



# Dynamic investment and capital structure under manager–shareholder conflict

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## ABSTRACT

This paper investigates the interactions between the investment and financing decisions of a firm under manager–shareholder conflicts arising from asymmetric information. In particular, we extend the manager–shareholder conflict problem in a real options model by incorporating debt financing. We show that manager–shareholder conflicts over investment policy increase not only the investment and default triggers but also coupon payments, which lead to a decrease in the equity value. Moreover, given the presence of manager–shareholder conflicts, debt financing increases investment and decreases total social welfare. As a result, there is a trade-off between the efficiency of investment and total social welfare with debt financing. These results fit well with the findings of previous empirical work in this area.

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## 1. Introduction

Modigliani and Miller (1958) argue that financing and investment decisions are completely separable in a perfectly competitive market. Since their seminal work, the corporate finance literature has studied the interaction between investment and financing decisions with various market frictions. In most modern corporations, for example, shareholders delegate the investment decision to managers, thereby taking advantage of their special skills and expertise. In this situation, asymmetric information is likely. Asymmetric information is the situation where managers privately observe a portion of the underlying state variable not observed by shareholders. Managers with private information thus have an incentive to provide false reports and then divert to themselves free cash flow. Consequently, asymmetric information leads to manager–shareholder conflicts.<sup>1</sup>

The real options model has become a standard framework for investment timing decisions in corporate finance. Dixit and Pindyck (1994) provide an excellent overview of the standard real options approach. In the standard real options model, however, there are two major limitations. First, the standard approach is within an all-equity financing framework. Second, there is no manager–shareholder conflict because the firm, by assumption, is owner-managed.

Several studies have already begun the task of *separately* incorporating either debt financing or manager–shareholder conflicts due to asymmetric information in the real options model. Dynamic models that allow for the interaction between

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<sup>1</sup> Starting with the seminal work of Myers and Majluf (1984), manager–shareholder conflicts resulting from asymmetric information have been widely discussed in static models.

investment and financing decisions include [Brenan and Schwartz \(1984\)](#), [Mauer and Triantis \(1994\)](#), and [Sundaresan and Wang \(2006, 2007\)](#). Alternatively, dynamic models under manager–shareholder conflicts resulting from asymmetric information include [Bjerksund and Stensland \(2000\)](#), [Grenadier and Wang \(2005\)](#), [Nishihara and Shibata \(2008\)](#), and [Shibata \(2009\)](#).<sup>2</sup> Under asymmetric information, shareholders must design a contract to provide incentives for managers to truthfully reveal private information. The implied investment timing then differs significantly from that in the standard full information real options model. Although these strategies turn out to be suboptimal, they reduce the shareholders' losses resulting from asymmetric information. Without any incentive mechanism that induces the manager to reveal private information truthfully, shareholders suffer further distortions.

[Grenadier and Wang \(2005\)](#) develop the agency model by designing a contract to give only a bonus to truthfully reveal manager's private information. [Shibata \(2009\)](#) extends the agency model developed by [Grenadier and Wang \(2005\)](#) by incorporating the audit technology with the penalty in order to reveal manager's private information. In the Shibata model, there are assumed to be limited-liability constraints on penalties when the manager is fined by detecting a false report with auditing. In these two models, the investment expenditure is financed by all-equity when the investment is exercised.

To our best knowledge, there has been little examination of debt financing over investment policy under manager–shareholder conflicts arising from asymmetric information. Recently, [Morellec \(2004\)](#) and [Childs and Mauer \(2008\)](#) examined the interaction between investment and financing decisions under manager–shareholder conflicts arising from managerial discretion, *not* asymmetric information.<sup>3</sup> Thus, we focus on the manager–shareholder conflicts arising from asymmetric information under debt financing. We then explore several important questions. First, how does debt financing influence the manager's investment decision? Second, how does the manager's informational advantage affect coupon payments, leverage and default decisions, and debt and equity values? Finally, how large are the total social losses with all-equity financing and debt financing?

