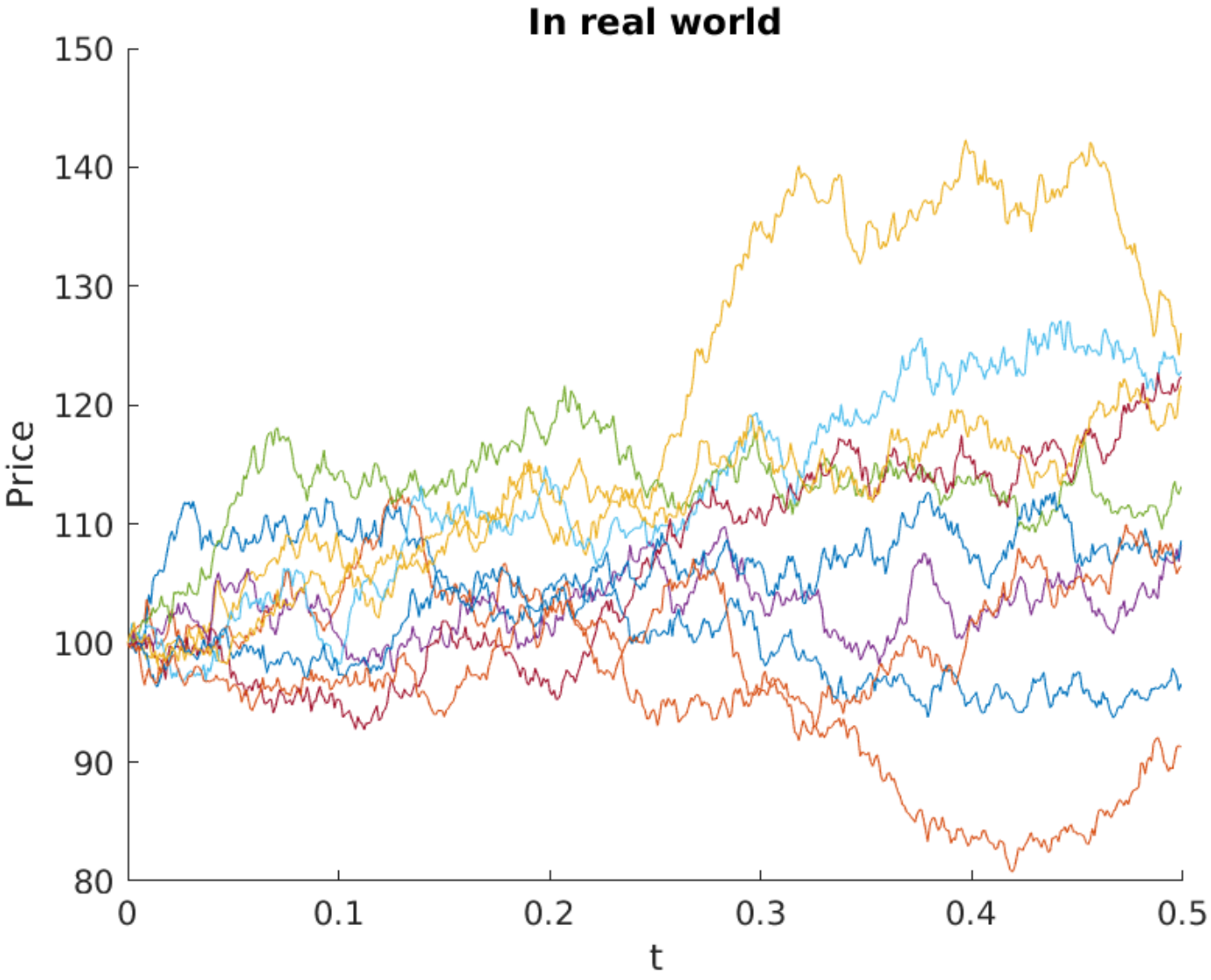
Financial Engineering Lab (MA374)

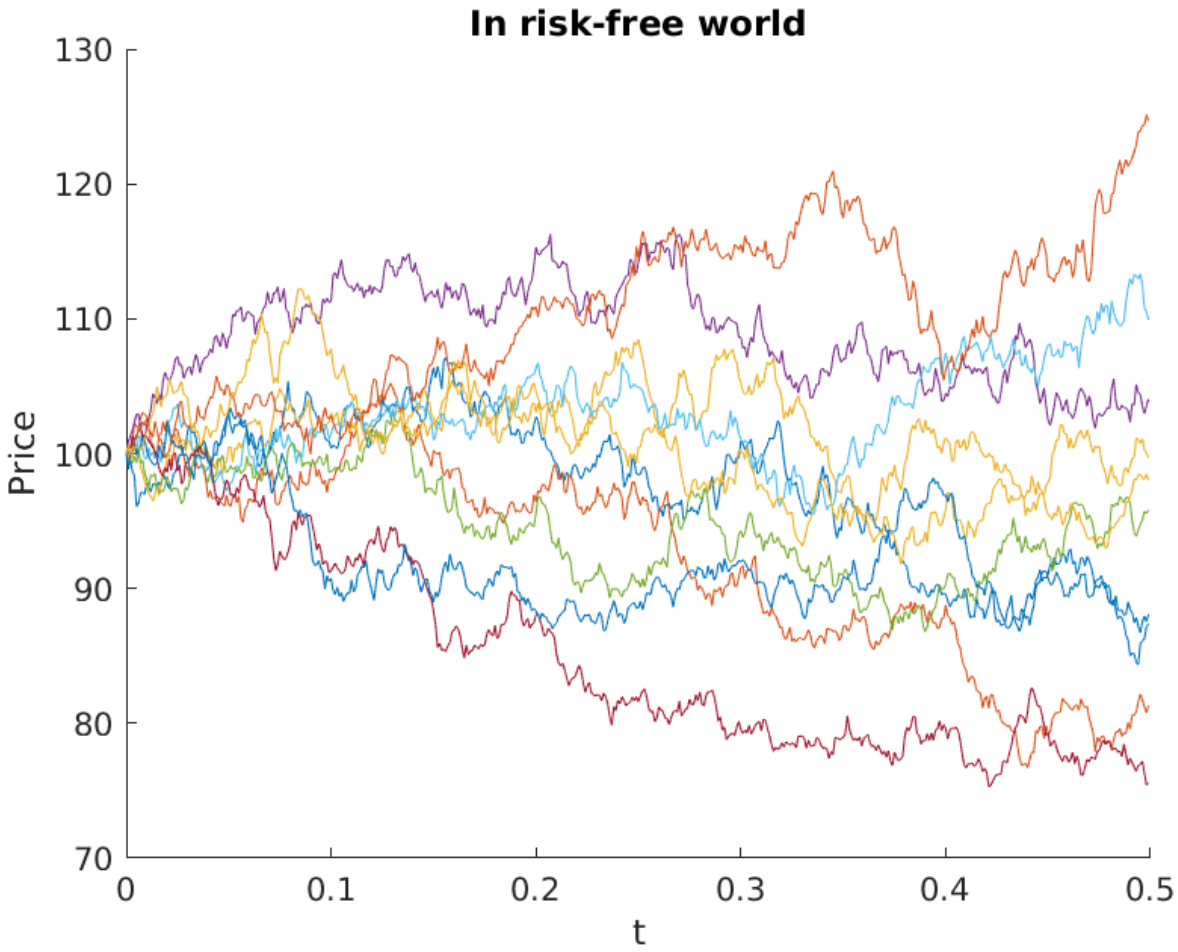
Neelabh Tiwari
160123024
Department of Mathematics
IIT Guwahati

