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Abstract

This paper examines the practice of resetting of the terms of previously-issued executive stock options. We identify the properties of the typical reset option, characterize the firms that have reset options, and develop a model to value options that may be reset. In our sample of 396 executives whose options had terms reset in the 1992–95 period, a large majority had exercise prices reset to the market price. This resulted in a reduction of the typical option's exercise price by about 40%. Slightly less than half of these options also had their maturities extended, generally receiving a new expiration of 10 years.

We find that resetting has a strong negative relationship with firm performance even after correcting for industry performance. Resetting is also significantly more common among small firms than among large firms. However, few other industry- or firm-specific factors appear to matter. Finally, we find that the possibility of resetting does not have a large impact on the ex-ante value of an option award, but the ex-post gain can be substantial.

1 Introduction

Executive stock options have long been touted as an effective way of reducing agency costs by better aligning mangers' interests with those of shareholders. Although these options are typically issued with fixed terms, casual and anecdotal evidence suggests that the terms of the contracts do sometimes get altered in practice, especially when declining share prices have moved the options out-of-the-money.[1] This paper attempts a systematic examination of the data on the resetting of the terms of executive stock options, with a view to better understanding the prevalence of resetting as well as its impact on the value of option awards. We focus on three main issues.

First, we seek to characterize broad categories of firms where resetting of executive stock options has been observed. We test for relationships between the frequency of resetting and such variables as firm size, ownership and management structure, and performance relative to the industry. We also examine whether incidence of resetting varies systematically across industries, a consideration motivated by the most common defense of resetting as a method of reducing employee turnover; this suggests, *ceteris paribus*, that the practice should be observed more frequently in industries in which managerial mobility is relatively high.

Second, we examine the resetting event itself. We identify the distribution of price declines that trigger resetting of executive stock options in a large sample of publicly traded firms. We also explore the characteristics of the reset options. These include the relationship between the new strike price, the old strike price, and the current price of the stock; and that between the maturity of the reset option and the time left to maturity on the original award at the time of resetting.

Finally, we look to quantify the impact on the value of executive stock options of the possibility that the terms of the option could be reset at some point during the option's life. To this end, we explore a model of option pricing that admits this feature. Then, using the data obtained on the event of resetting, we value options in this model and compare them to the values that would have obtained were resetting to be ruled out. This enables us to identify the benefit, ex-ante as well as ex-post, that results from resetting.

The paper is organized as follows. Section 2 surveys the related literature. Section 3 decribes our data. Sections 4 and 5 examine, respectively, the common characteristics of firms that have reset options, and the properties of the typical reset option. Section 6 discusses a framework for valuing options whose terms could be altered before maturity. Section 7 utilises this framework and the data from Section 5 to obtain an empirical estimate of the

[1] See, e.g., "Stock Swings make Options a Hot Topic" by Joann Lublin, *Wall Street Journal*, October 29, 1997.

impact of resetting on option values. Section 8 concludes. The appendix describes closed-form solutions in a Black–Scholes environment for the valuation framework of Section 6.

2 The Related Literature

The explosive growth in the use of executive stock options in the last two decades has been accompanied by increased academic interest in the subject. Among the many issues that have been the focus of recent research are: the valuation of executive stock options (Rubinstein [7]); the effect of financial reporting costs on the use of stock options (Matsunaga [6]); the effectiveness of options as a means of compensation (Yermack [11]); the timing of option awards (Yermack [12]); and the price impact of early-exercise decisions (Carpenter and Remmers [1], Seyhun [10]).[2]

The resetting of the terms of previously-issued stock options, however, remains a little-explored topic that has been addressed by just three papers. Two of these, Gilson and Vetsuypens [3] and Saly [9], study resetting induced by extraordinary circumstances. Gilson and Vetsuypens look at incidences of resetting by firms in financial distress; their sample covers the period 1981–87. Saly focusses on incidences of resetting following the stock market crash of 1987.

The third paper, Chance, Kumar, and Todd [2] is closer to ours in spirit. It examines—as our paper does—the practice of resetting in more "normal" circumstances. It focusses on two main issues: deriving a valuation model for options that may be reset; and examining the incentive impact of resetting by comparing the share-price performance of firms prior to the resetting event and subsequent to the resetting event. There are some resemblances between the analysis in this paper and ours, but there are two important differences. The first is empirical focus. Our paper aims to charaterize firms that have reset options using various criteria; to identify the features of the typical reset option; and to use this information to derive a value for the "resettable" option. However, we are not explicitly interested in the incentive effects of resetting, and, in particular, do not examine the post-resetting behavior of firms' share prices. Second, resetting in the valuation framework discussed by Chance, Kumar, and Todd involves only a change in the option's strike price, and not in its maturity; resetting is also taken by them to be a deterministic event (i.e., one that occurs with certainty when the stock price hits a pre-specified barrier). Our data indicates that maturity changes are an important component of resetting, affecting nearly half of all reset options; consequently, our valuation framework incorporates this feature. We also examine the implications of admitting stochastic resetting.

[2]The references cited in this paragraph are only meant to be indicative. They are by no means complete.

Less directly related to our paper, but of some relevance nonetheless as a further indication of unusual aspects of executive stock options, is the literature on "reload" options. Such options have the provision that if the exercise price is paid with previously owned shares of the company, then the holder will receive not only one share for each option exercised, but also one new option (typically issued at the money) for each share tendered. Thus, exercise by itself effectively triggers additional awards of stock options. The valuation of such options and related issues have been explored in a recent pair of papers by Hemmer, Matsunaga, and Shevlin [4],[5].

3 The Data

Our data for analysis of executive stock option resetting comes from Standard and Poor's ExecuComp database. ExecuComp reports annual compensation data for the top five officers in a sample of 1,500 firms, including those companies in the S&P 500 index, the S&P MidCap 400 Index, and the S&P SmallCap 600. In the release of ExecuComp that we use, we extract records for all executives who have nonzero holdings of stock options. As shown in Table 1, this candidate sample includes 30,468 person-year observations between 1992 and 1995.

Table 1 provides detail about our procedure for identifying stock option resetting events. ExecuComp records for each executive include a 0–1 indicator variable that equals 1 if the company publishes a "10-Year Option Repricings" table in its annual proxy statement and includes data about that particular executive in the table. According to SEC rules effective since 1992, companies must publish this table following any year in which the exercise prices of executive options are lowered, and the table must report information for any similar event that occurred during the prior ten years involving a current officer, whether or not that person had any options reset in the most recent year. Since some executives listed in these tables will not have had options reset during the most recent fiscal year, ExecuComp's variable for identifying resetting events is clearly over-inclusive. We therefore read copies of actual proxy statements from a variety of on-line sources to verify the accuracy of the variable.

As shown in Table 1, ExecuComp's resetting indicator equals 1 for 457 individual person-years in our sample, and we were able to obtain proxy statement detail for all but 63 of these events. We drop 55 of ExecuComp's observations because the executive in question had options reset only in earlier years and not the most recent one. An additional 4 observations were recoded from 0 to 1 to correct errors in data reporting by ExecuComp. Finally, 10 more observations were dropped because the resetting event involved only technical or inconsequential changes to the terms of options, such as the permanent fixing of exercise prices that had been contingent on the company's performance, which lay beyond the scope of our study.

Unfortunately, the SEC's disclosure rules do not appear to apply to cases in which companies change the maturities of options while leaving their exercise prices the same, and we found no reports of these types of events. Our final sample for analysis thus includes 396 executives with options reset in a given fiscal year; most of these events involved multiple executives in a smaller set of 134 companies who reset option terms in a given year. We were able to obtain detailed data reported by the company for 333 of the 396 executives with reset options. For these 333 executives, the resets involved adjustments to the terms of 806 individual award tranches (up to a maximum for 10 for one person), and we generally use individual tranches as the unit of analysis in the remainder of the paper.

Our ability to exploit Standard and Poor's transcription of proxy statement data into the ExecuComp database yields a sample several times larger than that used by Chance, Kumar, and Todd [2], who use a keyword search of proxy statement databases to generate a sample of 74 resetting events involving 40 companies. Along with the larger sample, the major advantage of our data gathering approach is the availability of a well-defined universe of sample firms, which allows us to report below such statistics as sample-wide frequencies of option resetting.

Table 2 gives basic descriptive statistics about our resetting events, all of which by definition involve changes to the options' exercise prices. The table shows that almost half of these cases also involve changes to time remaining in the option's life. While the large majority of these adjustments represent increases in option lives at the same time that exercise prices are lowered, in a small handful of cases firms either shorten the option life when lowering the exercise price, or raise the exercise price when lengthening the option's term. In other cases, which together include about 11% of the tranches analyzed, the company receives some consideration from the executive at the time of the option resetting, such as the surrender and cancellation of some fraction of the options involved. Finally, we were surprised to find that in some cases companies reset the terms of the same option tranche two or even three times in one fiscal year; about 5% of the observations that we analyze fall into this category.

4 Resetters and their Common Characteristics

In this section, we examine the first of the three questions raised in the introduction: what are the characteristics common to firms that reset the terms of previously-issued executive stock options?

