

# KASNEB

## CIFA PART III SECTION 6

### DERIVATIVES ANALYSIS

FRIDAY: 25 November 2016.

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) Derivatives trade in markets around the world, which include organised exchanges where highly standardised and regulated versions exist, and Over-the-Counter (OTC) markets, where customised and more highly regulated versions trade.

In relation to the above statement, discuss the following types of derivatives contracts:

- (i) Forward contract. (2 marks)
  - (ii) Futures contract. (2 marks)
  - (iii) Swap contract. (2 marks)
  - (iv) Option. (2 marks)
- (b) Consider a two-period binomial model in which a share currently trades at a price of Sh.97.50. The share price can increase by 30% or reduce by 25.50% in each period. The risk-free rate is 7.50%.

**Required:**

- (i) The price of a put option today that is expiring in two periods with an exercise price of Sh.90. (6 marks)
  - (ii) Based on the results in (b)(i) above, calculate the number of units of the underlying stock that would be required at each point in the binomial tree in order to construct a risk-free hedge. Use 15,000 puts. (6 marks)
- (Total: 20 marks)**

#### QUESTION TWO

- (a) Explain three factors that could affect the price of an option. (3 marks)
- (b) Citing three reasons, justify why futures options are increasingly becoming popular in the derivatives markets. (6 marks)
- (c) The following information relates to a European put futures option on crude oil:
- 1. The time to the option's expiration is 4 months.
  - 2. The current futures price is Sh.20.
  - 3. The futures exercise price is Sh.20.
  - 4. The risk-free interest rate is 9% per annum.
  - 5. The volatility on the futures price is 25% per annum.

**Required:**

The put price on a European put futures option. (3 marks)

- (d) A European receiver swaption expires in one year and is on a two-year swap that will make semi-annual payments. The swaption has an exercise rate of 7.2%. The notional principal is Sh.49 million. At the time of expiration, the term structure of interest rates is as follows:

$$\begin{aligned}L_0(180) &= 0.0412 \\L_0(360) &= 0.0465 \\L_0(540) &= 0.0533 \\L_0(720) &= 0.0648\end{aligned}$$

**Required:**

Illustrate four possible ways in which this swaption could be exercised, evaluating the relevant cash flows in each case. (8 marks)

**(Total: 20 marks)**

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### QUESTION THREE

- (a) (i) Distinguish between “price limit” and a “position limit” as applied in derivatives markets. (2 marks)
- (ii) Explain the purpose of price limit and position limit in derivatives markets. (2 marks)
- (b) Argue three cases against hedging in the derivatives markets. (3 marks)
- (c) The board of directors of Palex Ltd. is concerned about the downside risk of a Sh.100 million equity portfolio in its pension plan. The board’s consultant has proposed hedging the equity portfolio with either futures or options in a temporary period of one month.

**Required:**

Using the following factors, describe how the use of futures differ from the use of options when hedging a portfolio’s equity exposure:

- (i) Initial cost. (2 marks)
- (ii) Effect of implied volatility in pricing. (2 marks)
- (iii) Sensitivity to movement in the value of the underlying. (2 marks)
- (iv) Risk exposure. (2 marks)
- (d) The following information relates to a currency forward contract involving two currencies, the Kenya Shilling (KES) and the United States Dollar (USD):

Forward price (KES/USD)	0.01
Risk-free rate (Kenya)	6%
Risk-free rate (United States)	8%
Current spot rate (KES/USD)	0.009
Time to expiration	165 days

**Required:**

The value of the currency forward contract. (2 marks)

- (e) A portfolio manager expects to purchase a portfolio of stocks in 90 days from the Nairobi Securities Exchange (NSE). The manager decides to take a long position on a 90-day forward contract on the NSE 20 share index. The index is currently at 4580. The continuously compounded dividend yield is 1.75% while the discrete risk-free rate is 4.25%.

**Required:**

The value of the forward contract 28 days into the life of the forward contract; if the NSE 20 share index is at 4,900. Assume a 365-day year.

