

NATIONAL ECONOMIC
RESEARCH ASSOCIATES

1166 AVENUE OF THE AMERICAS
NEW YORK, NEW YORK 10036
TEL: 212.345.3000 FAX: 212.345.4650
INTERNET: <http://www.nera.com>



Letter of Comment No: 4359
File Reference: 1102-100

June 28, 2004

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

Re: Exposure Draft on Proposed Statement of Financial Accounting Standards –
Share-Based Payment, an amendment of FASB Statements No. 123 and 95
(File Reference No. 1102-100)

Dear Ms. Bielstein:

We are pleased to comment on the “Proposed Statement of Financial Accounting Standards: Share-Based Payment: An Amendment of FASB Statements No. 123 and 95: March 31, 2004” (“Proposed Statement”). We believe the Proposed Statement provides generally good, substantive guidance that is nearly sufficient to ensure that the fair value objective is applied with reasonable consistency and reliability to share-based payment arrangements. Nevertheless, we have some suggestions for improvement. We also want to emphasize that there is no perfect solution, and some merited criticisms are inevitable regardless of how the guidance is modified.

Our comment letter focuses on the issues listed under the “Fair Value Measurement” heading with the following objectives:

- Provides some general comments about the educational philosophy underlying the Proposed Statement guidelines.
- Identifies sections of the Proposed Statement that are unclear or might have unforeseen ramifications.
- Offers suggestions to clarify the valuation guidance set forth in the Proposed Statement.

We understand that the underlying philosophy for the Proposed Statement is to provide guidance, which is educational rather than dogmatic. Overall, we agree with this approach because it gives valuation professionals greater flexibility to provide the most accurate estimates of value for share-based payments. It also ensures that the Proposed Statement will grow with developments in valuation technology and with new structure and design in share-based compensation instruments. Nevertheless, there are drawbacks that should cause the FASB to consider providing specific rules instead of flexible suggestions in certain cases.

The most serious drawback to the educational guidance approach is that it leaves the valuation process vulnerable to gaming, although this risk is somewhat mitigated by the Sarbanes-Oxley Act. There may be a temptation by some companies to exploit rules or the lack of rules, and some valuation professionals may be willing to accommodate the demands of these companies. The Sarbanes-Oxley Act may help limit the potential abuse, but may not prevent aggressive valuations or intentional undervaluation. The Proposed Statement may consider laying out qualification requirements for professionals performing valuation on share-based payments.

An even more difficult problem is the risk that valuation professionals may apply the incorrect methodology in valuing the share-based payments as a result of their misunderstandings. For example, some are still propounding seemingly obvious errors, such as applying put option discounts to account for non-transferability, which explicitly violates the fundamental requirement that the company's perspective, as opposed to the employee's perspective, be used.

Despite the educational tone of the Proposed Statement, there are instances when the Proposed Statement appears to layout some specific guidance. Fearing the risk of litigation as a result of accusations of manipulating valuations by deviating from specific guidance, cautious companies and auditors may end up ensuring that these guidelines becomes a *de facto* rules. Such rules are not necessarily undesirable *per se*. Certain aspects of valuation, such as volatility, are notoriously difficult to handle, have a material effect on valuation estimates, involve potentially subjective estimation, and therefore are subject to gaming or error. Detailed rules judiciously applied in these limited situations may be appropriate and highly desirable.

Issue 4(a): Does the Proposed Statement Provide Sufficient Guidance To Ensure that Fair Value Measurement Is Applied with Reasonable Consistency?

The Proposed Statement provides helpful and detailed guidance for valuing share-based payments, but some additional clarification and modification would help ensure consistency. It is our experience that estimates of fair value will vary largely because of different assumptions rather than valuation techniques (such as whether a lattice models or Monte Carlo simulation is used). As a result, FASB's guidance should emphasize the need for supporting evidence to justify assumptions as well as to state clear preferences for the basis of the assumptions being made.

The Proposed Statement already requires that “estimates and assumptions should reflect information that is (or would be) available to form the basis for an amount at which the instruments being valued would be exchanged.”¹ Implicitly, this Statement, along with specific examples through Appendix B, suggests that supporting evidence is necessary to justify assumptions. We suggest that paragraph B7 be modified as follows to emphasize this requirement:

In applying a valuation technique, the inputs and the assumptions should be those that would be used or made in accordance with paragraph B5. [*Furthermore, evidence for these inputs and assumptions should be well documented.*] That is, the estimates and assumptions should reflect information that is (or would be) available to form the basis for an amount at which the instruments being valued would be exchanged.

