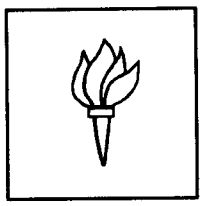

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Abstract

This paper analyzes stock option awards to CEOs of 792 U.S. public corporations between 1984 and 1991. Using a Black-Scholes approach, I test whether stock options' performance incentives have significant associations with explanatory variables related to agency cost reduction. Further tests examine whether the mix of compensation between stock options and cash pay can be explained by corporate liquidity, tax status, or earnings management. Results indicate that few agency or financial contracting theories have explanatory power for patterns of CEO stock option awards, a finding in accord with others' conclusions that CEO pay arrangements do not reflect well the normative predictions of compensation theorists.

Do Corporations Award CEO Stock Options Effectively?

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1. Introduction

The enormous growth in top U.S. executives' compensation during the last decade has resulted largely from stock option awards. Figure 1 illustrates average compensation levels for chief executive officers in a panel of 792 major corporations assembled for this study. Stock option awards, valued as of the date of grant with the Black-Scholes (1973) methodology, represented approximately one-third of CEO compensation in 1990 and 1991, up from one-fifth in 1984. While other forms of incentive compensation also increased during this period, the chart indicates that stock options accounted for the large majority of CEOs' income from contingent instruments.

This explosive rise in stock option awards has led to criticism in the popular media (see Crystal, 1991) and prompted requirements from government agencies for greater disclosure of executive compensation data (see Securities and Exchange Commission, 1992, and proposals in Financial Accounting Standards Board, 1993). However, financial economists have reached few

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firm conclusions about whether corporations award stock options in accord with theories of financial contracting and agency cost reduction. Table 1 lists nine previous studies of associations between executive stock option awards and different explanatory variables.[1] As shown by the table, the findings of these studies do not always agree, and differences in time periods, sample selection, and methodology make their results difficult to compare.

This paper extends the prior literature by studying stock option awards to CEOs of large U.S. public corporations between 1984 and 1991. Using a sample of nearly 6,000 CEO-year observations from all industries, I conduct tests of nine leading theories of why companies award stock options to their top managers. By examining a wide range of hypotheses, I hope to offer a more complete explanation of CEO stock option awards than prior studies, most of which have focused on a small number of theories and treated stock options as a minor part of a broader investigation. While Matsunaga (1994) stands out as an exception to this pattern, his company-level data does not permit analysis of how the option award process is affected by individual executives' characteristics such as age, stock ownership, and tenure.

Along with results for a comprehensive set of explanatory variables and a large, recent data set, this study contributes to the literature a new dependent variable for measuring the performance incentives provided by stock option awards. Prior investigators have struggled with the problem of finding an appropriate variable for this purpose. Eaton and Rosen (1983) and Lewellen et. al. (1987) study the mix of pay between options and other compensation, but they

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[1] Other papers have considered more limited questions related to executive stock options, such as how investors react when corporations announce the intention to adopt stock option plans (Brickley et. al., 1985, and DeFusco et. al., 1990) and whether stock option award activity increases in the aftermath of market-wide stock price declines (Saly, 1993).

value stock option awards not with the modern Black-Scholes approach but instead with an ex-post measure of the paper gains earned by executives. Murphy (1985) and Matsunaga (1994) use the Black-Scholes formula to measure the level of pay received from stock options, but they do not consider the degree of sensitivity between changes in award values and changes in the value of the firm. Smith and Watts (1992), Gaver and Gaver (1992), and Kole (1993) restrict their research to binary (0, 1) variables indicating whether firms have adopted stock option plans, without taking account of the frequency or size of awards under those plans. Only Jensen and Murphy (1990) and Bizjak et. al. (1992) measure incentives by estimating how executive stock option award values are influenced by changes in firm value, but each of these wide-ranging papers devotes only a small amount of space to the issue.

To estimate the pay-performance incentives from stock options, I use a dependent variable based upon the Black-Scholes formula's partial derivative with respect to stock price, times the fraction of a firm's equity represented by each CEO stock option award. In addition, I use an econometric framework which includes maximum likelihood Tobit estimation, and I incorporate firm effects into my models to control for omitted variable bias. All prior studies with continuous dependent variables have relied on ordinary least squares estimations, although a Tobit approach seems more appropriate for the truncated distribution of stock option award data with its large number of zero-valued observations. Controls for omitted variables are absent from all previous studies except Murphy (1985), who allows regression intercepts to vary for each executive.[2]

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[2] Matsunaga (1994) discusses having estimated both Tobit models and regressions with firm-specific intercepts, but he does not report results of either.

My results presented below indicate that few theories based in the agency or financial contracting literature have explanatory power for patterns of CEO stock option awards. I test nine hypotheses advanced by compensation theorists but find support for only two propositions: that companies in highly regulated industries use stock options less intensely as a source of managerial incentives, and that corporations shift the mix of executive pay away from cash salaries and bonuses and toward stock options when faced with internal liquidity problems. Additional hypotheses not supported by my results include conjectures that corporations provide greater incentives from stock options for executives who hold low fractions of their firms' equity; that CEOs nearing retirement receive greater incentives from stock options to motivate them to maintain high levels of investment spending; that firms provide greater incentives from stock options when accounting earnings contain large amounts of "noise," making managers difficult to monitor; that incentives from stock options decrease in highly levered firms due to the agency costs of debt; that corporations with low marginal tax rates pay a greater proportion of executive compensation in stock options; and that stock options are used as substitutes for cash compensation when implicit costs are high of reporting low accounting earnings.

The remainder of this paper is organized as follows. Section 2 discusses theories of why corporations award executive stock options and develops specific hypotheses for testing. Section 3 describes the sample selection and data used in this study. Section 4 discusses the estimation approach, including specification of the dependent variables and the choice of Tobit maximum likelihood framework. Section 5 presents results of the estimations. Section 6 contains a discussion and conclusions.

2. Theories and Hypotheses

This paper's major hypothesis is that boards of directors use stock options to increase CEOs' pay-performance sensitivities when expected agency costs are high. Further hypotheses are that stock option awards are influenced by considerations of financial liquidity, tax reduction, and implicit financial reporting costs. The following paragraphs present specific theories related to stock option awards and describe variables used to test each theory. Six hypotheses are rooted in agency theory and make predictions about the incentive-intensity of compensation. The other three hypotheses, related to the financial variables of liquidity, tax status, and earnings management, concern not the incentive power but rather the mix of compensation between options and cash salaries and bonuses.[3] I therefore define separate dependent variables in Section 4.1 below for testing the two groups of theories.

2.1. Alignment of CEO Wealth and Stockholder Returns

Theorists have long identified low levels of managerial stock ownership as a symptom of corporate agency problems. Berle and Means (1932) and Jensen and Meckling (1976) represent the most influential presentations of this idea, which has led many theorists to argue that CEO compensation contracts should take account of executives' personal stock ownership. CEOs with the smallest holdings of their companies' stock therefore appear to be the best candidates for

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[3] More precisely, the theories relate to the mix between stock option and all other compensation (the earnings management and tax reduction hypotheses) and the mix between all stock-based plus deferred compensation and current-period cash compensation (the liquidity hypothesis). Because stock options account for the overwhelming majority of stock-based and deferred compensation for most CEOs (see Figure 1), and because of the difficulties in assigning current-period values to many contingent pay instruments, I limit my empirical predictions about compensation mix to conjectures about the value of stock option awards compared to straight cash pay.

stock option awards providing large incentives. This conjecture leads to the hypothesis:

> *H1: Incentives provided by stock option awards will have a negative association with the fraction of their own firms' equity held by CEOs.*

This hypothesis is clouded an implicit assumption that CEOs exogenously choose personal stock ownership positions without regard to their firms' compensation policies. If CEO stock ownership represents an endogenous outcome of the contracting process, it may prove difficult to detect an inverse association between stock ownership and stock option awards.

