

ESO VALUATION EXPECTED VOLATILITY AND INTEREST RATE ASSUMPTIONS

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EXPECTED VOLATILITY

The Expected Volatility of a company can be calculated by blending the Historical Volatility (from the market price data) with the Implied Volatility (reflection of the market's expected future volatility) from exchange-traded options.

Option pricing models require expected volatility as an input assumption since an option's value is dependent on potential share returns over the option's term. FAS 123R does not specify a method of estimating expected volatility but provides a list of factors that should be considered in estimating expected volatility:

- a. *Volatility of the share price, including changes in that volatility and possible mean reversion of that volatility. [...] In computing historical volatility, for example, an entity might disregard an identifiable period of time in which its share price was extraordinarily volatile because of a failed takeover bid if a similar event is not expected to recur during the expected or contractual term. If an entity's share price was extremely volatile for an identifiable period of time, due to a general market decline, that entity might place less weight on its volatility during that period of time because of possible mean reversion. Volatility over the most recent period is generally commensurate with either of the following:
 1. *The contractual term of the option if a lattice model is being used to estimate fair value*
 2. *The expected term of the option if a closed-form model is being used**
- b. *The implied volatility of the share price determined from the market prices of traded options or other traded financial instruments such as outstanding convertible debt, if any.*
- c. *For public companies, the length of time its shares have been publicly traded. [...] A newly public entity also might consider the expected volatility of similar entities. [...]*
- d. *Appropriate and regular intervals for price observations. [...]*
- e. *Corporate and capital structure.*

(Accounting Standards Codification™ (ASC) 718-10-55-37 formerly FAS 123R Paragraph A32)



HISTORICAL VOLATILITY

Historical Volatility is a measure of price fluctuation over time. Historical volatility can be calculated using daily, weekly or monthly price data to empirically measure the past performance of the stock. To estimate the expected volatility we need to consider time periods equivalent to the Contractual term using daily, weekly, and monthly prices.

The Black-Scholes-Merton (B-S-M) model assumes that the rates of return are normally distributed and that the price movements are random. To decide whether the historical rates of return are consistent with these assumptions we should perform statistical tests regarding the Skewness, Kurtosis, Auto-correlation and Lomb periodogram on the daily, weekly and/or monthly data.

IMPLIED VOLATILITY

Implied volatilities are often referred to as a "market consensus" of volatility, an indication of risk that combines the insights of many market participants. The implied volatilities tend to be more responsive to current market conditions.

Statement 123R does not specify a particular method of estimating expected volatility. However, the Statement does clarify that the objective in estimating expected volatility is to ascertain the assumption about expected volatility that marketplace participants would likely use in determining an exchange price for an option. Statement 123R provides a list of factors entities should consider in estimating expected volatility. Company B may begin its process of estimating expected volatility by considering its historical volatility. However, Company B should also then consider, based on available information, how the expected volatility of its share price may differ from historical volatility. Implied volatility can be useful in estimating expected volatility because it is generally reflective of both historical volatility and expectations of how future volatility will differ from historical volatility.

SEC SAB 107 Pages 17-18

The extent of the ultimate reliance on implied volatility will depend on a company's facts and circumstances; however, the staff believes that a company with actively traded Options or other financial instruments with embedded options generally could place greater (or even exclusive) reliance on implied volatility.

SEC SAB 107 Pages 18-19

Implied volatility is the volatility assumption inherent in the market prices of a company's traded options or other financial instruments that have option-like features. Implied volatility is derived by entering the market price of the traded financial instrument, along with assumptions specific to the financial options being valued, into a model based on a constant volatility estimate (e.g., the Black-Scholes-Merton closed form model) and solving for the unknown assumption of volatility.

SEC SAB 107 Footnote 36



The staff believes that when valuing an at-the-money employee share option, the implied volatility derived from at- or near-the-money traded options generally would be most relevant. If, however, it is not possible to find at- or near-the-money traded options, Company B should select multiple traded options with an average exercise price close to the exercise price of the employee share option.

SEC SAB 107 Page 23-24

The staff believes a company could use a weighted-average implied volatility based on traded options that are either in-the-money or out-of-the-money. For example, if the employee share option has an exercise price of \$52, but the only traded options available have exercise prices of \$50 and \$55, then the staff believes that it is appropriate to use a weighted average based on the implied volatilities from the two traded options; for this example, a 40% weight on the implied volatility calculated from the option with an exercise price of \$55 and a 60% weight on the option with an exercise price of \$50.

SEC SAB 107 Footnote 48

SEC SAB 107 permits using implied volatility exclusively as expected volatility with certain requirements. One of the key requirements is that the remaining time on the traded options be equal to the expected life of the option.

Similarity of Length of Terms -

The staff believes that when valuing an employee share option with a given expected or contractual term, as applicable, the implied volatility derived from a traded option with a similar term would be the most relevant. However, if there are no traded options with maturities that are similar to the share option's contractual or expected term, as applicable, then the staff believes Company B could consider traded options with a remaining maturity of six months or greater. However, when using traded options with a term of less than one year, the staff would expect the company to also consider other relevant information in estimating expected volatility. In general, the staff believes more reliance on the implied volatility derived from a traded option would be expected the closer the remaining term of the traded option is to the expected or contractual term, as applicable, of the employee share option.

SEC SAB 107 Page 24

The staff believes it may also be appropriate to consider the entire term structure of volatility provided by traded options with a variety of remaining maturities. If a company considers the entire term structure in deriving implied volatility, the staff would expect a company to include some options in the term structure with a remaining maturity of six months or greater.

SEC SAB 107 Footnote 49

The staff believes the implied volatility derived from a traded option with a term of one year or greater would typically not be significantly different from the implied volatility that would be derived from a traded option with a significantly longer term.

SEC SAB 107 Footnote 50



INTEREST RATE

The Federal Reserve provides the constant maturity Bond Equivalent Yield (BEY) rates for “on-the-run” US Treasury securities. We should convert these rates into continuously compounded equivalent rates as required by the option pricing models. The risk-free interest rate for the expected term should be interpolated from the yield curve.

REFERENCES

Accounting Standards Codification™ (ASC) 718 Compensation – Stock Compensation. Norwalk, CT: Financial Accounting Standard Board (FASB). Available at http://asc.fasb.org/topic&trid=2228938&nav_type=left_nav&analyticsAssetName=left_nav_to_pic

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