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Abstract

This paper analyzes company disclosures of CEO stock option values in compliance with the SEC's regulations for reporting executive compensation data to stockholders. Companies appear to exploit the flexibility of the regulations to reduce the apparent value of managerial compensation. Companies shorten the expected lives of stock options and unilaterally apply discounts to the Black-Scholes formula. Theoretical support for these adjustments is often thin, 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 new FASB requirements for firms to disclose the compensation expense represented by executive stock options.

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

David Yermack*

1. Introduction

In the early 1990s, public protests over the level of managerial compensation in large U.S. companies led two government authorities to expand disclosure requirements for executive pay.¹ The most significant new requirements of both the Securities and Exchange Commission (SEC, 1992) and Financial Accounting Standards Board (FASB, 1995) involve data about stock options used in executive compensation. Stock options have largely fueled the growth in remuneration of American CEOs since the mid-1980s (Yermack, 1995). However, the limited data disclosed about these instruments under prior reporting requirements was insufficient to permit shareholders to value executives' awards using modern option-pricing methods.

This paper analyzes companies' claims about the value of CEO stock option awards in compliance with SEC disclosure requirements that became effective in late 1992 and were augmented in 1993 (SEC, 1993a and b).² Because the SEC and FASB regulations allow

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¹ Murphy (1995) provides a summary of the political and shareholder activism that led to increased disclosure requirements for executive compensation. For discussions of business leaders' opposition to the changes, see press reports such as Cowan (1992), Glassman (1994), and Harlan (1994).

² 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.

companies flexibility in how to calculate the value of executive stock options, shareholder activists have worried that firms will under-state the options' expected cost to shareholders (Lowenstein, 1995; Siconolfi and Raghavan, 1996).

I test the hypothesis that companies report low levels of stock option compensation by exploiting the flexibility of the SEC's new disclosure regulations. Using data for *Fortune 500* companies, I analyze the claimed values of CEO stock option awards for those firms that used the Black-Scholes (1973) approach as the basis of valuation. My hypothesis, that firms will report low values of executive stock options, has four empirical implications. First, I expect companies to report option values significantly below a benchmark implied by the Black-Scholes equation. Second, I expect the degree of under-reporting to diminish during the second year of the SEC's regulations, since rules were tightened in that year to require companies to provide greater justification for the Black-Scholes estimates. Third, I expect companies' unilateral modifications of the Black-Scholes formula generally to imply reductions rather than increases in estimated option values. Finally, I expect to find a connection between the degree of under-reporting compared to the Black-Scholes benchmark, and the extent to which CEOs are "overpaid" compared to their peers. The rationale for this hypothesis is that those CEOs receiving the most excessive compensation have the greatest fear of shareholder dissatisfaction over their pay levels.

I find evidence that supports all of these hypotheses. In a sample of 182 CEO stock option awards made by *Fortune 500* companies in the 1992-93 and 1993-94 fiscal years, claimed Black-Scholes values are an average of 8.9% below benchmark values that I produce from methods widely used by financial economists. The average discount narrows from 9.9% in

1992-93 to 7.8% in 1993-94 as predicted, although the difference is not statistically significant. For the 88 awards studied in 1993-94, approximately 40% of the sample firms modify the Black-Scholes equation, and every one of these modifications has the effect of reducing the estimated value of executive compensation. Finally, I find a statistically significant link between the size of a company's discount from the Black-Scholes benchmark, and the extent to which its CEO receives excessive compensation above that predicted by a simple regression model.

Some theoretical research has offered explanations for why employee stock options may have less cost to shareholders than implied by the Black-Scholes formula, which was developed for exchange-traded options.³ The most robust arguments of this type 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. Moreover, some managers will leave their firms before their options vest, meaning that they realize no value from the awards regardless of their *ex-ante* Black-Scholes value.

These arguments appears to offer sound support for companies who claim that the Black-Scholes formula over-states the value of their managers' stock options. However, my reading of proxy statements in gathering data for this paper indicates that virtually no companies cite managers' risk aversion and liquidity constraints as justifications for lowering options' Black-

³ See Foster, Koogler and Vickrey (1991), Lambert, Larcker and Verrecchia (1991), Jennergren and Nüslund (1993), Huddart (1994), Kulatilaka and Marcus (1994), Huddart and Lang (1996), and Rubenstein (1995).

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. Several firms, for example, imply to their stockholders that American options, which may be exercised at any time before expiration, have a lower expected cost to the company than European options, which can be exercised only at expiration.