Such a requirement for documentation would deter companies and valuation professionals from attempting to incorporate unsupported assumptions, and would make auditors’ task of reviewing an analysis easier. In turn, this would greatly improve consistency of reporting while reducing the likelihood of gaming.

Equally important is the need to state clearly which of the listed factors is to be considered or which of the approaches is preferred, and under which circumstances it is preferred. Also, if the preferred approach is rejected, the reason why a less desirable alternative is being chosen must be disclosed. The Proposed Statement sometimes clearly lists preferences for methods and circumstances, such as whether to use a lattice model, the Black-Scholes-Merton (“BSM”) model, or the intrinsic value model. However, the Proposed Statement often enumerates possible approaches without stating a preference, such as for the estimation of volatility. While this may appear to give valuation professionals more flexibility, it is also more likely to induce gaming. This in turn makes it difficult to ensure consistency. Stating a preference for methods, but permitting deviations if well documented, leaves valuation professionals with the same degree of flexibility needed to value share-based payments accurately and consistently.

For example, suppose that implied volatilities from exchange-traded options and historical volatility estimates from stock price data are both available. Also, suppose that the implied volatilities are generally higher than the historical volatility estimates.² The end result would be higher employee share option values if implied volatilities were used. Exchange-traded option implied volatilities should be preferable because they reflect the market’s forward-looking estimate of volatility and risk preferences, which would be most relevant to valuation of employee share options. However, the current guidelines give no preference for a

¹ Exposure Draft, Paragraph B7.

² In general, this need not be the case. Certainly, if one were to look at the historical volatility of a start-up company and compare it to its implied volatility, it is possible that implied volatilities could be lower than historical volatility.

method. Therefore, it would not be inappropriate for a company to choose historical volatility estimates to obtain a lower valuation according to the Proposed Statement. Ideally, the Proposed Statement guidelines should direct a company in this situation to use the implied volatility estimates (possibly together with historical volatility). Historical volatility estimates could be used exclusively if the company is able to present good economic reasons, supported by factual evidence, why it preferred historical estimates of volatility.

Issue 4(b): Can Employee Share Options Be Measured with Sufficient Reliability? Is a Lattice Model Sufficiently Capable of Valuing Employee Share Options and Therefore a Preferable and Reliable Method?

In most cases, lattice (and simulation) models are adequate numerical techniques that allow the inclusion of whatever assumptions needed to make a model sufficiently reliable.³ However, the Proposed Statement should also indicate that approved numerical techniques include more than lattice models, such as finite difference models and simulation models.⁴ These techniques can incorporate models that can capture the salient features of employee share options and therefore can value these options accurately.⁵

We also assume that a lattice model will be constructed with a sufficient number of steps to ensure an appropriate level of numerical precision; otherwise, a lattice model could not be reliable. For example, if a lattice model involved three time steps, the numerical precision would be quite poor relative to one with a thousand steps. In general, the numerical precision improves as more steps are added. At one thousand steps, a lattice model is very close to having converged to a value with only a small amount of error, and additional steps will not result in a materially significant improvement in precision. There are algorithms to determine

³ While lattice models are capable of valuing employee share options reliably, the reliability of a particular valuation will depend upon the economic assumptions integrated into the lattice model. This is discussed further under Issue 4(d).

⁴ Lattice models are typically understood to be binomial, trinomial, or more generally multinomial. Finite difference approaches may be thought of as more general variations of recombining lattice models that can result in better convergence properties (that is, more precision with fewer steps, resulting in faster, more efficient computation). Simulation models include simulation of stochastic processes as well as simulating across a lattice model. Irrespective of the chosen numerical technique, the valuation should be done in a risk neutral setting and in a contingent claim framework, as described in “Closed-form model” in Appendix E of the Exposure Draft.

