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Interfaces with Other Disciplines

Default and liquidation timing under asymmetric information☆

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ABSTRACT

We consider a dynamic model in which shareholders delegate the running of a firm to a manager, who observes private information about the firm's running and liquidation costs. We analytically derive the optimal compensation scheme contingent on the firm's cost structure. Information asymmetries can change the high-cost firm's bankruptcy choice and timing. Most notably, even if the liquidation value is higher than the face value of debt, the high-cost firm can choose default rather than liquidation to reduce the manager's information rent. This can lead to the counterintuitive result that the debt value increases beyond the face value as the firm approaches default, and that it jumps upward at the default time. Information asymmetries accelerate negative liquidation and delay positive liquidation, whereas they accelerate default. The optimal leverage ratio of the asymmetric information case becomes higher than that of the symmetric information case because more debt mitigates the loss due to information asymmetries. Our results can potentially account for many empirical findings.

1. Introduction

Since the seminal works by Leland (1994), Mella-Barral and Perraudin (1997), and Fan and Sundaresan (2000), many papers have investigated dynamic models of default, liquidation, and debt renegotiation. Most of the previous studies focused on conflicts between equity- and debt holders, assuming that managers completely act in the interests of shareholders. Although recent papers, such as Grenadier and Wang (2005) and Shibata and Nishihara (2010), have revealed how significantly the presence of managers' private information distorts a firm's investment decision and timing,[1] no paper has investigated the effects of information asymmetries on a firm's bankruptcy decision and timing.[2] To our knowledge, this paper is the first work that reveals the effects of information asymmetries on the bankruptcy decision and timing, as well as the dynamics of debt and equity values.

Our model builds largely on Mella-Barral and Perraudin (1997), Goldstein, Ju, and Leland (2001), and Grenadier and Wang (2005). Following Mella-Barral and Perraudin (1997), we consider shareholders who choose between default (stopping coupon payments) and liquidation (scrapping and/or selling assets along with retiring the face value of debt).[3] Following Goldstein, Ju, and Leland (2001), we also assume the trade-off between the tax shield and default costs of debt. Last and most importantly, as in Grenadier and Wang (2005), we consider information asymmetries between the manager and shareholders. Shareholders delegate the running of the firm to the manager, who observes private information about the running and liquidation costs of the firm (high-cost or low-cost firm). Shareholders offer a contract, which consists of the default or liquidation timing and compensation contingent on the firm's cost structure, to the manager so that they can maximize the ex-ante equity value. Note that the asymmetric information model

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[1] From other perspectives, Sannikov (2008), Grenadier and Malenko (2011), Morellec and Schürhoff (2011), and Delaney and Thijssen (2015) also examined corporate investment models under asymmetric information.

[2] Hotchkiss, John, Mooradian, and Thorburn (2008) state that management compensation tends to depend more on the firm's performance in a distressed firm, which implies that information asymmetries in a distressed firm are more severe than in an ordinary firm.

[3] Although Mella-Barral and Perraudin (1997) also examined the possibility of debt renegotiation, we do not consider debt renegotiation but focus on the effects of information asymmetries on the default and liquidation timing.

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approximates firms that have diffuse ownership as well as low levels of transparency and disclosure.

In the model, we analytically derive shareholders' optimal contract and then show that information asymmetries lead to many novel results, which have never been found under symmetric information. The most notable result is that the high-cost firm can default even when its liquidation value is higher than the face value of debt. This novel result is strongly contrasted with the well-known result (e.g., Mella-Barral & Perraudin, 1997) that the firm is liquidated if, and only if, the liquidation value is higher than the face value. The mechanism is explained as follows. Shareholders can cut the managerial rent regarding private information of the liquidation cost by choosing default of the high-cost firm. They can also decrease the managerial rent regarding private information of the running cost by accelerating the high-cost firm's default. If this rent-saving effect of choosing and accelerating default dominates the direct loss, i.e., the liquidation value minus the face value, shareholders choose default rather than liquidation even when the liquidation value is higher than the face value.

This distortion in the bankruptcy choice and timing also affects the debt value. First, the debt value of the high-cost firm can be higher than the face value. In other words, with asymmetric information, debt holders can receive more than the risk-less debt value. Second, the debt value of the high-cost firm can be higher than that of the low-cost firm. Although these results are counterintuitive and are quite different from findings in the previous literature, these results can lead to dynamics of market value of debt as follows: The debt value increases beyond the face value as the firm approaches default, and it jumps upward at the default time. This result can potentially provide a rationale for vulture investors' activity. As was documented in Hotchkiss and Mooradian (1997), vulture investors typically buy a large block of debt of a distressed firm, and after bankruptcy, they tend to make positive abnormal returns by controlling and selling the firm.