While firms in my sample appear eager to find justifications for reducing estimated option values, they completely overlook reasons why the Black-Scholes formula might *understate* the cost to shareholders of executive stock options. One obvious reason is that the Black-Scholes 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.⁴ Numerical simulations herein using a 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 5%, but for some stock option awards the ability to choose the exercise date contributes approximately 30% additional value.

While much of the debate about the value of executive stock options has been clothed in the rhetoric of financial theory, the results herein are consistent with broad-based criticisms of executive compensation that have permeated the U.S. popular media during the last decade. Such writers as Crystal (1991) have argued that boards of directors do not fully comprehend the

⁴ 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.

costs to stockholders of contingent pay instruments, and the systematic under-valuation of stock options illustrated herein provides support for this view.

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 valuation formula, and summary statistics about CEO stock option awards by sample companies. Section 3 presents empirical results. Section 4 contains a discussion of the relevance of the results for predicting compliance with FASB's reporting requirements effective in late 1995. Section 5 concludes the paper.

2. Data and Methodology

2.1 *Sample Selection*

Table 1 details my sample selection process, which uses the 1993 *Fortune 500* list of the largest U.S. industrial companies as its basis. 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.⁵ 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 not subject to the SEC's disclosure rules (60 firms in the first year of the study, a group that 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. Sixteen companies in the first year of the study did not report

⁵ 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.

compensation data for their CEOs because these executives had left their firms by the time of the proxy filing; the SEC closed this loophole in 1993 by forcing companies to report data for all CEOs who serve during a 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 firms were dropped from the sample because of problems in valuing 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).⁶

The SEC requires companies to report the value of options awarded during each fiscal year to a company's five highest-paid executives. Firms are permitted to calculate option values following either the Black-Scholes approach, or simpler rule-of-thumb equations that assume 5% and 10% annual rates of stock price appreciation. Those firms electing the Black-Scholes approach may choose the assumptions used as inputs in the formula, and are also free to modify the standard Black-Scholes equation.⁷ After one year of company reports, the SEC tightened these regulations, requiring companies using the Black-Scholes methodology to support their

⁶ 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.

⁷ SEC (1992) permitted firms to report "the present value of the grant at the date of grant, under any option pricing model," while indirectly suggesting use of the Black-Scholes model. SEC (1993b) permitted companies to use "a variation of the Black-Scholes or binomial option-pricing model ... [or] another valuation method," without giving further guidance as to what modifications of the standard equations would be appropriate. Among the *Fortune 500* firms in my sample, only one valued stock options using a binomial model (that company also reported a Black-Scholes value), and no firm used any other option valuation approach.

calculations by stating assumptions and describing any modifications of the standard equation. The FASB adopted similar regulations in late 1995 for use with 1996 financial statements, although firms are not permitted to opt out of using the Black-Scholes valuation approach.

As shown by Table 1, approximately one-third of those firms awarding CEO stock options chose the Black-Scholes reporting method in each year: 94 firms in 1992-93 and 88 in 1993-94. Almost every company awarding CEO stock options in both years made the same reporting choice each time; of the 231 firms in this group, 145 did not report a Black-Scholes value in either year, 73 reported a Black-Scholes value in both years, 9 switched from reporting a value in the first year to not doing so in the second year, and 4 switched in the other direction. Data obtained from these firms included the number of stock options awarded to CEOs, as well as exercise prices, 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 that firms used in calculating Black-Scholes values, as well as information about any modifications of the Black-Scholes formula. However, not all firms reported the supporting data completely.

2.2 *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.⁸

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

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

where

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

- 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 (continuously compounded)
- d = expected dividend rate (continuously compounded) over life of option
- σ = 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.
- 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.

⁸ 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 11 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.

- Stock return volatility (σ) 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.⁹

Under my benchmark assumptions, I estimate the average value of nonzero CEO stock option awards during the 1992-93 fiscal year as \$968,200 per company, with a median of \$584,200. These statistics include companies that did not make Black-Scholes valuation claims to their shareholders. During 1993-94, the value of the typical CEO option award rose significantly, to an average level of \$1,147,600 and a median of \$637,700.

3. Companies' Black-Scholes Claims

The following passages present analysis of companies' claimed Black-Scholes values of CEO stock option awards. Section 3.1 compares company claims with benchmark Black-Scholes values described above. Section 3.2 presents data about companies' unilateral modifications to the Black-Scholes formula. Section 3.3 presents evidence of an association between the size of discounts between claimed and benchmark Black-Scholes values, and the amount of "excessive" compensation received by company CEOs.

