

Simulation Methods for Finance

Barrier and Look-back Options

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Introduction

Outline

- 1 Random Variable Generation
- 2 European Call Option
- 3 Barrier Option
- 4 Look-back Option
- 5 Using our Code

Random Variable Generation - Task

Random Variable Generation - Analysis

Random Variable Generation - Results

European Call Option - Task

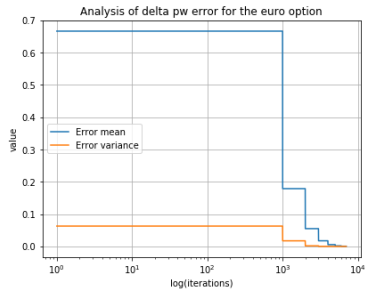
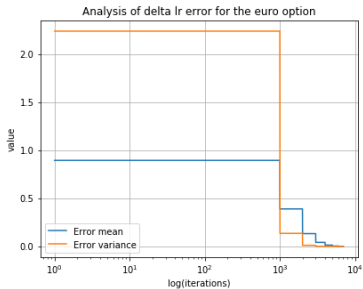
With the usual conventions, recall our model.

$$dS_t = rS_t dt + \sigma S_t dW_t, \quad 0 \leq t \leq T$$

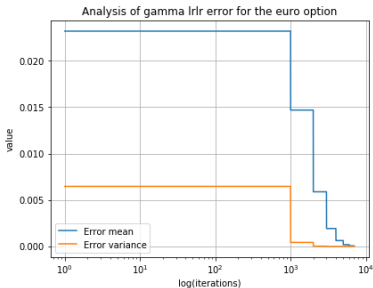
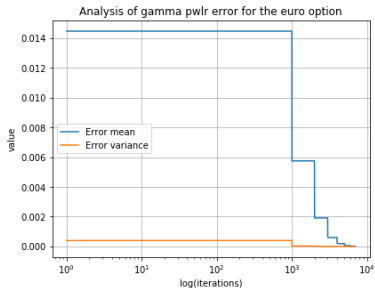
$$C_t = E[e^{-r(T-t)}(S_T - K)^+ | F_t]$$

- Create a module to simulate the results for the European option.
- Compute the Greeks (delta, gamma, vega) using different methods.
- Analyse the error compared to the theoretical result.

European Call Option - Analysis



European Call Option - Analysis



European Call Option - Results

- There is a significant accuracy gap beyond 1,000 simulations.
- We based our conclusions on the industry standard: 100,000 simulations.
- There is a trade-off computation time/accuracy.

| | Error Mean | Error Variance | Time |
|-------------------|------------|----------------|-------|
| Delta LR | Worst | Worst | Best |
| Delta PW | Best | Best | Worst |
| Gamma PWLR | Worst | Best | Best |
| Gamma LRPW | - | Worst | Best |
| Gamma LRLR | - | - | Worst |
| Vega LR | Worst | - | Worst |
| Vega PW | Best | - | Best |

Barrier Option - Task

Barrier Option - Analysis

Barrier Option - Results

Look-back Option - Task

Look-back Option - Analysis

Look-back Option - Results

Using our Code

Using our Code

Conclusion

Thank you!

`github.com/tjespel/barrier-and-look-back-options`