



CIFA PART III SECTION 5

FIXED INCOME INVESTMENTS ANALYSIS

WEDNESDAY: 28 November 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) Explain the following terms in relation to bonds secondary market:

- (i) Off-the-run issue. (1 mark)
- (ii) Bond equivalent yield. (1 mark)
- (iii) Settlement day. (1 mark)
- (iv) Bank discount basis of price quotes. (1 mark)

(b) Examine four main features of Eurobonds. (4 marks)

(c) Maurine Amwayi, a financial analyst at Nimo Financial Services is researching on the relationship between yield changes and bond price. She has gathered the following information on three bonds; A, B and C trading in the securities exchange.

Bond	Required yield (%)
A	6.8
B	11.0
C	10.0

Each of the above bonds has a par value of Sh.1,000 and offers an annual coupon rate of 10%, paid semi-annually. Each bond matures in 20 years.

Required:

- (i) The price of bonds A, B and C. (3 marks)
- (ii) Comment on the results obtained in (c) (i) above. (3 marks)

(d) An investor buys a 20-year, 9% annual coupon bond for Sh.1,213.55. The bond is callable in 3-years at a call price of Sh.1,090. Assume that the par value of the bond is Sh.1,000.

Required:

- (i) The bond's yield-to-maturity (YTM). (3 marks)
- (ii) The bond's yield-to-call. (3 marks)

(Total: 20 marks)

QUESTION TWO

- (a) Describe three ways of characterising a bond. (6 marks)
- (b) A fixed income analyst uses the following financial data from the new issue prospectus to calculate credit ratios:

	2016 Sh. "000"	2017 Sh. "000"
Revenues	20,500	18,700
Operating expenses	18,700	17,100
Depreciation	750	670
Interest	304	257
Taxes	149	135
Net income	597	539
Total debt	4,500	4,425

Required:

- (i) Debt-to-earnings before interest, tax, depreciation and amortisation (EBITDA) ratio. (1 mark)
- (ii) EBITDA-to-interest coverage ratio. (1 mark)
- (iii) Earnings before interest and tax (EBIT) to interest coverage ratio. (1 mark)
- (iv) Comment on your results obtained in (b) (i) to (b) (iii) above. (1 mark)
- (c) The following information relates to a bond credit ratio score table developed by a rating agency:

Initial rating	Rating at year end							
	AAA	AA	A	BBB	BB	B	CCC	Default
AAA	93.66	5.83	0.40	0.09	0.03	0.00	0.00	0.00
AA	0.66	91.72	6.94	0.49	0.06	0.09	0.02	0.01
A	0.07	2.25	91.76	5.18	0.49	0.20	0.01	0.04
BBB	0.03	0.26	4.83	89.24	0.44	0.81	0.16	0.24
BB	0.03	0.06	0.44	6.66	83.23	7.46	1.05	1.08
B	0.00	0.10	0.32	0.46	5.72	83.62	3.84	5.94
CCC	0.15	0.00	0.29	0.88	1.91	10.28	61.23	25.26
Default	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100

Required:

- (i) Explain the term "credit rating migration". (2 marks)
- (ii) The probability that a bond starting with credit rating BBB will drop to a lower rating. (1 mark)
- (iii) The probability that a bond whose rating at the beginning of the year is AA will default during the year. (1 mark)
- (iv) The probability that a bond initially rated at CCC will remain at CCC at year end. (1 mark)
- (d) A-20 year maturity bond with a 10% annual coupon rate currently sells at a yield-to-maturity (YTM) of 9%. An analyst forecasts that 2 years from now, 18-year bonds will sell at a YTM of 8% and that coupon payments can be reinvested in short-term securities over the coming years at a rate of 7% per annum.

Required:

- The bond's 2-year return. (5 marks)
- (Total: 20 marks)**

QUESTION THREE

- (a) Differentiate between "static spread" and "option adjusted spread (OAS)". (2 marks)
- (b) The following information relates to three bonds:

Bond	Maturities (years)	Coupon rate (%)	Yield-to-maturity (YTM) (%)
1	1	5	4.5
2	2	5	5.0
3	3	0	5.5

Additional information:

1. Each bond has a par value of Sh.100.
2. Coupons are paid annually with the first coupon payment coming in exactly one year from now.
3. The YTM is also quoted as an annual rate.