3.1 Company Claims Compared to Benchmark Black-Scholes 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

⁹ 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 daily and monthly stock return data. Virtually no differences arose in the distribution of estimated benchmark values.

percentage deviations from the benchmark values described above. Consistent with my main hypothesis, the mean difference between companies' claimed Black-Scholes values and the benchmark is -8.9%, and the median difference is -6.0%. Both are statistically significant below the 1% level. The summary statistics are similar to those reported by Murphy (1995) in his study of 230 CEO stock option awards made in 1992. By inspection of figure 1, the results appear driven by a cluster of firms that report values 20% to 40% below the benchmark.

Under the hypothesis that managers exploit the flexibility of the disclosure rules to report low option values, I expect the extent of under-reporting to narrow in 1993-94, since the SEC in that year reduced the flexibility of its regulations by requiring companies to document assumptions and modifications to the Black-Scholes formula. Consistent with this prediction, the mean difference between company reports and the benchmark narrowed from -9.9% in 1992-93 to -7.8% in 1993-94 (both significant at the 1% level), while the median difference fell from -6.0% to -4.0% (significant at the 1% and 11% levels, respectively). The one-year changes in the mean and median are not statistically significant at conventional levels; the t-statistic for difference in means is -0.77 (p-value 0.44), while the Wilcoxon rank-sum Z-statistic for difference in the central tendency of the distributions is -1.10 (p-value 0.27).

The SEC's tightening of reporting requirements for Black-Scholes option values appeared to reflect a concern over some companies reporting lower values than expected. In SEC (1993a), the Commission's staff noted its belief that complete disclosure of companies' assumptions and modifications to the Black-Scholes calculation was necessary because ". . . the use of conservative estimates can cause a significant variation in the value reported." However, SEC (1993b) notes that the Commission is limited in its ability to take action against firms that report

unexpectedly low award values, since an option value "is a projection of a financial item entitled to safe harbor protections, as are the underlying assumptions."

3.2 Company Modifications to the Black-Scholes Formula

Insight into reasons for companies' discounts from the Black-Scholes benchmark can be obtained for 1993-94 data only, since the SEC did not require companies to disclose assumptions or calculation methods in 1992-93.¹⁰ Table 2 presents data about 1993-94 option awards with the sample partitioned into three groups: those firms modifying the Black-Scholes formula in ways that decreased the reported value of compensation; those firms modifying the formula in value-increasing ways; and those firms that made no modification to the formula.

As shown by the table, 39% of the sample companies made value-decreasing changes to the Black-Scholes formula in 1993-94. No companies made value-increasing changes, and 61% left the formula unchanged. It is evident that the group of companies modifying the formula accounts completely for the mean and median deviations of the entire sample from the Black-Scholes benchmarks; for those companies making no changes to the Black-Scholes calculation, mean and median deviations from the benchmark are virtually zero. This evidence implies that companies proceed in an unbiased way when choosing the values of assumptions that serve as inputs to the standard Black-Scholes formula; separate analysis of individual firms' assumptions

¹⁰ For reports made following the 1992-93 fiscal year, I analyzed any explanatory text that companies published accompanying their claimed Black-Scholes values (I abandoned this exercise for 1993-94 awards, since the SEC in that year began requiring uniform disclosures of assumptions, as discussed below). Of the 94 companies making Black-Scholes claims in 1992-93, only 9 reported any of the assumptions underlying the calculation. Two-thirds of the firms (63 out of 94) printed some type of disclamatory text about the appropriateness of the Black-Scholes formula, though these companies did not report option value claims in a significantly different pattern than those making no disclaimer. One company (Gerber Products) published an enthusiastic endorsement of the Black-Scholes approach but nevertheless reported claimed values 35.5% below my benchmark.

for volatility, risk-free interest rates, and dividend yields confirms this finding. Modifications of the formula itself therefore appear to account for the sample-wide summary statistics that support the hypothesis of under-reporting.

3.2.1 Reduced option lives.

Twenty of 88 companies reporting Black-Scholes values in 1993-94 also reported shortening the expected lives of 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 empirical observation that executives generally exercise stock options well before expiration, contrary to the optimal behavior for a risk-neutral, diversified investor (Huddart and Lang, 1996). 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*; indeed, the flexibility to choose the exercise date is widely believed by finance theorists to make American options *more* valuable than their European counterparts.

In reporting to shareholders their reductions of CEO stock option values through the use of lower expected option lives, companies generally ignore or misrepresent the financial theories that might support such changes. As noted above, the risk aversion and liquidity constraints of managers provide the theoretical rationales that Huddart (1994) and related studies use in predicting the early exercise of executive options. I investigate whether the pattern of companies' discounts from the benchmark Black-Scholes value is associated with the dollar value of stock owned by CEOs, since this variable might represent a useful proxy for each CEO's

risk aversion. The sample correlation between these two variables is virtually zero and not significant.

