The Robust Computation and the Sensitivity Analysis of Finite-Time Ruin Probabilities and the Estimation of Risk-Based Regulatory Capital

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Abstract:

Prudential regulations require financial institutions to hold initial capital so that the possibility of ruin is very low. An important practical problem is to estimate the regulatory capital so the ruin probability is at the regulatory level, typically less than 0.1% over a finite-time horizon. Estimating probabilities of rare events is challenging, since naïve estimations via direct simulations of the surplus process is time consuming. In this paper, we present a stratification sampling algorithm for estimating finite-time ruin probabilities. We further introduce a sequence of measure changes to remove the pathwise discontinuities of the estimator, and compute unbiased first and second-order derivative estimates of the finite-time ruin probabilities with respect to both distributional and structural parameters. We then estimate the regulatory capital and its sensitivities. These estimates provide information to insurance companies for meeting prudential regulations as well as designing risk management strategies. Numerical examples are presented for the classical risk model, the Sparre Andersen risk model with interest and the periodic risk model with interest to demonstrate the speed and efficacy of our methodology.

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