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*Companies' Modest Claims About the Value of CEO Stock Option Awards*

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# **Companies' Modest Claims About the Value of CEO Stock Option Awards**

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# **Companies' Modest Claims About the Value of CEO Stock Option Awards**

## **Abstract**

This paper analyzes companies' disclosure of CEO stock option values in compliance with recent changes in the SEC's regulations for reporting executive compensation data to stockholders. Results suggest that companies exploit the flexibility of the SEC's disclosure regulations to reduce the apparent value of managers' compensation. Companies shorten the expected lives of stock options and independently apply discounts to the Black-Scholes formula. Theoretical support for these adjustments is often lacking, and companies universally ignore reasons that the Black-Scholes formula might underestimate the value of executive stock options. The findings not only cast light upon how corporations value executive stock options, but also provide a means of forecasting compliance with controversial FASB proposals to require disclosure of the implicit compensation expense represented by executive stock option awards.

## 1. Introduction

The valuation of executive stock option awards has become a highly politicized issue in the accounting and finance communities since mid-1993, when an exposure draft by the Financial Accounting Standards Board (FASB, 1993) proposed requiring companies to reduce their net income to reflect the Black-Scholes (1973) value of stock options awarded to managers as compensation. While the proposal found widespread support among academics, business executives opposed it fiercely. Arthur Levitt, Chairman of the Securities Exchange Commission (which oversees the FASB) stated in 1994 that he had "never seen such an outpouring from the business community on a single subject."<sup>1</sup> Many critics challenged the appropriateness of the Black-Scholes valuation approach, while others predicted that reductions in accounting earnings arising from the expenses for stock option compensation would make companies less attractive to suppliers of capital. Largely embracing arguments made by managers of small business and high-technology firms, the U.S. Senate in May 1994 overwhelmingly passed a resolution condemning the proposal. Responding to these pressures, the FASB in December 1994 considerably softened its position, tentatively deciding that companies would have the choice of disclosing stock option values in footnotes to financial statements as an alternative to recognizing

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<sup>1</sup> James K. Glassman, "Big Money: An Executive Compensation Outcry," *The Washington Post*, June 15, 1994. For more background on executives' lobbying against the FASB proposal, see, e.g., Alison Leigh Cowan, "Flap Over Value of Stock Options," *The New York Times*, October 26, 1992, and Christi Harlan, "Accounting Proposal Stirs Unusual Uproar in Executive Suites," *The Wall Street Journal*, March 7, 1994.

the options' values as expenses against net income.

Although the FASB proposal has an uncertain timetable for adoption, it appears likely that public companies will soon have to report some estimate of the value of stock options awarded to their managers each year. An indication of how corporations might comply with such disclosure requirements has been available since late 1992, when the SEC implemented its own rules requiring companies to report annually to stockholders the estimated value of executive stock option awards. The SEC has permitted companies to choose between using a Black-Scholes approach for valuing stock options, or reporting simulated future values of options under rule-of-thumb assumptions about the appreciation of the companies' stock prices.<sup>2</sup>

This paper examines companies' claims about Black-Scholes values of chief executive officer stock option awards pursuant to these new SEC requirements. Using proxy statements filed by *Fortune 500* companies since late 1992, I compare firms' purported Black-Scholes valuations with benchmark values generated from standard financial economics methods.

A majority of companies appear to under-report the value of CEOs' stock options by an average of five to ten percent compared to the benchmark calculations. Some companies make ad hoc changes to the Black-Scholes formula which lead to lower option values; these changes generally involve shortening options' expected lives because of historical patterns of exercise, and discounting option values by arbitrary factors based on probabilities that managers will leave their companies before options become exercisable. Such modifications are often presented to

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<sup>2</sup> The regulations appear in 17 C.F.R. 228, 229, 240, and 249, and in most cases require disclosure of executive compensation information in proxy statements mailed to stockholders in advance of firms' annual meetings. Generally the regulations apply to a company's CEO and five most highly paid officers. See SEC (1992). Companies are permitted to use other option valuation models instead of the Black-Scholes formula and the SEC's simulated values, but virtually no firm has done so.

stockholders with unsound theoretical justifications, or no justifications at all.

The overall pattern of results suggests that any regulations adopted by the FASB might be undermined by strategies for producing low estimated option values. Alternatively, the results may reflect good-faith beliefs by many corporations that the cost to shareholders of executive stock options lies somewhere below the value of exchange-traded options for which the Black-Scholes formula is widely used.

Some theoretical research, notably by Carpenter (1994), Huddart (1994), Huddart and Lang (1994), Jennergren and Nüslund (1993), Lambert, Larcker and Verrecchia (1991), and Foster, Koogler and Vickrey (1991), has offered explanations for why employee stock options may have less value than their exchange-traded counterparts. The most robust arguments rely upon the risk aversion and liquidity constraints faced by corporate managers. Managers cannot diversify away the firm-specific risks associated with their firms' stock, cannot sell their options into an open market, and cannot construct hedge portfolios against their options by taking short positions in their own stock. For these reasons, managers might be expected to behave differently than risk-neutral investors and exercise in-the-money options well before expiration.

This theoretical research appears to offer sound support for companies who claim that the Black-Scholes formula over-states the value of their managers' stock options. However, few companies have cited managers' risk aversion and liquidity constraints as justifications for lowering options' Black-Scholes values. Instead, many companies make no explanation at all for their reports of low option values, and others provide naive and incorrect interpretations of the Black-Scholes formula. Some firms, for example, imply to their stockholders that stock options which might be exercised at any time before expiration have a lower expected cost to the

company than options which may be exercised only at expiration.

Data in this paper illustrates how widely companies have embraced such arguments when reporting option values to stockholders. The evidence suggests that firms are eager to find justifications for reducing estimated option values, and equally eager to ignore arguments for why the Black-Scholes formula might *under*-state the true value of executive stock options; every modification of the Black-Scholes formula by *Fortune 500* companies to date has involved reducing estimated option values. (Most work by financial economists, including all of the studies cited above except Carpenter, 1994, have also overlooked arguments for why executive options may be more valuable than the Black-Scholes formula implies.)

