Fintech545 Project5

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1 Problem 1

Figure 1: Enter Caption

Given the example of strike price equaling to underlying prices. As implied volatility rises from 10% to 80%, the prices of both call and put options increase. This occurs because higher implied volatility reflects the market's expectation of greater future price fluctuations, which raises the likelihood that the options will end up in-the-money, thereby increasing their value. Options with high demand typically have elevated implied volatility, while those with lower demand or abundant supply will exhibit lower implied volatility.

2 Problem 2

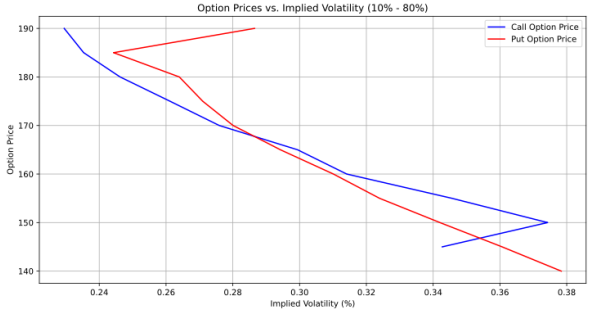

Figure 2: implied volatility vs the strike price for Puts and Calls

The implied volatility graph often shows a volatility smile (higher for in- and out-of-the-money options) or volatility skew (higher for low strike puts), reflecting market concerns over extreme movements or declines.

