WorldatWork journal
Fourth Quarter 2017

Is Black-Scholes Always the Right Option?

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After years of falling out of favor — due to both the financial crisis and proxy advisers considering them non-performance based — companies are once again considering the use of stock options to motivate and reward their executives and employees. Stock options are one of the best long-term incentives to encourage growth and create a longer-term orientation to executive compensation programs. Stock options also fill a hole in contemporary long-term incentive designs and can be effective in creating additional alignment with shareholders. However, stock option values can be volatile, and companies need to be thoughtful about how awards are calibrated.

In most contexts, the Black-Scholes model, which is the most common model used to determine the fair price or theoretical value of a stock option for accounting purposes, appears to work well for determining how many stock options to award to individual recipients as part of an incentive compensation package. Using the Black-Scholes value also makes sense on the surface: The value of the options is aligned with the accounting cost and the option awards can be calibrated on an

apples-to-apples basis across companies. Indeed, the majority of compensation surveys rely on Black-Scholes to value options and nearly all publicly traded companies use the model to report the value of equity that they are granting to their senior executives. What's not to like?

POTENTIAL ISSUES WITH THE BLACK-SCHOLES MODEL

The potential issue with using the Black-Scholes model is that the range of outcomes can be extremely broad. For example, among the companies in the S&P 100 that grant stock options, the multiple of options to full-value shares needed to deliver the same target value ranges from almost 2:1 to more than 10:1 — and this is among a sample of just 51 companies. (See Figure 1.)

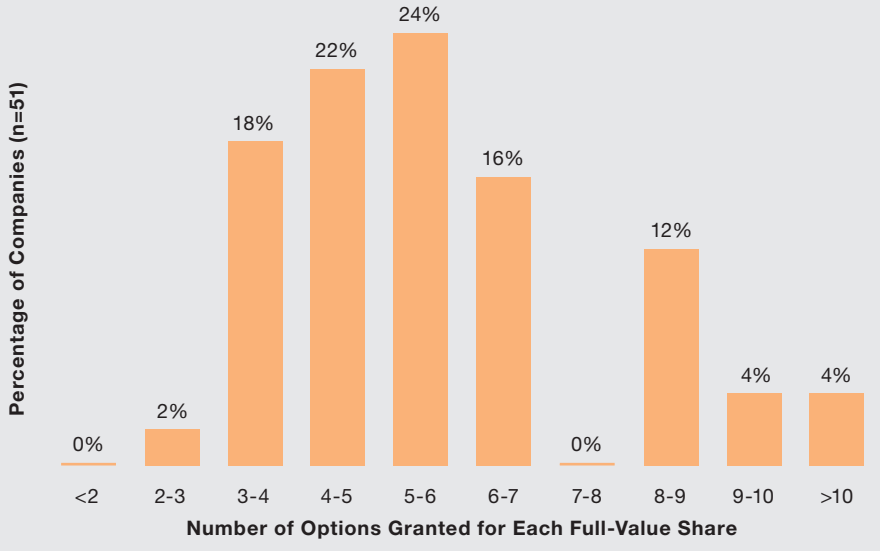
So why does this range of outcomes matter? As a practical matter, the greater the ratio between full-value shares and stock options, the greater the equity plan's leverage to the share price. In other words, executives at different companies will have different levels of rewards for the same level of performance. As shown in Figure 2, an executive at a company with a 3:1 ratio and an executive at a company with a 10:1 ratio can experience more than a $1 million difference in realizable value for the same grant value and same level of company performance over a five-year period.

These are big differences in the actual value realized from the same original accounting grant value and the same performance.

