Time dependent Heston model

Emmanuel Gobet, Laboratoire Jean Kuntzmann

The use of the Heston model is still challenging because it has a closed formula only when the parameters are constant [1] or piecewise constant [2]. Hence, using a small volatility of volatility expansion and Malliavin calculus techniques, we derive an accurate analytical formula for the price of vanilla options for any time dependent Heston model (the accuracy is less than a few bps for various strikes and maturities). In addition, we establish tight error estimates. The advantage of this approach over Fourier based methods is its rapidity (gain by a factor 100 or more), while maintaining a competitive accuracy. From the approximative formula, we also derive some corollaries related first to equivalent Heston models (extending some work of Piterbarg on stochastic volatility models [3]) and second, to the calibration procedure in terms of ill-posed problems.

Références

