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## Comment      Chris Riddell

Stock options and, in particular, equity awards broadly defined, remain an area with many unanswered questions. Why do companies use stock options (or other equity awards)? do they motivate employees; lead to greater retention? What value do employees place on equity awards? We still know relatively little about these fundamental questions. Further, in light of recent changes in accounting practices for stock options where firms are now required to recognize compensation expense at the time of the grant, as well as international generally accepted accounting principles (GAAP) standards likely coming to the United States, there are many policy issues still to be addressed such as what types of option pricing models may or should be mandated in the future.

A key reason why our knowledge is so limited in the area of equity compensation is data availability: to think deeply about issues such as those in the preceding, we require detailed information on the contractual parameters of a stock grant coupled with personnel records for a reasonable time period (e.g., long enough to examine such behavior as turnover or exercising and so forth). Locating such data is, unfortunately, far from straightforward! Hallock and Olson have done an admirable job in finding several sources of such data resulting in a series of exciting papers (also see Hallock and Olson 2007a,b).

In this chapter, the authors focus primarily on how employees value stock

options. In a separate section, they also provide a useful discussion on the wide variety of data sources that have been used for analyzing equity compensation, including the pros and cons of each. The latter will be a nice resource for researchers interested in the field. In my comment, I focus on the following: using data on employee exercising to learn about stock option valuation.

The main part of the chapter uses ten years of data from several stock grants made by a company to its middle managers as part of a stock purchase plan. This data contains the complete exercising history from this set of grants and all key contractual parameters. This is the exact sort of data that, while difficult, risky (because these attempts often do not pan out), and time consuming to compile, can lead to important insights into the role of compensation policy within the firm. The authors describe the Black-Scholes-Merton (BSM) method for option pricing, which has traditionally been the main method for computing fair value for tradeable options and show how basic exercising behavior—in particular, early or suboptimal exercising (i.e., exercising before the expiration date)—is inconsistent with BSM. Moreover, this finding comes from a sample of managers who remain with the company for the entire term of the grants. The authors then develop a framework for estimating the value of these options to employees. The key finding is that this group of middle managers valued their options at much less than the BSM value.

In keeping with the theme of the conference, and given that I only have a small set of comments on the empirical work, the main purpose of my comment is to bring some of the institutional framework up to speed with current practices in option pricing and, in particular, draw attention to how this type of data can be used to test other approaches to the valuation of stock options and other equity awards. On the latter point, it is useful to stress that (in addition to compensatory stock options) many other equity awards, including stock appreciation rights (SARs), performance-vesting awards, and phantom stock have had to be expensed since 1993.<sup>1</sup> The recent changes to the accounting of stock options, therefore, creates a level playing field for equity awards. Many practitioners are predicting that this will lead to a decline in the use of stock options and an increase in the use of other equity-related vehicles, where often the firm can be much more creative, and incentive-oriented, in the contractual parameters.

How employees value stock options is very important because for accounting purposes—including budget planning for firms because they have to issue (or buy back) new shares—we want to know what amount they have been compensated (just as with cash compensation). If, as most studies including this one have found, employees value stock options at substantially less than BSM, then stock options may be a rather expensive way

1. Specifically, since the first FAS 123 standard.

to compensate employees. Moreover, understanding how employees value stock options will surely help understand their effectiveness from a compensation policy standpoint. However, the analysis in the chapter should be framed within a more up-to-date institutional framework. Specifically, the chapter is framed solely within the context of BSM for computing fair value for equity awards. The BSM method is a simple, static, six-variable formula that is literally calculated by a single cell-Excel formula (in practice). It is referred to as closed-form given that the input variables are fixed assumptions and, therefore, cannot change over time or interact with other variables (such as exercising behavior). Most other papers in this literature, from the ones I am familiar with, do this as well because BSM has been, by far, the main method for the valuation of tradeable stock options.

While it may be true that BSM is still regarded as the workhorse valuation method, this appears to be changing. The 2004 revised Financial Accounting Standards Board (FASB) exposure draft Share-based Payments (FAS 123R), which led to the new requirement that noncompensatory stock options are expensed to the income statement at the time of the grant using a fair-value method, says a great deal more about models for valuing stock options.<sup>2</sup> To be brief, FAS 123R notes: “a lattice model is more fully able to capture and better reflects the characteristics of a particular ESO . . . is preferable and should be used if it is practical to do so.” Lattice models (i.e., binomials, trinomials) are, thus, now considered the preferred technique. Most practitioners believe lattice models (or other preferred numerical methods, such as Monte Carlo simulation) were denoted as preferred rather than mandated because the latter methodologies were—at that time—not readily available commercially and because companies may not have had the necessary data on input variables not required under BSM such as exercising behavior. I will say more on this in the following. But even a crude look through the major consulting firms that work in this area, as well as the many software packages that have emerged in the last few years, reveals that the BSM approach is quite likely on the way out.<sup>3</sup> Also, in practice, the “preferred” designation means that once firms switch, they will be essentially unable to go back. Given the current state of the practice on equity compensation valuation, it would have been a useful addition for the authors to show how their total cost calculations differ when the preferred valuation models are applied to the data. Moreover, this would distinguish the chapter from the others in the literature where multiple authors have

