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# Some contributions to sequential Monte Carlo methods for option pricing

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## ABSTRACT

Pricing options is an important problem in financial engineering. In many scenarios of

practical computational methods, the Monte Carlo method reduces to

computational methods. The Monte Carlo method reduces to

cannot be applied directly. The Monte Carlo method reduces to

the Monte Carlo method reduces to

at least the Monte Carlo method reduces to

option pricing. The Monte Carlo method reduces to

[Sequential Monte Carlo] The Monte Carlo method reduces to

that Sequential Monte Carlo method reduces to

and can be applied to the Monte Carlo method reduces to

and Shephard's method reduces to

significant computational barrier. The Monte Carlo method reduces to

densities over time. In particular, we approximate the optimal importance sampling

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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  $\mu(n, S_n)$  and  $\sigma(n, s_n)$  to denote  $\mu(t_n, R_{t_n})$  and  $\sigma(t_n, R_{t_n})$  respectively.
2. If  $\mu$  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  $e^{-\int_0^t r dt}$  multiplied with  $Q_t$ . This is a constant and affects the variance of the estimator.
4. Path dependent options are not covered by our method. Multiple copies of the same option can be simulated using the same SMC particles, but this is unreliable.



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