Two obvious factors to consider in this context are the share-price performance of the firm and its size. Although there is no a priori reason resetting should not follow a favorable stock-price performance (in the form of, for example, an increase in maturity to reward the good outcome), it is intuitively more likely that resetting should be associated with declining share prices. Confirmation of this hypothesis would mean that resetting is typically "bad news:" it effectively rewards management for poor performance. Under these circumstances, firm size becomes a factor of interest. For one thing, the higher share price volatility of small firms implies that large price declines should occur with greater frequency in small firms; *ceteris paribus*, this means resetting should be more common in smaller firms. Secondly, small firms are less monitored by the financial press and analysts than their larger counterparts; the extent of institutional ownership in these firms also tends to be smaller. Each of these factors should help reduce opposition to resetting.

Both of these hypotheses are strongly confirmed by the data. Figure 1 summarizes the relationship between three-year return to shareholders and the fraction of executives in each group whose options were reset.[3] The figure shows that the overwhelming majority of resetting events in our sample were associated with *negative* shareholder returns (i.e., with share-price declines). A strong negative relationship is also apparent between the level of performance and the incidence of resetting. In firms whose three-year return was between −10% and 0%, fewer than 3% of executives had options reset; the figure rises steadily as shareholder return worsens, reaching 18% in firms whose three-year return was worse than −30%.

Figure 2 explores whether using industry-adjusted returns, rather than raw shareholder returns, would make a difference to these results. The answer is negative: a strong monotonic connection remains between the extent of underperformance (relative to the industry) and the incidence of resetting.

Figure 3 relates the incidence of resetting to firm size. As anticipated, a strong monotonic relationship again emerges. Over our sample horizon, fewer than 0.3% of executives of S&P 500 firms had their option terms reset. The frequency of resetting quadruples to 1.2% for S&P MidCap 400 firms, and almost doubles again to over 2% for S&P SmallCap 600 firms. It is possible, of course, that this higher frequency may be solely on account of higher volatility in the returns of the small firms in our sample (see Table 3), rather than any other characteristics. A check of the data, however, reveals that this is clearly not the case: for any given range of three-year returns, the frequency of resetting is higher in smaller firms. For example, in small firms with three-year returns between −20% and −10%, around 6% of all executives had their options reset; the figure falls to 4% for midcap firms with returns in

[3] In all cases, the year in which the option was reset was the last of the three years used to compute the returns.

the same range, and to 1% for large firms. Size is, therefore, an important factor in resetting independent of its correlation with volatility.

It is important to note that our sample statistics may, on two counts, actually understate the extent of resetting. For one thing, resetting may have become more common in recent years: Figure 4 shows the observed frequency of resetting rising from 0.7% in the first year of our sample (1992) to almost 2% in the last year (1995). Second, our entire sample period was one of extraordinary increase in share prices; we remain curious about how high the frequency of resetting would be in a bear market environment.

Next, we examine whether industry-specific or firm-specific characteristics increase the frequency of resetting. Concerning the former, a natural issue to explore is whether resetting is more common in some types of industries than others.[4] Figure 5 plots the frequency of resetting against three-year stock price performance in a number of industries distinguished by their two-digit SIC codes. The figure shows no discernible patterns. Around half of all the industries had some instance of resetting, but not all such industries were low-performing ones. Indeed, the distribution of returns across industries which had some instances of resetting is almost identical to that across industries which had none. Finally, the industries that had some instances of resetting form a disparate group, with no apparent common characteristics.[5] The list does include some industries that could be classified as human-capital intensive (such as electronics, motion pictures, and health services). However, it also includes others that are not (e.g., textile mills, chemicals, and wholesale trade), and excludes some that are (e.g., personal services, insurance, and security and commodity brokers, dealers and services). Considering larger industry groupings does not help much either. While some manufacturing, financial, and services industries had incidences of resetting, others did not.

Turning to firm-specific characteristics, we examine next the impact of ownership and management structure on the incidence of resetting. Our results are summarized in Table 4. Unsurprisingly, one variable that turns out to be important in this context is the presence of a conflict of interest in the compensation committee. When such a conflict does exist, the frequency of resetting is almost 80% higher than when there is no conflict. A second factor that is also significant is separation of the jobs of CEO and chairman of the board of directors. However, our finding is counterintuitive: our data show that when the CEO and chairman are the same person, resetting is a third *less* likely than when the jobs are separated. Somewhat surprisingly, most other factors turn out to be statistically insignificant. For example, the frequency with which the options of chairmen and CEOs were reset were roughly the same as

[4]A common argument made by firms in justification of resetting is that such action is required in order to retain employees. If this argument is taken seriously, then it implies that the observed frequency of resetting should be higher in industries with high managerial mobility.

[5]Chance, Kumar, and Todd [2] also make the same point regarding their sample.

the frequency for, respectively, non-chairmen and non-CEO's. Nor does board membership confer an advantage: executives who were also directors had their options repriced with about the same frequency as executives who were not directors. Even stock ownership appears unimportant: executives who had their options reset owned a smaller (but not significantly different) fraction of the shares outstanding in their firms than those who had no resetting.

In summary, then, the two principal distinguishing features of firms that reset options appear to be stock-price performance and size. The incidence of resetting increases sharply as stock-price performance worsens, and is substantially higher for small firms than for larger ones. No industry-specific factors and few firm-specific factors appear to be of any importance in this context.

5 Features of the Reset Options

We saw in the previous section that the overwhelming majority of option resets occur when declining stock prices push the original awards out of the money. Under these circumstances, a company wishing to raise the values of these options can do so by lowering the strike price of the options or lengthening their maturities (or both). In this section, we describe the "typical" changes to an option's strike and maturity conditional upon it being reset. Unfortunately, as mentioned in Section 3, the SEC's disclosure rules do not appear to require companies to report changes that affect an option's maturity but not its strike. Our sample, therefore, contains no resetting event in which the strike price was unaffected.

Two especially interesting questions concerning the impact of resetting on the strike price are: (i) the relationship between the new strike price and the market price of the stock at the time of reset, and (ii) the percentage change in the original strike price upon reset. Figure 6 addresses these questions. It shows, first of all, that only 2 out of the 806 reset options in our sample—or under 0.25%—had their strike prices raised from their original levels at the time of reset; the remaining 804 had their strike prices lowered.

Of those options whose strikes were lowered, almost four-fifths were reset at-the-money, that is, their strike prices were set to the market prices that prevailed at the time of reset. Most of the remaining one-fifth had their new strike prices set above the market prices prevailing at the time of reset (but, of course, below the original strike price). A small fraction of the reset options, about 1.5% of the total, had their strike prices reset below prevailing market prices.

Figure 6 also describes the distribution of the percentage change in the strike prices of the reset options. The distribution is roughly symmetric; it indicates that in about a tenth of all cases, the change in strike price was small (the new strike price was 90% or more of the old strike price). The typical changes, however, were much larger. The mean and median changes were, respectively, 39.1% and 40.1%. In over one-third of the cases, the strike was lowered by 50% or more; and in a tenth of all cases, it was lowered by at least 70%.[6]

Maturity was unaffected by the resetting process in a little over half the cases in our sample. Of the remainder, the overwhelming majority (about 45% of the total) had their maturities increased; however, in a small handful of cases (about 1.6% of the total), the maturity was reduced. Figure 7 describes the change in maturity for those options whose maturities were extended. The figure shows that about 80% of these options were given a new maturity of exactly 10 years from the time of reset, while a further 13% were given a new maturity of exactly five years. Since the life of the typical executive stock option is 10 years with five years being a popular alternative, these figures suggest that the reset options were, from a maturity standpoint, essentially like new option grants.

For those options whose maturities were extended, Figure 7 also describes the distribution of the increase in the time to maturity afforded by the reset. The distribution is highly skewed. Although about a tenth of the options received extensions of 6 years or more, the increase in maturity was under 30 months in most cases, with a mean increase of 30.1 months. Given that most of these options were granted a new maturity of 10 years, these figures suggest that the options were typically far from maturity at the time of reset, and indeed, a check of the data confirms this. For the options whose maturities were extended, the mean time left to maturity at the time of reset was 78 months, with a median of 88 months. Since resetting added about 30 months to the average, the mean time left to maturity for this subsample *subsequent* to resetting was about 108 months or 9 years. The figure was lower, but not substantially so, for the sample as a whole: subsequent to resetting, the average time remaining to maturity was a little under 8 years at 92 months, with a median of 102 months.

An important unresolved issue is whether firms used lengthening of an option's maturity as a partial substitute for lowering its strike price. Although the data does not allow us to identify firms that lengthened maturity alone without also resetting the strike, we can examine a weaker version of this question: whether increases in an option's maturity were more likely when its strike was not lowered all the way to current market price. Table 2 presents information on the joint distribution of changes in strikes and maturities. The data in the table indicates that not only is longer maturity *not* used as a substitute for a

[6]Initial option awards are usually made at-the-money. Since we find that virtually all options in our sample were reset at or above the prevailing market price at reset time, the 39% average lowering of the strike price implies that share prices for firms in our sample fell, on average, over 39% between the grant of the original award and the time of reset.

lower strike, but, in fact, that the two may behave as complements to an extent. Maturity was extended in only about 39% of the cases where the new strike price was set *above* the prevailing market price at reset time. However, in cases where the new strike price was set *equal* to the prevailing market price, over 47% of the options also had their maturities extended.

These findings on the characteristics of reset options correspond well along one dimension, but not the other, with those reported by Chance, Kumar, and Todd [2]. As with us, Chance, Kumar, and Todd find that the overwhelming majority of reset options are reset at-the-money: this results, in their sample, in an average lowering of the strike price of 41.3%, a figure close to our sample average of 39.1%. However, under a tenth of the option awards in their sample had their maturities extended; for those extended, the average extension was over 6 years. In contrast, changes in maturity were effected in almost half the awards in our sample, but—although most of these options were given a new maturity of 10 years—the average extension was only 30 months. As a consequence, while Chance, Kumar, and Todd find that the average time left to maturity on the reset options in their sample was only around 66 months, it is substantially higher in our sample at 92 months.

