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CIFA PART III SECTION 6

DERIVATIVES ANALYSIS

THURSDAY: 28 November 2019.   **Time Allowed: 3 hours.**

Answer ALL questions. Marks allocated to each question are shown at the end of the question. Show ALL your workings.

QUESTION ONE

(a)   Your country's Securities Exchange recently introduced derivatives trading as a new strategy of expanding its product offerings:

In light of the above statement:

   (i)   Describe three types of traders common in the derivatives markets.   (3 marks)

   (ii)   Propose three factors that could have hindered the growth of derivatives markets in developing countries.
                                                                                                     (3 marks)

(b)   Hezbon Otieno owns a dividend paying stock which is currently worth Sh.150. He plans to sell the stock in 250 days. In order to hedge against possible price decline, Hezbon decides to take a short position in a forward contract that expires in 250 days.

Additional information:
1.   The risk-free rate is 5%.
2.   Over the next 250 days the stock will pay dividends as follows:

Days to next dividend	Dividend per share (DPS)
	Sh.
30	1.25
120	1.25
210	1.25

3.   Assume a 365-day year.

Required:
   (i)   The forward price of a contract established today which expires in 250 days.   (4 marks)

   (ii)   The value of the forward contract after 100 days assuming that the stock price is Sh.115 on that day.
                                                                                                     (4 marks)

   (iii)   The value of the contract at expiration assuming that the stock price is Sh.130 at expiration.   (2 marks)

(c)   A bank has committed to lend Sh.25 million to a corporate borrower in 30 days. The loan will mature in 180 days and carries an interest rate of London-Interbank Offered Rate (LIBOR) plus 150 basis points.

The bank is concerned that interest rates will fall and in order to lock the lending rate, it decides to short a forward rate agreement (FRA) with an interest rate of 5.5%

Required:
The effective rate on the loan assuming 180 day LIBOR in 30 days is 3.25%.   (4 marks)
                                                                                                 (Total: 20 marks)

QUESTION TWO

(a)   Suggest four reasons why futures options are popular in the derivatives market.   (4 marks)

(b)   Mercury Investment Limited holds an asset worth Sh.500,000. The firm intends to enter into a futures contract to sell the asset in 45 days.

   Additional information:
   1.   The risk-free interest rate is 8%.
   2.   Storage cost is Sh.22,500.
   3.   The future value of positive cash flow is Sh.7,500.
   4.   A year has 365 days.

   Required:
   The appropriate futures price of the asset:

   (i)   Assuming there is neither storage cost nor cash flows.   (2 marks)

   (ii)   Considering storage cost only.   (2 marks)

   (iii)   Considering the cash flows only.   (2 marks)

   (iv)   The future price of the asset is currently trading at Sh.600,000. Show how Mercury Investment Limited could execute an arbitrage transaction assuming that the cost of carry is Sh.35,500.   (4 marks)

(c)   An investment manager uses various hedging strategies. One of them is the box spread. The options have exercise prices of Sh.75 and Sh.85.

   The call prices are Sh.16.02 and Sh.12.28 for exercise prices of Sh.75 and Sh.85 respectively.

   The put prices are Sh.9.72 and Sh.15.18 for exercise prices of Sh.75 and Sh.85 respectively.

   The options expire in 6 months. The discrete risk-free rate is 5.13%.

   Required:
   (i)   Evaluate the value of the box spread and the profit at expiration.   (3 marks)

   (ii)   Show that the box spread is mispriced thereby giving rise to an arbitrage opportunity.   (3 marks)
   (Total: 20 marks)

QUESTION THREE

(a)   Explain the following terms in the context of options strategies for managing equity portfolios:

   (i)   Protective put.   (2 marks)

   (ii)   Money spread.   (2 marks)

   (iii)   Zero cost collar.   (2 marks)

(b)   A portfolio manager believes that the market will be volatile in the near future, but does not feel particularly strongly about the direction of the movement. With this expectation, he decides to buy both a call and a put option with the same exercise price and the same expiration date on the same underlying stock trading at Sh.49. He buys one call option and one put option on this stock, both with an exercise price of Sh.50.

   The premium on the call is Sh.6.25 and the premium on the put is Sh.5.875.

