CL 194

January 31, 2003

Ms. Suzanne Bielstein
Director of Major Projects and Technical Activities
Financial Accounting Standards Board
401 Merritt 7
Norwalk, CT 06856-5116

Re: File Reference No. 1102-001

Dear Ms. Bielstein,

The Committee on Corporate Reporting of Financial Executives International and the Financial Reporting Committee of the Institute of Management Accountants (the Committees) appreciate the opportunity to provide their views on the Invitation to Comment (ITC), "Accounting for Stock-Based Compensation: A Comparison of FASB Statement No. 123, *Accounting for Stock-Based Compensation*, and Its Related Interpretations, and IASB Proposed IFRS, *Share-based Payment*". In this request for comment, the FASB has identified a number of threshold issues that it believes have been adequately considered and on which it has therefore decided against seeking comment. We disagree, as a matter of principle, with this approach as we believe that it inhibits the free exchange of views on issues that are important to the Board's constituents. We note that members on both Committees hold strong views on many of these threshold issues, particularly on whether stock options should be expensed, and that the approach followed in the ITC provides a basis for constituents to criticize the Board's due process. We would therefore recommend that this practice not be repeated in future comment documents. While the Committees have agreed not to revisit these threshold issues in this response, in accordance with the views set forth in the ITC, agreement with the Board's views on these matters is not implied and should not be inferred.

Both the FASB and the IASB have indicated a strong interest in moving towards principles-based standards. A principles-based approach eschews detailed, rule-based requirements and the complexity in application that such guidance inevitably precipitates. As indicated in our responses to the Board's proposal on principles-based standards, we support this approach. We believe that the FASB and the IASB need to be sensitive to problems that are created when accounting standards provide prescriptive guidance in areas such as fair value measurement, where valuation methodologies are continuously evolving. As discussed further below, characteristics of employee stock options present unique issues that transcend the current state of the art in valuation methods. We therefore believe that the guidance

provided in both FAS 123 and the IASB ED needs to be challenged from that perspective.

Due to the timing of the request and the short time frame for responding, we have limited our comments to the most important issues within the scope of the ITC. We welcome the opportunity to supplement this response with views on other specific issues as the Boards deliberations progress.

Issuance, Forfeitures, and Attribution Methods

The Committees concur with the FASB's conclusion that an equity instrument is issued only when valuable consideration has been exchanged. The existence of vesting restrictions and the potential for forfeiture differentiate employee stock options from virtually any other equity instrument and support the view articulated in FAS 123. The Committees, therefore, do not agree with the units of service model proposed in the IASB ED. We do not subscribe to the IASB's logic that the objective should be to measure the value of the services received. While we would expect that prudent and responsible compensation policies would provide an appropriate linkage between the number of options granted and the value of the services provided, it is not demonstrable that the former equates to the latter. In our view, the underlying conceptual basis for the IASB attribution model is flawed. We do not agree that it is meaningful to recognize an expense for options that never vest, as the IASB requires. We also are troubled by the possibility that expenses recognized under the units of service approach can actually exceed the fair value of options granted. These outcomes stretch the credibility of the overall model.

With respect to the issue of whether convergence should be towards the IASB or FAS 123 models, we believe that the principles underlying the IASB model should only be adopted if they are demonstrably better than FAS 123. We note that the disclosure provisions of FAS 123 have been applied in financial statements since 1995, and that a number of companies have now chosen to adopt the recognition and measurement provisions of the standard in their 2002 financial statements. Others have announced plans to adopt in 2003. Although, we believe FAS 123 is in need of revision, we do not believe that moving towards the IASB model offers a better solution.

Income Taxes

The Committees do not support the accounting for income taxes proposed in either the IASB ED or the requirements under FAS 123. We observe that the tax issues associated with expensing employee stock have not yet become well understood by constituents, despite the fact that the accounting principles articulated in both models can have fairly dramatic effects on the financial statements. It would therefore be inappropriate for the Board to equate the absence of significant commentary on this issue with general acceptance of the principles. We believe that it is imperative that the Board find an acceptable solution to the problems identified below.

The IASB model can best be described as an exercise date model for recognition of tax effects: any and all tax benefits are recognized in earnings, even if those benefits exceed the pre-tax compensation expense recognized on the option. This model will give rise to the phenomenon of "stock option income" – a concept that investors aren't likely to grasp. Moreover, we believe it is inevitable that an accounting principle that creates the opportunity for stock options to generate earnings will engender public criticism. We therefore recommend that this model be rejected. However, we also believe that FAS 123 is

equally problematic, as it prescribes a lower of exercise date and grant date approach to recognizing tax benefits associated with stock options. The only exception to this principle occurs when sufficient accumulated excess tax benefits have been recorded in additional paid-in capital. In that circumstance, the excess of tax benefits accrued based on grant date fair values over exercise date benefits received may be charged to equity instead of expense. However, that treatment is limited to accumulated tax benefits that have been realized on options expensed under the fair value method. In the present environment, the likelihood that many companies will find themselves in this position seems remote.