2.2. *Horizon Problem of CEOs Nearing Retirement*

The "horizon problem" hypothesis predicts that CEOs nearing retirement will forego valuable research & development and investment projects, because incentive plans based on accounting data will penalize current CEOs and reward only their successors for the results of such spending. See Smith and Watts (1982), Dechow and Sloan (1991), and Murphy and Zimmerman (1993). This literature predicts that corporations could counteract the horizon problem by using more stock-based compensation for older CEOs, who would thereby receive incentives to maximize firm value so long as they believed that investors capitalized the expected returns of new investments. This leads to the hypothesis:

> *H2: Incentives provided by stock option awards will have a positive association with expected CEO retirements, as approximated by CEOs' ages.*

2.3. *Nature of Firms' Assets*

In companies with large "growth opportunities," as defined by Myers (1977) and Smith and Watts (1992), expected profits from future investments represent a significant portion of firm

value. Numerous studies of investment decisions (e.g. Holmström and Ricart i Costa, 1986, Smith and Watts, 1992, and Bizjak, Brickley and Coles, 1993) assume that managers hold private information about the value of growth opportunities. A further hypothesis is that as this information asymmetry grows, boards of directors have greater difficulty evaluating managers' success at choosing among investments. Therefore, companies with large growth opportunities should provide managers with more incentives from stock-based compensation, using these market-based pay mechanisms in place of salary and bonus revisions based upon direct monitoring.

To test this theory empirically, I require a variable to serve as a proxy for the presence of growth opportunities. Following Smith and Watts (1992), Bizjak, Brickley and Coles (1993), Gaver and Gaver (1993) and Kole (1993), I use an approximation of the ratio of market to book values of firms' assets for this purpose. I define a variable approximately equal to Tobin's Q by adding together the book value of assets and the difference between the market and book values of common stock, and dividing the total by the book value of assets:

$$Q \approx \frac{\textit{Total Assets (Book Value)} + \textit{Common Stock (Market Value - Book Value)}}{\textit{Total Assets (Book Value)}} \qquad \textbf{(1)}$$

I use this variable to test the hypothesis:

H3: Incentives provided by stock option awards will be larger in firms with valuable growth opportunities, as approximated by Tobin's Q.

2.4. Noisiness of Accounting Data

When boards of directors have difficulty obtaining clear signals of the quality of

managers' decisions, they cannot make reliable decisions about revising managers' cash salaries and bonuses. Stock-based compensation offers an alternative to salary revisions based upon direct monitoring in these types of firms. Lambert and Larcker (1987) analyze this problem by assuming that boards of directors receive information about CEO performance from both stock market returns and accounting earnings. They argue that CEO compensation should be tied more closely to the performance variable with the greater "signal-to-noise ratio." Following their model, I define a variable equal to the relative noisiness of accounting returns compared to stock returns. I calculate annual changes in return on equity (compounded continuously) for each firm and take the time series variance of this variable during the 1984-91 sample period. I divide this statistic by the variance of stockholders' returns over the same period. I expect that a high noisiness of accounting returns relative to stock returns will cause firms to rely more heavily on stock-based incentives, leading to the hypothesis:

> *H4: Incentives provided by stock option awards will be higher when accounting returns contain a large amount of relative noise, measured as the time series variance of changes in return on equity divided by the time series variance of stockholders' returns.*

2.5. *Agency Costs of Debt*

John and John (1993) analyze the interplay between firms' choices of compensation policy and capital structure. If managers have strong incentives to maximize the value of equity, the authors argue, debt holders will demand higher risk premia for supplying capital, out of fear that managers will pursue overly risky investment projects which transfer wealth from debt holders to equity holders. John and John present a model in which equity holders find it optimal to lower the pay-performance sensitivity of managers as leverage increases in order to reduce

these expected agency costs of debt. They predict that cross-sectional data will reveal an inverse association between leverage and the intensity of managers' incentives. Therefore I include in my model the book-value ratio of firms' total debt over total assets and use the variable to test the hypothesis:

> *H5: Incentives provided by stock option awards will decrease as financial leverage increases, reflecting attempts by firms to reduce expected agency costs of debt.*

2.6. Incentives in Regulated Industries

Numerous theorists (e.g. Demsetz and Lehn, 1985, and Smith and Watts, 1992) predict that executives in highly regulated industries will receive lower incentives from compensation or equity ownership, since the reduced range of managerial discretion in these industries diminishes the consequences of good or bad decision-making. Smith and Watts identify the utility, banking, and insurance industries as heavily regulated. I therefore expect that when industry dummy variables are included in regression models, their coefficients will indicate reduced levels of incentives from stock option awards:

> *H6: CEOs in highly regulated industries will receive lower incentives from stock option awards.*

2.7. Liquidity Constraints

Apart from their role in providing incentives, stock options offer companies a method for economizing cash. Since stock options represent "cashless" compensation (executives usually pay cash *into* their companies when exercising options), one should observe firms substituting stock option awards for straight salary in CEO pay packages when faced with a scarcity of cash.

Following Fazzari, Hubbard, and Petersen (1988), I attempt to identify companies facing liquidity constraints with a dummy variable equal to one if a firm pays zero dividends to its common stockholders during the last quarter of the year. For firms not following quarterly schedules, this variable equals one if no dividends are paid during the year. I test the hypothesis:

> *H7: Companies paying zero dividends should deliver a greater fraction of CEO compensation in the form of stock options.*

Tests of this hypothesis must be interpreted with caution, however, since Black-Scholes values of stock options rise as companies' dividend rates decrease.

2.8. Tax Reduction

Stock options offer tax advantages to executives, since they generally do not result in taxable income until the year of exercise or later, and often this income is taxed at capital gains rates. For corporations, however, stock option awards might be more costly from a tax standpoint than other compensation which immediately reduces taxable income. See Scholes and Wolfson (1992). The possibilities for using stock options to achieve net tax savings between a corporation and its managers motivated much of the early research on executive stock options (e.g. Holland and Lewellen, 1962). However, nearly all of this research analyzes economy-wide changes in the use of stock options in response to modifications of the federal tax code.