One obvious reason why the Black-Scholes formula might under-value executive stock options is that the formula assumes that stock options are European calls, exercisable only at expiration. However, nearly all executive stock options are American calls, exercisable at any time.<sup>3</sup> Numerical simulations herein using a Cox, Ross and Rubinstein (1979) binomial approach provide a basis for estimating how far European values of typical executive stock options should be revised upward to account for the American exercise provision; for typical values of dividend rates and stock return volatility, the necessary adjustment is approximately five percent, but for some stock option awards the ability to choose the exercise date contributes approximately 30 percent additional value.

While much of the debate about the value of executive stock options has been clothed in

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<sup>3</sup> Many companies restrict the right to exercise options for a short period after they are granted, such as one year. While this makes executive stock options look like hybrids of European and American calls, vesting periods are almost always brief in relation to options' lives and virtually never affect decisions to exercise according to binomial simulations.



the rhetoric of financial theory, the results herein are consistent with broad-based criticisms of executive compensation practices in the U.S. which have permeated the popular media during the last decade. Such writers as Crystal (1991) have argued that corporations do not fully comprehend the costs to stockholders of contingent pay instruments, and the systematic under-valuation of stock options illustrated herein provides support for this view.

Numerous others have charged companies with publishing convoluted disclosures of executive compensation in order to mislead shareholders about the true value of executive pay; Murphy (1994) characterizes such practices as attempts to reduce the non-pecuniary costs borne by managers who receive high compensation. Two pieces of evidence herein tend to support this interpretation. First, companies have a choice under the SEC's disclosure rules of whether to value stock options with the Black-Scholes methodology or simpler rule-of-thumb formulas, and the Black-Scholes approach is elected predominantly by companies with favorable values for parameters in the formula (i.e., those implying lower compensation estimates). Second, regression analysis herein suggests that an association exists between companies' propensities to under-report Black-Scholes option values and the extent to which their CEOs receive excessive compensation beyond that predicted by a simple model.

The remainder of this paper is organized as follows. Section 2 contains a discussion of the sample selection process, an overview of the Black-Scholes option valuation formula, and summary statistics about CEO stock option awards by sample companies. Section 3 presents the basic results, comparing firms' reports of Black-Scholes values with benchmark estimates from the raw data. I document a significant pattern of under-valuation of option awards, illustrate the importance of different types of companies' modifications to the Black-Scholes calculation, and

produce estimates of how CEO stock option values would increase if their American exercise provisions were taken into account. Section 4 discusses the circumstantial evidence about whether companies' under-valuations result from opportunistic manipulation of the SEC's disclosure requirements. Section 5 contains a discussion and conclusions.

## 2. Data Description

### 2.1. Sample Selection

Table 1 details the sample selection process, which uses the 1993 *Fortune 500* list of the largest U.S. industrial companies as its basis.<sup>4</sup> I obtain information about CEO stock option awards from the first two annual proxy statements filed by each company in compliance with the SEC's new disclosure rules. For most firms, this meant gathering data from proxy statements filed at the conclusion of fiscal years ending in November 1992 and thereafter.<sup>5</sup>

From the initial sample of 500 companies, I dropped those not providing usable data. The largest such group included foreign and private *Fortune 500* companies which were not subject to the SEC's compensation disclosure rules (60 firms in the first year of the study, a group which rose to 67 in the second year after the acquisition of eight firms and an initial public offering by one). One firm's filings were suspended in both years due to financial distress, and one company has yet to file a 1994 proxy statement due to a change in the timing of its fiscal

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<sup>4</sup> See the *Fortune* issue of April 19, 1993. The *Fortune 500* ranks firms by sales and includes only manufacturing and mining companies.

<sup>5</sup> Six of 35 sample companies with fiscal years ending in September or October 1992 voluntarily filed proxy statements in early compliance with the new SEC regulations, and I use data from those documents in my sample. Occasionally companies disclosed compensation data in Forms 10-K instead of proxy statements.

year. Sixteen companies in the first year of the study did not report compensation data for their CEOs because these executives had left their firms by the time of the proxy filing; the SEC closed this disclosure loophole in 1993 by forcing companies to report data for all CEOs who served during the prior fiscal year.

Within the resulting candidate sample, 66% of all companies awarded stock options to their CEOs in 1992-93, while 69% made awards in 1993-94. A handful of these companies were excluded from the final sample because of problems in valuing of their CEOs' options. The difficulties concerned awards made near the date of initial public offerings, in which case stock return volatility could not be reliably estimated; awards involving indexed exercise prices or other contingencies, in which case the Black-Scholes formula would not apply; and awards for which the dates of grant were not reported, a violation of the SEC's rules.<sup>6</sup>

The SEC requires companies to estimate the value of top managers' stock options as of the date of award. Firms may choose between two alternatives: presenting rule-of-thumb simulations of how much options would become worth in the future if the underlying stock appreciated at 5% and 10% annual rates, or reporting "the present value of the grant at the date of grant, under any option pricing model," such as Black-Scholes. As shown by Table 1, approximately one-third of those firms awarding CEO stock options chose the Black-Scholes reporting method in each year. Almost every company awarding CEO stock options in both years made the same reporting choice each time; of the 229 firms in this group, 63% did not report a Black-Scholes value in either year, 31% reported a Black-Scholes value in both years,

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<sup>6</sup> A small group of companies reported the month but not the exact date of stock option awards. For purposes of estimating stock return volatility prior to the award date, I assumed that these companies made awards on the first date of the month.

4% switched from reporting a value in the first year to not doing so in the second year, and 2% switched in the other direction.

