



EMPLOYEE STOCK OPTIONS

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1. WHAT ARE EMPLOYEE STOCK OPTIONS?

Employee or executive stock options (ESOs for short) are call options granted by a company to an employee on the stock of the company. These options are part of the remuneration package of the employee. However, they differ from ordinary options in at least one crucial way: they cannot be transferred, and in the event of the employee leaving the company, they are forfeited. They are a sweetener for the employee: they encourage him or her to remain an employee, and they encourage him or her to work towards an increase in the financial health of the company, which will translate into an increased share price, and eventual increased wealth of the employee.

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2. A VERY BRIEF HISTORY OF VALUATION QUESTIONS

Until the birth of option pricing algorithms in the 1970s the common wisdom concerning ESOs was that they were not an expense because there were no cash flow implications for the firm. The first valuation methodology to be introduced was that options should be expensed at their intrinsic value on grant date. Provided that these options were granted at the money, which was typical, there would be no profit and loss or bottom line effect.

In the 1990's it was recognised that options, even those struck at the money, had economic value, and thus needed to be expensed. However, very few companies chose to record any expenses for their ESOs, especially when there was no legal or regulatory requirement for such accounting treatment. In the USA for example, the Financial Accounting Standards Board only made footnote disclosure of such expenses mandatory, and because of this many companies did not record the impact of their ESO's, further than referring to it in a footnote to their financial statements.

After the dotcom crash, it was realised just how much of a burden ESOs were to the company. Many dot-com companies had relied very heavily on ESOs to incentivise employees, and these companies would have looked unprofitable a long time before they actually did, if those ESOs had been expensed, rather than just appear as footnotes to the accounts.

It is now almost universally accepted that ESOs are an expense to the company that need to be accounted for (see (Bodie, Kaplan & Merton 2003)) and that companies should expense their options using a recognised option pricing formula. The appropriate option formula is one that properly takes into account the essential features of the option grant.

Typically, options have American or Bermudan features, so the use of the Black-Scholes European option pricing formula is not considered appropriate. However there are many other option pricing approaches available.

National Economic Research Associates (NERA Economic Consulting 2 June 2004) cautions companies

against using cost as the primary factor when selecting an option valuation method, that is, shopping around for the method with lowest valuation. Cindy Ma, NERA Economic Consulting economist and a member of Financial Accounting Standards Board Options Valuation Group in the USA, says, “Cost is always important, but it cannot be at the expense of accuracy of the financial statement.”

Although the FASB exposure draft recommends using a “lattice” type model of valuation, Ma suggests that companies explore their options. “Companies will be spending many dollars on coming up with the right method”, she says. “In the era of Sarbanes-Oxley, in which the CEO and CFO are liable for their company’s financial statement, it is especially important that they select the method that’s most accurate. The alternative is unwanted litigation.”

3. THE GROSS INVALIDITY OF THE BLACK-SCHOLES EXPECTED LIFE APPROACH

Let us examine the issue of why binomial approaches are to be highly favoured over Black-Scholes approaches, which have until recently been prevalent.

In order to shoehorn the Black-Scholes model into employee stock option grant pricing, the entire Bermudan window of exercise opportunity needs to be reduced to a single expiry date. Recall that the employee can exercise at any time from the vesting date to the drop-dead date. Refer to Figure 1 where these dates are denoted v and d respectively. In order to find a single approximate expiry date, the notion of ‘expected life’ was introduced and calculated, as being a date intermediate between them, denoted e in the diagram. The option grant was then valued using the Black-Scholes formula with this date as the option expiry date.

Two problems then present themselves. The Black-Scholes formula is pricing the payoffs under the risk-neutral probabilities of the stock price ending in regions \mathcal{A} and \mathcal{B} . If the stock price ends in \mathcal{A} , the option is in the money, and there is a payoff, if the stock price ends in \mathcal{B} the option expires out of the money and worthless. However, if we consider the true picture, then from time e to d there is a chance of the stock price moving from \mathcal{B} into the shaded region marked \mathcal{C} , and this has value which is being ignored by the

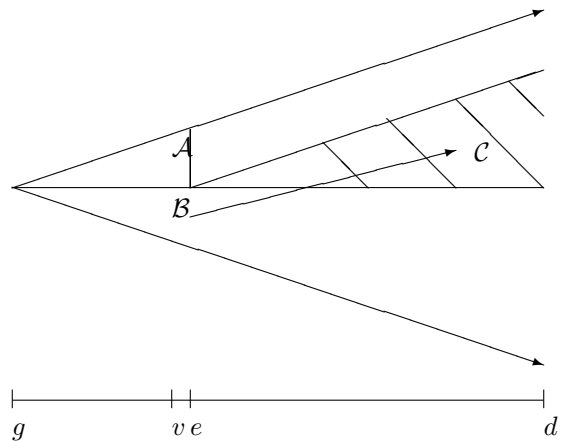


FIGURE 1. g is the grant date, v is the vesting date, e the expected life of the option, d is expiry (drop dead) date.

