong evidence of asymmetric effects.

The sample was modified to exclude new CEOs, i.e., those hired in 1996. The results were basically the same as those reported in Table 5. Furthermore, employing dummy variables for regulated firms and firms' capitalization level did not have any impact on the results reported in Table 5.

Consistent with the findings of a higher R^2 within, the estimated coefficients of *POSTRS*, *NEGTRS*, and *POSROA* are significantly different from

Table 5. Within-Group Estimates of the Asymmetric Model.

$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (1a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (2a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (3a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (4a)
$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (5a)
$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it}$ (6a)

Dependent Variable/Independent Variables:	ln $CASHCOMP_{it}$			ln $TOTALCOMP_{it}$		
	Model 1a	Model 2a	Model 5a	Model 3a	Model 4a	Model 6a
Constant	5.54783	5.59146	5.5482	5.53535	5.74301	5.62000
	(45.21)	(44.72)	(45.72)	(26.07)	(26.42)	(25.91)
ln $SALES_{it}$	0.21810	0.16759	0.19822	0.33793	0.28785	0.31090
	(12.96)	(9.78)	(11.87)	(11.61)	(9.67)	(10.42)
$POSTRS_{it}$	0.04510	—	0.03014	0.07293	—	0.06453
	(3.39)		(2.62)	(3.53)		(3.14)
$NEGTRS_{it}$	0.52871	—	0.45943	0.32952	—	0.25706
	(13.22)		(11.71)	(4.76)		(3.67)
$POSROA_{it}$	—	3.03790	2.59985	—	2.4140	2.07580
		(17.27)	(15.03)		(7.89)	(6.72)
$NEGROA_{it}$	—	−0.06829	−0.19482	—	0.11264	0.02658
		(−1.08)	(−3.14)		(1.02)	(0.24)

R^2:						
within	0.272	0.281	0.329	0.229	0.232	0.242
between	0.412	0.303	0.345	0.336	0.307	0.318
overall	0.377	0.294	0.341	0.304	0.283	0.295
F test (1)	112.72	118.02	120.95	89.77	91.00	78.77
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
F test (2)	15.23	15.90	16.86	10.20	10.44	10.42
p-value	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Number of observations	3183	3183	3183	3183	3183	3183

Note: POSTRS is the same as *TRS when* $TRS>0$ and zero otherwise and *POSROA* is the same as *ROA when* $ROA>0$ and zero otherwise. Likewise, *NEGTRS* is the same as *TRS when* $TRS<0$ and zero otherwise and *NEGROA* is the same as *ROA when* $ROA<0$ and zero otherwise. All other variables are defined as in Table 2, except that the values of are in decimals and not percentages. Year effects (in the form of yearly dummy variables) and a constant are included in all regressions. *t*-statistics are in parenthesis beneath the estimated coefficients. *F* test (1) is a test of the null hypothesis that all explanatory variables including the year effects (except the constant) are jointly not significantly different from zero. *F* test (2) is a test of the null hypothesis that the fixed effects are jointly not significantly different from zero.

zero at any conventional level and in all six estimated models. This provides substantial evidence that the effect of positive performance realization is significantly different from that of negative performance. Further, the Wald test of parameters, reported in Table 6, indicate strong non-linearity condition and the asymmetric influence of positive and negative performance measures. That is, a negative *TRS* is heavily penalized and a positive *TRS* is only mildly rewarded. In contrast, a positive *ROA* is heavily rewarded and a negative *ROA* does not appear to have any significant influence on CEO compensation. A formal test of the hypothesis that *TRS* and *ROA* share the same pattern of asymmetry is soundly rejected by the joint test of parameters as presented in Table 6. For Model (5a) (cash compensation model) the test statistic, with 2 and 2,717 degrees of freedom, yields an F value of 145.06, ($p<0.0000$), while for Model (6a) (total compensation model) the value of the F statistics, with 2 and 2,717 degrees of freedom, is 16.27 ($p<0.0000$).

This asymmetric structure is evident in both cash and total compensation regressions. Additionally, my results indicate that both performance measures have effects on executive compensation levels that are economically significant. In particular, based on the estimates of Models (5a) and (6a), for the median CEO the effect of a one percentage point change in positive *TRS* realizations on cash and total compensation is $1,875 and $9,902, respectively, while the effect of a similar change in negative *TRS* results in cash and total compensation declines of $28,755 and $39,464, respectively. Conversely, a one percentage point change in positive *ROA* realizations translates in a median change of cash and total compensation equal to $180,584 and $347,654, respectively, whereas a change in negative *ROA* realizations does not have any significant effects on either measure of compensation.