We understand that accounting for stock options creates unique problems under the deferred tax model because the option expense recognized does not true up to the value at exercise date. While we acknowledge that exercise date accounting for stock options would solve those problems, the Board is familiar with the issues that arise under that model, which are even more difficult to solve than those addressed in this letter. We are of the view that income taxes should be recognized based upon the amount recorded in the financial statements as compensation expense and any differences between benefits assumed based on grant-date fair values and actual benefits received should be recorded in equity. We note that our recommended treatment is similar to the approach required under FAS 109 for the tax consequences of other equity transactions. For example, assume an asset is acquired for a combination of cash and a commitment to issue a fixed number of shares of common stock in six months. For tax purposes, the value of the stock issued (and thereby the tax basis of the asset acquired) is determined based on the stock's fair value at the future date when it is legally issued. If the fair value of the capital stock at that future date is different than its fair value at the time of the acquisition of the asset, a temporary difference is created. Because the temporary difference is caused by a capital transaction, paragraph 36(c) of FAS 109 would require the tax effect of that temporary difference to be taken directly to equity as an addition to or reduction of the proceeds from the stock issuance. We believe that the issuance of equity instruments to employees is, in substance, the same kind of transaction and that the appropriate accounting for tax effects associated with stock options should follow the same principles.

In making this recommendation, the Committees recognize that information about likely future cash tax benefits may be highly relevant to financial statement users and we would not object to disclosure of such information if the accounting issues described above can be resolved. Because forecasts of this nature are highly speculative, we would recommend a principles-based disclosure requirement that does not burden preparers with contemplating the implications of every tax position across each tax jurisdiction.

Option Pricing Models/Valuation of Employee Stock Options

There is universal agreement among members of both Committees that standard option-pricing models significantly overstate the value of employee stock options and that adjustments are necessary to reflect the differences between traded options and employee stock options. There also is strong agreement that the adjustments provided for in FAS 123 (e.g., use of expected life) do not adequately reflect those differences. Moreover, there has been little progress in the development of a robust valuation model for employee stock options following the issuance of FAS 123 that would provide a reasonable basis for a prescriptive approach to measurement.

We note that most accounting standards provide only summary level guidance regarding fair value

measurement. For example, existing standards on accounting for derivatives, which cover trillions of dollars of notional value, provide no specific guidance on methodologies for determining fair value. Given that no robust valuation theory exists for determining the fair value of employee stock options, we believe that it would be inappropriate to provide highly prescriptive guidance in this area. If expense recognition is ultimately required for employee stock options in financial statements, the requirement should stop at the principles level by indicating that measurement should be at fair value. The Boards should not mandate the use of a particular option pricing model and companies should be permitted to use professional judgment in deriving their best estimate of each of the relevant variables consistent with the fair value objective.

If necessary, the standard could provide factors to consider in determining fair value, such as:

- The exercise price of the option
- The current price of the underlying security
- The expected life of the options, the period over which the options will actually be outstanding
- The anticipated risk-free interest rate for the period corresponding to the expected term of the option
- The expected future volatility of the underlying security
- Expected dividends
- The effect on value of the lack of transferability of the options
- The effect on value if the stock cannot be sold, once the option is exercised, because of a blackout period

It is axiomatic that the quality of the assumptions used in option pricing models is critical to determining an appropriate fair value. In applying the disclosure provisions of FAS 123, many U.S. companies have used unadjusted historical data (e.g., for volatility, expected life) to derive input assumptions. While that approach has the advantage of being verifiable, it is unlikely to provide values comparable to what a trader would pay to purchase the options in a market transaction. For example, it is unlikely that a trader would use an unadjusted historic rolling average of stock price movements to determine the expected volatility. In that regard, we have solicited the views of valuation experts on the parameters that should form the basis for a fair value requirement and were advised that in order to estimate fair value, companies should have the ability to: (1) use the probability distribution of an option's lifetime, as estimated from historical data, rather than its expected value only; (2) employ a stochastic model for volatility, calibrated to historical data; and (3) apply models other than standard geometric Brownian motion to describe the uncertainty in the temporal evolution of share prices into the future, provided empirical evidence can be produced that supports them. If such adjustments are permitted, we also would agree that it would be appropriate to provide disclosures that help investors understand the model that was used and the methodologies applied for determining the assumptions.

We note that several groups have undertaken work to improve the methodologies for valuing employee stock options. A copy is attached of one study in which companies represented on the Committees have participated. We believe that as work progresses, a consensus will begin to emerge on methods for determining assumptions and other adjustments, such that we do not expect that comparability of valuations will be as significant a problem as some have suggested.

Measurement Date for Transactions with Nonemployees

The Committees do not believe that employee and nonemployee transactions warrant different measurement dates for determining the fair value of equity instruments granted. Several of our members pointed out the complexity inherent in applying the model required by EITF Issue 96-18 as well the counterintuitive results that frequently result from applying this model. The determination of when a commitment date has been reached in accordance with the consensus has been very difficult in practice and we question whether it has been consistently applied. Movement towards a grant date fair value for nonemployee transactions would enable the model to be simplified, which would greatly improve practice in this area.