To test for cross-sectional differences, I require some variable to proxy for the marginal tax rates faced by different companies. I follow Clinch (1991) and others by using a dummy variable set equal to one when firms have nonzero tax loss carry-forwards. Since corporations generally have lower marginal tax rates in these situations, I conjecture that the relative

attractiveness of stock options to other forms of compensation will be greatest. I use this variable to test the hypothesis:

> *H8: Firms with tax loss carry-forwards should provide a greater fraction of CEO compensation in the form of stock options.*

2.9. Financial Reporting Costs

When reporting low levels of accounting earnings, corporations face implicit costs ranging from stockholder dissatisfaction to the violation of bond covenants. Because most types of executive stock options do not result in an expense against income, companies facing large financial reporting costs might use stock options as an instrument of "earnings management" by shifting the mix of CEO compensation toward options and away from such deductible items as cash salaries and bonuses. Matsunaga, Shevlin and Shores (1992) identify interest coverage as a common proxy used to suggest the presence of large financial reporting costs, since firms with low interest coverage may have low profitability and high risks of violating debt covenants. I adopt this variable and test the hypothesis:

> *H9: Firms with low interest coverage should provide a greater fraction of CEO compensation in the form of stock options.*

3. Data Description

The estimations presented below rely upon a data set tracking the compensation of CEOs in 792 U.S. corporations between 1984 and 1991. The panel is intended to represent the most important public companies in the U.S. during the sample period. To qualify, a company had to appear at least four times between 1984 and 1991 in *Forbes* magazine's ranking of the 500

largest U.S. corporations in any of the categories of sales, assets, net income, or market capitalization, as well as have its common stock trade publicly on a U.S. exchange for at least four consecutive full fiscal years in the period. While this screening process tends to favor large firms and impose some ex-post survivorship bias upon the sample, the restrictions are less severe than those for similar studies using panel data and still permit a great deal of cross-sectional variation in the characteristics of the 792 firms qualifying for the sample. I collect data for every full fiscal year for which a company's stock traded between 1984 and 1991, even if it did not qualify for the *Forbes* rankings each year. The resulting panel has 5,955 observations, with annual sample sizes ranging between 704 and 778.[4]

Each observation includes information about CEO compensation, equity ownership, age, and tenure, as well as company stock market performance and financial statement data. Stock market data were obtained from CRSP. Compustat provided financial statement data for most observations, and data was hand collected for a small number of companies. Corporations' proxy statements and Forms 10-K provided the main sources of compensation and stock ownership data; necessary information from these documents was obtained for all but 29 of the 5,955 observations. However, some firms engaged in vague or incomplete reporting of CEO compensation and stock ownership data and refused to clarify information when contacted by the

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[4] The year in which the final month of the fiscal year lies determines its placement in the sample. Thus a fiscal year from June, 1984, to May, 1985, appears as an observation for 1985. In 26 cases involving 24 firms, companies changed their fiscal years, resulting in observations for periods which are not 12 months long. In these cases, "flow" variables of sales, net income, and salary and bonus compensation are normalized to a 12-month period. Results below are insensitive to the deletion of this small group of observations. When fiscal years end close to but not exactly on the last day of a month, the difference is ignored when computing stock returns.

author.[5] As a result of these problems and occasional unreported items in financial statements, missing values occurred for approximately 4% of observations used in the analysis. Table 2 presents characteristics of all observations, including mean levels of sales, assets, net income, capitalization, and stock performance for each sample year, and also industry membership.

4. Estimation Framework

The following sections develop a framework for regression models of stock option awards. Section 4.1 discusses specification of the dependent variables, and Section 4.2 lists the explanatory variables. Section 4.3 motivates a Tobit estimation approach. Section 4.4 describes a method for controlling for omitted "firm effects."

4.1. Specification of Dependent Variables

Dependent variables in the models below are based upon the Black-Scholes formula for valuing European call options, as modified by Merton (1973) to account for dividend payments:

$$Award\ Value = N\ [P\, e^{-dT} \Phi\ (Z)\ -\ E\, e^{-rT} \Phi\ (Z - \sigma \sqrt{T})] \qquad (2)$$

where

$$Z = [\ln (P/E) + T (r - d + \frac{\sigma^2}{2})]\ /\ \sigma \sqrt{T} \qquad (3)$$

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[5] A common problems concerned aggregation of stock option awards into three- or five-year totals. Many companies also reported stock option awards for periods slightly longer than one year (usually from the start of the prior year through the date of the proxy statement, two to three months past the end of the year). Unless evidence indicated otherwise, I assumed that all data reported in this manner related to the fiscal year embraced by the reporting period.

Φ = cumulative probability function for normal distribution
N = number of shares covered by award
E = exercise price
P = price of underlying stock
T = time to expiration
r = risk-free interest rate
d = expected dividend rate over life of option
σ = expected stock return volatility over life of option

The Black-Scholes approach has limitations for executive stock options since they cannot be sold into an open market, and since such "perfect markets" assumptions as zero transaction costs and the ability to sell short one's own stock are violated by legal and institutional restrictions. However, using the Black-Scholes equation seems far more descriptive of options' value than the approaches of some prior studies which have examined the ex-post paper gains earned by executives. Moreover, the Black-Scholes approach has received an implicit endorsement for executive stock options in disclosure requirements promulgated by SEC (1992) and proposed by FASB (1993).

To test agency-based theories of when firms use stock options to increase CEOs' incentives, I follow the analytical framework of Jensen and Murphy (1990) by estimating the "pay-performance sensitivity" generated by new awards of stock options. Jensen and Murphy define pay-performance sensitivity as the change in CEO wealth per dollar change in the wealth of stockholders. For a stock option award, an estimate of pay-performance sensitivity is available from the product of two terms: the Black-Scholes formula's partial derivative with respect to stock price, times the fraction of equity represented by the award:

$$\textit{Pay-Performance Sensitivity} \approx \Delta \cdot \left(\frac{\textit{shares represented by option award}}{\textit{shares outstanding at start of year}} \right) \qquad (4)$$

where

$$\Delta = \frac{\partial\,(\textit{Black-Scholes value})}{\partial P} = e^{-dT}\,\Phi\left(\frac{\ln(P/E) + T\left(r - d + \left(\frac{\sigma^2}{2}\right)\right)}{\sigma\sqrt{T}}\right) \qquad (5)$$

This quantity provides an estimate of the change in the value of a CEO's stock option award for every dollar change in the value of a firm's common equity. The partial derivative Δ is the well-known "hedge ratio" used in Black-Scholes applications. My estimates of the Black-Scholes parameters use the following assumptions:

P = price of the underlying stock at time of award. Before 1993 firms rarely reported the date of stock option awards, making it impossible to observe P. Therefore, I assume P equals E, the exercise price of the options, because firms almost universally set exercise price equal to current stock price (see, e.g., Murphy, 1985, and Smith and Zimmerman, 1976).

d = ln(1+dividend rate), with dividend rate ordinarily defined as the last dividend paid during the fiscal year, multiplied by four, divided by the year-end stock price. When companies do not pay dividends quarterly, this variable is based on the sum of the entire year's dividends.

r = ln(1+interest rate), where interest rate is defined as the yield on ten-year U.S. Treasury bonds during the last month of the fiscal year.

T = life of options (in years), set equal to the longest period for which options may be granted according to a firm's most recently approved plan. If the maximum duration is not reported, I set the options' life equal to ten years, the duration for an overwhelming majority of awards and the limit imposed by the IRS for options to receive favorable tax treatment (see Matsunaga, 1994).

σ = annualized volatility, estimated as the square root of the sample variance of daily logarithmic stock returns during the last 120 trading days of the fiscal year, multiplied by 254, the number of trading days in a typical year.[6]

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[6] I checked the importance of the choice of a 120-estimation period by re-estimating volatility using ten years (or 2,540 days) of trading data; very little change occurred in regression estimates reported below.

I limit the valuation to new stock options, ignoring adjustments to existing options such as re-pricing or "reload" options.[7] I include schemes providing for stock appreciation rights. I do not include plans which impose serious restrictions before stock options become exercisable, such as requiring the company to meet performance goals.

