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REJOINDER

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Rejoinder to "Sequential Bayesian learning for stochastic volatility with variance-gamma jumps in returns" Reply to the discussions by Nalini Ravishanker and Refik Soyer

Many thanks to Professors Nalini Ravishanker and Refik Soyer for their insightful comments on our paper. There are clearly many interesting extensions yet to be done for particle learning (PL) with stochastic volatility and jumps. For example, Ravishanker asks about high-frequency trading and how to adapt the stochastic volatility with variance-gamma (SVVG) family and both Ravishanker and Soyer ask about multivariate extensions so that the methods can be applied to a large universe of stocks. These are clearly challenging problems. Soyer also asks about applications and extensions to sequential decision problems such as portfolio allocation.

Our main insight is that PL methods are tailor-made to address these problems. This is due to the use of an augmented state vector that needs to be tracked in real time, making the storage requirements of PL minimal. Smoothing would require extra computational effort, but generally, prediction is the goal of asset-pricing studies and again PL is directly suited to these problems and constructs the predictive distribution by averaging over particles and thus takes account of full uncertainty. For particle filtering in the high-frequency context, we refer the reader to the works of Lopes and Tsay[1] and Stroud and Johannes.[2]

As for generalizations of the SVVG jump models, we point the reader to self-excited jump models of Fulop et al[3] for particle methods and sequential Bayesian learning. Soyer asks about multivariate models generated by gamma subordination of Brownian motion. This seems totally feasible as particle methods can be naturally constructed when the process is generated by subordination; see, for example, the work of Li.[4] As for multivariate models, we refer the reader to the MCMC work of Lopes et al,[5] which could be implemented via PL by taking advantage of the inherent parallelization of their recursive dynamic regressions. Finally, Ravishanker asks about prior sensitivity and computational efficiency. Such issues arise in particle filters as in MCMC and have to be addressed carefully. The parameter that has the largest issue is ν as it does not admit a conditional sufficient statistic. Soyer asks about sequential decision problems where again augmented simulation methods are attractive[6,7] and where particle methods have a bright future as an alternative to reinforcement machine learning methods.

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