

Birla Institute of Technology & Science (BITS), Pilani

1st SEMESTER 2023-24

FINANCIAL DERIVATIVES AND ANALYSIS MPBA G531

Mid Semester Examination (Open Book)

Max. Time: 90 Minutes

Date: 09-10-2023

Max. Marks: 30

Question1. Derivatives may be used for both hedging and insurance. What is the difference in these two motives? [2]

Question2. Explain what is meant by a perfect hedge. Does a perfect hedge always lead to a better outcome than an imperfect hedge? Explain your answer. [2]

Question3. A US-based corporation has decided to make an investment in Sweden, for which it will require a sum of 100 million Swedish kronor (SEK) in three-months time. The company wishes to hedge changes in the US dollar (USD)-SEK exchange rate using forward contracts on either the euro (EUR) or the Swiss franc (CHF) and has made the following estimates:

- If EUR forwards are used: The standard deviation of quarterly changes in the USD/SEK spot exchange rate is 0.007, the standard deviation of quarterly changes in the USD/EUR forward rate is 0.018, and the correlation between the changes is 0.90.
- If CHF forwards are used: The standard deviation of quarterly changes in the USD/SEK spot exchange rate is 0.007, the standard deviation of quarterly changes in the USD/CHF forward rate is 0.023, and the correlation between the changes is 0.85.

Finally, the current USD/SEK spot rate is 0.104, the current three-month USD/EUR forward rate is 1.071, and the current three-month USD/CHF forward rate is 0.602.

- a) Which currency should the company use for hedging purposes? [2]
- b) What is the minimum-variance hedge position? Indicate if this is to be a long or short position. [2]

Question4. Assume that the yield curve is flat at 6%. All bonds pay semiannually. Bond A has a coupon of 5.5% and a maturity of seven years. Bond B has a coupon of 6.2% and a maturity of five years. We wish to short bond B to offset the risk of a long position in bond A. How many units of bond B do we need to short for every unit of bond A to achieve this (assume the curve uses a semiannual compounding convention)? [3]

Question5. On 10/10/23, consider a fixed-coupon bond whose features are the following:

- face value: ₹100
- coupon rate: 12%
- coupon frequency: semi-annual
- maturity: 04/15/38

Compute the accrued interest, considering the three different day-count bases: Actual/365, Actual/360 and 30/360. [3]

Question6. During the summer you had to spend time with your uncle, a wheat farmer. Knowing you are studying for an MBA at BITS Pilani, your uncle asked for your help. He is afraid that the price of wheat will fall, which will severely impact his profits. Thus, he asks you to compute the 1-year forward price of wheat. He tells you that its current price is \$3.4 per bushel and interest rates

are at 4%. However, he also says that storing wheat for one year is relatively expensive. Assume that this cost, which must be paid upfront, runs at about \$0.1 per bushel. What is the 1-year forward price of wheat? [2]

Question7. The futures price for the June 2023 bond futures contract is \$118-23.

- Calculate the conversion factor for a bond maturing on January 1, 2038, paying a coupon of 10%. [1.5]
- Calculate the conversion factor for a bond maturing on October 1, 2038, paying a coupon of 7%. [2]
- Suppose that the quoted prices of the bonds in (a) and (b) are 145.00 and 127.00, respectively. Which bond is cheaper to deliver? [1.5]

(Assume that the interest rate for all maturities equals 7% per annum with semi-annual compounding).

Question8. A five-year bond with a yield of 10% pays a 9% coupon semiannually (the bond's par value is Rs. 100).

- What is the bond's duration and convexity? [2+2=4]
- Use duration and convexity to calculate the effect on the bond's price of a 2% decrease in its yield. [2]

Question9. Suppose that zero interest rates with continuous compounding are as follows:

Maturity(years)	Rate (% per annum)
1	6.0
2	6.5
3	7.0
4	7.5
5	8.0

Use the rates above to value an FRA where you will pay 7.8% for the third year on \$1 million. [3]