⁵ All of these numerical techniques can handle simple employee exercise rules, such as whether to exercise when a stock price reaches some multiple of the exercise price. Lattice and finite difference models can be used where early exercise depends upon the current employee share option value (that is, an employee considers whether there is more value to keep an option alive going forward or exercise today). Simulation models are not very effective for these types of exercise rules. Simulation models are necessary when the exercise rule may depend upon the path of stock prices; for example, an employee exercises when, after exceeding some high, stock prices drop by X% below their all time high, which is known as a draw-down rule. Lattice and finite difference models cannot accommodate such exercise assumptions or become very inefficient.

the precision of an estimate. The FASB should specify an appropriate level of numerical precision, such as: “an error of 1% or within \$1,000 of convergence, whichever is less.”⁶

Issue 4(c): Should There Be a Specific Method for Estimating Expected Volatility?

We believe the guidance in paragraph B25 is sufficiently comprehensive and specific in detailing methods for estimating expected volatility, but it should also indicate a preference for the different approaches to ensure valuation consistency.

For non-public companies, there should be a preference for finding comparable companies, as indicated in B25(c), before using intrinsic value. Non-public companies should seek to estimate their volatility by comparing themselves to other public companies. Only if there are prudent economic reasons (such as, a lack of remotely comparable companies, or the company’s stock price is determined by book value and it will never trade publicly), then non-public companies may be allowed to ignore volatility estimation and use intrinsic value. Otherwise, the approach for estimating volatility should be the same as for public companies.

For public companies, clear preferences for methods for estimating volatility should be indicated. Volatility estimates could be obtained by averaging the results of a number of approaches, and by weighting these results according to preferences based on method and statistical accuracy. Exhibit 1 illustrates an example of preference ordering:

- If exchange traded options are traded, a term structure of implied volatilities should be estimated, as stated in B25(b), and should be given the highest preference. Implied volatilities reflect not only market expectations about future volatility, but also market preferences.

⁶ Numerical algorithms like lattice models and simulations converge to a single value as the number of steps (or simulations) increase, although actually reaching that convergence value may require an infinite number of steps or simulations. A numerical algorithm with a finite number of steps (or simulations) produces an estimate of this convergence value with numerical error. The potential magnitude of this error is expected to decrease with number of step or simulations or, in other words, numerical precision increases. By observing how numerical estimates converge as we increase the number of steps or simulations (or, if we are fortunate to possess a formula), we can measure the numerical precision of an estimate. For example, in the case of simulations, we possess formulas to measure confidence intervals for the estimates. These confidence intervals define the numerical precision of the estimates. Therefore, to meet a hypothetically required FASB numerical precision standard of 1%, it would be necessary that an estimate have confidence intervals no wider than 1%.

We want to emphasize that the question should not be how many time steps are necessary, but how numerically precise is the valuation. Lattice-based model can easily accommodate a variable number of steps. Furthermore, variable step sizes and variance reduction techniques make the number of steps a crude proxy for numerical precision. Instead, the general rule should be that as many steps as are computationally feasible be used to increase numerical precision up to a desired level of precision. So, in practice, there is a target for a certain level of numerical precision and a lattice model is constructed with an appropriate number of steps accordingly, rather than begin with the number of step sizes.

- “Exchange traded options” need not necessarily be limited to simple calls and puts, but can include warrants, embedded options such as convertible bonds, and other derivatives based on the company’s stock.
- If it is believed that a company’s structure is expected to change dramatically in the near future through a spin-off or merger, then volatility estimates should be obtained from comparable companies (corresponding to the expected company structure) as indicated in B25(f).
- If there is a historical stock prices, then a term structure of volatility should be estimated using the historical data as described in B25(a), B25(c), B25(d), and B25(e)
 - It is preferable to estimate term structure by using time series methods, such as FIGARCH,⁷ in the manner suggested in B25(a), or as a flat constant term structure of volatility.
- If there are comparable companies (even if no structural change for the company is expected), then volatilities could be estimated using data from these companies.
- Other techniques, such as economic models or structural models of the firm, can be used.

The volatility estimates produced from these different sources should then be combined in a manner similar to that described in paragraph B14. The different volatility estimates should be averaged, but different estimates should be given different weights. Preferred methods should be assigned heavier weights. Also, it is generally possible to estimate the statistical accuracy of a volatility estimate. Heavier weights should be assigned to those methods that have statistically higher accuracy.

The details of the procedures will depend upon the availability and quality of data as well as the circumstances of the firm. Furthermore, the procedures are likely to change with advances in technology. In any event, the estimation of volatility should be properly documented, so that it is easier for the auditors to review the valuation.

Issue 4(d): Does the Proposed Statement’s Methods Give Appropriate Recognition to the Unique Characteristics of Employee Share Options?

