Impact of rough stochastic volatility models on long-term life insurance pricing

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The Rough Fractional Stochastic Volatility (RFSV) model of Gatheral et al. (Quant Financ 18(6):933–949, 2014) is remarkably consistent with financial time series of past volatility data as well as with the observed implied volatility surface. Two tractable implementations are derived from the RFSV with the rBergomi model of Bayer et al. (Quant Financ 16(6):887–904, 2016) and the rough Heston model of El Euch et al. (Risk 84–89, 2019). We now show practically how to expand these two rough volatility models at larger time scales, we analyze their implications for the pricing of long-term life insurance contracts and we explain why they provide a more accurate fair value of such long-term contacts. In particular, we highlight and study the long-term properties of these two rough volatility models and compare them with standard stochastic volatility models such as the Heston and Bates models. For the rough Heston, we manage to build a highly consistent calibration and pricing methodology based on a stable regime for the volatility at large maturity. This ensures a reasonable behavior of the model in the long run. Concerning the rBergomi, we show that this model does not exhibit a realistic long-term volatility with extremely large swings at large time scales. We also show that this rBergomi is not fast enough for calibration purposes, unlike the rough Heston which is highly tractable. Compared to standard stochastic volatility models, the rough Heston hence provides efficiently a more accurate fair value of long-term life insurance contracts embedding path-dependent options while being highly consistent with historical and risk-neutral data.