Employee Stock Purchase Plans (ESPPs)

The Committees believe that some form of scope exclusion is appropriate for ESPPs that provide a *di minimus* discount from market price. Often the discounts offered under such plans are comparable to the stock issuance costs avoided by issuing the stock to employees rather than the public. We therefore do not believe that effort of applying the guidance in this standard to these plans would pass a reasonable cost benefit test. In addition, we believe it is better to have an explicit exclusion, as provided for in FAS 123, rather than to rely on an implied exclusion on the basis of materiality, as the IASB ED proposes. The latter requires an annual analysis to be performed and is less likely to be consistently applied.

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The Committees welcome the opportunity to continue an open dialogue on these issues and would be pleased to respond to any questions the Board may have regarding this joint response. Contact information is provided below.

Sincerely,

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Valuing Employee Stock Options: A Comparison of Alternative Models

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A publication of Financial Executives Research Foundation, Inc.

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A Comparison of Alternative Models For Valuing Employee Stock Options

Purpose
In an effort to better understand the issues associated with determining the fair value of employee stock options (ESOs), Financial Executives Research Foundation (FERF) had Analysis Group/Economics (AG/E) compare and contrast six valuation models that are used to price ESOs.

Executive Summary

Employee stock options contain features that make them substantially different from publicly traded stock options. These features include: vesting requirements, forfeiture provisions, non-transferability provisions, other stated restrictions, and the resulting early exercise behavior.

This study describes and compares the following six ESO valuation models that can be used to price ESOs:

(1) The Intrinsic Value Method
(2) The Minimum Value Model
(3) The Black-Scholes-Merton (BSM) Model
(4) The BSM Model with the FAS 123 Modifications
(5) The AG/E Binomial Model
(6) The AG/E Enhanced BSM Model

The study highlights the main differences between ESOs and traded call options, and explains why the BSM Model does not account for the distinctive features of ESOs.

FERF, working with a Task Force of FEI companies, provided AG/E with data for 27 ESO grants made by nine companies, for which AG/E calculated the ESO values using the valuation models. A comparison of the results is included in this study.

A key finding of the study is the significant reduction in value that results from the unique features present in ESOs but not in exchange-traded options. The study also demonstrates that the limited adjustments permitted by FAS 123 result in significant overvaluation.

A Comparison of ESOs and Publicly Traded Call Options

An exchange-traded call option gives the buyer the right, but not the obligation, to purchase an underlying security at a given strike price until the expiration date. These options are completely transferable, do not have vesting requirements, and are not forfeitable.

ESOs are long-dated call options granted to employees by their company to purchase shares of the company's common stock. They commonly have lives of up to 10 years, and usually require vesting periods of between one and five years. ESOs typically have a fixed share amount, and the exercise price is usually fixed at the date of grant. Once an employee has met the vesting requirements, ESOs mirror American-style call options. The exercise price almost always equals the market price of the stock (or its fair market value if the firm is private) at the time of grant, meaning that the ESOs are issued at-the-money. (American style call options can be exercised at any time up until the expiration date.)

ESOs have the following features that publicly traded options do not:

(1) **Vesting Requirements:** All ESOs contain a vesting requirement and can only be exercised at the completion of the vesting period. There are two common types of vesting.

a. Cliff Vesting: All ESOs granted on the same date vest at the same time.

b. Graded Vesting: ESOs vest in stages. For valuation purposes, graded vesting is most commonly handled by treating the option grant as a set of separate grants, one for each vesting date.

If the employee leaves the company before ESOs vest, they automatically expire worthless. As of the grant date, there will be some fraction of the newly granted ESOs that can be expected never to vest.

Statement of Financial Accounting Standards No. 123 ("Accounting for Stock-Based Compensation," FAS 123) permits an adjustment to the number of ESOs granted to account for anticipated forfeitures, based on past experience, and requires adjustments for subsequent changes in the expected forfeitures through the vesting period.

(2) **Forfeiture Provisions:** All ESOs are subject to forfeiture or forced early exercise after vesting if an employee terminates employment due to dismissal, retirement, death, disability, or voluntary termination.

(3) **Non-Transferability Provisions:** ESOs are either non-transferable or else transferable subject to severe restrictions. Non-transferability provisions require employees to hold their options during the vesting period, during which time the price of the stock might fall. Therefore, this restriction exposes employees who may want to dispose of (some of) their ESOs to unwanted risk. For comparison purposes, private placements of unregistered shares of common stock include a discount to reduce their fair value, because investors apply substantial marketability discounts to compensate for this risk.

FAS 123 does not permit a discount to reduce the value of ESOs to compensate for the risk of non-transferability during the vesting period.

(4) **Stated Restrictions:** Restrictions such as blackout periods for directors, officers, and principal stakeholders (as described in Section 16 of the Securities Act of 1934) are similar to non-transferability provisions in that they require employees to hold their options during periods when stock prices may be dropping, thereby exposing these employees to additional unwanted risk. As noted, private placements include a discount to reduce fair value to compensate for similar risk incurred by the holder of the placements.

FAS 123, however, does not permit a discount to reduce value to reflect the risk of trading blackout periods.

