Options Trading: Concepts, Examples, and Risk Management

1. Introduction to Options

Options are financial derivatives that give buyers the right, but not the obligation, to buy or sell an underlying asset at an agreed-upon price and date. They are called **derivatives** because their value is derived from an underlying asset.

2. Types of Options

2.1 Call Options

A call option grants the buyer the right to **purchase** the underlying asset at the strike price.

- The **buyer (holder)**:
  - The **buyer** pays a premium for the option.
  - Gains the right (not obligation) to buy the asset at the strike price.
  - Profits if the underlying price increases.
  - Maximum loss is the premium paid.
- The **seller (writer)**:
  - The **seller** receives the premium.
  - Has the obligation to sell the asset if exercised.
  - Faces potentially unlimited loss if asset price rises significantly.

2.2 Put Options

A put option grants the buyer the right to **sell** the underlying asset at the strike price.

- The **buyer (holder)**:
  - Pays the premium.
  - Has the right (not obligation) to sell at the strike price.
  - Profits if the underlying price falls.

  - Maximum loss is the premium.

- The **seller (writer)**:
  - Receives the premium.
  - Must buy at the strike price if exercised.
  - Risks significant losses if the asset price falls substantially.

2.3 Put Option Example

Consider a put option with the following parameters:

$$\text{Strike Price (K)} = 100 \tag{1}$$
$$\text{Premium (P)} = 5 \tag{2}$$
$$\text{Current Stock Price (S)} = 105 \tag{3}$$

Scenario: Stock falls to 80
For the Buyer:

- Intrinsic Value = $\max(K - S_T, 0) = \max(100 - 80, 0) = 20$
- Net Profit = Intrinsic Value - Premium = 20 - 5 = 15
- Return on Investment = $\frac{15}{5} \times 100\% = 300\%$

For the Seller:

- Must buy stock at 100 when market value is 80
- Loss = 100 - 80 = 20 per share
- Net Loss = 20 - 5 (premium received) = 15 per share

3. Option Risk Metrics: The Greeks

The Greeks measure various risk sensitivities of options to different market factors.

3.1 Delta ()

Delta represents the rate of change of the option price with respect to changes in the underlying asset price.

$$\Delta = \frac{\partial V}{\partial S} \tag{4}$$

where V is option value and S is stock price.
Properties:

- Call options: $0 \leq \Delta \leq 1$
- Put options: $-1 \leq \Delta \leq 0$
- At-the-money options: $\Delta \approx \pm 0.5$
- Measures hedge ratio for delta-neutral strategies

3.2 Theta ()

Theta measures the rate of change of option value with respect to time (time decay).

$$\Theta = \frac{\partial V}{\partial t} \tag{5}$$

Properties:

- Usually negative for long positions (time decay)
- Accelerates as expiration approaches
- At-the-money options have highest theta
- Critical for short-term trading strategies

3.3 Gamma ()

Gamma represents the rate of change of delta with respect to the underlying price (second derivative).

$$\Gamma = \frac{\partial^2 V}{\partial S^2} = \frac{\partial \Delta}{\partial S} \tag{6}$$

Properties:

- Always positive for long positions
- Highest for at-the-money options
- Measures convexity of option price
- Important for dynamic hedging strategies

4. Call Option Example – Microsoft (MSFT)

- Current Stock Price (S_0): \$108
- Strike Price (K): \$115
- Option Type: Call Option
- Premium: \$0.37
- Contract Size: 100 shares
- Total Premium Paid: $\$0.37 \times 100 = \$37$

Scenario 1: Stock rises to \$116 at expiry

- **Intrinsic Value:** $\$116 - \$115 = \$1$ per share
- **Net Profit per Share:** $\$1 - \$0.37 = \$0.63$
- **Total Profit:** $\$0.63 \times 100 = \$63$
- **Return on Investment (ROI):** $\frac{63}{37} \times 100 \approx 170.3\%$

Scenario 2: Stock falls to \$100 at expiry

- Option expires worthless.
- Loss = \$37 (premium paid)
- If 100 shares were bought instead: \$108 \$100 = \$8 loss/share Total = \$800

5. Put Option Example – Hypothetical Stock

- Current Stock Price (S_0): \$108
- Strike Price (K): \$100
- Option Type: Put Option
- Premium: \$0.40
- Contract Size: 100 shares
- Total Premium Paid: $\$0.40 \times 100 = \$40$

Scenario 1: Stock falls to $95 at expiry

- Intrinsic Value = $100 $95 = $5
- Net Profit per share = $5 $0.40 = $4.60
- Total Profit = $4.60 × 100 = $460
- Return on Investment = (460 / 40) × 100 = 1150%

Scenario 2: Stock rises to $115 at expiry

- Put option expires worthless.
- Loss = Premium paid = $40

6. Hedging Strategies

Hedging is a risk management strategy that offsets potential investment losses by taking an opposite position in a related asset.

- Aims to reduce or eliminate downside risk.
- Instruments: options, futures, forwards, swaps.
- Reduces potential loss and also potential gain.

Example:

If you own shares of XYZ Corp, you can buy a put option to protect against a large fall in price. The cost is the premium paid.

6.1 Delta Hedging

Delta hedging involves creating a **delta-neutral** position by offsetting the delta of options with opposite positions in the underlying asset.

Delta-Neutral Portfolio:

$$\text{Portfolio Delta} = \sum_i \Delta_i \times \text{Position}_i = 0 \tag{7}$$

7. Option Valuation Fundamentals

7.1 Intrinsic Value

The intrinsic value represents the immediate exercise value of an option.

Call Option:

$$\text{Intrinsic Value} = \max(S - K, 0) \tag{8}$$

Put Option:

$$\text{Intrinsic Value} = \max(K - S, 0) \tag{9}$$

7.2 Time Value

Time value represents the additional premium above intrinsic value, reflecting the potential for favorable price movements before expiration.

$$\text{Time Value} = \text{Option Premium} - \text{Intrinsic Value} \tag{10}$$

Factors Affecting Time Value:

- Time to expiration
- Implied volatility
- Interest rates
- Dividend expectations