

Q1:

[7.5+7.5+7.5+7.5=30 Marks]

(i) A Canadian company wishes to create a Canadian LIBOR futures contract from a U.S. Eurodollar futures contract and forward contracts on foreign exchange. Using an example, explain how the company should proceed. For the purposes of this problem, assume that a futures contract is the same as a forward contract.

(ii) A portfolio manager plans to use a Treasury bond futures contract to hedge a bond portfolio over the next three months. The portfolio is worth \$100 million and will have a duration of 4.0 years in three months. The futures price is 122, and each futures contract is on \$100,000 of bonds. The bond that is expected to be cheapest to deliver will have a duration of 9.0 years at the maturity of the futures contract. What position in futures contracts is required?

a) What adjustments to the hedge are necessary if after one month the bond that is expected to be cheapest to deliver changes to one with a duration of seven years?

b) Suppose that all rates increase over the three months, but long-term rates increase less than short-term and medium-term rates. What is the effect of this on the performance of the hedge?

(iii) Today is March 1, 2004. The day count basis is actual/365. You have the following contracts on your FX-book.

Contract A: On March 15, 2004, you will sell 1,00,000 EUR at a price F_t^1 dollars per EUR.

Contract B: On April 30, 2004, you will buy 1,00,000 EUR at a price F_t^2 dollars per EUR.

a) Contract one synthetic equivalent of each contract.

b) Suppose the spot EUR/USD is 1.1500/1,1505. The USD interest rate for loans under 1-year equal 2.25/2.27, and the German equivalent equal 2.35/2.36. Calculate F_t^1 numerically.

c) Suppose the forward points for F_t^1 that we observe in the markets is equal to 10/20. How can an arbitrage portfolio be formed?

(iv) Italian Asset Swap Volumes Soar on Buyback Plans

Volumes in the basis-swap spread market doubled last week as traders entered swaps in response to the Italian treasury's announcement that it "does not rule out buybacks." Traders said the increase in volume was exceptional given that so many investors are on holiday at this time of year.

Traders and investors were entering trades designed to profit if the treasury initiates a buyback program and the bonds increase in value as they become scarcer and outperform the swaps curve. A trader, said in a typical trade the investor owns the 30-year Italian government bond and enters a swap in which it pays the 6% coupon and receives 10.5 basis points over six-month Euribor. "Since traders started entering the position last Monday the spread has narrowed to 8bps over Euribor," he added. The trader thinks the spread could narrow to 6.5bps over Euribor within the next month if conditions in the equity and emerging markets improve. A trader at a major European bank predicts this could go to Euribor flat over the next six months. The typical notional size of the trades is EUR50 million (USD43.65 million) and the maturity is 30 years. (IFR, Issue 1217)

(a) Suppose there is an Italian swap curve along with a yield curve obtained from Italian government bonds (sovereign curve). Suppose this latter is upward sloping. Discuss how the two curves might shift relative to each other if the Italian government buys back some bonds.

(b) Is it important which bonds are bought back? Discuss.

(c) Show the cash flows of a 5-year Italian government coupon bonds (paying 6%) and the cash flows of a fixed-payer interest-rate swap.

(d) What is the reason behind the existence of the 10.15 bp spread?

(e) What happens to this spread when the government buys back bonds? Show your conclusions using cash flow diagrams.

Q2

[10+10+25=45 Marks]

(i) Calculate the price of a one-year European option to give up 100 ounces of silver in exchange for one ounce of gold. The current prices of gold and silver are \$1520 and \$16, respectively; the risk-free interest rate is 10% per annum; the volatility of each commodity price is 20%; and the correlation between the two prices is 0.7. Ignore storage costs.

(ii) What is the value in dollars of a derivative that pays off GBP 10,000 in one year provided that the dollar–sterling exchange rate is greater than 1.5000 at that time? The current exchange rate is 1.4800. The dollar and sterling interest rates are 4% and 8% per annum respectively. The volatility of the exchange rate is 12% per annum.

(iii) McLemore Industries has a zero-coupon bond issue that matures in two years with a face value of \$75,000. The current value of the company's assets is \$46,000, and the standard deviation of the return on assets is 60 percent per year.

- a. Assume the risk-free rate is 5 percent per year, compounded continuously. What is the value of a risk-free bond with the same face value and maturity as the company's bond?
- b. What price would the bondholders have to pay for a put option on the firm's assets with a strike price equal to the face value of the debt?
- c. Using the answers from (a) and (b), what is the value of the firm's debt? What is the continuously compounded yield on the company's debt.
- d. From an examination of the value of the assets of McLemore Industries, and the fact that the debt must be repaid in two years, it seems likely that the company will default on its debt. Management has approached bondholders and proposed a plan whereby the company would repay the same face value of debt, but the repayment would not occur for five years. What is the value of the debt under the proposed plan? What is the new continuously compounded yield on the debt? Explain why this occurs.

[Hint: Consider total asset as current stock price, face value of bond as strike price, value of equity as call option; total assets= equity + debt]

Q3:

[5+5+5=15 Marks]

(i) Consider a position consisting of a \$300,000 investment in gold and a \$500,000 investment in silver. Suppose that the daily volatilities of these two assets are 1.8% and 1.2% respectively, and that the coefficient of correlation between their returns is 0.6. What is the 10-day 97.5% VaR and ES for the portfolio? By how much does diversification reduce the VaR?

(ii) A company has a position in bonds worth \$6 million. The modified duration of the portfolio is 5.2 years. Assume that only parallel shifts in the yield curve can take place and that the standard deviation of the daily yield change (when yield is measured in percent) is 0.09. Use the duration model to estimate the 20-day 90% VaR for the portfolio. Explain carefully the weaknesses of this approach to calculating VaR. Explain two alternatives that give more accuracy.

(iii) Some time ago a company has entered into a forward contract to buy £1 million for \$1.5 million. The contract now has six months to maturity. The daily volatility of a six-month zero-coupon sterling bond (when its price is translated to dollars) is 0.06% and the daily volatility of a six-month zero-coupon dollar bond is 0.05%. The correlation between returns from the two bonds is 0.8. The current exchange rate is 1.53. Calculate the standard deviation of the change in the dollar value of the forward contract in one day. What is the 10-day 99% VaR? Assume that the six-month interest rate in both sterling and dollars is 5% per annum with continuous compounding.