The Proposed Statement does provide appropriate recognition to the unique characteristics of employee share options for the purpose of valuation. We agree that the “expected term” is appropriate rather than the contractual term, if the “expected term” denotes a distribution of maturity terms. In general, the manner in which the Proposed Statement

⁷ FIGARCH stands for “fractionally integrated generalized autoregressive heteroscedastic,” which refers to a class of long memory, time varying volatility models, which may be suitable for modeling volatility of employee share options.

addresses other distinguishing characteristics of employee share options is correct. Especially, we agree with FASB's treatment of the effects of non-transferability during the vesting period on the value of employee share options as having an effect only through the "expected term" of the option (rather than with an explicit discount to the option).⁸

Under the Proposed Statement, there are a couple of issues with the way in which vesting and value of employee share options are separated.⁹ There is very little guidance given to determining the quantity expected to vest. Vesting and value of employee share options are dependent, but are treated as independent in the Proposed Statement. The way in which expected vesting quantity is estimated can be almost as complicated as pricing. It could even be calculated using a lattice type model that makes forfeiture prior to vesting more likely when the stock is doing poorly. Therefore, the quantity of options that will vest is just as dependent on the company's share price as is the price of the options. For example, when the share price declines and an option is deep out-of-the-money, it is less likely that an employee will remain with the company until vesting than if the share price is high and an option is deep in-the-money. Technically, this means that quantity technically cannot be treated independently of the price of the options.

Issue 5: Is the Intrinsic Value Method with Remeasurement Through the Date of Settlement Date an Appropriate Alternative Accounting Treatment When It Is Not Possible To Estimate Fair Value?

We believe that situations where it is not possible to estimate fair value are exceedingly rare, and for those, intrinsic value (or the slightly better minimum value alternative) should be permitted only after consideration of all alternatives. Using comparable companies as a last

⁸ Value of employee share options to a company and to its employees need not be the same. It is generally agreed that valuation of employee share options must be from the company's perspective. This means it is inappropriate to apply direct discounts just because an employee perceives his option is less valuable because of non-transferability over the vesting period. Nevertheless, an employee's perception of option value does affect his decision to exercise his options or depart from the company. This affects the expected term of the option. In this way only, the non-transferability of the employee share options over the vesting period will affect employee share option fair value for the company.

Some valuation professionals have taken the approach that the value should be that of a third party purchaser of options. They have incorrectly argued that the perspective of a third party purchaser of options restricted in the manner of an employee is equivalent to the company's perspective. This is not true because this third party is nearly as encumbered as the employee, making it a virtual employee. The correct way to understand the meaning of perspective is to consider what would be the cost to the company to purchase employee share options from the marketplace to satisfy the company's obligations to its employees. This is equivalent to a company hedging its obligations using the same dynamic trading concept that underlies the BSM model, but taking into account the unique characteristics of employee share options.

⁹ As stated, "... the Board decided that compensation cost should be recognized only for those equity instruments that vest to take into account the risk of forfeiture due to vesting conditions." This appears to allude to the principle established in the Proposed Statement that separates the issue of pricing from the issue of determining the quantity of options that ultimately vest. Valuation is first calculated under the conditional assumption that service or performance requirements will be met. Then, the quantity is reduced to take into account the likely vesting.

resort, it should be possible to estimate the value of share-based payments in almost all cases. There are circumstances (such as a unique, privately-held start-up company with no options history that will never become public) in which it may not be possible to estimate fair value. In these situations, the minimum value approach should be preferred over the intrinsic value method.¹⁰

Generally, it should be possible to obtain a better estimate of fair value than intrinsic value. Intrinsic value effectively represents the lower bound for value rather than a best estimate, which is preferable for accounting purposes. In this sense, the BSM formula provides a better estimate as long as volatility, expected term, and stock price can be estimated. Stock price must be estimated regardless. There are numerous ways to estimate volatility as indicated in paragraph B25, including finding comparable companies that are public. Expected term could be estimated based on the company's past experience or through a comparable approach. Only the most extreme circumstances will preclude using BSM to obtain a better estimate of fair value than intrinsic value.

