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# A New Particle Filtering Approach to Estimate Stochastic Volatility Models with Markov-Switching

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## Abstract

A simple method is proposed to estimate stochastic volatility models with Markov-switching. It relies on a nested structure of filters (a Hamilton filter and several particle filters) to approximate unobserved regimes and state variables, respectively. Smooth resampling is used to keep the computational complexity constant over time and to implement a standard likelihood-based inference on parameters. A bootstrap and an adapted version of the filter are described and their performance are assessed using simulation experiments. The volatility of US and French markets is characterized over the last decade using a three-regime stochastic volatility model extended to include a leverage effect.

*Keywords:* stochastic volatility, Bayesian inference, Markov switching, particle filtering, smooth resampling, Kim filter, nonlinear Kalman filter

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