DERIVATIVES ANALYSIS AND VALUATION

IMPORTANT QUESTIONS

CLASS WORK QUESTIONS

Question 6:

Mr. X, is a Senior Portfolio Manager at ABC Asset Management Company. He expects to purchase a portfolio of shares in 90 days. However he is worried about the expected price increase in shares in coming day and to hedge against this potential price increase he decides to take a position on a 90-day forward contract on the Index. The index is currently trading at 2290. Assuming that the continuously compounded dividend yield is 1.75% and risk free rate of interest is 4.16%, you are required to determine:

i. Calculate the justified forward price on this contract.

ii. Suppose after 28 days of the purchase of the contract the index value stands at 2450 then determine gain/ loss on the above long position.

iii. If at expiration of 90 days the Index Value is 2470 then what will be gain on long position.

Note: Take 365 days in a year and value of $e^{0.005942}$ = 1.005960, $e^{0.001849}$ = 1.001851.

(Source: ICAI)

Question 14:

On January 1, 2018 an investor has a portfolio of 5 shares as given below:

Security	Price	No. of Shares	Beta
A	349.30	5,000	1.15
B	480.50	7,000	0.40
C	593.52	8,000	0.90
D	734.70	10,000	0.95
E	824.85	2,000	0.85

The cost of capital to the investor is 10.5% per annum.

You are required to calculate:

i. The beta of his portfolio.

ii. The theoretical value of the NIFTY futures for February 2018.

iii. The number of contracts of NIFTY the investor needs to sell to get a full hedge until February for his portfolio if the current value of NIFTY is 5900 and NIFTY futures have a minimum trade lot requirement of 200 units. Assume that the futures are trading at their fair value.

iv. The number of future contracts the investor should trade if he desires to reduce the beta of his portfolios to 0.6.

No. of days in a year be treated as 365.

Given: ln (1.105) = 0.0998 and $e^{(0.015858)}$ = 1.01598

(Source: ICAI)

Question 20:

On April 1, 2015, an investor has a portfolio consisting of eight securities as shown below:

Security	Market Price	No. of Shares	Value
A	29.40	400	0.59
B	318.70	800	1.32
C	660.20	150	0.87
D	5.20	300	0.35
E	281.90	400	1.16
F	275.40	750	1.24
G	514.60	300	1.05
H	170.50	900	0.76

The cost of capital for the investor is 20% p.a. continuously compounded. The investor fears a fall in the prices of the shares in the near future. Accordingly, he approaches you for the advice to protect the interest of his portfolio.

You can make use of the following information:

i. The current NIFTY value is 8500.
ii. NIFTY futures can be traded in units of 25 only.
iii. Futures for May are currently quoted at 8700 and Futures for June are being quotedat 8850.

You are required to calculate:

i. the beta of his portfolio.
ii. the theoretical value of the futures contract for contracts expiring in May and June.
Given ($e^{0.03}$ =1.03045, $e^{0.04}$ = 1.04081, $e^{0.05}$ =1.05127)
iii. the number of NIFTY contracts that he would have to sell if he desires to hedge until June in each of the following cases:
    a. His total portfolio
    b. 50% of his portfolio
    c. 120% of his portfolio

(Source: ICAI)

Question 25:

Doom Ltd. is an export business house. The company prepares invoice in customers' currency. Its debtors of US$ 48, 00,000 is due on April 1, 2020.

Market information as at January 1, 2020 is:

Exchange rates US$/INR		Currency Futures US$/INR	
Spot	0.014285	Contract size: ₹ 2,88,16,368	
1-month forward	0.014184	1-month	0.014178
3-months forward	0.013889	3-month	0.013881

	Initial Margin	Interest rates in India
1-Month	₹ 27,500	5.5%
3-Months	₹ 32,500	9%

On April 1, 2020 the spot rate US$/INR is 0.013894 and currency future rate is 0.013893.

Recommend as to which of the following methods would be most advantageous to Doom Ltd.

i. Using forward contract
ii. Using currency futures
iii. Not hedging the currency risk

Note: Round off calculation upto zero decimal points.

(Source: ICAI)

Question 37:

Ram holding shares of Reliance Industries Ltd. which is currently selling at ₹ 1000. He is expecting that this price will further fall due to lower than expected level of profits to be announced after one month. As on following option contract are available in Reliance Share.

Strike	Price	Option Premium (₹)
1030	Call	40
1010	Call	35
1000	Call	30
990	Put	35
970	Put	20
950	Put	8
930	Put	5

Ram is interested in selling his stock holding as he cannot afford to lose more than 5% of its value.

Recommend a hedging strategy with option and show how his position will be protected.