The final sample of *Fortune 500* companies making Black-Scholes valuation claims for their CEOs' awards totaled 93 firms in the first year of the study and 88 companies in the second year. Data obtained from these firms included the number of stock options awarded to CEOs, as well as their exercise prices, durations, dates of expiration, and the claimed Black-Scholes values. Because of the SEC rule changes implemented during 1993, data for the second year of the study also includes the estimated volatilities, risk-free interest rates and dividend yields which firms used in calculating Black-Scholes values, as well as information about any modifications made to the Black-Scholes formula. However, not all firms reported this supporting data completely.

## 2.2. *Benchmark Black-Scholes Values of CEO Stock Option Awards*

As noted above, about one-third of *Fortune 500* companies awarding stock options to their CEOs since late 1992 have reported to shareholders the estimated Black-Scholes values of those awards. To assess these claimed Black-Scholes values, I calculate a parallel set of benchmark Black-Scholes estimates using assumptions common among finance professionals.<sup>7</sup>

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<sup>7</sup> I follow the SEC and FASB by valuing stock appreciation rights (SARs) identically as options (when an SAR is exercised, its holder receives in cash the amount by which the underlying stock price has risen above the exercise price). I ignore awards of "re-load" options, which are issued by some firms when executives surrender shares of their companies' stock to pay the cost of exercising stock options (see note 10 below). A few companies award CEO stock options more than once during a fiscal year; in these cases I value each award separately and add values together for each CEO. When two or more people serve as CEO during a year, I collected data for the person in office for the longest period.

The Black-Scholes formula, as extended by Merton (1973) to accommodate dividends, is:

$$\text{Award Value} = N [P e^{-dT} \Phi(Z) - E e^{-rT} \Phi(Z - \sigma \sqrt{T})] \quad (1)$$

where

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

- $\Phi$  = 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 (continuously compounded)
- d = expected dividend rate (continuously compounded) over life of option
- $\sigma$  = expected stock return volatility over life of option

I rely on the following assumptions for inputs to the formula:

- The number of shares in each stock option award (N), its exercise price (E), the stock price on date of award (P) and the options' time to expiration (T) are all used as reported by the company.
- The risk-free interest rate (r) is the continuously-compounded annual yield prevailing on the date of the option award for the zero-coupon U.S. Treasury bond with duration closest to T. In using a zero-coupon bond as a proxy for the risk-free interest rate, I follow the recommendations of FASB (1993, ¶191) and Hull (1993, p. 336).
- The dividend yield (d) is estimated as four times the quarterly dividend declared nearest to the date of the stock option award, divided by the company's stock price on the award date, with this quotient compounded continuously.
- Stock return volatility ( $\sigma$ ) is estimated as the square root of the annualized sample variance of continuously compounded daily returns to holders of the company's common stock, using data from the 120 trading days immediately prior to the award date.<sup>8</sup>

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<sup>8</sup> Volatility assumptions generally pose the greatest difficulty when estimating stock option values. I checked the sensitivity of my results by repeating calculations with volatility estimated over five different intervals, using both

I multiply the Black-Scholes equation by a dilution factor to account for shares which would be issued if all newly awarded options were eventually exercised:

$$\frac{\text{Shares outstanding at start of year}}{\text{Shares outstanding at start of year} + \text{Total options awarded during year}} \quad (3)$$

A dilution factor appears to be appropriate because most executive stock options more closely resemble warrants, with the issuing company creating new shares of stock when options are exercised rather than delivering existing shares purchased on the open market. I calculate the average value of this dilution adjustment for companies reporting Black-Scholes estimates as .987, implying that stockholders (including the option holders themselves) will experience a rate of dilution of slightly more than 1% in the event that stock price rises and options are exercised. However, it is possible that investors rationally expect companies to issue executive stock options at the prevailing rate and that share prices are already adjusted in the market to take account of the expected dilution; if so, the dilution factor would be unnecessary. No company's proxy statement indicated that it had reduced its Black-Scholes estimates of options' values to account for dilution, and the absence of such adjustments suggests that my benchmark estimates include a degree of conservatism.

Under my benchmark assumptions, I estimate the average value of nonzero CEO stock option awards during the 1992-93 fiscal year as \$986,100 per company, with a median of \$565,800. These statistics include companies which did not make Black-Scholes valuation

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daily and monthly stock return data. Virtually no differences arose in the distribution of estimated benchmark values.

Some companies with fiscal years ending during mid or late 1994 awarded stock options to their CEOs after January 1, 1994. Because the CRSP database has not yet been updated with calendar 1994 data, I estimated these companies' volatilities over the last 120 trading days of calendar 1993.

claims to their shareholders. During 1993-94, the value of the typical CEO award rose significantly, to an average level of \$1,146,300 and a median of \$634,100.

### **3. Companies' Black-Scholes Claims**

#### *3.1. Under-Reporting of Option Values*

Figure 1 shows the distribution of companies' Black-Scholes claims of CEO stock option award values for both the 1992-93 and 1993-94 fiscal years, with data reported in the form of percentage deviations from the benchmark values described above.

In the first year under the SEC's new disclosure regime, a large majority of companies reported Black-Scholes values below the benchmark values. On average, companies' Black-Scholes claims were 9.3% below the benchmark, the median deviation was -6.8%, and 64 of the 93 deviations were less than zero. The mean deviation was significantly different from zero at the 1% level (T-statistic = 5.41), and the median was also significantly different from zero at the 1% level according to an exact confidence interval derived from the binomial distribution. One cannot learn much about the reasons for companies' systematic under-reporting of Black-Scholes award values in 1992-93 because the SEC did not require firms to describe assumptions used in Black-Scholes calculations during that year. Only a small handful of companies reported assumptions voluntarily, and it is possible that many used favorable values for volatility, interest rates, and dividend yields in order to generate lower Black-Scholes values.