DRIVERS OF BLACK-SCHOLES

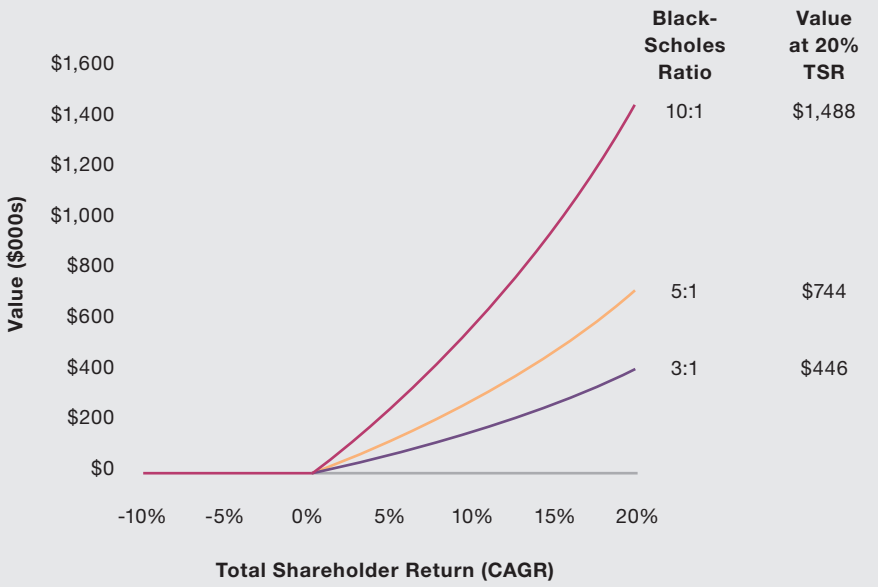
The key questions are: 1) Why do companies have such different Black-Scholes values and 2) Are these differences appropriate? The answer to these questions

FIGURE 1 **S&P 100 Stock Option to Full-Value Share Conversion**



Source: Semler Brossy Consulting Group

FIGURE 2 Value of a $100,000 Option Award (Black-Scholes Value) After 5 Years



depends on the driver(s) of the disparity. Table 1 shows a number of key factors that drive the Black-Scholes model.

Some of these inputs are unlikely to be very different between companies. For example, nearly all companies grant stock options with an exercise price equal to the market price on the date of grant (and it is the ratio between these inputs that drives the Black-Scholes ratio). And the "risk-free rate" is generally directly linked to the interest rate on U.S. government bonds, which will be effectively the same across companies.

However, other inputs will differ across companies, and these differences have a real economic impact on the value of the options. For example, if a company has

TABLE 1 Key Drivers in the Black-Scholes Model

An increase in:	Has the effect on the Black-Scholes value:	Because:
Exercise price relative to grant price	↘	Requires price growth before value can be realized
Volatility	↗	Broader distribution of potential stock price returns
Dividend yield	↘	Option holders do not participate in dividends
Expected term/ holding period	↗	More time to realize potential stock price growth
Risk-free rate	↗	Higher opportunity cost

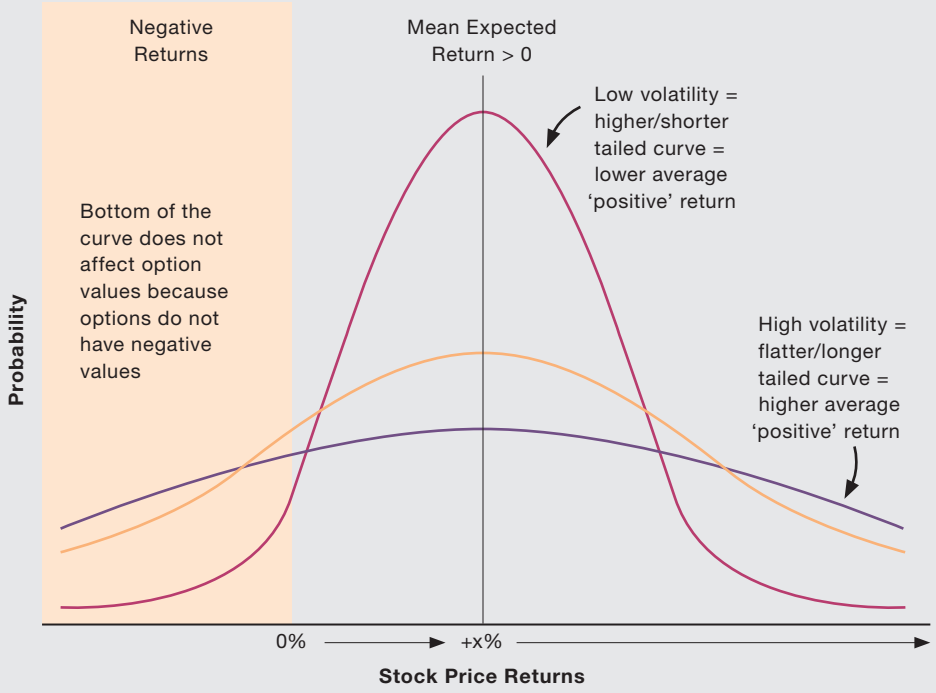
a large dividend yield, the options will be worth less because option holders do not participate in dividend distributions until the options are exercised. This has a real and potentially material impact on the participant's expected return. Likewise, a longer option term gives the participant even more time to realize the benefit of the option and future share price growth, which increases the value of the options.