Companies do not generally cite 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, the small number of firms that do explain their discounts generally rely on a simplistic and incorrect interpretation of the Black-Scholes formula: these companies assert that an option that might be exercised early is less costly to stockholders *a priori* than an option that must be held until expiration. For example, in its 1994 proxy statement Kellogg Co. assumed that its ten-year options would be exercised after three years due to the availability of "reload options" at the time of exercise.¹¹ The company therefore set $T = 3$ in its Black-Scholes calculations and explained, 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.

Occasionally company proxy statements exhibit confusion over whether American options are more valuable than European options, with some companies wrongly explaining to their

¹¹ 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 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.

stockholders that the Black-Scholes formula was developed for American and not European options, and that options' exercisability provisions affect their Black-Scholes values.¹² 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 stockholders will lack the financial sophistication to spot the misrepresentations.¹³

A further problem with most companies' rationales for shortening expected option lives lies in the use of historical company data as the basis for estimating an option's expected term. As noted by Kulatilaka and Marcus (1994), a company's historical record of employee option exercises will be heavily influenced by its historical path of stock prices. However, this information may not be relevant for predicting future exercise patterns, since a firm's stock market performance can be quite variable across different time periods.

Companies in my sample make no mention of two further arguments that 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 early. However, binomial simulations for the awards studied in this paper indicate that the expected optimal exercise date due to dividend payments rarely occurs before year nine of a ten-year option. For retirements, a clear argument exists that expected option terms should be shortened for executives nearing their companies' customary retirement

¹² See, for example, the 1993 proxy statements filed by Avery Dennison and Reynolds Metals. Reynolds writes that the Black-Scholes formula "assumes that the options may be exercised immediately," which is patently incorrect.

¹³ The assumption that most shareholders will not notice errors in companies' explanations of option values received strong support from an examination administered in a Columbia University MBA options pricing course taught by a colleague of the author. Asked to critique the quotation from Kellogg's proxy statement that is reproduced at the top of this page, a large majority of the students did not spot any error.

ages, since many companies require options to be exercised within a short period after retirement. However, the sample correlation between companies' adjustments to option lives and the age of executives holding each option is virtually zero.

3.2.2 Unilateral discounts to Black-Scholes estimates.

Fifteen companies reporting Black-Scholes option values in 1993-94 applied unilateral discounts to their estimates before reporting award values to stockholders; the average discount reduced the Black-Scholes value by about 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 choosing the magnitude of these ad hoc adjustments, although the method of calculation was never disclosed in detail.

Such reductions in option values ignore aspects of how stock options interact with executive turnover. 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. Second, a strong correlation probably exists between *involuntary* executive turnover and the probability that executives' 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.¹⁴ 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 cites these issues as justification for its unilateral reductions of Black-Scholes values.

3.2.3 Absence of value-increasing modifications.

While the SEC's disclosure rules allow great discretion in modifying the Black-Scholes formula, all such modifications reported by *Fortune 500* firms in 1993-94 had the same effect: reducing the estimated values of executive stock options. Companies completely ignored theoretical arguments that stock options awarded to managers have *greater* values than those implied by the Black-Scholes formula.

One reason that stock options have more value to corporate managers than public investors is that companies' executives hold private information about their firms' prospects. This allows for more informed choices of when to exercise the options. Huddart and Lang (1996) explore this possibility but fail to find evidence that executives exercise options in advance of stock price declines. Managers also have ability to influence their firms' dividend

¹⁴ 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.)

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 (for example, see the assumption in Huddart, 1994, that "the parameters of the stock price process are stationary irrespective of employee actions"). However, empirical research shows that dividend payments are lower than expected after firms adopt stock option plans (Lambert, Lanen, and Larcker, 1989), while stock price variance, a proxy for volatility, increases compared to prior levels (DeFusco, Johnson, and Zorn, 1990). Two recent studies also find that managers receive stock option awards at favorable times, shortly in advance of upward movements in company stock prices (Yermack, 1996), and just after declines in stock prices (Chauvin and Shenoy, 1995). All of these considerations would support *increasing* Black-Scholes estimates of executive stock option values by ad hoc factors, in much the same way that 40% of the sample firms apply ad hoc discounts.

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.

I calculate 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), following methods outlined by Hull (1993). I exclude

from the analysis the small portion of option awards with durations different than ten years, as well as options issued by companies paying zero dividends. Figure 2 displays a scatter-plot of the 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 .03 and stock return volatility close to .30, the data imply that stock options are worth about 5% 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; 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.

