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Corporate yield spreads and real interest rates

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ABSTRACT

The effect of inflation on the credit spreads of corporate bonds is investigated utilising real instead of nominal interest rates in extensions of the models proposed by Longstaff and Schwartz (1995) and Collin-Dufresne et al. (2001). Inflation is a critical, non-default, component incorporated in nominal bond yields, whose effect has not been considered by existing credit spread theory. In this sense the only true test of models of credit spread pricing must utilise real rates. To illustrate these requirements the Canadian bond data of Jacoby, Liao, and Batten (2009) is utilised. This Canadian data accommodates callability and the tax effects otherwise present in U.S. bond markets. The relation with historical default rates of both U.S. and Canadian bonds is also investigated since this approach is clean of both callability and tax effects. Overall, the analysis provides additional insights into the theoretical drivers of credit spreads as well as helping to explain observed corporate bond yield behaviour in financial markets.

1. Introduction

Much attention in recent years has been directed towards the catastrophic impact information opacity and design complexity present in credit derivatives has had on the valuations of financial institutions and subsequently on the real economy. This was especially the case during the 2007–2009 Global Financial Crisis (Avino, Lazar, & Varotto, 2013; Dabrowski, 2010; Domler, 2013; Gorton, 2009; van Rixtel & Upper, 2012).

As noted by Longstaff, Mithal, and Neis (2005), many simple questions concerning the underlying pricing and trading of credit based derivatives and securities in corporate bond markets remain unanswered. For example, how do financial markets price corporate debt and what proportion of the bond yield above the equivalent maturity risk-free bond – termed the credit spread – is due to default risk? What effect do non-default components, such as inflation, have on the pricing of credit spreads? Inflation is a critical non-default component incorporated in corporate bond yields that has not been previously recognised in theoretical models of corporate credit spread behaviour. In this sense the only true test of the various theoretical models should utilise real rates not nominal rates.

Motivated by these insights, the objective of this study is to investigate this last issue by identifying and then separating the inflation component of corporate bond yields prior to the investigation and modelling of credit spreads. We begin by updating and reviewing the existing literature on credit spread modelling, thereby providing clear insights into the theoretical drivers of credit spreads. Our contribution adds to the earlier work by Jacoby et al. (2009) by better explaining the observed corporate bond yield behaviour in financial markets, which has been shown by many other authors to include factors other than compensation for credit and liquidity risk (e.g. Breitenfellner & Wagner, 2012; Collin-Dufresne, Goldstein, & Helwege, 2010; Eom, Helwege, & Huang, 2004; Loncarski & Szilagyi, 2012; Ronen & Zhou, 2013).

In a key empirical paper, Longstaff and Schwartz (1995) extend the Merton (1974) model of corporate default to allow the testing of credit spreads using Moody's indexed U.S. bond yields. One of the more notable predictions of the Merton model is that the change in the credit spread is negatively correlated to the return on risky assets and changes in default-free interest rates. While the Longstaff and Schwartz (1995) results are consistent with this theoretical view, Duffee (1998) argued

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that since most bonds in the Moody's index are callable bonds, the negative yield spread–riskless rate relation could instead be due to the effect of the riskless rate on the value of the call option. More recently, Afik, Arad, and Galil (2012) also provide insights into how the choice of expected asset return and volatility can be applied to improve the predictability of the simple Merton (1974) model.

This issue was partly clarified in the paper by Jacoby et al. (2009) who use a unique database of Canadian bonds to control for issuer callability. Importantly, they find that once callability is accommodated the correlation between riskless interest rates and corporate bond spreads remains negligible. Consequently, their results provide support for the reduced-form models of Jarrow, Lando, and Turnbull (1997) and Duffie and Singleton (1999) which model default as a jump event, rather than the structural models of Merton (1974) and Longstaff and Schwartz (1995) that explicitly define a default hazard process and thereby untie the relation between the firm's asset value and default probability. However, as noted by Collin-Dufresne et al. (2010) reduced form models subsequently offer limited “out-of-sample” predictions about credit spreads since they must rely upon underlying assumptions concerning default intensity and recovery rate dynamics. Nonetheless, jump volatility has been shown to capture low frequency movements in credit spreads and comoves countercyclically with the price-dividend ratio and corporate default rate (Tauchen & Zhou, 2011), while defaults themselves can impact the credit spreads of surviving firms, allowing for a greater clustering of defaults (Berndt, Ritchken, & Sun, 2010).