Our paper examines the interactions between investment and financing decisions under manager–shareholder conflicts resulting from asymmetric information in a real options framework. In particular, we extend the manager–shareholder conflict problem in the real options model developed by [Grenadier and Wang \(2005\)](#) and [Shibata \(2009\)](#) by incorporating debt financing. Our paper differs from these models in two ways. First, we extend the agency model developed by [Shibata \(2009\)](#) by removing the limited-liability constraints on penalties when the manager is fined by detecting a false report with auditing. Second, when the investment is exercised, the investment expenditure is financed by debt financing.

Our paper provides several important results. First, manager–shareholder conflicts over investment policy increase *not only* the investment and default triggers *but also* coupon payments. Under the agency problem due to asymmetric information, the shareholder must give the incentive to the manager (give the manager's bonus and/or do the costly audit) to truthfully reveal manager's private information. Then these additional costs lead to the increase in the investment trigger as well as the coupon payment. Intuitively, the larger the manager's bonus to reveal private information, the larger the coupon payment via increasing the debt financing. This result is the same as in the static model of [John and John \(1994, Proposition 5\)](#). Second, relating to the above result, manager–shareholder conflicts decrease the equity value at the present time. This is because the investment trigger in the agency problem is larger than in the no-agency problem. These results are exactly the same in [Grenadier and Wang \(2005\)](#) and [Shibata \(2009\)](#). However, manager–shareholder conflicts increase the debt and equity values at the time of investment. This is because an increase in the investment trigger leads to the increase in the equity value, while an increase in the coupon payment leads to the increase in the debt value. Intuitively, the larger the investment cost is, the larger the equity value is. Also, the larger the coupon payment is, the larger the debt value is. These results are the same as those in the seminal work by [Myers and Majluf \(1984\)](#), and fit well with the findings of empirical studies (see [Korajczyk et al., 1991](#); [Jung et al., 1996](#)). Third, given the presence of manager–shareholder conflicts, debt financing leads to an increase in investment (i.e., a decrease in the investment trigger). This result is obtained by the tax benefit of debt. This is exactly the same as in the no-agency problem due to full information. We show that the tax benefit of debt is obtained even under agency problem. Fourth, given the presence of manager–shareholder conflicts, debt financing leads to a decrease in total social welfare (i.e., an increase in the total social loss). This result is obtained by the fact that the tax benefits of debt are exactly the same between both no-agency and agency problems. Thus, there is a trade-off in the efficiency of investment and total social welfare with debt financing. Fifth, the no-agency investment triggers and coupon payments can be approximated by making the penalty for a manager's false report sufficiently large. Thus, the equity (shareholder's) value in the agency problem converges to the one in the no-agency problem, as the penalty is increased without limit (although unlimited penalties are only of theoretical interest). The results for unlimited penalties are the same as in the seminal static work by [Baron and Besanko \(1984\)](#). Interestingly, however, an increase in the penalty does *not necessarily* decrease the total social loss, although it *always* increases the equity value. These results imply that a shareholder's (individual) rationality does *not necessarily* lead to total social rationality.

<sup>2</sup> While these papers focus on manager–shareholder conflicts, similar problems arise between shareholder and bondholders. [Mello and Parsons \(1992\)](#), [Leland \(1998\)](#), [Parrino and Weisbach \(1999\)](#), [Mauer and Ott \(2000\)](#), [Morellec \(2001\)](#), [Childs et al. \(2005\)](#), and [Mauer and Sarkar \(2005\)](#) examine shareholder–bondholder conflicts.

<sup>3</sup> In [Morellec \(2004\)](#), manager–shareholder conflicts are introduced by considering that the manager derives utility from both retaining control and investing in new projects. In [Childs and Mauer \(2008\)](#), they result from managerial risk aversion.

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