Making low claims of Black-Scholes option values became more difficult in 1993-94, because the SEC had tightened its regulations to require companies to list their assumptions for the calculation. As shown by Figure 1, this change led to lower mean (-6.5%) and median

(-2.0%) deviations between companies' claimed Black-Scholes values and the corresponding benchmarks. However, the mean deviation was still significantly nonzero and not significantly different from the previous year's mean.

### 3.2. *Companies' Modifications to the Black-Scholes Formula*

Analyzing the pattern of assumptions reported by companies in 1993-94 casts considerable light upon the reasons that many claimed Black-Scholes values below the benchmark. Most companies used assumptions for volatility, interest rates, and dividend yields quite close to the benchmark assumptions described above (no sample-wide differences were significant), but in some cases they shortened the duration of options. These modifications were often justified by citing historical data about how long company executives had held options before electing to exercise them. Further, some companies reduced Black-Scholes values by arbitrary discount factors ranging from 3% to 34%, in each case explaining these adjustments as corrections for the probability that the options might never become exercisable due to executive turnover.

Table 2 documents the frequency with which companies modified the Black-Scholes formula and reported the nature of the modification to stockholders. The first two lines of the table describe the distribution of company claims and benchmark values. The next four lines report how benchmark values would change if recalculated using assumptions reported by companies as the basis for their valuations. Differences between benchmark values and company claims largely disappear when benchmarks are re-calculated using the lower expected option terms (and the correspondingly lower risk-free interest rates) reported by 20 of 88 sample



companies. Differences also narrow considerably when 15 companies' independent discounts to the Black-Scholes formula are taken into account. When all company assumptions are used in the calculation of benchmark values, the resulting values are on average almost identical to company claims.

### *3.2(a). Reductions in Option Lives*

Twenty of 88 companies reporting Black-Scholes values in 1993-94 also reported shortening the expected lives of those options when calculating the estimate; the average change involved removing 4.2 years from the life of a ten-year option, although some firms removed as much as seven years.

At a naive level, reducing options' expected lives appears to accord with the widely found empirical observation that executives generally exercise stock options well in advance of expiration, contrary to the optimal behavior for a risk-neutral, diversified investor (see, e.g., Huddart and Lang, 1994, and Carpenter, 1994). However, the fact that many executives take advantage of their options' American call provisions and exercise the options prior to expiration does not necessarily make those options less costly to stockholders *ex-ante* compared to European options; indeed, the flexibility to choose the exercise date is widely believed by finance theorists to make American options *more* valuable than their European counterparts. Carpenter (1994) presents evidence that managers typically exercise options (and presumably sell the underlying stock) in advance of significant declines in stock price, possibly earning superior profits compared to public option holders who follow the optimal strategy for uninformed investors and hold options until expiration.

In justifying their reductions of claimed CEO stock option values through the use of lower expected option lives, companies have generally ignored or misrepresented the financial theories which might support such changes. As noted above, the risk aversion and liquidity constraints of managers provide the theoretical rationales which Huddart (1994) and related studies have used in predicting the early exercise of executive stock options.<sup>9</sup> However, companies do not generally cite the risk aversion or liquidity constraints faced by their executives as justifications for reducing options' Black-Scholes values, probably because the most frequently touted purposes of stock options are to encourage greater risk-taking and stock ownership by company managers.

Instead, explanations provided by many companies appear to rely on a simplistic and incorrect interpretation of the Black-Scholes formula which holds that an option which might be exercised early is less costly to stockholders *a priori* than an option which must be held until expiration. For example, the 1994 proxy statement of Kellogg Co. provides Black-Scholes estimated values for its executives' stock option awards. Kellogg's calculations assume that the ten-year options will be exercised after three years due to the availability of "reload options" at the time of exercise.<sup>10</sup> The company therefore sets  $T=3$  in its Black-Scholes calculations and

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<sup>9</sup> The FASB has voiced partial agreement with these types of arguments. Its 1993 exposure draft permits companies to lower expected option lives under a rationale that a shortened option term represents "a logical and practical means of reducing the option's value to reflect its nontransferability." FASB (1993), ¶128 and 129.

<sup>10</sup> Reload options are provided by some companies when managers exercise stock options and pay the exercise price with shares of the company's stock. Typically, reload options are issued for the number of shares of stock delivered, at an exercise price equal to the prevailing market price, for a term equal to the remaining life of the original option.

The payouts from exercising the original options and obtaining reload options are equivalent to the manager leaving the options unexercised, retaining ownership of his stock, and receiving a free put option from the company for each share of stock at an exercise price equal to the market price (I thank Kevin J. Murphy for making me aware of this unexpected feature of some companies' incentive compensation contracts). Many companies will issue further reload options in exchange for the exercise of previous groups of reload options, allowing a long sequence of these securities to

explains, incorrectly:

Depending upon fluctuations in the market price of the common stock, optionees may decide to exercise their options either earlier or later than these assumed periods resulting in Black-Scholes values which would be lower or higher than those shown.

It is not rare for company proxy statements to reflect confusion over whether American options are more valuable than European options. Moreover, many companies wrongly explain to their stockholders that the Black-Scholes formula was developed for American and not European options, and that options' exercisability provisions affect their Black-Scholes values.<sup>11</sup> One cannot tell whether statements of this type occur because of the ignorance of company officials and their compensation consultants, or because of firms' expectations that most stockholders will lack the financial sophistication to spot the misrepresentations.

Companies in my sample make no mention of two further arguments which might justify reducing the expected terms of options: dividend payments and managerial retirement schedules. If dividends are large, the opportunity cost of not receiving them might rationally motivate managers to exercise options ahead of expiration. However, binomial simulations for the awards studied in this paper indicate that the expected optimal exercise date due to dividend payments will rarely occur before year nine of a ten-year option, suggesting that any adjustment to option lives should be much smaller than those made by sample companies. For retirements, a clear argument exists that expected option terms should be shortened for executives nearing their companies' customary retirement ages, since many companies require options to be exercised

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be spawned over the life of the original options. Notwithstanding the unusual incentive features of reload options, it is difficult to think of a financial argument for why their attachment to the original options makes those options less valuable at the time of issue, as is claimed in this case.

