Shape-constrained Semiparametric Additive Stochastic Volatility Models

Abstract: Nonparametric stochastic volatility models, although providing great flexibility for modeling the volatility equation, often fail to account for useful shape information. For example, a model may not use the knowledge that the autoregressive component of the volatility equation is monotonically increasing as the lagged volatility increases. We propose a class of additive stochastic volatility models that allow for different shape constraints and can incorporate a leverage effect, the asymmetric impact of positive and negative return shocks on volatilities. We develop a Bayesian fitting algorithm and demonstrate model performance on simulated and empirical datasets. Unlike general nonparametric models, our model sacrifices little when the true volatility equation is linear. In nonlinear situations we improve the model fit and the ability to estimate volatilities over general, unconstrained, nonparametric models.

This research is in collaboration with Jiangyong Yin, Google Inc. and Xinyi Xu, The Ohio State University, and is funded in part by the US National Science Foundation.

References: