Fintech 590 week 06

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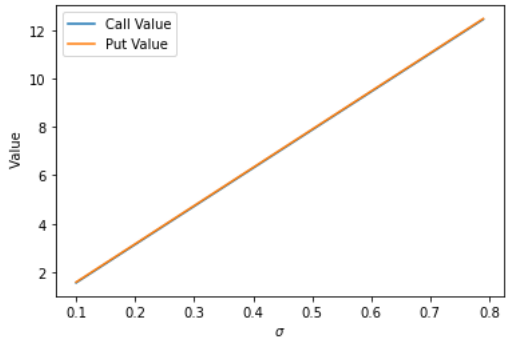
Problem 1

Time to maturity: 0.058

For a range of implied volatilities between 10% and 80%, plot the value of the call and the put.

The call value and put value are very close to each other. Both are increasing linearly with implied volatility.

Implied volatility is directly influenced by the supply and demand of the underlying options and by the market's expectation of the share price's direction. As expectations rise, or as the demand for an option increases, implied volatility will rise.

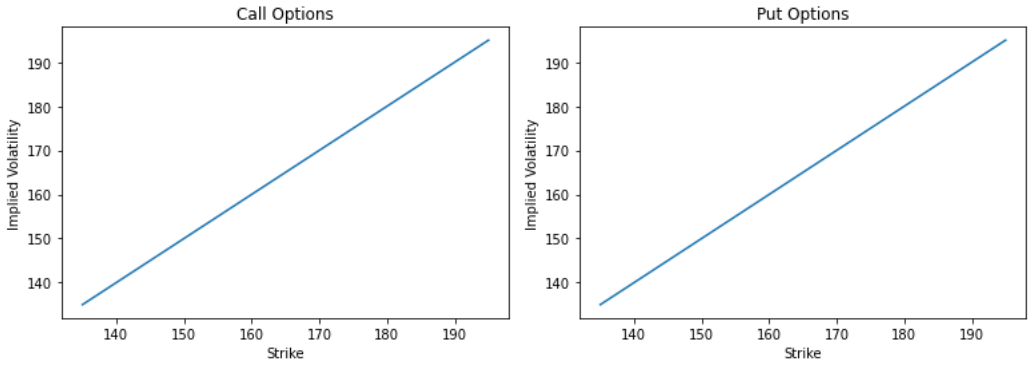


Problem 2

Calculate the implied volatility for each option.

	Stock	Expiration	Type	Strike	Last Price	implied vol
0	AAPL	3/18/2022	Call	135.0	30.175	0.7999
1	AAPL	3/18/2022	Call	140.0	25.300	0.786
2	AAPL	3/18/2022	Call	145.0	20.525	0.6546
3	AAPL	3/18/2022	Call	150.0	15.850	0.5265
4	AAPL	3/18/2022	Call	155.0	11.525	0.4179
5	AAPL	3/18/2022	Call	160.0	7.525	0.3258
6	AAPL	3/18/2022	Call	165.0	4.225	0.2734
7	AAPL	3/18/2022	Call	170.0	1.935	0.2783
8	AAPL	3/18/2022	Call	175.0	0.715	0.3423
9	AAPL	3/18/2022	Call	180.0	0.260	0.445
10	AAPL	3/18/2022	Call	185.0	0.115	0.558
11	AAPL	3/18/2022	Call	187.5	0.120	0.6162
12	AAPL	3/18/2022	Call	190.0	0.075	0.6694
13	AAPL	3/18/2022	Call	195.0	0.055	0.7746
14	AAPL	3/18/2022	Put	135.0	0.320	0.7999
15	AAPL	3/18/2022	Put	140.0	0.435	0.7828
16	AAPL	3/18/2022	Put	145.0	0.640	0.6502
17	AAPL	3/18/2022	Put	150.0	1.015	0.5256
18	AAPL	3/18/2022	Put	155.0	1.610	0.4118
19	AAPL	3/18/2022	Put	160.0	2.640	0.3218
20	AAPL	3/18/2022	Put	165.0	4.350	0.2701
21	AAPL	3/18/2022	Put	170.0	7.075	0.2761
22	AAPL	3/18/2022	Put	175.0	10.850	0.3398
23	AAPL	3/18/2022	Put	180.0	15.400	0.4429
24	AAPL	3/18/2022	Put	185.0	20.225	0.5542
25	AAPL	3/18/2022	Put	190.0	25.175	0.665
26	AAPL	3/18/2022	Put	195.0	30.175	0.7715

Plot the implied volatility vs the strike price for Puts and Calls:



When strike price increases, the implied volatility of both calls and puts increase. The growth rate is similar. Implied volatility and stock price trends are often closely related and contain certain regularities. Implied volatility decreases when a stock price is rising, and rises sharply when a stock price is falling. The reason is that stock prices generally fall faster

than they rise. From the observation of implied volatility, we find that when volatility hits a high, it is also often when the market reaches a bottom and starts to reverse or rebound.

