

Assignment 7

Summary

Question 1

For this question, I first build 6 greeks functions with both closed form with GBSM and finite difference derivative calculation. Here is the output:

		Call-GBSM	Call-finite diff	Put-GBSM	Put-finite diff
0	Delta	0.5007	0.5007	-0.4988	-0.4988
1	Gamma	0.0402	0.0402	0.0402	0.0402
2	Vega	19.7831	19.7766	19.7831	19.7766
3	Theta	-21.6286	-21.6286	-22.0903	-22.0903
4	Rho	N/A	-0.3558	N/A	-0.3596
5	Carry Rho	7.6091	7.6091	-7.3015	-7.3015

I think the two methods provide similar result. I find the gamma, vega, theta, rho not change by call or put; however, the Delta and Carry's outputs are positive for call and negative for put.

The second part for this question is calculate the binomial function for American option (with or without dividends). Here is the output:

	GBSM	Binomial w/o Div	Binomial with div
Call	3.935701257793056	3.9683834268184377	3.8558587740512866
Put	3.9774563953463797	4.007520415586837	4.417108066684497

Question 2:

For this question, I need to simulate the AAPL returns 10 days ahead and calculate the Mean, VAR and ES and calculate using Delta-Normal

Here is the result for this week:

	PnL Mean	5% VaR	5% ES	5% VaR, Delta Normal	5% ES, Delta Normal
Portfolio					
Call	1.463924	0.404872	0.493609	1.917504	3.535382
CallSpread	3.391540	-0.878051	-0.760532	0.078751	4.653264
CoveredCall	13.395477	-8.300323	-8.012009	1.831292	3.587795
ProtectedPut	2.074680	-0.328387	-0.243474	1.919471	3.534186
Put	-0.856873	1.905622	2.027395	-1.829325	5.813292
PutSpread	1.986405	-0.536829	-0.377449	-0.059001	4.737011
Stock	2.931552	0.294805	0.494382	3.748796	2.422035
Straddle	0.607051	-0.118608	-0.117298	0.088179	4.647532
SynLong	9.407051	-8.918608	-8.917298	3.746829	2.423231

This plot is the result for last week assignment:

	PnL Mean	5% VaR	5% ES
Portfolio			
Call	2.681833	-0.593863	-0.265604
CallSpread	5.136356	-2.201233	-1.765483
CoveredCall	16.313986	-10.908861	-9.987594
ProtectedPut	2.710068	-0.600388	-0.270919
Put	-1.922085	2.627516	2.702048
PutSpread	0.493284	0.467263	0.567195
Stock	4.632152	-1.314998	-0.721990
Straddle	0.759749	0.120747	0.185467
SynLong	9.559749	-8.679253	-8.614533

After compare with these two results, I think they are very similar.

Question 3:

For this question, I use the past years returns to find the expected annual return for each stock. I plot each individual stock with the corresponding values of each stock's annual return and risk. And find the best portfolio allocation.

Here is the result I get:

----- Maximum Sharpe Ratio Portfolio Allocation

Portfolio Annual Return: 0.1311
 Portfolio Annual Std: 0.1299
 Portfolio Sharpe Ratio: 0.9897

	AAPL	FB	UNH	MA	MSFT	NVDA	HD	PFE	AMZN	BRK-B	PG	\
allocation	5.28	4.05	0.0	0.0	6.46	1.34	13.62	8.13	0.0	31.18	9.7	
	XOM	TSLA	JPM	V	DIS	GOOGL	JNJ	BAC	CSCO			
allocation	12.29	2.0	4.9	0.0	0.0	0.0	0.0	0.33	0.73			