   Required:
   (i)   The profit that the manager realises when the price of the stock at expiration is Sh.37.   (3 marks)

   (ii)   The maximum loss from the strategy above.   (2 marks)

   (iii)   The break-even stock price at expiration of the option.   (2 marks)

(c)   Fanishi Limited issues a leveraged floating rate note (FRN) with a face value of Sh.5 billion that pays a coupon of 2.5 times 91 days Treasury bill rate. The company plans to generate a profit by selling the notes, using the proceeds to purchase a bond with a fixed coupon rate of 7% a year and hedging the risk by entering into an appropriate swap. A swap dealer provides a quote with a fixed rate of 6% and a floating rate of 91 days Treasury bill rate.

Required:

(i)   Determine the net cash flow from entering the swap.   (5 marks)

(ii)   Explain two additional risks that the company might be exposed to by entering into the above swap arrangement.   (2 marks)

(Total: 20 marks)

QUESTION FOUR

(a)   Assess four interest rate hedging strategies that could be used by a borrower of a variable interest rate loan.   (4 marks)

(b)   The discount rates on a 60-day Treasury bill and 150-day Treasury bill are 6% and 6.25% respectively.

Assume that the Treasury bill has a Sh.1 par value and that a year has 360 days.

Required:

(i)   The price of a 60-day futures contract.   (4 marks)

(ii)   Using suitable computations, outline the transaction that could be used to take advantage of any arbitrage opportunity assuming that the actual price of a 60-day futures contract is 0.9853.   (2 marks)

(iii)   Determine the repo rate.   (2 marks)

(c)   Sarah Kizito is a portfolio manager at TrueColours Asset Management firm. One of Sarah's clients has a portfolio valued at Sh.150 million that is allocated 75% to equities and 25% to bonds. Sarah wants to reduce the portfolio's equity allocation to 50% and raise its bond allocation to 50%. She intends to simultaneously lower the modified duration of the bond portfolio from 6.05 to 5.50 but leave the beta of the equity portfolio unchanged at 1.08. She will use equity index and bond futures to achieve these objectives.

Information on the relevant futures contract is as follows:

-       Beta of equity index futures contract   0.95
-       Price of equity index futures contract   Sh.125,000
-       Modified duration of bond futures contract   7.50
-       Price of bond futures contract   Sh.105,000
-       The yield beta of the bond futures contract   1.00

The risk-free rate is 2.15%.

Required:
To achieve Sarah's portfolio objective, determine:

(i)   The number of equity index futures contract that she should sell.   (3 marks)

(ii)   The number of bond futures contract that she should buy.   (5 marks)

(Total: 20 marks)

QUESTION FIVE

(a)   Explain the effect of the following factors on the value of a European put option and call option price:

(i)   The underlying price.   (1 mark)

(ii)   The exercise price.   (1 mark)

(iii)   Time to expiration.   (1 mark)

(iv)   Risk-free rate.   (1 mark)

(v)   Volatility of the underlying.   (1 mark)

(b)   A local pension fund has a 450,000 basis point value (BPV) duration gap with BPV of assets being less than that of liabilities. The fund uses a swap with a BPV per 100 notional of 0.2571 to construct a 50% hedge ratio. After setting up the 50% hedge, the manager forms the opinion that rates will increase and would like to benefit if his view is correct but unaffected if he is wrong.

The manager would be willing to adjust the hedge position by 15% to a 35% or 65% hedge. He checks and finds that both payer and receiver swaptions are available with a strike of 2.7%. The premiums for the payer and receiver swaptions are 55 and 75 basis points, respectively.

Required:
(i)   The notional principal of the 50% hedge ratio swap the manager could use.   (2 marks)

(ii)   The initial cost of the swaption the manager could buy or sell to adjust his hedge to a 35% hedge.   (3 marks)

(iii)   The rate on new swaps and indicate whether new rates will have to be higher or lower than the rate to make exercising the swaption profitable.   (2 marks)

(c)   A one year swap with quarterly payments pays a fixed rate and receives a floating rate. The term structure at the beginning of the swap was as follows:

$$L_0(90) = 0.0252$$
$$L_0(180) = 0.0305$$
$$L_0(270) = 0.0373$$
$$L_0(360) = 0.0406$$

In order to mitigate the credit risk of the parties engaged in the swap, the swap was marked to market in 90 days. After 90 days, the swap was marked to market. The new term structure of the swap was as follows:

$$L_{90}(90) = 0.0539$$
$$L_{90}(180) = 0.0608$$
$$L_{90}(270) = 0.0653$$

Required:
(i)   The market value of the swap per Sh.1 notional principal at the beginning of the swap.   (6 marks)

(ii)   The new fixed rate on the swap at which the swap would proceed after marking to market.   (2 marks)
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