Assignment - 10
(18 April 2019)

Question 1

Price of call option with strike price: 90 is 10.714566
Price of put option with strike price: 90 is 0.141943
Price of call option with strike price: 105 is 1.645191
Price of put option with strike price: 105 is 4.782734
Price of call option with strike price: 110 is 0.519963
Price of put option with strike price: 110 is 9.062596




In risk-free world
Price
t
130
120
110
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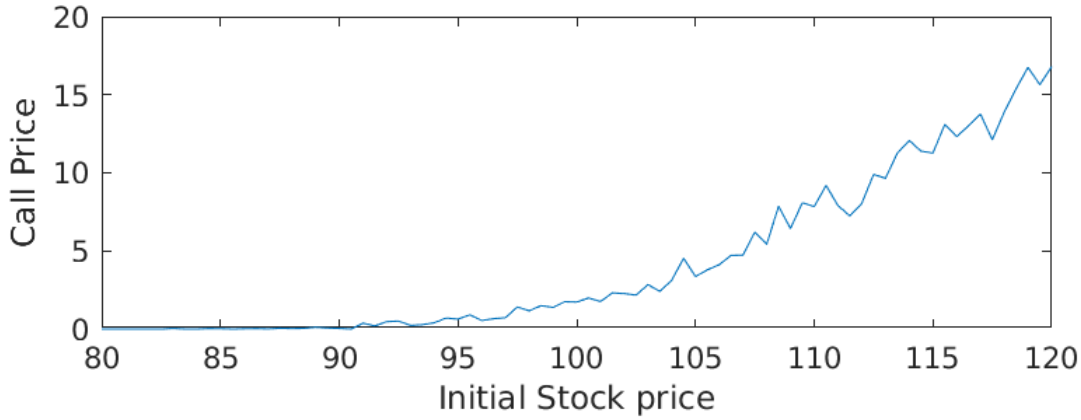
Call Price
Initial Stock price
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105
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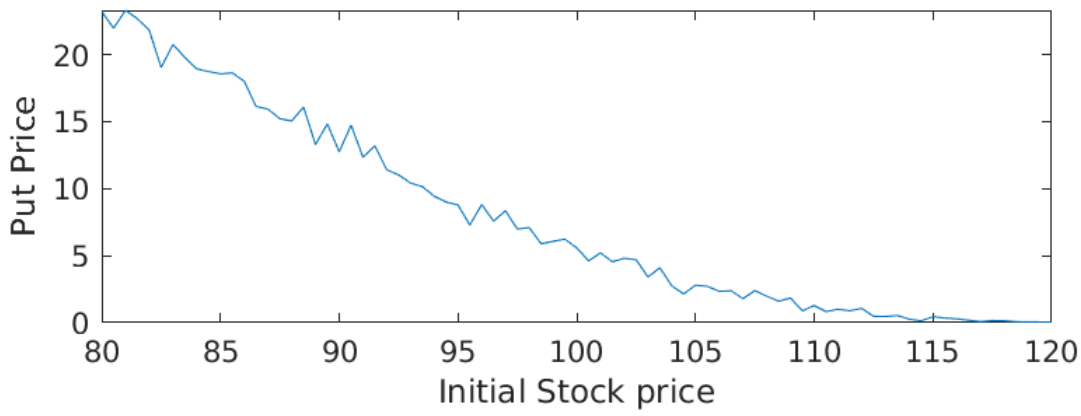
120