6 Valuing Resettable Options: A Theoretical Framework

In this section, we discuss the valuation of "resettable" options, i.e., options whose terms could be reset at some point before expiration. Given this paper's motivation, we focus solely on call options, though the arguments extend more generally.

We use the following notation. The current stock price is denoted S. The original strike price and maturity date of the option are denoted K and T, respectively. The current time is taken to be date 0, so the time left to maturity on the original option is also given by T. Finally, C^* will denote the initial value of the resettable option.

Our analysis will proceed in two stages. In Subsection 6.1, we consider the case of deterministic resetting. That is, we assume the option terms are reset using some pre-specified rules the first time that the stock price falls below a pre-specified "barrier" price denoted H. Then, in Subsection 6.2, we look at the case where the resetting event may be random. Throughout this section, Binomial pricing models are used to illustrate the arguments. Appendix A describes the closed-form solutions that obtain in a Black–Scholes enviroment.

6.1 Deterministic Resetting

Resetting of the terms of the option involves specifying a new strike price and/or a new maturity date. Throughout this section, we will assume that when the option is reset, the new strike price is given by some pre-specified value K^*. (If the new option is issued at-the-money, for example, then K^* must equal the barrier price H.) Regarding maturity, we have seen that for the vast majority of cases in our sample, maturity was either left unaltered or was reset to 10 years. Motivated by this, we consider two possibilities:[7]

1. The maturity is unchanged: the reset option also has maturity date T.
2. The maturity is changed: the reset option is given a fixed maturity of τ years from the time it is rewritten ($\tau \geq T$).

We look first at the case where maturity is left unaltered.

6.1.1 When Maturity is Not Changed

To value the resettable call in this case, consider a portfolio consisting of a knock-out call option and a knock-in call option, both with a maturity of T and a barrier price of H, and where the knock-out call has a strike of K and the knock-in call has a strike of K^*. Let $C^{out}(S, K, H, T)$ and $C^{in}(S, K^*, H, T)$ denote the respective prices of the two options given the current stock price of S. If the stock price does not breach the barrier H by time T, the payoff from this portfolio arises entirely from the knock-*out* call; however, if the barrier is breached before T, then the payoff is entirely from the knock-*in* call. Therefore, the time–T payoff from this portfolio is

$$\begin{array}{ll} (S_T - K)^+, & \text{if the stock price does not cross } H \text{ before } T \\ (S_T - K^*)^+, & \text{if the stock prices crosses } H \text{ at some point before } T \end{array}$$

These payoffs are exactly the same as those of the resettable call. It follows that the value C^* of the resettable call must satisfy

$$C^* \;=\; C^{out}(S, K, H, T) + C^{in}(S, K^*, H, T). \tag{1}$$

Therefore, the problem of valuing the resettable call may be reduced to one of valuing the barrier options C^{out} and C^{in}. The latter problem is not a difficult one. Barrier options have

[7] The first of these is the only case considered by Chance, Kumar, and Todd [2]. The solution they derive is the same as the one presented in Subsection 6.1.1 below.

been widely studied in the finance literature and are well understood. In Appendix A, we describe closed-form solutions for their values in a Black–Scholes environment.

Finally, expression (1) may also be used to characterize the increase in value that results from the contingent resetting.[8] Let $C(S, K, T)$ denote the value of the call when resetting under any circumstances is ruled out. Since a regular call can always be expressed as the sum of a knock-out call and a knock-in call with a common barrier and strike, we have:

$$C(S, K, T) \;=\; C^{out}(S, K, H, T) + C^{in}(S, K, H, T). \tag{2}$$

The gain from allowing resetting is given by $(C^* - C(S, K, T))$. From (1) and (2), this difference is simply

$$C^{in}(S, K^*, H, T) - C^{in}(S, K, H, T). \tag{3}$$

In words, the contingent resetting results in an increase in its value by an amount equal to the difference between the values of two knock-in options with a common barrier H, and with strikes of K^* and K, respectively. Of course, since $K^* < K$, the former option is always more valuable, so the gain from the presence of resetting is always positive.

6.1.2 When Maturity is also Reset

Under the second alternative, the value C^* of the original option can be expressed as the sum of a knock-out call option with barrier H, strike K, and maturity T; and a knock-in option which has barrier H and strike K^*, and which has τ years of life from the time it gets knocked-in, provided knock-in occurs before date T. (If knock-in does not occur by T, the option expires worthless.) The knock-out option is the same as in the earlier case. The knock-in option is different; to distinguish it, we will denote its value by $\widehat{C}^{in}(S, K^*, H, T, \tau)$. In this notation, the value C^* of the resettable option is given by

$$C^* \;=\; C^{out}(S, K, H, T) + \widehat{C}^{in}(S, K^*, H, T, \tau). \tag{4}$$

Thus, C^* may be identified from the values C^{out} and $\widehat{C}^{in}$ of the barrier options. Although $\widehat{C}^{in}$ is somewhat non-standard as a barrier option, it is easy to value. Appendix A describes the process of valuing $\widehat{C}^{in}$ in a Black–Scholes environment.

[8] Equivalently, this is the amount of undervaluation that would result if the possibility of resetting were ignored in the valuation exercise.

Once again, expression (4) may be used to characterize the benefit provided by the resetting. Using (2), this amount is seen to be

$$\widehat{C}^{in}(S, K^*, H, T, \tau) - C^{in}(S, K, H, T). \tag{5}$$

The benefit now equals the difference between a knock-in option with a strike of K^* that will have a maturity of τ from the time it is knocked in (provided knock-in occurs before T), and a knock-in option with a strike of K that will mature at date T if it gets knocked in. Of course, the benefit is greater now than when maturity was unchanged, since the knocked-in call now has a longer maturity.

6.2 Random Resetting

When the resetting event is random, hedging- or replication-based arguments cannot be used to derive arbitrage-free prices of resettable options, since the uncertainty in the resetting process cannot be hedged. Here is a simple example that illustrates this point.

Consider a two-period Binomial model in which the initial stock price is 100, and the stock price goes up or down by 10% in each period. Let the risk-free rate of interest per period be 2%. Suppose that we have a two-period call option in this model with an initial strike of 100. Suppose also that if the stock touches a price of 90 before the option expires, then with probability q, the option's strike is reset to 90, and with probability $(1 - q)$ it is left unaltered. The option's maturity is not touched.

If $q = 0$, resetting never occurs, so this is a standard call option. The usual arguments show that its initial value is approximately 7.27. If $q = 1$, resetting is deterministic, and the option can be valued using the procedure described in Section 6.1.1. A simple calculation shows that the initial value of the option in this case is about 9.35.

If $0 < q < 1$, then resetting is random. In this case, there are three possible states of the world at the end of one period: one in which the stock price is 110 ("state 1"), the second in which the stock price is 90 and the option will be rewritten ("state 2"), and the third in which the stock price is 90 and the option will not be rewritten ("state 3"). Since we have only two primitive assets (the stock and the riskless bond) to bridge these three states of nature, the market is incomplete, and there is no way to price the option by hedging arguments.[9]

[9]Nor is it possible to "complete" the market here by using derivatives, such as calls and puts, whose values are contingent on the prices of the model's primitive assets (the stock and the bond). This is easy to verify, and is, in fact, intuitive. Like the primitive assets, all such derivatives must have the same value in states 2 and 3; there is no way they can be used to replicate a security whose payoffs could differ at these nodes.

In fact, it is easily seen that if resetting is random, there are infinitely many risk-neutral probabilities in the model. If p_1, p_2, p_3 denote the risk-neutral probabilities of the three states, the only conditions that (p_1, p_2, p_3) must satisfy are that $p_i > 0$, $p_1 + p_2 + p_3 = 1$, and

$$p_1 \cdot (1.10) + p_2 \cdot (0.90) + p_3 \cdot (0.90) \;=\; 1.02. \tag{6}$$

All the conditions are satisfied for any combination of $p_2 > 0$ and $p_3 > 0$ such that $p_2 + p_3 = 0.40$. Now, a simple set of computations shows that the option is worth 12.35 in state 1, 5.29 in state 2, and 0 in state 3. Therefore, under risk-neutral valuation, the price of the option is

$$\frac{1}{1.02}[p_1 \cdot (12.35) + p_2 \cdot (5.29)] \;=\; \frac{1}{1.02}[7.41 + p_2 \cdot (5.29)]. \tag{7}$$

Letting p_2 range over the interval $(0, 0.40)$ of feasible values, it is seen that any price between 7.27 (which corresponds to the case $q = 0$) and 9.35 (which corresponds to the case $q = 1$) can arise as a "risk-neutral value" of the call. There is no way to reasonably restrict the price of the option between these two limits based solely on arbitrage arguments.

7 Estimating the Value of Resettable Options

From a practical standpoint, an assumption of random resetting is unhelpful for two reasons. First, as described in the previous subsection, it is not possible to derive a theoretical fair price for such an option using hedging arguments. Second, the stochastic resetting process is not observable; its parameters must be estimated from the data on options that have been reset. This is a non-trivial (and probably impractical) task. It requires us, for example, to identify not only the price histories of the stocks on which options were reset, but also all other stocks which had similar histories but did not have any experience of resetting.

