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Market conditions, default risk and credit spreads

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ABSTRACT

This study empirically examines the impact of the interaction between market and default risk on corporate credit spreads. Using credit default swap (CDS) spreads, we find that average credit spreads decrease in GDP growth rate, but increase in GDP growth volatility and jump risk in the equity market. At the market level, investor sentiment is the most important determinant of credit spreads. At the firm level, credit spreads generally rise with cash flow volatility and beta, with the effect of cash flow beta varying with market conditions. We identify implied volatility as the most significant determinant of default risk among firm-level characteristics. Overall, a major portion of individual credit spreads is accounted for by firm-level determinants of default risk, while macroeconomic variables are directly responsible for a lesser portion.

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1. Introduction

Credit risk and market risk are inherently linked. It has been documented that default probabilities and recovery rates vary through business cycles.[1] It is also well known that interest rates and corporate bond yield spreads fluctuate over business cycles, as aggregate and firm-level outputs critically depend on the state of the economy. For instance, Fama and French (1989) find that corporate bond yields rise when economic conditions are weak. However, these empirical findings have not been fully understood in a structural framework. In fact, traditional structural models based on the seminal Merton (1974) model have generally ignored the interaction between market risk and credit risk. Consequently, they have failed to match the levels of observed credits spreads ("the credit spread puzzle").

This paper examines the intrinsic link between market risk and credit risk inspired by recently developed structural models that directly explore the impact of market risk on credit spreads.[2] Specifically, we use individual firms' credit default swap (CDS) spreads to investigate new empirical implications from these structural models. For instance, in addition to the previously documented negative correlation between GDP growth rate and credit spreads, we show that credit spreads also increase in growth volatility as implied by these models. We further demonstrate that credit spreads decrease with a sentiment measure based on the Conference Board Consumer Confidence Index. Because consumer/investor sentiment is usually negatively correlated with the market-wide risk aversion and uncertainty about future economic growth, this result is consistent with the notion that credit spreads depend on investors' risk attitude and uncertainty about future economic prospects, as predicted by the models.

A number of existing empirical studies use yield spreads of corporate bond indices or average yield spreads within a particular rating class to characterize the dynamics of credit spreads (see, e.g., Huang and Huang, 2003). This approach may obscure the importance of firm heterogeneity and lead to underestimation of expected losses, as pointed out in Hanson et al. (2008). With aggregate credit spreads, macro variables tend to explain a big portion of their variations over time. However, when we re-examine these relations in a panel regression, we find that firm characteristics traditionally determining default risk account for the bulk of the explanatory power, while a monthly time dummy that captures the time series variation in credit spreads accounts for just about 6% of the overall variation. Much of that explanatory power stems

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[1] See, e.g., Acharya et al. (2007), Bonfim (2009), Bruche and González-Aguado (2010), Carling et al. (2007), Duffie et al. (2007) and Pesaran et al. (2006).

[2] These models include Bhamra et al. (2007), Chen (2007), Chen et al. (forthcoming), David (2008), Hackbarth et al. (2006) and Tang and Yan (2006).

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from the macro variables implied by the structural models, such as the sentiment indicator.

Recent models also provide additional cross-sectional predictions. We confirm that, across firms, credit spreads decrease with firm-specific growth rate of cash flows and increase with cash flow volatility, as predicted. More interestingly, we detect an important and time-varying role of cash flow beta, which measures the covariation of the firm-level cash flow with the aggregate output. In particular, the evidence suggests that during economic expansions, a high cash flow beta helps reduce credit spreads, while during economic recessions, a high cash flow beta may increase credit spreads. This pattern highlights the effect of the interaction between market risk and credit risk on the dynamics of credit spreads.

Jarrow and Turnbull (2000) suggest that incorporating macroeconomic variables may improve a reduced-form model of credit spreads. Duffie et al. (2007) use macroeconomic variables, such as industrial production growth, to help better predict corporate defaults. Our study represents an effort in a systematic investigation of the impact of market conditions on firm-level credit spreads in the structural framework provided by the recent theoretical models mentioned above. It also bridges the two strands of literature on credit risk that tend to focus separately on the macro and micro determinants and hence allows us to assess the relative explanatory power of macro and micro variables for firm-level credit spreads and examine the interaction between market conditions and firm characteristics.

The rest of this paper is organized as follows: Section 2 discusses the empirical implications of the recently developed models that incorporate market conditions into defaultable bond pricing. Section 3 introduces the CDS data used for the empirical analysis. Sections 4 and 5 present results of the time-series and cross-sectional patterns of credit spreads based on the model implications, respectively. Section 6 concludes.