A critical link between these various empirical studies concerns their use of nominal interest rates as the basis for estimating changes in both risky and riskless bond yields. In an earlier study, Fridson, Garman, and Wu (1997) suggest that any empirical investigation of the default risk — riskless rate relation should be undertaken using real rather than nominal interest rates. They argue that if the firm's revenues are fully adjusted with respect to inflation, its effective cost of capital is related to the real riskless rate rather than the nominal rate. In this context, an increase in the real riskless rate causes the firm's cost of short-term debt to increase as well, which will in turn result in a decrease in available cash flow. These combined effects will inhibit the firm's ability to issue new long-term debt and thereby exacerbate the probability of default.[2]

In this paper we first extend these earlier papers by applying the regression models used by Longstaff and Schwartz (1995) in the context of the unique Canadian bond dataset of Jacoby et al. (2009), and then accommodate the effects of time-varying volatility and autocorrelation using an Autoregressive GARCH (AR-GARCH) setting instead of the standard Ordinary Least Squares regression approach that was applied in many earlier papers. Second, we compare the effects of credit spreads measured both as absolute yield differences and as relative spreads (the ratio of the risky to riskless bond) as initially undertaken by Longstaff and Schwartz (1995) to ensure that the manner of credit spread calculation does not affect the results of model estimation.

Finally, we estimate an extended version of the Longstaff and Schwartz (1995) model, undertaken by Collin-Dufresne et al. (2001), using both nominal and real interest rates. This later model incorporates the key interest rate factors suggested by Duffee (1998) as well as a number of macroeconomic variables that have subsequently been used in more recent studies of credit spread behaviour (e.g. Dionne, Gauthier, Hammami, Maurice, & Simonato, 2011). We argue that it is vital that these models be estimated in the context of real interest rates given the failure of existing theory to incorporate the inflation component present in nominal interest rates. In this sense the only true test of the various theoretical models of risky credit spread pricing must utilise real rates. There is also another important dimension to this argument — call decisions by issuers are based on nominal rates and not real rates, highlighting the importance of using real rates in empirical studies.

The overwhelming conclusion of the modelling that is undertaken is that once the relationship between callability and the nominal interest rate is factored out, no relationship remains between the interest rate and the credit spread. This is in contrast to the negative relation suggested by structural model theory. To substantiate our contention that the prediction of the structural models does not hold empirically, we also model the relation with default rates using historical default rates of both U.S. and Canadian bonds. This approach is clean of both callability and tax effects (Jordan & Jordan, 1991).

The paper is organised as follows: next, the recent literature on credit spreads is briefly reviewed; then, the data and the models used are presented; the results and concluding comments then form the remaining sections of the paper.

2. Literature

Longstaff and Schwartz (1995) first used Moody's indexed U.S. bond yields to investigate the theoretical model of Merton (1974). Their analysis, using both relative and absolute credit spreads, identified a strong negative relationship between yield spreads and Treasury yields. The two factor model of Longstaff and Schwartz (1995) is an elegant extension of the closed-form solution of Merton (1974) where default is a function of the value of the firm at maturity, to a simple continuous-time valuation framework that allows for both default and interest rate risk. This structural model captures the stochastic nature of interest rates, where for simplicity the dynamics of the interest rate are explained using the simple term structure model of Vasicek (1977).

The key criticism by Duffee (1998) centres on the presence of callable bonds in the Moody's index used to test the theoretical predictions of the structural models. For callable bonds, higher interest rates imply a lower chance that the issuer will exercise the call option. Thus bondholders will demand a lower yield for this call provision, which will result in an overall decrease in the bond yield spread. To accommodate the call features present in most U.S. corporate bonds Duffee (1998) constructs a noncallable bond index and regresses spread changes on changes both in the short yield and in a term structure slope variable, for both callable and noncallable bonds. The results show that changes in the yield spread on callable bonds are strongly negatively related to changes in Treasury yields, while on the other hand, for noncallable bonds, there is a weak, although still negative relation. These results suggest that the negative relationship identified by Longstaff and Schwartz (1995) in U.S. bonds could be attributed to either the default premium or the effects of the call premium. Jacoby et al.'s (2009) investigation of Canadian bonds, which have no tax effects and allow callability to be controlled, provide further empirical support for reduced-form models that untie the otherwise endogenous relation between the firm's asset value and default probability.

Consideration of the effect embedded options in debt may have on credit spreads has been the subject of extensive recent investigation: Campbell and Taksler (2003) show that idiosyncratic firm-level volatility affects credit spreads, leading to the conclusion that firm-level volatility should also affect any embedded options in debt value, while Hackbarth, Miao, and Morellec (2006) also argue that credit spreads should be positively correlated with the volatility of cash flows from firm assets. Hwang, Min, McDonald, Kim, and Kim (2010) also use a credit spread as a proxy for stocks' default risk to control for the changing non-diversifiable option-risk characteristic of stocks. Because sensitivity to the excess credit spread becomes smaller as size increases and as value decreases, excess credit spread explains the CAPM anomalies in a fashion similar to the Fama-French factors.

[2] Davies (2008) also accounts for inflation in his study of the 85-year yield-spread dynamics of AAA and BAA US corporate-bond indices. However, he still uses nominal rates when considering the yield spread–riskless rate relation, but conditions on inflation in his cointegration analysis.