We discard the hypothesis of random resetting, therefore, and aim in subsection 7.1 at obtaining an idea of the value of resetting using a deterministic model. We do this by comparing an option that is reset the first time a barrier is breached to a benchmark option that is never reset. Complementing this analysis, we look in subsection 7.2 at the point of resetting and examine the *ex-post* increase in option value that results. Once again, as the benchmark, we use an option that is never reset. In each case, we make use the information described in the earlier sections to identify the cases of interest.

Throughout this section, we assume an underlying Black-Scholes environment and use barrier option pricing formulae derived on this basis to arrive at our estimates on the value of resetting. It is true that the Black–Scholes option price (or any option price derived using hedging arguments) might fail to be fully representative of executive stock option values, owing to non-tradeability constraints in the latter. This issue is not an unimportant one, but it is peripheral to our purpose. Our intention is only to understand the impact of resetting on option values, and from a qualitiative standpoint, any benchmark model will suffice. Given its widespread use, the Black–Scholes environment is a natural candidate.

A more important issue may be that the Black-Scholes framework involves continuous sample paths for the price of the underlying stock. The assumption that prices do not experience discontinuous changes (or "jumps") is questionable especially in the context of small stocks, where most resetting is concentrated. However, jump-diffusion based models of pricing are difficult to work with, especially when dealing with non-standard derivative products such as barrier options. We will, therefore, ignore this issue.

7.1 An Ex-Ante Valuation of Resetting

In this subsection, we estimate the value of resetting under the assumption of Section 6.1 that the option gets rewritten with certainty the moment the stock price falls below a given barrier. All options are assumed to be European in style. As mentioned above, our valuation is done in a Black-Scholes environment: the stock price follows a geometric Brownian motion with constant volatility, and interest rates are constant. For simplicity, we also assume zero dividend payouts. The attractiveness of this simple specification is that closed-form solutions are available for the price of a resettable option in this case. This solution is described in Appendix A.

Since our data indicates that virtually all reset options are reset at-the-money, we will make this assumption throughout. Concerning maturity, we will examine the two cases indicated by the data as the dominant ones: where maturity is undisturbed, and where the option is given a fresh life of 10 years. The benchmark on which comparisons will be based is the value of a ten-year option that is issued at-the-money and which is never reset.

Based on the formulae in Appendix A, we can compute the increases over the benchmark that result from the resetting process in each of the two cases of interest. Table 5 describes the percentage increases for a range of possible values of the barrier and a range of possible values for volatility.

It is well known that an increase in volatility does not always lead to an increase in the value of a knock-out option since the probability of the option getting knocked out also increases alongside. Table 5 reflects this feature: for most values of the barrier, the percentage gain from resetting is not monotonically increasing in the level of volatility.[10] Thus, for any given level of the barrier, the percentage benefit created by resetting is not always higher in high volatility firms.

For any fixed value of volatility, the benefit of resetting initially increases as the barrier falls and then also starts declining. This is intuitive. Resetting is initially substantially advantageous to the holder of the option. However, as the barrier becomes very low, the probability of the option getting knocked out goes to zero, and the resettable option begins to resemble the benchmark option. For the range of values considered in Table 5 for volatility, the percentage increase in value from resetting is highest when the barrier is set between 60% and 70% of the initial price. This implies a drop of 30–40% in the strike price upon resetting, a figure close to the mean and median values of 40% we found in the data (see Section 5).

Finally, Table 5 indicates that the benefit from resetting is increased substantially when maturity is also reset alongside the strike. For example, in Table 5, for a barrier equal to 70% of the intial stock price, the percentage increase in value over the benchmark resulting from resetting ranges from 8.3% to 10% if only the strike is reset. For the same parameter values, the benefit varies between 14% and 16.2% if the maturity is also reset.

Overall, Table 5 indicates that for reasonable parameter choices, the benefit from resetting can go up to 10% if only the strike is altered and to over 16% if maturity is also reset to 10 years. However, these figures are probably exaggerated by the assumption that the option is reset with certainty at the barrier. This assumption appears a strong one given the data. We saw in Section 4 that the firms that experienced the greatest proportion of resetting were those that had three-year returns of −30% or less; even in these firms, however, under a fifth of all options were reset.

If an option is not reset with certainty at the barrier, we have shown that it is not possible to derive a hedging-based price for the option. We can nonethless, obtain a crude estimate of its value by considering its "expected value." We have seen that the maximum possible benefit from deterministic resetting is of the order of 16–17%. If the probability of resetting is taken to be about 25% (a higher number than the data would suggest), then the expected ex-ante benefit from resetting is only around 4%. Thus, from an ex-ante standpoint, the possibility that the option may be reset if the stock price falls sufficiently does not appear to affect option values substantially.

[10]For example, when the barrier is fixed at 90% of the initial stock price, the gain from resetting *falls* from 6.74% to 3.19% as volatility increases from 20% to 40%.

7.2 An Ex-Post Valuation of Resetting

Since resetting involves a lowering of the strike price of an out-of-the-money option to the current stock price, it is apparent that from an ex-post standpoint the value of the option is raised considerably over that of the benchmark. Of course, the actual increase depends on a number of factors including (i) the relationship between the stock price at the time of reset and the initial stock price,[11] (ii) the time left to maturity on the option at the time of resetting, and (iii) whether maturity is reset alongside the strike. Note that it does not matter, for a post-hoc comparison of this sort whether the original model of resetting was stochastic or deterministic.

Taking all these factors into account, Table 6 gives quantitative expression to the amount of increase as a percentage of the benchmark value. The table considers five possible levels of the stock price at reset time, and for each level of the stock price it considers five possible values for the time left to maturity on the original option at the time of reset. Volatility in the table is fixed at an intermediate value of 30%.

From a qualitative standpoint, Table 6 offers no surprises. The table shows that the less the time left to maturity or the lower the stock price at which the option is reset, the greater the benefit from resetting. This is intuitive. As maturity approaches, there is less time for an out-of-the-money option to move into the money, so a lowering of the strike becomes more valuable. Similarly, the lower the stock price at the time of resetting, the more out-of-the-money the original option was at this point, and therefore the more valuable a lowering of the strike becomes. Finally, the table shows that a resetting of the strike can increase the benefit to the holder by a substantial amount, especially in the case where the difference between the new and old maturities is large.

The results are more interesting when viewed quantitatively. To take a typical case, suppose the option is reset when the stock price is 30% below its original value. The table shows that gain to the holder of the option from a resetting of the strike in this case is at least 31% of the benchmark value, and could be as much as 60%, depending on the time left to maturity at the time of reset. If maturity is also reset to 10 years, then the increases in value go even higher: from 40% when only a year has gone by since the issuance of the original option to 134% when five years have elapsed. It follows, then, that regardless of whether the resetting process was stochastic or not, the event of resetting leads to a significant increase in the value of the option over the value the option would have had were resetting not a possibility.

[11] As in the previous subsection, we assume that the option is initially issued at-the-money and that if it is reset, it is reset at-the-money.

8 Conclusions

The principal argument given in favor of stock options as a compensation mechanism is that they align the interests of shareholders and executives, by rewarding the latter only when share prices rise. This alignment is weakened if there is a possibility that option terms will be reset in a manner favorable to the executive when share prices decline. Nonetheless, such resetting does take place, and is usually justified as a necessary cost that must be incurred to retain scarce managerial talent. This argument appears most acceptable when poor industry performance, rather than poor firm performance alone, has resulted in lower share prices.

We examine the incidence of resetting in a comprehensive sample of firms of all sizes between 1992 and 1995. We find that 1.3% of all executives in those firms had options repriced in a given year, with average exercise price reductions of about 40%. Almost half of these repriced options also had their maturities lengthened, typically receiving a new expiration of 10 years.

We find that resetting is monotonically related to negative performance, with its incidence increasing as performance worsens; this remains true even after correcting for industry performance. Resetting is also much more common in smaller firms which tend to be less publicly visible. We also explore the importance of other industry- and firm-specific factors, but do not find many of significance.

Finally, we explore a model of option pricing that allows for the possibility of resetting and examine the impact that resetting has on the value of the initial award. From an ex-ante standpoint, we find, surpisingly, that the impact is small; even for implausibly large parameter values, the benefit from resetting is only around 15% of the initial award value. From an ex-post standpoint, however, the benefit can be substantial, amounting to an increase in the value of the option by a factor of 100% or more.

A Resetting in a Black–Scholes Environment

In this appendix, we describe closed-form solutions in a Black–Scholes environment for the prices derived in Section 6. The results presented here are either taken from Rubinstein and Reiner [8], or are derived based on material in that paper.

The following notation is used. The stock price is lognormal with volatility σ. The stock has a continuous payout at rate q. Finally, the continuously compounded rate of interest is r. The remaining notation is the same as in Section 6.