(Source: ICAI)

Question 40:

The current spot price of share of ABC Ltd. is₹ 121.00 and call options with strike price ₹ 125.00 and ₹ 130.00 are trading at a premium of ₹ 3.30 and ₹ 1.80 respectively. Mr. X, a speculator is bullish about the share price over next six months. However, he is also of belief that share price could also go down. He approaches to you for advice, you are required to:

i. Suggest a strategy that Mr. X can adopt which puts limit on his gain and loss.

ii. How much is maximum possible profit.

iii. Draw out a rough diagram of the strategy adopted.

iv. What will be break-even price of the share?

[Assume – No brokerage fees and interest cost/gains].

(Source: ICAI)

Question 41:

A Ltd. of U.K. has imported some chemical worth of USD 3,64,897 from one of the U.S. suppliers. The amount is payable in six months' time. The relevant spot and forward rates are:

Spot rate	USD 1.5617-1.5673
6 months' forward rate	USD 1.5455 –1.5609

The borrowing rates in U.K. and U.S. are 7% and 6% respectively and the deposit rates are 5.5% and 4.5% respectively.

Currency options are available under which one option contract is for GBP 12,500. The option premium for GBP at a strike price of USD 1.70/GBP is USD 0.037 (call option) and USD 0.096 (put option) for 6 months period.

The company has 3 choices:

i. Forward cover
ii. Money market cover, and
iii. Currency option

Which of the alternatives is preferable by the company?

(Source: ICAI)

Question 45:

The following table provides the prices of options on equity shares of X Ltd. and Y Ltd. The risk free interest is 9%. You as a financial planner are required to spot any mispricing in the quotations of option premium and stock prices? Suppose, if you find any such mispricing then how you can take advantage of this pricing position.

Share	Time to exercise	Exercise price (Rs.)	Share price (Rs.)	Call Price (Rs.)	Put price (Rs.)
X Ltd.	6 months	100	160	56	4
Y Ltd	3 months	80	100	26	2

(Source: ICAI)

Question 46:

Consider a two-year call option with a strike price of ₹ 50 on a stock the current price of which is also ₹ 50. Assume that there are two-time periods of one year and in each year the stock price can move up or down by equal percentage of 20%. The risk-free interest rate is 6%. Using binominal option model, calculate the probability of price moving up and down. Also draw a two-step binomial tree showing prices and payoffs at each node.

(Source: ICAI)

Question 47:

X Ltd.'s share is currently trading at Rs. 220. It is expected that in six months some if could double or halved (equivalent to a σ=98%). One year call option on X Ltd.'s share has an exercise price of Rs. 165. Assuming risk free rate of interest to be 20%, calculate.

a. Value of call option on X Ltd's share.
b. Option Delta for the second six month, in case stock price rises to Rs. 440 or falls to Rs. 110.
c. Now suppose in 6 months the share price is Rs. 110. How at this point we can replicate portfolio of call options and risk-free lending.

(Source: ICAI)

Question 48:

Mr. D is interested in purchasing equity shares of XYZ Ltd. which are currently selling at ₹ 600 each. He expects that price of share may go upto ₹ 780 or may go down to ₹ 480 in three months. The chances of occurring such variations are 60% and 40% respectively. A call option on the shares of XYZ Ltd. can be exercised at the end of three months with a strike price of ₹ 630.

Required:

i. Suggest the combination of share and option should Mr. D select if he wants a perfect hedge?
ii. Calculate the value of option today if the risk free rate is 10% p.a.
iii. Calculate the expected rate of return on the option?

(Source: ICAI)

Question 52:

You are trying to value a long term call option on the Standard and Poor's 500, expiring in 2 months, with a strike price of $900. The index is currently at $930, and the annualized standard deviation in stock prices is 20% per annum. The average dividend yield on the index is 0.3% per month, and is expected to remain unchanged over the next month. The treasury bond rate is 8%.

a. Estimate the value of the long term call option.
b. Estimate the value of a put option, with the same parameters.
c. What are the implicit assumptions you are making when you use the Black-Scholes model to value this option?

Which of these assumptions are likely to be violated? What are the consequences for your valuation?

(Source: ICAI)

Question 61:

Suppose that there is a future contract on a share presently trading at ₹ 1000. The life of future contract is 90 days and during this time the company will pay dividends of ₹ 7.50 in 30 days, ₹ 8.50 in 60 days and ₹ 9.00 in 90 days.