In addition to hypotheses based on incentive theories, I also seek to test financial contracting hypotheses related to the mix of compensation between stock options and cash salaries and bonuses. For this purpose, I use the ratio of the Black-Scholes value of stock option awards divided by the cash value of salaries and bonuses.

4.2. Functional Form of Explanatory Variables

Table 3 lists the dependent and explanatory variables used in regression models and provides descriptive statistics. The principal explanatory variables are described in Section 2, while the dependent variables are defined in Section 4.1. The definitions of most variables are straightforward. In calculating the percentage of equity owned by the CEO, I exclude shares held contingently (such as previously awarded options) as well as shares owned beneficially from which the CEO derives no economic benefit (such as those owned by a charitable foundation for which the CEO serves as a trustee). I calculate interest coverage as the ratio of income available for interest payments (Compustat item AFI) divided by interest expense (Compustat item XINT).

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[7] When a company has two or more CEOs during a year, I report data for the longest-serving CEO, although any stock option awards received by him may have occurred before his promotion. Deleting from the sample CEOs who do not serve full 12-month years (approximately 9% of the sample) results in very little change in regression estimates.

Re-pricing of existing stock options appeared to be an insignificant problem within the data set. Only about 1.5% of the firms reported changing the terms of previously awarded options in a given year. This low incidence of re-repricing matches the results from a survey of approximately 1,000 companies in SEC (1993). When firms did re-reprice or otherwise adjust the terms of older stock options, they rarely described the events in clear detail.

If interest expense is missing on the Compustat tape but long-term debt equals zero, I set interest expense equal to zero. For values of interest coverage above 50 or below -50, including cases where the denominator equals zero, I follow Matsunaga et. al. (1992) by truncating the ratio to lie between these two values.

I include several additional variables in regressions to control for expected associations between stock option awards and other parameters. Many investigators have documented the influence of firm size upon compensation policy, and I use the natural log of total assets to measure company size. I include firms' current-year stock returns in regressions to capture any association between CEOs' current performance and the value of contingent pay they receive. I use year dummy variables to control for any time-specific trends which may have influenced option awards. Finally, I include dummy variables for CEOs serving in their first and last years, since companies may consider "life cycle" effects when making CEO stock option awards.

4.3. Tobit Estimation Framework

I rely on a Tobit model to analyze CEO stock option awards, because my dependent variable has a "mass point" of observations at zero for the approximately 45% of company-years when firms award no CEO stock options. The Tobit specification assumes that an unobserved "latent variable index" determines the level of the dependent variable:

$$y_{i\tau} = x_{i\tau}\beta + \mu_{i\tau} \quad \textit{if} \quad x_{i\tau}\beta + \mu_{i\tau} > 0$$
$$= 0 \quad \textit{otherwise} \qquad (6)$$

In the model below, $y_{i\tau}$ equals the incentives provided from stock options awarded to the CEO of

firm i in year τ, according to the definition of pay-performance sensitivity in equations (4) and (5). The latent variable index, $x_{i\tau}\beta$, models the decision process of boards of directors in making stock option awards; the models below estimate the β coefficients of this index.

The Tobit functional form implies that observed values of stock option awards are censored at zero whenever the latent variable index plus the disturbance term $\mu_{i\tau}$ is negative; censored values would indicate cases where boards of directors believed CEOs' inventories of prior stock option awards provided sufficient or excessive incentives. This could occur if existing options moved so far into-the-money that CEOs behaved with risk aversion to protect paper gains. The model of Haugen and Senbet (1981) accommodates such a case, requiring continuous up-and-down adjustment of option terms to maintain optimal incentives. Marcus (1982) presents a model with similar implications, also noting that managers holding stock options might invest in projects which were *too risky*, instead of not risky enough, for stockholders' preferences. See also Lambert, Larcker, and Verrecchia (1991), who simulate changes in incentives from stock options as they move into- and out-of-the-money.

4.4. Controlling for Firm Effects

Many econometric studies risk encountering bias because of the possibility that omitted explanatory variables have significant influence upon the dependent variable. In studies of executive compensation, characteristics such as "management skill" and "corporate governance effectiveness" represent the types of variables which one would include in regressions if they could be observed and measured. Econometricians often control for omitted variables in a panel data setting by assuming they are correlated with other variables already in the model (see

Chamberlain, 1984). Because the data set used herein contains information for a panel of firms across eight years, I introduce firm effects to proxy for company- or CEO-specific characteristics which might influence the stock option award process.

I estimate a "correlated random effects" panel Tobit model following Mundlak (1978). This approach amounts to a restricted version of non-linear multivariate regression models implemented by Jakubson (1988) (Tobit) and Chamberlain (1984) (probit). Mundlak conjectures that within a panel of firms (indexed by i) across time (indexed by τ), an association exists between the dependent variable, $y_{i\tau}$, and the matrix of regressors, $x_{i\tau}$:

$$y_{i\tau} = x_{i\tau}\beta + c_i + \mu_{i\tau} \tag{7}$$

The firm-specific c_i term can represent a "correlated random effect," modeled as a linear combination of the average of the x_τ explanatory variables for each firm:

$$c_i = \bar{x}_i\delta + v_i \tag{8}$$

Results reported below are outcomes of pooled Tobit maximum likelihood estimations, with correlated random-effects intercept terms included to control for firm-specific characteristics. Because of the high danger of serial correlation in the panel data setting, I calculate standard errors and T-statistics robust to serial correlation and heteroskedasticity.

5. Results

The following sections discuss estimates for both the pay-performance sensitivity of CEO stock option awards and the mix of CEO compensation between stock options and cash salaries

and bonuses.

Tables 4 and 5 present Tobit estimates for the model of the pay-performance sensitivity of stock option awards, with coefficients for key explanatory variables displayed in Table 4 and coefficients for industry dummy variables in Table 5. The results provide very little support for hypotheses that companies award stock options in patterns designed to reduce expected agency costs. Of the five agency-related variables in Table 4, only one has a significant coefficient estimate, and that estimate takes the opposite sign from the prediction of its associated hypothesis. Industry dummy variable estimates in Table 5 give some support to the conjecture that stock options are used less intensively in certain regulated industries, as the utility dummy's coefficient has by far the lowest estimate.

Table 6 presents Tobit estimates for the model of the ratio of stock option compensation over cash salary and bonus pay. Only one of Table 6's three variables associated with financial contracting hypotheses has statistical significance: the zero dividend dummy variable intended to proxy for shortages of liquidity is positive as expected, suggesting that firms shift the mix of compensation toward stock options when liquidity is scarce.

Some investigators (e.g. Eaton and Rosen, 1983, and Lewellen et. al., 1987) have preferred studying the mix of pay between cash and stock when testing agency-based theories of compensation. However, results in Table 6 provide no more support for my agency-based hypotheses than those from the pay-performance model shown in Table 4.

5.1. Alignment of CEO Wealth and Stockholder Returns

I find that companies do not provide incentives from stock option awards in any

significant association with the fraction of equity owned by CEOs, as Table 4's coefficient on CEO stock ownership is negative as expected but has a T-statistic of only 0.89. This conclusion accords with results in Lewellen et. al. (1987), Kole (1993), and Matsunaga (1994). However, it is possible that CEOs receiving stock options systematically alter their direct stock ownership in response to company compensation decisions, thereby violating my underlying assumption that the stock ownership variable is exogenous. To analyze this problem, I study those CEOs receiving non-zero stock option awards and examine changes in their direct stock ownership in the year before receiving awards, the award year, and the following year. Results appear in Table 7. The data indicate no significant inter-year changes in stock ownership transactions. The same result holds for the sub-sample of CEOs who receive zero stock options in the years before and after the non-zero award year.

