

# VIX pricing in the rBergomi model under a regime switching change of measure

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## Abstract

The rBergomi model under the physical measure consists of modeling the log-variance as a truncated Brownian semi-stationary process. Then, a deterministic change of measure is applied. The rBergomi model is able to reproduce observed market SP500 smiles with few parameters, but by virtue of the deterministic change of measure, produces flat VIX smiles, in contrast to the upward sloping smiles observed in the market. We use the exact solution for a certain inhomogeneous fractional Ornstein-Uhlenbeck equation to build a regime switching stochastic change of measure for the rBergomi model that both yields upward sloping VIX smiles and is equipped with an efficient semi-analytic Monte Carlo method to price VIX options. The model also allows an approximation of the VIX, which leads to a significant reduction of the computational cost of pricing VIX options and futures. A variance reduction technique based on the underlying continuous time Markov chain allows us to further reduce the computational cost. We verify the capabilities of our model by calibrating it to observed market smiles and discuss the results.

**Keywords**— fractional Ornstein-Uhlenbeck process, rough volatility, VIX option pricing

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