(3 marks)

**(Total: 20 marks)**

### QUESTION FOUR

- (a) Johnson Mwakasi is a derivatives consultant handling three clients; A, B and C who have the following investment positions:
- Client A has invested in stocks with a strong European exposure and he says that his portfolio has a positive delta.
  - Client B has invested in stocks of financial firms and she says that her portfolio has a negative rho.
  - Client C has recently retired and has managed to establish large option positions as a stock investor. He says that his portfolio has a positive theta.

**Required:**

Explain the meaning of each claim made by each client. (6 marks)

- (b) In a Treasury bond futures contract, it is known that the cheapest bond to deliver will be a 12% coupon bond with a conversion factor of 1.6000. It is also known that the delivery will take place in 270 days. Coupons are payable semi-annually on the bond. The last coupon date was 60 days ago. The next coupon date is in 122 days and the coupon thereafter is in 305 days. The term structure is flat and the rate of interest with continuous compounding is 10% per annum. The current quoted bond price is Sh.115.

**Required:**

The quoted futures price.

(5 marks)

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- (c) The following information relates to a European call option on the S&P 500 market index with two months to maturity:
1. The current value of the index is Sh.930.
  2. The exercise price is Sh.900.
  3. The risk-free interest rate is 8% per annum.
  4. The volatility of the index is 20% per annum.
  5. Dividend yields of 0.2% and 0.3% are expected in the first and second month.

**Required:**

The call price using Black-Scholes-Merton (BSM) model. (4 marks)

- (d) The spot price of corn is Sh.3.50 and it costs Sh.0.017 to store a bushel of corn for 1 month while the relevant cost of financing is 1% per month. The corn futures contract matures in 6 months and the current futures price for this contract is Sh.3.95 per bushel. The storage cost is paid at the onset of the transaction. There are 5,000 bushels per contract.

**Required:**

The arbitrage profit from the transaction. (5 marks)

**(Total: 20 marks)**

**QUESTION FIVE**

- (a) Assess three types of margins that an investor participating in a futures exchange could access. (6 marks)

- (b) Boaz Miriti manages the family investment portfolio which initially consisted of Sh.46 million of equities and Sh.32 million of bonds. As a result of a change in family circumstances, the portfolio is rebalanced using the transaction shown below:

Type of futures contract	Action	Number of futures contract to buy or sell	Price per futures contract (Sh.)
Equity futures contract	Buy	42	160,000
Bond futures contract	Sell	35	190,000

Three months after the above transactions, the market value of the family portfolio's equities has increased by 300% and the market value of its bonds has decreased by 240%. The prices of the equity futures contract and bond futures contract are now Sh.165,000 and Sh.185,250 respectively.

**Required:**

The profit or loss of the family investment portfolio over the past three months. (4 marks)

- (c) John Mukungi is a portfolio manager with Raimulo Financial Services. He manages a portfolio consisting 65% allocation to equities and 35% allocation to bonds. The portfolio has a market value of Sh.200 million. The beta of the equity position is 1.15, and the modified duration of the bond position is 6.75. The portfolio manager wishes to increase the equity allocation to 85% and reduce the bond allocation to 15% for a period of 6 months.

In addition to altering asset allocations, John Mukungi would also like to increase the beta on the equity position to 1.20 and increase the modified duration of the bonds to 8.25.

A stock index futures contract that expires in six months is priced at Sh.157,500 and has a beta of 0.95. A bond futures contract that expires in six months is priced at Sh.109,000 and has implied modified duration of 5.25. The stock futures contract has a multiplier of 1.

