Student Research Group 'Stochastic Volatility Models'

Methods of Simulation of the Heston Model: A Review

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Table of Contents

Heston Model Definition

Assume that the spot asset at time t follows the diffusion

$$dS(t) = \mu S(t)dt + \sqrt{v(t)}S(t)dZ_1(t), \tag{1}$$

$$dv(t) = \left(\delta^2 - 2\beta v(t)\right)dt + 2\delta\sqrt{v(t)}dZ_2(t), \tag{2}$$

where Z_1, Z_2 are the correlated Wiener processes with $dZ_1 dZ_2 = \rho dt$

Table of Contents

Table of Contents

Table of Contents

Table of Contents

Performance Comparison

Method	Euler	Broadie-Kaya	Andersen
Elapsed, s	0.0001	0.0001	0.0001

Accuracy Comparison

Parameters: $\mu = 0.1$, $\rho = -0.5$, $\delta = 0.1$, $\beta = 0.1$, $S_0 = 100$, $v_0 = 0.1$, $r = 0.05$, $N = 1000$

Method	Euler	Broadie-Kaya	Andersen	Exact
European Call Option Price	0.0001	0.0001	0.0001	0.0001
Relative Error, ϵ	0.00%	0.00%	0.00%	0.00%

Table of Contents

Table of Contents

Conclusion

We introduced the three most common simulation methods for dynamics of the Heston stochastic volatility model:

1. Euler scheme;
2. Broadie-Kaya scheme;
3. Andersen scheme.