

**OFFICE OF ECONOMIC ANALYSIS
MEMORANDUM**

TO: Donald Nicolaisen, Chief Accountant

FROM: Office of Economic Analysis¹

DATE: March 18, 2005

RE: Economic Perspective on Employee Option Expensing: Valuation and Implementation of FAS 123(R)

Valuation methods permitted under FASB Statement No. 123 (revised 2004), *Share-Based Payment* (FAS 123(R)), are conventional and well-known. The issues that practitioners will likely face in estimating option values under FAS 123(R) are not unusual and indeed arise in other areas of accounting and finance. In those other areas, practitioners have identified suitable methods for estimating future outcomes and obtaining reliable value estimates in compliance with U.S. GAAP. Financial economists have developed methods for valuing employee stock options that are reliable and appropriate for use by companies in complying with FAS 123(R).

FASB rejected the one-size-fits-all approach to valuation modeling when it allowed companies under FAS 123(R) to exercise discretion over the choice of valuation method. This will enable companies to incorporate information about their specific circumstances in applying standard principles of financial economics to estimate option values. The SEC staff is providing interpretive guidance on the use of valuation methods and assumptions in Staff Accounting Bulletin No. 107 (SAB 107).

Strong management incentives to obtain good estimates of compensation costs, and to report this information to investors, will further enhance the quality of the value estimates produced under the new accounting standard. These incentives are important for effective decision-making about compensation structure within corporations, even independently of financial disclosures. The real economic cost of individual employee option programs will indeed remain unaffected by the change in the new accounting standard.

Numerous questions have arisen about the availability of suitable methods for companies to use in valuing employee stock options and related compensation. In this memorandum, we address the key questions and misconceptions related to the economics of FAS 123(R) that have been brought to our attention.

¹ Questions should be directed to the Office of Economic Analysis. The authors of this memorandum are Chester S. Spatt (Chief Economist), Cindy R. Alexander, David A. Dubofsky, M. Nimalendran, and George Oldfield of the Office of Economic Analysis.

ECONOMIC PERSPECTIVE ON EMPLOYEE OPTION EXPENSING: VALUATION AND IMPLEMENTATION OF FAS 123(R)

Questions about possible difficulties in obtaining reliable estimates of the value of employee options under FAS 123(R) often appear to arise from misconceptions about modern financial economics and valuation methods. Below, we address key questions and misconceptions. Our conclusions are based on a review of standard methods of valuation from financial economics theory and practice, focusing on the following topics:

- Benefits of expensing employee stock options
- Choice of model
- Estimation of model parameters (assumptions, inputs)
- Verification of model and parameters, ex post
- General misconceptions and errors

1. *Benefits* from the expensing of employee options

- Improved transparency of financial condition.
 - Companies that expense their employee options voluntarily have tended to experience a positive or neutral stock-price movement at the announcement of the decision to expense. This is consistent with a favorable market reaction to an improvement in the transparency of the cost of employee stock options.²
- Improved comparability among the financial reports of different companies.
 - In February 2004, the International Accounting Standards Board issued an accounting standard that requires a fair-value based method for measuring employee stock option expense that is similar to FAS 123(R). Using similar methods will improve comparability and make it easier for companies to report under U.S. GAAP and International Financial Reporting Standards.
 - Reports of U.S. companies that voluntarily expense their employee options would become more comparable with the reports of companies that do not expense.

2. *Suitable models* are available for estimating option value under FAS 123(R)

- To avoid confusion, it is important to recognize that the objective of the model is to estimate the *cost to the company* (as a payment for employee services), which may be different from the value of the option to the employee.

² See D. Aboody, E.M. Barth and D. Kasnik (2004), "Firms' voluntary recognition of stock-based compensation expense", *Journal of Accounting Research* 42(2), 123-150; Faye A. Elayan, Kuntara Pukthuanthong and Richard Roll (2005), "Investors like firms that expense employee stock options and they dislike firms that fail to expense," *Journal of Investment Management*; and Nicole Bastian, Shivaram Rajgopal and Mohan Venkatachalam (2003), "Recognition versus disclosure: Evidence from voluntary recognition of stock option compensation," working paper, Stanford University and Duke University. See also Bodie, Zvi, Robert S. Kaplan and Robert C. Merton, 2003, "For the Last Time: Stock Options Are an Expense," *Harvard Business Review*.

