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Can credit spreads help predict a yield curve? ☆

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In this paper we investigate whether information in credit spreads helps improve the forecasts of government bond yields. To do this, we propose and estimate a joint dynamic Nelson–Siegel (DNS) model of the U.S. Treasury yield curve and the credit spread curve. The model accounts for the possibility of regime changes in yield curve dynamics and incorporates a zero lower bound constraint on yields. We show that our joint model produces more accurate out-of-sample density forecasts of bond yields than does the yield-only DNS model. In addition, we demonstrate that incorporating regime changes and a zero lower bound constraint is essential for forecast improvements.

1. Introduction

Many studies (e.g., Collin-Dufresne et al., 2001; Davies, 2008; Duffee, 1998; Longstaff and Schwartz, 1995) find a negative relationship between risk-free interest rates and credit spreads. Longstaff and Schwartz (1995) provide a theoretical explanation of this negative relationship using the model-implied positive relationship between firm value and the risk-free rate. An increase in firm value reduces the probability of default, which in turn increases corporate bond prices. Consequently, corporate bond yields fall and the credit spread tightens. Thus, in theory, government bond yields and credit spreads should be interconnected. In this study, we examine whether information contained in the term structure of credit spreads helps predict government bond yields. For this purpose, we follow Christensen

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and Lopez (2012) and extend the dynamic Nelson–Siegel (DNS) approach, as proposed by Diebold and Li (2006), to jointly model the dynamics of the U.S. government bond yield curve and the credit spread curve.

We consider models where the joint dynamics of the yield and credit spread curves are governed by up to six unobserved factors: three yield curve factors and three credit spread factors. As in the standard DNS model, the three yield curve factors are identified as the level, slope, and curvature of the yield curve. Similarly, the credit spread factors are the level, slope, and curvature of the credit spread curve. The relationship between bond yields and credit spreads is modeled through the interactions of all six factors. These factors are assumed to follow a first-order vector-autoregressive process, and are allowed to interact with lags of each other or instantaneously through correlated factor shocks.

We incorporate two additional extensions to the model in order to improve its forecast performance. First, we consider regime shifts in the factor dynamics, modeled through a first-order Markov switching process. This extension is motivated by findings in the literature that suggest the U.S. yield curve experienced structural changes in volatility over the past few decades (e.g., Ang et al., 2008; Bech and Lengwiler, 2012; Chib and Kang, 2013; Dai et al., 2007). These structural changes appear to be associated with the business cycle. Further, credit risk is closely related to economic conditions, and the relationship between the government and corporate bond markets possibly changes over time. Indeed, by isolating the so-called deflationary and inflationary regimes, Davies (2008) finds that credit spreads are substantially more sensitive to changes in the risk-free rate in deflationary regimes compared to normal or inflationary regimes.

Second, we follow Kang (2015) and impose a zero lower bound (ZLB) on the factor dynamics to constrain the model-implied bond yields and credit spreads to non-negative values. Kang (2015) proposes and estimates DNS models of bond yields with a ZLB constraint. In terms of econometric modeling, our joint DNS model of bond yields and credit spreads with regime-switching can be viewed as an extension of the model in Kang (2015). We show that this ZLB restriction is essential to produce economically plausible yield curve density forecasts when the short-term bond yield is near zero.

We consider several alternative model specifications: models with two or three yield curve factors; one, two, or three credit spread factors; and up to three different regimes for factor dynamics. Our estimation approach is Bayesian, and therefore we use a Bayesian measure of predictive accuracy to compare the forecasting performance of these models. Specifically, the accuracy of yield curve forecasts is evaluated by the cumulative posterior predictive likelihood (CPPL). The CPPL is particularly useful for evaluating yield curve density forecasts because it accounts for the co-movement of bond yields with various maturities.[1]

We apply our proposed model to U.S. yield data for the period from August 1996 through March 2013. Our estimation results indicate that the joint model with three yield curve factors, one credit spread factor, and two regimes is best supported by the data. In particular, this joint model produces out-of-sample density forecasts that are more accurate than do the three-factor DNS yield curve model when two regimes are incorporated. Meanwhile, it turns out that the yield curve has little information about future credit spreads. According to the estimated regime process and model parameters, regime changes are mainly driven by changes in the variance–covariance of the factor shocks. The timing of regime shifts appears to be closely associated with the 2007 financial crisis, when the short-term interest rate decreased and the credit spread increased substantially. Finally, we demonstrate that imposing a ZLB constraint is essential to ensure non-negative yield curve density forecasts. We show that the model without a ZLB constraint produces implausibly large probabilities of negative one-month-ahead forecasts for the short-term bond yield.

Our empirical findings have several important implications for bond market investors. The investors pursue utility maximization via portfolio selection, and the predictive accuracy of bond yields is critical to successful bond portfolio management. The Nelson and Siegel (1987) framework is widely used by central banks and other market participants for predicting the term structure of interest rates (Basel Committee on Banking Supervision, 2005). First, our econometric approach enables market participants to obtain more accurate predictive yield curve densities by incorporating credit spread

[1] We concentrate on density prediction rather than point prediction because yield curve forecasting is often conducted for bond portfolio selection in which measuring the diversification gain among bonds with different maturities is critical.