In short, by accounting for asymmetry, the economic significance of the relationship between executive compensation and performance is much greater than what is suggested by the analysis that ignores asymmetry. While theory is largely silent on the size of the incentives that would be optimal from the standpoint of the shareholders, these results indicate that American CEOs in the late 1990s and early 2000s had much more to gain from improving accounting returns than from improving market returns.

Alternatively, this evidence suggests that risk preferences may not be invariant to incentives. Executive compensation contracts may be constructed to encourage risk-taking behavior in accounting performance, as executive compensation is relatively shielded from negative *ROA* realizations, while at the same time compensation contracts may strengthen risk-averting behavior in market performance, as executive compensation is not insulated from negative *TRS* realizations. This incentive structure may also motivate

Table 6. Estimates of Asymmetric Performance Effects Wald Test.

$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (1a)$$
$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (2a)$$
$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSTRS_{it} + \delta_2 NEGTRS_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (3a)$$
$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_1 POSROA_{it} + \delta_2 NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (4a)$$
$$\ln(CASHCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (5a)$$
$$\ln(TOTALCOMP_{it}) = \alpha + \beta \ln(SALES_{it}) + \delta_{11} POSTRS_{it} + \delta_{12} NEGTRS_{it} + \delta_{21} POSROA_{it} + \delta_{22} NEGROA_{it} + \gamma DUMYEAR_t + \varepsilon_{it} \quad (6a)$$

Dependent Variable:	ln $CASHCOMP_{it}$			ln $TOTALCOMP_{it}$		
	Model 1a	Model 2a	Model 5a	Model 3a	Model 4a	Model 6a
Panel A: $\delta\_1 - \delta\_2$						
TRS, F (1, 2717)	112.77	—	91.89	10.41	—	5.79
Prob > F	(0.0000)		(0.0000)	(0.0013)		(0.0162)
ROA, F (1, 2717)	—	260.40	222.15	—	47.31	37.41
Prob > F		(0.0000)	(0.0000)		(0.0000)	(0.0000)
Panel B: Joint Tests						
$\delta_{11} - \delta_{12}$ and $\delta_{21} - \delta_{22}$	—	—	145.06	—	—	22.34
F (2, 2717); Prob > F			(0.0000)			(0.0000)

Note: Variables are defined as in Table 2.

unintended and unanticipated effects. For instance, it may result in too much risk-taking or it may shorten the time horizon used to make decisions. Among other things, however, this asymmetric structure of incentives appears to be consistent with and may help explain the increased number of mergers and acquisitions that occurred in the late 1990s.

A comparison between these estimates and those presented earlier clearly indicates that imposing the assumption of symmetry results in substantial specification bias. Interestingly, the bias appears to operate in opposite directions. The estimates in Tables 3 and 4 underestimate the impact of a positive *ROA* and overestimate the impact of a negative *ROA*. Conversely, they overestimate the impact of a positive *TRS* realization and underestimate the impact of a negative *TRS* realization. It is thus quite evident that the structure of asymmetry present in *TRS* does not mirror the structure of asymmetry present in *ROA*, as asymmetry is concave in *ROA* and convex in *TRS*.

In summary, evidence provided by estimates of the asymmetric version of the executive compensation model lends strong support in favor of the main hypotheses: (a) performance has non-linear asymmetric effects on executive compensation; and (b) alternate measures of performance display different patterns of asymmetry and non-linearity. Further, it suggests that modeling executive compensation as a symmetric performance process leads to a statistically mis-specified model and fails to resolve the compensation anomalies first noticed by Jensen and Murphy (1990).

6. SUMMARY AND CONCLUDING REMARKS

In this study, an empirical model to assess the importance of asymmetries in executive compensation contracts was presented. This issue is for the most part an unexplored area of agency theory. However, the empirical results of this study provide a great deal of evidence suggesting that ignoring them leads to serious misspecifications. It was also shown that these issues are important because they offer an answer as to why in the current literature the estimates of the effects of performance on executive compensation appear to be too small to have any economic significance.

Consistent with previous studies, the response of executive compensation to accounting returns is much stronger than the response to shareholder returns. While theory offers little guidance to the size of the incentives that would be optimal from the standpoint of the shareholders, the strength of the relationship indicates that in the late 1990s and early 2000s American CEOs had much more to gain from improving accounting returns than from improving market returns. Second, strong evidence of asymmetry and non-linearity in the relationship between executive compensation and firm performance is observed. Jensen and Murphy (1990) argue that the effects of performance on executive compensation are too low to be consistent with formal agency theory. The asymmetric specification of the executive compensation model offers a resolution about such concerns, as the results indicate that the performance measures have effects on executive compensation levels that are not only statistically significant but also economically meaningful. Thus, ignoring such asymmetries can lead to results that substantially understate the economic significance of the relationship between executive compensation and performance. Third, the results indicate that the structure of asymmetry is not invariant to the measures of performance. In fact, convexity appears to dominate the asymmetry of the relationship between executive compensation and market returns, while concavity is the main feature that characterizes the asymmetry of the relationship between executive compensation and accounting returns. Negative market returns are heavily penalized while positive market returns are only mildly rewarded. Conversely, positive accounting returns are heavily rewarded, while negative accounting returns are not penalized at all.

