Bayesian Analysis of Long Memory and Roughness in Financial Volatility

Toshiaki Watanabe (Hitotsubashi University)
Jouchi Nakajima (Hitotsubashi University)

Abstract

Realized volatility (RV) calculated using intraday returns has recently been used as an accurate estimator of financial volatility. Some researchers have documented that the log-RV may follow a long-memory process, which is represented by a fractional Brownian motion with the Hurst exponent greater than 0.5 or a fractionally integrated process with a positive difference parameter. Recent studies show that the log-difference in RV may be rough, which is represented by a fractional Brownian motion with the Hurst exponent less than 0.5 or a fractionally integrated process with a negative difference parameter. This article presents a discrete-time model that is consistent with these two phenomena and develops a Bayesian method for the analysis of this model using Markov chain Monte Carlo. The proposed model is applied to the daily RV of Nikkei 225 stock index. It is compared with a model that only has long memory and a model that only has roughness using the marginal likelihood and the predictive ability of volatility.