BDO KNOWS:
COMPENSATION & BENEFITS

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REDUCE EMPLOYEE STOCK OPTION EXPENSE BY INTRODUCING DIFFERENT ENTRY LEVELS AND FORFEITURE TECHNIQUES

Companies can reduce employee stock option expense up to 30% or more using current Non-Qualified Stock Options pool by introducing different forfeiture elements, changing its effective start date, or by triggering the grant at a premium of the current underlying asset to re-characterize the pricing models. This is the first article in a three-part series.

INTRODUCTION

Companies have adjusted over the years since the days of APB 25 to account for the expense of its employee stock options. And ever since, companies have adjusted the different variables within the traditional Black-Scholes-Merton pricing model to reduce the expense (e.g., reducing the once standard 10-year term to 7-years or less, premium pricing the strike/grant price above the underlying asset price, or using an annual risk of forfeiture rate to discount the option valuation). These minor measures do little to reduce the stock expense to a company's books and do little to further support its overall rewards programs.

There are, however, three other techniques that can significantly reduce the total stock option expense which accounts for stock option grant practices already in place, or practices that are philosophically practiced but are not accounted for in the current pricing of a company's stock options. The three techniques in this three-part article series are: *Down and Out*, *Up and In*, and *Forward Start*. Each one of the techniques, when applied to employee stock options, will have their own discounts, features, and drawbacks. Each one of these techniques uses a pricing model that is compliant with today's ASC 718 requirements (formerly FAS 123R), so we'll cover the necessary base calculations for each one of these before we discuss each of the different techniques. This article will focus on Down and Out options.

Equity Volatility Calculation

For our purposes, we'll use the industry-standard historical volatility calculation for the underlying asset. While implied volatilities have been used in some studies and benchmark analysis (an iterative process, whereas for European-options, we may be able to estimate the implied volatility using a closed-form approach but we won't cover that here since the options we'll be dealing with are considered exotics), historical volatilities will allow us to use a full 36-period lookback for a more long-term approach when granting stock options.

The historical volatility calculation we'll use is described below:

$$r_i \ldots r_{i+36} = \ln\left(\frac{S_p}{S_{p-1}}\right), \text{thus}$$

$$\bar{r} = \frac{\sum_{i=1}^{36} r_i}{36}, \text{ and then finally}$$

$$(1) \quad \sigma_0 = \left[\frac{\sqrt{\sum_{i=1}^{36}(r_i - \bar{r})^2}}{35}\right], \text{ and for our purposes}$$

$$\sigma = \sigma_0\sqrt{12} \text{ for the annualized historical volatility.}$$

Therefore, if you're using your own custom data list of asset prices, then you'll use (1) to correctly compute the historical volatility for the pricing models. In our examples, we'll assume 40% as the volatility.

Continuously Compounded Risk-free Rate of Return Calculation

For continuity across our different calculations, we'll use the standard continuously compounded rate of return for r:

$$r = r_0 e^{r_0 t},$$

where r_0 = risk-free rate and t = term (years)

For example, if you have r_0 = 2.23%, t = 10 then we'll have a continuously compounded rate, r, equal to 3.0%.

THE BD&O OPTION TYPE

The Down and Out option type (*Barrier Down and Out*, or *BD&O Option* for short) introduces a barrier as a forfeiture element. In this case, the forfeiture element is a price barrier below the current grant price of the employee stock option. If the price barrier is hit (in our case, if the underlying stock price drops and hits the barrier price), then the entire employee stock option grant expires worthless. In exchange for the additional forfeiture element, the option grant is appropriately priced to account for this risk of forfeiture.

In addition to the typical closed-form option pricing variables that affect the pricing of a *BD&O Option*, the forfeiture element further reduces the option price dependent upon how far the barrier is set from the current grant price. For example, let's consider the underlying stock of XYZ Corporation and the following closed-form option pricing model variables:

- S = Underlying stock price of $10.00 per share
- X = Strike price of option of $10.00
- t = 10 years to expiration
- r = 3.0% (continuously compounded rate)
- σ = 40% historical volatility rate
- H_0 = BD&O barrier at $5.00
- H_1 = BD&O barrier at $3.00

First, for comparison, a *Black-Scholes-Merton* price would yield an employee stock option value of $5.512. Now the first *BD&O Option* at a $5.00 forfeiture barrier yields a stock option value of $4.71 (a 15% reduction in option expense), and the second *BD&O Option* at a $3.00 forfeiture barrier yields a stock option value of $5.39 (a mere 2% reduction in option expense).

