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The Effect of Executive Stock Option Plans on Stockholders and Bondholders

RICHARD A. DeFUSCO, ROBERT R. JOHNSON, and THOMAS S. ZORN*

ABSTRACT

Executive stock option plans have asymmetric payoffs that could induce managers to take on more risk. Evidence from traded call options and stock return data supports this notion. Implicit share price variance, computed from the Black-Scholes option pricing model, and stock return variance increase after the approval of an executive stock option plan. The event is accompanied by a significant positive stock and a negative bond market reaction. This evidence is consistent with the notion that executive stock options may induce a wealth transfer from bondholders to stockholders.

MANAGERIAL STOCK OPTIONS HAVE been proposed as a method that ameliorates the agency problems that exist between managers and shareholders (Haugen and Senbet (1981)). The typical stock option plan grants the executive the option to purchase a number of shares of common stock at a stated exercise price that is normally equivalent to the market value of the stock on the date of the grant. These options differ from listed options in that there is usually a minimum holding period required before the options can be exercised. In addition, the options are long-term in nature (typically ten years) and are strictly nonmarketable.

Since Jensen and Meckling (1976), it has been widely held that agency costs are reduced by relating an executive's compensation to firm performance (e.g., Beck and Zorn (1982) and Haugen and Senbet (1981)). The empirical evidence indicates that proposed changes in long-range managerial compensation plans (option, restricted stock, performance, stock appreciation rights, and phantom stock) are met with positive share price reactions (e.g., Brickley, Bhagat, and Lease (1985)).

The positive share price reaction to the announcement of executive stock option plans is consistent with the contention that these plans improve managerial incentives. Improved incentives are the reason most often cited by firms seeking shareholder approval for the adoption of stock option plans. A study by Masson (1971) found that firms with compensation packages that emphasize stock market performance (and de-emphasize other firm performance measures) outperform firms without such an arrangement. Murphy (1985) also finds that

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shareholders' realized returns are positively related to managerial remuneration. Tehrani, Travlos, and Waagele (1987) find that divesting companies with long-term performance plans experience a more favorable stock market reaction at the announcement of sell-off proposals relative to firms without long-term performance plans. These findings are consistent with the notion that managerial security holdings have a role in reducing agency costs and motivate managers to make better decisions.

Executive stock options may also cause managers to take on more risk (Haugen and Senbet (1981)). The asymmetric payoffs of call options make it more attractive for managers to undertake risky projects. This view is consistent with the findings of Agrawal and Mandelker (1987) that firms undertaking variance-increasing (decreasing) investments have management compensation contracts with a larger (smaller) common stock and option component. In the absence of stock options, managers may be overly concerned with job security. Some evidence of excessive managerial risk aversion is presented by Amihud and Lev (1981) in the context of conglomerate mergers. Executive stock options may be an efficient means to induce management to undertake more risky projects.¹

Increased managerial risk-taking may benefit shareholders at the expense of bondholders. Jensen and Meckling (1976) view stockholders in a levered firm as holding a European call option (e.g., Merton (1974) and Black and Scholes (1973)) to buy back the entire firm at an exercise price equal to the face value of the debt. The value of this call option is an increasing function of the variance of the cash flows of the underlying asset (the firm). Stockholders, therefore, have the incentive to engage in high-risk activities at the expense of bondholders.

In this paper we examine whether the adoption of executive stock options results in an increase in managerial risk-taking. For firms announcing changes in executive stock option plans, we find a significant increase in implicit stock variance and stock return variance. This is consistent with a rational response by investors to an increase in managerial risk-taking. Consistent with the variance result, we find an increase in stockholder wealth and a decrease in bondholder wealth.

The remainder of this paper is organized as follows. Section I describes the sample of firms proposing changes in executive stock options. The results of variance change tests are discussed in Section II. In Section III we present further tests on stockholders' and bondholders' wealth. Section IV concludes the paper.

I. Sample Design

A comprehensive list of New York Stock Exchange firms voting on "stock option plans" was obtained from the Exchange.² The list from 1978 through 1982

¹ Other explanations for executive stock options are possible. Options may be an attractive part of the compensation package because of tax benefits (e.g., Miller and Scholes (1982)). The adoption of managerial stock options also could signal that managers have favorable inside information concerning the future prospects of the firm's stock. Of course, the news the managers are reacting to could be a pre-existing change in firm's variance. We thank the referee for the latter point.

