

## SPX calibration of option approximations under rough Heston model

### ABSTRACT

The volatility of stock return does not follow the classical Brownian motion, but instead it follows a form that is closely related to fractional Brownian motion. Taking advantage of this information, the rough version of classical Heston model also known as rough Heston model has been derived as the macroscopic level of microscopic Hawkes process where it acts as a high-frequency price process. Unlike the pricing of options under the classical Heston model, it is significantly harder to price options under rough Heston model due to the large computational cost needed. Previously, some studies have proposed a few approximation methods to speed up the option computation. In this study, we calibrate five different approximation methods for pricing options under rough Heston model to SPX options, namely a third order Padé approximant, three variants of fourth order Padé approximant, and an approximation formula made from decomposing the option price. The main purpose of this study is to fill in the gap on lack of numerical study on real market options. The numerical experiment includes calibration of the mentioned methods to SPX options before and after the Lehman Brothers collapse.

**Keyword:** Rough Heston model; Option pricing; Padé approximants; Approximation formulas; SPX calibration