

Accounting for Employee Stock Options

Position Paper

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The problem of accounting for employee stock options (ESOs) has proven surprisingly intractable. Rubinstein, in his 1995² article, argues that the one barrier complicating a clear solution to this problem is the difficulty of measuring the value of these options. Approaches to valuing standard listed options do not seem easily transferable due to the difficulty of measuring volatility and dividends over the long times-to-expiration, the seeming necessity of forecasting employee option forfeiture and departure rates, and the effects of non-transferability on the optimal timing of exercise. However, using something similar to the service period accounting method discussed briefly in FASB 123 and advocated recently anew by Bulow and Shoven, this problem can be overcome. Indeed, we show below that the accounting problem can be reduced to valuing over time a sequence of short-term options for which these measurement problems become relatively unimportant. Our solution offers a more general justification for the service period method than heretofore advanced and harmonizes accounting in both the post- and pre-vesting periods. For both periods, only short-term options need be valued. In particular, for almost all large firms, the market prices of similar exchange-traded options can be used as objective valuation estimates. Theoretical considerations and desirable practice can now be combined in a happy marriage.

Post-Vesting Period

Method for determining annual expense. During a fiscal year, for each employee stock option outstanding at the beginning of the year, expense the “premium over parity” of the option, estimated at the beginning of the year, adjusted so that the option is to expire at the end of the year (or the final option expiration date if that is sooner); we will call this the “one-year POP value.”³

¹ An earlier working paper by Mark Rubinstein, “Employee Stock Options: Getting the Accounting Right” (February 2004) is superseded by this paper. Like this one, the earlier paper also advocated amortizing the option expense over the post-vesting as well as the pre-vesting period. It advised amortizing the expected expense (matched to each future period) as calculated on the grant date. This paper, heavily influenced by the Bulow-Shoven paper cited below, instead advises amortizing the realized expense each year as the life of the option unfolds. FASB 123, *Accounting for Stock-Based Compensation*, October 1995, paragraphs 126-131, discusses a similar method. We understand that, although their names were not officially mentioned, Jules Cassel and Diana Willis, staff of the FASB at the time, had originally suggested this method to the Financial Accounting Standards Board; and Fischer Black supported their proposal because he believed that, compared to the other methods, it more accurately represented the economic compensation for labor services.

² Mark Rubinstein, “On the Accounting Valuation of Employee Stock Options,” *Journal of Derivatives* (Fall 1995).

³ For simplicity, the valuation interval we have chosen is the fiscal accounting year. Implicitly, we are assuming that at the beginning of each year, the employee commits to work for the firm for one year and the firm commits to retaining him, and they consider renewing that commitment one year later, etc. A

Example. Suppose at the beginning of the year, the stock price $S_t = \$100$, the strike price of an outstanding ESO expiring at least one year in the future is $K = \$90$. By some method calculate the market value $C_t = \$13$ of a call with strike price 90 and 1 year to expiration. The expense for the year, or the one-year POP value, equals $C_t - \max[0, S_t - K] = 13 - \max[0, 100 - 90] = \3 .

Reasoning. We are applying a version of the revenue-expense matching principle of financial accounting. The expense answers the question: by working another year at the firm, how much better off in terms of compensation does the employee expect to be at the end of the year compared to the beginning of the year? At the beginning of the year, he could have exercised his option, left the firm and walked away with $\max[0, S_t - K] = \$10$. On the other hand if he stays, the present value of his option compensation over the year will be $C_t = \$13$. So the present value of his added compensation over the year is the POP value, $\$13 - \$10 = \$3$. This is what he expects to earn from his option by working one more year.⁴

If his cash or salary compensation over the year is $\$100$, then at the beginning of the year he will rationally calculate that he will leave the firm for an otherwise similar job if

recent working paper by Jeremy Bulow and John Shoven, "Accounting for Stock Options" (April 2, 2004) and a report, "Proposal by Integrated Finance Limited for Expensing Employee Compensatory Stock Options for Financial Reporting Purposes," co-authored by Robert C. Merton, have greatly influenced our opinions. These papers advise using a period equal to the actual commitment of the firm, typically 90 days. We have no problem with this valuation interval; however, the chosen interval, whether it be 90 days or a year, is a second order matter. In particular, even if the employee has only, say, 30 or 90 days to exercise his option upon leaving the firm, it is still the case that the expense recognized should reflect the premium over parity for an option with a full year (assuming we are using an annual reporting period) to maturity.