² Gary Tuttle, NYSE Marketing Director, believes this list to be comprehensive. All NYSE firms are required to report executive compensation plans to the Exchange. When reported, these plans are included on the list.

contains the name of each firm, the shareholder meeting date, and a brief description of the plans voted upon for 1442 firm events, representing 987 different firms. The majority of the proxy statements, 1240 (86 percent), were available on the Q-File. In addition, 115 (8 percent) of the proxy statements were obtained from the SEC in Washington, D.C. Eighty-seven (6 percent) of the proxy statements were not available.

According to Brickley, Bhagat, and Lease (1985), proposed executive compensation plan changes presented for shareholder approval are invariably ratified. Plans are easily ratified, as they only require a majority vote to pass. After a review of the proxy statements, each observation was classified as either "clean" or "contaminated." An event was considered "clean" if the proxy statement contained no other board-sponsored agenda item except the proposed stock option plan, the election of directors, and the ratification of auditors.³

Contaminated events and three plans that provided in-the-money stock option grants were eliminated from the sample. Some of the clean plans described in the proxy contained performance unit, phantom stock, bonus, and employee savings plan elements. Inclusion in the sample was limited only to the 641 firm events (537 different firms) that represented only changes in executive stock option plans.

II. Variance Tests

A. Evidence from Call Options

In this section, we test whether the adoption of executive stock option plans is followed by increases in share price variance. Our first test examines the share price variance implied in traded call options before and after plan adoption.

The normal sequence of events in the adoption of a new managerial compensation plan is board meeting, proxy, SEC stamp, and shareholder meeting dates. The SEC stamp date is the date that the SEC mailroom opens the proxy and stamps it as received. Larcker (1983), Lambert and Larcker (1985), and Tehranian and Waagelein (1985) have used either the SEC stamp date or the proxy date as the relevant event date. Brickley, Bhagat, and Lease (1985) report that the stock market reaction to the adoption of managerial compensation plans occurs over the interval from the board meeting date, reported on the proxy statement, to the day following the SEC stamp date. Two dates which fall before and after any of these possible event dates were chosen. Implied volatility was measured six months prior to and six months following the proxy statement date in order to ensure that the relevant event was contained in the time interval.⁴

³ Nearly all proxy statements contain agenda items to elect directors and to ratify auditors. Since shareholder proposals are normally overwhelmingly defeated, such proposals are not classified as contaminating. This definition of "clean" events is the same used by DeAngelo and Rice (1983), Bhagat and Brickley (1984), and Brickley, Bhagat, and Lease (1985).

⁴ We measure volatility six months prior to the event to avoid expectations contaminating the sample. This date falls well before the board meeting dates. Six months after the event was chosen for the post-event date to avoid any possible effect, the plan announcement itself might contribute to volatility that is temporary.

The Black-Scholes (1973) option pricing model was employed to calculate pre- and post-plan adoption stock variances. Numerous researchers have employed the Black-Scholes option pricing model to obtain implied variances. In this study, we employed an algorithm developed by Manaster and Koehler (1982) to estimate implied variance.

Call options that were closest to being at-the-money were examined because the Black-Scholes option pricing model produces unreliable estimates for deep in-the-money and deep out-of-the-money options. (See MacBeth and Merville (1980).) The option with the longest time to expiration with at least three months to expiration was chosen. Fifty-nine firms (59 different firms) had at-the-money call options traded six months before and six months after the proxy. We use the Treasury bill rate whose maturity most closely corresponded to the maturity of the call option as an estimate of the risk-free rate. Stock option prices and Treasury bill rates were gathered from the *Wall Street Journal*.

Changes in implied variance were computed for each of the 59 firms in the sample. The average change in variance was +15.96%. Of the 59 firms in our sample, 35 experienced variance increases and 24 variance decreases. We use the Wilcoxon matched-pairs signed-ranks test. The mechanics of the test are straightforward. The implied variance before the executive stock option plan adoption ($VARPRE_i$) is subtracted from the implied variance after the adoption ($VARPOST_i$) in order to obtain a percentage change in variance ($CHNVAR_i$) for each of the 59 firms in the sample:

$$CHNVAR_i = (VARPOST_i - VARPRE_i)/VARPRE_i.$$

The percentage differences are rank-ordered in terms of their absolute size, and the sign of the difference is attached to the rank for that difference and produces a Z-statistic of 2.51, which is significant at the 1% level.⁵ The result is consistent with the hypothesis that executive stock option plans induce managers to undertake more risky projects.

B. Further Evidence

In this section we examine whether other measures of firm variance also increase subsequent to the adoption of a managerial stock option plan. Stock market data are readily available on a daily and monthly basis for NYSE firms.

