Problem 1

Implement the closed form greeks for GBSM. The result is below:
Call Delta: 0.5343
Call Gamma: 0.0401
Call Theta: -24.9090
Call Vega: 19.7196
Call Rho: 7.5836
Put Delta: -0.4657
Put Gamma: 0.0401
Put Theta: -18.7974
Put Vega: 19.7196
Put Rho: -7.2770

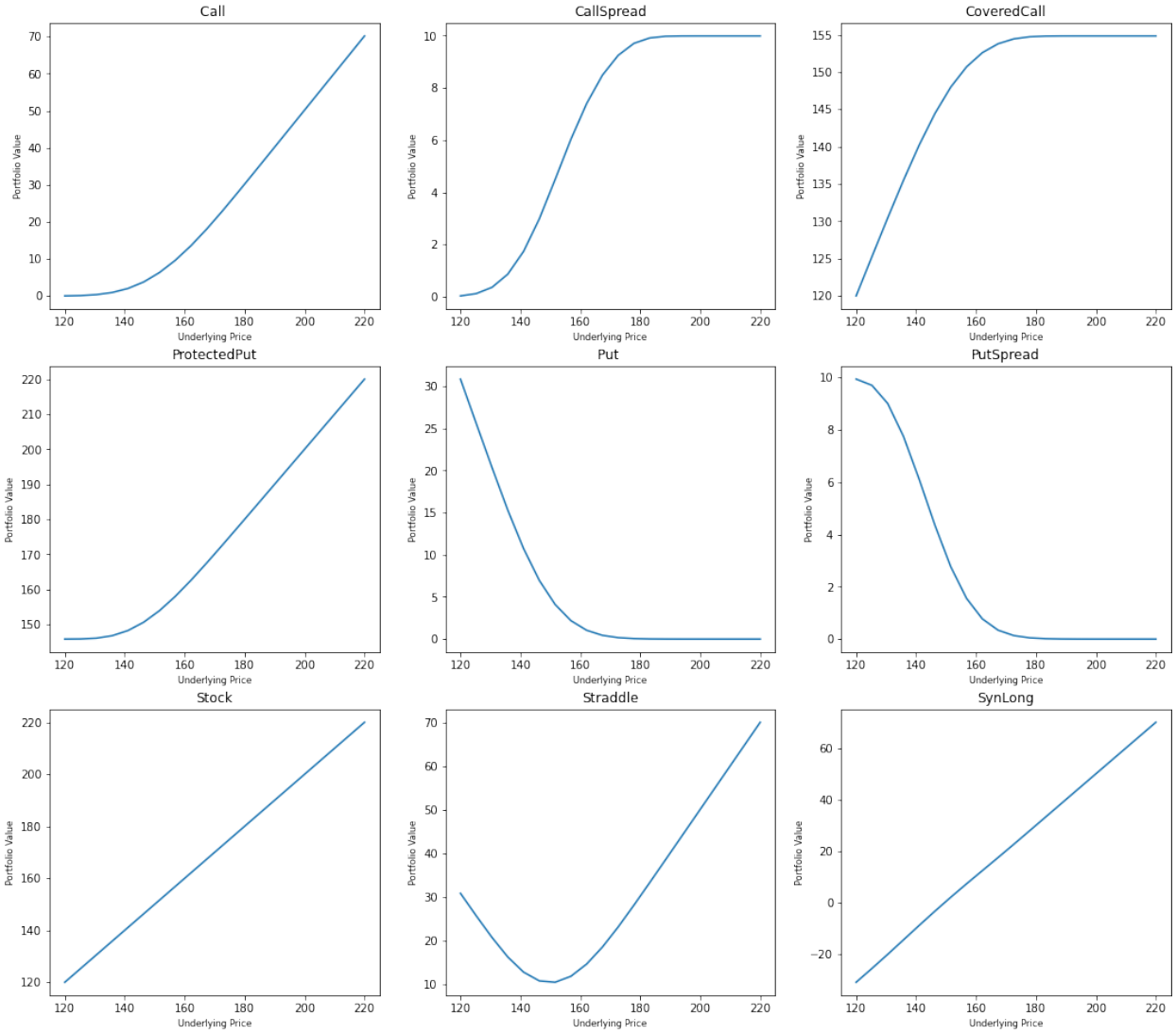
Implement a finite difference derivative calculation. The result is below:
Call Delta: 0.5340
Call Gamma: 0.0400
Call Theta: -24.9322
Call Vega: 19.7101
Call Rho: 7.5836
Put Delta: -0.4655
Put Gamma: 0.0400
Put Theta: -18.8207
Put Vega: 19.7101
Put Rho: -7.2770

Comparison
The results generated by both methods show that the greeks are very close. For call and put options, the results calculated by the GBSM are generally greater than the results generated by a finite difference derivative calculation.

Sensitivity to dividend amount: Call: -0.517, Put: 0.483

Problem 2

Simulation



Fit a Normal distribution and calculate Mean, VaR and ES.

Portfolio	Mean	VaR	ES
Call	-0.126615	6.201060	6.562662
CallSpread	-0.525887	4.030262	4.362484
CoveredCall	-1.733921	13.923459	18.803451
ProtectedPut	0.043535	7.651911	8.041389
Put	1.954384	4.356013	4.649988
PutSpread	0.818833	2.628327	2.854175
Stock	-1.510773	17.813569	22.800091
Straddle	1.827769	1.347783	1.385781
SynLong	-2.080999	19.084993	24.336698

Calculate VaR and ES using Delta-Normal.

Portfolio	Mean	VaR	ES
Call	0	9.51986	11.938288
CallSpread	0	5.26384	6.601068
CoveredCall	0	10.901461	13.670872
ProtectedPut	0	12.141348	15.225741
Put	0	8.187534	10.267498
PutSpread	0	4.91698	6.166092
Stock	0	17.627131	22.105134
Straddle	0	1.332326	1.67079
SynLong	0	17.707393	22.205786

Problem 3