(5) **Early Exercise Behavior:** Past experience shows that vesting requirements and lack of free transferability have another effect that is evident post vesting. It has been observed that employees often tend to exercise ESOs several years prior to expiration (usually within the first three years after vesting) for a variety of reasons. An ESO holder might desire liquidity in order to diversify his or her personal investment portfolio, to exercise and sell after the stock has appreciated significantly (due to the holder's risk aversion and inability to hedge against a price decline), and to generate cash for consumption purposes or to meet other personal needs.

Thus, the ESO holder is unlike the holder of a market-traded call option on a non-dividend paying stock, who would never exercise early, because greater value is always realized by selling the option in the market. Early exercise reduces the time value of the ESO at the date of grant.

FAS 123 permits the use of the expected life of the option in place of the contractual time to expiration in an option pricing model.

Criteria for Comparison of ESO Valuation Models

This paper compares six alternative ESO valuation models. The models can be judged based on several criteria to assess the viability and usefulness of each. The following criteria are used:

- Accuracy
- Comparability
- Consistency
- Simplicity
- Reproducibility
- Flexibility

The models have common parameter values, such as the strike price and the current price of the underlying common stock, but the parameter sets are not identical. The research reported in this study demonstrated that these differences can lead to very significant differences in ESO values depending on the parameter omitted. In addition, small changes in parameter values, such as the underlying stock's volatility, may give rise to large changes in the ESO values. Consequently, it is extremely important that the parameter values are measured properly.

One of the primary drivers of option value, the volatility of the underlying stock, can be one of the more difficult parameters to estimate. In most option models, volatility can either be derived using implied values from exchange-traded put (the right to sell the instrument) and call options, or calculated by annualizing the standard deviation of the stock's historical returns (the methodology recommended by FAS 123). Alternatively, some statisticians note that volatility is dynamic as opposed to static, and thus maintain that it is best estimated via the use of complex econometric techniques. However, if one assumes, as did Black and Scholes, that variability is constant, then the calculation of volatility is simplified; finance professionals routinely value derivative securities based on statistical estimates of volatility.

Accuracy is the primary criterion of a valuation method and, hence, is the single most important criterion in grading ESO valuation methods. The accuracy of any valuation method depends on whether the model properly takes into account all the factors that affect ESO value. It also depends upon the accuracy of the parameter values inserted into the model. For the purposes of this paper, accuracy is defined as the ability of a model to measure fair value, as defined in FAS 123: "The amount at which an asset could be bought or sold in a current transaction between willing parties, that is, other than in a forced or liquidation sale."

Comparability implies that values of ESOs for different companies can be meaningfully compared at a point in time. Comparability requires consistency in the choice of the valuation model and in the calculation of parameters. For example, all companies being compared must estimate volatility on the same basis. Without clear guidance in the accounting rules concerning how volatility should be measured, there is the potential for widely differing ESO values due to differences in the way companies choose to measure volatility. For example, some companies may use a short-term historical average volatility, others may use a long-term historical average (corresponding to the time to exercise), while others may use an implied (short-term) volatility observed in the traded options market. Yet others may use a long-term implied volatility from the over-the-counter market if options on their stocks are traded there. Derivatives market participants have developed statistical techniques for estimating volatilities to use in valuing long-dated call and put options with the BSM model, but these techniques are familiar to only a relatively small group of market professionals. [1]

Consistency implies that values for a particular company can be compared across time, from reporting period to reporting period. Again, it is highly dependent upon consistency in the choice of model and in the calculation of parameter values.

Simplicity refers to the ease with which a value can be computed. The Minimum Value Model, for example, does not require an estimate of volatility, and is thus simpler to use than the other valuation methods discussed in this paper.

Reproducibility implies that for a particular ESO, the model's output is independent of the person doing the calculation. That is, given the parameter values, multiple users would calculate the same ESO value. Reproducibility is highly desirable from an auditing perspective and also to make the ESO values companies report in their financial statements (and the information derived from these values) as transparent as possible to investors and securities analysts. This requires strict specification of each parameter and the basis for its selection.

[1] Hull, John. 2002. A Methodology for Assessing Model Risk and Its Application to the Implied Volatility Function Model. *Journal of Financial and Quantitative Analysis* 37: 297-318.

Flexibility refers to the model's ability to value options with non-traditional or complex features, e.g., indexed options or performance-vested options.

Alternative ESO Valuation Models

Broadly speaking, ESOs are currently valued using one of three basic approaches, the intrinsic value method (Intrinsic Value Method), the minimum value method (Minimum Value Model), or some fair value method (Fair Value Method).

Fair value is the price at which an asset (such as an ESO) can be exchanged between knowledgeable and willing parties in an arm's-length transaction. Fair value captures both the option's intrinsic value (defined below) and its time value (defined below). Implementing the fair value approach usually involves using the BSM Model or a binomial option-pricing model to value the ESOs, making suitable adjustments to reflect their distinguishing features.

The Intrinsic Value Method

Intrinsic value is defined as the difference between the market price of the underlying shares of stock and the exercise price of the call option. Typically, ESOs have zero intrinsic value at the date of grant because the exercise price is set equal to the market value of the shares at the grant date. In most cases, therefore, valuing ESOs at their intrinsic value at grant date is equivalent to attributing no value to the options. It understates the ESOs' fair value by ignoring their time value, the component of value that reflects the opportunity for appreciation in (intrinsic) value before the ESO expires.