3 Problem 3

Figure 3: call

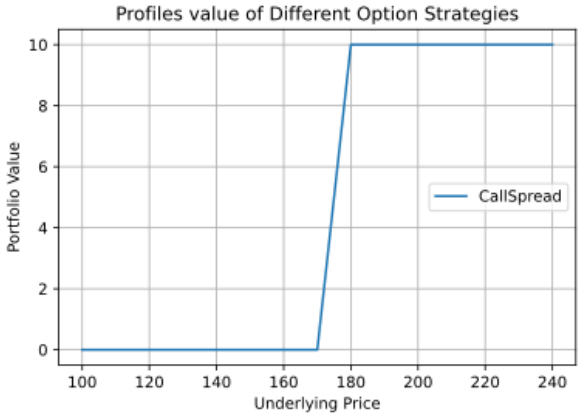

Figure 4: CallSpread

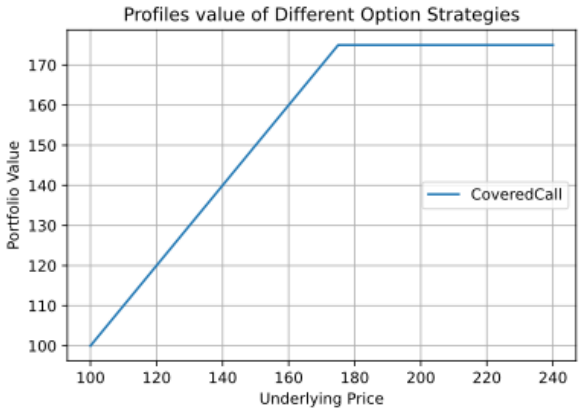

Figure 5: CoveredCall

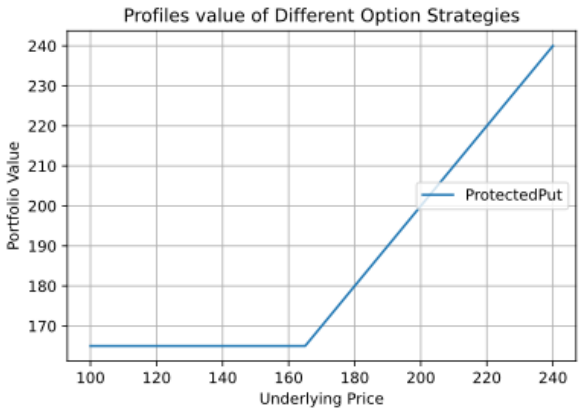

Figure 6: ProtectedPut

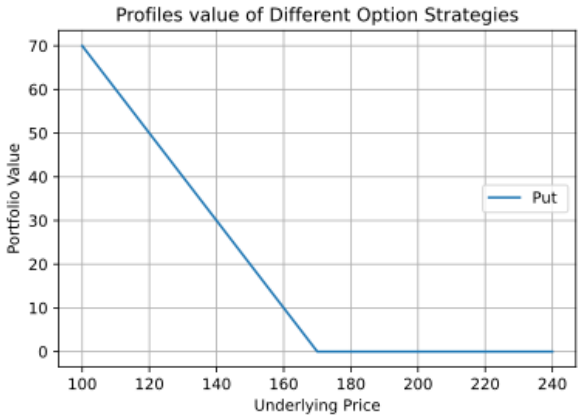

Figure 7: Put

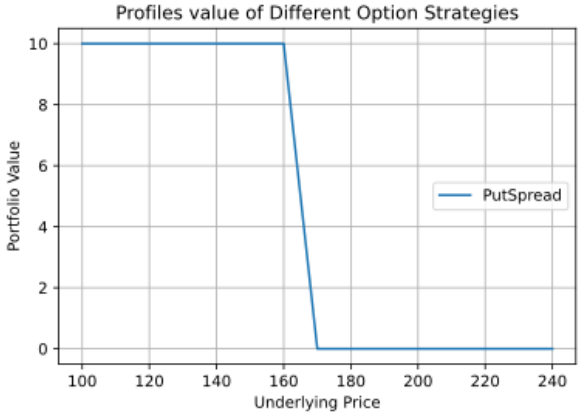

Figure 8: PutSpread

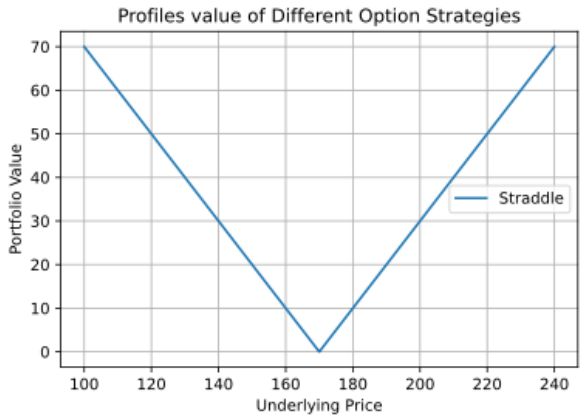

Figure 9: Strade

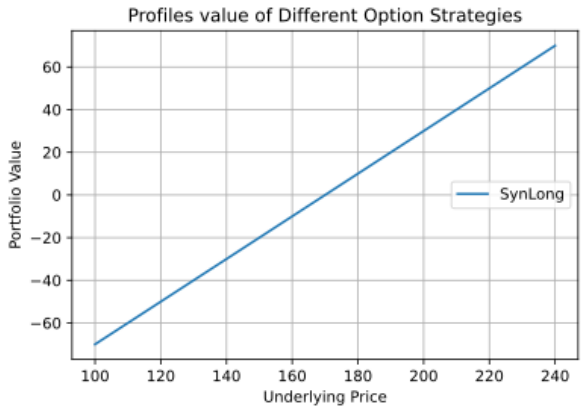

Figure 10: SynLong

Portfolio Value Shapes and Interpretation

Straddle: The V-shaped curve around the strike price indicates profits from large price moves in either direction, benefiting from high volatility.

Synthetic Long: An upward-sloping curve, similar to holding the stock, shows gains as price rises. Put-call parity equates this setup to direct stock exposure.

Call Spread: Shows limited gains, flattening at higher prices. Buying a lower strike call and selling a higher one caps profit once the price exceeds the upper strike.

Put Spread: Provides limited downside protection, declining with price but leveling off at lower levels, as profit is capped.

Put-Call Parity Explanation
Put-call parity clarifies that combinations like the straddle capture volatility, while synthetic longs and spreads target directional or capped gains, reflecting market sentiment and investor risk preferences.

df_ - DataFrame

Portfolio	Mean	VaR	ES
Call	8.92823	8.66865	8.63551
CallSpread	4.92088	4.87375	4.86758
CoveredCall	163.934	163.693	163.664
ProtectedPut	175.713	175.498	175.47
Put	7.36997	7.15717	7.12987
PutSpread	3.18334	3.17861	3.17785
Stock	170.15	170.15	170.15
Straddle	16.2982	15.8258	15.7654
SynLong	1.55826	1.51148	1.50564

Figure 11: Portfolio value table