3.3 Association Between Under-Reporting and Level of CEO Compensation

Further evidence that companies seek to conceal large executive compensation packages emerges from analyzing the association between companies' discounts of Black-Scholes stock option values and the level of compensation received by their CEOs. If companies do attempt to reduce the reported value of compensation, one would expect larger option value discounts from those firms whose CEOs are "overpaid" compared to their peers.

I estimate a model of predicted CEO pay, assuming 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):

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

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.

I fit this regression over a pooled cross-section time series using data for all 770 CEO-years for which the CEO served twelve months and no data problems led to missing values. I estimate $\beta_1 = 716.4$ ($t = 11.88$), $\beta_2 = 296.5$ ($t = 1.40$), and $\beta_3 = -15.5$ ($t = -1.61$), with $r^2 = .16$ and F-statistic of 48.1. I assume that the unexplained residual in the regression, ϵ_{it} , represents excess compensation above that predicted by company size, performance, and CEO age. I save this residual and use it as an explanatory variable in a second regression. This regression models the magnitude of a company's reporting discount from the benchmark Black-Scholes option value:

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

I fit this regression over the sub-sample of 166 CEOs whose companies reported claimed Black-Scholes option values and also provided usable data for the first regression. A finding of $\gamma < 0$ would suggest that companies whose CEOs receive excessive compensation apply the greatest discounts to Black-Scholes values. Consistent with this hypothesis, I estimate $\gamma = -0.032$ (t -statistic = -2.19, $r^2 = .03$). 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 a little over three cents. However, companies' propensities to under-report option values might have changed after the SEC tightened its disclosure rules in 1993. To capture this possibility, I interact the ϵ_i , "overpayment" residual with dummy variables for the 1992-93 and 1993-94 fiscal years. This leads to the modified equation:

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

If excess compensation is associated with attempts to mislead stockholders, I should find $\gamma_{92} < 0$ and $\gamma_{93} < 0$, as well as $\gamma_{92} < \gamma_{93}$. I estimate $\gamma_{92} = -.043$ (t-statistic = -2.11) and $\gamma_{93} = -.020$ (t = -0.99), consistent with this hypothesis ($r^2 = .03$, $F = 2.7$). I conclude that the evidence supports the presence of an 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 much of this pattern in 1993-94.

4. Relevance of Results for Predicting Compliance with FASB Regulations

Beginning in late 1995, the FASB will require firms to disclose estimated option values in footnotes to financial statements using a Black-Scholes framework, and FASB (1995) directly endorses the use of shortened option lives and ad hoc discounts similar to those used by many firms in this study. Although the analysis in this paper indicates that companies systematically report to the SEC executive stock option values below benchmark Black-Scholes levels, two types of problems may limit the relevance of the results for predicting companies' compliance with the FASB regulations. First, the sample of companies studied in this paper may not be

representative of all *Fortune 500* firms, since companies were able to choose whether to use the Black-Scholes framework when reporting values of executive option awards to the SEC, while FASB will not permit such opting out. Second, the parameters for valuing stock option awards throughout an entire company, as required by the FASB, may differ from those used in valuing awards for the top five executive officers, as required by the SEC.

4.1 Characteristics of Firms Reporting Black-Scholes Option Values to the SEC

As permitted by the SEC, approximately two-thirds of companies awarding CEO stock options since late 1992 have chosen not to use the Black-Scholes framework when reporting estimated values of stock options. Instead these companies have reported options' simulated future values under the 5% and 10% rule-of-thumb assumptions about annual stock price appreciation. Systematic differences might exist between these two groups of firms; since the FASB's proposed requirements were subject to heated debate when the SEC introduced its rules, it is possible that those firms most opposed to using the Black-Scholes approach for valuing executive stock options might have opted out of reporting Black-Scholes values to the SEC.

A related hypothesis is that firms might simply report the lower of the two permitted types of option value estimates. However, if firms followed this strategy they would almost always report Black-Scholes values, since these are almost invariably less than future option values calculated under the assumptions of 5% and 10% annual stock price appreciation. The main reason for this difference is that the future values, when calculated as specified by the SEC, are not discounted back to the present by an appropriate factor for the time value of money.

Data suggest that companies with relatively low Black-Scholes option values have been

more likely to report those values to the SEC. 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). 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, again due to the absence of a discount factor for the time value of money in the SEC's rule-of-thumb formulas.