5.2. Horizon Problem of CEOs Nearing Retirement

I find no evidence that corporations increase incentives from stock option awards as CEOs approach retirement, as Table 4's coefficient on the variable for CEO age is virtually zero. This result accords with Eaton and Rosen (1983), who find no significant association, and runs counter to Lewellen et. al. (1987), who find a positive and significant association.

It is possible that corporations award stock options gradually to CEOs so that accumulating inventories of previously awarded options will provide increasing incentives as retirement approaches. However, further analysis (not displayed) indicates no significant differences in the ownership of vested options or stock for CEOs between the ages of 58 and 65.

5.3. Nature of Firms' Assets

I estimate a negative association between incentives provided by stock option awards and the presence of growth opportunities, as approximated by the value of Tobin's Q. This result, which runs counter to the prediction that companies with growth opportunities will use more stock-based incentives, accords with the "surprising" findings of Bizjak et. al. (1993) but contradicts a line of other studies which estimate a positive association (see Table 1).

It appears difficult to reconcile these results, although the specification of the dependent variable seems to be important: of the studies listed, only my model and that used by Bizjak et. al. rely on estimates of the sensitivity of CEO wealth to changes in firm value; Smith and Watts (1992), Gaver and Gaver (1992) and Kole (1993) all use binary (0, 1) variables indicating the presence of stock option plans, Lewellen et. al. (1987) use the value of executives' ex-post paper gains on option awards, and Matsunaga (1994) uses the value of stock option awards. Collectively the results suggest an interpretation that firms with growth opportunities provide higher levels of CEO compensation, perhaps to attract managers with more talent, but that the value of compensation for these managers is relatively insensitive to subsequent performance.

My use of a market-to-book value ratio as a proxy for growth opportunities is similar to the approach of most prior studies. To check whether some other variable might indicate a positive association between growth opportunities and stock option incentives, I re-estimate the model in Table 4 using the ratio of research & development spending to total assets as a proxy for the presence of growth opportunities. R&D information is available from Compustat for approximately one-third of sample observations. The estimate for this variable is virtually zero, with a T-statistic of 0.15. I conclude that no evidence supports the hypothesis that firms with

valuable growth opportunities will provide more incentives to CEOs from stock options.

5.4. Noisiness of Accounting Data

To test whether CEOs receive greater incentives from stock options when accounting earnings contain a large amount of noise relative to stock returns, I rely on the ratio of the time series variance of change in ROE over the time series variance of stock returns, a variable based upon the model of Lambert and Larcker (1987). I estimate a positive coefficient as expected, but the estimate is significant at only the 20% level. I therefore conclude that firms do not provide greater incentives from stock options when accounting data contains a large amount of noise. The conclusion does not change if I re-estimate the model using only the variance of changes in ROE, instead of the ratio of this variance over the variance of stock returns.

My result agrees with the finding of Matsunaga (1994) but contradicts those of Eaton and Rosen (1983) and Lewellen et. al. (1987). Both of those studies estimated significantly positive coefficients when measuring monitoring difficulty with the time series variance of stock returns. However, their results may be linked to the use of ex-post paper gains on stock option awards as the dependent variable, since companies with the greatest variances of stock returns should also experience the greatest ex-post increases in equity value, regardless of monitoring considerations.

5.5. Agency Costs of Debt

I find no significant association between financial leverage and incentives from stock option awards, despite the prediction of a negative relation in John and John (1983), and counter to positive finding of Lewellen et. al. (1987). I check the importance of my use of book values in

the debt/assets ratio by re-estimating the model using the market value of common equity in the denominator, but the estimate remains insignificant. Dropping the interest coverage variable from the model because of the danger of multicollinearity leads to virtually no change in the leverage variable's estimate or significance.

5.6. Incentives in Regulated Industries

Alone among the variables associated with agency-related hypotheses, certain industry dummy variables have estimated coefficients in line with theory. Smith and Watts (1992) and earlier writers have conjectured that mangers in utility and financial industries would receive lower compensation incentives. Table 5's dummy variable for utility companies (SIC 49) has an extremely negative estimate which lies almost three standard errors from the next-lowest industry. Estimates for insurance carriers (SIC 63) and other financial companies (SIC 61-62 and 64-69) also rank among those indicating lower stock option incentives, but the estimate for banks and other depository institutions (SIC 60) lies near the midpoint of all industries.

5.7. Liquidity Constraints

The significantly negative estimate in Table 6 for the dummy variable indicating non-payment of dividends provides evidence that companies shift CEO compensation from cash salaries and bonuses and toward stock options when facing internal liquidity constraints. Given the average value of the dependent variable of .421 (see Table 3), the coefficient estimate of .409 implies that the ratio of stock option to cash compensation almost doubles in firms paying zero dividends.

Several qualifications cloud the strength of this result. First, managers holding stock options may reduce dividend payments to increase the options' value; Lambert, Lanen and Larcker (1989) and DeFusco, Zorn, and Johnson (1991) have produced studies reaching opposite conclusions on this question. Second, as noted above, the Black-Scholes methodology implies higher option values when dividends are lower. Simulations of changes in the value of typical CEO stock options (not displayed) imply increases of about 60 percent when dividend rates are reduced from three percent (a typical recent average) to zero. However, this does not account for the entire regression estimate of a 100 percent rise in the ratio of option to cash compensation when firms pay zero dividends. Third, re-estimating the model with a cash flow measure of liquidity (operating income plus depreciation, divided by total assets) results in a negative coefficient as expected, but the new variable's estimate is not significant.

5.8. Tax Reduction

Evidence from the model does not support tax reduction as an explanation for the mix of CEO pay between stock options and cash salaries and bonuses. The dummy variable for the presence of a tax loss carry-forward has a positive estimate as expected but a low T-statistic of 0.65.

Matsunaga (1994) notes that the tax advantages of executive stock options are lower when the options are awarded in the form of stock appreciation rights, which pay executives the difference between the exercise price and stock price at the time of exercise. I re-estimate the model taking into account only awards under stock option plans which do not permit SARs. In this specification, the coefficient for the tax loss carry-forward variable moves even closer to

zero and remains insignificant.

5.9. Earnings Management

I find no evidence that earnings management plays a role in corporations' use of CEO stock options. The interest coverage variable used as a proxy for the costs of reporting low accounting earnings has a negative coefficient as expected but a T-statistic of only 0.74. It changes very little when the financial leverage variable is dropped from the model as a check for multicollinearity.

Matsunaga (1994) finds some evidence that earnings management influences stock option awards. He assumes that return on assets follows a random walk with drift, and estimates for some (but not all) of his models indicate that firms are more likely to award a larger value of stock options per employee when ROA falls below its target level. I attempt to reproduce these results by also assuming that ROA follows a random walk (but without drift, due to data limitations). I re-estimate the model including the one-year change in ROA as an explanatory variable, and decomposing this variable into two pieces based upon whether it has a positive or negative value. Neither variable's estimate comes close to having significance.

5.10 Other Variables

I include in both Tobit models variables expected to influence the compensation process based upon the findings of prior research: firm size, current firm performance, and dummy variables for CEOs serving in the first and last years. Table 8 presents coefficient estimates for these variables in both models.

