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### **Issues Addressed**

In this comment, we address several critical issues regarding the choice of an appropriate option pricing model, the parameters used in such a model, and the issue of forfeiture as a component of ESO cost. Specifically, we comment on Issue 2(b), Issue 2(c), Issue 2(d), Issue 2(e), Issue 7, and Issue 11.

## I. Option Pricing Models [Issue 2(b) and Issue 2(d)]

Cost vs. Value

Reported employee stock option (ESO) expenses should reflect the cost to a firm's shareholders. This is a fundamental principle of accounting that is sometimes forgotten in the ongoing debate over how to account for ESOs on the financial statements. "Cost" and "value" are often used interchangeably, but any analysis of option pricing models for the purpose of measuring cost requires distinguishing between the two.

We define "cost" as the amount that an asset would trade for in an arm's length transaction between willing buyers and sellers. For ESOs, this cost is the amount an outside investor would pay for the right to obtain the cashflows from an ESO grant, based on the forfeiture and exercise behavior of the company's employee. From the firm's perspective, this is the opportunity cost of the grant, i.e., how much outside investors would pay for the right to the actual option profits realized by employees, given the characteristics and limitations (vesting and forfeiture requirements, transferability restrictions, blackout periods, etc.) of the ESO program. Alternatively, one could think of this cost as the amount a firm would have to pay an external agent, at the grant date, to cover its expected obligations to employees resulting from future ESO excreise. By contrast, we define "value" as the minimum amount that the holder of an asset would have to receive to give up the right to that asset (in this case, the amount for which an employee would be willing to sell her ESOs). It is thus critical that an option pricing

model, used for the purpose of calculating a firm's ESO expense, is measuring the right thing: the cost to shareholders.

By way of example, suppose a company spends \$50 million on a new cafeteria, and nobody ever uses it. Even though the employees derive no *value* from the facility, it will nonetheless still *cost* the company \$50 million. The same principle applies to the financial statements of a firm: the cost to its shareholders is what is being measured, not the value to its employees.

In order to accurately reflect the firm's ESO expense, option pricing models must take into account the critical drivers of this cost. Exchange-traded option models typically utilize six parameters to calculate value: the price and volatility of the underlying stock, the strike price, the expected dividends, the duration of the option and the risk free rate. Employee stock options, however, have fundamental characteristics that make them distinct instruments, materially different from ETOs. These characteristics, including forfeitability, vesting requirements, and non-transferability, are critical drivers of employee behavior and, therefore, the ultimate cost to the firm. In addition, these parameters may not be constant, but may vary over time. For example, the strike price of an ESO may vary according to a prescribed schedule or it may be tied to a market index. Also, some ESOs can't be exercised until a particular condition is met (e.g., the price of the underlying stock reaches a prescribed level). The affect of these features must be included in any accurate option pricing model.

## Why Black-Scholes-Merton Doesn't Work

The most widely used option pricing model, Black-Scholes-Merton (BSM), is designed to value exchange-traded European options (i.e., options that can be exercised only at their expiration date), not ESOs. It does not have placeholders for the addition of new inputs, and therefore cannot account for the unique characteristics of ESOs. Nonetheless, an "adjusted" BSM model is commonly used by companies to disclose the cost of their stock-based compensation. This adjustment is the substitution of the option's expected life for its contractual life (or duration). But this adjustment is a concoction; the BSM model was not designed to be used in this manner. By failing to reflect the key differences between ESOs and ETOs, the BSM model has been found to produce valuations that are substantially in error. Our research, and that reported in economic literature, indicates that even with the expected life adjustment, BSM still overvalues ESOs by a significant margin, as much as 45% in some cases.

As an example of why BSM cannot accurately estimate the cost of ESOs, consider the effect of volatility. The BSM model, like most ETO valuation models, assumes that the cost of an ESO will progressively increase with increases in volatility. But this is not necessarily true for ESOs, because risk averse employees will exercise high volatility stocks earlier than low volatility stocks. All else being equal, early exercise will tend to reduce cost, because it reduces the time value of the option. Thus, the ultimate effect of increases in volatility will depend on which influence dominates. This means that for sufficiently risk averse employees, increases in volatility will lead to a reduction in cost.

By failing to reflect the counterbalancing effect of risk aversion, the BSM (as well as other models traditionally used to value ETOs) systematically overestimates ESO cost. Moreover, this bias increases as volatility increases. This is of particular concern to technology firms and others with volatile stock prices.

#### Towards a Better Model

To accurately determine the cost of ESOs, a valuation model should:

- Explicitly address the features that differentiate ESOs from ETOs;
- Utilize methods that are consistent with those reported in the peer reviewed literature;
- · Be calibrated to observed measures of employee exercise and forfeiture behavior.

The proper modeling of ESO characteristics requires fundamental changes to the usual procedures for valuing ETOs. For example, because of risk aversion and lack of diversification, transferability restrictions will tend to cause employees to exercise their ESOs earlier than would holders of ETOs (who can easily hedge their positions and diversify their portfolios). Early exercise, in turn, will reduce the cost of the ESO to the company, by reducing the time value of the option. As a consequence, calculating the effect of non-transferability requires modeling the impact of risk aversion and non-diversification. These factors are irrelevant when valuing ETOs.