<sup>11</sup> See, for example, the 1993 proxy statements filed by Avery Dennison and Reynolds Metals.

within a short period after retirement, such as six months. However, the sample correlation between companies' adjustments to option lives and the age of executives holding each option is virtually zero.

### 3.2(b). *Independent Discounts to Black-Scholes Values*

Fifteen companies reporting Black-Scholes option values in 1993-94 also reported independently applying discounts to their Black-Scholes estimates before reporting award values to stockholders; the average discount reduced the Black-Scholes estimate by 20%. Every company making such reductions cited the probability that executives might leave the firm before their option awards became exercisable. About half the companies also cited the possibility of executive turnover before the end of options' lives (but after the date of full vesting). Some companies purported to use long-run averages of executive turnover when calculating the appropriate discount factors for these ad hoc adjustments, although the method of calculation was never disclosed in detail.

Such reductions in option values appear to ignore important aspects of how stock options interact with executive turnover. First, a commonly stated purpose of stock option awards is to provide a curb against *voluntary* executive departures, especially for CEOs and other top managers. Therefore, executives receiving stock options should be expected to leave their firms with less frequency than historical company data would predict, especially if the stock options provide effective performance incentives. Second, a strong correlation probably exists between *involuntary* executive turnover and the probability that executives' stock options will have fallen far out-of-the-money. Therefore, executives who are dismissed will be forced to surrender

options with below-average values. For both these reasons, only modest adjustments to option values appear to be appropriate to take account of managerial departure frequencies.<sup>12</sup> One clear exception would again occur for planned executive retirements. However, near-zero sample correlation exists between companies' independent discounts to option values and CEO ages.

Additional arguments related to liquidity and institutional restrictions, already discussed above, might also provide suitable rationales for discounting Black-Scholes value estimates. However, no *Fortune 500* company has cited these issues as justification for its independent reductions of Black-Scholes values.

### 3.3. *Does the Black-Scholes Formula Under-Value Executive Stock Options?*

While the SEC's disclosure rules allow great discretion in modifying the Black-Scholes formula so long as the adjustments are disclosed to shareholders, all such modifications reported to date by *Fortune 500* firms have had the same effect: reducing the estimated values of executive stock options. Companies have completely ignored theoretical arguments that stock options awarded to managers have *greater* values than those implied by the Black-Scholes formula.

#### 3.3(a). *Managers' Private Information*

One reason that stock options have more value to corporate managers than public

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<sup>12</sup> An alternative argument would suggest that CEOs who perform well are more likely to leave their firms because their strong records will generate offers from other companies. However, studies of CEO turnover (which do not separate voluntary and involuntary departures, due to the absence of clear explanations for many CEO transitions) universally show an inverse association between performance and the incidence of departures. See, e.g., Warner, Watts and Wruck (1988).

investors is that companies' executives hold private information about their firms' prospects. This allows for more informed choices of when to exercise the options, consistent with the findings of Carpenter (1994). Another advantage rests in managers' ability to influence their firms' dividend payouts, stock return volatilities, and stock price paths. All of these variables might be manipulated to increase managers' stock option values, again implying that the Black-Scholes formula under-states the value of executives' options. Theoretical research has implicitly or explicitly ignored the importance of these effects, in part because of their analytical intractability (for example, see the assumption in Huddart, 1994, that "the parameters of the stock price process are stationary irrespective of employee actions").

### *3.3(b). Leverage*

The presence of leverage in the capital structures of nearly all major public companies raises another possibility of bias in Black-Scholes estimates of options' value. A well-known result in the options literature is that an option on the stock of a levered company represents a compound option, since the firm's equity is itself an option on the value of the firm. Geske (1979) shows that the Black-Scholes formula will produce biased estimates of options on levered equity; for deep in-the-money options, Black-Scholes estimates will be too high, while for deep out-of-the-money options, Black-Scholes estimates will be too low. For options issued at-the-money, the effects are unclear but probably small, which means that the Black-Scholes formula is approximately correct for most executive options. However, just under 10 percent of my sample companies issue CEO stock options which are out-of-the-money, and for these firms, Black-Scholes estimates of option values will be biased downward. (No company in my sample

awarded in-the-money options.)

### 3.3(c). *American exercise provisions*

One further element of executive stock options unquestionably gives them higher value than the Black-Scholes formula, and this increase in value can be estimated by straightforward methods. As noted above, most executive options are American call options, which may be exercised at any time, as opposed to European calls, which are exercisable only at expiration and which the Black-Scholes formula was created to value. Binomial option pricing models provide a convenient method for estimating the value of options' American exercise provisions.

Binomial models utilize series of "nodes" to represent likely ranges of stock prices at different times, and the values of options in both their exercised and unexercised states can be estimated by taking expectations over appropriately large sets of nodes. I follow a binomial procedure outlined by Hull (1993) to estimate the values of all stock options awarded to *Fortune* 500 CEOs in both 1992-93 and 1993-94 under the alternative assumptions that the options have European and American exercise provisions. My binomial model contains 40 sequential sets of nodes, with each node sequence representing three months of the ten-year life of a typical CEO stock option; the three-month period is convenient since it matches the dividend cycles of most companies, and dividend payments are the most obvious motivation for exercising options before expiration. I exclude from the analysis the small portion of option awards with durations different than ten years, as well as options issued by companies which pay no dividends (since American and European calls have the same binomial values if the dividend rate is zero).