Paragraph B2: Disclosure of Value After Granting

It may be beneficial for shareholders and debtholders if companies disclose the values or other measures of dilution of all option grants in periods subsequent to granting (at least annually).¹¹ Reporting just the total option grants does not provide a good indication of the potential dilution because they may include many out-of-the-money options, overstating the potential dilution effect. Instead, option values provide a better indication of potential dilution. In-the-money options will have significant value while out-of-the money options will have little value, reflecting the likelihood of exercise and dilution. An even better measure would be to report employee total share option deltas, which are share equivalents that would directly measure potential dilution.

Paragraph B2: Valuation of Reload and Clawback Features

We suggest the following modification to the portion of the Proposed Statement that states:

Reload features and contingent features that require an employee to transfer equity shares earned or realized gains from the sale of equity instruments earned as a result of share-based payment arrangements to the issuing enterprise for consideration that is less than fair value on the date of transfer, such as a clawback feature shall not be *[directly]*

¹⁰ "Minimum value" is a BSM valuation formula with volatility set to zero and time to maturity being the expected term (calculated in some manner, possibly even an industry average) or the contractual term. Note that neither minimum value nor intrinsic value methods are desirable approaches. Minimum value at least provides a better lower bound value.

¹¹ Ideally, all options outstanding would be marked-to-market quarterly to reflect their potential impact on the company's cost. It is our understanding that because employee share options are considered equity awards rather than liabilities, marked-to-market accounting treatment is not applicable under current accounting rules.

considered in estimating the fair value of an equity instrument on the date it is granted. Those features are only accounted for *[in the expected term of the option and]* if and when a reload grant or contingent event occurs.

We understand that the original intent is to capture effect of the reload features at later dates, but not because they are fundamentally difficult to value. However, these features have an effect on the expected term of the option. The term of a reload option would reasonably be expected to be less than a comparable non-reload option.

Paragraph B7: Explicit Need for Documentation and Non-Public Information

Currently, it is understood that share-based payments will be valued using companies' records of employee exercise patterns and demographic information, which is non-public information. However, this paragraph is unclear about the use of the company's other non-public information.

In some situations, a company may possess knowledge about future events that will affect the value of share-based payments. The issue is whether the valuation of share-based payments should reflect this non-public information. If a company's executive officers know that certain non-public information, such as a merger, employee layoffs, or dividend policies, will affect share-based payment valuations and they are compelled by the Sarbanes-Oxley Act to affirm the accuracy of their financial statements, executive officers may not be able to affirm valuations based only on public information without being held liable for misstatement. This is further complicated by how the marketplace sometimes already incorporates the so-called "non-public" information, such as through its anticipation of a merger, which makes the task separating non-public and public information difficult.

Arguments against the use of non-public information are compelling. If assumptions were to be documented, then this would force companies to reveal non-public information, which could put them at a competitive disadvantage. Even simply reporting valuations that incorporate non-public information will be revealing of company proprietary information. Consider a company that knows privately it will be acquired in the next quarter, resulting in a marked increase in the stock price over the current trading price, but the market believes this takeover is only a possibility. If the non-public information is used, share-based payment values will reflect the known acquisition, and they will be revealing to the marketplace that the takeover will occur. As such, share-based payment valuations could have an unintended role of an information source about future company business activities. In the same way, managers could manipulate investors by incorporating their own optimistic biases about the company.

For these reasons, we suggest that with the exception of employee exercise patterns, only public information be used for valuation. Changes in dividend policy and company structure that would not be expected by the market should not be incorporated into the valuation. This should be made clear in paragraph B7 with the following addition:

With the exception of information used to estimate employee exercise patterns, only publicly available information should be

used in estimating values; that is, information concerning changes in company structure, dividend policy, and other material variables that are not known to the marketplace should not be used in determining fair values.

Paragraph B10-B11: Use of the Black-Scholes-Merton Model

We agree completely with paragraph B10, and we note that BSM values can be obtained as a special case (that is, under specific assumptions) from a lattice model. The only limitation preventing the use of a lattice model is a company's technical capability and cost.

For the latter reason, we agree with paragraph B11, but we believe that a company should explain the reasons for its choice of particular model. A BSM model should be permitted if there are compelling reasons, such as a lack of data to support developing a more sophisticated model. Use of a BSM model, however, should require justification, through documentation, why a lattice model cannot be used.

The BSM model (using expected life for time to maturity) is also useful as a benchmark model. This model is easily understood because it has been the convention for disclosures for many years. For this reason, it may be worthwhile, only during the transition period of the Proposed Statement, to require disclosure of the values estimated under the BSM model as a comparative measure for the benefit of those who have relied on that model in prior years.

Paragraph B14: Generalization of the Averaging Principle

Paragraph B14 advises that if multiple estimates of volatility, dividends, or option term are obtained, then they should be averaged to obtain an expected value, which presumably is the single best estimate. First, it should be made clear that the objective is a best estimate. Second, the different estimates to be averaged can be obtained from very different sources that are not equally accurate. Third, the average should be a weighted average, whose weights are proportional to the relative accuracy. Therefore, a modified, more generalized version of this statement would serve as beneficial guidance:

There is likely to be a range of reasonable estimates for expected volatility, dividends, and option term. If no amount within the range is more or less likely [*accurate*] than any other amount, an average of the range (its expected value) should be used to obtain a best estimate. [*If one estimate is more accurate than another, a weighted-average that places more weight on the more accurate estimate should be used to obtain a best estimate.*] In using a lattice model, the ~~expected values~~ [*best estimates*] used are to be determined for a particular node (or multiple nodes during a particular time period) of the lattice and not over multiple periods, unless such application is supportable given the characteristics of the instrument being valued.

It is well known (in filtering theory) that the best estimate when faced with a choice of two estimates from two different information sources is some weighted-average of the two estimates. The weights are proportional to the relative reliability of the estimate.¹² The resulting weighted average estimate will be more reliable than either individual estimate alone.¹³ Often, but not always, the best estimate is the expected value.¹⁴

This prescription for combining estimates is intended for combining estimates obtained from different sources, such as historical data and “comparable companies” as described in paragraphs B15 – B16. As a result, the estimation methods mentioned in paragraphs B15 – B16 are not just alternatives when historical data are inadequate, but further supplement and improve the estimates based on historical data.

Paragraph B18: Exceptions to Changes in Models

Footnote 13 to this paragraph should include another exception to the rule: “*Once an entity changes ...to a lattice model, it may not change to a less preferable valuation technique.*” If there is a significant change to the capital structure, then it may be acceptable to switch to a less preferable valuation method for the reasons stated in paragraphs B10 – B11. An example of a significant change is a bankruptcy, resulting in the shedding of in-business units and the remainder of the company being made private.

Paragraph B20: Risk Neutral or True Expected Term

Paragraph B20 refers to “expected term” without indicating whether the expected term is based on risk neutral or true probabilities.¹⁵ The “expected term” is a *probability-weighted* average of possible times before employee shares are exercised, forfeited or matured. The probabilities used can be either true probabilities as we would observe in the real world or they can be risk neutral probabilities as used in valuation. The statement “Expected term then could

¹² Typically, the weights reflect the relative probability that an estimate is correct. (For example, if all estimates possess standard errors, then the weights will be proportional to the inverse of the standard errors.) Hence, this is the expected value of the estimate since an expected value is a probability-weighted estimate (much as the Proposed Statement describes in glossary under “Volatility”).

¹³ Practically, we realize that it may not be possible to calculate a precise, optimal weighting. While this means that practically may not be possible to determine a “best” estimate, such weighted average estimates should be better than a single estimate alone.

¹⁴ On a more technical note, the best estimate also depends upon the application. For example, if a simple average (equal weights for all estimates) of volatility estimates gives the best estimate of expected volatility and if a simple average of option values that use different volatility estimates gives the best estimate of option value, then the average price of options using different volatilities (which is the best estimate of option price) will generally be different than an option price using expected volatility. The best estimate of volatility for estimating option value, which is our objective, will instead be some weighted average of the volatility estimates and not expected volatility.

¹⁵ True probabilities represent the true likelihood of events occurring in the real world. Risk neutral probabilities are mathematical constructs used to value a contingent claim (or derivative) as its expected present value of payoffs.

be estimated based on the output of the resulting lattice” suggests that a risk neutral expected term should be obtained from a lattice valuation.

Depending upon which probabilities are used, the expected term may be different. Consider the example in paragraph B20 in which employees exercise their options whenever the share price reaches 200 percent of the exercise price.¹⁶ Then, the expected term using actual employee exercise data (true expected term) is 5.20 years, but the risk neutral expected term is 7.59 years.¹⁷ (Furthermore, the method described in footnote 16 gives an expected term of 6.29 years.¹⁸) These are significantly different numbers.

