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# Discussion of "uncertainty, investment and managerial incentives" by Glover and Levine

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ABSTRACT

Glover and Levine provide an elegant framework to quantify the investment distortions created by managerial compensation. My discussion focuses on how one should model managers, on the potential endogeneity of managerial compensation, and on the macroeconomic relevance of the mechanism.



## 1. Introduction

Both the average amount and type of compensation received by chief executives have changed over the past 30 years. The average amount of executive compensation has grown significantly, largely outpacing the growth of median income. Moreover, stock grants and stock options have come to represent a significant fraction of an executive's total compensation, making it more variable and especially sensitive to the firm's stock price. These trends have been greatly debated not only through the media but also in the academic literature. A significant amount of academic research attempts to explain the changes in size and form of executive compensation. At one extreme, some researchers argue that higher pay for executives merely reflects firm growth and a more intense competition for good managers; moreover, they contend that stock options are a welcome innovation that elicits more effort from managers and focuses them on value maximization. At the other end, some researchers argue that higher pay for executives reflects "rent extraction", weak corporate governance, or directors' complacency.[2] This debate over executive compensation structure has also percolated into public policy. Lawmakers are discussing the appropriate taxation of stock options, and they are also worrying that financial incentives for executives may make them prone to "excessive" risk-taking and "short-termism". The debate on executive compensation became particularly heated following the 2008 financial crisis, and the Dodd–Frank Wall Street Reform and Consumer Protection Act, signed into federal law in 2010, took several steps to regulate this compensation. Financial firms must disclose to regulators the incentive pay of a larger set of employees, and explain how they control risk-taking. Moreover, the act mandates that all firms hold regular shareholder votes on executive compensation (at least every three years). Finally, companies are required to be ready to claw back executive pay following an earnings restatement.

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[2] See, for instance, Frydman and Jenter (2010) for a recent survey.

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Perhaps surprisingly, in light of this wide debate on managerial compensation, the vast majority of investment models still assume that the manager makes decisions so as to maximize equity value. Given the size and form of incentive compensation in the United States, it plausibly affects not only effort but also managerial decisions. For these reasons, the paper by Glover and Levine (2015) fills an important gap in the literature. In this creative and technically rigorous paper, the authors propose a tractable quantitative framework that embeds agency concerns in an otherwise standard structural model. The paper will likely be a stepping stone for further studies of how managerial incentives affect a whole range of decisions.

I start by summarizing the approach and key contributions of the paper. I then discuss the novel and interesting issues that arise in modeling managers. I next discuss the endogeneity of executive compensation structure. And finally I turn to the broader macroeconomic relevance of this line of research.

## 2. Summary

Following the seminal works of Gomes (2001) and Hennessy and Whited (2005), researchers have generated a large literature that matches structural models of firm investment and capital structure to data in a rigorous manner. As is fairly standard in this quantitative corporate finance literature, Glover and Levine (2015) start from the partial-equilibrium investment problem of a firm that operates a decreasing-to-run production function, subject to both real frictions (quadratic costs of adjusting the capital stock) as well as financial frictions (a linear cost of having negative free cash flow). This firm faces uncertainty about its future profitability, which has a standard AR(1) structure; moreover, the amount of uncertainty varies over time, i.e., the profitability process is heteroscedastic. The single decision variable here is investment, which determines dividends (or, if negative, equity issuance) as a residual given that there is no financial savings or borrowing choice. The authors then depart from the literature in an important way: rather than assuming that managers maximize equity value (the expected present discounted value of dividends), they suppose that the manager running the firm maximizes his own expected utility, which depends solely on his compensation. This compensation is a combination of fixed pay, stock grants, and stock options; and hence, it can be represented as $C(V)$, where $C$ is an increasing and convex function and $V$ is the equity value. However, the manager is assumed to be risk averse and to have a utility over his wealth, which is his compensation next period. As a result, he maximizes $E(U(C(V)))$ —where $U$ is a standard von Neumann–Morgenstern utility function and $E$ denotes expectations—instead of maximizing the "optimal" $E(V)$.

This highly tractable structure clarifies the key trade-off. On the one hand, the manager's risk aversion makes him want to take less risk (typically invest less) than a diversified shareholder would like to. On the other hand, the convex compensation may lead him to take more risk (invest more) than such a shareholder would like. Which effect dominates, then, is an empirical question. Moreover, when uncertainty increases, the firm will typically reduce investment—indeed, that would be the case if the firm were run to maximize equity value—but this effect may be stronger (if risk aversion is large) or weaker (if the compensation is highly convex) and may even go the other way, reflecting large distortions in real decisions arising from agency issues.

The paper then studies a large sample of firms in Compustat; for each individual firm, the authors measure (i) its managerial compensation contract and (ii) its volatility process. Next, the authors assume that firms share the same remaining parameters (e.g., the managerial risk aversion as well as some technology parameters) and set these parameters to match some key moments. They can then use their model to calculate the investment distortion (the difference between investment choice by the manager and investment choice that would maximize equity value) for each firm. Their results suggest that the median firm suffers from overinvestment because of the convexity of stock options, but there is a wide range of distortions across firms and across time, reflecting the wide variation of compensation in the cross-section and time-series. Typically, the overinvestment becomes less pronounced when volatility becomes large, as risk aversion eventually kicks in. This suggests that managerial risk aversion may partly explain the sharp response of investment to increases in uncertainty, which is consistent with the reduced form results of Bloom (2009) and especially (Panousi and Papanikolaou, 2012). Glover and Levine (2015) provide some independent evidence in favor of their mechanism in the form of related panel regressions (Tables 3 and 4)—and perhaps more strikingly, they show (in Fig. 5) that depending on the compensation structure, firms reacted differently to the 1998 and 2008 uncertainty crises.

## 3. How to model managers' objectives

The approach taken by the Glover and Levine (2015) is reasonable and highly tractable, and it circumvents some difficulties that naturally arise when modeling managers. This section lists some of these difficulties, that are neglected in the current approach, either because the required data are not available or because the model would become excessively complicated. To be clear, this is not meant as a criticism of their work, which I believe is overall quite plausible, but since they open the "black box" of managerial compensation and incentives, a host of new interesting issues come up.

In the paper, a contract is a triplet $\{\theta_s, \theta_o, F\}$ that specifies stock grants, stock options, and a fixed salary. While this is a good first-order description of managerial compensation, it omits some important elements such as taxes, perks, pensions, golden parachutes, and golden hellos, and might not reflect well the complicated rules that govern stock options such as vesting and clawbacks. Perhaps more significantly, bonuses, which remain an important share of managerial compensation, are not introduced, owing largely to data limitations. Another important omission is that the entire wealth of the manager is