I estimate the value of American exercise provisions by calculating the difference in

binomial values of stock options under the European and American exercise assumptions (binomial European estimates are within 1% of Black-Scholes estimates in a large majority of cases). Figure 2 displays a scatter-plot of the percentage American call premium as a function of each option's underlying dividend rate. The lower panel of Figure 2 presents regression lines calculated from these observations. For a typical company with a dividend rate near 3 percent and stock return volatility close to .30, the data imply that stock options are worth about 5 percent more with the American exercise provision compared to the European. For companies with higher dividend rates, the value of the American exercise premium can be considerably higher, as the top panel of Figure 2 indicates that some CEO option value estimates should be increased by as much as one-third. Nonetheless, the importance of the American exercise provision has been widely ignored in the debate over the appropriateness of the Black-Scholes formula for valuing executive stock options, and companies have uniformly omitted it when presenting shareholders with estimates of stock option values.

#### **4. Black-Scholes Estimates and Company Characteristics**

As noted above, companies may systematically lower their Black-Scholes estimates of CEO stock option values in order to reduce stockholder scrutiny of executive pay levels. This section presents two types of circumstantial evidence in support of this conjecture. First, I note that companies may elect to avoid the Black-Scholes calculation entirely and use simpler rule-of-thumb estimates of option values. Data indicate that those companies which forego the Black-Scholes reporting alternative are those with dividend rates and option lives implying the highest Black-Scholes values. Second, I provide evidence of an association between the amount by



which a company's Black-Scholes claim falls short of the benchmark, and the amount by which a CEO is "overpaid" according to the predictions of a simple regression model. Such an association, if present, would imply that those CEOs whose compensation is most worthy of stockholder scrutiny are also the most likely to report low estimates of the compensation's value.

#### 4.1. *Companies' Choices of Reporting Methods*

Approximately one-third of companies awarding CEO stock options since late 1992 elected to report to shareholders estimates of the options' Black-Scholes values. Other companies were required to report options' simulated future values under the rule-of-thumb assumptions that the underlying stock price increased at annual rates of 5% and 10% over the options' lives. (Companies were free to use additional option pricing models, such as the binomial approach, but no *Fortune 500* firms did so.) Since the latter calculation could be done independently by stockholders, companies provide incremental information about option values only if they report Black-Scholes estimates. Therefore, if companies systematically attempt to reduce stockholder scrutiny of large executive compensation packages, one would expect less frequent use of the Black-Scholes formula by companies with higher-valued options.

Table 3 presents a comparison of average Black-Scholes benchmark values for both groups of companies in 1992-93 and 1993-94 (as noted above, the vast majority of companies awarding stock options in both years made the same reporting choice each time). As expected, companies choosing the Black-Scholes reporting alternative have lower average award values than their counterparts, although the differences are not significant. Two significant patterns are that companies with higher dividend rates and longer option lives are more likely to report

Black-Scholes claims. The first association makes sense, since higher dividends imply lower Black-Scholes values. The latter pattern can be understood with reference to the alternative of reporting simulated option values under the rule-of-thumb assumptions that the underlying stock price increases at 5% and 10% annual rates. The relative Black-Scholes value of options compared to the two hypothetical values becomes lower as option life increases (see simulations in Murphy, 1994).

#### 4.2. *CEO Pay Levels and Black-Scholes Under-Reporting*

Further evidence that companies seek to conceal large executive compensation packages from stockholders emerges from an analysis of whether an association exists between companies' discounts of Black-Scholes CEO stock option values and the level of total compensation received by CEOs. If companies do attempt to conceal the value of compensation, one would expect larger option value discounts from those firms whose CEOs are "overpaid" according to some objective measure.

I begin with a model of predicted CEO pay, which assumes that compensation is a function of a CEO's age, company size (the log of sales), and net-of-market stock performance during the fiscal year (I use the S&P 500 index's dividend-inclusive return as the market return):

$$Compensation_{it} = \alpha + \beta_1 \log(Sales)_{it} + \beta_2 (Stock\ Return_{it} - Market\ Return_t) + \beta_3 Age_{it} + \epsilon_{it} \quad (4)$$

The model is similar to numerous others in the executive compensation literature (see, e.g., Agrawal and Walking, 1994). The dependent variable equals the sum of the values of cash salary and bonus payments, restricted stock awards (as reported by the company), and the

benchmark value of stock option awards (as calculated herein). Other compensation is omitted because it is either too difficult to value (as is the case with long-term, accounting-based bonus schemes) or has minimal importance in relation to other categories.

I estimate this regression over a pooled cross-section time series using data for all 771 CEO-years for which the CEO served twelve months and no data problems led to missing values. I assume that the unexplained residual in the regression,  $\epsilon_{it}$ , represents "excess" compensation above that predicted by company size, performance, and CEO age. I take this residual and use it as an explanatory variable in a second regression which has as its dependent variable the shortfall of a company's Black-Scholes claim compared to the benchmark option value:

$$(\text{Option Value Claim} - \text{Benchmark Option Value})_{it} = \delta + \gamma \epsilon_{it} + v_{it} \quad (5)$$

I estimate this regression over the sub-sample of 165 CEOs whose companies made claims about the Black-Scholes value of CEO stock option awards. A finding of  $\gamma < 0$  would suggest that companies with CEOs receiving excessive compensation have the greatest tendency to under-report the value of stock option compensation. Consistent with this hypothesis, I estimate  $\gamma = -.035$  (T-statistic = 2.57; robust T-statistic 0.92). This estimate implies that for every dollar of excess or unexplained compensation received by a CEO, his company under-reports the value of his stock option award (if any) by three and a half cents. However, companies' propensities to under-report option values might have changed after the SEC tightened its disclosure rules in 1993 by requiring firms to state the assumptions used in Black-Scholes calculations. To capture this possibility, I interact the  $\epsilon_{it}$ , "overpayment" residual with dummy variables for the 1992-93 and 1993-94 fiscal years. This leads to the modified equation:

$$(Option\ Value\ Claim - Benchmark)_{it} = \delta + \gamma_{92} \epsilon_{i92} + \gamma_{93} \epsilon_{i93} + v_{it} \quad (6)$$

If excess compensation is associated with attempts to mislead stockholders, I should estimate  $\gamma_{92} < 0$  and  $\gamma_{93} < 0$ , as well as  $\gamma_{92} < \gamma_{93}$ . I estimate  $\gamma_{92} = -.066$  (T-statistic = 3.34) and  $\gamma_{93} = -.008$  (T = 0.44), consistent with this hypothesis (robust T-statistics are 2.41 and 0.14, respectively). I conclude that the evidence is consistent with some association between CEO overpayment and the under-reporting of stock option values in 1992-93, and that the SEC's disclosure reforms appear to have eliminated this pattern in 1993-94.