This is easily understood. For example, suppose I give you (1) a 2 year option that you must hold to maturity, or instead I give you (2) a one year option, but tell you that at the end of the year I will extend that option for one more year. Clearly as long as you do not exercise at the end of the first year, the payoffs of these two options are identical and the two options will therefore have the same present value. Now, if I "Americanize" these options and allow you to exercise in both cases at the end of the first year, if you are rational you will either exercise both at the end of the first year or hold both one more year. Therefore, again the payoff will be the same in both cases, so the present values of the two options must be the same. Indeed, as you can see, if you now allow me to extend the second option every 90 days, or every month, and Americanize them to allow exercise at these intervals as well, this changes nothing and the options will continue to have the same present value as each other. So we conclude that, irrespective of the renewal interval Δt , the present value of an American option which say expires in 10 years will be the same as the present value of an American option which expires in Δt years, but is continued to be renewed successively every Δt years until a total of 10 years elapses or the options are exercised, whichever happens sooner. Similarly, within a single accounting period, the present value of an option that gets extended once for one year is identical to the present value of an option that gets extended four times for three months each time, or twelve times for one month each time.

⁴ One might worry that although this analysis is correct for the last year in the life of the ESO, it might not hold for the next-to-the-last year, the year before that, etc. For example, in the next-to-the-last year by working that year, in addition to what we have counted above, the employee also receives an option to work in the last year. However, in an analysis of working backwards from the last year, we show in the Appendix that the above method is correct for all years in the post-vesting period, not just the last year before the option expires.

another firm will pay him total compensation worth slightly more than $\$100 + \$3 = \$103$. For example, if at the beginning of the year, the employee is holding only deep out-of-the-money options that perforce have a one-year POP value near zero, and he is making a rational decision about whether to continue working for the firm, he will not consider his options. If at the beginning of the year, the employee is holding only deep in-the-money options that also have perforce a one-year POP value near zero, he will rationally conclude that he can leave the firm and still get almost full value for his options by exercising them just before he leaves. On the other hand, if he holds only at-the-money options with a considerable one-year POP value, he may see those as a significant portion of his compensation and be less likely to leave the firm. It is perhaps for this reason that we see an increasing tendency for firms with deep out-of-the-money options to re-price the options to restore the greatly diminished POP value component of annual compensation.⁵

In the sense of labor market economics, the market value of his labor services must be at most \$103 since if the employee's labor were worth more, he would rationally leave the company for higher compensation. However, his labor services could be worth less. If so, in an idealized world, the firm might adjust his cash compensation so that the total annual compensation including the option would equal the revenues (before fair profit) expected from the employee's services. In this case, neglecting to consider the option expense as we have done would then violate the matching principle. We realize that in the actual world, salary compensation is complex and sticky and the firm may very well, because the options remain near-the-money, end up temporarily paying its employees more than they could have received elsewhere in the labor market. But we submit that the employee's labor is like any other asset the firm may have contingently purchased at an excessive price. For accountants, it is the price actually paid that matters and is expensed, not the price the firm "should" have paid.⁶

Adjusting the number of shares. A second accounting principle we would like to honor says that in and of itself the decision to exercise ESOs should not change reported earnings per share. This makes sense since the employee's decision to exercise his option (which we assume for simplicity only can occur at the end of each year) does not represent any direct change in the welfare of the firm; it should not change the market value of the stock in a rational market; hence the exercise should not alter the reported earnings per share. In other words, if an employee rationally decides to exercise his options and become a full-fledged shareholder thereby creating more shares, the reported earnings per share based on this enlarged number shares should remain the same as it would have been if the employee had rationally decided not to exercise his options.

