Efficient Randomized Quasi-Monte Carlo Methods For Portfolio Market Risk

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Abstract
We consider the problem of simulating loss probabilities and conditional excesses for linear asset portfolios under the t-copula model. Although in the literature on market risk management there are papers proposing efficient variance reduction methods for Monte Carlo simulation of portfolio market risk, there is no paper discussing combining the randomized quasi-Monte Carlo method with variance reduction techniques. In this paper, we combine the randomized quasi-Monte Carlo method with importance sampling and stratified importance sampling. Numerical results for realistic portfolio examples suggest that replacing pseudorandom numbers (Monte Carlo) with quasi-random sequences (quasi-Monte Carlo) in the simulations increases the robustness of the estimates once we reduce the effective dimension and the impact of the non-smoothness of the integrands.

Keywords: risk management; quasi-Monte Carlo; importance sampling; stratified sampling; t-copula

1 Introduction

Market risk management deals with the estimation of loss distribution of a portfolio of assets over a fixed time horizon. The widely used risk measures Value-at-Risk (VaR) and expected shortfall require accurate estimates of loss probability and conditional excess under a realistic model that captures dependence structure of the log-returns of multiple

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