

Derivative Instruments

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Exercises Chapter 5

Exercise 1 *An investor receives \$1,100 in one year in return for an investment of \$1,000 now.*

Calculate the percentage return per annum with

- a) annual compounding;*
- b) semiannual compounding;*
- c) monthly compounding; and*
- d) continuous compounding.*

Exercise 2 *What rate of interest with continuous compounding is equivalent to 15% per annum with monthly compounding?*

Exercise 3 *A deposit account pays 12% per annum with continuous compounding, but interest is actually paid quarterly.*

How much interest will be paid each quarter on a \$10,000 deposit?

Exercise 4 (Done) *A bank quotes you an interest rate of 14% per annum with quarterly compounding.*

What is the equivalent rate with (a) continuous compounding and (b) annual compounding?

Exercise 5 *The six-month and one-year zero rates are both 10% per annum. For a bond that has a life of 18 months and pays a coupon of 8% per annum (with semiannual payments), the yield is 10.4% per annum.*

- (a) What is the bond's price?*
 - (b) What is the 18-month zero rate?*
- (All rates are quoted with semiannual compounding.)*

Exercise 6 Suppose that zero interest rates with continuous compounding are as follows

Maturity (months)	3	6	9	12	15	18
Rate (% per annum)	8.0	8.2	8.4	8.5	8.6	8.7

Calculate forward interest rates for the a) second; b) third; c) fourth; d) fifth; and e) sixth quarters.

Exercise 7 Assuming that zero rates are as in Exercise 6, what is the value of an FRA that enables the holder to earn 9.5% for a three-month period starting in one year on a principal of \$1,000,000?

The interest rate is expressed with quarterly compounding.

Exercise 8 Suppose that 6-month, 12-month, 18-month, 24-month, and 30-month zero rates are 4%, 4.2%, 4.4%, 4.6%, and 4.8% per annum with continuous compounding respectively.

Estimate the cash price of a bond with a face value of 100 that will mature in 30 months and pays a coupon of 4% per annum semiannually.

Exercise 9 A three-year bond provides a coupon of 8% semiannually and has a cash price of 104. What is the bond's yield?

Exercise 10 Suppose that the 6-month, 12-month, 18-month, and 24-month zero rates are 5%, 6%, 6.5%, and 7% respectively.

What is the two-year par yield?

Exercise 11 A 10-year, 8% coupon bond currently sells for \$90. A 10-year, 4% coupon bond currently sells for \$80.

What is the 10-year zero rate?

(Hint : Consider taking a long position in two of the 4% coupon bonds and a short position in one of the 8% coupon bonds.)

Exercise 12 Show that when the yield y is expressed with a compounding frequency of m times per year we have

$$\Delta B = -\frac{\Delta y BD}{1 + \frac{y}{m}}$$

Exercise 13 (Done) A five-year bond with a yield of 11% (continuously compounded) pays an 8% coupon at the end of each year.

a) What is the bond's price?

b) What is the bond's duration?

c) Use the duration to calculate the effect on the bond's price of a 0.2% decrease in its yield.

d) Recalculate the bond's price on the basis of a 10.8% per annum yield and verify that the result is in agreement with your answer to (c).