Put Price
Initial Stock price
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100
105
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115
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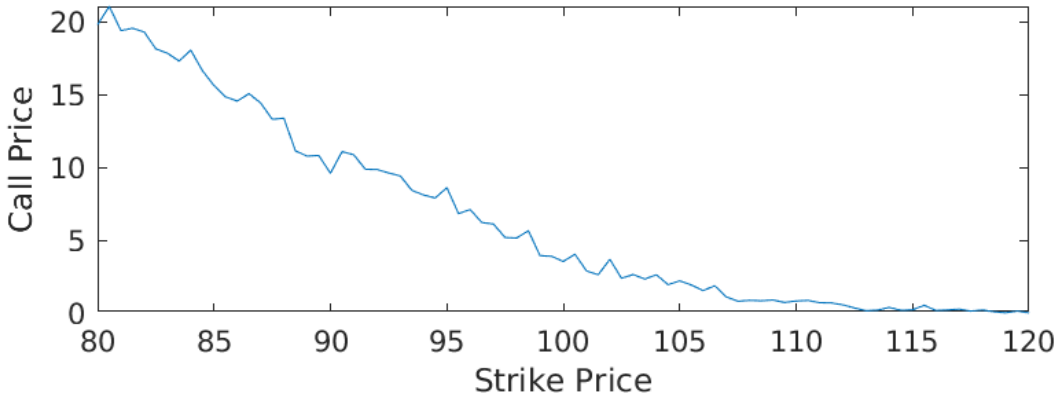
Call Price
20
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105
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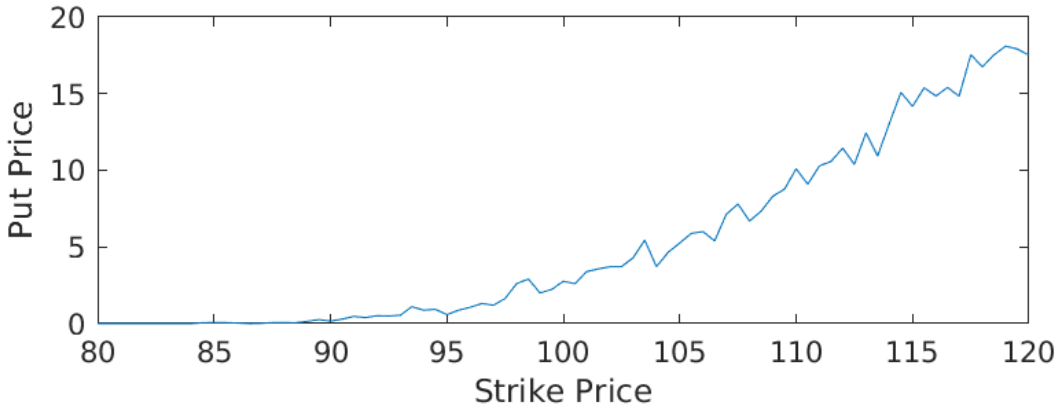
115
120
Strike Price


Put Price
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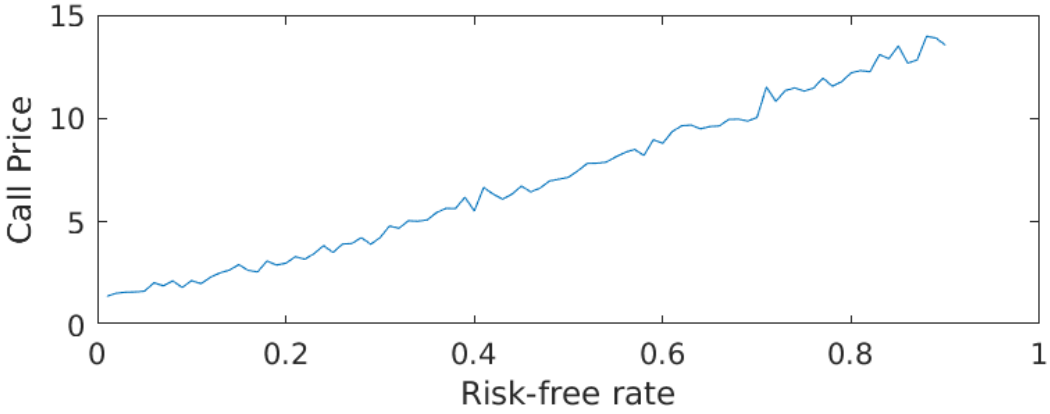
Strike Price


Call Price
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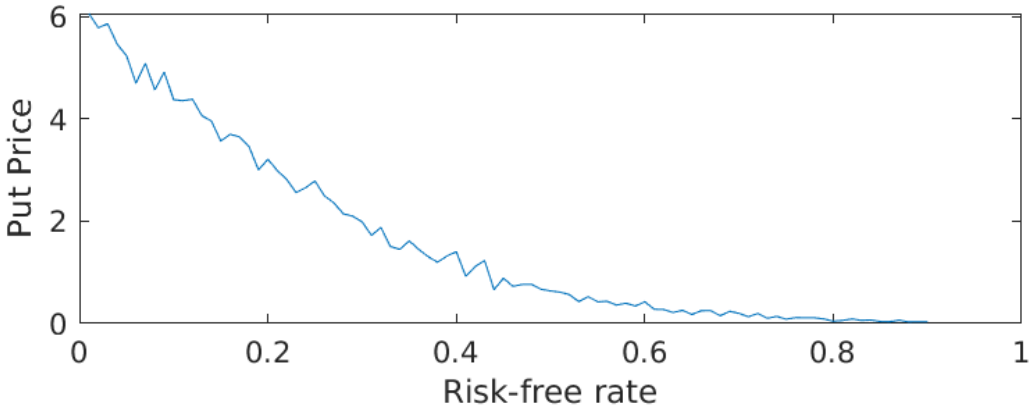
Risk-free rate