For many options, time value represents a substantial part of their total value. Ignoring time value by applying the Intrinsic Value Method at the grant date when the intrinsic value is zero understates the fair value of an at-the-money option.

The Minimum Value Model

The Minimum Value Model (also known as the minimum value method) is based on someone's willingness to buy a call option on a share of stock at the current fair value of the stock with the right to defer payment of the exercise price until the end of the option's term, ignoring the volatility of the underlying stock in the valuation calculation. Minimum value should not be confused with fair value.

The Minimum Value Model has the advantage of simplicity, and partially accounts for the time value of the option, but only the value of the right to defer payment of the exercise price until the exercise date. It does not capture the effect of volatility (a primary driver of option value) or the opportunity to benefit from subsequent share price appreciation. Option holders benefit from volatility because they have the right to participate in gains from changes in the share price during the option term, without having to bear the full risk of loss from decreases in the share price. By ignoring volatility, the Minimum Value Model ignores a key component of fair value. Thus, while the Minimum Value Model has the advantage of simplicity, achieving this simplicity requires sacrificing some accuracy. Nevertheless, there are some who believe that avoiding the subjectivity inherent in estimating volatility is also an important advantage of the Minimum Value Model.

FAS 123 allows non-public entities to use the Minimum Value Model, maintaining that "estimating expected volatility for the stock of a newly formed entity that is rarely traded, even privately, is not feasible."

The Black-Scholes-Merton Model

Published in 1973, the Black-Scholes Model values options under the assumption that both the options and the underlying common stock trade in liquid markets. The Black-Scholes Model, as modified by Merton to incorporate the payment of cash dividends (BSM Model), is a widely used technique to value market-traded call and put options as well as over-the-counter options. With an adjustment to the option's expected life, as allowed by FAS 123, the BSM Model is currently the most widely used method to value ESOs.

The BSM Model assumes that the risk-free interest rate and the stock's price volatility are constant during the option's life, neither of which is the case when options have long lives, as ESOs do. Also, the model makes certain assumptions about the distribution of common stock returns, which are, at best, only approximately true. Option market participants adjust for these deficiencies by using the zero-coupon Treasury rate that corresponds to the expected life of the option and estimating an appropriate stock price volatility by extrapolating from the range of volatilities implied by the market prices at which (shorter-term) options are trading in the market. With these adjustments, market professionals use the BSM Model to value long-dated equity options with times to expiration of 10 years or longer.

The BSM Model without ESO-specific adjustments (Unadjusted BSM Model in this study) is considered useful by option market participants because its features and its limitations have been exhaustively studied and are well known. Other more complex option pricing models exist, but their features are less familiar to all but the most active option market participants. [2]

The BSM Model with the FAS 123 Modifications

The BSM Model, adjusted for the early exercise behavior of ESOs as allowed by FAS 123, is currently the most common model used. Companies substitute the average time to exercise for the contractual time to expiration in the BSM Model to calculate the fair value of ESOs (FAS 123 Adjusted BSM Model in this study). This adjustment is needed to reflect the early exercise behavior of ESO holders. FAS 123, however, does not allow companies to apply a discount to the BSM value to reflect the ESO's lack of transferability during the vesting period. Thus, the ESO values companies report under FAS 123 still tend to overstate the value of ESO grants.

[2] Hull, John. 2000. *Options, Futures, and Other Derivatives*. Upper Saddle River, NJ: Prentice Hall.

The Two AG/E Models

Analysis Group/Economics (AG/E) has developed two additional ESO pricing models. One is a binomial tree model (AG/E Binomial Model in this study), and the other is an enhanced BSM Model (AG/E Enhanced BSM Model in this study). The binomial model is designed for situations that are more complex in nature, while the enhanced BSM Model is designed to value conventional ESOs.

The AG/E Binomial Model

The AG/E Binomial Model is designed both to meet the requirements of FAS 123 and to incorporate the unique features that differentiate ESOs from exchange-traded options. As such the model explicitly reflects such standard features of ESOs as early exercise, forfeiture, and vesting requirements.

The model assumes that the price of the underlying stock evolves according to a binomial process and that exercise decisions are made so as to maximize the expected utility of the option holder's terminal wealth. One of the model's outputs is an estimate of *the cost to the issuing company's shareholders of meeting the company's ESO obligations*. To ensure that the model is grounded in reality, it is calibrated to actual exercise and forfeiture data.

The AG/E Binomial Model applies a two-step process. In the calibration step, the model determines the expected life of the ESO. This value is then compared with the expected life calculated from the observed data on forfeiture and early exercise, and the model parameters are adjusted to equate the two. In the valuation step, the calibrated model is used to value the ESO.

The model addresses such non-standard features as time varying or indexed strike prices (Indexed ESOs), performance-vested ESOs (vesting can occur only if the stock price exceeds a preset level), repriceable ESOs (where the strike price may be reset if the ESO is too far "underwater"), purchased ESOs (where the employees must pay a certain percentage of the strike price at the grant date and the remainder when the option is exercised), and blackout periods. Of the models included in this study, the AG/E Binomial Model is the only one designed to address these features.

