PGDM/IB, 2018-20

Fixed Income Securities

DM-513/IB-514

Trimester – V, End-Term Examination: December 2019

Time allowed: 2 Hrs 30 Min
Max Marks: 50

Roll No: ____________

Instruction: Students are required to write Roll No on every page of the question paper, writing anything except the Roll No will be treated as **Unfair Means.** All other instructions on the reverse of Admit Card should be followed meticulously.

Sections	No. of Questions to attempt	Marks	Total Marks
A	Minimum 3 question with internal choices and CILO (Course Intended Learning Outcome) covered	3*10	30
	Or	Or	
	Maximum 6 questions with internal choices and CILO covered (as an example)	6*5	
B	Compulsory Case Study with minimum of 2 questions	20	20
			50

Section A

CILO-1

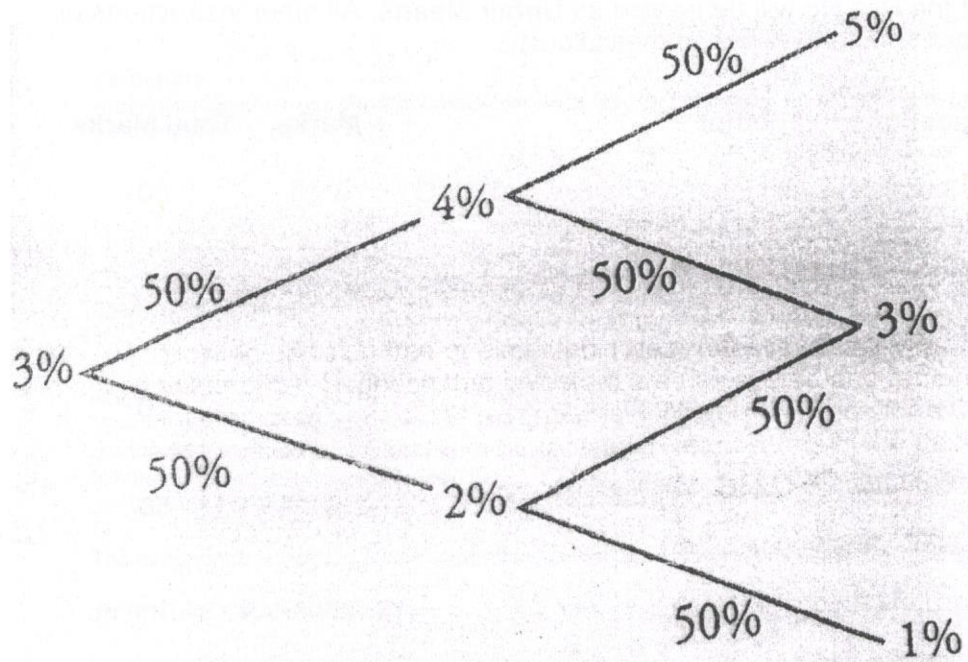
A1A- A bond with a $ 100 par value pays a 5% coupon annually for 4 years. The spot rates corresponding to the payment dates are as follows; Year 1: 4.0%, year 2: 4.5%, year 3: 5.0% and year 4: 5.5%. Assume the price of the bond is $ 98.47. Show the calculation of the price of the bond using spot rates and determine the Yield to maturity (YTM) for the bond. *(5 Marks)*

A1B- Use the following information and the bootstrapping methodology. What is the 2-year spot rate? *(5 Marks)*

Price as a percentage of par	annual coupon	annual period	maturity (years)
102.6364	4.25%	1	1
105.3651	4.75%	2	2

OR,

A1C- The following decision tree of expected 1-year rates is for a 2-year zero-coupon bond with a face value of $1. Suppose that investors are risk averse and require a risk premium of 30 basis points for each year of interest rate risk. What is the price for a 2-year zero-coupon bond with a face value of $1 using the expected 1-year returns in the decision tree? *(10 Marks)*



CILO- 2

A2A- An investor buys a 15-year semiannual coupon bond yielding 4%. The bond has a market value of $100 and is currently trading at par. The bond's DV01 is 0.1119. The investor plans to hedge this bond position by selling call options. The DV01 of the call options when the rate is 4% is 0.1045. Compute the face value of the call options that is needed to hedge the 15-year bond position. *(5 Marks)*

A2B- An investor has a short position in a 20-year 5% coupon, U.S. treasury bond with a yield to maturity of 6% and par value of $100. Assume discounting occurs on a semiannual basis. calculate DV01. *(5 Marks)*

A2C- Assume a 3-year bond with a face value of $100 pays a 3.5% coupon on a semiannual basis. What is the price of the bond according to the following spot rates? *(10 Marks)*

Maturity (Years)	Spot rates (%)
0.5	2.20%
1.0	2.25%
1.5	2.30%
2.0	2.35%
2.5	2.40%
3.0	2.45%

CILO-3

A3A- Estimate the percentage price change in bond price from a 25 basis point increase in yield on a bond with a duration of 7 and a convexity of 243. *(5 Marks)*