Required:

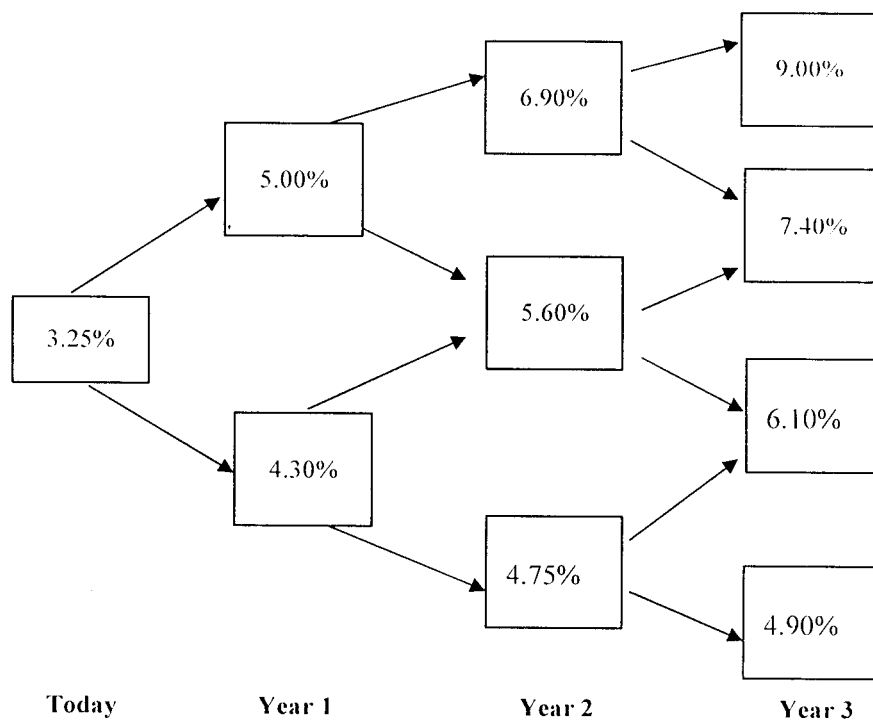
- (i) The price of a bond with a maturity of 3 years and a coupon rate of 5%. (3 marks)
 - (ii) The modified duration of a bond portfolio with 30% invested in bond 1 and 70% invested in bond 2. (2 marks)
 - (iii) Determine by how much the value of the portfolio in (b) (ii) above would change assuming that the yields of all bonds increase by 0.15%. (1 mark)
 - (iv) Outline three limitations of modified duration. (3 marks)
- (c) A semi-annual Sh.1,000 par value floating rate note (FRN) has two years to maturity. The reference rate is 180 day London Interbank offered rate (LIBOR) and the quoted margin is 60 basis point. The 180 day LIBOR today is 3% and the required margin is 86 basis point.

Required:

The value of the floating rate note. (3 marks)

- (d) Ann Mwaura gathers the following data relating to a bond that is callable at Sh.101.00 every year starting one year from today.

The binomial interest rate tree (10% volatility assumed) for valuing a 3-year callable bond with a coupon rate of 6.0% is provided below:



Required:

The value of the callable bond using the interest rate tree above.

(6 marks)
(Total: 20 marks)

QUESTION FOUR

- (a) Examine two implications for each of the following term structure of interest rates theories when the yield curve is downward sloping:
- (i) Pure expectation theory. (2 marks)
 - (ii) Liquidity preference theory. (2 marks)
- (b) Citing four reasons, explain why the price of a bond could change over a given period of time. (8 marks)
- (c) The following prices are available for treasury strips with a principal of 100.

Bond	Maturity year	Price
A	1	95.92
B	2	92.01
C	3	87.00

Required:

Compute the annual forward rate from year two to year three. (4 marks)

- (d) The following information relates to a certain bond quoted at the securities exchange:

Price as a percentage of par value	Annual coupon rate (%)	Annual period	Maturity (years)
102.6364	4.25	1	1
105.3651	4.75	2	2

Required:

The 2-year spot rate using the bootstrapping method. (4 marks)

(Total: 20 marks)

QUESTION FIVE

- (a) A bond with a coupon rate of 5.25% and 3 years to maturity has the following forward rates:

Year	One year forward rate (%)
1	3.5
2	4.523
3	5.58

The bond has a par value of Sh.100.

