Simple Examples on Option Portfolios

Example 1: Suppose that an investor buys a call option on IBM stock with a strike price $40 and writes a put option on IBM stock with strike price $50. The call option has a price of $5 and the put option has a price $8 and they both have the same expiration date.

- a) What is the payoff to the investor if the IBM stock price at expiration date turns out to be $S_T = 45$? (include initial cost and gain from creating the portfolio).
- b) What is the payoff to the investor if the IBM stock price at expiration date turns out to be $S_T = 35$? (include initial cost and gain from creating the portfolio).
- c) What is the payoff to the investor if the IBM stock price at expiration date turns out to be $S_T = 55$? (include initial cost and gain from creating the portfolio).
- d) What is the payoff to the investor in general as a function of the IBM stock price at expiration date (include initial cost and gain from creating the portfolio).

Answer to Example 1:

- a) The payoff to the investor if $S_T = 45$ is given by
  \[(45 - 40) - (50 - 45) + 8 - 5 = 3\]
- b) The payoff to the investor if $S_T = 35$ is given by
  \[0 - (50 - 35) + 8 - 5 = -12\]
- c) The payoff to the investor if $S_T = 55$ is given by
  \[(55 - 40) - 0 + 8 - 5 = 18\]
- d) The payoff to the investor as a function of $S_T$ is

\[
\begin{array}{ll}
-(S_T - 40) + 8 - 5 = S_T - 47 & \text{for } S_T < 40. \\
(S_T - 40) - (50 - S_T) + 8 - 5 = 2S_T - 87 & \text{for } 40 < S_T < 50. \\
(S_T - 40) + 8 - 5 = S_T - 37 & \text{for } S_T > 50.
\end{array}
\]
• Example 2: Suppose that an investor buys a put option on Microsoft stock with a strike price $70 and sells a call option on Microsoft stock with a strike price $70. The call option has a price of $5 and the put option has a price $4, and both options have the same expiration date.

  a) What is the payoff to the investor if the Microsoft stock price at expiration date turns out to be $S_T = 60$? (include initial cost and gain from creating the portfolio).

  b) What is the payoff to the investor if the Microsoft stock price at expiration date turns out to be $S_T = 80$? (include initial cost and gain from creating the portfolio).

  c) What is the payoff to the investor in general as a function of the Microsoft stock price at expiration date (include initial cost and gain from creating the portfolio).

• Answer to Example 2:

  a) The payoff to the investor if $S_T = 60$ is given by
  $$(70 - 60) - 0 + 5 - 4 = 11$$

  b) The payoff to the investor if $S_T = 80$ is given by
  $$0 - (80 - 70) + 5 - 4 = -9$$

  c) The payoff to the investor as a function of $S_T$ is given by
  $$(70 - S_T) + 5 - 4 = 71 - S_T \quad \text{for } S_T < 70.$$  
  $$-(S_T - 70) + 5 - 4 = 71 - S_T \quad \text{for } S_T > 70.$$  

Example 3: Suppose that an investor owns 1 share of Microsoft stock, and he sells a call option on Microsoft stock with a strike price $50. The call option has a price of $5.

  a) What is the payoff to the investor if the Microsoft stock price at expiration date turns out to be $S_T = 40$? (include initial cost and gain from creating the portfolio).

  b) What is the payoff to the investor if the Microsoft stock price at expiration date turns out to be $S_T = 90$? (include initial cost and gain from creating the portfolio).
c) What is the payoff to the investor in general as a function of the Microsoft stock price at expiration date (include initial cost and gain from creating the portfolio)

- **Answer to Example 3:**
  
  - a) The payoff to the investor if $S_T = $40 is given by
    
    $40 + 5 = 45$
  
  - b) The payoff to the investor if $S_T = $90 is given by
    
    $90 - (90 - 50) + 5 = 55$
  
  - c) The payoff to the investor as a function of $S_T$ is given by
    
    $\begin{array}{|c|c|}
    \hline
    S_T + 5 & \text{for } S_T < 50. \\
    S_T - (S_T - 50) + 5 = 55 & \text{for } S_T > 50. \\
    \hline
    \end{array}$