The AG/E Enhanced BSM Model

The AG/E Enhanced BSM Model extends the BSM Model to reflect the vesting requirements, transfer restrictions, early exercise, and forfeiture features of ESOs. Variables representing ESO exercise and forfeiture rates are inserted as separate parameters to enhance the BSM Model. With these enhancements, the model measures the fair value of ESOs based on the hypothetical price a fully diversified outside investor would pay in an arm's-length transaction to purchase the right to receive the ESO's cash flow (as distinct from the ESO itself, which is not transferable).

Forfeiture before vesting is handled by calculating the fraction of ESOs that can be expected never to vest (and as a result, to expire worthless) based on actual ESO data. Actual ESO data are also used to calculate the fraction of ESOs that will be forfeited without exercise after the vesting date (but prior to the expiration date). In the event that no ESO history exists for a particular company, data from a sector basket of like companies are used to estimate the parameter values.

Transfer restrictions are taken into account in two ways. Actual ESO exercise data are used to calculate the fraction of ESOs that holders would be expected to exercise each year prior to the vesting date were it not for the vesting restrictions. The holder's inability to exercise or transfer the ESOs during the vesting period is modeled as the loss of the value of a put option, and the value of this put option is calculated and subtracted from the value of the (unrestricted) ESO. AG/E also uses this analytical approach to calculate the discount for lack of free transferability when valuing unregistered privately placed shares of common stock.

Transfer restrictions post vesting are taken into account by modeling early exercise. An ESO holder who desires liquidity must exercise ESOs and sell the exercised shares to achieve it. Thus, early exercise captures the effect of the transfer restrictions post vesting.

Actual ESO data are used to estimate the rate at which ESO holders (1) exercise available ESOs (those that have vested and not been exercised or forfeited previously) and (2) forfeit available ESOs. The exercise rate and the forfeiture rate are each modeled as a random process in which the respective rate varies around a long-run average, which is also calculated from historical ESO exercise and forfeiture data. Each rate moves randomly about its long-run average as stock prices, interest rates, and other economic factors change causing changes in ESO holders' exercise and forfeiture behavior.

Treatment of Key ESO Features by the Six ESO Valuation Models

Feature	Unadjusted BSM	Intrinsic Value	Minimum Value	BSM with FAS 123 Modifications	AG/E Binomial	AG/E Enhanced BSM
Volatility	Volatility parameter must be estimated from market data	Intrinsic value is independent of volatility	Effectively assumes volatility to be zero	Volatility parameter must be estimated from market data	Volatility parameter must be estimated from market data	Volatility parameter must be estimated from market data
Time Value	Includes the option's time value	Calculates intrinsic value, which is exclusive of time value	Includes time value only to the extent of the delayed timing of the exercise payment	Includes the option's time value	Includes the option's time value	Includes the option's time value
Early Exercise	Ignores early exercise	Ignores early exercise	Ignores early exercise	Substitutes the expected life for the contractual life to take into account non-transferability, which causes early exercise	Models the holder's exercise decision within a utility maximization framework	Assumes a constant annual proportional rate of exercise, estimated from actual ESO data
Forfeiture Before Vesting	Ignores forfeiture	Ignores forfeiture	Ignores forfeiture	Allows the number of ESOs to be adjusted for forfeiture prior to vesting	Models the holder's forfeiture decision within a utility maximization framework	Assumes a constant annual proportional rate of forfeiture estimated from actual ESO data
Forfeiture After Vesting	Ignores forfeiture	Ignores forfeiture	Ignores forfeiture	Does not permit any adjustment for forfeiture after vesting	Models the holder's forfeiture decision within a utility maximization framework	Assumes a constant annual proportional rate of forfeiture estimated from actual ESO data
Non-Transferability	Assumes a liquid market exists for the options	No adjustment for non-transferability	No adjustment for non-transferability	Does not permit any adjustment for non-transferability during the vesting period	Incorporates non-transferability into the valuation by explicitly reflecting risk aversion and by calibrating the model to observed measures of forfeiture and exercise	Applies a separate discount for non-transferability during the vesting period, which is modeled like the discount for non-transferability of unregistered common stock
Non-Standard Features (Indexed Options, Performance Vested Options, etc.)	Can not be addressed using this model	Can not be addressed using this model	Can not be addressed using this model	Can not be addressed using this model	Explicitly modeled	Can not be addressed using this model

Research Methodology and Valuation Results

FERF provided ESO data it obtained from nine companies. These companies represent several industries, ranging from petrochemical to pharmaceutical to semiconductor. Two of these nine companies provided data for one grant each, five provided data for three grants each, one provided data for four grants, and the last one provided data for six grants. In total, data for 27 ESO grants were analyzed for this study. The vesting schedule varies from one-year cliff vesting to four-year graded vesting. Except for one company, the initial option life for all of these companies is 10 years.

This study compares the ESO value at grant date under five[3] valuation methods. ESO valuation is not adjusted for forfeitures prior to the vesting date under FAS 123; instead, the number of ESOs is adjusted. To reflect this factor and ensure comparability among all five models, this study reduces the FAS 123 ESO value by the fraction of ESOs that are not expected to vest.

