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Credit risk and asymmetric information: A simplified approach

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ABSTRACT

We present a simple model for risky, corporate debt. Debtholders and equityholders have incomplete information about the financial state of the debt issuing company. Information is incomplete because it is delayed for all agents, and it is asymmetrically distributed between debtholders and equityholders. We solve for the equityholders' optimal default policy and for the credit spreads required by debtholders. Delayed information accelerates the equityholders' optimal decision to default. Interestingly, this effect is small, implying only a small impact on credit spreads. Asymmetric information, however, has a major impact on credit spreads. Our model predicts high credit spreads for short-term debt, as observed empirically in credit markets.

1. Introduction

The risk of monetary losses due to debt issuers who do not honor contractual debt payments is commonly referred to as *credit risk* and explains the existence of credit spreads.

We present a theoretical model of credit spreads for corporate debt, where debtholders and equityholders have *incomplete* information about the financial state of the company. The information is incomplete because the true state of the issuer is only revealed with a time delay (*delayed* information). In addition, the information is *asymmetrically* distributed in cases where debtholders and equityholders observe the true state with different time delays. The model is structural, and in contrast to the seminal structural models, it predicts that also short-term credit spreads can be wide, in line with empirical findings.

A (rational) default policy describes when the equityholders (rationally) choose not to service contractual debt payments. We find that the *length* of the information delay for equityholders is not important for the default policy. The delay is therefore not important for credit spreads either. The degree of information asymmetry, however, i.e., the *difference* in the length of the information delay between debtholders and equityholders, is of crucial importance for credit spreads.

On a more general level, our paper addresses how incomplete information influences the pricing of bonds. We do not consider noisy information, only delayed information. One can always argue that noisy information in many circumstances

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is more common than delayed information. However, our main focus in this paper is on which aspects of information structures that are important to obtain realistic models of credit spreads, and not on the realism of different information structures.

One assumption of our model is that equityholders are better informed than debtholders. This assumption is based on the idea that equityholders are closer to the day-to-day operations of the company than the debtholders, and, thus, receive information earlier than debtholders. Although we can visualize cases where this may not be the situation (e.g., a company may have passive owners), we find it plausible that the best informed equityholder is better informed than the best informed debtholder. Debtholders must assess the value of the company based on less information than the equityholders, but they rationally include the observation whether the company is bankrupt or not in their assessment.

In the special case where debtholders and equityholders have complete information, i.e., there is no delay in the flow of information, our model simplifies to the classical Leland (1994) model. The current paper is also inspired by, and closely related to, the seminal Duffie and Lando (2001) model of credit risk. Our model includes continuously observed, but delayed information about the state variable, where the true state is immediately, i.e., without a delay, revealed upon bankruptcy. The model of Duffie and Lando (2001) includes noisy (accounting) information released at discrete points in time. They assume that equityholders have complete information and, thus, that only debtholders are subject to incomplete (noisy) information. Their model, as ours, includes incomplete and asymmetric information, but does not explicitly cover the case where all agents are subject to delayed information. We simplify the Duffie and Lando (2001) model by excluding noisy (accounting) information, and extend it by explicitly exposing all agents to delayed information.

The main merit of our paper is that we identify information asymmetry, and not delay, noise, or other characteristics of the information, as the important property for a simple and realistic model of corporate credit spreads. This insight also refines the results by Choi (2008), who studies some aspects of delayed information (he uses the terminology *lagged*) in a similar set-up.

Structural models were pioneered by Merton (1974). Merton models the value of a company's assets by a stochastic process and debt and equity are considered as contingent claims on total asset value. Some of the papers in this tradition include Black and Cox (1976), Geske (1977), Longstaff and Schwartz (1995), Leland (1994), and Duffie and Lando (2001). In our model the default policy is expressed by an endogenous default barrier. Giesecke (2006) analyzes two classes of models of imperfect information: (1) Models where the bankruptcy barrier is not observable to all agents.[1] (2) Models with incomplete information about the value of the company's assets. Our model belongs to his category (2), and according to his Proposition 6.4, a default intensity exists in our model. Default intensities are important for reduced-form models. These types of models were pioneered by Jarrow and Turnbull (1992), for extensions see e.g., Jarrow and Turnbull (1995), Jarrow et al. (1997), and Schönbucher (1998).[2] Papers analyzing technical aspects about credit risk and incomplete information include Coculescu et al. (2008) and Guo et al. (2009). Other issues related to credit risk are analyzed in Rosen and Saunders (2009), Huang and Yu (2010), and Azizpour et al. (2011).

Jarrow and Protter (2004) argue that the difference between structural and reduced form essentially is the assumption of what information the modeler has access to. In their terminology, a model is structural if the modeler can observe the state of the company, and reduced form if he cannot. They write (page 2): "…there appears to be *no* disagreement that the asset value process is unobservable by the market…Although not well understood in terms of its implications, this consensus supports the usage of reduced form models." Our results indicate that if different groups of agents have access to the same incomplete information about the process, the error made by using a structural model compared to a reduced form model, interpreted as in Jarrow and Protter (2004), is negligible.

The paper is organized as follows: In Section 2 we present our economic model. Section 3 presents optimal default policy and credit risk valuation. Special cases with numerical examples are presented and analyzed in Section 4. Section 5 concludes the paper and gives suggestions for future research.

2. Economic model

This section presents our model of a company with incomplete information about the credit quality of its debt. Because our focus is on default policy and debt valuation, we do not address whether debt is issued in an optimal way, i.e., whether the capital structure of the issuer is optimal or not. Our model is standard, and we follow closely the set-up by Leland (1994) and Duffie and Lando (2001).

Our model consists of two distinct groups of agents, equityholders and debtholders. In general, the two groups do not have access to the same information and there is no information leakage between the two groups. Equityholders have at least as much information as debtholders and constitute the group of *better informed* agents. The debtholders are the *less informed* agents. To rule out the possibility that debtholders extend their information set by buying equity, we (as Duffie and Lando, 2001) assume that equity is not traded. Furthermore, we assume that equityholders do not buy debt from the company because debtholders could potentially extract information from such transactions. Also, it would alter the

[1] See also Giesecke and Goldberg (2004) for more on this.

[2] Comprehensive treatments of these two approaches can be found in the encyclopedic monograph by Bielecki and Rutkowski (2002) or in the more accessible monograph by Duffie and Singleton (2003).