Pricing under rough volatility

Christian Bayer
(in collaboration with Peter K. Friz and Jim Gatheral)
Weierstrass Institute, Berlin, Germany

From an analysis of the time series of realized variance (RV) using recent high frequency data, Gatheral, Jaisson and Rosenbaum [1] previously showed that log-RV behaves essentially as a fractional Brownian motion with Hurst exponent H of order 0.1, at any reasonable time scale. The resulting Rough Fractional Stochastic Volatility (RFSV) model is remarkably consistent with financial time series data. We now show how the RFSV model can be used to price claims on both the underlying and integrated variance. We analyze in detail a simple case of this model, the rBergomi model. In particular, we find that the rBergomi model fits the SPX volatility markedly better than conventional Markovian stochastic volatility models, and with fewer parameters. Finally, we show that actual SPX variance swap curves seem to be consistent with model forecasts, with particular dramatic examples from the weekend of the collapse of Lehman Brothers and the Flash Crash.

References

[1] Gatheral, J., Jaisson, T., Rosenbaum, M. Volatility is rough *Preprint*, 2014.