An apparently dualistic view of firm performance emerges from the results of this study. Performance is viewed as good, and rewarded as such, when positive realizations in accounting returns are obtained, whereas performance is deemed poor, and penalized as such, when negative realizations in stock market returns occur. Consequently, when performance is judged in terms of accounting returns, good performance is rewarded more than poor performance is penalized. Conversely, when performance is judged in terms of market returns, poor performance is penalized more than good performance is rewarded. This evidence, in turn, seems to suggest that risk preferences may not be invariant to incentives. Executive compensation contracts may be constructed to encourage a risk-taking behavior in accounting-based performance, as executive compensation is relatively shielded from negative accounting returns realizations, and, at the same time, to strengthen a risk-averting behavior in market-based performance, as executive compensation is not insulated from negative stock market realizations. This conjecture is consistent with agency theory, as executives are more likely to understand the drivers of accounting-based returns than to recognize the factors that can explain stock prices.

Inferences from this empirical study may be bounded by the temporal context in which it is embedded. The late 1990s have been a singular time in America's corporate history. The panel nature of the data makes the findings more robust; however, the economic outlook of the late 1990s may be fundamentally different from the one-facing firms now or in the future. Consequently, future research will be needed to determine to the extent to which these results can be generalized in periods of different economic prospects. On the whole, however, the findings in this study help provide a better understanding of the nature of the relationship between firm performance and executive compensation, and indicate that the relationship between executive compensation and performance is far more complex and multifaceted than the vast majority of previous studies have described.

NOTES

1. For a review of the theoretical and empirical research on the subject, see Murphy (1999) and Rosen (1992).
2. Beginning with fiscal year 1993, companies have been required by the SEC to annually report individual salary, bonus, other annual compensation, restricted stock grants, long-term incentives payouts, stock option grants, and all other compensation for the top five paid executives.
3. Elasticity compares the percentage change of one variable x with the percentage change of the other variable y ($\mathrm{dln}(y)/\mathrm{dln}(x)$). Semi-elasticity, on the other hand, compares the level change in one variable x with the percentage change of the second variable ($\mathrm{dln}(y)/\mathrm{d}x$).
4. The sample has a mean market capitalization of $5.53 billions, and a median of $1.25 billions. 48 firms have a market capitalization above $10 billion, 66 firms with capitalization of $4–$10 billion, 152 firms with capitalization of $1–$4 billion, and 189 firms have a market capitalization below $1 billion.
5. The sample consists of 149 S & P 500 firms, 118 Mid-Cap, and 133 Small-Cap firms. Fifty-five firms did not have S & P classification.
6. *ExecuComp*'s modified Black–Scholes formula – *ExecComp* values options using an ''expected life'' equal to 70% of the actual term. In addition, *ExecComp* sets volatilities below the 5th percentile or above the 95th percentile to the 5th and 95th percentile volatilities, respectively; similarly, dividend yields above the 95th percentile are reduced to the 95th percentile.
7. Each model was also estimated using ordinary least-squares (OLS) and random effects (RE) estimators. These estimates, however, are not reported because (a) the Lagrangian multiplier test (Greene, 2003) rejects the OLS model, and (b) the Hausman test (Baltagi, 2001) rejects the random effects model at any conventional level.

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REFERENCES

Abowd, J. M. (1990). Does performance-based managerial compensation affect corporate performance? *Industrial and Labor Relations Review*, *43*(suppl.), 52–73.

Baber, W. R., Janakiraman, S. N., & Kang, S. H. (1996). Investment opportunities and the structure of executive compensation. *Journal of Accounting and Economics*, *21*, 297–318.

Baltagi, B. H. (2001). *Econometric analysis of panel data*. Chichester, NY: Wiley.

Bebchuk, L. A., & Fried, J. M. (2003). Executive compensation as an agency problem. *Journal of Economic Perspectives*, *17*, 71–92.

Bertrand, M., & Mullainathan, S. (2000). Agent with and without principals. *The American Economic Review*, *90*, 203–208.

Black, F., & Scholes, M. (1973). The pricing of options and corporate liabilities. *Journal of Political Economy*, *81*, 637–654.

Boschen, J. F., Duru, A., Gordon, L. A., & Smith, K. J. (2003). Accounting and stock price performance in dynamic CEO compensation arrangements. *The Accounting Review*, *78*, 143–168.