2. Compensatory stock options actually had to be expensed before FAS 123R, but—based on what practitioners have written in many articles in the practitioner journals—most firms avoided expensing options by making them noncompensatory with a strike price equal to the current market price (despite it being quite clear, even in job ads, that they were a form of compensation).

3. The more advanced methodologies are now very approachable with several plug-and-play Excel-based options on the market.

developed a new framework and found that employees value options at less than BSM.<sup>4</sup>

Hallock and Olson provide a very nice summary of the assumptions inherent to BSM, but a couple of additional points can be made, although it should be stressed that not all of the following issues necessarily hold to the specific case examined in the chapter. There are several reasons why employees may have undiversified portfolios that make employee stock options valuation inconsistent with standard financial theory. Clearly a key feature is that a stock option cannot be sold, but other possibilities are contractual requirements that the individual must have large holdings of the company's stock (more common for executives, however) or that such holdings are encouraged. As well, other contractual parameters such as vesting conditions (both time-based and performance-based), forfeiture of unvested or out-of-the-money options when an employee leaves, and blackout periods can also make stock option valuation more complex than standard option valuation. FAS 123R solidifies the use of more advanced methods in its recommendation on using lattice (and several other) models by noting that such approaches: (a) allows for changes in the traditional six variables over the contractual term, and (b) allows for estimates of early exercising patterns and postvesting termination over the term (thereby providing a more accurate adjustment for nontransferability). Overall, exercising behavior, in particular, is likely to be key in advancing this literature.

Hallock and Olson note that rigorously modeling turnover and exercising is a difficult step. Indeed, the expectation for employers appears to be that data on previous grants is used to simply calculate some average values for these variables. But, with this data, the authors can test not only BSM, as they have currently done, but also the preferred methods and, in particular, draw a more transparent link between their approach (which, of course, builds off of exercising behavior) and other available methods including those in the academic literature. We know, as far I can tell, very little about the interactions between market conditions, exercising behavior, and exiting the firm, but such decisions made by employees are going to be important for future option-pricing models. Moreover, a rigorous analysis of exercising and exit rates from the firm will have stronger implications for compensation policy as a behavioral lever, particularly given the prediction that FAS 123R may lead to an increased use of other equity vehicles, such as SARs and performance-vesting awards, where firms can be more creative in the terms of the contract.

There are two empirical issues in the chapter worth considering, particularly given the important policy and practitioner implications of the chapter.

4. Other related papers not discussed that interested readers can look at include Bettis, Bizjak, and Lemmon (2003), Detemple and Sundaresan (1999), and Ingersoll (2006). Interestingly, Hodder and Jackwerth (2005) find that managers who have control over the risk level in the firm value options at considerably more than the BSM amount.

First, it is unclear that restricting the sample to individuals who stayed with the firm for the duration of the contractual term is reasonable. This certainly simplifies the analysis and yields a strong test of heterogeneity in exercising behavior (because we know everyone stayed until the expiration date). But, if the model is to be taken seriously as a way employees value options, we need to, among other things, account for employees exercising “early” as a joint decision with leaving the firm.<sup>5</sup> Further, even if the model is not meant to be an option-pricing methodology itself but rather an approach for testing key assumptions of valuation methods, we simply lose too much information about employee behavior that is common in practice and often noted as central to the limitations of BSM valuation. Second, and related to the preceding point, the empirical strategy relies on there being multiple grants so that we have multiple exercising decisions (across grants) for a given employee. This is a clever approach from an econometric standpoint but is problematic from an option-pricing standpoint because firms have to calculate fair value for a single grant.

Hallock and Olson have provided a nice review piece on current issues in stock options, including a thorough review of the various data sources available to researchers; a detailed summary of the Black-Scholes-Merton method for valuing options; and, most important, a summary of some of their evidence on exercising behavior using a detailed case study of a firm and the implications of these results for how we value stock options. The latter is exactly the kind of rigorous empirical work with detailed data and contractual information from a firm that we need to move the compensation literature forward.

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5. As noted in the preceding, even practitioners will likely need to start building in simple assumptions on exercising and turnover into their valuation models. Indeed, Monte Carlo models of option valuation—now also readily available in Excel-based option-pricing software—explicitly allow for users to include such assumptions.