Assuming that the Compounded Continuously Risk free Rate of Interest (CCRRI) is 12% p.a. you are required to find out:

i. Fair Value of the contract if no arbitrage opportunity exists.

ii. Value of Cost to Carry

[Given $e^{-0.01} = 0.9905$, $e^{-0.02} = 0.9802$, $e^{-0.03} = 0.97045$ and $e^{0.03} = 1.03045$]

(Source: ICAI)

Question 63:

A company is long on 10 MT of copper @ ₹ 474 per kg (spot) and intends to remain so for the ensuing quarter. The standard deviation of changes of its spot and future prices are 4% and 6% respectively, having correlation coefficient of 0.75.

What is its hedge ratio? What is the amount of the copper future it should short to achieve a perfect hedge?

(Source: ICAI)

HOME WORK QUESTION

Question 1:

Sensex futures are traded at a multiple of 50. Consider the following quotations of Sensex futures in the 10 trading days during February, 2009:

Day	High	Low	Closing
4-2-09	3306.4	3290.00	3296.50
5-2-09	3298.00	3262.50	3294.40
6-2-09	3256.20	3227.00	3230.40
7-2-09	3233.00	3201.50	3212.30
10-2-09	3281.50	3256.00	3267.50
11-2-09	3283.50	3260.00	3263.80
12-2-09	3315.00	3286.30	3292.00
14-2-09	3315.00	3257.10	3309.30
17-2-09	3278.00	3249.50	3257.80
18-2-09	3118.00	3091.40	3102.60

Abshishek bought one sensex futures contract on February, 04. The average daily absolute change in the value of contract is ₹ 10,000 and standard deviation of these changes is ₹ 2,000. The maintenance margin is 75% of initial margin.

Determine the daily balances in the margin account and payment of margin calls, if any.

(Source: ICAI)

Question 7:

Ram buys 10,000 shares of X Ltd. at a price of ₹ 22 per share whose beta value is 1.5 and sells 5,000 shares of A Ltd. at a price of ₹ 40 per share having a beta value of 2. He obtains a complete hedge by Nifty futures at ₹ 1,000 each. He closes out his position at the closing price of the next day when the share of X Ltd. dropped by 2%, share of A Ltd. appreciated by 3% and Nifty futures dropped by 1.5%.

What is the overall profit/loss to Ram?

(Source: ICAI)

Question 10:

Details about portfolio of shares of an investor is as below:

Shares	No. of shares (lakh)	Price per share	Beta
A Ltd.	3.00	₹ 500	1.40
B Ltd.	4.00	₹ 750	1.20
C Ltd.	2.00	₹ 250	1.60

The investor thinks that the risk of portfolio is very high and wants to reduce the portfolio beta to 0.91. He is considering two below mentioned alternative strategies:

i. Dispose off a part of his existing portfolio to acquire risk free securities, or
ii. Take appropriate position on Nifty Futures which are currently traded at 8125 and each Nifty points is worth ₹ 200.

You are required to determine:

a. portfolio beta,
b. the value of risk free securities to be acquired,
c. the number of shares of each company to be disposed off,
d. the number of Nifty contracts to be bought/sold; and
e. the value of portfolio beta for 2% rise in Nifty.

(Source: ICAI)

Question 14:

A trader is having in its portfolio shares worth ₹ 85 lakhs at current price and cash ₹ 15 lakhs. The beta of share portfolio is 1.6. After 3 months the price of shares dropped by 3.2%.

Determine:

i. Current portfolio beta
ii. Portfolio beta after 3 months if the trader on current date goes for long position on₹ 100 lakhs Nifty futures.

(Source: ICAI)

Question 28:

XYZ Ltd. a US firm will need £ 3,00,000 in 180 days. In this connection, the following information is available:

Spot rate 1 £ = $ 2.00

180 days forward rate of £ as of today = $1.96

Interest rates are as follows:

	U.K.	US
180 days deposit rate	4.5%	5%
180 days borrowing rate	5%	5.5%

A call option on £ that expires in 180 days has an exercise price of $ 1.97 and a premium of $ 0.04.

XYZ Ltd. has forecasted the spot rates 180 days hence as below:

Future rate	Probability
$ 1.91	25%
$ 1.95	60%
$ 2.05	15%

The company has following four choices:

i. A forward contract;
ii. A money market hedge;
iii. An option contract;
iv. No hedging.

Recommend the alternative (among the four choices mentioned above) that would be preferable by the company.

(Source: ICAI)

Question 29:

The current market price of an equity share of Penchant Ltd is Rs. 420. Within a period of 3 months, the maximum and minimum price of it is expected to be Rs. 500 and Rs. 400 respectively. The risk-free rate of interest be 8% p.a.

Estimate the value of a 3 months Call option using "Risk Neutral" method at the strike rate of Rs. 450.

Given $e^{0.02} = 1.0202$

(Source: ICAI)