On the other hand, if the difference is caused by the volatility assumption, it is not readily apparent that there is an economic difference that should affect the pay-for-performance relationships among different companies. Volatility is a measure of the degree of expected variance in share price returns over time — in other words, how much the stock price is expected to swing up or down from day to day. High-volatility companies will have higher highs and lower lows than lower-volatility companies. So why should a company with high volatility have a higher Black-Scholes value?

To understand this impact, one needs to conceptually comprehend how the Black-Scholes model works. The model is predicated on the belief that the stock market returns over time will follow a normal distribution. A higher-volatility company will have a broader distribution of returns (a flatter, wider curve), while a lower-volatility company will have a narrower distribution of returns (a narrower, higher curve). This relationship is illustrated in Figure 3.

Since stock options only value the positive appreciation of the stock and ignore any decreases in the stock price below the original exercise price, high volatility stocks will have more, larger positive observations than lower volatility stocks,

FIGURE 3 Distribution of Expected Future Stock Price Returns



while the correspondingly larger negative returns of high-volatility stocks don't count for the purposes of Black-Scholes.

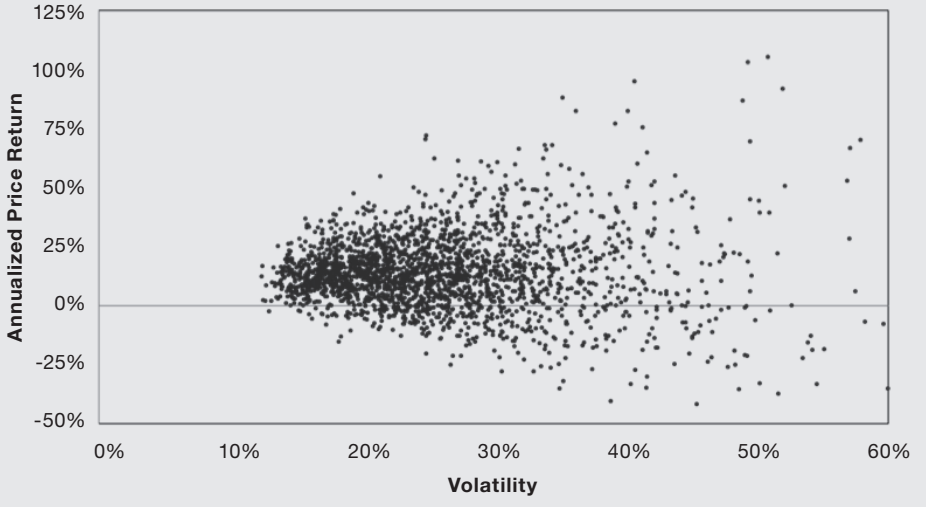
Volatility in Practice

Across a wide range of companies, the relationship between volatility and stock price returns works out as expected under the Black-Scholes model. Figure 4 illustrates this relationship for the S&P 500 for the past five rolling three-year cycles (most recent cycle ending Dec. 31, 2016). The resulting plot is a fairly close approximation of a normal distribution. Higher-volatility stocks do have greater positive stock price returns than lower-volatility stocks, on average. They also have bigger negatives — but those don't count in measuring the value of options.

When considered across industries, this result also has a strong economic logic. High-volatility companies tend to be in high-growth, very competitive industries such as technology — where the opportunities to create real value for shareholders are high, but so are the risks. Lower-volatility companies are in more stable and lower-growth industries, such as many manufacturing or consumer products businesses. Here, the opportunities to create shareholder value certainly still exist, but at a much lower level than a tech company. So options should be worth more in a tech company than in an industrial company.