We first identify the option price if the possibility of resetting were ignored. Given a strike price of K and a maturity of T, this is simply the Black–Scholes call price

$$C^{bs}(S,K,T) \;=\; e^{-qT}SN(d_1) - e^{-rT}KN(d_2) \tag{8}$$

where d_1 and d_2 are given by

$$d_1 \;=\; \frac{1}{\sigma\sqrt{T}}\left[\ln\left(\frac{S}{K}\right) + \left(r - q + \frac{1}{2}\sigma^2\right)T\right]. \tag{9}$$

$$d_2 \;=\; d_1 - \sigma\sqrt{T}. \tag{10}$$

Now, consider the case when resetting is deterministic and occurs at the first time the stock price falls below a barrier H. Suppose first that the maturity of the reset option is not altered, but that its strike is changed to K^*. Then, we saw in Section 6.1.1 that the price of the original option is given by the decomposition

$$C^* \;=\; C^{out}(S,K,H,T) + C^{in}(S,K^*,H,T),$$

where C^{out} and C^{in} are a knock-out and a knock-in option, respectively, defined in Section 6.1.1. Rubinstein and Reiner [8] describe the pricing of such barrier options in a Black–Scholes world. They show that $C^{out}(S,K,H,T)$ is given by

$$\begin{aligned} C^{out}(S,K,H,T) \;=\;& Se^{-qT}\left[N(d_1) - \left(\tfrac{H}{S}\right)^{2\lambda}N(d_3)\right] \\ & -e^{-rT}K\left[N(d_2) - \left(\tfrac{H}{S}\right)^{2\lambda-2}N(d_4)\right], \end{aligned} \tag{11}$$

where d_1 and d_2 were defined above in the Black–Scholes solution, and λ, d_3, and d_4 are given by

$$\lambda \;=\; \frac{1}{\sigma^2}\left[r - q + \frac{1}{2}\sigma^2\right] \tag{12}$$

$$d_3 = \frac{1}{\sigma\sqrt{T}}\left[\ln\left(\frac{H^2}{SK}\right) + \lambda\sigma^2 T\right] \tag{13}$$

$$d_4 = d_3 - \sigma\sqrt{T}. \tag{14}$$

If $C(S, K, T)$ denotes the price of a vanilla call option with strike K and maturity T, then it is easily seen that the price of a knock-out and knock-in must be related by

$$C^{in}(S, K, H, T) = C(S, K, T) - C^{out}(S, K, H, T).$$

In a Black-Scholes world, of course, $C(S, K, T)$ has the form (8), while $C^{out}(S, K, H, T)$ is given by (11). Using these expressions, the price of the knock-in option in a Black-Scholes world works out to

$$C^{in}(S, K, H, T) = Se^{-qT}\left(\frac{H}{S}\right)^{2\lambda} N(d_3) - e^{-rT}K\left(\frac{H}{S}\right)^{2\lambda-2} N(d_4). \tag{15}$$

We turn now to the case where maturity is also changed at the time of reset. The reset option has a strike K^* and a maturity of τ years measured from the time of reset. As earlier, reset occurs the first time the stock price falls below a barrier price H. We saw in Section 6.1.2 that the price of such an option is given by

$$C^* = C^{out}(S, K, H, T) + \widehat{C}^{in}(S, K^*, H, T, \tau),$$

where C^{out} is as defined above, and $\widehat{C}^{in}$ is the price of an option that gets knocked-in when the barrier H is touched (provided this occurs before T), has a strike of K^*, and has a life of τ years from the time of knock-in.

To value $\widehat{C}^{in}$ in a Black–Scholes world, note first that at the time the option is knocked-in, it is simply a standard call option with τ years to maturity, and so has the value of a Black-Scholes call given in (8), with the strike equal to K^*, and the asset price S equal to H. Denoting this Black-Scholes value by V^{in}, we have

$$V^{in} = C^{bs}(H, K^*, \tau) \tag{16}$$

The issue time of the option is the first time the asset price crosses the barrier H. Rubinstein and Reiner [8] have shown that the density of this first-passage time (under the risk-neutral measure) is given by:

$$h(t) = -\left(\frac{\alpha}{\sigma t\sqrt{2\pi t}}\right) e^{-\frac{1}{2}v^2}, \tag{17}$$

where

$$\alpha = \ln\left(\frac{H}{S}\right),$$

$$v = \frac{1}{\sigma\sqrt{t}}\left[-\alpha + \left(r - \frac{1}{2}\sigma^2\right)t\right]$$

The value $\widehat{C}^{in}$ of the knock-in option is, evidently, simply the discounted expectation of the value V^{in} at issue time with respect to the density h:

$$\widehat{C}^{in} = \int_0^T e^{-rt} V^{in} h(t) dt. \tag{18}$$

Since V^{in} does not depend on t, it can be pulled out of the integral, which means

$$\widehat{C}^{in} = V^{in} \cdot \int_0^T e^{-rt} h(t) dt. \tag{19}$$

A closed-form expression for the integral on the right-hand side of (19) is also provided in Rubinstein and Reiner [8]. Using their result, we finally have

$$\widehat{C}^{in} = V^{in}\left[\left(\frac{H}{S}\right)^{a+b} N(d_5) + \left(\frac{H}{S}\right)^{a-b} N(d_6)\right], \tag{20}$$

where

$$d_5 = \frac{1}{\sigma\sqrt{T}}\left[\ln\left(\frac{H}{S}\right)\right], \tag{21}$$

$$d_6 = d_7 - 2b\sigma\sqrt{T}, \tag{22}$$

$$a = \frac{1}{\sigma^2}\left(r - \frac{1}{2}\sigma^2\right), \tag{23}$$

$$b = \frac{1}{\sigma^2}\left[(r - \frac{1}{2}\sigma^2)^2 + 2r\sigma^2\right]^{\frac{1}{2}}. \tag{24}$$

Table 1: Sample Selection

Sample selection for a study of executive stock option resettings. The candidate sample of 30,468 observations includes all 1992–95 observations in the Standard & Poor's ExecuComp database for which the executive holds stock options at the start of the year.

Observations in sample for which executive holds stock options at start of year	30,468
Resetting events reported by ExecuComp	457
Elimination of observations for which the reported resetting had occurred in a prior year	(55)
Addition of observations miscoded by ExecuComp	4
Events that represented technical changes to option terms and not genuine resettings	(10)
Net resetting events in sample	396
Frequency of all observations	1.30%
Information successfully obtained from proxy statements	333
Individual award "tranches" studied	806

Table 2: Changes in Options Exercise Prices and Expirations

Changes in executive stock option exercise prices and expiration dates for a sample of 806 award tranches whose terms were modified during 1992–95. The sample is drawn from Standard & Poor's ExecuComp database. Of the 806 events, 38 represented the second or third repricing of an award during a single fiscal year; 92 involved the surrender by the executive of some options involved in the resetting.

	Expiration Lengthened	Expiration Unchanged	Expiration Reduced	Data Missing	TOTAL
Strike price increased	2				2
Strike price unchanged					
Strike price lowered; left above market	59	89		3	151
Strike price lowered to market price	294	309	13	4	620
Strike price reduced below market price	11				11
Data missing		16		6	22
TOTAL (percent)	366 45%	414 51%	13 2%	13 2%	806 100%

Table 3: Returns for Sample Firms Sorted by Size

This table describes the mean and standard deviations of three-year returns across our sample observations sorted by size.

Observations from	Mean Return	Standard Deviation
S&P 500	14.9%	20.8%
S&P MidCap 400	16.5%	23.9%
S&P SmallCap 600	20.1%	30.2%

Table 4: Firm Structure and the Incidence of Resetting

This table presents the results on the relationships between incidences of resetting and a number of variables pertaining to firm structure.

Are the CEO and Chairman separate jobs?

	Same Person	Separated	Difference	T-Statistic
Observations	22,886	10,930		
Frequency of Resetting	1.14%	1.56%	−0.42%	−3.02***

Do any executives have a conflict of interest in the compensation committee?

	Conflict	No Conflict	Difference	T-Statistic
Observations	5,045	28,771		
Frequency of Resetting	2.02%	1.14%	0.88%	4.23***

Is Resetting more common for CEOs than non-CEO's?

	CEOs	Non-CEOs	Difference	T-Statistic
Observations	6,186	27,630		
Frequency of Resetting	1.26%	1.28%	−0.02%	−0.11

Is Resetting more common for Chairmen than non-Chairmen?

	Chairmen	Non-Chairmen	Difference	T-Statistic
Observations	5,346	28,470		
Frequency of Resetting	1.14%	1.30%	−0.16%	−0.99

Does it matter if executives are also directors?

	Also directors	Non-directors	Difference	T-Statistic
Observations	12,995	20,821		
Frequency of Resetting	12.85%	12.68%	0.17%	0.46

Does stock ownership (as % of outstanding) matter?

	Executives with options reset	All Others	Difference	T-Statistic
Observations	422	28,128		
Stock Ownership	0.83%	1.04%	−0.21%	−1.38

Table 5: Increase in Ex-Ante Option Value Created by Resetting

This table examines the increase in the initial value of an at-the-money 10-year European call option if the option is reset with certainty when the stock price falls below a prespecified barrier. The stock price is assumed to follow a Black-Scholes process with volatility σ. The initial stock price is taken to be 100, the rate of interest to be 5%, and the rate of dividend payouts to be zero. In the table, (i) "Barrier as % of S" refers to the barrier expressed as a percentage of the initial stock price S; (ii) "% gain: only K reset" refers to the percentage gain in option value (over the benchmark Black-Scholes value) if the option's strike is reset at-the-money when the barrier is touched, but its maturity is unaffected; and (iii) "K and T reset" refers to the percentage gain if the option's strike is reset as above, and its maturity is reset to 10 years at this point.