Required:

- (i) The arbitrage free value of the bond. (2 marks)
 - (ii) The value of the bond using the spot rate method. (5 marks)
- (b) Assess three types of event risks that could affect a fixed income instrument. (6 marks)
- (c) Sabety Amusimbwa, a risk manager at Fanisi Bank is assessing how rating agencies measure sovereign default risks. In particular, she is researching common mistakes made by rating agencies when rating sovereigns and corporations.

Required:

In relation to the above statement, argue four cases against relying on credit agencies in evaluating the creditworthiness of a corporate or sovereign bond. (4 marks)

- (d) A Sh.1,000 par value bond with 22 years to maturity and a 4% semiannual coupon rate has a yield-to-maturity (YTM) of 5%.

Required:

The convexity of the bond assuming a 5 basis point change in yield. (3 marks)

(Total: 20 marks)

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Present Value of 1 Received at the End of n Periods:

$$PVIF_{r,n} = 1/(1+r)^n = (1+r)^{-n}$$

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%	36%
1	.9901	.9804	.9709	.9615	.9524	.9434	.9346	.9259	.9174	.9091	.8929	.8772	.8696	.8621	.8475	.8333	.8065	.7813	.7576	.7353
2	.9803	.9612	.9426	.9246	.9070	.8900	.8734	.8573	.8417	.8264	.7972	.7695	.7561	.7432	.7182	.6944	.6504	.6104	.5739	.5407
3	.9706	.9423	.9151	.8890	.8638	.8396	.8163	.7938	.7722	.7513	.7118	.6750	.6575	.6407	.6086	.5787	.5245	.4768	.4348	.3975
4	.9610	.9238	.8885	.8548	.8227	.7921	.7629	.7350	.7084	.6830	.6355	.5921	.5718	.5523	.5158	.4823	.4230	.3725	.3294	.2923
5	.9515	.9057	.8626	.8219	.7835	.7473	.7130	.6806	.6499	.6209	.5674	.5194	.4972	.4761	.4371	.4019	.3411	.2910	.2495	.2149
6	.9420	.8880	.8375	.7903	.7462	.7050	.6663	.6302	.5963	.5645	.5066	.4556	.4323	.4104	.3704	.3349	.2751	.2274	.1890	.1580
7	.9327	.8706	.8131	.7599	.7107	.6651	.6227	.5835	.5470	.5132	.4523	.3996	.3759	.3538	.3139	.2791	.2218	.1776	.1432	.1162
8	.9235	.8535	.7894	.7307	.6768	.6274	.5820	.5403	.5019	.4665	.4039	.3506	.3269	.3050	.2660	.2326	.1789	.1388	.1085	.0854
9	.9143	.8368	.7664	.7026	.6446	.5919	.5439	.5002	.4604	.4241	.3606	.3075	.2843	.2630	.2255	.1938	.1443	.1084	.0822	.0628
10	.9053	.8203	.7441	.6756	.6139	.5584	.5083	.4632	.4224	.3855	.3220	.2697	.2472	.2267	.1911	.1615	.1164	.0847	.0623	.0462
11	.8963	.8043	.7224	.6496	.5847	.5268	.4751	.4289	.3875	.3505	.2875	.2366	.2149	.1954	.1619	.1346	.0938	.0662	.0472	.0340
12	.8874	.7885	.7014	.6246	.5568	.4970	.4440	.3971	.3555	.3186	.2567	.2076	.1869	.1685	.1372	.1122	.0757	.0517	.0357	.0250
13	.8787	.7730	.6810	.6006	.5303	.4688	.4150	.3677	.3262	.2897	.2292	.1821	.1625	.1452	.1163	.0935	.0610	.0404	.0271	.0184
14	.8700	.7579	.6611	.5775	.5051	.4423	.3878	.3405	.2992	.2633	.2046	.1597	.1413	.1252	.0985	.0779	.0492	.0316	.0205	.0135
15	.8613	.7430	.6419	.5553	.4810	.4173	.3624	.3152	.2745	.2394	.1827	.1401	.1229	.1079	.0835	.0649	.0397	.0247	.0155	.0099
16	.8528	.7284	.6232	.5339	.4581	.3936	.3387	.2919	.2519	.2176	.1631	.1229	.1069	.0930	.0708	.0541	.0320	.0193	.0118	.0073
17	.8444	.7142	.6050	.5134	.4363	.3714	.3166	.2703	.2311	.1978	.1456	.1078	.0929	.0802	.0600	.0451	.0258	.0150	.0089	.0054
18	.8360	.7002	.5874	.4936	.4155	.3503	.2959	.2502	.2120	.1799	.1300	.0946	.0808	.0691	.0508	.0376	.0208	.0118	.0068	.0039
19	.8277	.6864	.5703	.4746	.3957	.3305	.2765	.2317	.1945	.1635	.1161	.0829	.0703	.0596	.0431	.0313	.0168	.0092	.0051	.0029
20	.8195	.6730	.5537	.4564	.3769	.3118	.2584	.2145	.1784	.1486	.1037	.0728	.0611	.0514	.0365	.0261	.0135	.0072	.0039	.0021
25	.7798	.6095	.4776	.3751	.2953	.2330	.1842	.1460	.1160	.0923	.0588	.0378	.0304	.0245	.0160	.0105	.0046	.0021	.0010	.0005
30	.7419	.5521	.4120	.3083	.2314	.1741	.1314	.0994	.0754	.0573	.0334	.0196	.0151	.0116	.0070	.0042	.0016	.0006	.0002	.0001
40	.6717	.4529	.3066	.2083	.1420	.0972	.0668	.0460	.0318	.0221	.0107	.0053	.0037	.0026	.0013	.0007	.0002	.0001		
50	.6080	.3715	.2281	.1407	.0872	.0543	.0339	.0213	.0134	.0085	.0035	.0014	.0009	.0006	.0003	.0001				
60	.5504	.3048	.1697	.0951	.0535	.0303	.0173	.0099	.0057	.0033	.0011	.0004	.0002	.0001						

