Handout 7 Exercise Questions

Question 1

The 3, 5, 7-year spot rates are 6%, 5.7% and 5% pa respectively. The 3-year forward rate from time 4 is 5.2% pa. Calculate f_3, $f_{5,2}$, y_4, and $f_{3,4}$.

Question 2

In a bond market, the two-year par yield at time t = 0 is 4.15% and the issue price at time t = 0 of a two-year fixed interest stock, paying coupons of 8% annually in arrears and redeemed at 98, is 105.40 per 100 nominal. Calculate the one-year spot rate and the two-year spot rate.

Question 3

Calculate, using 10% pa interest, the convexity of the following assets, each of which has a discounted mean term of 11 years. Comment on your answer.

- Asset A is an 11-year zero-coupon bond.
- Asset B will provide a lump sum payment of 9,663 in 5 years' time and a lump sum payment of 26,910 in 20 years' time.
- Asset C is a level annuity of 1 pa payable annually in arrears for 50 years.

Question 4

A fund must make payments of 50,000 at the end of the sixth and eighth years. Show that, if interest rates are currently 7% pa at all durations, immunization to small changes in interest rates can be achieved by holding an appropriately chosen combination of a 5-year zero-coupon bond and a 10-year zero-coupon bond.

Question 5

A coupon bond pays annual coupons of 6% in arrear and is redeemable at par in 10 years. The bond has just been issued at a price to give an investor a rate of return of 4.2% per annum effective.

(a) Calculate the discounted mean term (duration) of the bond at issue.

(b) Calculate the effective duration (volatility) of the bond at the time of issue and explain the implication of the effective duration for an investor who plans to sell the bond in the next few months.

Question 6

A fund holds two bonds. The first bond pays annual coupons of 10% and is redeemed at par in 5 years' time. The second bond pays annual coupons of 5% and is redeemed at par in 10 years' time. The fund is liable for annuities payable in arrear for 40 years at a rate of $1 million per annum.

The present value of the assets in the fund is equal to the present value of the liabilities of the fund and exactly half the assets are invested in each bond. All assets and liabilities are valued at a rate of interest of 4% per annum effective.

(a) Calculate the duration of the liabilities of the fund.
(b) Calculate the nominal amount held of each bond purchased by the fund.
(c) Calculate the duration of the assets of the fund.