Journal of Statistical Computation and Simulation ›
Volume 87, 2017 - Issue 4

Original Articles

Some contributions to sequential Monte Carlo methods for option pricing

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Pages 733-752 | Received 16 Aug 2015, Accepted 10 Aug 2016, Published online: 29 Aug 2016

Cite this article https://doi.org/10.1080/00949655.2016.1224238 Check for updates

ABSTRACT

Pricing options is an important problem in financial engineering. In many scenarios of practical interest, financial option prices associated with an underlying asset reduces to computing an expectation w.r.t. a diffusion process. In general, these expectations cannot be calculated analytically, and one way to approximate these quantities is via the Monte Carlo (MC) method; MC methods have been used to price options since at least the ... of barrier options ... Moral P. [Sequen... 29:292–316] that Se... is context and ... Del Moral and She... can achieve significa... icial target densities ... ampling distribution in the SMC algorithm by using a sequence of weighting functions. This is

demonstrated on two examples, barrier options and target accrual redemption notes (TARNs). We also provide a proof of unbiasedness of our SMC estimate.

KEYWORDS: Diffusions sequential Monte Carlo option pricing

AMS SUBJECT CLASSIFICATION: 91G60 (primary) 65C05 (secondary)

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes

1. We have a slight abuse of notation in the above, wherein we have used $\mu(n,Sn)$ and $\sigma(n,sn)$ to denote $\mu(tn,Rtn)$ and $\sigma(tn,Rtn)$ respectively.

2. If μ is a constant other than 0, then it is trivial to extend the methods we propose. If it is a function of the asset value, we could do things similar to what we do in the local volatility model considered later.

3. We have assumed here that the interest rate is 0. If the interest rate was r, then there would be a factor of $e\int 0Tr(t)dt$ multiplied with QD. This is a constant and affects the variance of the estimate only up to a (known) scale factor.

4. Path degeneracy is when repeated resampling steps lead to many multiple copies of the same particle X1:N. This causes estimates based on the entire paths being unreliable.

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Fun

AJ was s Fund Tier 1 grant [R Z was

supported by a Singapore Ministry of Education Academic Research Fund Tier 2 grant [R-155-000-143-112].

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