

Measuring Equity Volatility for Closely Held Company Securities

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Valuation analysts may use option pricing models to estimate the fair market value of stock options. This discussion focuses on the implied volatility estimate within the Black-Scholes-Merton (BSM) option pricing model. Specifically, this discussion (1) highlights the procedures that valuation analysts may use to estimate implied volatility, (2) observes the impact that implied volatility has on stock options for closely held companies, and (3) addresses factors that can change that implied volatility.

INTRODUCTION

There are many nonmarketable stock options issued by companies with shares that are publicly traded. Incentive stock options issued to employees is one example.

The fair market value of the stock options may be needed for any one of a variety reasons, including the following:

1. Dispute resolution
2. Gift and estate tax
3. Transactions
4. Financial accounting requirements

The measure of volatility has an important impact on the fair market value of those derivative securities.

The fair market value of a stock option takes into consideration the relationship between:

1. the observable price of the underlying security and
2. the rights associated with the stock option.

Volatility is a measurement of the risk of owning the security. Volatility measures the magnitude of spread, both positive and negative, in observable historic stock prices during a given period of time.

Higher volatility means that the value of the security underlying the derivative is expected to fall within a wider range of values in the future when the rights under the derivative may be executed.

Higher volatility means that the price of the security can change dramatically over time in either direction. A lower volatility means that a security's value does not fluctuate dramatically but, instead, the security's value is expected to change within a narrow range.

When all else is equal, a derivative on a security for which investors expect highly volatile trading prices is more valuable than a derivative on a security with low expected volatility.

Many types of options to buy a security (a call option) or to sell a security (a put option), along with the underlying security itself, trade on organized exchanges such as the Nasdaq or the New York Stock Exchange.

To decide whether the observable trading price of the option is favorable or not, investors can compute the prices of an option by applying an options pricing model such as the Black-Scholes-Merton (BSM) option pricing model.

When the stock options are issued by a closely held company, the analysis is even more complicated. This discussion summarizes some of the factors that analysts should consider when estimating the

volatility factor to be used to estimate the fair market value of derivative securities issued by closely held companies.

THE BLACK-SCHOLES-MERTON OPTION PRICING MODEL

The BSM option pricing model is commonly applied by valuation analysts to estimate the fair market value of stock options for closely held companies.

The BSM is composed of five factors:

1. Time to expiration
2. Option exercise price
3. Risk-free rate
4. Current price of the underlying security
5. The implied volatility

In this discussion, we assume that the appropriate inputs for all of the factors are known, including the price of the closely held firm's stock. The focus of this discussion is on implied volatility.

Stock price volatility can be historical (i.e., based on past price fluctuations) or implied (i.e., the market's expectation of the volatility of the stock price in the future). Implied volatility helps capture the amount of excess or deficit value of an option compared to the theoretical price output.

In other words, implied volatility helps to find the difference in theoretical value and the value assigned in the market of a stock option. Implied volatility is calculated by including all of the other inputs: stock price, strike price, risk-free rate, days to expiration, and the market price of the option.

Then, the analyst solves for the isolated variable of implied volatility. The implied volatility component of the BSM is a forward-looking variable and is readily accessible for publicly traded companies. It is noteworthy that this form of measured volatility is not certain.

Although it is based on historical performance, being a forward-looking measure, it must be considered a proxy and not an absolute parameter. Due to the infrequent trading activity of closely held companies, implied volatility is unavailable.

There are existing procedures that can assist valuation analysts in solving for the implied volatility of a closely held stock option. However, these procedures should be used in accordance with the changing circumstances presented in each case.

One procedure used by analysts when estimating implied volatility of a closely held business stock is analyzing the volatility of guideline publicly traded companies (GPTCs).

There are three procedures that are often used when analyzing GPTCs:

1. Review and analyze the volatility that each GPTC reports in its SEC Form 10-K.
2. Calculate the historical volatility of the stock prices for the GPTC.
3. Analyze the implied volatility in the GPTC stock options.

GPTC search criteria should be as comparable to the subject interest as possible. If comparable GPTCs are identified, the estimated implied volatility for the subject interest should be reasonable.

There are factors that increase the volatility of closely held stock, and there are factors that decrease the volatility of closely held stock. Closely held stocks are typically smaller and do not have the same access to capital as their GPTC counterparts.

Feasible access to capital encourages funding for new company projects, ultimately leading to increased profitability when utilized effectively.

Generally, smaller companies have fewer operating locations, resulting in a smaller geographic footprint. These factors are typically associated with a higher cost of equity for closely held companies, because of the increased risks a smaller, non-publicly-traded company experiences when compared to GPTCs.