But if we set the *BD&O Option* barrier at $6.00, we now reach a stock option value of $4.08 (a 26% reduction in option expense). As you can see, the closer the *BD&O Option* barrier is set to the grant price, the higher the discount in the option expense but the greater the risk of the underlying stock price hitting the barrier and causing the grant to expire worthless.

Table 1: Comparison of Black-Scholes-Merton to BD&O Option

Option Pricing Method (10-year expiration)	Option Value
Black-Scholes-Merton	$5.51
BD&O Barrier $6.00 (26% reduction)	$4.08
BD&O Barrier $5.00 (15% reduction)	$4.71
BD&O Barrier $3.00 (2% reduction)	$5.39

Before we get deeper into the details of the *BD&O Option* characteristics and its application, let's cover the underlying calculations (Haug, 1997) of the *BD&O Option*:

$$(2) \qquad Se^{(b-r)T}N(x_1) - Xe^{-rT}N(x_1 - \sigma\sqrt{T}) -$$

$$(3) \qquad Se^{(b-r)T}(\tfrac{H}{S})^{2(\mu+1)}N(\eta y_1) - Xe^{-rT}(\tfrac{H}{S})^{2\mu}N(\eta y_1 - \eta\sigma\sqrt{T}) +$$

$$(4) \qquad K\left[\left(\tfrac{H}{S}\right)^{\mu+\lambda}N(\eta z) + \left(\tfrac{H}{S}\right)^{\mu-\lambda}N(\eta z - 2\eta\lambda\sigma\sqrt{T})\right],$$

further we denote:

where $\chi_1 = \frac{\ln\left(\frac{S}{X}\right)}{\sigma\sqrt{T}} + (1+\mu)\sigma\sqrt{T}$,

where $y_1 = \frac{\ln\left(\frac{H^2}{SX}\right)}{\sigma\sqrt{T}} + (1+\mu)\sigma\sqrt{T}$,

where $= \frac{b - \frac{\sigma^2}{2}}{\sigma^2}$, and finally $\lambda = \sqrt{\mu^2 + \frac{2r}{\sigma^2}}$

The artistry, so to speak, comes in setting an appropriate barrier that is an acceptable compromise between the probability of hitting the barrier and the option expense discount. There are two straightforward ways to calculate the underlying probabilities of hitting a barrier: a deterministic method and a probabilistic method. The deterministic method is a more qualitative method and relies on experience in your company's stock price movement, so we won't cover that method here. Instead, we'll cover one method under the probabilistic method to help determine the down barrier.

PROBABILISTIC SETTING OF THE DOWN BARRIER

The first way we'll cover for helping to set the down barrier using a probabilistic model involves utilizing the cumulative normal distribution function. Using the cumulative normal distribution, we can estimate the probability of the underlying stock price hitting the barrier price (McMillan, 1986):

$$(5) \qquad P(H) = N\left[\frac{\ln\left(\frac{H}{S}\right)}{\sigma_t}\right], \text{ where } \sigma_t = \sigma\sqrt{t}$$

and conversely, we can denote the following for the probability of the underlying stock price staying above the H barrier:

$$(6) \qquad P(>H) = 1 - P(H)$$

therefore, in our example above, we would calculate the P of hitting \$5.00 during the term of the option grant:

$$P(5.00) = N\left[\frac{\ln\left(\frac{5.00}{10.00}\right)}{(0.40)(3.16228)}\right],$$

$= N\left[\frac{-0.69314}{1.26491}\right]$ = 29% probability of hitting the \$5.00 down barrier, or

Using (6), we can say there is a 71% probability the underlying asset price will stay above the \$5.00 down barrier during the term of the option.

Depending on whether this is an acceptable probability level or not, we can make further modifications to the overall employee stock option grant by reducing the time to expiration (and hence reducing the amount of time the underlying stock price will hit the barrier), which we'll do in the next section.

