SEMINÁRIO DE PROBABILIDADE

Rough continuous states branching processes and their applications in volatility modelling

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Abstract. This presentation is based on three different papers sharing the idea to jointly calibrate SPX and VIX implied volatilities and many empirical facts in a parsimonious way. The three models are exponential affine and then the Fourier-Laplace transform of the log returns and the square of the volatility index can be computed explicitly in terms of solutions of deterministic pseudo-Riccati (Volterra) equations. The first model is driven by a branching alpha-stable and then also reproduces the empirical results on jump infinite activity by Todorov and Tauchen. The two other models are based on extension of Hawkes processes since the intensity of the jumps coincides with the volatility process itself. In the last case, the volatility is rough. We show that our parsimonious setup is able to simultaneously capture, with a high precision, the behavior of the implied volatility smile for both S&P 500 and VIX options. Besides the applications in mathematical finance many open questions arise that can be resumed by which properties of CSBPI are preserved when a kernel is added based on

1) Jiao, Y., Ma, C., Scotti, S., & Zhou, C. (2021). The Alpha-Heston stochastic volatility model. Mathematical finance, 31(3), 943-978.

2) Bernis, G., Brignone, R., Scotti, S., & Sgarra, C. (2021). A gamma Ornstein-Uhlenbeck model driven by a Hawkes process. Mathematics and Financial Economics, 15(4), 747-773.

3) Bondi, A., Pulido, S., & Scotti, S. (2024). The rough Hawkes Heston stochastic volatility model. Mathematical Finance, https://doi.org/10.1111/mafi.12432