Exhibit 1 compares the per share ESO values for the 27 grants based on the Unadjusted BSM, Minimum Value, FAS 123 Adjusted BSM, AG/E Binomial, and AG/E Enhanced BSM Models. Note that the Unadjusted BSM Model value is always the largest, and the Minimum Value Model price is usually the smallest.

Exhibit 2 simplifies the comparison further by using the Unadjusted BSM Model value as the standard (Unadjusted BSM Model value = 100). For example, the Unadjusted BSM Model value for Company 1 Grant 1 is $25.27 and the Minimum Value Model price is $8.76. Therefore, the corresponding relative Minimum Value Model price reported in Exhibit 2 is 34.66% of the Unadjusted BSM Model value.

Exhibit 3 provides a statistical summary comparison of the relative ESO values reported in Exhibit 2. For each valuation method, the minimum, maximum, and average values are reported. The Minimum Value Model price ranges from 7.38 (7.38% of the Unadjusted BSM Model value) to 65.37 with an average of 41.70. The average FAS 123 Adjusted BSM Model value is 76.39, which is significantly larger than both the average AG/E Enhanced BSM Model indexed value of 59.25 and the average AG/E Binomial Model indexed value of 64.15. The difference between the two AG/E models is due mainly to the discount for lack of transferability taken in the AG/E Enhanced BSM Model, which measures the fair market value from the perspective of an outside investor in an arm's-length transaction, but not taken in the AG/E Binomial Model, which measures the cost of the ESOs from the perspective of the company's shareholders.

Exhibit 4 compares values from the various ESO models to the FAS 123 Adjusted BSM Model values. The AG/E Enhanced BSM Model values represent a discount of between 11% and 49% when compared to the FAS 123 Adjusted BSM Model values. The average difference is 23%.

[3] The Intrinsic Value Method is not included. This method results in a value of zero at the grant date when the strike price equals the current market price, as it did for each of the 27 grants.

Conclusions

ESOs contain features that make them substantially different from publicly traded stock options. These features include: vesting requirements, forfeiture provisions, non-transferability provisions, other stated restrictions, and the resulting early exercise behavior.

This study described six different ESO valuation models and valued 27 historical ESO grants to compare the six models. The study found that ESO valuations can differ significantly depending on the valuation model used, the corresponding assumptions, and the features of each ESO grant. A consistent finding in this study is that the Minimum Value Model tends to produce the lowest valuations, the Unadjusted BSM Model produces the highest valuations, and the valuations produced by the other models fall somewhere in between.

When ESOs are valued at grant date, it cannot be known for sure how many will be exercised, nor how many will be forfeited and therefore never exercised. Even for those ESOs that will be exercised, it cannot be known at grant date when they will be exercised and at what price. However, this paper describes the assumptions made by various valuation models so that companies can decide for themselves which model best suits their circumstances. Ultimately, the choice of valuation model requires a trade-off between accuracy on the one hand, and simplicity and comparability on the other.

Exhibit 1

Comparison of ESO Values Obtained from Five Valuation Models

Company	Unadjusted BSM	Minimum Value	BSM with FAS 123 Modifications[1]	AG/E Binomial	AG/E Enhanced BSM
Company 1					
Grant 1	$25.27	$8.76	$16.17	$11.10	$11.48
Grant 2	13.42	4.12	9.65	8.26	6.98
Grant 3	18.07	5.14	13.02	11.68	9.43
Company 2					
Grant 1	13.00	5.66	8.58	5.51	6.24
Grant 2	20.22	6.68	12.92	7.31	9.44
Grant 3	21.59	5.96	13.76	8.14	10.05
Company 3					
Grant 1	14.51	5.67	9.58	6.45	4.90
Company 4					
Grant 1	3.07	0.97	1.60	1.43	1.13
Company 5					
Grant 1	2.90	1.34	2.34	2.14	2.00
Grant 2	4.22	1.82	3.22	2.79	2.87
Grant 3	11.83	3.33	10.02	9.65	7.81
Company 6					
Grant 1	4.25	0.31	4.01	4.36	3.30
Grant 2	4.68	1.09	4.28	4.41	3.56
Grant 3	6.83	1.09	6.30	6.44	4.81
Company 7					
Grant 1	4.41	2.88	3.98	3.73	3.12
Grant 2	6.52	4.21	5.64	4.98	4.17
Grant 3	7.39	4.07	6.13	5.56	4.36
Grant 4	4.69	1.91	4.05	3.93	2.90
Company 8					
Grant 1	4.57	2.69	3.62	2.90	3.13
Grant 2	7.06	4.27	5.41	3.80	4.72
Grant 3	8.04	4.33	6.15	4.57	5.38
Grant 4	12.47	7.66	9.44	6.49	8.25
Grant 5	13.15	7.69	9.94	6.98	8.71
Grant 6	8.41	3.70	6.68	5.83	5.80
Company 9					
Grant 1	2.43	1.08	1.79	1.48	1.22
Grant 2	4.50	1.80	3.25	2.67	2.33
Grant 3	8.86	4.06	6.02	4.76	4.42

Note:

[1] To allow for model comparability, the discount for forfeiture that would normally be made to the number of options recognized for financial reporting purposes is included in this valuation figure.

