

Comprehensive Examination

Course No.: ECON F354 & FIN F311 2nd Semester, 2016-17, Course Title: Derivatives and Risk Management

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Duration: 180Minutes

Maximum Marks: 80(40%)

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1. Several months ago, an investor sold 100 units of a one-year European call option on a non-dividend-paying stock. She immediately delta-hedged the commitment with shares of the stock, but has not ever re-balanced her portfolio. She now decides to close out all positions. You are given the following information:

(i) The risk-free interest rate is constant.

(ii)	Several months ago	Now
Stock price	\$40.00	\$50.00
Call option price	\$ 8.88	\$14.42
Put option price	\$ 1.63	\$ 0.26
Call option delta	0.794	

The put option in the table above is a European option on the same stock and with the same strike price and expiration date as the call option. Calculate her profit. (15marks)

$$\begin{aligned} \text{Position} &= 100 \Delta S - 100 C \\ &= 100 \times 79.45 - 100 C \quad (\text{several months ago}) \end{aligned}$$

Current Position = 0

Using Put - Call parity.
Several months ago, ($t=0$)

$$S + P = C + \frac{R}{1+r}$$

$$\Rightarrow 40 + 1.63 = 8.88 + \frac{R}{1+r} \Rightarrow R = 32.75 = \frac{35.84}{1+r}$$

Now, ($t=1$)

From (1)

$$\Rightarrow 1+r = 1.07435$$

$$\Rightarrow r = 7.44\%$$

$$S + P = C + \frac{R}{1+r}$$

$$\Rightarrow 50 + 0.26 = 14.42 + \frac{R}{1+r}$$

$$\Rightarrow R = 48 = \$35.84 \quad \text{(1)}$$

Payment and receipt at $t=0$ = $\cancel{+100 \times 40} + +888$

$$= -\$ + 388.50 - 2288$$

He has to make - \$ = ~~388.50~~ 2270

Payment and receipt at $t=1$ = ~~50 + 0.26 - 14.42 - 35.84~~ $\times 100$

$$= \$388.50 - 388.50 - 100 \times 35.84$$

$$= -20.6450$$

$$= \$2554$$

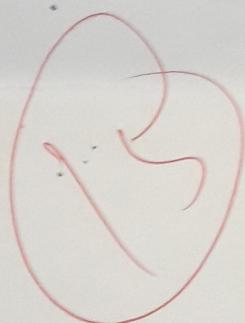
ock's current price is \$100. There are two possible prices at the end of the year: \$150 or \$75. A call option to buy one share at \$100 at the end of the year sells for \$20. Suppose that you are told that

- (1) Writing 3 calls,
- (2). buying 2 stocks,

And (3). Borrowing \$140 is a perfect hedge portfolio, i.e. a risk free portfolio. What is the risk free rate of interest? (15marks)

$$C_{t=0} = \$20 \quad C_{t=1} = ?$$

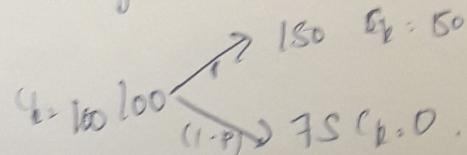
Portfolio = $-0.3C + 2S + -140 (t=0)$ (risk free).
This means there will be no loss.



$$\frac{1-20}{1+n}$$

if $S > R$

Using Binomial Pricing Model.



$$100(1+n) = 150p + 75(1-p)$$

$$\Rightarrow 100(1+n) - 75 = 75p$$

$$\Rightarrow p = \frac{4}{3}(1+n) - 1$$

$$(E[S_{t=1}]) = 50 \times \left(\frac{4}{3}n + \frac{1}{3}\right)$$

$$(at t=0) \quad \frac{20}{3}(1+n) = \frac{4}{3}n + \frac{1}{3} \Rightarrow 1.2 + 1.2n = 4n + 1 \Rightarrow 0.2 = 2.8n \Rightarrow n = 7.142\%.$$

Using concept of risk free returns.

$$\text{Payment at } t=1 \Rightarrow -60 + 200 = 140$$

So we borrow \$140.

If $S = 75$

$$\text{Returns} = 2 \times 75 - = \$150 \quad (\text{Sell two stocks at } \$75 \text{ each})$$

if $S = 150$

$$\text{Returns} = 2 \times 150 - 3 \times 100 - 130 = \$150 \quad (\text{Sell 2 stocks at } \$150 \text{ and buying back at } \$130)$$

$$(140)_{t=0} = (150)_{t=1} \quad (\text{for risk free returns})$$

$$\Rightarrow 140(1+n) = 150$$

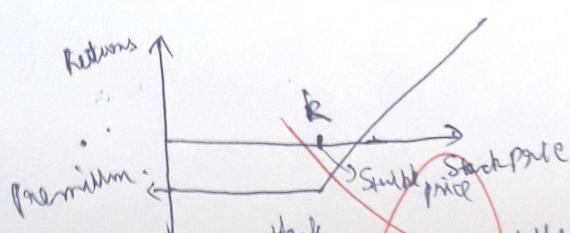
$$\Rightarrow n = 7.142\%. \quad (\text{Ans})$$

For any call option when is the time value maximum in terms of strike price? Explain it with proper diagram? (4marks)

Time value is maximum when at $t=0$ it decreases as time increases.

It is maximum there as at $t=0$. Stock price = Strike price.

Any option can have only time value and intrinsic value.
~~(Stock price > 0 otherwise)~~
 Value at $t=0$: If Stock price increases intrinsic value increases and as stock price decreases time value decreases.

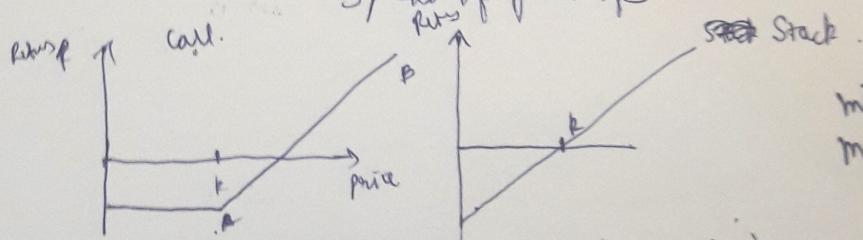


~~X~~

As stock price increases the worth of option increases but only the intrinsic value increases.
 As stock price decreases the worth of option decreases but intrinsic value = 0 So time value decreases.

5. What are minimum and maximum values a delta of call option can take? When these values will tend to reach in terms stock price and strike price? Also show diagram to explain this. (4marks)

$$\Delta = \frac{\text{Spread of price of C}}{\text{Spread of price of S}} = \frac{SC - S}{SS} \approx \text{Value between } [0 \text{ and } 1]$$



min = 0
max = 1

It will be zero when Stock price is less than strike price.

It will be one when the line AB is steeper (Stock price is greater than strike price).

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6. If a short seller of an underlying wants to generate additional income by writing options, does it matter which type of option is chosen? Explain your answer, (4marks)

He should write a ~~put~~ call

Writing a ^{call} will ensure that if stock price is above strike price then also he receives the money required.

X O

7. Why is gamma neutrality a convenience for an option portfolio manager? (4marks)

Not taught in class -

X O

8. Explain the difference between swap price and swap value. (4marks)

Swap price or rate is the fixed interest that has to be paid or received in a swap.

(U)

Swap value is the difference between present values of inflow and outflow. It is zero at $t=0$ but is positive or negative for one set of the swap holders for any time other than $t=0$, (let say $t=1, 2, \dots$).