**Required:**

- (i) Demonstrate how John Mukungi could achieve his goals by using stock index and bond futures. (5 marks)

- (ii) The number of futures contracts. (4 marks)

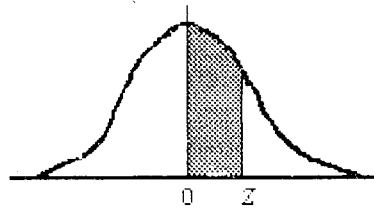
- (iii) Indicate whether the portfolio manager should go long or short. (1 mark)

**(Total: 20 marks)**

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z	0	1	2	3	4	5	6	7	8	9
0.0	.0000	.0040	.0080	.0120	.0160	.0199	.0239	.0279	.0319	.0359
0.1	.0398	.0438	.0478	.0517	.0557	.0596	.0636	.0675	.0714	.0754
0.2	.0793	.0832	.0871	.0910	.0948	.0987	.1026	.1064	.1103	.1141
0.3	.1179	.1217	.1255	.1293	.1331	.1368	.1406	.1443	.1480	.1517
0.4	.1554	.1591	.1628	.1664	.1700	.1736	.1772	.1808	.1844	.1879
0.5	.1915	.1950	.1985	.201	.2051	.2088	.2123	.2157	.2190	.2224
0.6	.2258	.2291	.2324	.2357	.2389	.2422	.2454	.2486	.2518	.2549
0.7	.2580	.2612	.2642	.2673	.2704	.2734	.2764	.2794	.2823	.2852
0.8	.2881	.2910	.2939	.2967	.2996	.3023	.3051	.3078	.3106	.3133
0.9	.3159	.3186	.3212	.3238	.3264	.3289	.3315	.3340	.3365	.3389
1.0	.3413	.3438	.3461	.3485	.3508	.3531	.3554	.3577	.3599	.3621
1.1	.3643	.3665	.3686	.3708	.3729	.3749	.3770	.3790	.3810	.3830
1.2	.3849	.3869	.3888	.3907	.3925	.3944	.3962	.3980	.3997	.4015
1.3	.4032	.4049	.4066	.4082	.4099	.4115	.4131	.4147	.4162	.4177
1.4	.4192	.4207	.4222	.4236	.4251	.4265	.4279	.4292	.4306	.4319
1.5	.4332	.4345	.4357	.4370	.4382	.4394	.4406	.4418	.4429	.4441
1.6	.4452	.4463	.4474	.4484	.4495	.4505	.4515	.4525	.4535	.4545
1.7	.4554	.4564	.4573	.4582	.4591	.4599	.4608	.4616	.4625	.4633
1.8	.4641	.4649	.4656	.4664	.4671	.4678	.4686	.4693	.4699	.4706
1.9	.4713	.4719	.4726	.4732	.4738	.4744	.4750	.4756	.4761	.4767
2.0	.4772	.4778	.4783	.4788	.4793	.4798	.4803	.4808	.4812	.4817
2.1	.4821	.4826	.4830	.4834	.4838	.4842	.4846	.4850	.4854	.4857
2.2	.4861	.4864	.4868	.4871	.4875	.4878	.4881	.4884	.4887	.4890
2.3	.4893	.4896	.4898	.4901	.4904	.4906	.4909	.4911	.4913	.4916
2.4	.4918	.4920	.4922	.4925	.4927	.4929	.4931	.4932	.4934	.4936
2.5	.4938	.4940	.4941	.4943	.4945	.4946	.4948	.4949	.4951	.4952
2.6	.4953	.4955	.4956	.4957	.4959	.4960	.4961	.4962	.4963	.4964
2.7	.4965	.4966	.4967	.4968	.4969	.4970	.4971	.4972	.4973	.4974
2.8	.4974	.4975	.4976	.4977	.4977	.4978	.4979	.4979	.4980	.4981
2.9	.4981	.4982	.4982	.4983	.4984	.4984	.4985	.4985	.4986	.4986
3.0	.4987	.4987	.4987	.4988	.4988	.4989	.4989	.4989	.4990	.4990
3.1	.4990	.4991	.4991	.4991	.4992	.4992	.4992	.4992	.4993	.4993
3.2	.4993	.4993	.4994	.4994	.4994	.4994	.4994	.4995	.4995	.4995
3.3	.4995	.4995	.4995	.4996	.4996	.4996	.4996	.4996	.4996	.4997
3.4	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4997	.4998
3.5	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998	.4998
3.6	.4998	.4998	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.7	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.8	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999	.4999
3.9	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000	.5000