Martingale expansion in Finance

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Abstract

Martingale expansion developed by Yoshida (1997,2001) is a refinement of central limit theorem for martingales. It gives an asymptotic expansion of marginal distribution of martingale and has been applied to higher-order statistical theory of stochastic processes. In this talk, we consider its application to finance. We review several perturbation techniques for stochastic volatility models such as fast mean-reverting model developed by Fouque, Papanicolaou and Sircar (2000), and observe that the perturbation expansions of option prices are validated in an extended form in light of the martingale expansion. A quite simple expansion formula for the Black-Scholes implied volatility is given, which enable us to calibrate fast and stably.