FINM3093 Investments

Lecture 6 Exercises

1. Assume you have a 1-year investment horizon and are trying to choose among three bonds. All have the same degree of default risk and mature in 10 years. The first is a zero-coupon bond that pays $1,000 at maturity. The second has an 8% coupon rate and pays the $80 coupon once per year. The third has a 10% coupon rate and pays the $100 coupon once per year.
    a. If all three bonds are now priced to yield 8% to maturity, what are the prices of (i) the zero-coupon bond; (ii) the 8% coupon bond; (iii) the 10% coupon bond?
    b. If you expect their yields to maturity to be 8% at the beginning of next year, what will be the price of each bond?
    c. What is your holding-period return on each bond based on (a) and (b)?
    d. Recalculate your answers to parts (b) and (c) under the assumption that you expect the yield to maturity on each bond to be 7% at the beginning of next year.

2. A 20-year maturity bond with par value of $1,000 makes semiannual coupon payments at a coupon rate of 8%. Find the bond equivalent and effective annual yield to maturity of the bond if the bond price is:
    a. $950
    b. $1,000
    c. $1,050

3. A bond has a current yield of 9% and a yield to maturity of 10%. Is the bond selling above or below par value? Is the coupon rate of the bond more or less than 9%? Explain.

4. A 30-year maturity, 8% coupon bond paying coupons semiannually is callable in five years at a call price of $1,100. The bond currently sells at a yield to maturity of 6% (3% per half-year).
    a. What is the yield to call?
    b. What is the yield to call if the call price is only $1,050?
    c. What is the yield to call if the call price is $1,100 but the bond can be called in two years instead of five years?

5. FinCorp issued two bonds with 20-year maturities. Both bonds are callable at $1,050. The first bond was issued at a deep discount with a coupon rate of 4% and a price of $580 to yield 8.4%. The second bond was issued at par value with a coupon rate of 8.75%.
    a. What is the yield to maturity of the par bond? Why is it higher than the yield of the discount bond?
    b. If you expect rates to fall substantially in the next two years, which bond has the higher expected rate of return?
    c. In what sense does the discount bond offer "implicit call protection"?

6. The following is a list of prices for zero-coupon bonds of various maturities. The face value of the bond is $1,000.

Maturity (years)	Price of Bond
1	$943.40
2	898.47
3	847.62
4	792.16

    a. Calculate the yield to maturity for a bond with a maturity of (i) one year; (ii) two years; (iii) three years; (iv) four years.
    b. Calculate the forward rate for (i) the second year; (ii) the third year; (iii) the fourth year.
    c. Assuming that the expectations hypothesis is valid, compute the expected price of the 4-year bond at the end of (i) the first year; (ii) the second year; (iii) the third year; (iv) the fourth year.
    d. What is the rate of return of the bond in years 1, 2, 3, and 4? Conclude that the expected return equals the forward rate for each year.

7. The yield to maturity on 1-year zero-coupon bonds is currently 7%; the YTM on 2-year zeros is 8%. The Treasury plans to issue a 2-year maturity coupon bond, paying coupons once per year with a coupon rate of 9%. The face value of the bond is $100.
    a. At what price will the bond sell?
    b. What will the yield to maturity on the bond be?
    c. If the expectations theory of the yield curve is correct, what is the market expectation of the price for which the bond will sell next year?
    d. Recalculate your answer to part (c) if you believe in the liquidity preference theory and you believe that the liquidity premium is 1%.

8. The yield to maturity on 1-year zero-coupon bonds is 5%, and the YTM on 2-year zeros is 6%. The YTM on 2-year-maturity coupon bonds with coupon rates of 12% (paid annually) is 5.8%.
    a. What arbitrage opportunity is available for an investment banking firm?
    b. What is the profit on the activity?

9. Suppose that a 1-year zero-coupon bond with face value $100 currently sells at $94.34, while a 2-year zero sells at $84.99. You are considering the purchase of a 2-year-maturity bond making annual coupon payments. The face value of the bond is $100, and the coupon rate is 12% per year.
    a. What is the yield to maturity of the 2-year zero?
    b. What is the yield to maturity of the 2-year coupon bond?
    c. What is the forward rate for the second year?
    d. According to the expectations hypothesis, what are (i) the expected price of the coupon bond at the end of the first year and (ii) the expected holding-period return on the coupon bond over the first year?
    e. Will the expected rate of return be higher or lower if you accept the liquidity preference hypothesis?

10.
    a. Find the duration of a 6% coupon bond making *annual* coupon payments if it has three years until maturity and has a yield to maturity of 6%.
    b. What is the duration if the yield to maturity is 10%?
    c. Repeat (a) and (b), but not assume the coupons are paid semiannually.

11.
    a. A 6% coupon bond paying interest annually has a modified duration of 10 years, sells for $800, and is priced at a yield to maturity of 8%. If the YTM increases to 9%, what is the predicted change in price based on the bond's duration?
    b. A 6% coupon bond with semiannual coupons has a convexity (in years) of 120, sells for 80% of par, and is priced at a yield to maturity of 8%. If the YTM increases to 9.5%, what is the predicted contribution of convexity to the percentage change in price due to convexity?
    c. A bond with annual coupon payments has a coupon rate of 8%, yield to maturity of 10%, and Macaulay's duration of 9 years. What is the bond's modified duration?
    d. When interest rates decline, the duration of a 30-year bond selling at a premium:

i) Increases.
ii) Decreases.
iii) Remains the same.
iv) Increases at first, then declines.

e. Which bond has the longest duration?
i) 8-year maturity, 6% coupon.
ii) 8-year maturity, 11% coupon.
iii) 15-year maturity, 6% coupon.
iv) 15-year maturity, 11% coupon.

12. A newly issued bond paying a semiannual coupon has the following characteristics:

Coupon	Yield to Maturity	Maturity	Macaulay's Duration
8%	8%	15 years	10 years

a. Calculate modified duration using the information above.
b. Explain why modified duration is a better measure than maturity when calculating the bond's sensitivity to changes in interest rates.
c. Identify the direction of change in modified duration if:
i) The coupon of the bond were 4%, not 8%.
ii) The maturity of the bond were 7 years, not 15 years.
d. Define convexity and explain how modified duration and convexity ae used to approximate the bond's percentage change in price, given a change in interest rates.