4.2 Different Valuation Issues for FASB and SEC Requirements

While the SEC requires companies to estimate the value of stock options awarded to the top five executives, the FASB's requirements concern aggregate totals of option awarded to employees throughout a company. As shown by Huddart and Lang (1996), some firms award options to hundreds of managers at all levels of the chain of command. The nature and extent of companies' modifications to the Black-Scholes may differ substantially when one attempts to value options awarded at all levels of a firm instead of those awarded to senior managers.

Shortening the predicted lives of options, to reflect managers' expected early exercise due

to risk aversion and liquidity constraints, represents one such area where firms may make different assumptions about the behavior of top executives compared to all managers. Huddart and Lang (1996) present evidence that top-level managers exhibit less risk aversion in the pattern of option exercises than other employees, and they also conjecture that top managers will be reluctant to exercise options early for signalling reasons. If true, companies may shorten the expected life more for all employees than for top managers, and report lower option values to the FASB than to the SEC.

Similar issues arise with such variables as the expected rate of employee turnover and the access of employees to private information. The frequency of employee departures, and therefore the probability that options will expire unexercised, is likely greater at lower levels of the firm than among top management. Therefore, companies applying unilateral discounts to the Black-Scholes formula to reflect the probability that options will never be exercised will probably report lower values to the FASB than to the SEC. Access to private information is almost certainly greatest for top managers. Private information is central to arguments outlined above about why stock options are more valuable to top managers than the Black-Scholes formula suggests; for example, managers can exploit inside information to exercise options at favorable times. If a company were to increase option values above the Black-Scholes level to reflect these considerations (although no firms have done so to date), such a change would probably be more appropriate when reporting values to the SEC for the five top executives, than when reporting values to the FASB for all employees.

A final consideration about firms' reporting strategies concerns the exposure of top executives to criticism for receiving high levels of compensation. While the preceding

paragraphs suggest that firms might report higher option values to the SEC than to the FASB, the hypothesis of this paper is that firms are especially concerned about shielding top managers from embarrassment or shareholder dissent. Since numbers reported to the FASB will be aggregates that do not draw attention to the pay of any individual, it is possible that firms will be more aggressive in discounting option values reported to the SEC regardless of the underlying theoretical considerations.

5. 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 rules and those recently adopted by the FASB requiring companies to report the estimated cost to shareholders of executive stock options.

I find evidence consistent with a hypothesis that companies exploit the flexibility of the SEC's disclosure requirements to report low values of managerial compensation. Those *Fortune 500* companies that elect to disclose Black-Scholes values of CEO stock options under-report the values by an average of 8.9% compared to my benchmark. The discount narrows in the second year under the SEC's disclosure requirements, when the Commission required companies to provide more supporting data about their calculations. Approximately 40% of the sample companies account for the overall pattern of discounts by applying unilateral modifications to the Black-Scholes equation. Some companies reduce the expected lives of stock options, while others apply multiply the formula by ad hoc discount factors, often justifying the changes with

reference to historical company data for option exercises. 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. Companies universally ignore valid arguments that the Black-Scholes formula under-estimates the value of executive stock options -- especially because of their American exercise provisions -- and that Black-Scholes estimates of executive option values should be scaled upward instead of discounted.

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

Sample selection of 1993 Fortune 500 companies 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 that are not subject to the SEC's proxy regulations. Other omitted firms included those not filing proxy statements due to financial distress, those not reporting compensation data for a CEO who had served 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 and de-listed 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>	
Fortune 500 companies (April 1993)	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)			
	-----		-----	
Candidate sample of filing companies	423		432	
No stock options awarded to CEO	(142)	34%	(136)	31%
Valuation problems				
Awards near IPO date	(4)		(1)	
Awards with contingent or indexed exercise price	(3)		(1)	
Grant date not reported	(2)			
	-----		-----	
Final sample of companies with CEO stock option awards	272		294	
Reporting choice of companies in final sample				
Black-Scholes	94	35%	88	30%
Simulated values	178	65%	206	70%

FIGURE 1

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

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 181 Fortune 500 firms making stock option awards to their CEOs in the 1992-93 and 1993-94 fiscal years 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.