Put Price
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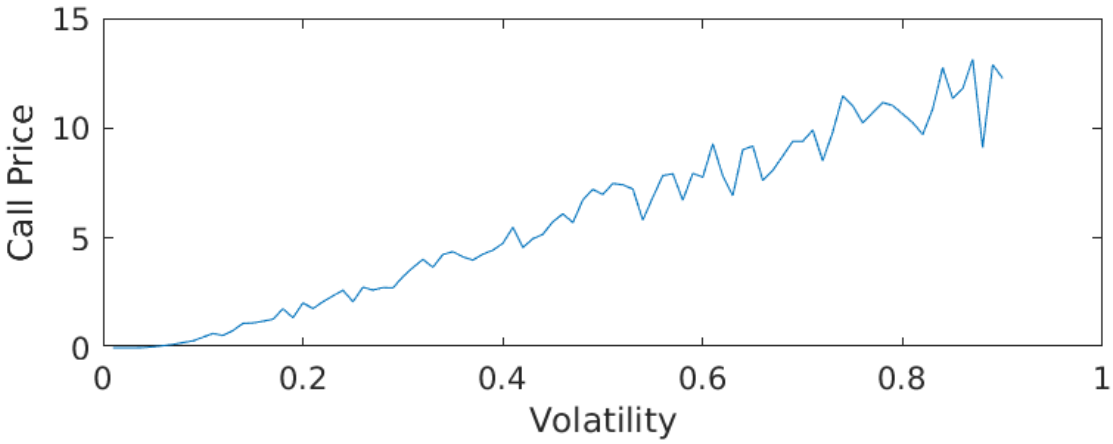
1
Risk-free rate


Call Price
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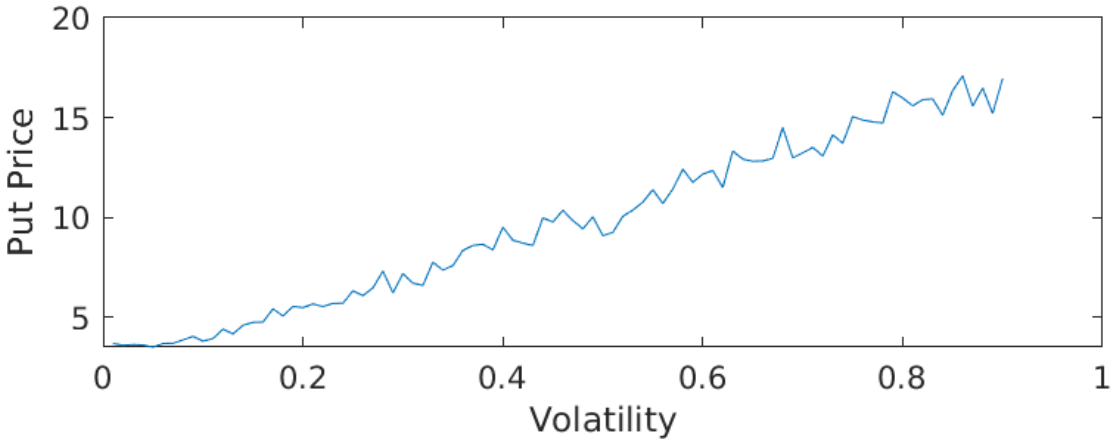
1
Volatility


Put Price
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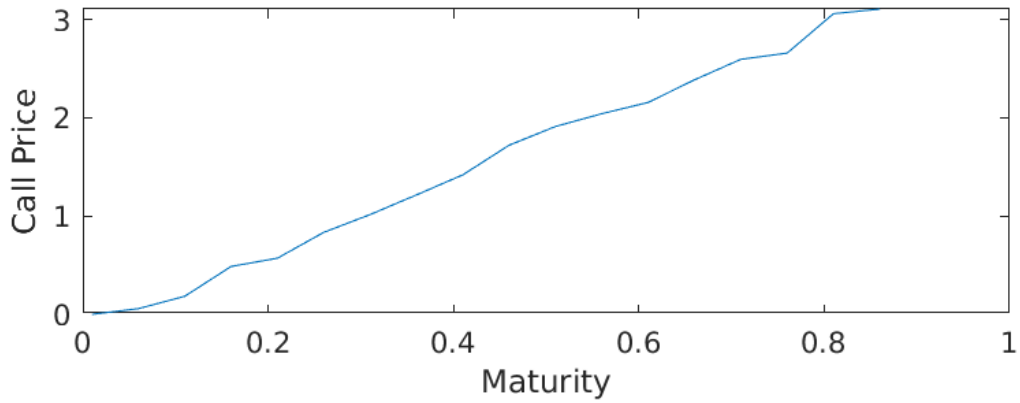
Volatility


Call Price
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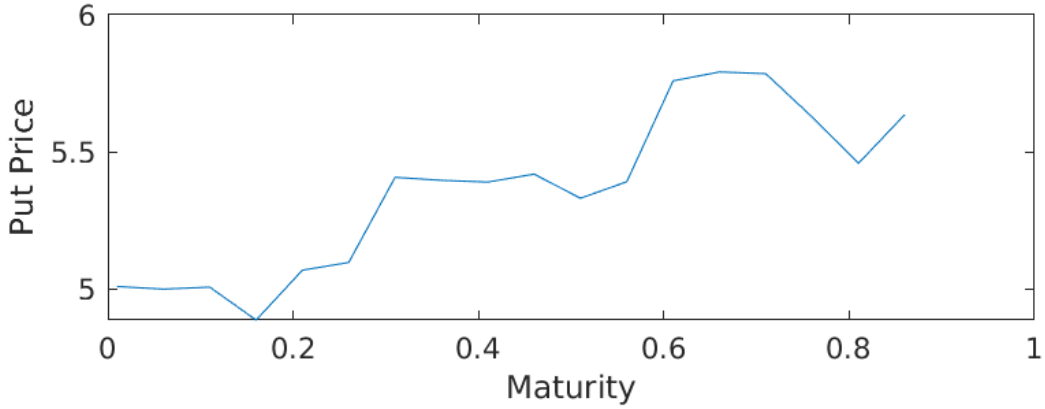
Maturity


