Received: 5 June 2018 | Revised: 6 June 2018 | Accepted: 6 June 2018

DOI: 10.1002/asmb.2367

DISCUSSION

WILEY

Discussion of "Sequential Bayesian learning for stochastic volatility with variance-gamma jumps in returns"

I would like to congratulate Warty, Lopes, and Polson (henceforth, WLP) for their interesting article developing a novel sequential Bayesian inference for the SVVG models of Madan and Seneta (1990).[1] Inference for SVVGs poses challenges due to the nonlinearity of the model. Previous attempts for Bayesian analysis of SVVGs include the MCMC-based approach of Li et al (2008)[2] and the SMC method proposed by Jasra et al (2011).[3] The MCMC methods' computational inefficiency is well known for sequential Bayesian analysis. Use of SMC methods also pose potential challenges in updating the static parameters. These issues seem to be alleviated by the proposed approach of WLP who use the particle learning (PL) method of Carvalho et al (2010)[4] for updating the static parameters in the SVVG model. The attractive feature of the PL approach is the use of *conditional sufficient statistics* for the static parameters Θ for the SVVG model of equations (1) to (3). Availability of the sufficient statistics for all static parameters except the rate ν provides a computationally efficient updating scheme.

WLP presents a detailed comparison of their method with the MCMC approach of Li et al (2008)[2] and compare their model in Figure 7 with that of the work of Jasra et al (2011)[3] where the rate ν is treated known. I would also like to see some brief discussion on how the PL approach compares with the work of Jasra et al (2011)[3] in terms of computational efficiency. I would expect that, for the case of known ν, the PL approach should compare more favorably with the SMC. Any comments on this by the authors will be appreciated.

WLP point out the challenges in estimation of the rate ν in the model. I was wondering if it is possible to estimate ν by using off-line methods, and then treat ν fixed in the model. Since static parameters usually converge to a region pretty quickly after observing some data, such a hybrid approach may work in some applications.

A multivariate generalization of Madan and Seneta variance gamma process has been proposed by Semeraro (2008).[5] Following Semeraro's work, other generalizations have been considered in the literature, starting with the work of Wang (2009).[6] A recent review of these can be found in the work of Buchmann et al (2017)[7] who presented a unification of these models, which involve multivariate Gamma subordination of Brownian motion jumps. I would like to see the authors comment briefly if they have considered an extension of the PL approach to the multivariate case and discuss feasibility and challenges of a multivariate extension. This is especially important for optimal portfolio selection problems as in the work of Polson and Tew (2000)[8] who considered single-period optimal portfolios. Portfolio selection in multivariate variance gamma models has been addressed by Hitaj and Mercuri (2013)[9] based on classical methods. In addition, the on-line updating via the proposed PL approach is attractive for the multiperiod portfolio selection problems considered by Soyer and Tanyeri (2006).[10] I would like to invite authors to comment on how plausible it is to to use their approach for sequential decision problems.

Refik Soyer

Department of Decision Sciences, The George Washington University, Washington, District of Columbia

Correspondence

Refik Soyer, Department of Decision Sciences, The George Washington University, Washington, DC 20052.

Email: soyer@gwu.edu

REFERENCES

1. Madan DB, Seneta E. The variance gamma (V.G.) model for share market returns. *J Bus*. 1990;63(4):511-524.
2. Li H, Wells MT, Yu CL. A Bayesian analysis of return dynamics with Levy jumps. *Rev Financ Stud*. 2008;21(5):2345-2378.
3. Jasra A, Stephens DA, Doucet A, Tsagaris T. Inference for Levy-driven stochastic volatility models via adaptive sequential Monte Carlo. *Scand J Stat*. 2011;38(1):1-22.
4. Carvalho C, Johannes M, Lopes H, Polson N. Particle learning and smoothing. *Stat Sci*. 2010;25(1):86-106.
5. Semeraro P. A multivariate variance gamma model for financial applications. *Int J Theor Appl Finance*. 2008;11(1):1-18.

6. Wang J. *The Multivariate Variance Gamma Process and Its Applications in Multi-Asset Option Pricing* [dissertation]. University of Maryland, College Park, 2009.
7. Buchmann B, Kaehler B, Maller R, Szimayer A. Multivariate subordination using generalised Gamma convolutions with applications to variance gamma processes and option pricing. *Stoch Process Appl*. 2017;127(7):2208-2242.
8. Polson NG, Tew BV. Bayesian portfolio selection: an empirical analysis of the SP500 index 1970-1996. *J Bus Econ Stat*. 2000;18(2):164-173.
9. Hitaj A, Mercuri L. Portfolio allocation using multivariate variance gamma models. *Fin Mkts Portfolio Mgmt*. 2013;27(1):65-99.
10. Soyer R, Tanyeri K. Bayesian portfolio selection with multivariate random variance models. *Eur J Oper Res*. 2006;171(3):977-990.

How to cite this article: Soyer R. Discussion of "Sequential Bayesian learning for stochastic volatility with variance-gamma jumps in returns". *Appl Stochastic Models Bus Ind*. 2018;34:482–483. https://doi.org/10.1002/asmb.2367