Pricing Corporate Bonds With Interest Rates Following Double Square-root Process

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Summary

The empirical evidence does not support the idea of a model of asset values or liabilities which drift with interest rates. This paper develops a corporate bond pricing model, using a structural approach, in which the leverage ratio does not have any explicit relationship with the risk-free interest rate. By using a stochastic interest rate which is governed by a double square-root (DSR) process in the pricing model, we derive a closed-form solution for corporate bond prices with default at maturity and default prior to maturity with an adjustable moving default barrier respectively. As the interest rate under the DSR process is sticky downward, this feature is relevant to a low interest rate environment, when the short rate is sticky at a level marginally above zero, as is has been in many of the major economies following the global financial crisis in 2008.

The numerical results from our closed-form solutions show that credit spreads generated from such a pricing model depend explicitly upon the level of the risk-free interest rate via a nonlinear effect arising from the DSR process if the correlation between the interest rate and

leverage ratio is non-zero. Given a positive correlation between the interest rate and leverage ratio, credit spreads decrease with an increase in interest rates. This characteristic is consistent with the empirical findings using bond market data covering the period from 2008 to 2013. This demonstrates the importance of allowing for interest rate risk in addition to default risk in valuing corporate debt securities. In particular, our results show that a corporate bond pricing models that incorporates a DSR model for the interest rate works well empirically.