Duke University

Project Week04

February 12, 2022

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Answer 1

Classical Brownian Motion:

$$E(P_t) = P_0$$
$$Var(P_t) = t\sigma^2$$

Arithmetic Return System:

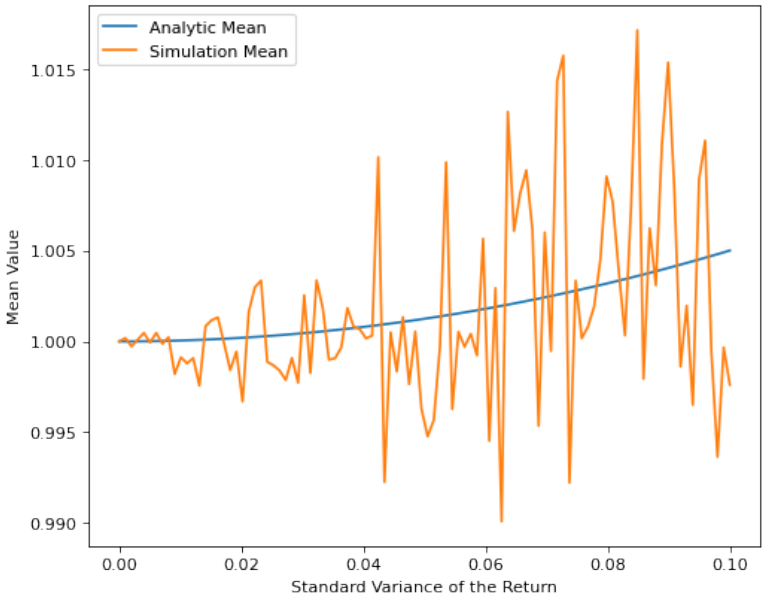
$$E(P_{t+1}) = P_t$$
$$Var(P_{t+1}) = \sigma^2 P_t$$

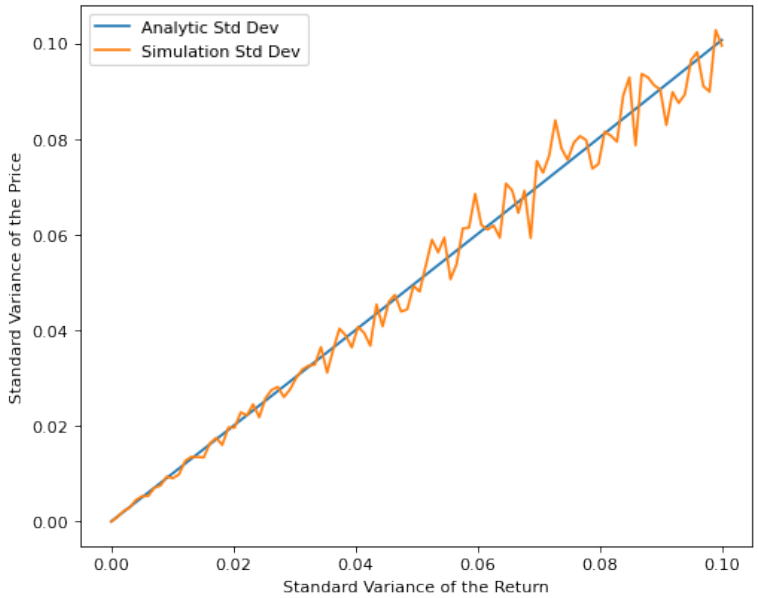
Log Return Motion:

$$E(P_{t+1}) = e^{ln(P_t)+\sigma^2/2}$$
$$Var(P_{t+1}) = (e^{\sigma^2} - 1)e^{2ln(P_t+\sigma^2)}$$

