

Bayesian Analysis of Stochastic Volatility Models with Fat-tails and Correlated Errors

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Abstract

The basic univariate stochastic volatility model specifies that conditional volatility follows a log-normal auto-regressive model with innovations assumed to be independent of the innovations in the conditional mean equation. Since the introduction of practical methods for inference in the basic volatility model (JPR~(1994)), it has been observed that the basic model is too restrictive for many financial series. We extend the basic SVOL to allow for a so-called "leverage effect" via correlation between the volatility and mean innovations, and for fat-tails in the mean equation innovation. A Bayesian Markov Chain Monte Carlo algorithm is developed for the extended volatility model. Thus far, likelihood-based inference for the correlated SVOL model has not appeared in the literature. We develop Bayes Factors to assess the importance of the leverage and fat-tail extensions. Sampling experiments reveal little loss in precision from adding the model extensions but a large loss from using the basic model in the presence of mis-specification. There is overwhelming evidence of a leverage effect for weekly and daily equity indices. The evidence in favor of fat-tails is very strong for daily exchange rate and equity indices, not so strong for weekly data. We also find that volatility estimates from the extended model are markedly different from those produced by the basic SVOL.

JEL Classification: C1, C11, C15, G1

Key words: ARCH, Bayes factor, Fat-tails, Gibbs, Leverage effect, Metropolis, MCMC, Stochastic volatility.

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