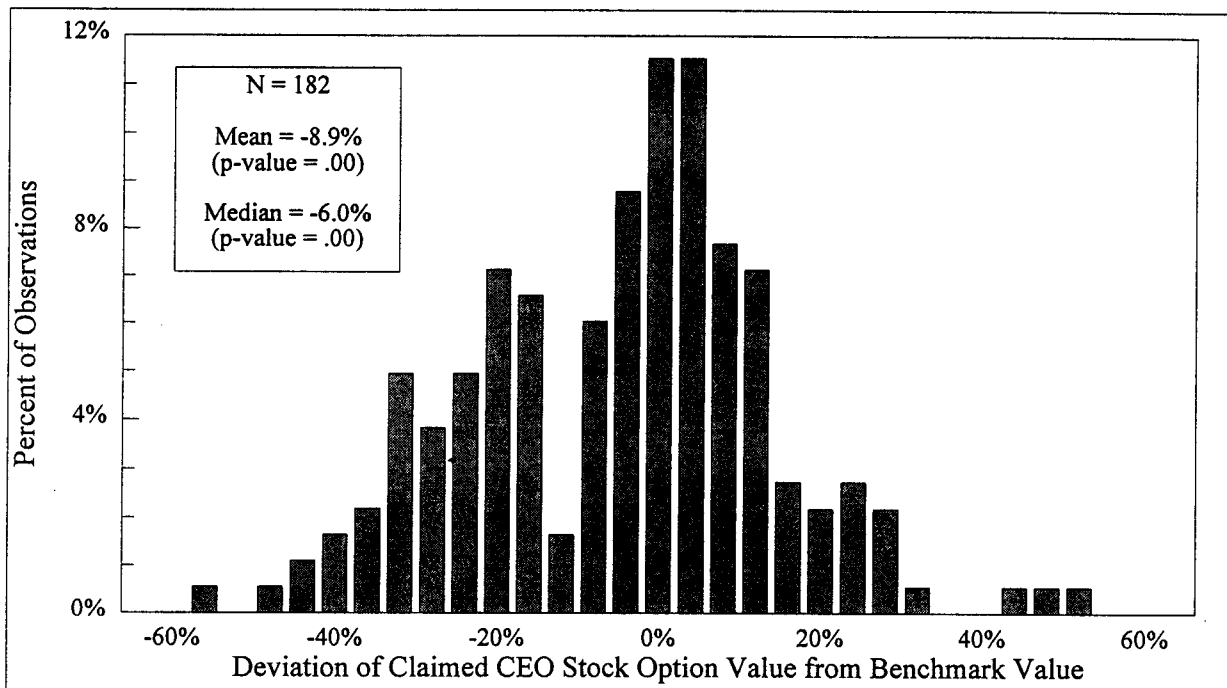


TABLE 2
Company Modifications to the Black-Scholes Formula in 1993-94
When Calculating CEO Stock Option Values

Descriptive statistics about companies' modifications of the Black-Scholes formula when reporting value of CEO stock option awards in shareholder proxy statements. The sample includes all 88 Fortune 500 firms that reported Black-Scholes values of CEO stock option awards in proxy statements filed after the 1993-94 fiscal year. Companies are grouped in the table according to whether they reported making any adjustments to the standard Black-Scholes (1973) formula for calculating the value of call options.

The table reports mean and median values for the percentage deviation between a company's claimed value of its CEO's stock option award and a benchmark value calculated from the Black-Scholes formula. Assumptions for all calculations are given in the text. The p-value for whether the median deviation is significantly different from zero is calculated from an exact confidence interval derived from the binomial distribution.

	<u>Obs.</u>	<u>% of Total</u>	<u>Mean difference from benchmark</u>	<u>T-statistic</u>	<u>Median difference from benchmark</u>	<u>P-value</u>
Value-decreasing modifications						
Shortening of expected option life	19	22%	-21.6%	-5.27 ***	-23.6%	0.00 ***
Discount for forfeiture possibility	14	16%	-16.4%	-3.33 ***	-24.2%	0.06 *
Both	1	1%	-24.0%	n/a	-24.0%	n/a
Value-increasing modifications						
	None	0%				
No modifications						
	54	61%	-0.4%	-0.15	0.5%	0.34

*** Significant at 1% level
 ** Significant at 5% level
 * Significant at 10% level

FIGURE 2

Estimated Value of American Exercise Provisions In CEO Stock Option Awards

Illustrations of how estimated values of CEO stock option awards increase if the ability of executives to exercise options prior to expiration is taken into account. Each chart plots the value of American call options compared to the value of European call options, using data for 447 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 value of the American call feature is obtained by using a binomial model to value each option award under the American assumption that it may be exercised at any time, and again under the European assumption that it may only be exercised at expiration. The analysis includes only CEO stock option awards with terms of ten years made by companies paying nonzero dividends.

The top panel shows a scatterplot of the data for all 447 option awards. The lower panel shows the results of an OLS regression using the same sample. The American call option premium was regressed against each award's estimated volatility, dividend rate, risk-free interest rate and their squares. Regression lines are drawn for volatility of 0.2 and 0.4, under the assumption that the risk-free rate is 7%. The lines would shift downward approximately one percentage point for each 1% increase in the risk-free rate within reasonable limits.

