

Avoiding Distortion When Using An OPM to Allocate Value

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In a recent BVU article, Walling and Moore noted some of the problems that emerge when valuation professionals apply Black-Scholes option pricing models (OPM) to allocate value to multiple classes of equity securities.¹ They note that the lognormal distribution assumptions underlying the OPM model are often violated and may lead to over-allocation of value to common stock. Their conclusions have been challenged by Beauchene and Ghaidarov, who argue that the OPM's reliance on a lognormal distribution actually provides a good fit to empirically observed data.² This exchange of views points to one of several issues that arise in the use of an OPM in connection with the valuation of private company equity securities.

In this article, we focus on a different issue associated with applying the OPM approach— choosing the proper term for the option. The relevant AICPA Practice Aid³ recommends that the term used for the hypothetical options in the OPM should equal the estimated time to an exit event. Our

experience indicates that when that standard is applied, the OPM approach is likely to overvalue lower priority equity claims (such as common stock) by failing to include the impact of anticipated future dilution. Given that specific facts associated with the future dilution are difficult to predict, we believe that a better approach is to set the term to equal the expected time to the next equity financing event (assuming it is likely to occur prior to an exit).

Allocation vs. Valuation

The OPM approach is frequently applied in valuing early-stage companies with multiple classes of equity. The OPM has the advantage of modeling in detail the claims of different classes of stock, including liquidation preferences, participation rights, and preferential rankings. It also has the practical advantage of requiring only a small number of inputs. One is the market value of the company's total equity, which can be estimated using standard business valuation methods. The only other inputs required are information about the claims of different classes of stock (which are obtained from the cap table and the company's Articles or Certificate of Incorporation), the risk free interest rate, an estimate of volatility, and the expected term or duration of the option.

The use of the OPM to allocate a pre-determined total company value among different classes of stock, however, involves a fundamental divergence from the standard application of Black-Scholes. The Black-Scholes option pricing methodology was developed to *estimate the value* of an exchange-traded option. In contrast, the OPM uses Black-Scholes to *allocate a pre-determined value* among equity classes, with the allocation resulting in a zero-sum transfer from one class of stock to another.

- 1 Scott Beauchene and Stillian Ghaidarov, "Lognormal Distributions vs. Empirical Observation -- a Defense of the Option Pricing Method", *Business Valuation Update*, Vol. 16, No. 3, March 2010.
- 2 James Walling and Cindy Moore, "Does Black Scholes Overvalue Early Stage Company Allocations?", *Business Valuation Update*, Vol. 16, No. 1, January 2010.
- 3 *Valuation of Privately-Held-Company Equity Securities Issued as Compensation*, ("AICPA Practice Aid"), the American Institute of Certified Public Accountants ("AICPA"), 2004.

This distinction between *valuation* and *allocation* requires us to rethink the nature of the option that is being valued using the OPM and the implications for determining the appropriate term of the option. The OPM allows one to take into account potential time value for different equity claimants. It also recognizes that future gains are distributed based on the hierarchical payoff structure embedded in the company's capital structure and that the values of those claims (expressed in a "payoff matrix") are likely to grow disproportionately to one another over time as the value of the company changes.

This theoretical construct causes the selection of the proper term to use in the OPM to become a high impact decision, and it creates a potentially important distinction between the term that is appropriate for *determining value* and the term used to *allocate value*. It is our view that the appropriate measuring stick for the term should differ for each purpose and particularly for early stage companies. In the case of using a transaction in the company's equity to *determine value* (e.g., when using an OPM "back-solving" approach), the appropriate term to use is the investor's investment horizon—the length of time until an exit is expected to be reached and the potential investment return will be realized.

For *allocation of value*, on the other hand, we believe the appropriate term is considerably shorter (except in those infrequent instances in which an exit is imminent and its timing can be reliably predicted). Allocation of value in an OPM can only apportion today's market value of equity among existing claimants. If the term extends beyond another equity financing event, the pre-financing OPM payoff matrix will not incorporate the new or modified claims that arise from the latest financing. Therefore, the OPM allocation will overstate the value of the pre-financing claims.⁴ In our view, the most theoretically appealing choice for selecting the term for allocation purposes is the period of time until a new equity financing

is expected. Any longer period of time is highly speculative since it assumes not only highly volatile and uncertain future prospects for the firm, but also unknown dilution that will result in the redistribution of total value among equity claimants, including those that are added to provide additional financing in the future.

The choice of the OPM term has direct implications for the allocation of value if the relative values of each "slice" of value are changed. As the term increases, the value of out-of-the-money call options rises faster than deep in-the-money call options. The relative increase in value has to do with the time value of the option. The longer the term, the greater the chance that the company will achieve favorable results and the option can be cashed in for greater value.⁵

Consider two options: one in-the-money and one out-of-the-money. As an option is increasingly in the money, the time value approaches zero and is intrinsic. In this situation, an increase in the term has little impact on the value of the option. Conversely, for an option that is well out-of-the-money, the option has no intrinsic value; it has only time value based on those possibilities occurring in the future where the option is in the money and has some intrinsic value. In this case, the longer the term, the more value that option gains.

In the context of the OPM model, the more out-of-the-money slices of value will rise in value at a faster rate than those that are closer to being in-the-money. Thus, by construction, those equity claimants whose claims are more in-the-money (i.e., those with liquidation preference claims) have smaller proportional time value gains compared to those farther down the priority list. Since the OPM is a zero sum game when used to allocate value, this implies that the longer the term

4 In other words, the new financing extinguishes all of the pre-financing "options" and replaces them with a new set of options that take effect when the financing closes and incorporates all post-financing claims to value.