Put Price
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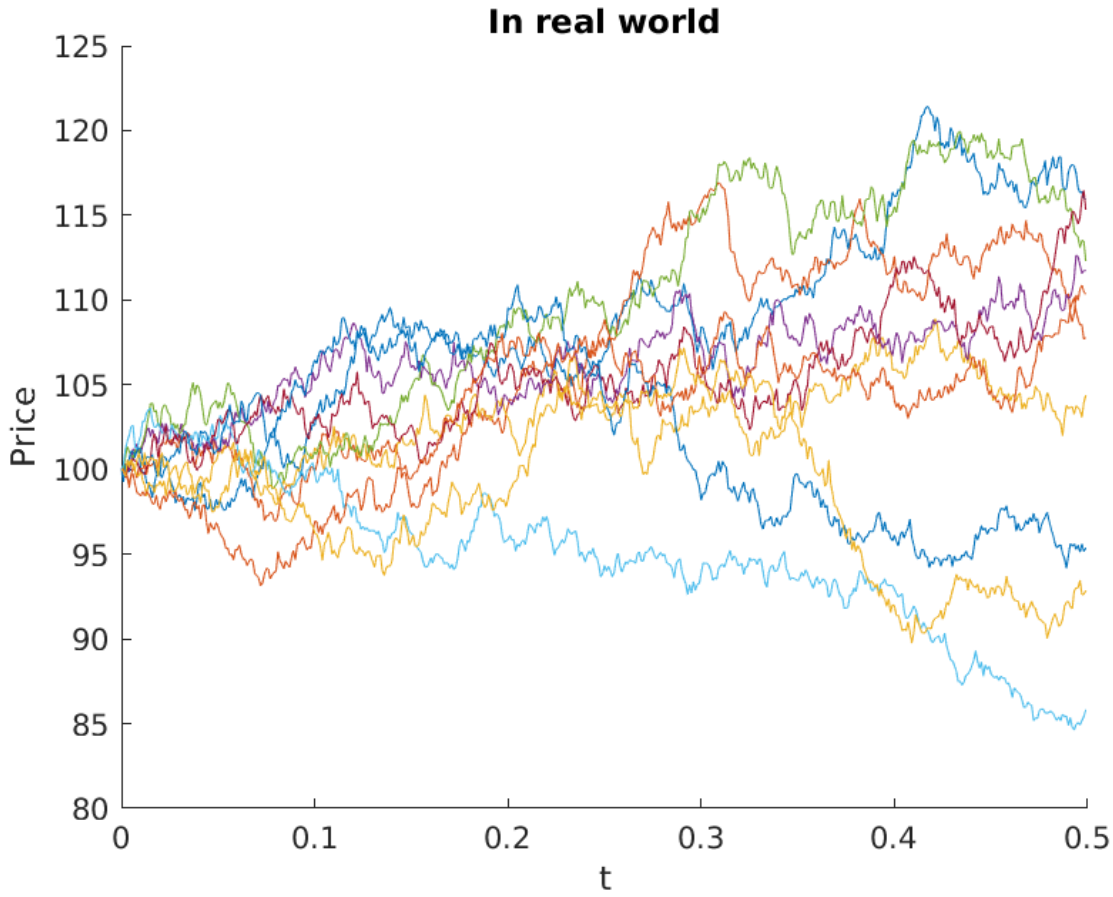
1
Maturity

