Homework 7

Problem 1: Simulation in the Heston Model

1. Find a set of Heston parameters that you believe govern the dynamics of SPY. You may use results from a previous Homework, do this via a new calibration, or some other empirical process. Explain how you got these and why you think they are reasonable.

I use the parameter from homework 3 since it was tested by the professor with least squred error and stable outcomes.

Those, my parameter will be $3.51, 0.052, 1.17, -0.77, 0.034$

2. Choose a discretization for the Heston SDE. In particular, choose the time spacing, ΔT as well as the number of simulated paths, N. Explain why you think these choices will lead to an accurate result.

I use business daily steps with $\frac{1}{252}$ and simulation with 40000 times

3. Write a simulation algorithm to price a European call with strike K = 285 and time to expiry T = 1. Calculate the price of this European call using FFT and comment on the difference in price.

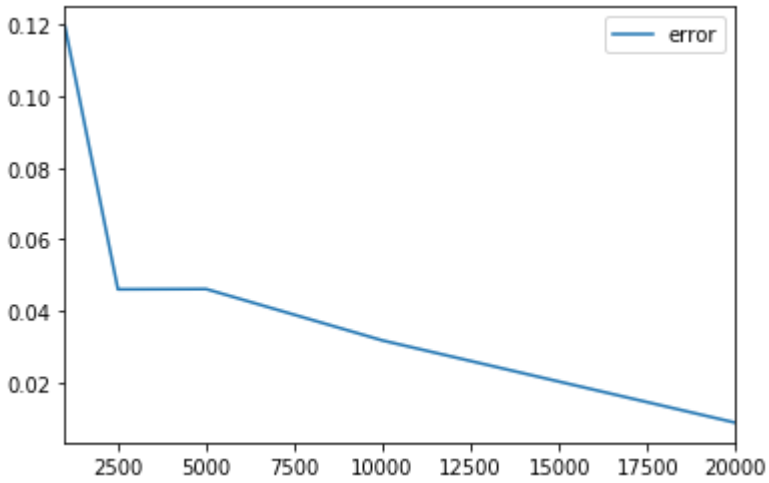
FFT and simulation

use parameter above i calculate the fft with$17.5288$and the simulation give the 17.6064The difference is 0.005. Small enough to be ignored.

4. Update your simulation algorithm to price an up-and-out call with T = 1, K1 = 285 and K2 = 315. Try this for several values of N. How many do you need to get an accurate price?

Use $N = 100000$ as true price,which is 2.8652, i try different n and compare with true price to see the converge rate

	error
1000	0.119577
2500	0.046010
5000	0.046088
10000	0.031688
20000	0.008675



5. Re-price the up-and-out call using the European call as a control variate. Try this for several values of N. Does this converge faster than before?

Does not improve the converge rate that much, since the co-variance is very low between these two assets with 0.00138316.

	converge
1000	-0.018825
2500	0.038030
5000	0.034828
10000	0.030581
20000	0.000269