These differences also highlight a danger in using and mixing different expected terms as inputs. In the above example, employees exercised whenever the share price exceeded twice their option’s exercise price, which results in an expected term of 5.20 years using historical observed terms. The true expected term of 5.20 years is lower than risk neutral expected term of 7.59 years. If 5.20 years were used as a risk neutral expected term input to either the correct Hull and White or the closed-form BSM model, then the value of employee share options would generally be understated.¹⁹ Instead of estimating the expected term from historical data, the correct way to account for early exercise patterns in employee share options would estimate the employee exercise rule directly; that is, the multiple of exercise price that share prices must reach for exercises to occur. Then, expected term is no longer needed as an input.

Paragraph B21: Clarification of What Is Required, Preferred, or Suggested

Paragraph B21 lists “[o]ther factors that may affect ... exercise and ... termination ... behavior” without indicating whether the inclusion of these factors is required, preferred, or suggested. We believe that since blackout periods are relatively straightforward to determine and are easily accounted for in a lattice model, the Proposed Statement should express a preference for inclusion in a lattice model. That is, unless there are reasons to exclude blackout periods, lattice models should incorporate their effect.

¹⁶ This exercise rule corresponds to the simplistic ESO model by Hull, J. and A. White, 2004, “How to Value Employee Stock Options,” *Financial Analyst Journal*. We also assume that employee share options are plain vanilla with a ten-year stated maturity, are immediately vesting, are not subject to blackouts, have a zero probability of forfeiture, and are issued at the money (exercise price equals stock price). Furthermore, the stock price is modeled as in BSM with a constant volatility of 30%, initial stock price of \$30, and is expected to return 15% per year (in reality). Also, the risk free rate is constant at 4% per annum.

Under risk neutrality, which is used for valuation, the stock price is expected to grow at a lower rate (the risk free rate 4%) than in reality (15%). This results in a longer expected time until the stock price reaches 200 percent of the exercise price.

¹⁷ We calculate the expected terms directly from the lattice model. If initial stock price (and exercise price) is \$30, the BSM model prices are \$12.81 for the risk neutral expected term and \$10.41 using the true expected term.

¹⁸ This is obtained by solving the BSM formula for the maturity that gives a price equal to \$11.56, which was given by the lattice model.

¹⁹ This is because the value of the employee share options generally increase with expected term.

Paragraph B22: Use of Other Techniques to Estimate Term of Employee Share Options

The use of other techniques to estimate the distribution of the term of employee share options should be encouraged regardless of whether or not there is sufficient information about exercise and post-vesting termination behavior. As discussed earlier, using more than one source of information potentially can improve any single estimate. This paragraph seems to suggest that if data exist on employee exercise and post-vesting termination behavior, no further information should be considered.

Paragraph B26: Lattice Models Preferably Should Incorporate a Term Structure of Volatility

Paragraph B26 should express a preference for including a term structure of volatility in lattice models.²⁰ Unless there is a reason for excluding a term structure of volatility, such as lack of data, it should be incorporated in a lattice model. The Proposed Statement only states that it is feasible to incorporate term structures of volatility.

Paragraph B27 – B28: Dividends

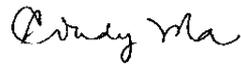
We recommend that the Proposed Statement should express a preference for using expected dividend amounts as opposed to yields. Treating dividends as being paid discretely at specific times reflects reality better than assuming that they are continuously paid. This is important because it is possible that dividends induce early exercise. Most off-the-shelf software considers only a continuous dividend because it is simple to implement. However, it is feasible to implement discrete dividends in a lattice model, so technical reasons should not be an impediment.

As discussed earlier, we agree that only publicly available information should be used to determine expected dividends. Therefore, we urge that the adverb “*Generally*” be removed from paragraph B28.

²⁰ By term structure of volatility, we also loosely mean time varying models of volatility in general as well as stochastic volatility models.

If you have any questions about our comments or wish to discuss any of the issues further, please contact Cindy Ma at (212) 948-2540 or Algis Remeza at (212) 345-5516.

Sincerely,



Cindy W. Ma
Ph.D., CPA, CFA



Algis T. Remeza

These comments represent our opinions only and do not necessarily represent those of our parent Marsh & McLennan Company or any of its operating companies.

Exhibit 1
Sample Flow Chart of Volatility Estimation for the Proposed Statement