- The models that FAS 123(R) recognizes for estimating the value of employee options are well known to practitioners and in academic research. The standard expressly allows for the use of models that comply with the basic principles of modern financial economics, which include:
 - The modified *Black-Scholes-Merton model*, which estimates the value of employee stock options using a closed-form equation.
 - The *lattice, binomial, and Monte Carlo* approaches, which estimate the value of employee stock options using standard numerical methods.
- These approaches are not new. FAS 123(R) is flexible in allowing the company to choose among alternative approaches in obtaining the best estimate in light of the company's circumstances.
 - There is evidence that the modified Black-Scholes-Merton approach provides reliable estimates of option value,³ even while the lattice, binomial and Monte Carlo approaches have important structural advantages that make them better suited for use by many companies.
 - The structural advantages of the lattice and related models are likely to become more apparent as companies gain experience with valuation under FAS 123(R). The SEC staff recognizes that practical considerations may warrant the continued use of the modified Black-Scholes-Merton approach, which many companies have used under FAS 123.

3. *Reliable parameters and inputs can be obtained for estimating the value of employee options by standard methods*

- Two differences between the parameters that are used in valuing employee and exchange-traded options have raised issues in the estimation of employee option values. These are addressed in FAS 123(R) and related SEC staff guidance in SAB 107.
 - *Volatility* must be estimated over a longer period when estimating the value of employee options than when estimating the values of other, exchange-traded options because employee options tend to have longer contractual lives.
 - The actual *term* of an employee option is typically less than its contractual life – unlike the term of an exchange-traded option, which typically equals its contractual

³ Recent literature on the use of the modified Black-Scholes-Merton model in valuing employee options includes Carpenter, Jennifer N., 1998, "The Exercise and Valuation of Executive Stock Options", *Journal of Financial Economics*, Vol. 48, No. 2, 127-158; Marquardt, Carol A. 2002, "The Cost of Employee Stock Option Grants: An Empirical Analysis", *Journal of Accounting Research*, Vol. 40, No. 4, 1191-1217; and Bettis, J. Carr, John M. Bizjak, and Michael L. Lemmon, 2005, "Exercise Behavior, Valuation, and the Incentive Effects of Employee Stock Options," *forthcoming, Journal of Financial Economics*.

life – because employees are not permitted to trade their options and are thus able to cash out only by exercising early, which they often do for personal reasons.

3.1) There is nothing new about the essential requirement to make estimates of future outcomes, as in estimation of future stock volatility and option term

- FAS 123(R) and the staff guidance in SAB 107 are very clear that companies are required to use all information that is available at the time of grant to estimate the relevant parameters for their valuation models. This recognizes that estimates of future outcomes will in this setting not typically equal the future realizations of those outcomes.
- FAS 123(R) does not appear to require efforts to estimate future volatility and term parameters beyond what was required under previous disclosure rules. Under FAS 123, companies are already required to provide estimates of the fair value of employee stock options in footnotes.
- Companies routinely incorporate estimates of important cost items in their financial statements. For example, pension accounting already requires that companies make estimates of future cash flows, employee retention rate, employee retirement dates, longevity of their employees; other postretirement benefit accounting requires the estimation of future medical costs – all of which raise challenges beyond what is encountered in the estimation of future volatility and term of employee stock options under FAS 123(R).

3.2) Volatility estimation methods are well known and readily accessible to practitioners

- Methods for estimating future stock price volatility are well known to financial economists and practitioners.
 - FAS 123(R) and SAB 107 recognize several alternative methods for estimating volatility, which are distinguished by the type of data they require. The alternatives described are the *historical* volatility, *implied* volatility, and *comparable-firm* volatility methods.
- The appropriate choice of method depends on the circumstances of the company, and on the availability of data. FAS 123(R) thus appropriately allows companies some flexibility, while providing guidance in the form of a list of factors for companies to consider in choosing a method. For example,
 - Estimation of implied volatility requires that the company have exchange-traded options (or other traded securities that comprise embedded options).

- Implied volatility methods are best suited for use by public companies with actively traded long-term options (with a time to expiration of one year or more);⁴ for these companies using implied volatility is likely to provide the best estimate for the expected volatility.⁵
- Some methods for estimating volatility that are clearly inappropriate for valuing employee options are explained in the SEC staff guidance (SAB 107). For example,
 - The volatility of a stock index or portfolio of stocks is an inappropriate measure of volatility that, if used, would cause a company to understate the value of its employee options. This is because the volatility of a stock index is typically less than the volatility of an individual stock.⁶

3.3) Methods for estimating the *exercise parameters* of option valuation models also are well known and accessible to practitioners.

- The relevant exercise parameter depends on the choice of valuation method. For example,
 - The Black-Scholes-Merton model requires the estimation of expected term as an input.
 - Some lattice models require the estimation of the stock price, expressed as a multiple of the exercise price, above which employees are assumed to exercise their options.
- The appropriate method for estimating the exercise parameter depends on the circumstances of the company.
 - Standard empirical methods are available for using historical data on exercise patterns to obtain estimates of exercise parameters for the Black-Scholes-Merton and other valuation models.

