

**Exercise Set 6**

1. Your company purchased the logging rights for a forest for the next 2 years by $3M. If the area is logged, your company will receive $2M in 1 year and $2.5M in 2 years. What is the NPV of the project? Consider a 6% discount rate.
2. Consider the following projects and the respective cash flows:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Project | Y0 | Y1 | Y2 | Y3 | Y4 | Y5 |
| A | -1300 | 1000 | 500 | 400 | 300 | 200 |
| B | -1500 | 600 | 400 | 400 | 300 | 200 |
| C | -1000 | 2000 | -100 | -1300 | 300 | 50 |

* 1. Calculate the NPV of each project with a discount rate equal to:
     1. 10%
     2. 20%
     3. 35%
  2. Which projects would you invest in assuming you had no capital restriction, considering a 20% discount rate? Why?

1. The following is a list of prices for zero-coupon bonds of various maturities. Calculate the yields to maturity of each bond and the implied sequence of forward rates.

|  |  |
| --- | --- |
| Maturity (years) | Price of Bond |
| 1 | $955.00 |
| 2 | $901.47 |
| 3 | $838.62 |
| 4 | $779.89 |

1. Consider the following spot and forward rates.

|  |  |
| --- | --- |
| 1y Spot | 4% |
| One-year forward rate one year from today | 5.5% |
| One-year forward rate two years from today | 8.5% |

What is the price of a 3-year bond that has a 5% coupon rate paid annually and a face value of $1000?

1. Consider a 9% coupon bond selling today for $964.8, with 3 years until maturity making annual coupon payments.
   1. Calculate the yield to maturity.
   2. After reaching maturity, you look back to the bond that you bought 3 years ago and are interested in knowing how well it performed. During this 3-year period, the observed 1-year interest rates were: r1=6%, r2=8%, and r3=9%, where r1 corresponds to the rate observed at beginning of year 0 (for the period 0-1y), r2 in the beginning of year 1 (for the period 1-2y) and r3 in the beginning of year 2y (for the period 2-3y). Calculate the realized compound return of the bond (i.e. assuming you reinvested the coupons).
2. Assume you have a one-year investment horizon and are trying to choose among three bonds. All the bonds have the same degree of default risk and mature in 8 years. The first is a zero-coupon bond that pays €1000 at maturity. The second has an 7% coupon rate and pays €70 coupon once per year. The third has a 8% coupon rate and pays €80 coupon once per year.
   1. If all three bonds are now priced at yield to maturity of 6%, what are their prices?
   2. If you expect their yields to maturity to be 10% at the beginning of next year, what will their prices be then? Assume you are computing the prices after coupons have been paid.
   3. What is your holding period return on each bond if the investment horizon is 1 year?
   4. Decompose the holding period return, over the first year, into return coming from the coupon (current yield) and price changes (capital gain).
3. A coupon bond pays annual interest, has a par value of $1,000, matures in 5 years, has a coupon rate of 10% and has a YTM of 11%. What is the current yield of this bond? *Note: A bond's current yield is defined as the ratio between the investment's annual income (including interest payments and, if any, dividends payments) and the current price of the security.*
4. Ceteris paribus, the price and yield on a bond are:
   1. Positively related
   2. Negatively related
   3. Sometimes positively and sometimes negatively related
   4. Not related
   5. Indefinitely related
5. A coupon bond that pays interest annually is selling at par of $1,000, matures in 5 years and has a coupon rate of 10%. The YTM on this bond is:
   1. 8.0%
   2. 8.3%
   3. 9.0%
   4. 10.0%
   5. None of the options above

Use the information in the table to answer questions 10. and 11.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Years | 1 | 2 | 3 | 4 | 5 |
| Strip Price | 99 | 96 | 94 | 91 | 88 |

1. What is the yield to maturity (YTM) of a 5-year coupon bond with a coupon rate of 5% paid annually?
2. The yield to maturity is not the same as the expected return in each year over the life of a bond except when one holds a zero-coupon bond until maturity. Expected return depends on yield of bonds with shorter maturities, which for coupon bonds means the rate at which coupons can be reinvested. We explore this in the following set of questions. Assume the expectations hypothesis of the term structure is correct.
   1. Compute the spot rates from the strip prices.
   2. What is the no-arbitrage price of a 5-year coupon bond paying 5% annually with a par value of €1000?
   3. Compute the expected return if you purchase the coupon bond at the no-arbitrage price and expect to hold it for one year. In other words, what is the expected return after the 1st year?
   4. Repeat **c** for the 2nd, 3rd, 4th and 5th years if you similarly buy at the beginning of the year and expect to hold the bond for only one year.
   5. What is the expected return if you buy the bond at time 0 and plan to sell in 3 years’ time?