

## Assignment 1

### 1. Bonds and accrued interest

- 1) We consider a bond with a face value of \$500, a coupon rate of 5%, emitted on  $10.25.N$ , reimbursed at par value on the  $10.25.N+5$ . If coupon payments are annual, what was the accrued interest on the  $12.12.N+3$ ?
- 2) We consider a bond with a face value of \$1000, quoted today at 65, with accrued interest (in %): 7.396. What is the price of the bond today?
- 3) Suppose that you invest today in a bond with face value of \$1000, a coupon rate of 5%, an emission price of \$995, and a 4 years maturity. We assume that coupon payments are annual. Compute the associated yield to maturity.
- 4) Consider 600 bonds, emitted on  $7.1.N$ , with face value \$1000, reimbursement price \$1010, coupon rate 4%, reimbursed in 5 years. Coupon payments are annual.
  - (a) Calculate the yield to maturity of these bonds.
  - (b) What is the value of the bond on the  $4.5.N+3$ , given that the market interest rate is 6%. What is then the quoted price of the bond?

### 2. Bonds and YTM

On October 28th 2018, firm X emits bonds with the following characteristics

- Emission price: 990.40
- Face value: \$1000
- Coupon rate: 3,75%, coupons are paid annually.
- Maturity: 5 years.
- Reimbursed at par value.

- 1) What is the yield to maturity on the emission date?
- 2) Assuming that on October 28th 2021 and on October 28th 2022, the market interest rate went from 4.50% to 3%, compute on each of these dates the price of the bond.
- 3) How does the market value of the bond change when the market interest rate changes as well? Mention two indicators allowing to measure the exposure of bond to the interest rate risk.

### 3. Bonds and compounding

We consider the following term-structure of interest rates

Maturity	ZC rate
1 year	4.00%
2 years	4.50%
3 years	4.75%
4 years	4.90%
5 years	5.00%

- 1) What is the price of a bond with maturity 5 years, face value \$100 and an annual coupon rate of 5%?
- 2) What is its yield to maturity?
- 3) We suppose that the spot curve increases instantaneously and uniformly by 0.5%. What is the new price and the new yield to maturity of the bond? What is the impact of this rates increase for the bondholder?
- 4) We suppose now that the spot curve will remain stable over time. You hold the bond until maturity. What is the annual return rate of your investment? Why is this rate different from the yield to maturity?

#### 4. Bootstrap method

We suppose known the following spot rates for maturities less than one year.

Maturity	Spot rate (annual)
1 day	3.20%
1 month	3.30%
2 months	3.40%
3 months	3.50%
6 months	3.60%
9 months	3.80%
1 year	3.20%

We also suppose that the following bonds are sold on the market. Their face values are \$100, they are emitted and reimbursed at par value, and coupon payments are annual.

Maturity	Coupon rate (annual)	Price
1 year and 4 months	4.0%	102.8
1 year and 5 months	4.50%	102.5
2 years	3.50%	98.3
3 years	4%	98.7
4 years	5%	101.6

- 1) Using the bootstrap method with linear interpolation, determine the spot rates for the maturities 4 months, 5 months, 1 year and 4 months, 1 year and 5 months, 2 years, 3 years and 4 years.
- 2) Represent the spot curve for maturities between 1 day and 4 years.