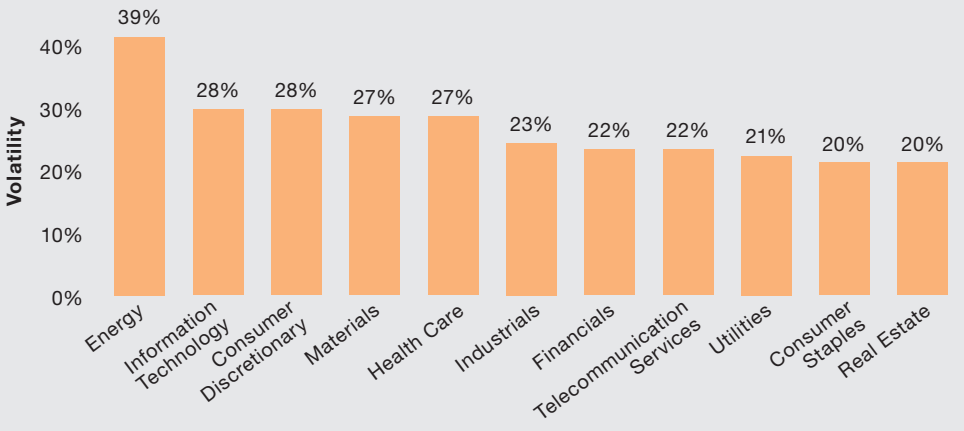
However, this relationship starts to break down when looking at a smaller group of companies or even within companies in a single industry. For example, in the Global Industry Classification Standard's (GICS) "Consumer Discretionary" companies, there is no discernable relationship between volatility and stock price returns (S&P 2016). (See Figure 6.)

FIGURE 4 S&P 500 Stock Price Return vs. Volatility (Past Five Rolling Three-Year Periods)



Source: Semler Brossy Consulting Group

FIGURE 5 Average S&P 500 Stock Price Volatility by GICS Sector (Three Years Ending Dec. 31, 2016)



Source: Semler Brossy Consulting Group

Why Does All This Matter?

These differences in volatility can have a material impact on the value of stock options as determined by Black-Scholes, and the relative differences in grant levels are further exacerbated at lower volatility levels. When the volatility input is more than 30%, a 1% change in the assumption results in less than a 4% change in the number of stock options awarded. When the volatility assumption is less than 20%, a 1% change in the assumption can change the number of options granted by 7% or more. This is a fairly large swing in the number of options granted for relatively small changes in the inputs, especially when it is not clear the assumption has a material impact on the long-term wealth creation opportunity for the participant.

FIGURE 6 S&P 500 Consumer Discretionary Companies' Stock Price Return vs. Volatility

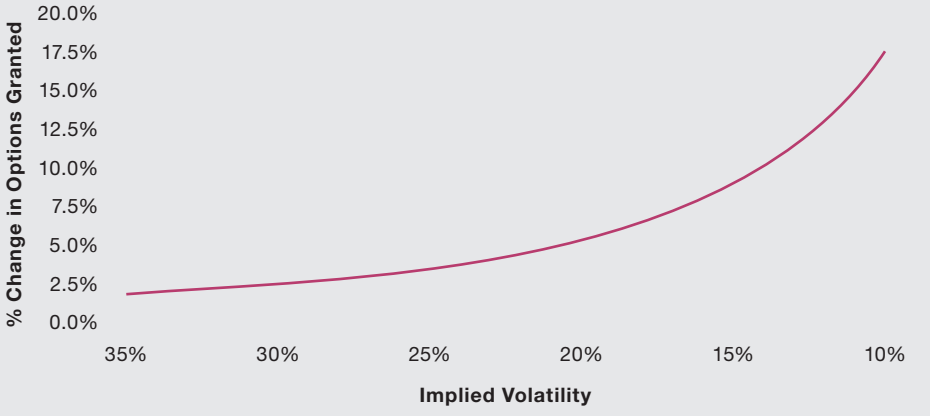
Source: Semler Brossy Consulting Group

When setting pay, companies generally do not benchmark pay levels against the entire market or across industries — where differences in volatility represent a real difference in the economic opportunities for managers to create value for their shareholders. Instead, companies use a subset of companies — either through general industry survey data or a defined peer group (competitive market) generally within their own or similar industries. Pay levels are then determined based on an assessment of pay and performance expectations relative to the competitive market. When stock options are used, companies then generally take the target grant value and determine the number of stock options to grant using the Black-Scholes values.