Volatility: $\sigma = 20\%$									
Barrier as % of S	90	80	70	60	50	40	30	20	10
% gain: only K reset	6.74	9.14	8.27	5.64	2.85	0.97	0.19	0.01	0.00
% gain: K and T reset	11.60	15.47	13.97	9.72	5.16	1.95	0.44	0.04	0.00

Volatility: $\sigma = 25\%$									
Barrier as % of S	90	80	70	60	50	40	30	20	10
% gain: only K reset	6.00	9.23	9.84	8.33	5.62	2.84	0.94	0.15	0.00
% gain: K and T reset	10.14	15.30	16.16	13.73	9.48	5.05	1.85	0.35	0.01

Volatility: $\sigma = 30\%$									
Barrier as % of S	90	80	70	60	50	40	30	20	10
% gain: only K reset	5.18	8.57	10.04	9.64	7.70	4.90	2.24	0.57	0.03
% gain: K and T reset	8.65	14.04	16.24	15.51	12.48	8.19	3.99	1.15	0.09

Volatility: $\sigma = 35\%$									
Barrier as % of S	90	80	70	60	50	40	30	20	10
% gain: only K reset	4.42	7.66	9.54	9.92	8.83	6.54	3.70	1.30	0.14
% gain: K and T reset	7.34	12.49	15.30	15.76	14.00	10.51	6.18	2.37	0.32

Volatility: $\sigma = 40\%$									
Barrier as % of S	90	80	70	60	50	40	30	20	10
% gain: only K reset	3.76	6.73	8.73	9.60	9.20	7.55	4.97	2.20	0.36
% gain: K and T reset	6.23	10.94	13.96	15.13	14.39	11.85	7.96	3.73	0.72

Table 6: Increase in Ex-Post Option Value Created by Resetting

This table examines the ex-post increase in option value if the strike of the option is reset at-the-money at some point when the stock price is below the initial strike price. The benchmark option is an option with the same initial parameters but which is never reset. The table comapres the value of the reset option to that of the benchmark immediately subsequent to the resetting event. Five values are considered for the stock price at which resetting occurs. For each value, the increase in value from resetting is computed for five cases, distinguished by the time left to maturity on the option when the barrier is first touched. The stock price is assumed to follow a geometric Brownian motion with volatility $\sigma = 0.30$. The initial stock price is $S = 100$, the initial strike price is $K = 100$, the initial maturity is 10 years, and the interest rate is 5%. In the table, (i) "Time to maturity" refers to the time left to maturity on the original option when the barrier is first touched, (ii) "% increase: only K reset" refers to the increase in value over the benchmark when only the strike is reset, and (iii) "% increase: K and T reset" refers to the percentage gain if the option's maturity is also reset to 10 years.

New strike price = 90% of initial strike price					
Time to maturity	9 years	8 years	7 years	6 years	5 years
% increase: only K reset	7.60	8.54	9.70	11.19	13.15
% increase: K and T reset	13.72	22.17	32.82	46.65	65.42

New strike price = 80% of initial strike price					
Time to maturity	9 years	8 years	7 years	6 years	5 years
% increase: only K reset	17.68	20.00	22.92	26.72	31.88
% increase: K and T reset	24.36	35.07	48.82	67.13	92.80

New strike price = 70% of initial strike price					
Time to maturity	9 years	8 years	7 years	6 years	5 years
% increase: only K reset	31.58	36.06	41.79	49.42	60.13
% increase: K and T reset	39.05	53.14	71.66	97.07	134.10

New strike price = 60% of initial strike price					
Time to maturity	9 years	8 years	7 years	6 years	5 years
% increase: only K reset	51.84	59.90	70.47	84.99	106.22
% increase: K and T reset	60.47	79.98	106.39	143.99	201.47

New strike price = 50% of initial strike price					
Time to maturity	9 years	8 years	7 years	6 years	5 years
% increase: only K reset	83.71	98.32	118.13	146.48	190.24
% increase: K and T reset	94.14	123.22	164.09	225.08	324.30

References

[1] Carpenter, J. and B. Remmers (1998) Stock Price Performance Following Insider Option Exercise, mimeo, Department of Finance, New York University.

[2] Chance, D., R. Kumar, and R. Todd (1997) The "Repricing" of Executive Stock Options, mimeo, Department of Finance, Virginia Tech.

[3] Gilson, S. and M. Vetsuypens (1993) CEO Compensation in Financially Distressed Firms: An Empirical Analysis, *Journal of Finance* 48, 425–458.

[4] Hemmer, T., S. Matsunaga, and T. Shevlin (1996) Optimal Exercise and the Value of Employee Stock Options granted with a Reload Provision, mimeo, School of Business Administration, University of Washington.

[5] Hemmer, T., S. Matsunaga, and T. Shevlin (1997) An Empirical Examination of Incentives to Adopt Reload Employee Stock Option Plans, mimeo, School of Business Administration, University of Washington.

[6] Matsunaga, S.R. (1995) The Effects of Financial Reporting Costs on the use of Employee Stock Options, *The Accounting Review* 70(1), 1–26.

[7] Rubinstein, M. (1994) On the Accounting Valuation of Employee Stock Options, paper presented at Conference on *Derivatives: The State of the Art*, New York University, November 1994.

[8] Rubinstein, M. and E. Reiner (1991) Breaking Down the Barriers, *Risk*, September 1991.

[9] Saly, P.J. (1994) Repricing Executive Stock Options in a Down Market, *Journal of Accounting and Economics* 18, 325–356.

[10] Seyhun, H.N. (1992) The Effectiveness of Insider-Trading Sanctions, *Journal of Law and Economics* 35, 149–182.

[11] Yermack, D. (1995) Do Corporations Award CEO Stock Options Effectively?, *Journal of Financial Economics* 39, 237–269.

[12] Yermack, D. (1997) Good Timing: CEO Stock Option Awards and Company News Announcements, *Journal of Finance* 52(2), 449–476.

FIGURE 1

Company performance and executive stock option repricing

The annual frequency of stock option repricing for top managers covered by the Standard & Poor's ExecuComp database. The sample includes 23,281 executive-year observations for which managers have nonzero holdings of stock options and the database includes a three-year cumulative stock return for the company. The stock return includes the year during which the repricing event occurs.

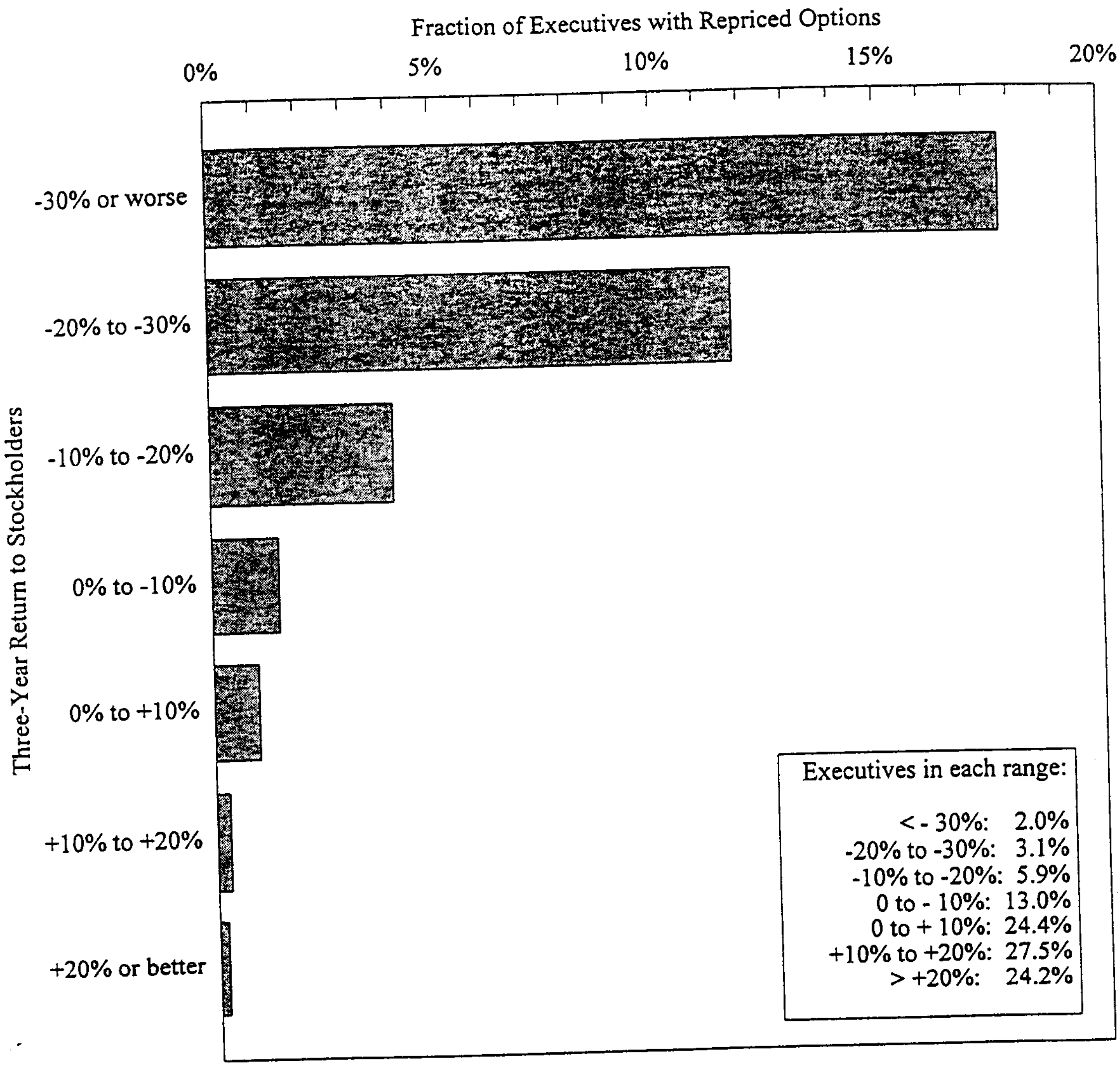


FIGURE 2

Performance relative to industry and executive stock option repricing

The annual frequency of stock option repricing for top managers covered by the Standard & Poor's ExecuComp database. The sample includes 23,281 executive-year observations for which managers have nonzero holdings of stock options and the database includes a three-year cumulative stock return for the company. The stock return includes the year during which the repricing event occurs. Industry-adjusted returns are raw stock returns minus the mean returns over the same period for other sample companies with the same two-digit SIC code.

