CALIBRATION AND BACKTESTING OF THE HESTON MODEL FOR COUNTERPARTY CREDIT RISK

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Use of market implied calibration has become increasingly popular for counterparty risk modelling, especially since the publication of the Basel Committee's Review of the Credit Valuation Adjustment Framework consultative document (2015). In this paper, we describe a fast new method for the market implied calibration of the Heston (1993) model for equity, based on the parabolic pricing algorithm of Levendorskiĭ (2012) and the use of multiple starting points determined by a 5D quasi-random (Sobol) sequence. We show that the pricing methodology, when used in the calibration, is either much faster or better reproduces the market implied volatilities than alternative methods (COS, Carr-Madan FFT method, adaptive quadrature) which are popular with practitioners. We also show that the Heston model, calibrated to fit the implied volatility surfaces between January 2008 and December 2014, performs well in historical backtesting for a range of exception counting and distributional tests across multiple time horizons. Our benchmarking tests were designed in accordance to the Federal Reserve's Supervisory Guidance Letter SR-11-7 (2011), which has become a worldwide standard for model development and validation.

We explain why oversimplified prescriptions for the choice of the parameters of numerical scheme in COS and Carr-Madan method often lead to either the *sundial calibration* (models with heavy tails cannot be seen due to large numerical errors of pricing methods) or the *ghost calibration*: the automatic calibration procedure declares a certain parameter set a "good fit" because the "true calibration error of the model" (calculated using a perfect pricing procedure) and the error of the pricing procedure almost cancel one another. In the twilight zone of the parameter space, where the method becomes unreliable, one sees local minima ("ghosts") of the sum of these two errors.

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