One possible criticism of these result is that the  $\epsilon_{it}$  "overpayment" residual from the first regression may be correlated with the dependent variable in the second equation, simply because the benchmark option value comprises part of the dependent variable for each of the two equations. To check the importance of this, I re-estimate the first equation using the claimed stock option value in place of the benchmark value for those companies reporting Black-Scholes claims; if the original model tended to bias the overpayment residuals upward, this method will bias them in the other direction, given the observed propensity of most companies to under-report the Black-Scholes values of stock options. As expected, the re-estimation leads to a  $\gamma$  estimate in the first equation closer to zero and insignificant, but in the second equation  $\gamma_{92}$  remains negative and significant as before.

## 5. Discussion and Conclusions

This paper analyzes companies' disclosure of CEO stock option values in compliance with new SEC regulations for reporting executive compensation data. The results are important

not only because they cast light upon how corporations value executive stock options, but also because of the similarity between the SEC's regulations and controversial proposals by the FASB which would require companies to report the estimated grant date value of executive stock option awards.

Results of the study indicate that companies use several methods to reduce the estimated value of executive stock options below levels implied by the Black-Scholes formula. Many companies reduce the expected lives of stock options, while others apply arbitrary discount factors to Black-Scholes values. These modifications are often justified with reference to historical company data for option exercises, although the theoretical support for these changes is not always strong. Moreover, valid arguments that the Black-Scholes formula under-estimates the value of executive stock options -- especially because of their American exercise provisions -- are universally ignored in companies' discussions of the formula's suitability.

Some circumstantial evidence suggests that companies exploit the flexibility of the SEC's disclosure regulations, possibly to minimize the intangible costs to managers of reporting high compensation levels. First, companies are more likely to elect the Black-Scholes reporting choice when parameters used in the formula imply lower option valuations. Second, an association appears to exist between the amount by which companies under-report the value of CEO stock option awards, and the degree to which CEOs receive excessive compensation above that predicted by a simple regression model.

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**TABLE 1**  
**Sample Selection for Analysis of**  
**Claimed CEO Stock Option Award Values**

This table describes the process used to select companies in the 1993 "Fortune 500" for inclusion in the study of how corporations report the value of CEO stock option awards. Companies were excluded from the candidate sample if they filed no data regarding CEO stock option awards. This group consisted largely of foreign and private firms which are not subject to the SEC's proxy regulations. Other excluded firms included those not filing proxy statements due to financial distress, those not reporting compensation data for a CEO who had served for the majority of the prior year before being dismissed (it was not longer permissible to omit data for these ex-CEOs after the 1992-93 proxy year), and firms acquired during the 1993-94 fiscal year. Within the resulting candidate sample, a handful of companies were excluded from the final sample because of valuation problems with respect to CEO stock option awards.

	<u>Fiscal Year</u> <u>1992-93</u>		<u>Fiscal Year</u> <u>1993-94</u>	
<b>Fortune 500 companies (April 1993)</b>	500		500	
No compensation data available				
Private and foreign firms	(60)		(67)	
Delayed filing due to financial distress	(1)		(1)	
Exiting CEO not included in proxy statement	(16)			
1993-94 proxy statement not yet filed			(1)	
	-----		-----	
<b>Candidate sample of filing companies</b>	423		431	
No stock options awarded to CEO	(143)	34%	(135)	31%
Valuation problems				
Awards near IPO date	(4)		(1)	
Awards with contingent or indexed exercise prices	(3)		(1)	
Grant date not reported	(2)			
	-----		-----	
<b>Final sample of companies with CEO stock option awards</b>	271		294	
<b>Reporting choice of companies in final sample</b>				
Black-Scholes	93	34%	88	30%
Simulated values	178	66%	206	70%



**TABLE 3**  
**Average Characteristics of Fortune 500 Companies**  
**Sorted By Reporting Choice For CEO Stock Option Values**

The table shows average characteristics of Fortune 500 companies awarding stock options to their CEOs. The sample is partitioned according to whether companies report to shareholders estimated Black-Scholes values of their CEOs' stock option awards. If companies do not report Black-Scholes estimates, they must report simulated future option values under the assumptions that the underlying stock price appreciates at annual rates of 5% and 10% over the options' lives.

The second line of the table presents average Black-Scholes values of stock option awards across companies, with award values calculated according to the "benchmark" assumptions described in the text. The remaining lines present average values of dividend rates, stock return volatilities, and option lives as used in the Black-Scholes calculations. Dividend rates are those prevailing for each company on the stock option award date. Stock return volatilities are estimated over the 120 trading days prior to the award. The lives of options are obtained from company proxy statements. The risk-free rates used in calculations are equal to the yields on zero-coupon U.S. Treasury bonds with maturity closest to each option's expiration date. Benchmark values include dilution factors to account for shares which would be issued if options were exercised. When companies make more than one stock option award to CEOs during a fiscal year, the benchmark values include the sum of all individual award values, and data in the table for dividend rates, stock return volatilities, and option lives reflects the terms of the first awards received by CEOs during a fiscal year.