Black-Scholes formula. In the case where the option has a long life, this value will be material.

The second problem is not unrelated to the first; it is that the whole concept of expected life is fraudulent, as it requires some kind of crystal ball prediction of the extent to which the option will be in the money on the vesting date. Arguments such as ‘the option will be so deeply in the money at the vest date that the expected life is not much more than the vest date’ are clearly fraudulent: the whole point of the option having an extensive Bermudan period is that it allows for the finding of a point where the moneyedness of the option is material enough for the holder to consider it attractive enough to exercise, and this may occur well after the vest date. The stock might indeed find this value after the option had been out the money for a significant period of time. This is especially clear in the case of a high volatility stock.

4. THE THREE MOST COMMON STYLES OF EMPLOYEE STOCK OPTION

Typically ESO schemes presented to us are as follows:-

- (1) Typically employee stock option grants are Bermudan options¹, where, after some vesting period, the

¹A European option is one which can only be exercised on the expiry date. An American option is one that can be exercised

employee may at any time until some ‘drop-dead’ date exercise the options and take possession of the stock, or possibly receive cash. Typically, the vesting of the options proceeds in proportions.

- (2) European or Bermudan forwards (not strictly options) where the employee is granted forwards and must take possession of stock at the pre-specified date at the pre-specified price. However, in some schemes, the employee will not be forced to take the shares if there will be a loss to them; so in this case these are actually options.
- (3) Bermudan options where the employee may exercise as above, but the payment of the strike and the taking possession of stock again is for some later date. Broadly speaking the historical rationale in South Africa for such behaviour was tax avoidance, but with changes in legislation this motive no longer exists.

In reality, the employee may leave the employ of the firm at any time. In this case, any benefits of unvested or unexercised options are voided.

Broadly, the rationale for vesting, and in particular proportional vesting, is in order to ‘lock in’ the employee in the service of the company for as long as possible. Hence employee stock options are the so-called ‘golden handcuffs’: they incentivise the employee to remain in the employ of the company and as a group for the employees to work towards the best interests of the company (this assumes that the free-rider and other game-theoretic issues are not important).

5. THE ASYMMETRY OF VALUE, COST TO THE COMPANY AND FAIR VALUE

It is important to note that the value of the asset that the individual employee stock option holder has is not equal to the liability of the company. This is because the employee has various constraints pertaining to his / her holding as opposed to an ordinary stock option held by an outsider. For instance, the employee is unable to sell the option on, and is unable to hedge it, as insiders are prevented from short selling the stock. In

at any time up to exercise date. A Bermudan option is an intermediate case: the option can only be exercised on contractually specified dates or in specified periods.

addition, if the employee resigns any unvested or undelivered options have to be forfeited. On the other hand, the employee may exercise early in order to achieve liquidity, because they are risk averse, or because of tax considerations.

As a result, an employee’s valuation reflects risk aversion and other necessarily subjective preferences.

In a discussion memo dated December 15, 2003, FASB stated that the value of an employee stock option as measured by a company is the “fair value” that the company would be required to pay a hypothetical market participant to assume the employee stock option obligations. That is the company’s perspective. In particular, “the market participant is hypothetical and does not represent the biases of a particular participant, such as an employee whose personal wealth is concentrated in the employer’s equity instruments, but rather reflects the notional consensus of the market.” Indeed, if a company used employees’ valuations, the resulting estimates would not represent fair value, because they would be the values to individual employees rather than to the marketplace.

6. THE VALUATION OF THE VARIOUS OPTION TYPES

We keep the numbering scheme seen in §4.

- (1) These appear to be ordinary Bermudan options. The only addition factors are that the option may be forfeited (because of resignation of the employee) or exercised early, which is sub-optimal from the usual option pricing point of view. As seen in (Carpenter 1998), it is appropriate to price the option using the usual risk-neutral valuation methodology (either via a tree in the spirit of (Cox, Ross & Rubinstein 1979) or a finite difference scheme) but with an additional factor, which models the per annual intensity of such early terminations.

As we will see in §7, according to IFRS2, the typical approach is that options first are valued assuming that there will be no staff attrition. For this, we can modify the model of (Carpenter 1998) by assuming that early termination only occurs because of redemption, not resignation. The staff attrition factor can then be taken into account in later valuation passes.