* The factor is zero to four decimal places

Present Value of an Annuity of 1 Per Period for n Periods:

$$PVIF_{r,n} = \sum_{t=1}^n \frac{1}{(1+r)^t} = \frac{1 - \frac{1}{(1+r)^n}}{r}$$

Number of payments	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%	16%	18%	20%	24%	28%	32%
1	0.9901	0.9804	0.9709	0.9615	0.9524	0.9434	0.9346	0.9259	0.9174	0.9091	0.8929	0.8772	0.8696	0.8621	0.8475	0.8333	0.8065	0.7813	0.7576
2	1.9704	1.9416	1.9135	1.8861	1.8594	1.8334	1.8080	1.7833	1.7591	1.7355	1.6901	1.6467	1.6257	1.6052	1.5656	1.5278	1.4568	1.3916	1.3315
3	2.9410	2.8839	2.8286	2.7751	2.7232	2.6730	2.6243	2.5771	2.5313	2.4869	2.4018	2.3216	2.2832	2.2459	2.1743	2.1065	1.9813	1.8684	1.7663
4	3.9020	3.8077	3.7171	3.6299	3.5460	3.4651	3.3872	3.3121	3.2397	3.1699	3.0373	2.9137	2.8550	2.7982	2.6901	2.5887	2.4043	2.2410	2.0957
5	4.8534	4.7135	4.5797	4.4518	4.3295	4.2124	4.1002	3.9927	3.8897	3.7908	3.6048	3.4331	3.3522	3.2743	3.1272	2.9906	2.7454	2.5320	2.3452
6	5.7955	5.6014	5.4172	5.2421	5.0757	4.9173	4.7665	4.6229	4.4859	4.3553	4.1114	3.8887	3.7845	3.6847	3.4976	3.3255	3.0205	2.7594	2.5342
7	6.7282	6.4720	6.2303	6.0021	5.7864	5.5824	5.3893	5.2064	5.0330	4.8684	4.5638	4.2883	4.1604	4.0386	3.8115	3.6046	3.2423	2.9370	2.6775
8	7.6517	7.3255	7.0197	6.7327	6.4632	6.2098	5.9713	5.7466	5.5348	5.3349	4.9676	4.6389	4.4873	4.3436	4.0776	3.8372	3.4212	3.0758	2.7860
9	8.5660	8.1622	7.7861	7.4353	7.1078	6.8017	6.5152	6.2469	5.9952	5.7590	5.3282	4.9464	4.7716	4.6065	4.3030	4.0310	3.5655	3.1842	2.8681
10	9.4713	8.9826	8.5302	8.1109	7.7217	7.3601	7.0236	6.7101	6.4177	6.1446	5.6502	5.2161	5.0188	4.8332	4.4941	4.1925	3.6819	3.2689	2.9304
11	10.3676	9.7868	9.2526	8.7605	8.3064	7.8869	7.4987	7.1390	6.8052	6.4951	5.9377	5.4527	5.2337	5.0286	4.6560	4.3271	3.7757	3.3351	2.9776
12	11.2551	10.5753	9.9540	9.3851	8.8633	8.3838	7.9427	7.5361	7.1607	6.8137	6.1944	5.6603	5.4206	5.1971	4.7932	4.4392	3.8514	3.3868	3.0133
