Fintech 590 Week 07

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Problem 1

delta of call option using closed form: 0.51
delta of put option using closed form: -0.49
gamma of call option using closed form : 0.04
gamma of put option using closed form : 0.04
vega of call option using closed form : 19.78
vega of put option using closed form : 19.78
theta of call option using closed form: -21.63
theta of put option using closed form: -22.09
rho of call option using closed form: 0.07
rho of put option using closed form: -0.08
carryRho of call option using closed form: 7.61
carryRho of put option using closed form: -7.30

delta of call option using forward difference method: 0.51
delta of put option using forward difference method: -0.49
gamma of call option using forward difference method: 0.00
gamma of put option using forward difference method: 0.00
vega of call option using forward difference method: 19.78
vega of put option using forward difference method: 19.78
theta of call option using forward difference method: -21.63
theta of put option using forward difference method: -22.09
rho of call option using forward difference method: -0.36
rho of put option using forward difference method: -0.36
carry rho of call option using forward difference method: 7.61
carry rho of put option using forward difference method: -7.30

Generally, the values between the two methods for both a call and a put are similar. The gamma and rho values are slightly different between two methods.

call option value using binomial tree valuation: 3.85
put option value using binomial tree valuation: 7.18

call option value using binomial tree valuation: 3.85
put option value using binomial tree valuation: 7.18
delta of call option using binomial tree valuation: 0.54
delta of put option using binomial tree valuation: -0.03
gamma of call option using binomial tree valuation: 0.00
gamma of put option using binomial tree valuation: 0.00
vega of call option using binomial tree valuation: 19.62

vega of put option using binomial tree valuation: 19.62
theta of call option using binomial tree valuation: -21.88
theta of put option using binomial tree valuation: -41.90
rho of call option using binomial tree valuation: 6.55
rho of put option using binomial tree valuation: 0.7

Problem 2

	Portfolio	Type	Underlying	...	ivol	Delta	Values
0	Straddle	Option	AAPL	...	0.30	0.525165	3.676464
1	Straddle	Option	AAPL	...	0.16	-0.039603	4.685824
2	SynLong	Option	AAPL	...	0.30	0.525165	3.676464
3	SynLong	Option	AAPL	...	0.16	0.000000	4.685824
4	CallSpread	Option	AAPL	...	0.30	0.525165	3.676464
5	CallSpread	Option	AAPL	...	0.24	0.000000	0.459715
6	PutSpread	Option	AAPL	...	0.16	-0.039603	4.685824
7	PutSpread	Option	AAPL	...	0.10	0.000000	7.160076
8	Stock	Stock	AAPL	...	NaN	1.000000	NaN
9	Call	Option	AAPL	...	0.30	0.525165	3.676464
10	Put	Option	AAPL	...	0.16	-0.039603	4.685824
11	CoveredCall	Stock	AAPL	...	NaN	1.000000	NaN
12	CoveredCall	Option	AAPL	...	0.30	0.000000	3.676464
13	ProtectedPut	Stock	AAPL	...	NaN	1.000000	NaN
14	ProtectedPut	Option	AAPL	...	0.16	-0.039603	4.685824

[15 rows x 11 columns]

	Mean	VaR	ES
Portfolio			
Straddle	3.676464	-153.084390	-149.647495
Straddle	4.685824	-153.257463	-150.523578
SynLong	3.676464	-153.885289	-151.861471
SynLong	4.685824	-154.409488	-152.570781
CallSpread	3.676464	-154.663000	-153.267379
CallSpread	0.459715	-154.989514	-153.833476
PutSpread	4.685824	-155.288802	-154.274144
PutSpread	7.160076	-155.516765	-154.699501
Stock	NaN	-155.923809	-154.975901
Call	3.676464	-156.347169	-155.253139
Put	4.685824	-156.466882	-155.606305
CoveredCall	NaN	-156.866079	-155.931967
CoveredCall	3.676464	-157.264001	-156.195346
ProtectedPut	NaN	-157.369545	-156.606624
ProtectedPut	4.685824	-157.553196	-156.865441

Problem 3
Expected annual returns:

	stocks	expected annual return
0	AAPL	-1835.296303
1	FB	-1770.859807
2	UNH	-1981.493569
3	MA	-1734.939893
4	MSFT	-1835.134815
5	NVDA	-1591.620330
6	HD	-1846.532657
7	PFE	-1843.741622
8	AMZN	-1951.061113
9	BRK_B	-1861.732784
10	PG	-2058.907590
11	XOM	-1688.606908
12	TSLA	-1614.228172
13	JPM	-1761.539434
14	V	-1746.240913
15	DIS	-1881.321058
16	GOOGL	-1857.970949
17	JNJ	-2491.953354
18	BAC	-1706.094936
19	CSCO	-1916.759653