Why Employee Stock Options Could Be Worth Much More To The Manager Than Commonly Estimated

by

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The academic discussion of the value of employee stock options has focused for a long time on the reduced value of the employee stock option to the employee. This low value is typically attributed to market incompleteness, as the employee cannot hedge the option perfectly. However, in a recent working paper, Hodder and Jackwerth (2004) argue that employee stock options are much more valuable once we take into consideration that managers (and possibly some lower level employees, too) can actually influence the risk taking of the firm. What we find is that the manager will optimally take on risks in order to increase the value of his employee stock options.

Historically, the valuation of employee stock options started out with the Black-Scholes model which has served as the workhorse of option pricing for a long time. Early authors suggested incorporating simple adjustments to the Black Scholes formula, such as accounting for the vesting period, forfeiture, and taxes, in order to adapt the model to the intricacies of employee stock options. Nonetheless, the resulting models still hinged upon the key assumption that the manager is able to fully hedge the option position by continuously and costlessly trading in the underlying stock and the bond. It was quickly realized however, that managers are typically severely restricted in trading their own company's stock. In particular, they are often prohibited from shorting their own company's shares.

As a result, subsequent papers take into consideration the market incompleteness, due to the lack of perfect hedging, from the prospective of the manager, and explicitly specify the utility function of the manager. Typically, a power utility function with risk aversion coefficient of around 2-3 is assumed. These models then proceed to finding the certainty equivalent value (CEV) of the employee stock option. The CEV

is the exact amount of money which needs to be added to the initial wealth of the manager, in order to give the manager the same utility that he would have had through the possession of the employee stock option. So far, the assumptions are quite defensible.

Most of the existing literature completely ignores the ability of a manager to influence firm risk-taking. The few papers that allow some control stipulate that the manager will determine the balance between risky and riskless investments only once and then hold this proportion constant until the terminal date. Even those authors often realise that this assumption is somewhat counter-intuitive since managers are supposed to adjust risk through time as market conditions and firm values change. After all, one important reason for granting employee stock options to begin with is to induce the manager to take risks in line with what shareholders deem as appropriate risk levels.

Hodder and Jackwerth (2004) address this issue by setting up a discrete time model of dynamic risk-taking where the manager can choose the optimal risk-taking over time and in accordance with the current firm value. Furthermore, the manager will choose risk levels as a function of the distance to some lower barrier at (and below) which he will be fired for poor performance. We document in this more realistic setting that managers follow very rich optimal risk-taking strategies with widely varying risk levels across time and firm value. For example, they increase risk along the lower barrier, when there is little hope of rescuing the firm otherwise, while they will reduce risk taking some distance above the lower boundary, as they can still hope for gradual improvement in that situation. Even more importantly, the manager will want to increase the risk of the firm if he holds employee stock options which are somewhat

out-of-the-money, in order to have the chance of finishing in-the-money with his employee stock options.

An important implication of such managerial risk-taking is that it significantly increases the potential value of employee stock options. The existing literature often estimated the CEV value of employee stock options to be only half of the equivalent Black-Scholes value, whereas we come to the conclusion that the value of an optimally controlled employee stock option can exceed, and in certain cases double, the Black-Scholes value. A further implication is that early exercise is less desirable the more control the manager has: if control can be used to increase the value of the employee stock option through optimal risk-taking, then the manager is much more reluctant to early exercising and giving up this control.

The more realistic modelling of dynamic risk-taking by managers changes our assessment of the certainty equivalent values of employee stock options. Namely, it can significantly increase the CEV value of employee stock options and should therefore be taken into account when considering employee stock option grants and their valuation.

Literature

Hodder, James, and Jens Jackwerth (2004), "Employee Stock Options: Much More Valuable Than You Thought," working paper, University of Konstanz.