Another method we can use is a Monte Carlo simulation. This is a computational method that simulates possible outcomes by using random trials. Although we will not cover this method in this article, we will revisit this technique later in the article series.

PLAN DESIGN CONSIDERATIONS

As a straightforward matter, the *BD&O Option* can be used to reduce overall option expense in a company's equity incentive plan by granting the same number of shares as originally planned for the employee, or it can be used to add additional employee equity while maintaining the cost structure of the original option grant. For example, with a \$5.00 down barrier, the option cost is \$4.71 compared to an original cost of \$5.51 per option. Therefore, one could grant an extra option for every six options granted to the employee to increase the ownership leverage for the employee:

\$5.51 - \$4.71 = \$0.80, price difference, therefore

$\frac{\$4.71}{\$0.80}$ = 5.89, *or* 1 *additional option for every 6 options*

Another issue to consider is the idea of option reversion, where forfeited options revert back to the plan. This will have the benefit of automatically replenishing your option pool without having the need to garner additional shareholder approval as options forfeit upon hitting the down barrier. However, as with all technical considerations, careful planning with your consultants, accountants, and general counsel are required to understand the impact of the forfeiture and to help determine the timing of future or replacement grants.

And lastly, the other major consideration is with the other variables related to the option grant. Although the introduction of a barrier could potentially reduce the overall expense cost, modifying other variables in the option grant can add to the effect. For example, when we consider plan designs using a *BD&O Option*, we would put together option structure scenarios which is an intuitive iterative process.

Figure 1: Base case is a $5.00 barrier

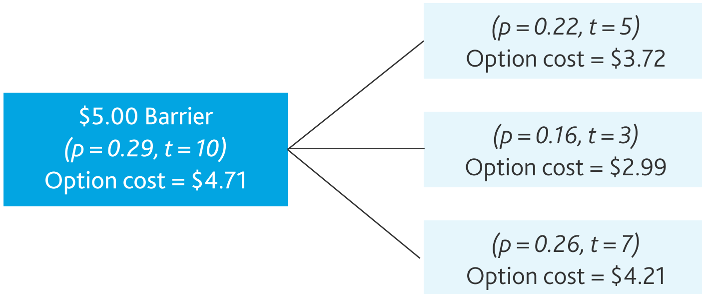
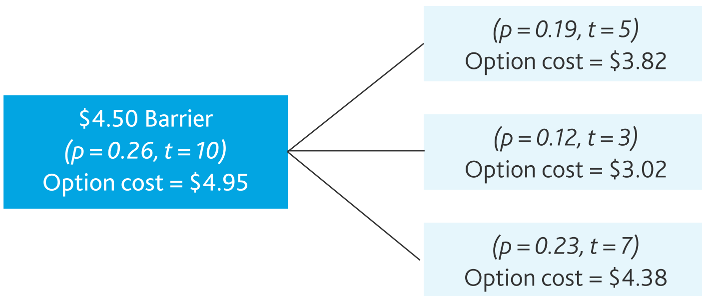


Figure 2: Modified case is a $4.50 barrier



In both Figures 1 and 2, we use the same option parameters as in the article with the exception of the base barriers and the option term. The first thing you'll notice between the two base cases is that reducing the probability of hitting a barrier (lowering the barrier amount) comes at an increase of the cost of the option. But let's say you wanted to reduce the overall probability of hitting the barrier by lowering the barrier amount without increasing the overall cost of the option. In Figure 2, we can reduce the barrier to $4.50 and then select an option term that closely resembles the original base cost in Figure 1 of $4.71. The resulting term comes in our example is a 7-year term, with a lower probability of 0.23, and total option cost of $4.38 (which is even lower than our base case of $4.71).

CONCLUSION

For companies that are considering ways to reduce stock option expense or perhaps looking into increasing employee stock option leveraging while holding stock option expense relatively constant, the BD&O Option may be one alternative to consider. The two main factors that affect the overall option price reduction in this option is the setting of the down barrier and the option term.

In the next article, we'll look at the use of an up-and-in option as another way to reduce stock option expense. This type of option comes into effect for the employee once an upper barrier has been reached. The resulting option pricing methodology is structurally different from a standard premium-priced option under a Black-Scholes-Merton priced option.