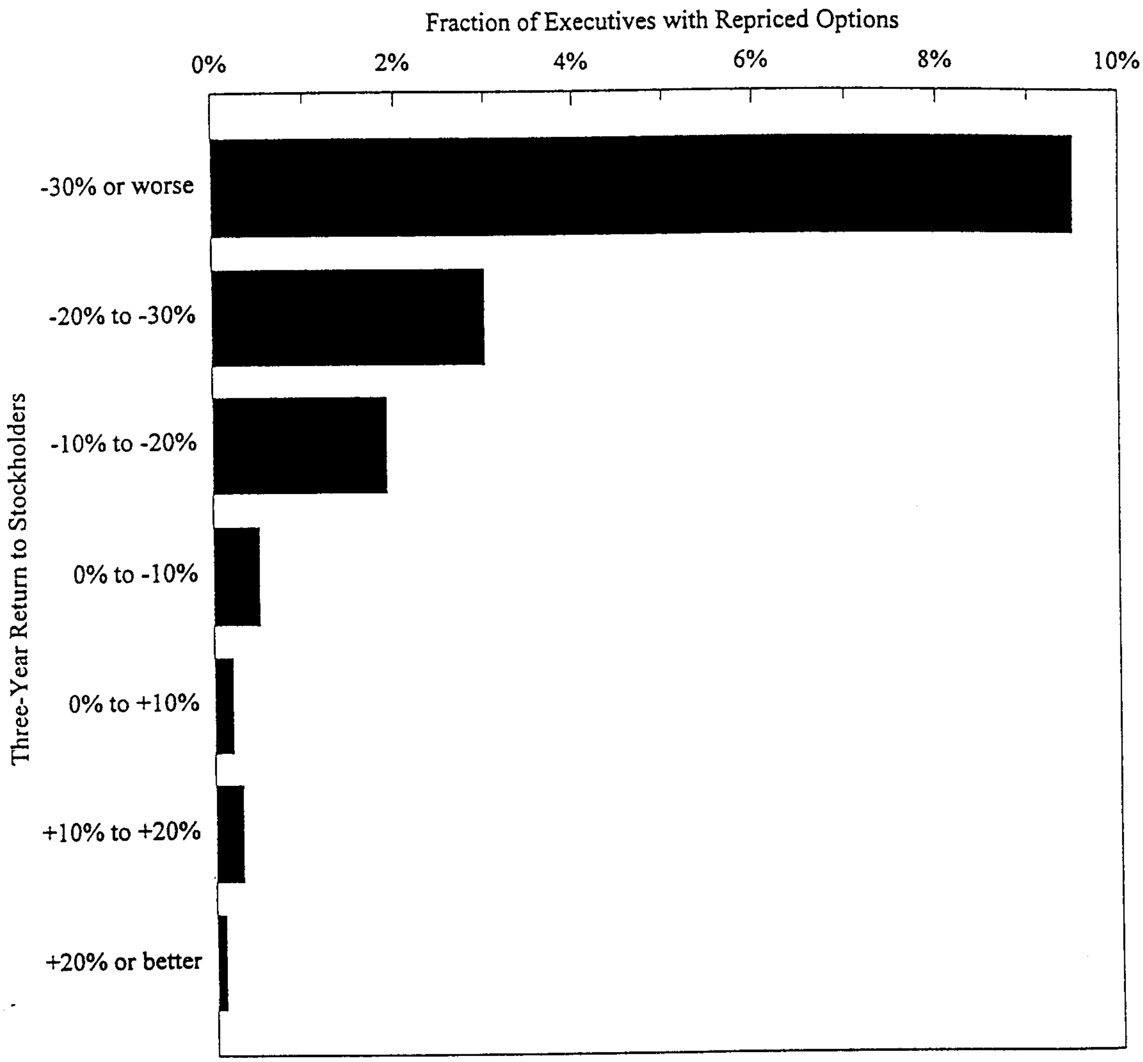


FIGURE 3
Frequency of executive stock option repricing, 1992-95

The annual frequency of stock option repricing for top managers covered by the Standard & Poor's ExecuComp database. The sample includes 30,468 executive-year observations for which managers have nonzero holdings of stock options.

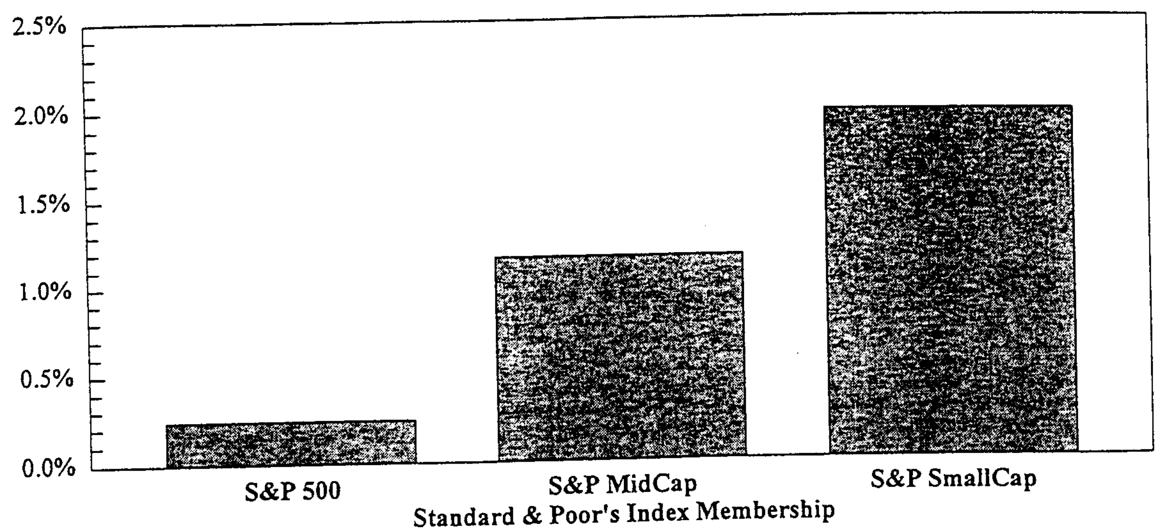


FIGURE 4

Frequency of executive stock option repricing, 1992-95

The annual frequency of stock option repricing for top managers covered by the Standard & Poor's ExecuComp database. The sample includes 30,468 executive-year observations for which managers have nonzero holdings of stock options.

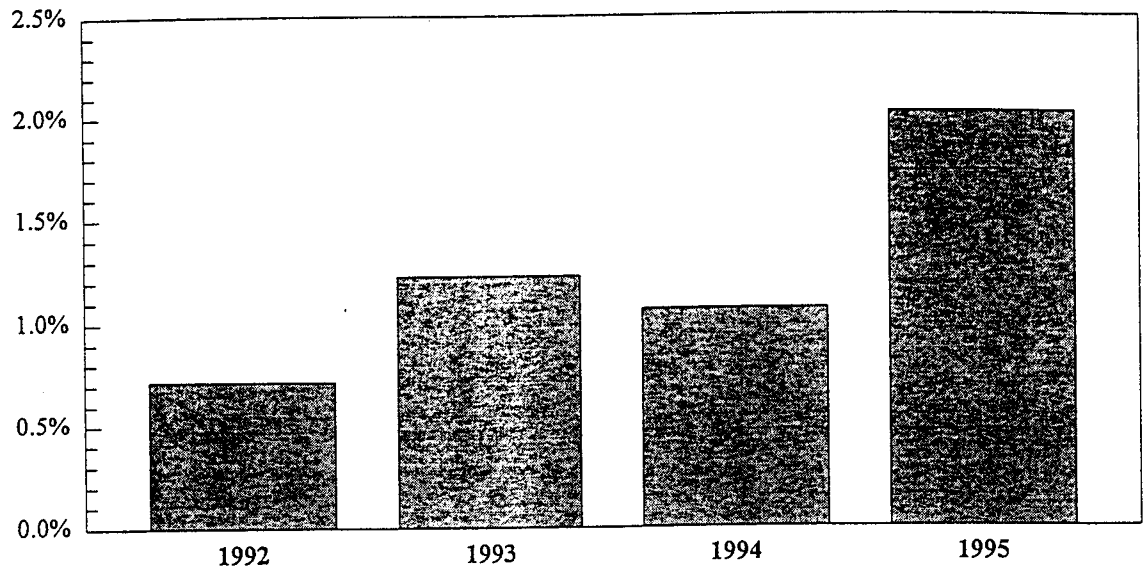


FIGURE 5

Option repricing and performance in individual industries

The annual frequency of stock option repricing for top managers covered by the Standard & Poor's ExecuComp database. The sample includes 23,281 executive-year observations for which managers have nonzero holdings of stock options and the database includes a three-year cumulative stock return for the company. The chart plots the average three-year stock return against the frequency of option repricing for two-digit SIC industries. Twelve industries with less than 100 executive-year observations are excluded from the analysis. SIC codes are displayed on the chart as labels below each data point.