Exhibit 2

Relative ESO Values Obtained from Five Valuation Models

(Unadjusted BSM = 100)

Company	Minimum Value	BSM with FAS 123 Modifications[1]	AG/E Binomial	AG/E Enhanced BSM
Company 1				
Grant 1	34.66	63.97	43.92	45.41
Grant 2	30.71	71.93	61.54	51.99
Grant 3	28.46	72.01	64.64	52.17
Company 2				
Grant 1	43.51	65.98	42.42	47.98
Grant 2	33.04	63.87	36.14	46.69
Grant 3	27.61	63.77	37.71	46.54
Company 3				
Grant 1	39.10	66.01	44.43	33.74
Company 4				
Grant 1	31.69	52.05	46.50	36.83
Company 5				
Grant 1	46.23	80.76	73.76	69.16
Grant 2	43.10	76.34	66.01	68.06
Grant 3	28.14	84.70	81.52	65.99
Company 6				
Grant 1	7.38	94.36	102.60	77.56
Grant 2	23.30	91.49	94.16	76.01
Grant 3	15.92	92.25	94.39	70.49
Company 7				
Grant 1	65.37	90.28	84.52	70.60
Grant 2	64.50	86.42	76.32	63.90
Grant 3	55.12	82.95	75.24	59.03
Grant 4	40.71	86.40	83.75	61.93
Company 8				
Grant 1	58.90	79.24	63.48	68.49
Grant 2	60.40	76.59	53.73	66.80
Grant 3	53.81	76.48	56.80	66.92
Grant 4	61.39	75.66	52.05	66.15
Grant 5	58.45	75.61	53.10	66.22
Grant 6	43.99	79.51	69.40	68.96
Company 9				
Grant 1	44.52	73.88	60.90	50.41
Grant 2	39.95	72.14	59.23	51.76
Grant 3	45.85	67.92	53.68	49.86

Note:

[1] To allow for model comparability, the discount for forfeiture that would normally be made to the number of options recognized for financial reporting purposes is included in this valuation figure.

Exhibit 3

Summary Statistical Comparison of Relative ESO Values Obtained from Five Valuation Models
(Unadjusted BSM = 100)

	Minimum	Maximum	Average
Unadjusted BSM	100.00	100.00	100.00
Minimum Value	7.38	65.37	41.70
BSM with FAS 123 Modifications [1]	52.05	94.36	76.39
AG/E Binomial	36.14	102.60	64.15
AG/E Enhanced BSM	33.74	77.56	59.25
AG/E Binomial/ FAS 123	0.57	1.09	0.83
AG/E Enhanced BSM/ FAS 123	0.51	0.89	0.77

Note:
[1] To allow for model comparability, the discount for forfeiture that would normally be made to the number of options recognized for financial reporting purposes is included in this valuation figure.

Exhibit 4

Percentage Difference between BSM with FAS 123 Modifications and Other ESO Valuation Models

Company	BSM with FAS 123 Modifications[1]	Unadjusted BSM	Minimum Value	AG/E Binomial	AG/E Enhanced BSM
Company 1					
Grant 1	$16.17	56%	-46%	-31%	-29%
Grant 2	9.65	39%	-57%	-14%	-28%
Grant 3	13.02	39%	-60%	-10%	-28%
Company 2					
Grant 1	8.58	52%	-34%	-36%	-27%
Grant 2	12.92	57%	-48%	-43%	-27%
Grant 3	13.76	57%	-57%	-41%	-27%
Company 3					
Grant 1	9.58	51%	-41%	-33%	-49%
Company 4					
Grant 1	1.60	92%	-39%	-11%	-29%
Company 5					
Grant 1	2.34	24%	-43%	-9%	-14%
Grant 2	3.22	31%	-44%	-14%	-11%
Grant 3	10.02	18%	-67%	-4%	-22%
Company 6					
Grant 1	4.01	6%	-92%	9%	-18%
Grant 2	4.28	9%	-75%	3%	-17%
Grant 3	6.30	8%	-83%	2%	-24%
Company 7					
Grant 1	3.98	11%	-28%	-6%	-22%
Grant 2	5.64	16%	-25%	-12%	-26%
Grant 3	6.13	21%	-34%	-9%	-29%
Grant 4	4.05	16%	-53%	-3%	-28%
Company 8					
Grant 1	3.62	26%	-26%	-20%	-14%
Grant 2	5.41	31%	-21%	-30%	-13%
Grant 3	6.15	31%	-30%	-26%	-13%
Grant 4	9.44	32%	-19%	-31%	-13%
Grant 5	9.94	32%	-23%	-30%	-12%
Grant 6	6.68	26%	-45%	-13%	-13%
Company 9					
Grant 1	1.79	35%	-40%	-18%	-32%
Grant 2	3.25	39%	-45%	-18%	-28%
Grant 3	6.02	47%	-32%	-21%	-27%

Note:

[1] To allow for model comparability, the discount for forfeiture that would normally be made to the number of options recognized for financial reporting purposes is included in this valuation figure.

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