If companies use this approach and there are material differences in the Black-Scholes values, there may be a significant disconnect in the level of pay delivered to employees relative to the competitive market, even for the same level of target pay and stock-price performance. Further, if these differences are driven mostly by the volatility assumption, then these big differences in Black-Scholes may not reflect any real underlying economic differences between companies. Does one company truly have less opportunity to create value for shareholders than another company in the same industry just because their historical stock price volatility has been lower? Probably not. But the executives of this company could end up being paid much more — for the same performance — just because of this somewhat arbitrary input into the Black-Scholes model. In the earlier example, the difference was greater than $1 million for the same level of performance, simply due to differences in starting Black-Scholes values.

Note that the other most common valuation model for stock options (the binomial model) suffers from many of the same issues — volatility continues to be a major input, so one cannot avoid these problems by changing models.

FIGURE 7 Volatility and % Change in Options



Source: Semler Brossy Consulting Group

What Can Companies Do?

When a company's Black-Scholes value materially differs from the Black-Scholes values at competitor businesses, the authors recommend that the company step back to understand why the differences exist. Companies should understand if the differences are driven by real economic drivers or by arbitrary accounting assumptions that may not meaningfully reflect the economic realities of the company's business or industry dynamics. If the former, the calibration mechanism is probably appropriate and no further action is needed. If the latter, companies need to determine what to do. Often an adjustment from a pure Black-Scholes calculation could be appropriate.

Specific alternatives include:

- Continuing to use Black-Scholes. Even if there is a potential disconnect, companies may want to stay the course and use the predominant practice.
- Switching to a peer-based assumption. Companies can plug in a peer-based assumption (e.g., median volatility) in order to limit distortions relative to market. This allows for the real economic drivers of stock options — term and dividend yield — to drive the relative differences in Black-Scholes values.
- Adding a floor and/or ceiling. Companies can allow the Black-Scholes value to fluctuate while identifying specific levels above or below which the ratio cannot go.
- Switching to a fixed ratio. Companies can move away from assumptions altogether and instead create a fixed ratio (e.g., 5:1) that is used to calibrate awards each year.

The Coca-Cola Co. is an example of a business using a floor and ceiling approach. The following was disclosed in its most recent proxy statement:

When determining the number of stock options awarded, a Black-Scholes value is first calculated and, beginning in 2015 and continuing in 2016, a floor and ceiling are applied based on a 30-day average stock price. This stock option "guardrail" increases predictability, helps manage the burn-rate commitment and is intended to mitigate against excessively high and low Black-Scholes values. For stock option grants in 2016, the low end of our guardrail was used, which valued options at 20% of the 30-day average stock price. This resulted in fewer stock options actually being granted than the pure Black-Scholes model would have suggested (Coca-Cola 2017).

Another example of a business that uses a fixed ratio is the Monsanto Co. The following was disclosed in its most recent proxy statement:

60% (of the target LTI value) was converted to a number of stock options by dividing the dollar amount by the estimated Black-Scholes value of our stock on the Oct. 26, 2015, grant date (estimated at 40% of the fair market value of a share of the stock on the grant date consistent with long-standing practice) (Monsanto 2016).

Note that using any calibration methodology other than the calculated Black-Scholes value will create a disconnect between the target value and the actual grant date fair value that a company is required to report. This means that a company's actual accounting expense will be higher or lower than intended.

For the named executive officers (NEOs), this approach has implications for the numbers reported in the proxy statement and the associated compensation discussion and analysis (CD&A) text. Continuing with the Monsanto example, the target stock option value as described in the CD&A is about 75% more than the value disclosed in the Grants of Plan Based Awards Table because a fixed or estimated Black-Scholes was used to calibrate the award, instead of the actual value. While a change to the calibration mechanism may be appropriate, it is important that the implications of such a change are fully vetted and understood before any decision is made.

SUMMARY

Stock options can be an effective tool to align executives with shareholders over the long term, if calibrated properly. When a company has a materially different Black-Scholes value from the competitive market, it is important to understand what is driving the differences to ensure this disconnect is appropriate. In most cases, using Black-Scholes to calibrate awards remains a reasonable approach, but at the extremes, Black-Scholes may not always be the right option.

AUTHOR

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