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Default Risk Modeling Beyond the First-Passage Approximation. I. Extended Black-Cox Model

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We develop a generalization of the Black-Cox structural model of default risk. The extended model captures uncertainty related to firm's ability to avoid default even if company's liabilities momentarily exceeding its assets. Diffusion in a linear potential with the radiation boundary condition is used to mimic a company's default process. The exact solution of the corresponding Fokker-Planck equation allows for derivation of analytical expressions for the cumulative probability of default and the relevant hazard rate. Obtained closed formulas fit well the historical data on global corporate defaults and demonstrate the split behavior of credit spreads for bonds of companies in different categories of speculative-grade ratings with varying time to maturity. Introduction of the finite rate of default at the boundary improves valuation of credit risk for short time horizons, which is the key advantage of the proposed model. We also consider the influence of uncertainty in the initial distance to the default barrier on the outcome of the model and demonstrate that this additional source of incomplete information may be responsible for non-zero credit spreads for bonds with very short time to maturity.

Comments:	We considerably revised the article. In particular, we performed the stochastic optimization of the parameters, which significantly improved the fitting procedure (see the completely revised Section IV)
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