⁵ See Conover (1971, p. 206). Other nonparametric sign tests only examine one feature of the data, the sign of the difference between each pair. These tests overlook one other important property of any matched pair of data: not only does a difference have a direction, but also a size that can be ranked in order among the set of all such differences. The Wilcoxon test has high power-efficiency compared to the other methods designed for the matched-pair situation. The null hypothesis tested by the Wilcoxon test is that the two populations represented by the respective members of the matched pairs are identical. When this hypothesis is true, then each of the 2^N possible sets of signed ranks obtained by arbitrarily assigning plus or minus signs to the ranks 1 through N is equally likely. For large N (number of pairs), the sampling distribution is approximately normal with

$$E(T) = [N(N + 1)]/4 \text{ and } \sigma_T^2 = [N(N + 1)(2N + 1)]/24,$$

so that a large sample test is given by $z = [T - E(T)]/\sigma_T$. T is the sum of the ranks with the less frequent sign.

Table I
Variance Ratios for Firms That Adopted Changes in
Executive Stock Option Plans, January 1978
to December 1982

Stock return variances are estimated for periods of 500 days and 24 months (monthly data) preceding and following the announcement of a change in option plan. In the pre-event period, variances are calculated up to six months before the proxy date. In the post-event period, variances are calculated starting six months after the proxy date. For the 500-day interval, at least 480 returns are required. For the 24-month period, at least 22 returns are required. Daily variances are estimated as the average squared daily return (where returns are continuously compounded). Monthly variances use the standard calculation. The numbers in parentheses are adjusted for shifts in market variance.

Estimation interval (in days or months on either side of proxy date)	± 500 [†] days	± 24 months
Number of firms with data available	424	408
Estimated variance for period after proxy date divided by estimated variance before:		
Mean	1.168 (1.245)	1.228 (1.461)
Fractiles		
1st	0.404 (0.293)	0.311 (0.354)
5th	0.618 (0.426)	0.502 (0.499)
10th	0.666 (0.547)	0.575 (0.616)
25th	0.830 (0.853)	0.750 (0.892)
Median	1.081 (1.161)	1.053 (1.220)
75th	1.356 (1.545)	1.499 (1.841)
90th	1.734 (1.915)	2.075 (2.433)
95th	2.191 (2.203)	2.509 (3.194)
99th	2.929 (3.354)	3.957 (4.926)
Percentage of firms for which measured volatility increases	57.6 (65.1)	54.4 (68.6)
Two-tailed signed-rank probability for a change in variance	0.0001 (0.0001)	0.0001 (0.0001)

Variances are estimated with both daily and monthly data to examine the robustness of any changes. Variances are also estimated with accounting rates of return.

The approach detailed in Skinner (1989) is used to test for differences in stock return variance. We form a variance ratio for each firm by dividing the variance computed after the proxy date by the variance before (ratios larger than one indicate a variance increase following plan adoption). We use average squared daily returns to compute an estimate of the daily variance because $\text{Var}(R_t)$ approximately equals $E(R_t^2)$ for short intervals. Variances estimated with monthly data use the standard variance estimator.

To account for changes in market volatility, market-adjusted variance ratios are computed for both daily and monthly returns. Before forming the variance ratio, we first divide each firm's estimated variance by the variance of the CRSP

equally weighted market index estimated over the same time interval. Ratios computed in this manner are referred to as market-adjusted variance ratios.

Variances are computed over intervals preceding and following plan adoption. To avoid any effects of plan announcement, we exclude six-month intervals on either side of the proxy date in the calculation of pre- and post-adoption variance. Estimation intervals cover periods of 500 days and 24 months. Firms included are from the sample of 641 described in Section I that have proxy dates available. Table I presents the variance ratios with and without the market adjustment (market-adjusted variance ratios are in parentheses) for 500-day and 24-month sampling intervals. The average ratios are greater than one with both daily and monthly sampling intervals. In both cases, the proportion of firms for which volatility increases is approximately 55 percent. Median ratios are also greater than one for both sampling intervals. The Wilcoxon signed-rank test indicates that the distribution of return variances increases following option plan adoption.

Table I also presents the results with market-adjusted variances. In all cases the market adjustment reinforces the finding that volatility increases following plan adoption. The same test was conducted for the 59 firms with traded options. For unadjusted daily return variances, 67 percent of the firms experienced a variance increase (Wilcoxon $Z = 3.22$). With market adjustment, 60 percent experienced variance increases (Wilcoxon $Z = 2.87$). Based on our median results with daily data, we observe that post-plan adoption variance increases anywhere from 8 percent to 16 percent (market-adjusted).

