kasneb

CIFA PART III SECTION 6

DERIVATIVES ANALYSIS

FRIDAY: 25 May 2018.
                                                        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) Describe two possible arrangements that could be used to settle forward contract obligations upon expiration.
(4 marks)

(b) Onyango Omamo holds an asset worth Sh.125.72 million. He wishes to raise funds and intends to sell the asset in nine months time. Onyango is concerned about the uncertainty in the price of the asset at that time. As an investment analyst specialising in derivatives, you advise Onyango to take advantage of using a forward contract by entering into such a contract to sell the asset in nine months time, which he accepts. The risk-free rate is 5.625 percent.

Required:

(i) The appropriate price that Onyango Omamo could receive in nine months time using forward contract.
(2 marks)

(ii) Suppose that the counterparty to the forward contract in (b) (i) above is willing to engage in such a contract at a forward price of Sh.140 million, illustrate the type of transaction that the investor could execute to take advantage of the situation. (2 marks)

(iii) Calculate the rate of annualised return using the information given in (b) (ii) above and explain why the transaction is attractive. (3 marks)

(iv) Assume that the forward contract is entered into at the price computed in (b) (i) above, and two months later, the price of the asset is Sh.118.875 million. Onyango would like to evaluate his position with respect to any gain or loss accrued on the forward contract.

Determine the market value of the forward contract at this point in time from the perspective of the investor in (b)(i) above. (3 marks)

(v) Determine the value of the forward contract at expiration assuming the contract is entered into at the price computed in (b)(i) above and the price of the property is Sh.123.50 million at expiration.

Comment on how the investor performed on the overall position of both the asset and the forward contract in terms of the rate of return. (3 marks)

Hint:

1. Value of a forward contract at any time, t:
   $V_t(0,T) = S_t - F(0,T)/(1 - r)^{T-t}$

2. Value of a forward contract at expiration (t = T):
   $V_T(0,T) = S_T - F(0,T)$

3. Value of a forward contract at initiation (t = 0):
   $V_0(0,T) = S_0 - F(0,T)/(1 - r)^T$

Where:

S	=	Price of the underlying asset.
F(0,T)	=	Price of the forward contract.
V(0,T)	=	Value of the forward contract.
r	=	Risk-free rate.
T	=	Time at expiration.
t	=	Time t during the life of the contract.

(c) A corporation sold 10 million Euros against a British pound forward at a forward rate of 0.8000 GBP/Euro at time 0. The current spot rate at time t is 0.7500 GBP/Euro and the annually compounded risk-free rates are 0.80% for the British pound and 0.40% for the Euro. Assume that at time t, there are three months until the forward contract expiration.

Required:
The value of the foreign exchange forward contract at time t.

(3 marks)
(Total: 20 marks)

QUESTION TWO

(a) Describe the following four possible options positions:

(i) Long call. (1 mark)

(ii) Short call. (1 mark)

(iii) Long put. (1 mark)

(iv) Short put. (1 mark)

(b) A Kenyan company enters into a currency swap in which it pays a fixed rate of 6 percent in United States dollars ($) and the counter party pays a fixed rate of 5 percent in Kenya Shillings (Ksh.). The notional principals are Ksh.75 million and $105 million. Payments are made semi-annually and on the basis of 30 days per month and 360 days per year.

Required:

(i) The initial exchange of payments that takes place at the beginning of the swap. (2 marks)

(ii) The semi-annual payments. (2 marks)

(iii) The final exchange of payments that takes place at the end of the swap. (2 marks)

(c) An investor wishes to purchase a European put option on Tausi Limited Shares. The details of the put option on Tausi Limited shares are provided below:

Time to expiration	1 year
Current market price per share	Sh.52
Exercise price per share	Sh.45
Model predicted up move	15%
Model predicted down move	20%
Annualised risk-free rate	6%

Required:
Using a one period binomial model, calculate the value of a one-year put option on Tausi Limited shares.

(4 marks)

(d) A Sh.30 million portfolio consists of Sh.20 million of equity with a beta of 1.15 and Sh.10 million of bonds with a modified duration of 6.25 and a yield-to-maturity of 7.15%. The portfolio manager would like to change the allocation to Sh.15 million of equity and Sh.15 million of bond. In addition, the portfolio manager would like to adjust the equity beta to 1.05 and the modified duration on the bonds to 7. Equity index futures contract has a price of Sh.225,000 and a beta of 1.0. A bond futures contract is priced at Sh.92,000 with an implied modified duration of 5.9 and an implied yield-to-maturity of 5.65%.

The portfolio manager intends to use futures to synthetically sell Sh.5 million of equity, reduce the beta on the remaining equity, synthetically buy Sh.5 million of bond and increase the modified duration on the remaining bonds. The investment horizon date is three months, after which the equity index future price is expected to be Sh.217,800 and the bond futures price is expected to be Sh.92,878. The equity portfolio declines by 3% and the bond portfolio increases by 1% in three months period.

Required:
The overall value of the portfolio in three months period.