A3B- Bond A has an effective duration of 12,13 and a 2-year key rate exposure of $4.04. You would like to hedge it with a security with an effective duration of 2.48 and a 2-year key rate exposure of 0.81 per $100 face value. What amount of face value would be used to hedge the 2-year exposure. *(5 Marks)*

OR,

A3C- Table below shows selected T-bond prices for semiannual coupon $100 face value bonds . Prices are from 5/14/06 with t+1 settlement. Generate the discount factors for the dates indicated. *(10 Marks)*

Bond	Coupon	Maturity	Price
1	4.25%	11/15/06	101-16
2	7.25%	5/15/07	105-31+
3	2.00%	11/15/07	101-07
4	12.00%	5/15/08	120-30
5	5.75%	11/15/08	110-13+

Section B - Both the questions are compulsory

B1. Suppose Company X pays 5% annually (in euros) to Company Y and receives 4% annually (in dollars). Company X pays a principal amount of $ 150 million to Y, and Y pays a Euro 100 million to X at the inception of the swap. Assume the yield curve is flat in the United States and in Germany (Europe). The U.S. rate is 3%, and the German rate is 5%. The current spot exchange rate is $ 1.45/ Euro. What is the value of the currency swap to Company X using the bond methodology if it is expected to last for two more years? *(10 Marks)*

B2. Cooper industries (Cooper) is the pay-fixed counterparts in an interest rate swap. The swap is based on the 6-month Hong Kong Interbank Offered Rate (HIBOR). Cooper pays a fixed rate of 7% semiannually. A swap payment has just been made. The swap has a remaining life of 18 months, with pay dates at 6,12 and 18 months. Continuously compounded spot HIBOR rates are as below. Please calculate the value of swap using forward rate agreement (FRA) methodology. *(10 Marks)*

6 Month HIBOR	**6.5%**
12 Month HIBOR	6.8%
18 Month HIBOR	7.5%
24- Month HIBOR	7.7%

Formulas

1. To determine the future value of any sum of money invested today the following equation is used.

   $P_n = P_0(1+r)^n$

   Where:

   - n= number of periods
   - P_n=future value n periods from now (in dollars)
   - P_0= original principal (in dollars)
   - r= interest rate per period (in decimal form)

2. Future Value of an ordinary annuity $P_n = A[\frac{(1+r)^n - 1}{r}]$

3. Present Value formula $PV = P_n[\frac{1}{(1+r)^n}]$

4. Present value of a series of future values $\mathrm{PV}=\sum_{t=1}^{n} \frac{P_t}{(1+r)^t}$

5. Present value of an ordinary annuity $\mathrm{PV}=A[\frac{1-\frac{1}{(1+r)^n}}{r}]$

6. Pricing a Bond-Formula

   In general the price of a bond can be computed using the following formula

   $\mathrm{P}=\sum_{i=1}^{n} \frac{C}{(1+r)^t} + \frac{M}{(1+r)^n}$ Where,

   - P=price (in dollars)
   - n=number of periods
   - C=semiannual coupon payment
   - r=periodic interest rate
   - M= Maturity value
   - t= time period when the payment is to be received.

   or Since, the semiannual coupon payments are equivalent to an ordinary annuity, applying the formula for the present value of an ordinary annuity gives the present value of the coupon payments.

   $\mathrm{P}=C[\frac{1-\frac{1}{(1+r)^n}}{r}] + \frac{M}{(1+r)^n}$

7. Pricing a Bond-Zero Coupon Bond $\mathrm{P}=\frac{M}{(1+r)^n}$

8. Yield or internal rate of return on any investment

   $P = \sum_{t=1}^{N} \frac{CF_t}{(1+y)^t}$

   where

   - CF_t= Cash flow in year t

- P= Price of the investment
- N= Number of years

9. Yield - Special case (Investment with only one future cash flow
   P= $\frac{CF_n}{(1+y)^n}$

10. Annualizing Yields
    effective annual yield= $(1 + periodicinterestrate)^m - 1$

    - where, m is the frequency of payments per year.

11. Current Yield
    current yield= $\frac{annual-dollar-coupon-interest}{price}$

12. Macaulay Duration Macaulay duration= $\frac{\frac{1C}{1+y} + \frac{2C}{(1+y)^2} + ... + \frac{nC}{(1+y)^n} + \frac{nM}{(1+y)^n}}{P}$

    where,

    - P= price of the bond
    - C= semiannual coupon interest (in dollars)
    - y= one-half the yield to maturity or required yield.
    - n= number of semiannual periods (number of years*2)
    - M= maturity value (in dollars)
    - the term in brackets is the weighted average average term to maturity of the cash flows from the bond, where the weights are the present value of the cash flow.

13. Modified Duration
    Modified Duration=[Macaulay Duration/(1+ $\frac{YTM}{n}$)]

14. dollar duration=-(modified duration)P

15. percentage price change ≈ duration effect + convexity effect
    = [-duration*change in yield*100]+[(1/2)*convexity*(change in yield*100]

16. convexity= $\frac{BV_{-\Delta y} + BV_{+\Delta y} - 2 * BV_0}{BV_0 * \Delta_y^2}$