5 The increase in value is the result of the truncated set of outcomes. The value of the option cannot go below zero; so in bad states of the world, the values of those outcomes are at worst zero. A value of zero results in an asymmetric result—options gain from good states of the world and in rare occasions where the company is extremely successful but the options do not suffer equally in the event of the company falling faster than expected since the value cannot fall below zero.

the more the value is shifted away from higher priority claims to lower priority claims.

Going the other way, as the term approaches zero, the allocation is essentially equal to what each class of equity would receive if the current MVE were to split up immediately based on their priority and rights (referred to as the “Current Value Method” in the AICPA Practice Aid). Compared to other allocation methods, the Current Value Method typically yields the lowest value to the common stock because the full amount of liquidation preference is allocated off the top to the preferred stockholders before to the common stock. In contrast, an OPM allocation typically allocates an amount equal to less than 100% of liquidation preference to the preferred stock, leaving more for allocation to the common stock.

This artifact of the model puts the option term at the center of the allocation problem. A longer term implies that there is more upside potential since the firm has a longer period over which to achieve success. With a longer term, it is expected that, in the event of a highly successful outcome at the end of the road, all equity holders will benefit. However, on a *proportional* basis, those with claims that currently are well out-of-the-money will have a proportionally larger increase in value than those that already have some intrinsic value. Thus, a longer term will tend to increase the value allocated to the common stock relative to other classes of equity.

Choosing the Appropriate Term

The AICPA Practice Aid suggests that the term should be measured as the interval of time from the valuation date to the time the company enters an exit window. The most common definition of “exit” is the occurrence of an IPO, sale of the company, or liquidation of the company. All of these events either liquidate the investor’s investments or provide the investor with a liquidation option (following an IPO, the investor has the option to sell the stock or continue to hold it).

In determining the appropriate term, two types of uncertainty must be considered. The first type is

survivor risk: will the company survive until the eventual exit that is being used to estimate the option term in the Black-Scholes model? The second type is dilution risk: will the company’s capitalization structure remain static throughout the assumed option term, or will additional equity be issued before the end of the assumed term, thereby changing the allocation of value among equity classes?

Future dilution risk poses a serious challenge to the application of OPM. Unless the OPM is modified to incorporate the impact of new shares of issuances on the cap table—requiring assumptions about the size of the investment, the ownership purchased, priority, and rights assigned to the shares (as well as potential refreshing of the option pool)—the OPM implicitly assumes that the future benefits are shared only by the current equity claimants. When future dilution is likely, this assumption is false and results in a bias to overvalue the existing shares with low priority claims—particularly common stock.

Overcoming this weakness of the OPM model requires one of two approaches. First, the term can be limited to the time remaining until further dilution is expected. This amount of time can be quantified by examining cash flow projections and calculating the point in the future at which a new financing round is likely to be required. The second approach requires estimating the impact of future investments on the value of current claims by incorporating claims of future investors over a term that extends until an exit event is expected to occur.

In our view, the less speculative approach to the future dilution issue is to define the term as the period until the likely timing of the next equity financing event. It is arguable that this is also the time to one of the potential exit events, when the company is running out of money and may experience an exit in the form of a shutdown or liquidation. This approach has the benefit of reducing the speculative and potentially distorting element that is implicit in using a longer term in the Black Scholes model. For example, the estimated time to other types of exit, such as the sale of the company or an IPO, requires estimating likely dilution. We would also suggest that in

most cases, estimates of the timing of the next financing event are inherently less speculative than predictions regarding the timing of an exit.

The time to next financing assumption also has the advantage of consistency with the real-world behavior of venture capital markets. Typically, in the early stages of company development, the time between financing rounds is shorter, the amounts invested are smaller, and the potential changes to the cap structure are more uncertain. There is far more uncertainty about future prospects, leading investors to be more cautious about the amount of capital to put at risk until the company's demonstrated progress increases the likelihood of success. This behavior, therefore, suggests that a shorter time horizon is relevant for evaluating the company's prospects.

Conclusions

The OPM model offers a useful tool to valuation professionals when valuing private company equity securities. However, indiscriminate adherence to the literal AICPA Practice Aid guidance related to the OPM term may yield dubious common stock values under some circumstances. Increasing the length of the term past the expected date of the next financing round may artificially inflate the value allocated to lower-priority classes of stock and understate the amounts allocated to higher-priority equity classes. This potential for undervaluing and overvaluing different stock classes can be mitigated by constraining the OPM option term so that it does not extend beyond the time when the company is likely to cause a change in the claims to value by selling additional equity.

In our opinion, the reliability of the OPM approach when used to *allocate value* can be improved by recognizing that only reasonably foreseeable time periods and future events should be considered. To that end, a term which covers the time a company has to operate before it needs new investment is likely to be considerably less speculative in most cases. To use a longer term (to an exit), the impact of future dilution must be explicitly included, along with assumptions

about rights assigned to the resulting new claims to value.

For the reasons discussed above, we believe the distinction between purposes (*determining value* versus *allocating value*) is a valid basis for using different measures of the option term. The Practice Aid is now six years old and does not appear to have considered the issues discussed in this article when setting the standard for determining the OPM option term. Due to the increased use of the OPM approach since the advent of IRC 409A and FAS 123(R), we think the time has come to refine the treatment of the term issue in the Practice Aid.

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