Question 2


In real world
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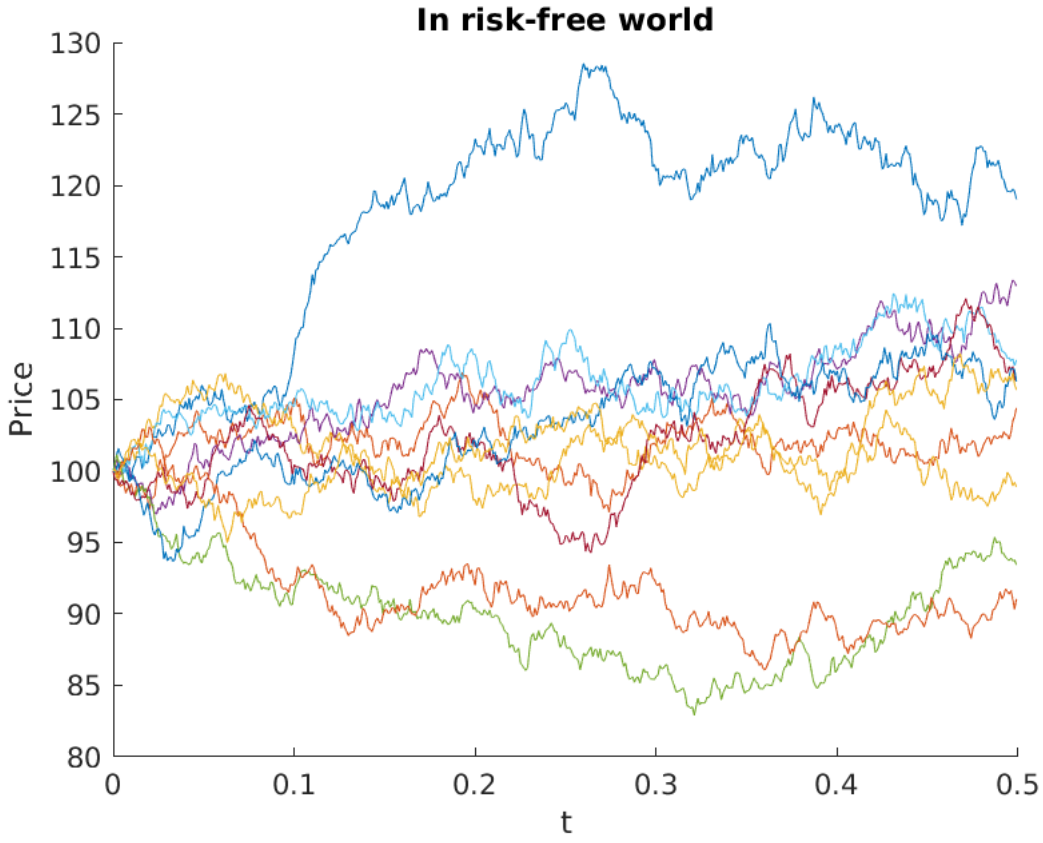
In risk-free world
Price
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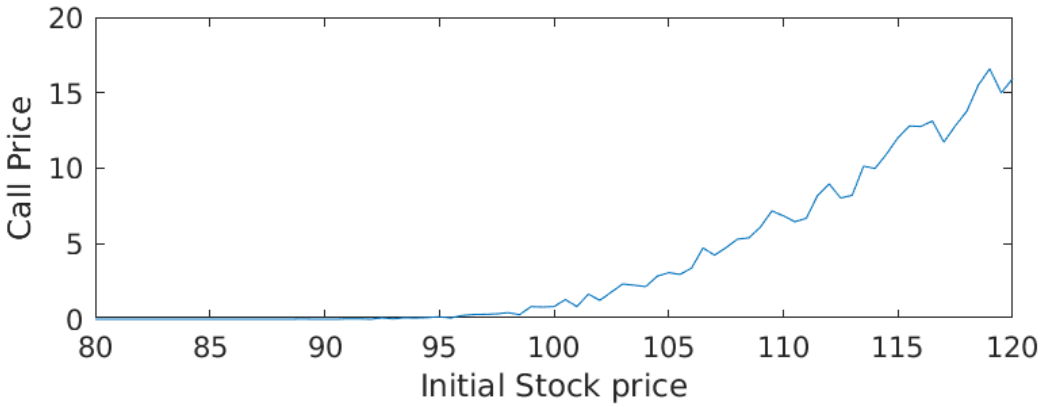
Call Price
Initial Stock price
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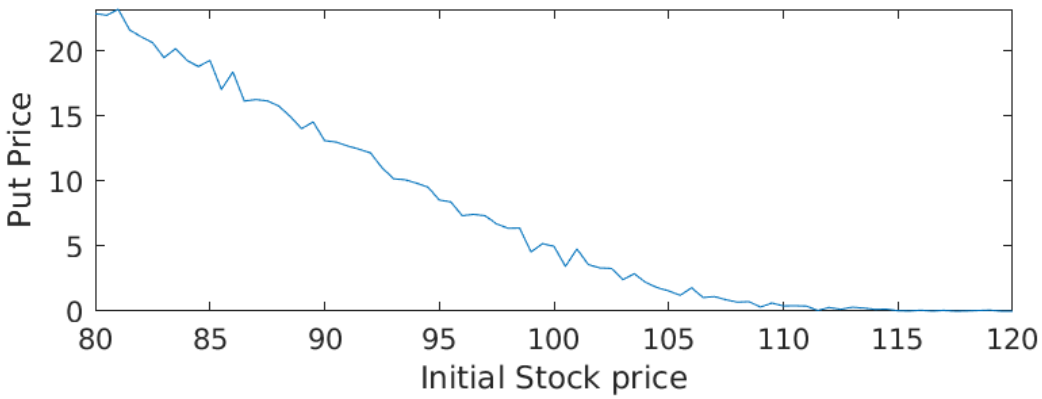
Put Price
Initial Stock price
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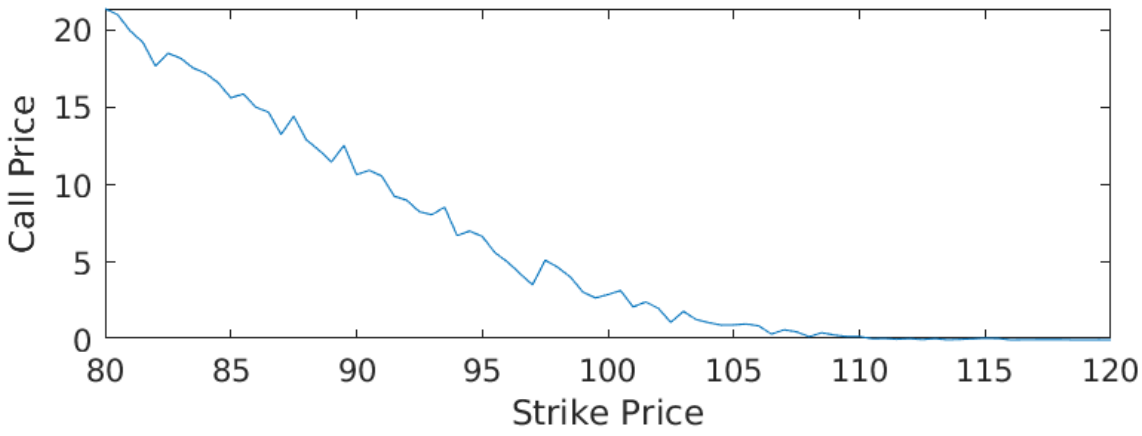
Call Price
Strike Price
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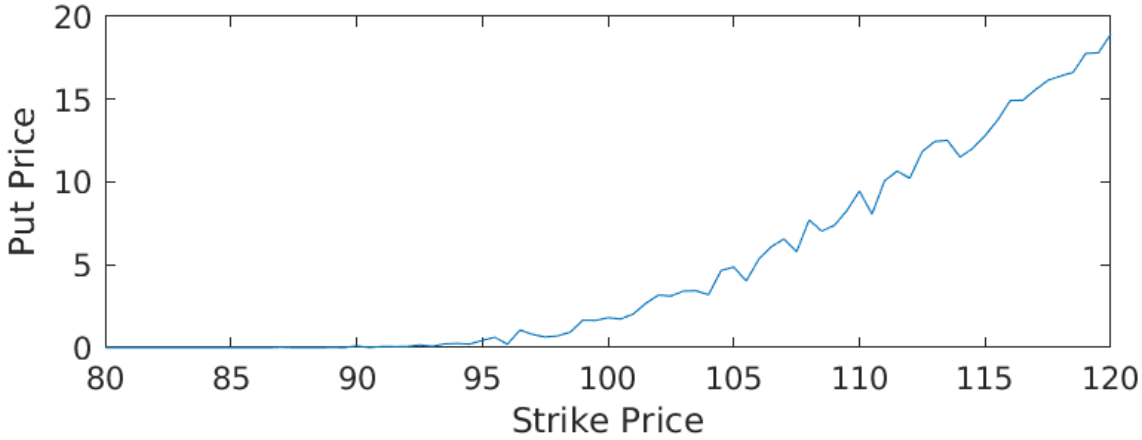
Put Price
Strike Price
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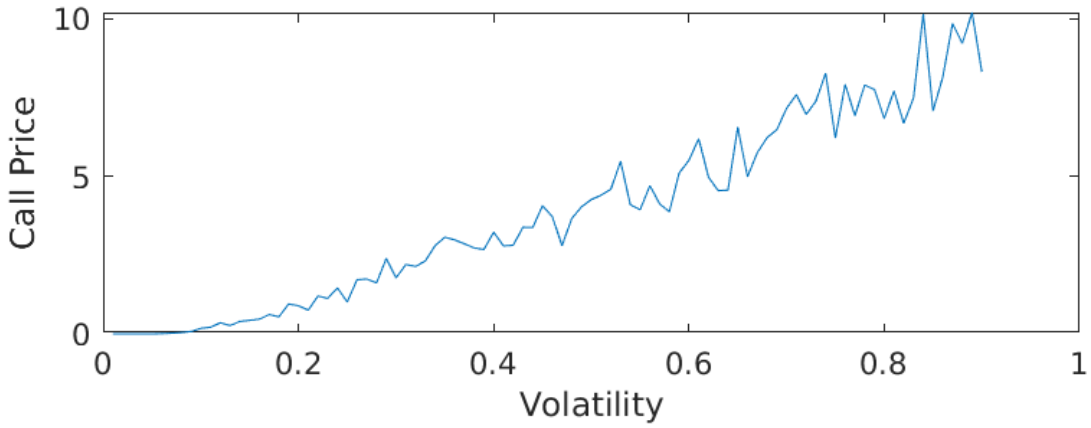
Call Price
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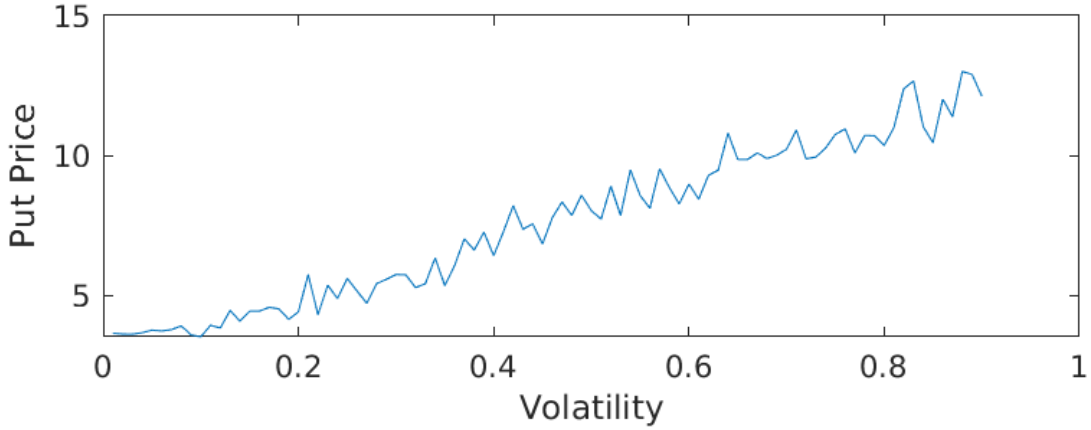
1
Volatility


