Notes on Options

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Contents

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1   Introduction

1.1   Learning Resource

1.1.1   Courses

- Options Trading Strategies In Python: Basic. From quantra (**free**). **Several sections of this document cite contents from this course**.

1.1.2   Online resources

1. Website to build and analyze options strategies: https://optioncreator.com/

1.2   Option Strategies

1. Trade on volatility-> straddle, butterfly

2. Market will rise-> bull call spread

3. Market will fall-> bear put spread

1.3   Systematic Options Trading

2   Basics

Buyer of the option has the right but not the obligation to buy or sell the underlying on or before a specified date at a specified price.

2.1   Symbology

Options can only be purchased in unit of lot size. Premium is the upfront payment from the option buyer. Strike price is the price of the underlying security at which the option can be exercised.

Figure 1: Options Symbology

2.2 Types of options

Based on Exercisability:

1. European options: Exercisable only on the expiry date. Options traded on NSE are European style options.

2. American Options: Exercisable any time before the expiry date.

3. Bermudan Options: Exercisable on specific dates till the expiry date.

Plain Vanila vs Exotic options[1]:

1. Plain Vanilla and Exotic options: Plain Vanilla Options are standard options with standard features such as simple expiration and strike price. An example of this is a call or a put option on the Nifty Index.

2. have additional contingencies added, which alter the components of the traditional options to make them more complex in nature, and are mostly traded over the counter. Examples of a few exotic options are Asian options, Barrier options, Binary options, etc.

2.3 Payoff

2.3.1 Long Put

Assuming stock price at 900, strike price at 900, and premium of 20. Even if the price of Infosys goes above the strike price of 900, the maximum loss seems to be just INR 20/-. Therefore, the loss to the put option buyer is restricted to the extent of the premium he has paid.

The profit from this put option seems to increase linearly as and when Infosys starts to move below the strike price of 900. Therefore, the lower the spot price goes, the higher will be the profit.

Though the put option is supposed to make a profit when the spot price moves below the strike price, the put option buyer first needs to recover the premium he has paid.

From the above points, we can say that the buyer of the put option has limited risk and the potential to make a huge profit. See illustrative payoff graph below[1].
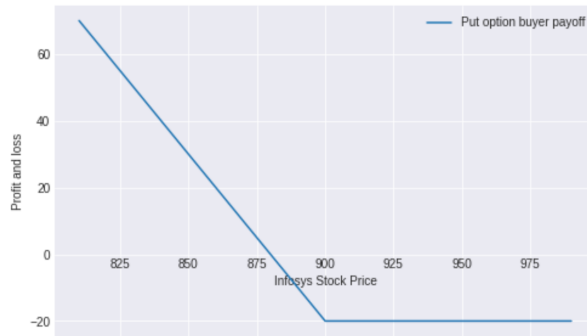
Figure 2: Payoff: Long put

2.3.2 Short/Sell Put

The put option seller payoff looks like a mirror image of the put option buyer payoff.

The profit is restricted to INR 20/- as long as the spot price is trading at any price above the strike price of 900. From 900 to 880, we can see the profits getting reduced. Below 880, the put option seller starts losing money. The losses increase with a decrease in stock price.

Figure 3: Payoff: Short/Sell put

2.3.3 Long Call

The payoff function is $Max(0, S - X)$. The buyer of the call option has limited risk and the potential to make an unlimited profit.

Figure 5: Payoff: Short Call
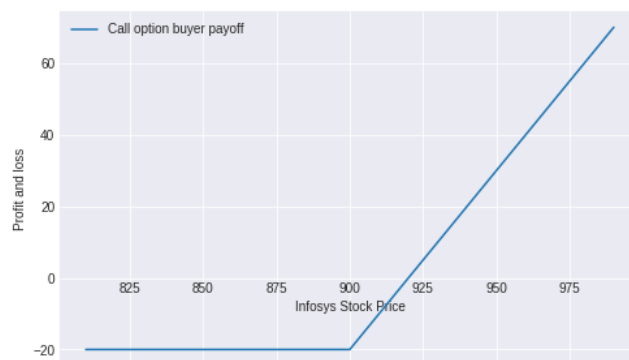
Figure 4: Payoff: Long Call

2.3.4 Short/Sell Call

The call option seller payoff looks like a mirror image of the call option buyer payoff.