Boschen, J. F., & Smith, K. J. (1995). You can pay me now and you can pay me later: The dynamic response of executive compensation to firm performance. *Journal of Business*, *68*, 577–608.

Carpenter, M. A., & Sanders, W. G. (2002). Top management team compensation: The missing link between CEO pay and firm performance. *Strategic Management Journal*, *23*, 367–375.

Ciscel, D. H., & Carroll, T. M. (1980). The determinants of executive salaries: An economic survey. *The Review of Economics and Statistics*, *62*, 7–13.

Conyon, M. J., Peck, S. I., & Sadler, G. (2000). Econometric modeling of UK executive compensation. *Managerial Finance*, *26*, 3–20.

Cordeiro, J. J., & Veliyath, R. (2003). Beyond pay for performance: A panel study of the determinants of CEO compensation. *American Business Review*, *21*, 56–66.

Core, J. E., Guay, W. R., & Verrecchia, R. E. (2003). Price versus non-price performance measures in optimal CEO compensation contracts. *The Accounting Review*, *78*, 957–981.

Coughlan, A., & Schmidt, R. (1985). Executive compensation, management turnover and firm performance. *Journal of Accounting and Economics*, *7*, 43–66.

Crystal, G. S. (1991). *In search of excess: The overcompensation of American executives*. New York: W.W. Norton.

Dechow, P. M., Huson, M. R., & Sloan, R. G. (1994). The effect of restructuring charges on executives cash compensation. *The Accounting Review*, *69*, 138–156.

Ely, K. (1991). Interindustry differences in the relation between compensation and firm performance. *Journal of Accounting Research*, *29*, 37–58.

Gaver, J. J., & Gaver, K. M. (1998). The relation between nonrecurring accounting transactions and CEO cash compensation. *The Accounting Review*, *73*, 235–253.

Greene, W. (2003). *Econometric Analysis*. Englewood, CO: Prentice-Hall.

Healy, P. (1985). The effect of bonus schemes on accounting decisions. *Journal of Accounting and Economics*, *7*, 85–107.

Holmstrom, B. (1979). Moral hazard and observability. *The Bell Journal of Economics*, *10*, 74–91.

Indjejikian, R. J., & Nanda, D. (2002). Executive target bonuses and what they imply about performance standards. *The Accounting Review*, *77*, 793–819.

Jensen, M. C., & Murphy, K. J. (1990). Performance pay and top-management incentives. *Journal of Political Economy*, *98*, 225–264.

Joskow, P. L., & Rose, N. L. (1994). *CEO pay and firm performance: Dynamics, asymmetries, and alternative performance measures*. NBER Working Paper no. 4976, Cambridge, MA.

Kaplan, S. (1994). Top executive rewards and firm performance: A comparison of Japan and the US. *Journal of Political Economy*, *102*, 510–546.

Lambert, R. A. (2001). Contracting theory and accounting. *Journal of Accounting and Economics*, *32*, 3–87.

Lambert, R. A., & Larker, D. F. (1987). An analysis of use of accounting and market measures of performance in executive compensation contracts. *Journal of Accounting Research*, *25*(suppl), 85–125.

Lewellen, W. G., & Huntsman, B. (1970). Managerial pay and corporate performance. *The American Economic Review*, *60*, 710–720.

Main, B., Bruce, A., & Buck, T. (1996). Total board remuneration and company performance. *The Economic Journal*, *106*, 1627–1644.

Mishra, C. S., Gobeli, D. H., & May, D. O. (2000). The effectiveness of long-term accounting-based incentive plans. *Journal of Managerial Issues*, *12*, 48–60.

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

Murphy, K. J. (1986). Incentives, learning and compensation: A theoretical and empirical investigation of managerial labor contracts. *The Rand Journal of Economics*, *17*, 59–76.

Murphy, K. J. (1999). Executive compensation. In: O. Ashenfelter & D. Card, (Eds), *Handbook of labor economics* (Vol. 3). Amsterdam, Holland: North-Holland.

Rich, J. T., & Larson, J. A. (1984). Why some long-term incentives fail? *Compensation Review*, *16*, 26–37.

Rosen, S. (1992). Contracts and the market for executives. In: L. Werin & H. Wijkander (Eds), *Contract economics*. Oxford, UK: Basil Blackwell.

Sloan, R. G. (1993). Accounting earnings and top executive compensation. *Journal of Accounting and Economics*, *16*, 55–100.

Standard & Poor's (2004). *S&P compustat execucomp: The executive compensation database*. Englewood, CO: McGraw-Hill.

Yermack, D. (1995). Do corporations award stock options effectively? *Journal of Financial Economics*, *39*, 237–269.