CEO "life cycle" considerations appear to be extremely important in determining patterns of stock option awards. New CEOs receive especially large awards. This result supports a conjecture that lower-level executives receive less incentive compensation due to the reduced impact of their decisions upon firm value. Upon promotion to CEO these executives would be receiving incentives from a relatively low inventory of previously granted stock options (for CEOs recruited from outside, this inventory would be zero), and boards of directors might therefore make large option awards in CEOs' first years.

Exiting CEOs receive abnormally low levels of stock option awards. This suggests that boards pay relatively little long-term compensation to executives scheduled to leave their firms, although such a practice would be at odds with proposed solutions to the "horizon problem" of CEOs reducing capital spending as retirement nears.

Estimates for firm size provide weak evidence of greater use of stock options by larger companies. This may occur because boards have more difficulty monitoring managerial performance directly as firm size increases, and also because larger firms are more able to incur the fixed administrative costs of implementing sophisticated compensation plans.

Current firm performance appears to lead to a shift in CEO pay from cash salaries and bonuses and toward options. While the result is significant, the estimated coefficient has only a small magnitude; for the average CEO with a ratio of option to cash pay of .421, the estimate of .224 implies that a firm earning a 50 percent return on its stock (usually a very good year) would increase the ratio of option-to-cash pay to .533, a change which is not substantial. The association between current performance and incentives from new stock option awards is virtually zero.

6. Discussion and Conclusions

In their comprehensive examination of CEO pay, Jensen and Murphy (1990) conclude that a "general absence of managerial incentives" characterizes most CEO compensation contracts, and that observed compensation patterns are "inconsistent with formal agency models of optimal contracting." The findings of this study have a similar spirit. After collecting information about stock option awards for nearly 6,000 CEO-years and estimating a variety of econometric models, I conclude that seven of nine leading compensation theories are not supported by the data, and one of these seven is directly contradicted. Both theories which are supported are subject to qualification: among regulated industries, utilities appear to provide lower CEO incentives from stock options but banks do not; and while liquidity-constrained firms appear to provide a greater fraction of CEO compensation from stock options, the result may be largely due to the Black-Scholes valuation methodology.

It is possible that faulty data definitions or analysis account for my weak results. However, this study has advantages over much prior research because of its large and recent sample, the use of the Black-Scholes valuation approach, the controls included for omitted firm effects, and the use of the Tobit maximum likelihood framework to take account of the truncated distribution of award values. Moreover, I test the sensitivity of numerous results to variable definitions by re-estimating the basic models with other candidate explanatory variables. A further possibility is that this study overlooks an important theory of compensation contracting which could bring order to the data. However, the relatively large number of hypotheses tested and close attention paid to results of prior studies appears to belie this conjecture. The best interpretation of the results may be that contingent pay instruments used in CEO compensation

are not well designed to reduce agency costs and are not awarded with great sensitivity to firms' financial environments.

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FIGURE 1
CEO Compensation By Sample Companies

Annual Averages

The chart shows average compensation levels for CEOs in a panel of 792 large U.S. public corporations. Characteristics of the sample are shown in Table 2. Compensation data is obtained from corporate proxy statements. Stock option awards are valued using the Black-Scholes approach based upon assumptions described in the text. Other compensation includes long-term awards and fringe benefits as reported in proxy statements. Long-term awards (principally restricted stock and earnings-related performance plans) are attributed to the year in which payouts are made or ownership restrictions lapse. Stock option awards accounted for 20% of CEO income in 1984, 35% in 1990, and 30% in 1991.

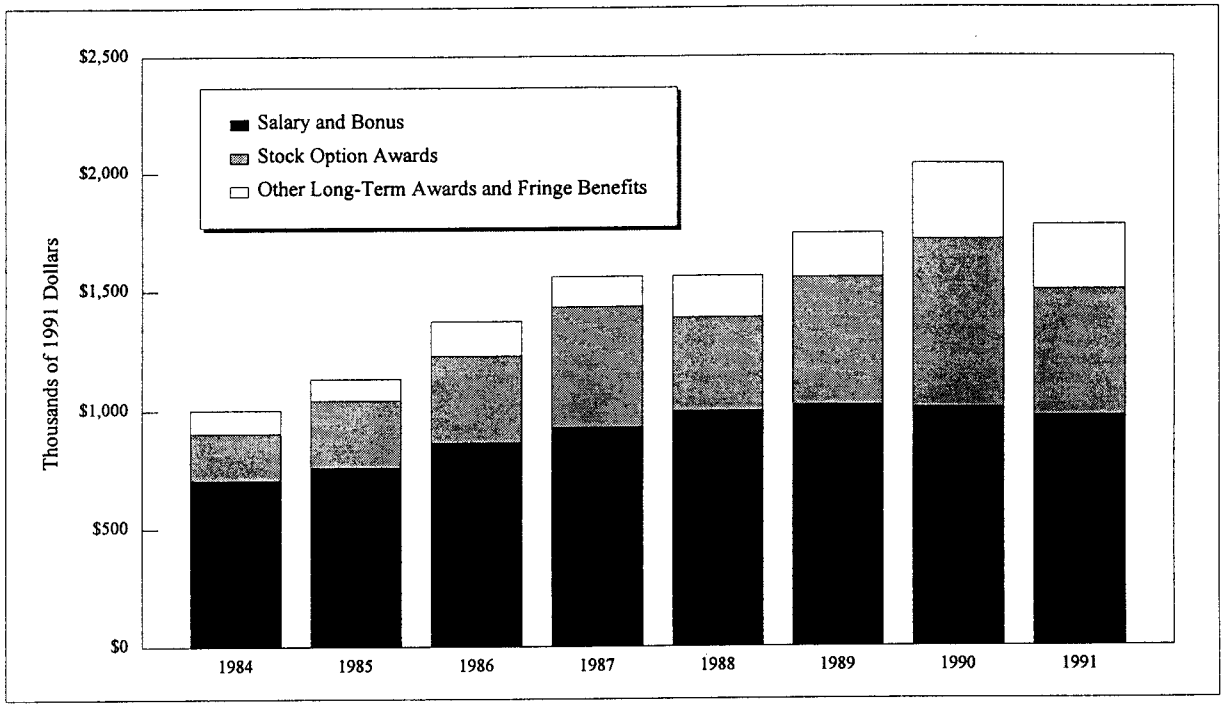

TABLE 1
Previous Studies of Executive Stock Option Awards

Research Design

The table lists nine previous studies which have explored associations between executive stock option awards and different independent variables. Immediately below are data about the sample size, time period, industry restrictions and unit of analysis used in each study.

	Sample	Industries	Period	Unit of Analysis
Eaton & Rosen (1983)	22 firms	Manufacturing	1970-73	Managers
Murphy (1985)	72 firms	Manufacturing and Mining	1964-81	Managers
(sample also used by Jensen & Murphy, 1990)				
Lewellen et. al. (1987)	49 firms	Manufacturing	1964-69	Managers
Smith & Watts (1992)	16 Industries	All	1965-85	Industries
Gaver & Gaver (1992)	443 firms	All except Financial and Utilities	1985	Firms
Kole (1993)	303 firms	Manufacturing and Mining	1980	Firms
Bizjak et. al. (1993)	418 firms	All	1974-88	Managers
Matsunaga (1994)	123 firms	All except Financial and Utilities	1979-89	Firms

Findings

The table summarizes conclusions of the studies listed above. The heading of each column refers to a hypothesis about variables influencing firms' use of executive stock options. "Positive" indicates that regression models revealed a positive, statistically significant association between the dependent variable and the authors' relevant explanatory variable, according to a two-tailed T-test. "Negative" indicates that an inverse association was found, while "0" indicates that a hypothesis was tested but no statistically significant association found. Note: several studies present multiple sets of results, and this table reflects the most comprehensive model estimated in each paper. For Eaton & Rosen (1983) I use results from the model with industry dummy variables (Table II). For Murphy (1985) I use the "time series" model including both sales and stock return variables (Panel A of Table 6). For Lewellen et. al (1987) I use the model including executive stock ownership as an explanatory variable (Table 5).