⁵ It must be admitted that this same logic also suggests that firms will want to quickly re-price or replace options that become deep in-the-money, since their POP value is also very low; but we do not seem to see this in practice.

⁶ A model justifying compensation which is never below an employee's outside opportunities (because an employee is always free to leave the firm), but can become in excess of this alternative compensation is developed by Milton Harris and Bengt Holmstrom in "A Theory of Wage Dynamics," *Review of Economic Studies* 49, No. 3 (July 1982), pp. 315-333. The intuition is that risk averse employees implicitly want to insure their compensation against decline, which makes the ideal compensation package both long-term and sticky on the downside.

To achieve this result, one adjustment is needed: the denominator of the EPS calculation (the number of shares) should remain unchanged irrespective of actual exercise.

Calculate the number of shares by using current “fully diluted methods;” that is, at the end of the year at date $t+1$, calculate the number of shares as:

$$\text{outstanding shares} + [\text{number of outstanding options} \times \max(0, S_{t+1} - K)/S_{t+1}]$$

This calculation predicts that only if options are in-the-money will they be rationally exercised. Second, it assumes that for each exercised option the firm will issue one share and use the proceeds K from the exercise to buy back K/S_{t+1} shares of stock at the concurrent market price so that the net number of new shares issued will be $1 - K/S_{t+1} = (S_{t+1} - K)/S_{t+1}$. It should be easy to see that only if shares are counted in this way will the denominator of the EPS calculation remain unchanged, irrespective of the number of options rationally exercised. Note also that if the firm is assumed to buy back shares with the strike price proceeds, the numerator of the EPS calculation will also be unaffected by exercise (since the firm's operating assets will have increased by receiving the strike price).

Separating recurring from non-recurring EPS. EPS calculated in this way is really the sum of recurring EPS and non-recurring EPS. The non-recurring EPS comes about because the stock price changes unexpectedly over the year, from S_t to S_{t+1} . If it rises faster than expected, the employee will have ex-post received more compensation than he expected or the firm intended; if it rises more slowly, his compensation will have been less. This unexpected change will create non-recurring EPS.

To separate recurring from non-recurring EPS, we suggest recalculating EPS as if the firm had paid its planned compensation by selling just enough stock at the beginning of the year so that the proceeds from the sale provide it with exactly the amount needed to buy back the options at their then exercisable value from their employees. Assume the firm has done this so that at the beginning of the year its employees now own shares in place of their options and have received an addition to their salary cash compensation equal to the one-year POP value of the options. In our example, this would be the equivalent of paying an additional \$3 of cash compensation and selling additional stock worth \$10 (or $.1 = \$10/\100 shares) to the employees at the beginning of the year. We suggest that the ratio of earnings and the number of shares calculated with this assumption be considered the recurring EPS.

The difference between the “fully-diluted EPS” we calculated above and this option-free recurring EPS then equals non-recurring EPS. Non-recurring EPS then occurs because the stock bought back with the strike price paid by the employee at exercise will actually be purchased at the time of exercise (at price S_{t+1}), not at the beginning of the year (at price S_t). Had the firm been able to forecast the amounts raised from option exercise at

the end of the year and had it hedged by buying back the stock in advance at the beginning of the year (instead of at the end), there would be no non-recurring EPS.⁷

Pre-Vesting Period

Our goal in the pre-vesting period will be to apply the same three accounting principles we use in the post-vesting period: (1) matching the timing and magnitude of revenues with the timing and magnitude of expenses, (2) making adjustments so that earnings per share does not depend on whether or not options are exercised, and (3) distinguishing between recurring and non-recurring EPS. Our solution is to treat the vesting period identically to the post-vesting period, except that we also expense $1/n$ new one-year options each year at their then concurrent market value (where n is the number of years in the vesting period, and each option has strike price K).