2. Empirical implications of recent theories

The recent literature has seen a number of theoretical papers attempting to understand the link between credit spreads and macroeconomic risk. For example, Tang and Yan (2006) investigate the dynamics of firm-level credit spreads by highlighting the role of a firm's cash flow beta that measures its exposure to macroeconomic risk. They show that incorporating a macroeconomic influence on a firm's cash flow process helps improve significantly the fit of default probabilities and credit spreads. Other papers introduce habit-formation or recursive preference structures in order to illustrate the connection between the equity risk premium puzzle and the credit spread puzzle (Bhamra et al., 2007; Chen et al., forthcoming), or reconcile the observed high credit spreads with low corporate leverage ratios (Chen, 2007). Moreover, Chen (2007) and David (2008) consider the impact of inflation and allow for regime-switching in the growth rate of aggregate consumption or production to capture the uncertainty in the business cycle.[3] These models are calibrated to aggregate historical data and demonstrate a good fit with credit spreads on average.

Analysis in these papers manifests the significant impact of macroeconomic conditions on credit spreads, with major predictions consistent across all models. First, credit spreads are counter-cyclical, widening during recessions and narrowing during expansions. This result is related to the observed negative correlation between interest rates and credit spreads, as discussed in Longstaff and Schwartz (1995), due to an inherently close relation between the economic growth rate and the risk-free rate. While the counter-cyclical nature of credit spreads has been documented before, the intuition for this result is much more clear in these structural models: the growth rate of a firm's cash flow process is generally positively related to the economic growth rate. All else being equal, an increase in the economic growth rate, such as the GDP growth rate, will increase the firm-level growth rate and hence decrease the default probability and the credit spread.

Second, theoretical analysis indicates that credit spreads increase with the volatility of the economic growth rate. A firm is more likely to experience cash flow shortfalls in a more volatile economic environment, and hence more likely to default. Therefore, this represents the effect of intertemporal economic risk, as the volatility of the economic growth rate tends to be higher in recessions than expansions. Hence, this implication distinguishes the risk effect from the growth effect discussed above.

Third, credit spreads also widen when investors are more risk averse. It has been argued that investors become more risk averse during economic downturns, and this effect has been linked to the "flight to quality" phenomenon. Even though some of the papers we discussed above do not explicitly model the endogenous change of investors' preferences, comparative static analysis provides a gauge of the sensitivity of credit spreads to changes in preferences. One possible proxy for investors' preferences is the measure of their sentiments. We will discuss further the use of sentiment measures to proxy for investors' attitude towards risk in our empirical examination.

The firm-level analysis also yields cross-sectional implications for credit spread dynamics and for the effect of the interaction between macroeconomic conditions and industry or firm-level characteristics. First, it indicates that credit spreads should decrease with the current firm-specific growth rate and increase with the volatility of cash flows. Secondly, the correlation between the firm-level cash flow and the aggregate output introduces an effect of cash flow beta. Credit spreads may increase with cash flow beta during an economic downturn while decrease with cash flow beta during an economic expansion. This highlights the impact of the interaction between market risk and credit risk on credit spreads due to firm heterogeneity.

In the remainder of this paper, we empirically examine these implications with the credit default swap (CDS) data, which we describe in the next section.

3. Data and sample description

Several data issues make empirical analysis of credit risk difficult. Corporate bond yields are known to contain substantial liquidity and tax premia due to illiquidity of the corporate bond market and different tax treatments between corporate bonds and Treasury bonds. Many corporate bonds also have embedded options, further complicating the measurement of credit spreads based on corporate bond yields. To make the matter worse, there is a debate about an adequate reference for the risk-free rate in order to obtain yield spreads.

The rapidly growing credit derivatives market provides a relief for the data problem. Without concerns of a reference risk-free rate and embedded optionality and with improved liquidity in the credit default swap (CDS) market, CDS spreads have become a preferred proxy for credit spreads. Duffie (1999) shows that under certain conditions, CDS spreads indeed equal credit spreads. Ericsson et al. (2009) and Tang and Yan (2007), among others, show that

[3] The regime-switching mechanism, also considered in Hackbarth et al. (2006) and Bhamra et al. (2007), introduces a jump component in the pricing kernel and through its correlation with the flow-level cash flow prices a jump component at the firm level as well. This provides an economic backdrop to a structural model proposed by Leland (2006), who shows that with the addition of a jump component and liquidity costs, traditional structural models can be made to match both default probabilities and credit spreads.

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