We also have a model which includes both the staff attrition factor and the early exercise factor. We have a significant preference for using this model, however, it is constructed contrary to the abovementioned IFRS2 approach. It is however important to understand that there will be differences in valuation from taking the two approaches, and these differences could be material: the impact of attrition is not linear, for example, attrition is less likely when the option is well in the money and/or near to vesting than when not.

- (2) Forwards can be valued in the usual way. Once again, staff attrition can be taken into account in the final valuation step.

Bermudan forwards can be valued by fairly simple modification of the model that we have developed above.

- (3) Bermudan Options with deferred payment of the strike and taking possession of the stock - historically this has been the most interesting valuation case, because of the impact of tax on the valuation. Given only a moderate willingness to assume risk, it is typical for the employee to convert the options into forwards quite early on, as this often minimises expected tax liabilities.

This type of structure will not appear any more as a consequence of changes to South African tax legislation. However, we have an archived pricing model that is conceptually similar to the schemes above but takes this tax differential into account.

The basic reason for this was previously that the employee is subject to income tax on the difference between the strike price and the price on exercise date, and subject to capital gains tax on the difference between the exercise price and the delivery price.

Given that the capital tax gains rate is 25% of the income tax rate, we can see the motivation to exercise the options when the price is still near the strike price and the income tax payable is minimised.

Our model quantifies this phenomenon by utilising a standard option pricing scheme which also determines the optimal exercise time(s) by taking the tax effect into account.

7. EMPLOYEE HAZARD RATES

In reality, the employee may leave the employ of the firm at any time. In this case, any benefits of exercised or unexercised options are voided as are any unsettled tax liabilities. However, it is prescribed audit practice to simply estimate the hazard factor and then post-multiply the value of the employee stock options found by assuming no attrition with the survival fraction. Of course this assumption does not take into account any non-linearity in the hazard phenomenon. Broadly following the approach of (Carpenter 1998), we have valuation mechanisms to test the materiality of this assumption.

8. ACCOUNTING IMPLICATIONS OF EMPLOYEE STOCK OPTIONS

It is typical audit practice to simply

- Calculate the value of the options assuming that no employees resign before vesting;
- estimate the rate at which employees resign before vesting, and hence determine the survival fraction i.e. the proportion of employees who will still be in the employ of the company at vesting;
- multiply the value of the employee stock options found by assuming no attrition with the survival fraction.

Of course this assumption does not take into account any non-linearity in the hazard phenomenon. We prefer to use the model described previously in order to include non-linearities within the model.

The accounting treatment of employee stock options divides into three cases:

- The employee stock options can only be exercised into shares: in this case, the fair value is calculated at the issue date. This amount is then amortised on a linear basis from that accounting year to the year at which the options first vest. The only adjustment that is required is if the actual attrition rate observed is different to that predicted. Thus, at the end of each period, we will revalue the options, using all the same model inputs as originally, except we might adjust the attrition rate.

Here is a numerical example of what can be done:

Assume

- 4 years to first vesting;
- with a given attrition assumption, the ESO is valued at 100.

Thus in the first year 25 must be passed as an expense to the income statement.

Suppose after the first year the attrition experienced is in fact materially different to that used in the model originally. If this attrition rate had been used, the ESO would have been valued at 92. All other inputs to the original model are reused.

Now, 25 has already been expensed, but we see retrospectively that only 23 needed to be expensed, that is, we are ‘2 ahead’. Thus, in the second year, only 21 is expensed, with the intention to expense 23 in the third and fourth years.

This procedure continues until the vesting of the ESO.

- The employee stock options are cash settled: in this case the ESO is treated as a true derivative. This means the ESO has to be revalued every year, with all inputs to the model (including expected attrition) being recalibrated. In every accounting period from issue date to first vesting date, the remaining value of the ESO has to be amortised on a linear basis.

For example, suppose at inception the ESO is worth 100 and there are 4 years to vesting. Then in the first year 25 has to be amortised. Suppose then at the end of the first year the ESO revalues to 124. Now 25 has already been amortised, but we now see that 31 should have been amortised. Thus we are ‘6 behind’. We amortise 37 in the second year, with the intention to amortise 31 in the third and fourth year.

This procedure continues until the vesting of the ESO.

- The employee stock options can be settled in cash or by the issue of shares depending on what the employee selects:

In this case, it should be estimated what proportion of exercises will be into stock and what proportions into cash, and the amortisation performed accordingly. As exercise into cash is more plausible, given that employees are usually cash hungry, it seems best to assume the option is a cash liability to the company, until such time as the employee perchance chooses stock.

Typically, a scheme will have many different options with many different vesting dates. In this case, each option must be treated separately in terms of amortising their cost. The population of option holders can be considered homogenous in terms of their attrition (although it seems that, for example, those whose options are near vesting would be less likely to resign, all other factors being equal, than those far from vesting).

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