Pricing Options Embedded in Bonds under Jump-diffusion Interest-Rate Models*

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Abstract

In this paper, we examine the application of the multinomial truncated trees proposed by Beliaeva et al. (2008) and Beliaeva and Nawalkha (2012) for the approximation of the exponential jump-extensions of the Vasicek (1977) and Cox, Ingersoll, and Ross (1985) (CIR) interest-rate models to the pricing of call and put options embedded in bonds. To do so, we first provide an in-depth convergence analysis of discount bond prices obtained using the truncated jump-diffusion trees to those given by analytical formulas derived in Beliaeva et al. (2008) and Beliaeva and Nawalkha (2012) and propose the optimal combinations that allow to achieve good levels of numerical efficiency. The proposed lattice method is then applied to the pricing of callable and puttable bonds. We finally conduct an extensive numerical sensitivity analysis of the obtained bond and option prices with respect to the input parameters under both models.

JEL Classification: C61; C63; G12; G13.

Keywords: Jump-diffusion interest-rate models; options embedded in bonds; multinomial trees; American-style interest-rate derivatives.

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