Put Price
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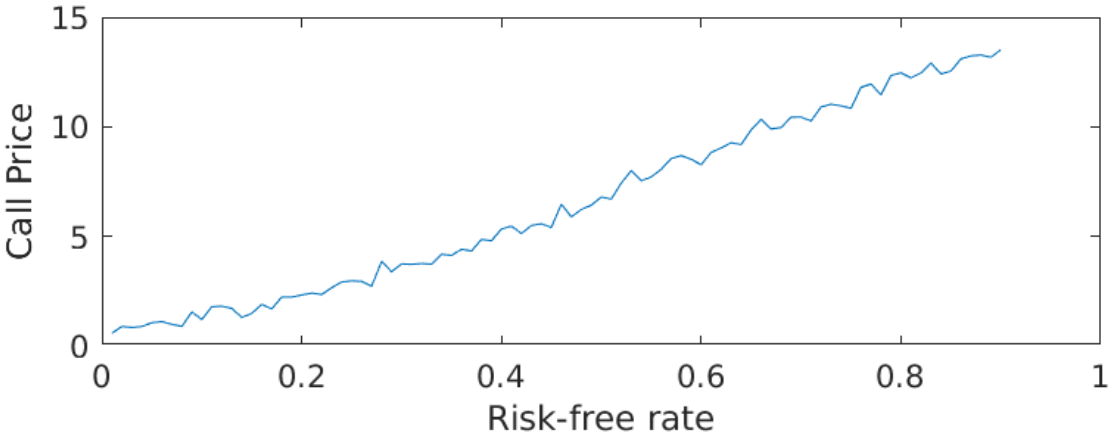
1
Volatility