13	12.1337	11.3484	10.6350	9.9856	9.3936	8.8527	8.3577	7.9038	7.4869	7.1034	6.4235	5.8424	5.5831	5.3423	4.9095	4.5327	3.9124	3.4272	3.0404
14	13.0037	12.1062	11.2961	10.5631	9.8986	9.2950	8.7455	8.2442	7.7862	7.3667	6.6282	6.0021	5.7245	5.4675	5.0081	4.6106	3.9616	3.4587	3.0609
15	13.8651	12.8493	11.9379	11.1184	10.3797	9.7122	9.1079	8.5595	8.0607	7.6061	6.8109	6.1422	5.8474	5.5755	5.0916	4.6755	4.0013	3.4834	3.0764
16	14.7179	13.5777	12.5611	11.6523	10.8378	10.1059	9.4466	8.8514	8.3126	7.8237	6.9740	6.2651	5.9542	5.6685	5.1624	4.7296	4.0333	3.5026	3.0882
17	15.5623	14.2919	13.1661	12.1657	11.2741	10.4773	9.7632	9.1216	8.5436	8.0216	7.1196	6.3729	6.0472	5.7487	5.2223	4.7746	4.0591	3.5177	3.0971
18	16.3983	14.9920	13.7535	12.6593	11.6896	10.8276	10.0591	9.3719	8.7556	8.2014	7.2497	6.4674	6.1280	5.8178	5.2732	4.8122	4.0799	3.5294	3.1039
19	17.2260	15.6785	14.3238	13.1339	12.0853	11.1581	10.3356	9.6036	8.9501	8.3649	7.3658	6.5504	6.1982	5.8775	5.3162	4.8435	4.0967	3.5386	3.1090
20	18.0456	16.3514	14.8775	13.5903	12.4622	11.4699	10.5940	9.8181	9.1285	8.5136	7.4694	6.6231	6.2593	5.9288	5.3527	4.8696	4.1103	3.5458	3.1129
25	22.0232	19.5235	17.4131	15.6221	14.0939	12.7834	11.6536	10.6748	9.8226	9.0770	7.8431	6.8729	6.4641	6.0971	5.4669	4.9476	4.1474	3.5640	3.1220
30	25.8077	22.3965	19.6004	17.2920	15.3725	13.7648	12.4090	11.2578	10.2737	9.4269	8.0552	7.0027	6.5660	6.1772	5.5168	4.9789	4.1601	3.5693	3.1242
40	32.8347	27.3555	23.1148	19.7928	17.1591	15.0463	13.3317	11.9246	10.7574	9.7751	8.2438	7.1050	6.6418	6.2335	5.5482	4.9966	4.1659	3.5712	3.1250
50	39.1961	31.4236	25.7298	21.4822	18.2559	15.7619	13.8007	12.2335	10.9617	9.9148	8.3045	7.1327	6.6605	6.2463	5.5541	4.9995	4.1666	3.5714	3.1250
60	44.9550	34.7609	27.6756	22.6235	18.9293	16.1614	14.0392	12.3766	11.0480	9.9672	8.3240	7.1401	6.6651	6.2402	5.5553	4.9999	4.1667	3.5714	3.1250