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LATTICE-BASED STOCK OPTION VALUATION MODELS

The Financial Accounting Standard Board's (FASB) Exposure Draft on amendments to FASB Statement No. 123 states that a lattice-based option valuation model (e.g., binomial) is preferable to a closed-form model (e.g., Black-Scholes-Merton) and should be used if it is practicable to do so. The lattice model is deemed preferable because of its ability to more fully capture and better reflect the characteristics of employee stock options. This letter was written in a collaborative effort with Equity Methods (specialists in the field of employee stock option valuation) and is meant to provide a technical framework regarding lattice-based option valuation models.

Lattice Models in the Context of FASB's Exposure Draft on Share-Based Plans

The FASB Exposure Draft on Share-Based Plans (to amend Statement No. 123) permits the use of both lattice-based and closed-form option valuation models. However, the Statement also states that "a lattice model is more fully able to capture and better reflects the characteristics of a particular employee share option or similar instrument in the estimate of fair value," and further says that "a valuation model that is more able to fully capture and better reflects those characteristics is preferable and should be used if it is practicable to do so." Whether or not it is practical to use a lattice model is based on a variety of factors, including the availability of reliable historical data on employee exercise patterns. Note that once a company switches from a closed-form model to a lattice-based model, it generally may not switch back.

The rationale for the FASB's preference for lattice models is based on the flexibility and accuracy that these models may provide when valuing employee stock options. However, while lattice models can provide better estimates in many cases than closed-form solutions like the Black-Scholes-Merton (BSM) formula, not all lattice models are created equal. It may be useful for companies to compare option values using a variety of lattice models.

Besides model choice, the FASB Exposure Draft also goes to great lengths to emphasize the development and importance of valuation assumptions/model inputs. This is not surprising because the model inputs, such as stock price volatility and expected term, can have a significant impact on the value that is ultimately calculated, regardless of the model employed.

In particular, the FASB Exposure Draft, in contrast to SFAS 123, emphasizes the importance of a careful estimate of the expected term (expected life) of the option, and also adds consideration of other techniques like implied volatility when developing estimates of the expected volatility. It is required and important to assess all model inputs very carefully, as these estimates are critical to the values assigned to options and the expense that will be reported.

The General Class of Lattice Models (such as a Traditional Binomial Model) vs. Closed-Form Solutions (such as the Black-Scholes-Merton formula)

Lattice models use a procedural method rather than a closed formula (such as the BSM) in determining the value of options. Lattices, in the form of binomial or trinomial trees, represent a finite number of different paths that the stock price may follow over the life of the option.¹ In general, the option value is customarily derived in these models by working backward through a binomial tree from the end of the tree to the beginning, testing at each node to see whether early exercise is optimal. Option values are calculated by taking the present value of the expected payoff (or probability weighted payoff in more complex models) at the point of exercise, discounted at the risk-free rate.

There are two primary reasons why the FASB and its Option Valuation Group (OVG) favor lattice models over closed form solutions such as the BSM:

1. Impact of Early Exercise Can Be Better Reflected

One of the key determinants in accurately estimating the costs of employee stock options is appropriately accounting for early exercise. Lattice-based models can explicitly incorporate the early exercise of employee stock options to provide more accurate valuations. Most closed-form solutions, such as the BSM, merely adjust the value by assuming that an early exercise occurs at a fixed period of time after the grant date (i.e., option term is an input to the model). Lattice-based models incorporate the full option term in combination with assumptions pertaining to early exercise patterns that may be differentiated by employee group (i.e., option term is an output to the model).

A simple adjustment of the expected life of the option to capture the effects of early exercise in the BSM formula can seriously miscalculate the option's value. In our experience, the BSM framework (when simply adjusting for early exercise) may lead to an overestimate of option values by 20% or more. Given that early exercise is prevalent in employee stock options and that different classes of employees' exhibit different exercise behaviors, more formal modeling of the exercise decision as seen in a lattice model, can produce more accurate estimates of option costs.

¹ The most basic form of binomial trees was first articulated by Cox, Ross, and Rubenstein in 1979. Examples of basic lattice models are also discussed in Hull, "Options, Futures, and Other Derivatives", Prentice Hall, Fifth Edition 2003.

2. Greater Flexibility in Selection of Valuation Inputs

Lattice-based models allow more flexibility in modeling the parameter inputs that are critical in estimating the cost of stock options. For example, some of the most robust lattice models can incorporate multiple inputs of volatility, risk-free rates, and dividend yields and specifically model how these may be changing at different decision nodes of the lattice. To the degree that model inputs, such as volatility, can change over the life of the option, incorporating these changes can have a significant effect on option values.

In contrast, a closed-form solution is much more limited. In general, the only modification available to the BSM (and other closed-form solutions) to take into account changes in these important employee stock option characteristics across the option life is merely the use of weighted-average assumptions for each of the characteristics. This approach is rigid and sub-optimal, whereas the lattice models offer more flexibility in adjusting for changes in parameter inputs over the life of the option.

The FASB Exposure Draft clearly raises the bar for the option valuation process for companies with equity compensation plans. Where in the past companies were able to make do with closed-form solutions and applying rough approximations for the assumptions, looking ahead companies must pay close attention to both the valuation models and the valuation assumptions/inputs used.

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This letter is intended to alert compensation professionals about developments that may affect their companies. Questions about the FASB's Exposure Draft and stock option valuation models may be addressed to David Cole at (212) 986-6330. This letter and other published materials, including a broader summary and analysis of the Exposure Draft, are available on our website, www.fwcook.com.