Another new result is that the impact of information asymmetries on the liquidation timing depends on the liquidation type. Two types of liquidation exist: positive and negative liquidation. Positive liquidation occurs primarily from the high liquidation value, and hence, the lower-cost firm, which receives the higher liquidation value, goes into liquidation earlier. Negative liquidation occurs primarily from the high running cost, and hence, the higher-cost firm goes into liquidation earlier. We show that information asymmetries delay the high-cost firm's positive liquidation while they accelerate the high-cost firm's negative liquidation. This result is contrasted with the monotonic result in the previous literature on asymmetric information (e.g., Grenadier and Wang, 2005; Shibata & Nishihara, 2010). In our model, unlike in the previous models, shareholders pay the manager two types of information rents, i.e., the rent for the running cost and the rent for the liquidation cost. Delaying liquidation decreases the rent for the liquidation cost but increases the rent for the running cost. In the positive liquidation case, the former effect dominates the latter, whereas in the negative liquidation case, the latter effect dominates the former. This is why the impact differs according to the liquidation type.

We also show that the sensitivities of the running and liquidation costs of the low-cost firm on the equity value depend on the liquidation type. Interestingly, with asymmetric information, increased costs of the low-cost firm play a positive role in decreasing managerial information rents. Increased costs improve the equity value when the positive effect dominates the direct negative effect of the higher cost. Actually, an increase in the running cost improves the equity value in the positive liquidation case, whereas an increase in the liquidation cost improves the equity value in the negative liquidation case. This equivocal result has not been seen in the previous literature on asymmetric information.

Furthermore, we show that more risky debt plays a role in reducing managerial information rents and loss due to information asymmetries. Thus, in the optimal capital structure under asymmetric information, the firm increases its leverage ratio beyond that of the symmetric information case. This result is consistent with Lambrecht and Myers (2008), who argued that risky debt can reduce the managerial rents and mitigate manager–shareholder conflicts, although their model does not include information asymmetries but rather managerial rents until bankruptcy. Several empirical studies, including Agrawal and Nagarajan (1990) and McConaughy, Matthews, and Fialko (2001), showed the positive relation between ownership dispersion and leverage.

We also show that an increased volatility tends to cause a wealth transfer from debt holders and the manager to shareholders. This result is not new but is consistent with findings in the previous literature. Indeed, asset substitution between equity- and debt holders is well known (e.g., Jensen & Meckling, 1976), whereas asset substitution between the manager and equity holders is also found in Shibata (2009) and Shibata and Nishihara (2010).

The remainder of this paper is organized as follows. As a benchmark, Section 2 presents the results under symmetric information. Section 3 shows the key results under asymmetric information. In Section 4, we discuss several implications regarding market reactions and the optimal capital structure as well as comparative statics. Section 5 concludes the paper.

2. Symmetric information

2.1. Setup

2.1.1. Firm until bankruptcy

The symmetric information model builds on the seminal works of Mella-Barral and Perraudin (1997) and Goldstein, Ju, and Leland (2001). We consider a firm that is receiving earnings before interests and taxes (EBIT) $X(t) - (w + w_i)$ at time t, where $X(t)$ is a stochastic component, and $w + w_i$ stands for the firm's running costs. We also suppose that the firm issued console debt with coupon $C(\geq 0)$ and is paying coupon C continuously. Following the standard literature, we assume that $X(t)$ follows a geometric Brownian motion:

$$\mathrm{d}X(t) = \mu X(t)\mathrm{d}t + \sigma X(t)\mathrm{d}B(t) \ \ (t > 0), \quad X(0) = x,$$

where $B(t)$ denotes the standard Brownian motion defined in a probability space $(\Omega, \mathcal{F}, \mathbb{P})$ and μ, $\sigma(> 0)$ and $x(> 0)$ are constants. We assume that the probability space is equipped with the filtration $\{\mathcal{F}_t\}$ generated by the Brownian motion $B(t)$ and assume that $X(0) = x$ is sufficiently large to exclude bankruptcy at time 0. A positive constant r denotes the interest rate, and for convergence we assume that $r > \mu$. The running costs consist of two components: public component $w(\geq 0)$ and private component $w_i(\geq 0)$. The private component potentially takes on two types: w_L $(i = L$: Low-cost firm) and w_H $(i = H$: High-cost firm), which satisfies $\Delta w = w_H - w_L > 0$.

2.1.2. Bankruptcy choice between liquidation and default

Following Mella-Barral and Perraudin (1997), we assume that shareholders choose between liquidation and default. When they choose liquidation (scrapping and/or selling of assets), the firm receives a liquidation value $\theta - \theta_i(\geq 0)$ depending on the type.[4] The component $\theta(\geq 0)$ is publicly observed, while the liquidation cost

[4] For simplicity, this paper does not consider partial liquidation, which is typically accompanied by debt renegotiation. For instance, Nishihara and Shibata (2016) examined the firm's optimal choice between full liquidation and partial liquidation with debt restructuring.