

# On Empirical Martingale Simulation and Its Financial Applications

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## **Abstract**

The simulation technique known as empirical martingale simulation (EMS) was proposed by Duan and Simonato (1998) to improve simulation accuracy through substantially reducing simulation errors. By an adjustment to the standard Monte Carlo simulation, the EMS ensures that the underlying price simulated satisfies the rational option pricing bounds and that the estimated derivative contract price holds strong consistency with regular payoffs and follows asymptotic normality. However, for some commonly used derivative contracts including self-quanto options and some asymmetric or symmetric power options, it is open whether the above asymptotic results hold. In our research, we strengthen the EMS method in two ways: we prove that the strong consistency of the EMS estimates for contingent claims still holds for a wider class of payoffs than those restricted by Lipschitz condition; we also extend the asymptotic normality of the price estimates to more general continuous payoffs than the piecewise linear continuous payoffs. A conjecture is proposed for the case of discontinuous payoffs.