⁴ Several valuation professionals have reported that the term structure of implied volatilities is relatively flat after one year, so that implied volatilities based on options with maturities greater than one year would provide reasonably good estimates for employee stock options that have terms greater than a year, as is typically the case. SAB 107 recognizes the potential for volatility estimates to be obtained using data on traded options with terms of less than one year.

⁵ “Implied volatility” here refers to the volatility parameter in a Black-Scholes-Merton model that sets the market price of a traded option equal to the Black-Scholes-Merton value, given all the other parameters of the model. As such, implied volatility can be understood as the option market’s assessment of the expected future volatility for the term of the option, reflected in the market price of the option.

⁶ Beta-adjusted volatilities are also inappropriate because they too understate the volatility of the stock and thus the value of employee options. The beta-adjusted volatility excludes the idiosyncratic component of the total volatility of the stock.

- SAB 107 provides guidance on the estimation of expected term for use in applying the Black-Scholes-Merton model for companies that lack sufficient access to data on historical exercise patterns.⁷

4. There is nothing new about the issues likely to arise in the third-party verification of the employee stock option values that are estimated under FAS 123(R)

- Issues in verifying the validity of models and parameters used in estimating the value of employee options do not appear to be different from the issues raised by other methods of generating estimates of value from forward-looking information in other areas of accounting.
- For example, issues in the verifiability of defined benefit pension plans are similar to the issues in auditing employee option values:
 - Requirement to estimate future employee turnover;
 - Delayed vesting of grantees' claims;
 - Computing present values for future uncertain outcomes.
- Audits of estimated employee option values will indeed require an understanding of the parameters, assumptions and application of the valuation technique. It is our understanding that audit firms propose to meet the relevant challenges with several different initiatives:
 - Training audit team members in valuation techniques;
 - Providing technical manuals to support audit procedures;
 - Backing audit teams with specialized valuation teams at central locations to provide technical support.

5. Common misconceptions and errors that occur in discussions of ESO valuation

- Inappropriate volatility measurement:
 - Methods that use daily data and place extreme emphasis on the most recent period, such as the exponentially weighted moving average method.
 - More generally, exclusive reliance on the methods and data that are successfully used in valuing exchange-traded options is not appropriate in valuing employee stock options.

⁷ For research findings on the relevance of expected term as a measure of early exercise behavior, see for example Carpenter, Jennifer N., 1998, "The Exercise and Valuation of Executive Stock Options", *Journal of Financial Economics*, Vol. 48, No. 2, 127-158; Marquardt, Carol A. 2002, "The Cost of Employee Stock Option Grants: An Empirical Analysis", *Journal of Accounting Research*, Vol. 40, No. 4, 1191-1217; and Bettis, J. Carr, John M. Bizjak, and Michael L. Lemmon, 2005, "Exercise Behavior, Valuation, and the Incentive Effects of Employee Stock Options," *forthcoming, Journal of Financial Economics*.

- Use of index volatility, or beta-adjusted volatility, which is known to understate the volatility of the individual stock.
- Failure to discount outcomes at the risk-free rate.
- Failure to make reasonable choices when confronted with alternative inputs or models.
- Computation of the value to the employee, rather than cost to issuer.
- Misinterpretation of the academic debate and academic discussions about valuation methods, which reflect financial economists' depth of knowledge and experience in valuing employee options and other instruments. This debate reflects the incentives of academic financial economists to improve the usefulness of their models beyond what accountants or legal rules might require.

5.1) Errors in the application of available methods for valuing employee options have led to exaggerated claims about the range of parameter values that can be achieved by applying the FAS 123(R) standard

- The exercise of appropriate judgment will limit the range of value estimates that could be achieved with a given model.
- Market forces prevent all parameters from taking their most extreme values simultaneously. Some parameters increase as others decline, and this limits the range of values that have any economic validity, even before more careful judgments about relevant inputs are made, as FAS 123(R) requires.
- The effect of the choice of model on the estimate of value is likely to be small if parameters of the model are assigned appropriately.⁸
- The effect of the choice of parameter inputs is relatively modest, even before incorporating the exercise of judgment that is required under FAS 123(R).

⁸ See, for example, Manuel Amman and Ralf Seiz, 2004, "Valuing employee stock options: does the model matter?" *Financial Analysts Journal*, Vol. 60, No. 5 (presenting a detailed comparison of the option prices obtained by using different models).