Furthermore, a greater cost of equity generally is characterized by greater volatility of returns,¹ demonstrating the effect of uncertainty among shareholders.

There are factors that can lessen the stock volatility of a closely held company relative to GPTCs. Closely held stock may not be influenced to the same degree by the macroeconomic forces that can change the stock prices of the GPTCs.

For example, a closely held company may not have as much of a geographic footprint when compared to the GPTCs. Now consider a change in monetary policy in a foreign country where the closely held business *does not* operate, but the GPTCs *do* operate.

In this example, the foreign central bank employs an expansionary plan for the economy. One of the by-products of an expansionary policy is a decrease in interest rates.

A decrease in interest rates makes an economy less attractive to investors because of the lack of return investors can earn on domestic bonds.

As a result, foreign investors pull their money out of that country in search of higher returns. As direct investment in the foreign country decreases, the value of the country's currency decreases.

A decrease in the foreign currency in countries in which the GPTCs operate would affect the GPTC stock price. This is because the decrease in foreign currency value would relatively increase the GPTCs price for inputs for the goods it produces in that country.

The closely held company remains relatively unaffected by this macroeconomic change because it does not operate within the foreign country's boundaries and is not subject to the increased price of inputs.

Since GPTCs are often subject to frequent trading and macroeconomic changes due to their interconnectedness to the economy, investors may require a higher return.

Closely held companies may not be as connected to the macroeconomic environment; in this case, investors may not require a higher return to compensate for their level of risk.

Exhibit 1 further illustrates how a change in macroeconomic events can affect the stock prices of GPTCs—in this case, the United Kingdom vote to leave the European Union (EU) on June 24, 2016.

Exhibit 1 compares the closing prices and daily percent change from the Dow Jones Industrial

Average (DJIA) and a selected group of financial services stocks: Wells-Fargo & Company (WFC); Citigroup, Inc. (C); U.S. Bancorp (USB); Bank of New York Mellon (BK); and SunTrust Banks (STI).

The EU referendum affected many companies. However, the financial services industry was heavily influenced. In the United States, a low federal funds rate and low government bond interest rates have affected the ability for banks to improve their profitability from their net interest spread in recent years. Therefore, these financial institutions have invested elsewhere in the markets.

As a result of the referendum, many financial institutions will be forced to terminate and relocate thousands of jobs to adhere to new regulations. This type of example would increase the stock price volatility of GPTCs relative to a smaller, non-publicly-traded company.

In this case, a valuation analyst may need to decrease the implied volatility estimate of the closely held stock option.

Macroeconomic events do not always bear as much influence on closely held business stock. When purchasing a closely held stock, there may be adjustments leading up to the purchase price.

However, these adjustments result from the subject interest's historical performance, not solely based on economic news events. This suggests that the stock price of closely held businesses should be less volatile than their GPTC counterparts.

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Exhibit 1 Daily Index Value Change

Date (2016)	Dow Jones Industrial Average		Financial Services Companies (WFC, C, USB, BK, STI)	
	Closing Price [a]	Daily Change (percent) [a]	Average Closing Price [b]	Average Daily Change (percent) [b]
June 22	17,780.83	-0.3	42.66	-0.1
June 23	18,011.07	+1.3	43.87	+2.9
June 24	17,400.75	-3.4	40.88	-6.9
June 27	17,140.24	-1.5	39.18	-4.2

[a] Source: Yahoo Finance.

[b] Calculated by authors – average of WFC, C, USB, BK, and STI. Individual closing prices and percentages from Yahoo Finance.

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Fundamentally, estimating stock option volatility for a closely held business is subjective. A higher required return for closely held businesses compared with GPTCs commonly reinforces a higher level of implied volatility.

However, lower volatility tends to materialize when additional factors, which have a lesser impact on closely held companies, are introduced.

Once the valuation analyst determines an acceptable GPTC estimate for implied volatility, the analyst applies the estimate in the BSM for the closely held business stock option.

However, given the fundamental differences between GPTCs and closely held businesses, the analyst should apply professional judgment when considering the final implied volatility estimate.

An analyst may consider the closely held company geographic footprint in the market it serves, the reactivity to macroeconomic news events, and access to capital compared to the GPTCs.

This is by no means an exhaustive list—many other factors may change the implied volatility estimate. The analyst should be aware of these potential influential factors and apply them on a case by case basis.

Essentially, when selecting a closely held implied volatility estimate, valuation analysts apply professional judgment in relying on GPTC implied volatility data.

Note:

1. Aaron M. Rotkowski, “Estimating Stock Price Volatility in the Black-Scholes-Merton Model,” *The Value Examiner* (November/December 2011).

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