Share-Based Payment > Best Practice Series

Interest Rate Assumption - Implied Forward Rates

The Overview

As part of our Share-Based Payment (SBP) Best Practice Series, Montgomery Investment Technology, Inc. (MITI) is pleased to provide you with research which focuses on the interest rate assumption of an option pricing model.

The Standard

ASC 718 (FAS 123R) states that an entity "must use as the risk-free interest rates the implied yields currently available from the U.S. Treasury zero-coupon yield curve over the contractual term of the option if the entity is using a lattice model" or over the expected term if a closed-form model is used. It is pointed out that it may be necessary to use an appropriate substitute if circumstances indicate that the implied yield on zero-coupon government issues is not representative of a risk-free interest rate.

The Practice

Many companies currently use the Black-Scholes-Merton model to calculate the fair value of an employee stock option (ESO) where a single interest rate commensurate with the expected term is selected. For companies that have migrated to the lattice model, multiple interest rates are typically applied, with implied forward rates using one year intervals being a common practice.

The Future

A more refined option valuation process incorporates multiple interest rates in either the lattice model or Monte Carlo simulation. Some accounting firms have indicated a preference for implied forward rates when lattice models are used. To calculate the fair value of either an ESO (using a suboptimal exercise factor) or a performance price target award, the time value of money is better accounted for by using forward rates.

Once the payoff of a contract has been generated within the model, it must be discounted to the present. The appropriate timeframe for the discount rate is not available on the valuation date because we do not know when the payoff will be achieved. However, we can discount back using the term structure of interest rates.

MITI has researched the impact of a single rate versus multiple interest rates as the assumption in the valuation of options and derivative securities. To download a sample of implied forward rates derived from the U.S. Treasury yield curve, please click here.

Suggestions

If you would like to consider alternative SBP valuation techniques or discuss the interest rate assumption with one of our valuation specialists, please contact us at 610-688-8111. We welcome your comments and questions at miti@fintools.com. Thank you for your feedback!

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References

Financial Accounting Standard No. 123(R)

Valuation Techniques for Share Options and Similar Instruments

A15. The Black-Scholes-Merton formula assumes that option exercises occur at the end of an option's contractual term, and that expected volatility, expected dividends, and risk-free interest rates are constant over the option's term. If used to estimate the fair value of instruments in the scope of this Statement, the Black-Scholes-Merton formula must be adjusted to take account of certain characteristics of employee share options and similar instruments that are not consistent with the model's assumptions (for example, the ability to exercise before the end of the option's contractual term). Because of the nature of the formula, those adjustments take the form of weighted-average assumptions about those characteristics. In contrast, a lattice model can be designed to accommodate dynamic assumptions of expected volatility and dividends over the option's contractual term, and estimates of expected option exercise patterns during the option's contractual term, including the effect of blackout periods. Therefore, the design of a lattice model more fully reflects the substantive characteristics of a particular employee share option or similar instrument. Nevertheless, both a lattice model and the Black-Scholes-Merton formula, as well as other valuation techniques that meet the requirements in paragraph A8, can provide a fair value estimate that is consistent with the measurement objective and fair-value-based method of this Statement.

Risk-Free Interest Rate(s) for the Expected Term of the Option

A25. Option-pricing models call for the risk-free interest rate as an assumption to take into account, among other things, the time value of money. A U.S. entity issuing an option on its own shares must use as the risk-free interest rates the implied yields currently available from the U.S. Treasury zero-coupon yield curve over the contractual term of the option if the entity is using a lattice model incorporating the option's contractual term. If the entity is using a closed-form model, the risk-free interest rate is the implied yield currently available on U.S. Treasury zero-coupon issues with a remaining term equal to the expected term used as the assumption in the model. For entities based in jurisdictions outside the United States, the risk-free interest rate is the implied yield currently available on zero-coupon government issues denominated in the currency of the market in which the share (or underlying share), which is the basis for the instrument awarded, primarily trades. It may be necessary to use an appropriate substitute if no such government issues exist or if circumstances indicate that the implied yield on zero-coupon government issues is not representative of a risk-free interest rate.

Nature of the Option-Pricing Model Used

B64. As discussed in paragraphs A10–A17, closed-form models are one acceptable technique for estimating the fair value of employee share options. However, a lattice model (or other valuation technique, such as a Monte Carlo simulation technique, that is not based on a closed-form equation) can accommodate the term structures of risk-free interest rates and expected volatility, as well as expected changes in dividends over an option's contractual term. A lattice model also can accommodate estimates of employees' option exercise patterns and post-vesting employment termination during the option's contractual term, and thereby can more fully reflect the effect of those factors than can an estimate developed using a closed-form model and a single weighted-average expected life of the options.

B65. For the reasons discussed in paragraph B64, the Exposure Draft would have established a lattice model as preferable for purposes of justifying a change in accounting principle. Once an entity had adopted that valuation technique, it would have been prohibited from changing to a less preferable technique. Many of the respondents to the Exposure Draft who addressed the issue objected to establishing a lattice model as preferable and said that the guidance in the Exposure Draft would have

been interpreted as effectively requiring most public entities to use a lattice model once the necessary data were available. Some of those respondents noted that other valuation techniques, such as a Monte Carlo simulation technique, also generally would provide estimates of fair value that are superior to those resulting from use of a closed-form model, such as the Black-Scholes-Merton formula. Some respondents said that establishing a lattice model as preferable might inhibit future development of better models for estimating the fair value of employee share options.

FASB Accounting Standards Codification, Topic 718, Compensation – Stock Compensation

Selecting or Estimating the Risk-free Rate for the Expected Term

55-28 Option-pricing models call for the risk-free interest rate as an assumption to take into account, among other things, the time value of money. A U.S. entity issuing an option on its own shares must use as the risk-free interest rates the implied yields currently available from the U.S. Treasury zero-coupon yield curve over the contractual term of the option if the entity is using a lattice model incorporating the option's contractual term. If the entity is using a closed-form model, the risk-free interest rate is the implied yield currently available on U.S. Treasury zero-coupon issues with a remaining term equal to the expected term used as the assumption in the model. For entities based in jurisdictions outside the United States, the risk-free interest rate is the implied yield currently available on zero-coupon government issues denominated in the currency of the market in which the share (or underlying share), which is the basis for the instrument awarded, primarily trades. It may be necessary to use an appropriate substitute if no such government issues exist or if circumstances indicate that the implied yield on zero-coupon government issues is not representative of a risk-free interest rate.