Problem 3

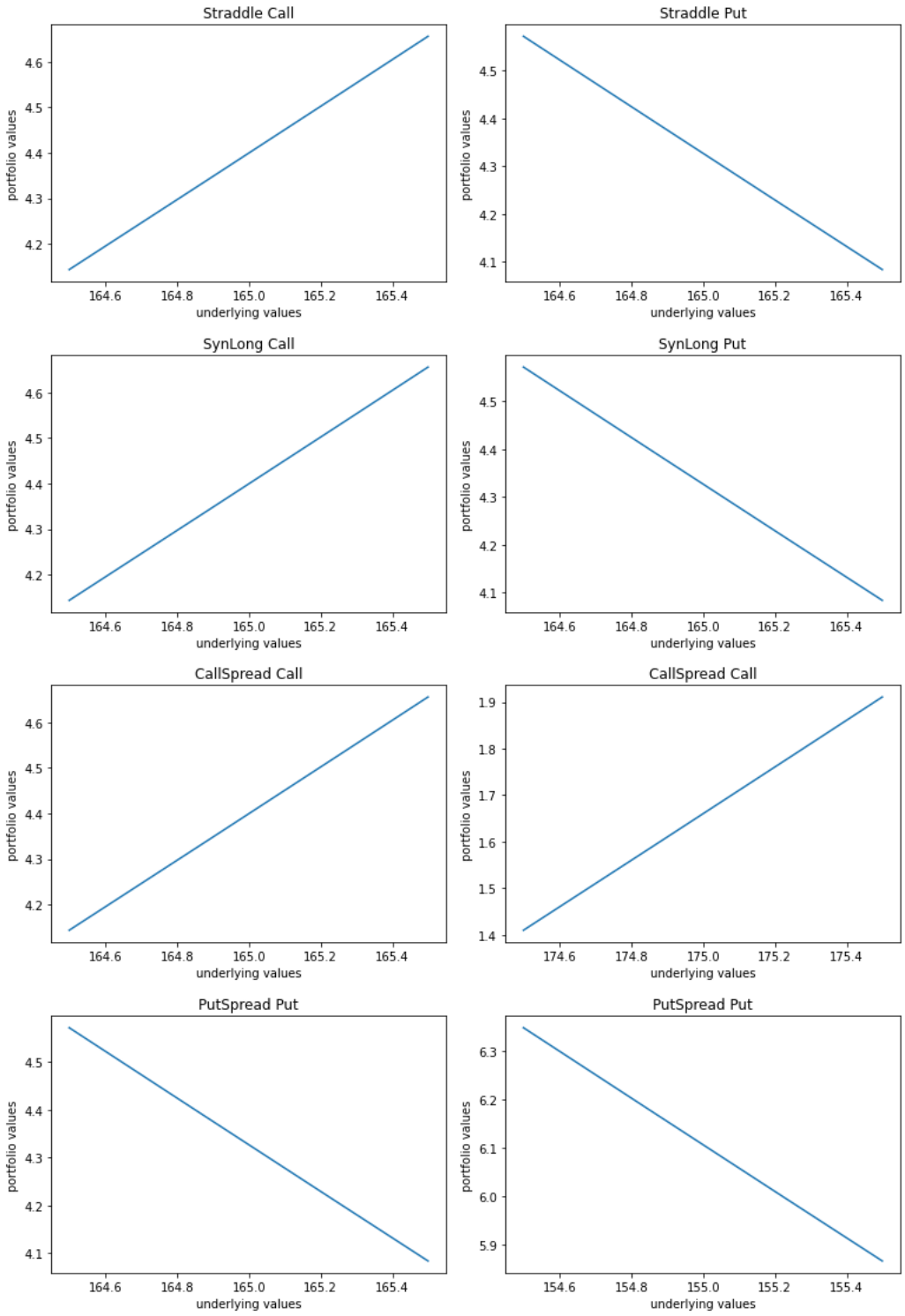
Calculate the implied volatility:

	Portfolio	Type	Underlying	...	Strike	CurrentPrice	implied vol
0	Straddle	Option	AAPL	...	165.0	4.50	0.2796
1	Straddle	Option	AAPL	...	165.0	4.40	0.2733
2	SynLong	Option	AAPL	...	165.0	4.50	0.2796
3	SynLong	Option	AAPL	...	165.0	4.40	0.2733
4	CallSpread	Option	AAPL	...	165.0	4.50	0.2796
5	CallSpread	Option	AAPL	...	175.0	0.72	0.1
6	PutSpread	Option	AAPL	...	165.0	4.40	0.2733
7	PutSpread	Option	AAPL	...	155.0	1.60	0.4111
8	Stock	Stock	AAPL	...	NaN	164.85	None
9	Call	Option	AAPL	...	165.0	4.50	0.2796
10	Put	Option	AAPL	...	165.0	4.40	0.2733
11	CoveredCall	Stock	AAPL	...	NaN	164.85	None
12	CoveredCall	Option	AAPL	...	165.0	4.50	0.2796
13	ProtectedPut	Stock	AAPL	...	NaN	164.85	None
14	ProtectedPut	Option	AAPL	...	165.0	4.40	0.2733

[15 rows x 9 columns]

From the graph, we can observe that the portfolio values are generally linear related. Whether the slope is positive or negative is determined by the portfolio and option type.

The expected shortfall is greater than value at risk. Expected shortfall has tail risk since it chooses the riskier portfolio as a result of its disregard of extreme losses.


Straddle Call
portfolio values
underlying values
Straddle Put
portfolio values
underlying values
SynLong Call
portfolio values
underlying values
SynLong Put
portfolio values
underlying values
CallSpread Call
portfolio values
underlying values
CallSpread Call
portfolio values
underlying values
PutSpread Put
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PutSpread Put
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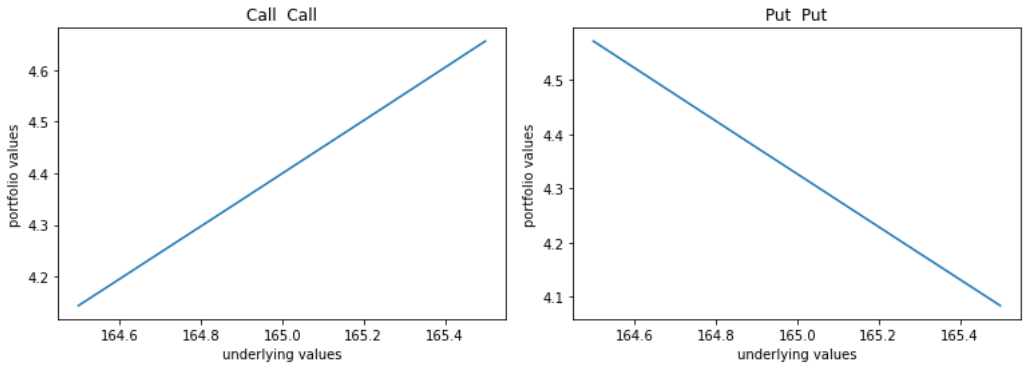

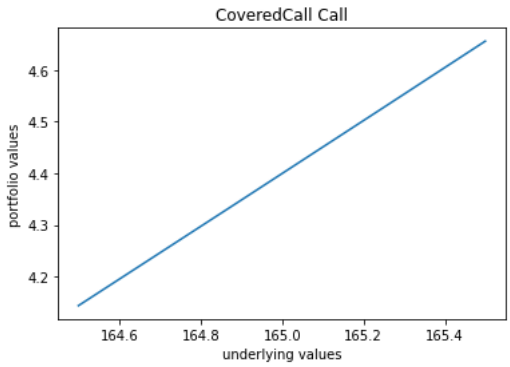

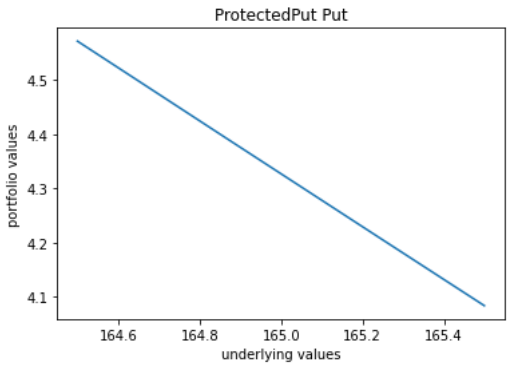

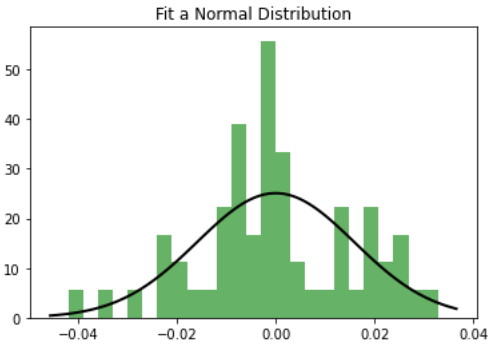


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Mean is 0.00
VaR is 0.02
ES is 0.04
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