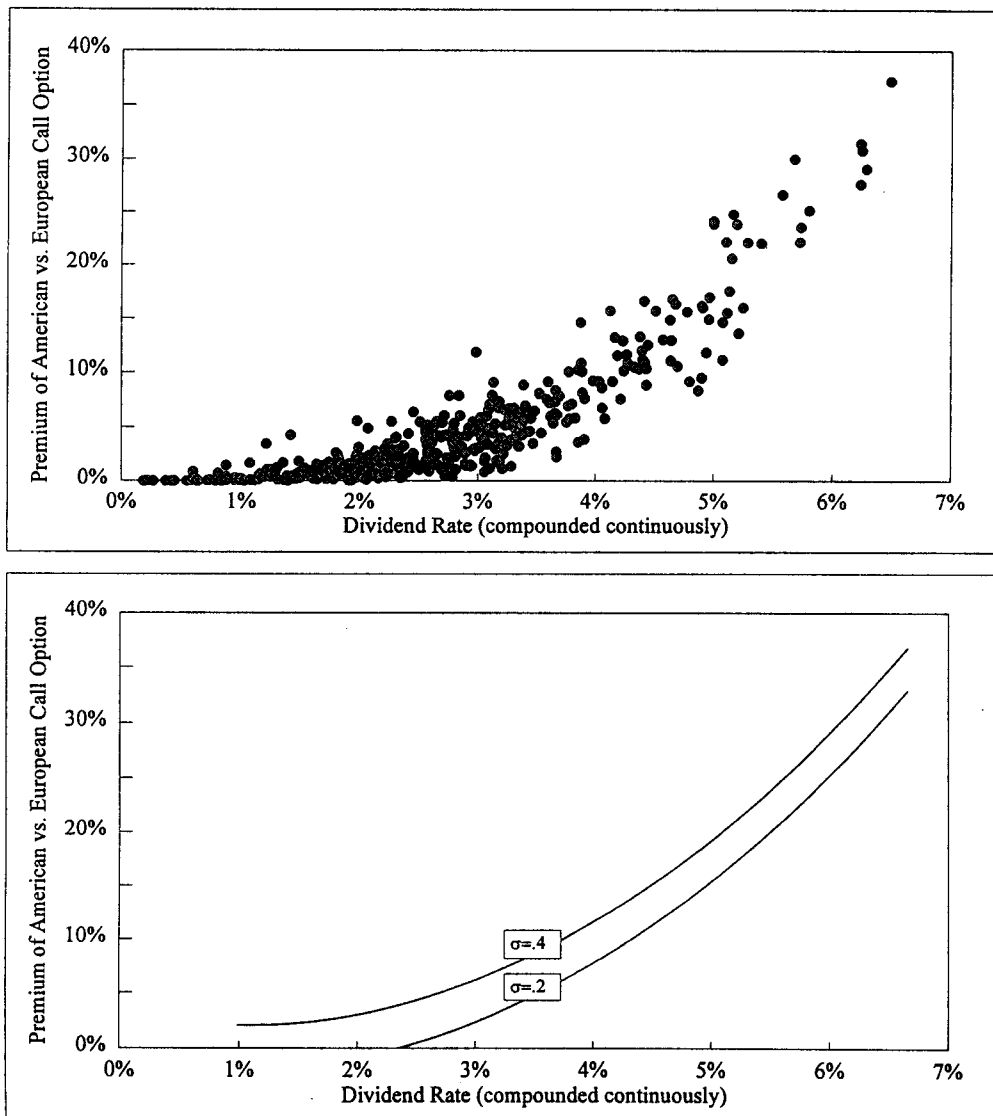


TABLE 3
Average Characteristics of Fortune 500 Companies
Sorted By Reporting Choice For CEO Stock Option Values

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 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. When companies make more than one stock option award to CEOs during a fiscal year, benchmark values include the sum of all individual award values, and data in the table for dividend rates, 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	94	178		88	206	
Black-Scholes value (thousands)	\$930	\$1,033	-0.56	\$1,009	\$1,247	-0.94
Dividend rate (logarithmic)	2.52%	2.10%	2.22 **	2.40%	1.88%	2.98 ***
Stock return volatility	0.32	0.31	0.58	0.28	0.31	-1.67 *
Life of options (years)	9.87	9.30	3.63 ***	9.90	9.40	3.50 ***

Significant at 1% (***), 5% (**) and 10% (*) levels.