	Firm Size	Monitoring Difficulty	CEO's Age	Firm's Stock Return	Growth Opportunities	Stock Owned By Mangers
Eaton & Rosen (1983)	0	Positive	0			
Murphy (1985)	Negative			0		
Lewellen et. al. (1987)		Positive	Positive		Positive	0
Jensen & Murphy (1990)				Positive		
Smith & Watts (1992)	Positive				Positive	
Gaver & Gaver (1992)	Positive				Positive	
Kole (1993)	0				Positive	0
Bizjak et. al. (1993)					Negative	
Matsunaga (1994)	0	0			Positive	0

	Leverage	Regulated Industries	Family-Run Firms	Firm's Tax Status	Liquidity	Financial Reporting Costs
Eaton & Rosen (1983)						
Murphy (1985)						
Lewellen et. al. (1987)	Positive					
Jensen & Murphy (1990)						
Smith & Watts (1992)		Negative				
Gaver & Gaver (1992)						
Kole (1993)			Negative			
Bizjak et. al. (1993)						
Matsunaga (1994)	0			0	0	Positive

TABLE 2
Characteristics of Sample Companies

The table presents descriptive statistics about companies qualifying for the sample. To be included, firms must rank among the 500 largest U.S. public corporations in any of the categories of sales, assets, net income, or market capitalization at least four times between 1984 and 1991, according to annual tabulations by Forbes magazine.

Industry Membership

Industry	SIC	Firms	Pct.
Mining	10-14	9	1%
Construction	15-19	7	1%
Food and tobacco	1, 20-21	36	5%
Paper	26	26	3%
Printing and publishing	27	13	2%
Chemicals	28	47	6%
Petroleum refining	29	22	3%
Rubber and plastics	30	9	1%
Stone, clay and glass	32	5	1%
Primary metals	33	12	2%
Fabricated metals	34	8	1%
Industrial machinery	35	36	5%
Electrical equipment	36	18	2%
Transportation equipment	37	28	4%
Instruments	38	17	2%
Toys	39	2	0.3%
Other manufacturing	22-25, 31	11	1%
Manufacturing		290	37%

Industry	SIC	Firms	Pct.
Air transportation	45	10	1%
Ground and water transport	40-44, 46-47	14	2%
Communications	48	24	3%
Transportation and Communication		48	6%
Utilities	49	89	11%
Wholesale trade	50-51	21	3%
Retail trade	52-59	50	6%
Wholesale and Retail Trade		71	9%
Depository Institutions	60	177	22%
Insurance	63	35	4%
Other Financial	61-62, 64-69	39	5%
Banking and Finance	60-69	251	32%
Services	70-89	27	3%
TOTAL		792	100%

Average Characteristics of Companies By Year

	1984	1985	1986	1987	1988	1989	1990	1991
Sample Size	726	746	757	778	770	747	727	704
Net Sales	$4.4 bn	$4.5	$4.4	$4.6	$4.9	$5.1	$5.2	$5.1
Total Assets (start of year)	$7.0 bn	$7.5	$8.3	$8.8	$9.0	$10.0	$10.4	$10.6
Market Capitalization (common stock, start of year)	$2.2 bn	$2.1	$2.6	$3.0	$3.0	$2.9	$3.7	$3.3
Net Income	$228 mm	$208	$211	$220	$278	$250	$217	$161
Stockholders' Return (compounded continuously)								
(weighted equally)	5%	30%	17%	-1%	10%	16%	-24%	26%
(weighted by market capitalization)	5%	26%	17%	3%	10%	23%	-7%	22%

Source: CRSP (stock returns and market capitalization) and Compustat (all other variables).
All dollar amounts are expressed in constant 1991 units.

TABLE 3
Descriptive Statistics for Key Variables

The table lists dependent and independent variables used to estimate Tobit models of CEO stock option awards. The sample consists of 5,955 observations from a panel of 792 companies in all industries during the 1984-91 period.

Dependent Variables	**Theories Tested**	**Functional Form**	**Missing Values**	**Mean**	**Median**	**Std. Dev.**
Pay-performance sensitivity of stock option awards	Agency-based	Black-Scholes partial derivative times fraction of equity represented by award	55	$0.59 per $1000 change in stockholder wealth	$0.07	$2.44
Ratio of stock option pay to cash salary and bonus	Financial contracting	Black-Scholes value of option award / value of cash compensation	77	0.421	0.097	1.362
Independent Variables	**Theories Tested**	**Functional Form**	**Missing Values**	**Mean**	**Median**	**Std. Dev.**
CEO age	Horizon problem	Years	0	57.4	58	6.9
CEO stock ownership	Alignment of incentives	Fraction of equity held by CEO through direct stock ownership. Excludes shares held contingently and those for which CEO derives no economic benefit (e.g. charitable trusteeships).	144	2.41%	0.14%	7.53%
Tobin's Q	Growth opportunities	(Book value of debt and preferred stock + market value of common stock) / book value of assets.	1	1.37	1.10	0.71
Relative "noise" in accounting earnings	Monitoring difficulty	Variance of annual changes in ROE / variance of annual stock returns	0	0.323	0.072	0.884
Leverage	Agency costs of debt	Book value of debt / book value of assets	0	0.678	0.638	0.21
Interest coverage	Financial reporting costs	Operating income / interest expense	22	4.65	3.06	16.21
Zero dividend dummy variable	Liquidity	=1 if firm not paying dividends at end of year	0	0.145	0	0.352
Tax loss carry-forward dummy variable	Tax minimization	=1 if firm has net operating loss carry-forward	4	0.094	0	0.291

All dollar amounts are expressed in constant 1991 units.

TABLE 4
Tobit Coefficient Estimates:
Incentives from CEO Stock Option Awards

The table shows maximum likelihood estimates for a Tobit model of incentives provided by annual CEO stock option awards. T-statistics robust to serial correlation and heteroskedasticity appear below each coefficient estimate.

The sample consists of annual observations for 792 large U.S. corporations during the 1984-91 period. Definitions of the dependent and explanatory variables appear in Table 3. In addition to the explanatory variables listed in the table, the model includes variables to control for firm size and current-period stock return, dummy variables for CEOs serving in their first and last years, and dummy variables for years and two-digit SIC industries. Table 5 presents estimates for dummy variable coefficients, and Table 8 presents estimates for the additional control variables.

