A Stochastic Model for Credit Spreads Under a Risk-Neutral Framework Through the Use of an Extended Version of the Jarrow, Lando and Turnbull Model

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Abstract

The model derives risky corporate bond prices (or equivalently credit spreads) subject to credit default and migration risk, based on an extended version of the Jarrow, Lando and Turnbull model, under a risk-neutral framework, as a result of the simulation of a continuous time, time-homogeneous Markov chain. The inclusion of credit default and migration risk is made possible due to an allowance for a credit risk premium that varies stochastically. While the standard Jarrow-Lando-Turnbull model assumes that the credit risk premium is a deterministic function of time which, along with the assumption of a constant "real-world" transition matrix and constant recovery rate, leads to deterministic credit spreads, the extension proposed through this article captures a stochastic risk premium in order to better fit with historical observation. The model is of particular importance in the European Embedded Value (i.e. EEV) context where risk-neutral scenarios are required for calculating the Time Value of Options and Guarantees (i.e. TVOG) covering all material options and guarantees embedded following the requirements of EEV principles. Moreover, the model can also be used in a real-world framework for pricing government and risky corporate debts with the exclusion of the Markov chain. This allows to capture the marginal impact of credit default and migration risk at the TVOG level due to the corresponding changes that arise on the economic scenarios. The methodology is applied to corporate debts, but the extension proposed is flexible enough to be applicable to other securities as well.

Keywords: bond pricing, stochastic credit spreads, enhanced Jarrow, Lando and Turnbull model, risk-neutral valuation, Markov chain, arbitrage-free condition, European embedded value, time value of options and guarantees

JEL Classification: C00, C10, C13, C15, C60, G00, G10, G12, G22

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