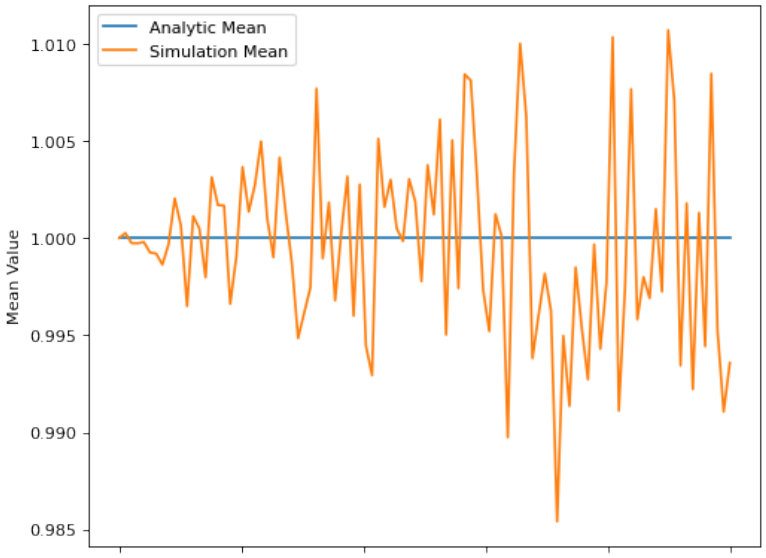
Answer 1

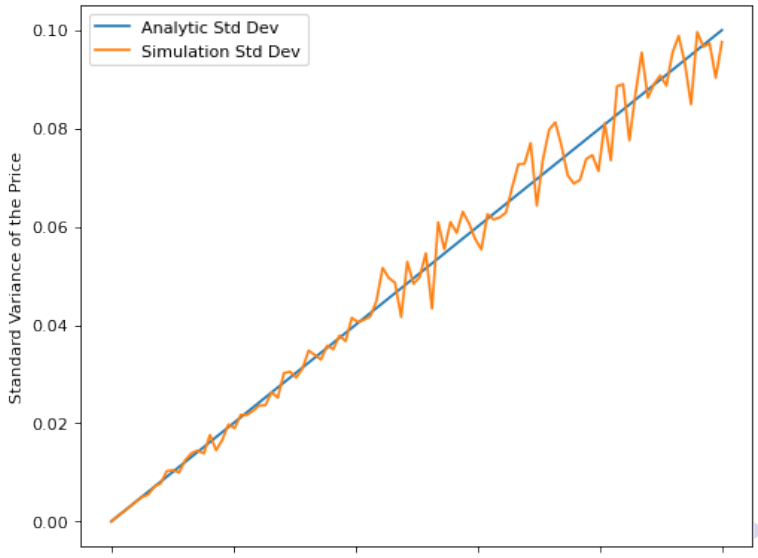
Classical Brownian Motion



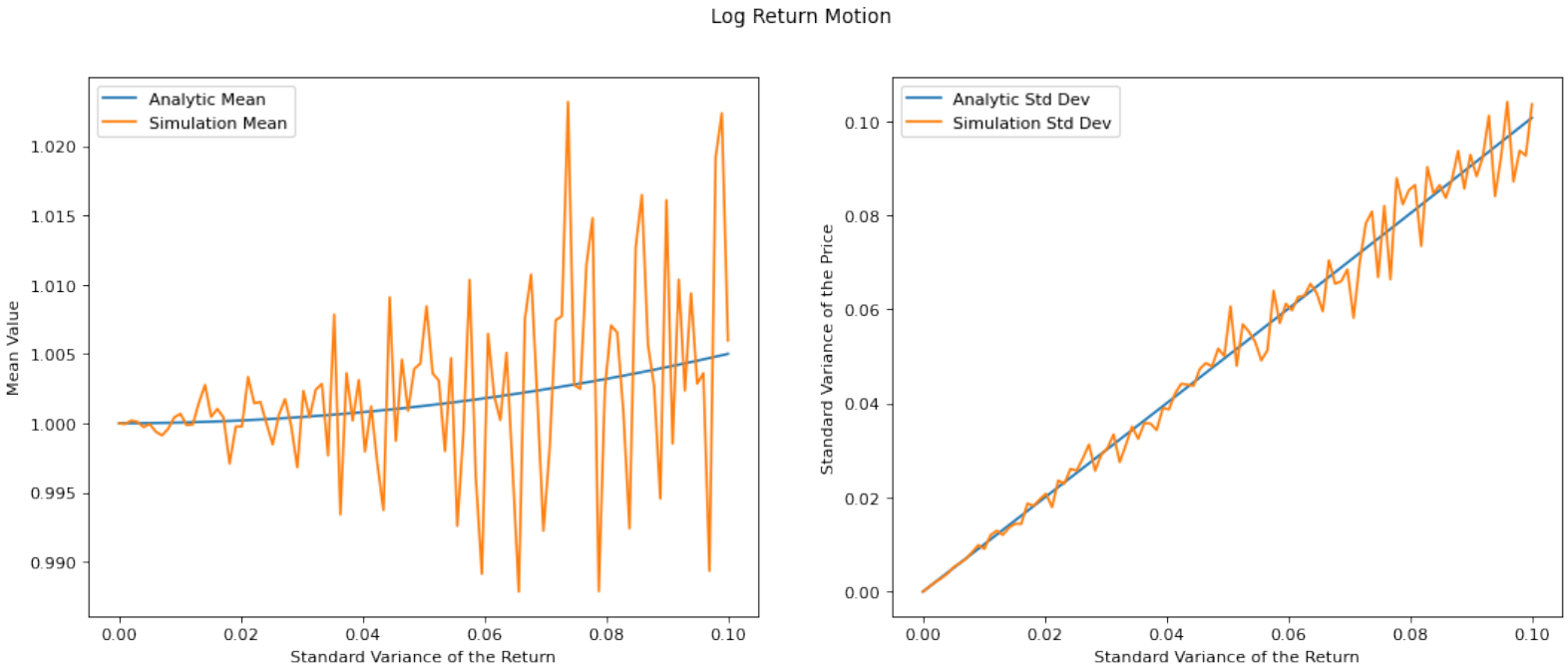


Arithmetic Return System





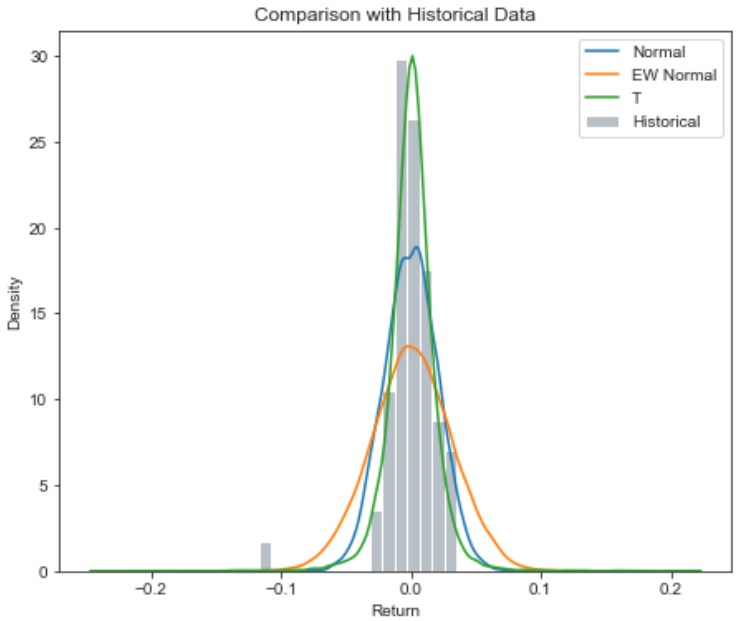
Answer 1

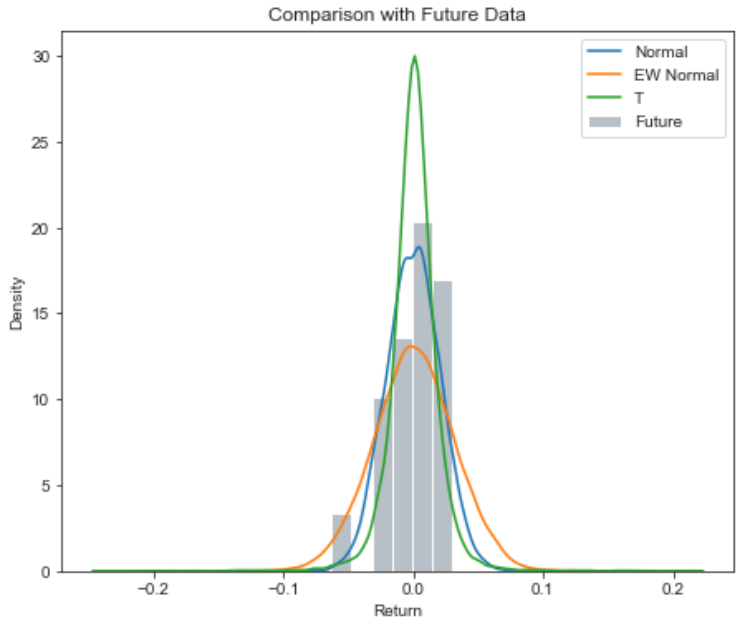

Log Return Motion
Analytic Mean
Simulation Mean
Mean Value
1.020
1.015
1.010
1.005
1.000
0.995
0.990
0.00
0.02
0.04
0.06
0.08
0.10
Standard Variance of the Return
Analytic Std Dev
Simulation Std Dev
Standard Variance of the Price
0.10
0.08
0.06
0.04
0.02
0.00
0.00
0.02
0.04
0.06
0.08
0.10
Standard Variance of the Return

Answer 2

Method	VaR
Historical	2.07%
Normal	3.40%
EWNormal	5.04%
T	2.70%

Answer 2


Comparison with Historical Data
Normal
EW Normal
T
Historical
Density
Return
30
25
20
15
10
5
0
−0.2
−0.1
0.0
0.1
0.2


Comparison with Future Data
Normal
EW Normal
T
Future
Density
Return
30
25
20
15
10
5
0
−0.2
−0.1
0.0
0.1
0.2

Answer 3

Portfolio	VaR
A	6469.05
B	6073.01
C	3679.06
Total	16221.13