Because of the upward bias encountered with variance ratios (via Jensen's inequality), we perform the variance test on a control group of NYSE firms. All NYSE firms not proposing changes in option plans with data on the CRSP daily returns file are randomly assigned one of the proxy dates. The 500-day market-adjusted variance described above is calculated for this sample. For all fractiles the variance ratios for firms announcing changes in stock option plans are greater than for the control sample of NYSE stocks. The median ratio for those firms proposing changes in stock option plans is 1.161, compared with 1.03 for the NYSE control. A Mann-Whitney test indicates that variance ratios for firms making changes in stock option plans are significantly larger than for the NYSE control group ($Z = 4.34$).

We also examine whether a variance increase was detectable in our sample using accounting data. For each firm the variability of annual return on assets over the five-year period immediately preceding and following the proxy date was computed. We delete those firms that made more than one plan change within five years. Two hundred forty-three firms had complete data available on COMPUSTAT. To control for changes in industry-wide variance, each firm's variance was standardized by its industry (two-digit SIC code) variance in return on assets. In fifty-five percent of the cases (134 out of 243), the variability of adjusted return on assets increased. A Wilcoxon test yields a Z -statistic of 2.99 and indicates that the distribution of return on assets variability has changed.

III. Tests on Stockholder and Bondholder Wealth

In this section the stock and bond market reactions are analyzed using a standard event study methodology. As indicated earlier, researchers have differed in the

selection of event dates because the financial press rarely reports changes in managerial compensation plans. Bhagat and Brickley (1984) contend that information is released on the proxy date, which is generally the date the proxy statement is mailed. Tehranian and Waagelein (1985) use the proxy date in their analysis of the market reaction to the adoption of short-term compensation plans. Larcker (1983) defines the event date as the SEC stamp date and finds a significant market reaction on this date. Lambert and Larcker (1985) also use the SEC stamp date as the relevant event date for the adoption of golden parachutes. We report event study results on the days surrounding the SEC stamp date and, when data availability permits, the cumulative abnormal return in the interval from the board meeting date to the day following the stamp date.

For the stock market part of the analysis, stamp dates for 107 clean events were collected at the SEC in Washington, D.C. Of the 107 events, 53 had board meeting dates available. To test for a potential wealth transfer, publicly traded nonconvertible bond issues were identified from Moody's Bond Record for the 641 clean events described in Section I. Of the 641 firm events, 190 had listed nonconvertible debt on the New York or American Bond Exchanges. Bonds also must have traded at least once per week over the examination period $t = -60$ to $t = +12$ relative to the SEC stamp date. Thirty-six events (34 different firms) had frequently traded debt over this interval.⁶ SEC stamp dates were collected from the original proxy statement at the Securities and Exchange Commission. One bond per firm was chosen. Bond prices were collected from the *Wall Street Journal*. Board meeting dates were available for 19 of the 36 events.

Stockmarket daily abnormal returns were collected from the CRSP daily excess returns file. Bond daily abnormal returns were computed according to the methodology described in Dennis and McConnell (1986). This procedure involves a comparison of bond returns during the event period with the return of an appropriate (risk-adjusted) market index. Any difference between the bond return and the market index return is labeled the bond daily abnormal return. The market index is the Dow Jones Industrial Bond Index taken from the *Wall Street Journal*.

Standard t -tests, as described in Brown and Warner (1985), are computed to determine whether the daily abnormal returns for the firms are statistically significant. To test the significance of the cumulative abnormal return between the board meeting date and the stamp date, we followed the procedure outlined in Dodd and Warner (1983).

Table II presents results of the average daily and cumulative abnormal returns of the common stocks of firms announcing executive stock option plans. The 107 firms with available stamp dates exhibit an average increase in shareholder wealth of approximately 0.40% ($t = 1.80$) on the stamp date and 0.68% ($t = 2.25$) for the two-day interval (0, +1) around the stamp date. Over this two-day interval, 59 percent of the firms exhibited a positive abnormal return. For the 53 firms for which we have both the stamp and board dates, the mean cumulative abnormal return was 4% and is significantly different from zero at the 95% level of

⁶ We chose to begin the examination interval at $t = -60$ because this represents the average length of time between board meeting and stamp dates. The sample size is not abnormally small for studies involving senior securities. For instance, Dennis and McConnell (1986) used samples of 15 and 21 when studying returns to nonconvertible bonds.

Table II
Daily and Cumulative Stock Market Abnormal Returns for the Sample of NYSE Firms
Announcing Changes in Executive Stock Option Plans during the Period
1978 Through 1982

Sample sizes vary due to the lack of board meeting dates. The statistic for the board meeting date through the day following the stamp date is the Z-statistic described in Dodd and Warner (1983). The last column reports the nonparametric Wilcoxon Z-value of the null hypothesis that the abnormal return has mean value equal to zero.