	Fiscal Year 1992-93			Fiscal Year 1993-94		
	Reporting Policy			Reporting Policy		
	<u>Black-Scholes</u>	<u>Simulated Values</u>	<u>T-statistic</u>	<u>Black-Scholes</u>	<u>Simulated Values</u>	<u>T-statistic</u>
Number of companies	93	178		88	206	
Black-Scholes value (thousands)	\$881	\$1,041	-0.89	\$995	\$1,211	-0.88
Dividend rate (logarithmic)	2.56%	2.03%	2.72 *	2.40%	1.89%	2.89 *
Stock return volatility	0.32	0.31	0.70	0.28	0.30	-1.39
Life of options (years)	9.87	9.31	3.59 *	9.90	9.42	3.37 *

\* Significant at 1% level

## TABLE 2 Reconciliation of Benchmark CEO Stock Option Award Values With Companies' Claimed Black-Scholes Values

The table gives descriptive statistics about differences between companies' claimed Black-Scholes values of CEO stock option awards and benchmark values for the same option awards. Assumptions used for the benchmark calculations are based upon company data at the time of each award and are described fully in the text. The lower four lines of the table illustrate how benchmark option values would change if assumptions conformed with those provided by the companies. The sample consists of awards to all CEOs of Fortune 500 companies with fiscal years ending between November 1993 and October 1994 for which companies reported estimated Black-Scholes values.

	<u>Companies Affected</u>	<u>Average Award Value</u>	<u>Median Award Value</u>	<u>Average Deviation Vs. Claim</u>	<u>Median Deviation Vs. Claim</u>
Company claims	n = 88	\$890.8	\$522.9		
Benchmarks		\$994.9	\$636.0	6.5% *	2.0%
Adjusted for volatility and dividend assumptions	s: 72 (82%) d: 77 (88%)	\$977.7	\$639.9	9.3% *	4.9% *
Adjusted for option life and interest rate assumptions	T: 20 (23%) r: 75 (85%)	\$942.3	\$553.3	0.6%	-1.9%
Adjusted for forfeiture and vesting risk discounts	15 (17%)	\$944.9	\$596.2	2.8%	-0.6%
Adjusted for all company assumptions		\$879.8	\$554.9	0.0%	-1.0% *

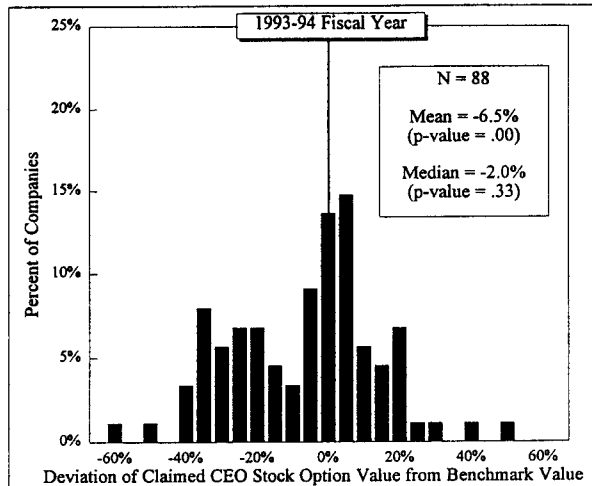
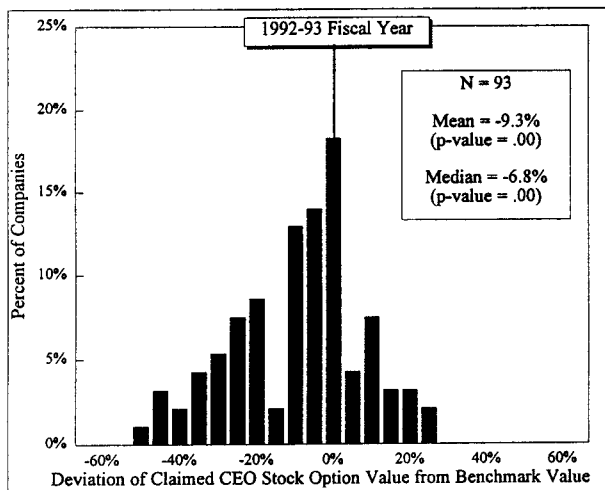
\* Significant at 1% level

Significance levels are calculated from T-tests assuming unequal variance (means) and exact confidence intervals based upon the binomial distribution (medians).

# FIGURE 1

## Distribution of Companies' Claimed Values Relative to Benchmark Values For CEO Stock Option Awards

The figure shows the frequency distribution of differences between companies' claimed Black-Scholes values of CEO stock option awards and benchmark values calculated from assumptions given in the text. The samples include all Fortune 500 companies making stock option awards to their CEOs and reporting estimated Black-Scholes values for the awards in stockholder proxy statements. P-values for the null hypothesis that the mean difference equals zero are calculated from T-statistics; p-values for the null hypothesis that the median difference is zero are calculated from exact confidence intervals derived from the binomial distribution.



## FIGURE 2

### Estimated Value of American Exercise Provisions In CEO Stock Option Awards

The top panel illustrates how the estimated values of CEO stock option awards are affected by the ability of executives to exercise options prior to expiration. The chart illustrates data for 363 stock option awards to CEOs of Fortune 500 companies between 1992 and 1994. In all cases, executives have the right to exercise their options during the large majority of the options' terms. The estimated value of the American call feature is obtained by using a binomial model to value each option award under the assumption that it may be exercised at any time, and again under the assumption that it may only be exercised at expiration. The analysis includes all CEO option awards with terms of ten years made by companies paying nonzero dividends. Observations are excluded for companies making more than one stock option award to their CEO during a fiscal year, since different dividend rates would apply for each award. One outlier observation for a company with a 9% dividend rate is also excluded.

The lower panel shows the results of a regression using the same data. The American call option premium for each award was regressed against the associated estimates of volatility, dividend rate, risk-free interest rate and their squares. Regression lines are displayed for different values of volatility under the assumption that the risk-free rate is 7%; the lines shift downward approximately one percentage point for each 1% increase in the risk-free rate (within reasonable limits).