(6 marks)
(Total: 20 marks)

QUESTION THREE

(a) Highlight four factors that could affect the price of a futures contract. (4 marks)

(b) Peter Oteba intends to purchase a futures contract whose underlying asset is gold. The following information is provided to him:

    1.   The current price of gold is Sh.30,000.
    2.   The net cost of carry for gold is zero.
    3.   The risk-free rate is 6 percent.
    4.   One year has 365 days.

Required:

(i) The price of a 90-day futures contract. (2 marks)

(ii) Illustrate how an arbitrage transaction could be executed if the futures contract is priced at Sh.30,600. (4 marks)

(iii) Illustrate how an arbitrage transaction could be executed if the futures contract is priced at Sh.30,300. (4 marks)

(c) A bank plans to make a Sh.10 million floating rate loan in 90 days. The loan period will be 180 days and the rate will be 180-day LIBOR plus 150 basis points. The current 90-day LIBOR is 10.5%. The bank is worried about falling interest rates over the period from now until the loan starts and decides to use an interest rate put option with an exercise price of 9% priced at Sh.5,023.

Required:

The effective rate on the loan given that the LIBOR at expiration is 5%. (6 marks)

(Total: 20 marks)

QUESTION FOUR

(a) Named after its founders, Fisher Black, Myron Scholes and Robert Merton, the Black-Scholes-Merton (BSM) model earned Scholes and Merton a Nobel Prize in 1997 for developing the model, two years after the death of Fisher Black in 1995.

In relation to the above statement, discuss the five inputs of the Black-Scholes-Merton (BSM) model. (5 marks)

(b) An interest rate call option based on a 90-day underlying rate has an exercise rate of 7.5% and expires in 180 days. The forward rate is 7.25% and volatility is 0.04. The continuously compounded risk-free rate is 5%.

Assume that the value of d_1 is −1.1928.

Required:

The price of the interest rate call option using the Black model. (6 marks)

(c) The current share price of ABC Ltd. is Sh.100. The shares volatility is 15%. The risk-free rate is 5% and the company pays no dividend. The strike price on the ABC shares is Sh.100.

Required:

Show that the put-call parity holds. (5 marks)

(d) An option trader has the following four transactions:

Transaction	Exercise price (Sh.)
Long 1 call	95
Short 1 call	105
Long 1 put	105
Short 1 put	95

Additional information:

    1.   The stock price at expiration is Sh.102.
    2.   Options expire in 1 year.
    3.   The risk-free interest rate is 10%.

Required:

(i) The value of the trader's box spread. (2 marks)

(ii) The cost of the box spread. (2 marks)

(Total: 20 marks)

QUESTION FIVE

(a) Highlight three similarities between swap contracts and forward contracts. (3 marks)

(b) A financial institution has entered into a 10-year currency swap with company Y. Under the terms of the swap, the financial institution receives interest at a rate of 3% per annum in Swiss Francs and pays interest at a rate of 8% in U.S. dollars. Interest payments are exchanged once a year. The principal amounts are 7 million US dollars ($) and 10 million Swiss Francs (SFr). Company Y happens to declare bankruptcy at the end of year 6, when the exchange rate is $0.80 per Swiss Franc. At the end of year 6, the interest rate is 3% per annum in Swiss Francs and 8% per annum in U.S. dollars for all maturities. All interest rates are quoted with annual compounding.

Required:
The cost of currency swap to the financial institution. (5 marks)

(c) A currency swap has a remaining life of 15 months. It involves exchanging interest at a rate of 10% on 20 million Sterling pounds for interest rate of 6% on 30 million USD once a year. The term structure of interest rates in both the United Kingdom and the United States is currently flat, and if the swap were negotiated today the interest rates exchanged would be 4% in US dollars and 7% in Sterling pounds. All interest rates are quoted with annual compounding.

The current exchange rate (US dollar per Sterling pound) is 1.8500.

Required:
Determine the value of the swap to the party paying US dollars. (4 marks)

(d) A party has entered a receive-floating 6 x 9 FRA (forward rate agreement) at a rate of 0.86% with notional amount of 10,000,000 Canadian dollars (C$) at time 0. The six month spot C$ LIBOR was 0.628% and the nine month C$ LIBOR was 0.712%. The 6 x 9 FRA rate is quoted in the market at 0.86%. After 90 days have passed, the three month C$ LIBOR is 1.25% and the six month C$ LIBOR is 1.35%.

Required:
Using the appropriate discount rate, calculate the value of the original receive-floating 6 x 9 FRA. (4 marks)

(e) A put option with an exercise price of Sh.45.00 is currently trading at Sh.3.50. The underlying share is trading at a market price per share (MPS) of Sh.45.00. The MPS is expected to increase to Sh.50.00.

Required:
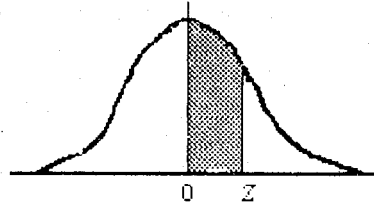In relation to the above statement, explain the effect of the following:

(i) Put option's Delta. (2 marks)

(ii) Put option's Gamma. (2 marks)

(Total: 20 marks)

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NORMAL CURVE

AREAS
under the
STANDARD
NORMAL CURVE
from 0 to z

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	.2704	.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