Efficient Value-at-Risk Estimation for Mortgage-Backed Securities

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ABSTRACT

We develop an efficient Monte Carlo simulation-based methodology for value-at-risk analysis of mortgage-backed securities (MBS). The method requires analytic models for the interest rate term structure (in the sense of analytic bond pricing formulas) and the prepayment behavior; we focus on the Hull-White two-factor model of the interest rate term structure, and the Goldman Sachs prepayment model. To balance the computational requirements with accuracy, we adopt the delta-gamma methodology for value-at-risk estimation. The validity of our approach can be traced to a fundamental result in the theory of perturbation analysis (PA), and leads to the classical numerical tradeoff between the number of iterations versus the computational complexity per iteration. We examine this tradeoff vis-à-vis finite-difference schemes in terms of both computational complexity and numerical accuracy.