Homework 1 FE521/AD516, Spring 2023

This homework is an individual-effort work. Still, you can get help from anybody in banking, Borsa Istanbul, the Central Bank, any professor of your choice and even ChatGPT. But you should report your answers yourself and in your own words / numbers. That is, please do not cut-and-paste or plagiarize. Convince yourself that you understand the solutions. The answers are due before the end of May.

1. The table below describes three risk-free bonds, all of which have a face value of 1,000TL.

	Price (01/01/23)	Cash flow (01/01/24)	Cash flow (01/01/25)
Bond A (zero-coupon)	855	1,000	0
Bond B (zero-coupon)	720	0	1,000
Bond C (10% coupon)	860	100	1,100

   a. Calculate the yield-to-maturity for each bond. What is the implied forward rate for the period between 01/01/24 and 01/01/25?
   b. Assuming Bond A and Bond B are correctly priced, is Bond C relatively overpriced or underpriced? To benefit from this mispricing, set up a portfolio of bonds that will generate a positive cash flow now and zero cash flows in later years.
   c. What should be the price of another risk-free bond with a maturity of 2 years and 20% annual coupon interest?
   d. Draw the spot yield curve as of 01/01/23.

2. You are to design for a small pension fund, a bond portfolio to fund a ₺10 million obligation due in 4 years. The fund managers would like to use a 2-year zero along with an 8-year zero to fund the obligation. Currently, the yield curve is flat at around 25% for all maturities.
      a. Design a bond portfolio that will protect the pension fund from fluctuations in interest rates.
      b. Suppose that immediately after you set up the portfolio, the yield curve shifts to 35% at all maturities. Calculate what you expect the future value of the investment in the two bonds to be in year 4. Do you exactly meet the obligation of the fund? Explain any difference.

3. Suppose that the BIST100 Index has a level of 5,400. The continuously compounded rate of return on a 1–year Treasury bill is 15%. You wish to hedge an ₺10,000,000 portfolio that has a beta of 1.1 and a correlation of 0.95 with BIST100. One index futures contract is on ₺100 times the index and the index has a 5% expected dividend yield this year.
      a. What should be the 1–year futures price for the BIST100 index?
      b. How many index contracts should you short to hedge your portfolio?
      c. What is the expected value and variance of the rate of return on the hedged portfolio?

4. You are the CFO of a large multinational corporation based in Frankfurt. The CEO has asked you to raise €8,000,000 one year from now to fund a strategic investment. The company has to raise the capital either through a UK (in £) or a German (in €) bank. The annual interest rates on UK and German government short-term bills are 8% and 6%, respectively. The

current exchange rate (€/£) is 1.14 and the 1-year futures price is 1.20.

a. Where would you lend and where would you borrow?
b. You realize that given the above data, you may benefit from an arbitrage opportunity that would allow you to raise the necessary capital at no cost for the company. Describe in a table like the one below the necessary actions (and associated cash flows in euros) you need to take now and in one year in order to earn €8,000,000 in one year at no cost.

Action Now	Cash Flow in €	Action in 1Year	Cash Flow in €
Total		Total	

c. Assuming the interest rates and the current exchange rate given above are correct. What should the futures price of one GBP be in Euros according to the interest rate parity theorem?
d. Discuss why would not all investors decide to invest their money in the UK, even though the interest rate in the UK (8%) is higher than in Germany (6%.)

5. You have ₺10 million invested in Treasury bonds with a modified duration of 3.8 years. Because of the possible aftermath of the upcoming elections, you are concerned that interest rates may rise further. In BIST, there are Treasury bond futures contracts with a 1-year price of $X_1 = ₺75.15$ per ₺100 of face value, and one contract is for ₺100,000 face value. The modified duration of the bond underlying the contract is 3.64 years. The current short rate is 16%. How can you use these contracts to hedge against the interest rate risk of your portfolio?

6. In BIST VIOP, USDTRY June futures contracts (expiry on 29/06) require ₺550 margin for each \$1,000 contract. The current spot rate is $P_0 = 20.28\ ₺/\$$ and the futures price is $X_{29/06} = 20.75$. On the other hand, in the London swap market, the swap rates for 29/06 are quoted as $r_₺ = 38.10\%$ and $r_\$ = 4.30\%$.
   a. To hedge against a USDTRY exposure, which market would you prefer, VIOP futures or London forwards?
   b. Based on the figures given, is there an arbitrage profit in the current futures versus forward prices? If so, how?

7. Consider Company A that holds mostly floating-rate short-term TL-denominated assets, partly financed with a €50m 4-year bonds with fixed 10% annual coupons. As a result, Company C is faced with both an interest rate risk and a foreign exchange risk. On the other side, consider Bank B with mostly fixed-rate long-term €-denominated assets, which have been partly financed with ₺2,000b floating-rate short-term deposits. Bank B is also faced with interest rate risk and foreign exchange risk. Design a "fixed-to-floating currency swap" between the two parties to reduce their risk exposures.

8. Suppose ICE LIBOR discount rates $L(0,t)$ are given in the table below. Consider a 2-year swap whose floating payments are at the then-current LIBOR rate, and whose fixed payments are at the annual rate of $R_{fix} = 0.025$.
    a. If the notional principal is 1 million dollars, what is the value of the swap?
    b. What is the par swap rate? In other words, what value of R_{fix} sets the value of the swap equal to zero?

Payment date t	$L(0,t)$
0.5	0.9821
1.0	0.9708
1.5	0.9527
2.0	0.9416

9. Firm A enters a 5-year swap with firm B to pay SOFR in return for a fixed 8% rate on a notional principal of $10 million. Two years later, the market rate on 3-year swaps is SFOR for 7%.; at this time, firm B declares bankruptcy and defaults on its swap obligation.
    a. How is firm A harmed by the default?
    b. What is the market value of the loss incurred by A as a result of the default?
    c. Suppose instead that A had gone bankrupt. How much would B's loss be in this case?

10. Due to an urgent working capital need, a company gets a 3-month bank credit at an annual rate of 22%. They expect a decline in interest rates and do not want to have borrowed at a high rate. Explain how they can use TLREF OIS contracts to reduce their interest cost. The current fixed rate of OIS is 19% with quarterly settlement. Calculate the net interest cost if, as of 3 months from now,
    a. The compounded (in-arrears) average of overnight TLREF rates over the 3-month period turns out to be 18% per annum (that is, the TLREF Index goes up from 100 to 104.2) – expected good news
    b. The average turns to be 20% per annum – unexpected bad news