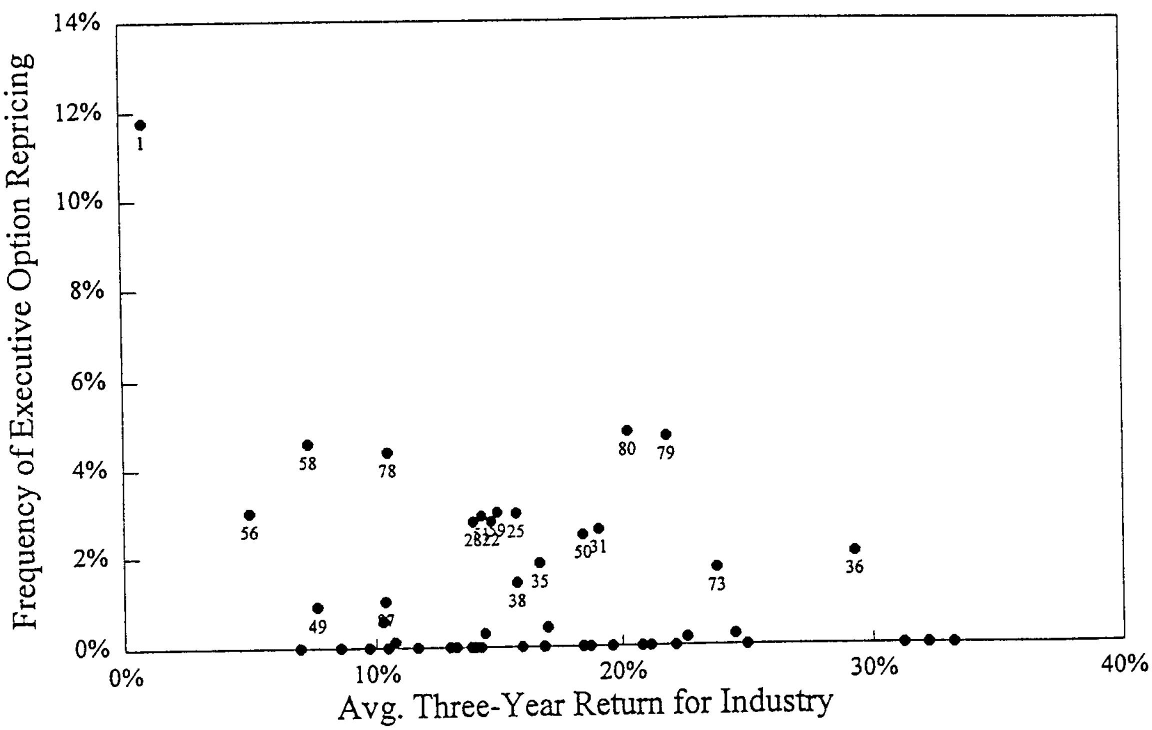
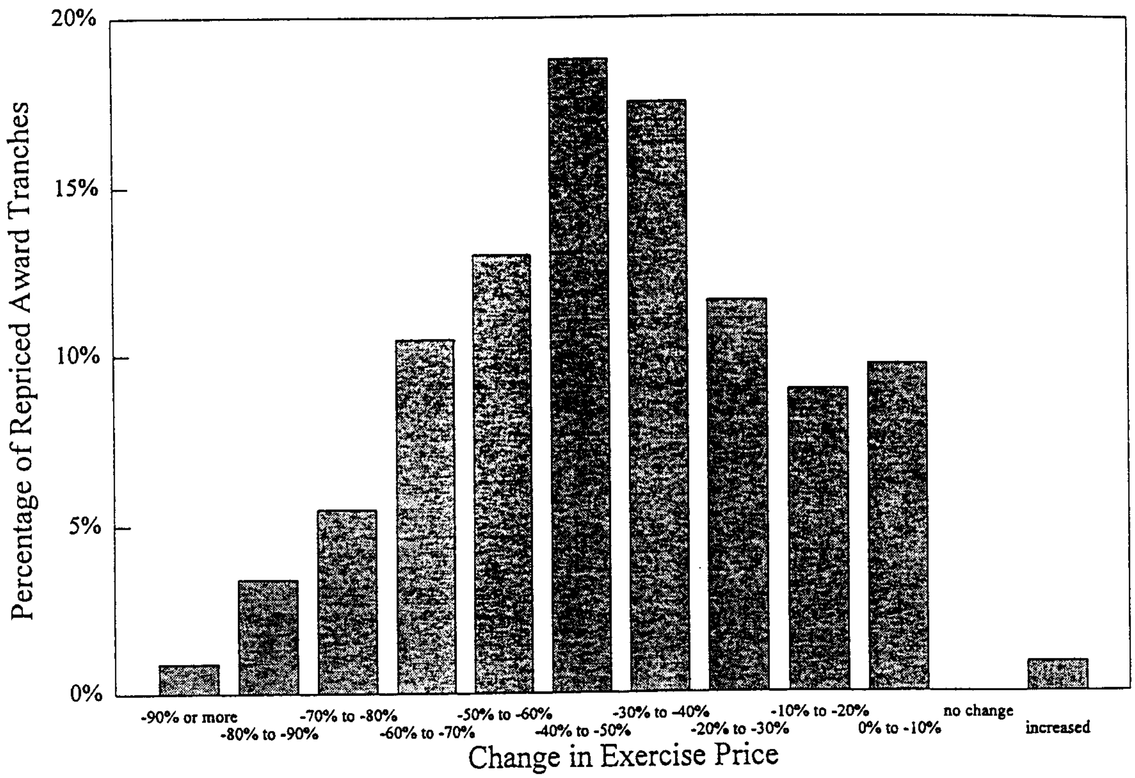


FIGURE 6

Distribution of changes in option exercise prices

The distribution of changes in executive stock option exercise prices, for a sample of 784 executive stock option award tranches whose terms are modified during the 1992-95 period. The sample is drawn from Standard & Poor's ExecuComp database.



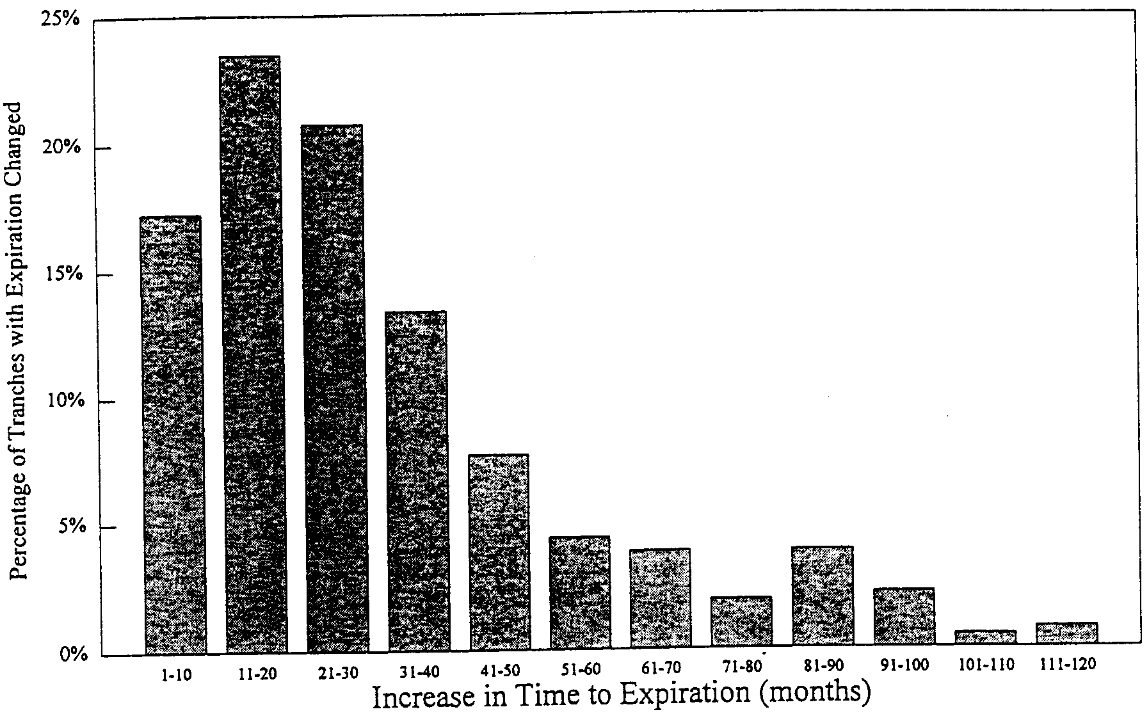
New Exercise Prices of Awards

	Number	Percentage
Above prior exercise price	2	0.3%
Below prior exercise price but above current market price	151	19.4%
Current market price	616	79.0%
Below current market price	11	1.4%

FIGURE 7

Distribution of changes in option expirations

The distribution of changes in executive stock option expirations, for a sample of 366 executive stock option award tranches whose exercise prices are lowered and expirations also extended during the 1992-95 period. The sample is drawn from Standard & Poor's ExecuComp database.



New Expiration of Awards That Are Extended

	Number	Percentage
Less than 60 months	18	5%
Exactly 60 months	46	13%
Between 61 and 119 months	17	5%
Exactly 120 months	284	78%
More than 120 months	1	0.3%