Call Price
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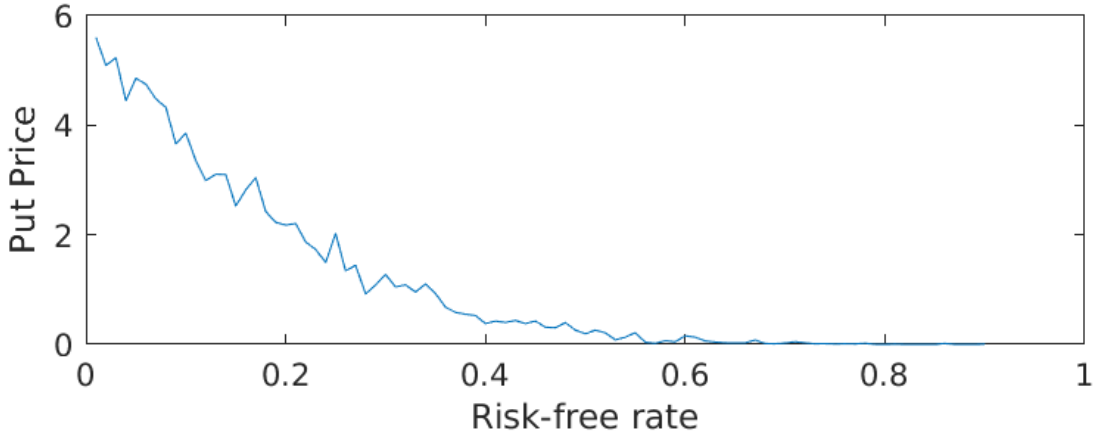
Risk-free rate


Put Price
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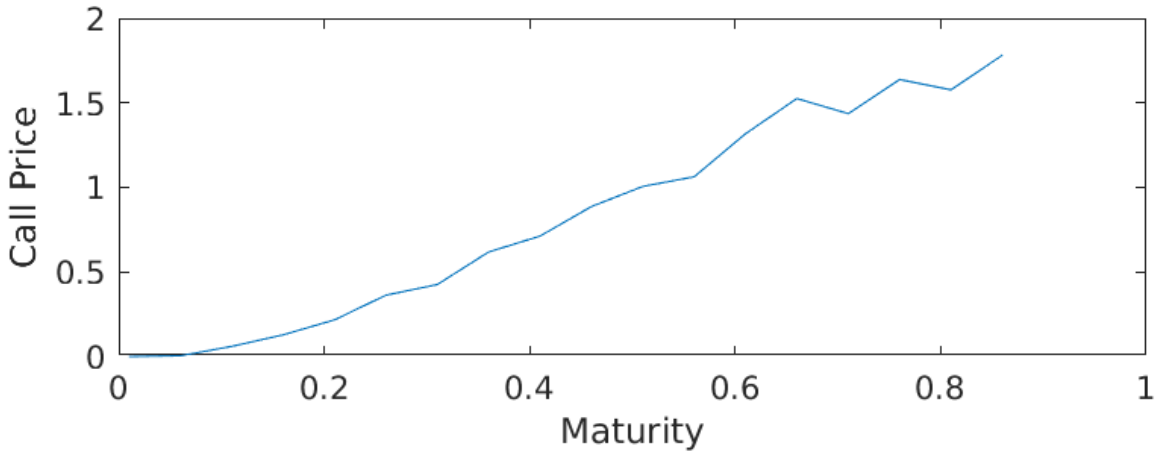
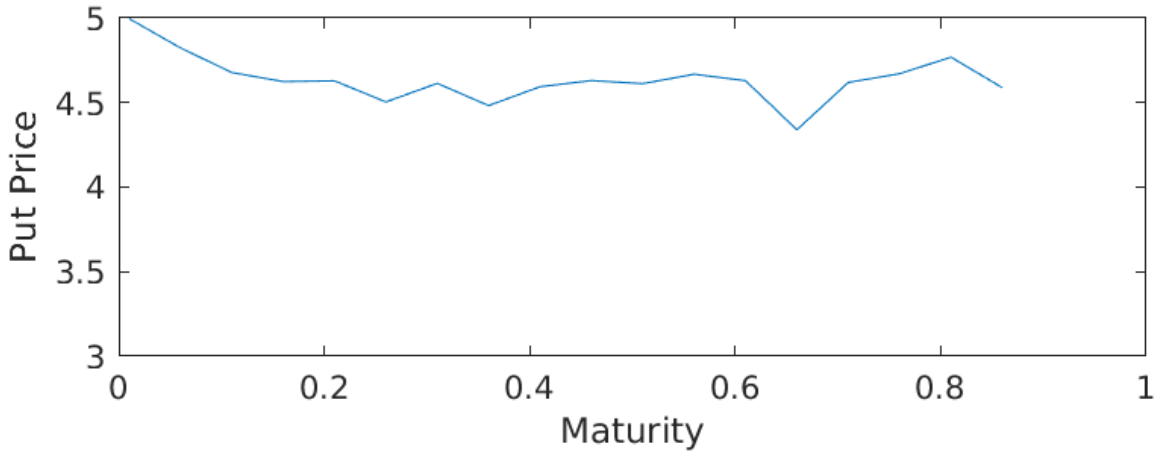
Risk-free rate





$S_{red} = (S_1 + S_2)/2$
Where S_{red} = Prices with reduced variance,
S_1, S_2 = Usual Stock prices following GBM,

The advantage of using these variance reduction techniques is to decrease the time of the above algorithms.

Stock prices following GBM require generation of more number of paths for smoother graphs (sensitivity graphs) as they have high variance. To reduce the strokes in the graphs(sensitivity graphs as they should be ideally continuous) and to make the curve more smoother we require more number of paths.

Whereas in Stock prices with reduced variance, this is not the case, only a few number of paths are sufficient to get the sensitivity graph smoother.

Variance using normal methods:183.9574
Variance using variance reduction techniques: 84.6114