EXAM MFE QUESTIONS OF THE WEEK

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Week of February 12/07

Price of XYZ stock at time 0 is 20. Annual effective interest is at rate 5%. Call and put option (European) values for various strike prices are:

Strike Price	Call Price	Put Price
15	6.46	0.75
17	5.16	1.35
19	4.06	2.16
20	3.59	2.64
21	3.17	3.17
23	2.45	4.36
25	1.89	5.70

It is assumed that XYZ stock pays no dividends.

Use the XYZ options to find the payoff and profit on a butterfly spread consisting of a written straddle with strike price 20 combined with a purchased put with strike price 15 and a purchased call with strike price 25 (purchased strangle).

The solution can be found below.

Week of February 12/07 - Solution

The combined payoff is

payoff on straddle + payoff on strangle

$$= \begin{cases} S_1 - 20 & \text{if } S_1 \le 20 \\ 20 - S_1 & \text{if } S_1 > 20 \end{cases} + \begin{cases} 15 - S_1 & \text{if } S_1 \le 15 \\ 0 & \text{if } 15 < S_1 \le 25 \\ S_1 - 25 & \text{if } S_1 > 25 \end{cases} = \begin{cases} -5 & \text{if } S_1 \le 15 \\ S_1 - 20 & \text{if } 15 < S_1 \le 20 \\ 20 - S_1 & \text{if } 20 < S_1 \le 25 \\ -5 & \text{if } S_1 > 25 \end{cases}.$$

The cost at time 0 to create this butterfly is $-6.23 + 2.64 = -3.59$, and the accumulated cost is -3.77. (a net amount of premium of 3.59 is received at time 0). The profit at time 1 is

$$= \begin{cases} -5 & \text{if } S_1 \le 15 \\ S_1 - 20 & \text{if } 15 < S_1 \le 20 \\ 20 - S_1 & \text{if } 20 < S_1 \le 25 \\ -5 & \text{if } S_1 > 25 \end{cases} + 3.77 = \begin{cases} -1.23 & \text{if } S_1 \le 15 \\ S_1 - 16.23 & \text{if } 15 < S_1 \le 20 \\ 23.77 - S_1 & \text{if } 20 < S_1 \le 25 \\ -1.23 & \text{if } S_1 > 25 \end{cases}.$$

The graph of the profit on the written straddle and the profit on the butterfly spread is below.