Method for determining annual expense. Here is an example. Suppose the firm grants an employee 300 options with strike price K on date 0 which vest 3 years later at date 3. Based on the concurrent stock price S_0 and strike price K , the firm calculates the market value at date 0 of 100 options (the first third) that expire in 1 year at date 1. We believe this should be the entire recurring reported option compensation expense during the first year. On date 1, based on the then concurrent stock price S_1 and strike price K , the firm calculates the market value of 100 options (the second third) assumed to expire in 1 year at date 2. Based on the concurrent stock price S_1 , the firm also calculates the one-year POP value of the 100 options originally valued at date 0. The sum of these two amounts is the entire recurring reported option compensation expense during the second year. On date 2, based on the then concurrent stock price S_1 and strike price K , the firm calculates the market value of 100 options (the last third) assumed to expire in 1 year at date 3. Based on the concurrent stock price S_2 , the firm also calculates the one-year POP value of the now 200 options originally valued at dates 0 and 1. The sum of these two amounts is the entire recurring reported option compensation expense during the third year.

Reasoning. The employee knows that if he is still working for his company after three years, he will then have 300 vested options. If he leaves at that time, his payoff will be their exercisable value at the end of the third year. If he says on and works another year, as we have argued above under post-vesting, he will earn their one-year POP value. That implies that during the first three years we need to allocate only the value of the 300 options, but for this purpose we can regard them as having a 3-year maturity.

So on the grant date (date 0) the employee says to himself that if he works for the firm for the next three years, the current market value of his option compensation will be 300 3-year options. But, to get this, he must work for three years, so what portion of this should be allocated during the first year?

⁷ If the firm has a designated stock buy-back plan clearly intended to hedge this source of non-recurring earnings, then we suggest it be permitted to offset its non-recurring earnings accordingly. If the hedge works but imperfectly, non-recurring earnings will be reduced; if the hedge works perfectly, non-recurring earnings will be entirely eliminated.

Unfortunately, we don't believe that there is a definitive answer to the question. In that case, we suggest that among the set of reasonable allocation schemes that could be adopted, the accounting profession should prefer a simple one in which the allocations can be calculated with high reliability relatively free from manipulation. For the allocation to be reasonable, we believe it needs to have the property that, assuming the employee stays with the firm for 3 years, at date 0 the total expected allocated expense over the 3 years equals the market value of 300 3-year options evaluated at date 0. Unfortunately, this criterion by itself does not lead to a unique allocation rule.⁸

Again, consistent with our post-vesting analysis, we hope to find an allocation of the expense over the 3 years that answers the question: by working another year at the firm, how much better off in terms of compensation does the employee expect to be at the end of the year compared to the beginning of the year? We believe that an employee could rationally think as follows. On the grant date, he knows he has been granted 300 options, but he must work 3 years to get to the point where he has earned their exercisable value. So during the first year, he can think of earning the date 0 market value of 100 (one-third) of the options (based on a stock price of S_0). But since he knows that to get the full 3-year POP value for these 100 options he will have to work two more years, he only considers their one-year POP value (plus any in-the-money amount at grant, should the options not have been granted at- or out-of-the-money), since he is matching his compensation to his work only over the first year.

At the end of the first year (date 1) when the stock price is S_1 the employee again estimates what his option compensation will be by working yet another year. Now he sees his compensation as deriving from two sources:

- (1) the one-year POP value, based on stock price S_1 , of the 100 options he already attributed to his compensation in the first year; he gets this POP value by working the second year by a similar logic that we used above for the post-vesting period.
- (2) the market value at date 1 of the second tranche of 100 options; if these options were granted at-the-money so that $K = S_0$ and if $S_1 \neq S_0$, then these options will be valued as in- or out-of-the-money options.