Dependent Variable: $\Delta * \frac{\text{Shares in option award}}{\text{Shares outstanding}} * \$1{,}000$

Variable	Agency Hypothesis	Estimate
CEO Stock Ownership (%)	Alignment of incentives (expect -)	-2.3492 (0.89)
CEO Age	Horizon problem (expect +)	0.0044 (0.25)
Tobin's Q	Growth opportunities (expect +)	-0.3301 ** (2.26)
Relative "Noise" in ROE	Monitoring difficulty (expect +)	0.2316 (1.28)
Financial Leverage	Agency costs of debt (expect -)	1.3256 (1.31)
Zero-Dividend dummy variable		1.2337 *** (2.99)
Tax Loss Carry-Forward dummy variable		-0.1104 (0.41)
Interest Coverage		0.0115 * (1.66)
Sample Size		5,741

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
Δ = partial derivative of Black-Scholes option value with respect to stock price

TABLE 5
Tobit Coefficient Estimates:
Incentives from CEO Stock Option Awards

The table shows maximum likelihood estimates for a Tobit model of incentives provided by annual CEO stock option awards. Standard errors robust to serial correlation and heteroskedasticity appear with each coefficient estimate. Estimates below are for two-digit SIC dummy variables in the model described in Table 4.

The sample consists of annual observations for 792 large U.S. corporations during the 1984-91 period. The omitted dummy variable represents a group of manufacturing industries not individually identified (SIC codes 22-25 and 31).

Dependent Variable: $\Delta * \frac{\text{Shares in option award}}{\text{Shares outstanding}} * \$1{,}000$

		Estimate	Std. Error
Intercept		-0.1864	0.9613
Industry dummy variables	**SIC Code**		
Utilities	49	-2.1058	0.5824
Construction	15-19	-0.7120	0.6846
Petroleum refining	29	0.0624	0.5859
Fabricated metals	34	0.1607	0.6167
Electrical equipment	36	0.1932	0.5898
Insurance carriers	63	0.2651	0.5936
Stone, clay and glass	32	0.2879	0.6875
Other financial	61-62, 64-69	0.2903	0.6508
Wholesale trade	50-51	0.3282	0.6156
Communications	48	0.3550	0.5887
Transport equipment	37	0.4806	0.5949
Rubber and plastics	30	0.4878	0.7542
Retail trade	52-59	0.5269	0.6312
Industrial machinery	35	0.5396	0.5805
Depository institutions	60	0.5999	0.6155
Airline transportation	45	0.7347	0.7914
Mining and extraction	10-14	0.7465	0.6268
Rail, ground, and water transport	40-44, 46-47	0.7615	0.6097
Primary metals	33	0.8877	0.6101
Printing and publishing	27	1.0385	0.6494
Paper	26	1.1407	0.5941
Services	70-89	1.1572	0.6316
Food	1, 20-21	1.2831	0.6054
Instruments	38	1.3880	0.6178
Chemicals	28	1.4424	0.5981
Toys	39	2.4547	0.8211
Sample Size		5,741	

Δ = partial derivative of Black-Scholes option value with respect to stock price

TABLE 6
Tobit Coefficient Estimates:
Mix of Stock Option and Cash Compensation for CEOs

The table shows maximum likelihood estimates for a Tobit model of the mix of CEO compensation provided by stock option awards and cash salary and bonuses. T-statistics robust to serial correlation and heteroskedasticity appear below each coefficient estimate.

The sample consists of annual observations for 792 large U.S. corporations during the 1984-91 period. Definitions of the dependent and explanatory variables appear in Table 3. In addition to the explanatory variables listed in the table, the model includes variables to control for firm size and current-period stock return, dummy variables for CEOs serving in their first and last years, and dummy variables for years and two-digit SIC industries. Table 8 presents estimates for the additional control variables.

Dependent variable: $\frac{\text{Black-Scholes value of option award}}{\text{Salary + Bonus}}$

Variable	**Financial Contracting Hypothesis**	**Estimate**
CEO Stock Ownership (%)		-1.2869
		(0.80)
CEO Age		-0.0076
		(0.99)
Tobin's Q		0.0829
		(0.72)
Relative "Noise" in ROE		0.2249
		(1.61)
Financial Leverage		-0.7630
		(1.45)
Zero-Dividend dummy variable	Liquidity constraints (expect +)	0.4093 **
		(2.48)
Tax Loss Carry-Forward dummy variable	Tax minimization (expect +)	0.2056
		(0.65)
Interest Coverage	Financial reporting costs (expect -)	-0.0045
		(0.74)
Sample Size		5,719

** Significant at 5% level

TABLE 7
Changes in CEO Stock Ownership Around Year of Option Awards

The table shows mean changes in CEOs' stock ownership measured as a percentage of their firms' common equity. Figures include direct stock ownership only. The sample includes CEOs from a panel of 792 large U.S. corporations between 1984 and 1991. Changes are calculated from data in proxy statements (or similar documents) filed annually, shortly after the start of each company's fiscal year. Note that changes in stock ownership could occur because of vesting of shares previously owned by CEOs with contingencies, or because of the dilution or inflation of a CEO's ownership stake as a result of corporate transactions.

The first line below presents data for all CEOs receiving stock option awards for whom a sufficiently long time series of data exists to calculate stock ownership changes in both the year before and year after the award year. Since this requires two trailing years and one following year of stock ownership data, the analysis is restricted to CEOs receiving stock option awards between 1986 and 1990 who were employed by their firms for at least two years prior to and one year following the award. The second line presents data for the sub-set of this group who received no stock option awards in either the year before or year after the award year. In all cases the median change in stock ownership is zero.

	Previous Year	Award Year	Following Year
All CEOs receiving stock option awards, 1986-1990			
Number in sample	1,486	1,486	1,486
Mean ownership change	-0.053%	-0.011%	-0.014%
T-statistic for significance vs. prior year's change		0.60	0.08
All CEOs receiving stock option awards, 1986-1990, and receiving zero award in previous year and following year			
Number in sample	122	122	122
Mean ownership change	-0.003%	0.119%	0.009%
T-statistic for significance vs. prior year's change		0.15	0.43

TABLE 8
Tobit Coefficient Estimates: Other Variables

The table shows maximum likelihood estimates for Tobit models of annual CEO stock option awards. The first column of estimates corresponds to the model of incentives from stock option awards, for which other estimates appear in Tables 4 and 5. The second column of estimates corresponds to the model of the mix of CEO compensation between stock options and cash salaries and bonuses, for which other estimates appear in Table 6. T-statistics robust to serial correlation and heteroskedasticity appear below below each coefficient estimate.

The sample consists of annual observations for 792 large U.S. corporations during the 1984-91 period. Definitions of the dependent and explanatory variables appear in Table 3. In addition to the explanatory variables listed in the table, the model includes variables for CEO stock ownership, CEO age, Tobin's Q, the relative noisiness of accounting earnings, leverage, interest coverage, and dummy variables for the non-payment of dividends, tax loss carry-forwards, CEOs serving in their first and last years, two-digit SIC industries, and years.

Dependent Variables:	Δ * Shares in option award / Shares outstanding * \$1,000	Black-Scholes value of option award / Salary + Bonus
Variable	**Estimate**	**Estimate**
Log (Total Assets)	0.2721	0.4504 *
	(0.97)	(1.89)
Current-year stock return	-0.0433	0.2243 **
	(0.13)	(1.98)
New CEO dummy variable	0.7383 ***	0.3476 ***
	(3.02)	(2.89)
Departing CEO dummy variable	-0.8810 ***	-0.6021 ***
	(3.70)	(4.12)
Sample size	5,741	5,719

*** Significant at 1% level
** Significant at 5% level
* Significant at 10% level
Δ = partial derivative of Black-Scholes option value with respect to stock price