2.4 Nomenclature

2.4.1 Option Premium

: Option premium has two components: **intrinsic value** and **time value**. For call option, intrinsic value is equal to stock price- strike price. For put option, intrinsic value is equal to strike price - stock price. The option value in excess of the intrinsic value is called the time value. In the money options have both components, while out of money option have only time value.

Option Chain (Equity Derivatives)

	CALLS										Strike Price	PUTS										
Chart	OI	Chng In OI	Volume	IV	LTP	Net Chng	Bid Qty	Bid Price	Ask Price	Ask Qty		Bid Qty	Bid Price	Ask Price	Ask Qty	Net Chng	LTP	IV	Volume	Chng In OI	OI	Chart
	52,875	2,025	27	-	2,078.15	-0.90	75	2,073.20	2,096.05	75	8250.00	675	0.75	0.85	1,575	0.30	0.85	28.36	308	2,400	22,200	
	1,565,325	-20,175	309	-	2,028.05	-2.50	75	2,030.85	2,039.10	75	8300.00	60,450	0.60	0.65	2,700	-	0.65	26.96	1,720	-3,525	260,850	
											8350.00	6,000	0.25	3.00	3,000							
	205,350	225	11	-	1,945.00	8.50	300	1,928.00	1,940.90	75	8400.00	4,275	0.80	0.85	375	-0.05	0.85	26.37	159	-825	105,150	
											8450.00	6,000	0.25	3.00	3,000							
	835,125	-1,950	550	-	1,832.00	-3.70	75	1,832.15	1,840.00	75	8500.00	41,625	0.85	0.90	10,350	-0.05	0.85	25.05	2,849	-5,100	294,825	
											8550.00	6,000	0.55	3.00	3,000							
	57,300	-75	2	-	1,751.00	20.25	75	1,728.65	1,743.00	75	8600.00	525	1.00	1.15	1,200	0.05	1.10	24.40	374	-	54,975	
						2,058.90				75	8650.00	6,000	0.55	3.00	3,000							
	38,025	-150	3	-	1,644.90	10.20	150	1,633.15	1,649.70	75	8700.00	1,575	1.40	1.50	975	-0.05	1.55	23.99	289	1,725	48,900	
											8750.00	6,000	0.55	3.00	1,500							
	127,275	75	13	-	1,530.90	-7.90	75	1,531.60	1,548.15	75	8800.00	750	1.80	1.90	75	-0.05	1.85	23.12	1,078	2,475	141,675	
											8850.00	6,000	0.55									
	48,150				1,443.00	-2.10	75	1,440.00	1,453.65	75	8900.00	1,500	2.55	2.65	75	-0.20	2.60	22.70	2,403	50,775	199,575	
											8950.00	7,500	0.60									
	861,600	39,225	753	-	1,345.40	3.15	150	1,340.25	1,346.90	75	9000.00	4,275	3.05	3.10	4,500	0.10	3.05	21.75	6,956	76,800	965,550	

Figure 6: Options Chain

2.4.2 Options Chain

2.4.3 Open Interest and Volume

1. **Open Interest**: the number of options or futures contracts that is open in the moment.

2. **Volume**: the number of contracts that are traded.

Change in volume is equal to the absolute amount of contracts traded. If existing contracts change hand, volume will increase but open interest will stay the same. If trading involves opening (closing) of new contracts, then open interest will increase (decrease). High turnover market will typically be characterized by high volume to open interest ratio.

2.5 Put-call parity

For European options, two portfolios will have the same payoff at time t, hence their values must be equal due to no arbitrage.

$$c + K \cdot e^{-rt} = p + S_0$$

Where t is time to maturity.

Put-call parity is not valid for American options, unless they are held to expiry.

2.6 Volatility

1. **Historical Volatility**: realized volatility.

2. **Implied Volatility**: the expected fluctuation in the underlying till expiration of option contract. It's a forward looking estimaiton, and is based on supply and demand.

Option premium for a more volatile security will be higher.