Event Period	Sample Size	Abnormal Return (%)	t- Statistic	Percent Positive	Wilcoxon Z
Two days before SEC stamp date	107	-0.24	-1.12	46%	-0.85
One day before SEC stamp date	107	0.07	0.34	48%	-0.27
SEC stamp date	107	0.38	1.80*	55%	1.14
First day after SEC stamp date	107	0.30	1.39	51%	0.93
SEC stamp date through next trading day	107	0.68	2.25**	59%	1.86*
Board meeting date through the day after the SEC stamp date	53	4.00	2.01**	66%	2.21**

* Significant at the 90 percent level.

** Significant at the 95 percent level.

Table III

Debt Daily Average Abnormal Returns Surrounding the SEC Stamp Date (Event Day 0)

The sample consists of 36 firms announcing executive stock option plans that had frequently traded debt from 1978 through 1982. Event day sample sizes vary because some bonds did not trade. The last column reports the nonparametric Wilcoxon Z -value of the null hypothesis that the abnormal return has mean value equal to zero.

Event Day	Abnormal Return (%)	t -Statistic	Sample Size	No. Pos.: No. Neg.:	Wilcoxon Z
-2	0.3610	0.45	20	11: 9	0.34
-1	-0.4015	-2.17**	26	10:16	-1.87*
0	-0.3815	-0.98	26	12:14	-1.82*
+1	0.1712	0.68	25	13:12	0.40
+2	0.2023	0.66	26	10:16	-1.02

* Significant at the 90 percent level.

** Significant at the 95 percent level.

confidence ($z = 2.01$). From the board meeting date to the day following the stamp date, 66 percent of the firms had positive abnormal returns.

These results are consistent with the interpretation that some, but not all, of the information regarding the change in stock option plans is gradually revealed between these two dates through either leakage or insider trading.⁷ Table III presents results of the average daily abnormal returns of the debt of thirty-six firm events with frequently traded debt announcing proposed executive stock option plans. On the day preceding the SEC stamp day, we observe that 16 of the 26 firms with debt traded had negative bond returns. The abnormal bond return for this day is -0.40% ($t = -2.01$). A nonparametric Wilcoxon test ($Z = -1.87$) also shows that the mean return is less than zero at the 10% level of significance.

The board meeting date is available for 19 of the 36 events. The cumulative abnormal return between these two dates is -0.12% ($t = -0.18$). Results covering the interval $(-60, +1)$ are similar and reveal a cumulative abnormal bond return of -0.33% ($t = -0.28$). It is puzzling that some, but not apparently all, of the stock market reaction takes places between the board and stamp dates while the bond reaction occurs near the stamp day.

To ensure that the bond reaction around the stamp date is not a normal reaction to general news contained in the proxy, we randomly selected 100 firms with "clean" proxies not proposing changes in stock option plans from the Q-file. We were able to obtain the SEC stamp date for 53 of these firms. As before, we computed daily abnormal bond returns for the two-day interval $(-1, 0)$ around the stamp day. The day -1 and day 0 abnormal returns are -0.03% ($t = -0.12$) and -0.11 ($t = -0.47$), respectively. There is no significant bond price reaction on stamp dates for firms not adopting stock option plans.

⁷ Our results are roughly consistent with Brickley, Bhagat, and Lease (1985) (BBL). BBL find a smaller reaction between board and stamp dates for plans that contain an option component (1.46%) and a smaller two-day announcement effect (0.30% , $t = 1.26$). The samples, however, are not identical. Our sample years cover 1978–1982; BBL's cover 1979–1982. The former result reported by BBL is not for pure option plans. The BBL two-day announcement result, for example, includes restricted stock plans, performance plans, and mixed plans.

IV. Conclusions

In this paper the effect of changes in executive stock option plans on share price variance is examined. Implicit share price variances, computed from the Black-Scholes option pricing model, increase after the approval of an executive stock option plan. An increase in stock return volatility is also found with variances estimated from stock return data. The variability of accounting return on assets is also found to increase. The results are consistent with the hypothesis that stock option holding executives undertake more risky investment opportunities.

We also documented an increase in shareholder wealth surrounding the announcement of an executive stock option plan. The bond market reaction to changes in stock option plans was also examined. A significant negative reaction was found. Our findings appear to be consistent with rational investors reacting to the anticipated increases in managerial risk-taking as a consequence of the adoption of executive stock option plans.

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