MFE5130 – Financial Derivatives

Class Activity (22-November-2018) (Solution)

Important Notes:

1. This class activity is counted toward to your class participation score. **Fail** to hand in this class activity worksheet in the class will receive **0 score** for that class.
2. **0 mark** will be received if you leave the solution blank.

Name:	Student No.:

Problem 1

The price of a stock is \$94. The stock does not pay dividends. The four call options described below are written on the stock.

Type	Strike	Maturity	Price	Delta	Gamma
Call	90	91 days	8.81	0.6909	0.0250
Call	95	91 days	6.03	0.5546	0.0281
Call	100	91 days	3.94	0.4188	0.0277
Call	95	180 days	9.18	0.5958	0.0196

A market-maker writes a 90-95-100 butterfly spread with 91-days until maturity.

The market-maker uses the stock and the \$95-strike 180-day call option to delta-gamma hedge the position.

The number of shares of stock that the market-maker purchases to delta-gamma hedge the position is X. The number of \$95-strike 180-day call options that the market-maker purchases to delta-gamma hedge the position is Y.

Determine the values of X and Y.

Solution

A butterfly spread can be created by buying a \$90-strike call, selling 2 \$95-strike calls, and buying a \$100-strike call. In this case, the market-maker **writes (or sells)** the butterfly spread, so the market maker sells the \$90-strike call, buy 2 \$95-strike calls, and sells a \$100-strike call.

The gamma of the position to be hedged is:

$$-1\times 0.0250 + 2\times 0.0281 - 1\times 0.0277 = 0.0035.$$

We can now solve the quantity, Y, of the 180-day call option that must be purchased

to bring the hedged portfolio's gamma to zero:

$$0.0035 + 0.0196Y = 0$$

$$Y = -0.1786.$$

The delta of the position becomes:

$$-1 \times 0.6909 + 2 \times 0.5546 - 1 \times 0.4188 - 0.1786 \times 0.5958 = -0.1069.$$

The quantity of the underlying stock that must be purchased, *X*, is the opposite of the delta of the position being hedged:

$X = 0.1069$.