At the end of the second year (date 2) when the stock price is S_2 , the employee again estimates what his option compensation will be by working yet another year. He again sees his compensation as deriving from two sources:

- (1) the one-year POP value, based on stock price S_2 , of the 200 options he already attributed to his compensation in the first and second year; he gets this POP value by working the third year by a similar logic that we used above for the post-vesting period.

⁸ It should be noted that the rule we adopted above for the post-vesting period also had this property. That is, the present value, estimated on the vesting date, of the sequence of the expected one-year POP value expenses over the remaining life of the option was in fact equal to the POP value calculated on the vesting date for an option with a time-to-expiration equal to the elapsed time between the vesting date and the option's actual exercise date.

- (2) the market value at date 2 of the third and last tranche of **100** options; again if these options were granted at-the-money so that $K = S_0$ and if $S_2 \neq S_0$, then these options will be valued as in- or out-of-the-money options.

We believe this method is reasonable. Like the post-vesting proposal, it has the estimation advantage over some other proposals of only requiring the evaluation of options that have a maturity of one-year. The method is also designed to be as similar to the post-vesting suggestion as possible, which we believe is esthetically appealing, at least to those who care about that sort of thing.

Adjusting the number of shares and non-recurring expenses. We continue to advise adjusting the number of shares by using a “fully-diluted earnings” calculation as in the post-vesting period. There is one modification. Continuing with our example, in the first year account is only taken of the first **100** options of the grant as if they and only they had been granted and vested; in the second year account is taken only of the first **200** options of the grant as if they and only they had been granted and vested; and in the third year, all **300** options are taken into account. And for the same reason as in the post-vesting period, there will be some non-recurring expense if at the beginning of each year the firm does not completely hedge its net purchase of stock that it will eventually need should the in-the-money options be exercised.

Appendix

Consider the post-vesting situation. To make it easier, imagine that there are two years left in the life of an ESO and at the beginning of each year an employee has to commit himself to working one more year. So he can quit at date 0 and receive $\max(0, S_0 - K)$ or he can work one more year to date 1 and receive $\max(0, S_1 - K)$ then, or commit himself then to work one more year to date 2 and earn $\max(0, S_2 - K)$ at the end of the second year, on the expiration date of the option. To reiterate:

Date 0: Take $\max(0, S_0 - K)$ or buy option (by investing his own working time) to get either $\max(0, S_1 - K)$ at date 1 or by investing more time after that getting $\max(0, S_2 - K)$ at date 2.

Date 1: Take $\max(0, S_1 - K)$ or (by investing his own working time) get $\max(0, S_2 - K)$ at date 2.

Working backwards, clearly at date 1, the value of the working one more year (in terms just of the ESO) is:

$$PV_1[\max(0, S_2 - K)] - \max(0, S_1 - K)$$

where the stock price S_1 is used to assess this present value ($PV_1[]$ means the present value measured at date 1 of the payoff in the brackets).

So what do we have at date 0?

$$PV_0[\max(0, S_2 - K)] - \max(0, S_0 - K) - PV_0\{ PV_1[\max(0, S_2 - K)] - \max(0, S_1 - K) \}$$

where the stock price S_0 is used to assess this present value.

The argument here is that at date 0, the employee knows that the total value of the option assuming he continues working to its expiration at date 2 must be $PV_0[\max(0, S_2 - K)]$ (the first term). But the employee has already earned $\max(0, S_0 - K)$ (the second term) which he can pick up simply by quitting at date 0. From our discussion above, the third term is the present value at date 0 (PV_0) of committing to work in the second year. Therefore, whatever remains must be the portion of the entire PV_0 that comes just from working in the first year (that is why this third term in braces is being subtracted).

Since

$$PV_0[\max(0, S_2 - K)] = PV_0\{ PV_1[\max(0, S_2 - K)] \}$$

Then we can simplify the above expression to:

$$PV_0[\max(0, S_1 - K)] - \max(0, S_0 - K)$$

which is indeed the current POP value of a one-year option, evaluated based on S_0 .