2.7 Strategies

2.7.1 Bull Call Spread

Bull call spread is best implemented when your outlook on the stock/index is 'moderately bullish' as it involves taking positions in options of the same underlying asset at different strike prices in order to make profits from a small increase in the stock price. Also known as vertical spread. In the below example[1], ihe max profit is capped at INR 15 and the max loss is limited to INR 5. Therefore, this strategy is suitable when your outlook is moderately bullish on the stock.

Payoff of a bull call spread is the sum of the payoff of a long call leg (with a lower strike price, and higher premium paid) and the payoff of the short call leg (with a higher strike price, and less premium received).

Figure 7: Bull Call Spread

2.7.2 Bear Put Spread

Bear put spread is best implemented when your outlook on the stock/index is 'moderately bearish' as it involves taking positions in options of the same underlying asset at different strike prices in order to make profits from a small decrease in the stock price.

In the below example[1], the max profit is capped at INR 15 and the max loss is limited to INR 5. Therefore, this strategy is suitable when your outlook is moderately bearish on the stock.
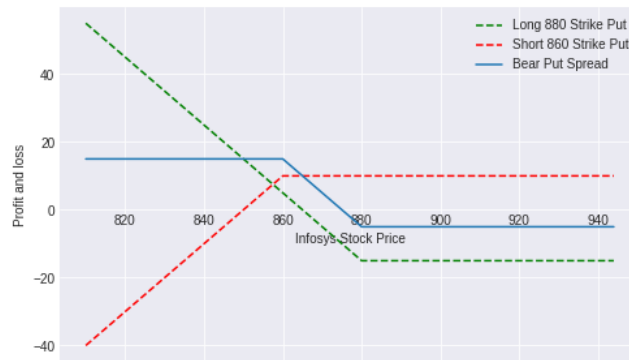
Figure 8: Bear Put Spread

2.8   Protective Put

Purchase put to protect the downside movement from the underlying. In the below example[1], the max profit is unlimited and the max loss is limited to INR 20.

Figure 9: Protective Put

2.9   Covered Call

A covered call strategy involves buying a stock and selling an at-the-money call option on the same stock. The upside is limited, but downside is unlimited. The stock long in this case provides the cover, as when call option holds exercises the option we can deliver the shares using the lonk stock position. In the below example[1],the max profit is capped at INR 10 if the Wipro stock moves to any price above INR 300 and the max loss is proportional to price fall below INR 300.
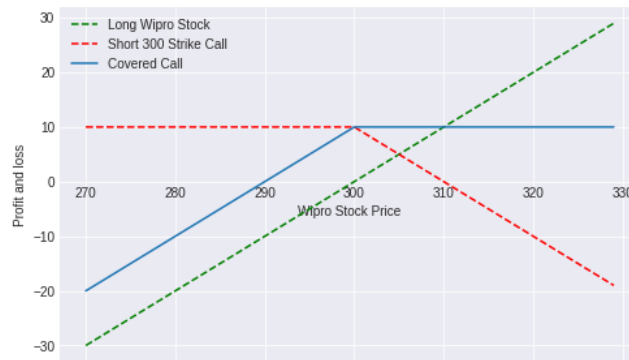
Figure 10: Covered Call

2.10   Neutral Strategy: Iron Condor

The iron condor is a limited risk options trading strategy that is designed to have a large probability of earning a small limited profit when the underlying security is perceived to not move much.

3   Option Pricing

3.1   Black Scholes Merton

3.1.1   Intuition

The value of a call option when it's in the money has two components:

1. Component 1: the payment we pay at strike. The expected vlaue of the first component is $EV_1 = -X \cdot P(S_t > X)$ (negative sign indicates that money is going out of our pocket.

2. Component 2: and the value of the stock we receive. $EV_2 = E(S_t|S_t > x) \cdot P(S_t > X)$

In summary, the price of an European call option is:

$$c_t = E(S_t|S_t > x) \cdot P(S_t > X) - X \cdot P(S_t > X)$$

This formula provides the intuition behind of the BS formula:

$$C_t = S_t \cdot N(d_1) - X \cdot e^{-rt} \cdot N(d_2)$$

4 Backtesting

Probability of profit Expected profit

References

[1] NSE Academy. Course: Options trading strategies in python: Basic.