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On an automatic and optimal importance sampling approach with applications in finance

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Abstract

Calculating high-dimensional integrals efficiently is essential and challenging in many scientific disciplines, such as pricing financial derivatives. This paper proposes an exponentially tilted importance sampling based on the criterion of minimizing the variance of the importance sampling estimators, and its contribution is threefold: (1) A theoretical foundation to guarantee the existence, uniqueness, and characterization of the optimal tilting parameter is built. (2) The optimal tilting parameter can be searched via an automatic Newton's method. (3) Simplified yet competitive tilting formulas are further proposed to reduce heavy computational cost and numerical instability in high-dimensional cases. Numerical examples in pricing path-dependent derivatives and basket default swaps are provided.

Keywords:

Importance sampling | Exponential tilting | Conjugate measures | Newton’s method | Exotic options | Caps | Basket default swaps | Gaussian copula

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