The interplay between departure, forfeiture and forced exercise is another important consideration in the valuation of ESOs. The departure of an employee has different consequences depending on whether or not the ESO has vested. Forfeiture can occur both during and after vesting; if the employee leaves prior to the ESO being vested, the ESO is forfeited. If the employee leaves after the ESO has vested, the option is exercised only if it is "in the money;" otherwise it is forfeited. The possibility of forfeiture or "forced exercise" reduces the value of an ESO compared to an ETO.

Vesting requirements and blackout periods also impact the cost of ESOs. With American-style ETOs, the option can be exercised at any time up to and including the option's expiration date. With ESOs, the holder is precluded from exercising them if either a) it has not yet vested, or b) it has vested but the company is in the midst of a blackout period. These exercise restrictions affect the cost of ESOs. The direction of the change, however, depends on the employee's exercise behavior in the absence of the excretise constraint. Contrary to the valuation of ETOs, the constraint can cause the cost of the ESO to increase if it prevents early exercise that would have reduced the time value of the option.

For all of the reasons discussed above, a flexible modeling framework is required to correctly measure the cost of ESOs. The binomial model, for example, can easily incorporate the traditional features of ESOs, and can be further adopted to account for more complex, non-traditional features, e.g., indexed options and performance-vested options. Moreover, the binomial can be viewed as a generalization of the BSM. In the

absence of forfeiture and early exercise, valuations from the binomial model converge to valuations produced by the BSM model. However, unlike the BSM, the binomial model can be used to value options that can be exercised prior to their expiration date.

# Calibrating the Model to Observed Data

ETO models are calibrated using observed market prices. Since no such information is available for ESOs, it is necessary to calibrate ESOs to other observable information, including measures of employee departure, forfeiture and exercise behavior. Calibrating the model in this way will serve to both produce more accurate estimates and reduce the potential for "gaming" (i.e., manipulating inputs in order to produce a desired result). We believe the forfeiture rate and expected option life constitute the minimum set of inputs required to calibrate the model.

What is therefore required is a flexible model, such as the binomial model, that can both predict the calibration metrics and also calculate the cost of the ESO. The model should apply a two-step process. In the calibration step, the model determines the expected life and forfeiture rate. These values are then compared with observed expected option life and forfeiture rate data, and the model parameters are adjusted to equate the two. In the valuation step, the calibrated model is used to determine the cost of the ESO.

# II. Forfeiture as a Component of Fair Value [Issue 7 and Issue 11]

It is uncontested that forfeiture affects the 'cost' of an ESO to the company. We therefore advocate that forfeiture should factor into the fair value of an ESO at the grant date, consistent with the IASB approach. This will enable the model to reflect correctly the interrelationship between departure, forfeiture and exercise. Currently, under FAS 123, forfeiture is not incorporated in the measurement of fair value of the ESO. Rather, it is used to reduce the number of shares recognized over the vesting period.

There is a philosophical inconsistency in retroactively adjusting for actual forfeiture. Forfeiture is similar to the other parameters already used in basic ETO valuation models. Volatility over the life of the option, for example, is unknown at the time the option is granted. Yet, it is accepted that the models use an appropriate estimate of volatility as a given parameter. No ex-post adjustments are made if the volatility over the life of the option diverges from this initial value. Forfeiture should be treated no differently. It too can be estimated using standard, recognized methods. Indeed, in most instances, the model can be calibrated to observable forfeiture data.

# III. Factors Used in the Models and Requirements for Their Disclosure [Issue 2 (c) and Issue 2 (e)]

While we believe reporting companies should have some leeway in choosing an appropriate option-pricing model, the calculation of each parameter input should be

derived from a single, unambiguous, easily reproducible methodology. Volatility, for example, can be calculated in several different ways: from historical data, or via econometric techniques, or derived from of the implied volatility of exchange-traded options. Each of these methods is arguably valid, but for the benefit of consistency and comparability, we advocate that FASB choose only one as the acceptable method.

Another example is the ambiguity which currently exists concerning the meaning of "expected option life." Some treat it as the expected time to exercise. However, because of the possibility of forfeiture and the option expiring worthless, we believe that expected option life should be defined as the ESO's expected duration, which would reflect that the option can be terminated due to exercise, expiration, or forfeiture.

In addition to creating strict guidelines with regard to how each input parameter is calculated, we also advocate company disclosure of the critical parameters used in calculation of ESO cost as well as values to which the model is calibrated. Comparisons between companies and across time periods can then be made regardless of the model used for reporting purposes. At a minimum, we believe companies should disclose the six parameters common to ETO models, as well as the forfeiture rate and expected option life.

## **IV.** Summary

We strongly recommend that FASB support an option pricing model designed to account for the unique features of ESOs, and which can be calibrated to observed data. The model should be flexible enough to handle more complex features, e.g., indexed options and performance-vesting options. In order to ensure consistency and comparability, we also urge FASB to explicitly and unambiguously define the model's input parameters, and the specific way in which each is to be calculated. These parameters should be fully disclosed by reporting companies. Finally, for the reasons discussed above, we advocate that FASB include forfeiture in the measurement of cost (the IASB approach), rather than using it to discount the number of options recognized over the vesting period.

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