

## Lecture 2

This second lecture captures the materials from chapter 3 to 6 and consists of two parts, the first part was about the Time Value of Money and the second part about Bond Pricing.

### Time Value of Money

For making financial decisions time is an important variable. Your future outcomes are namely determined when you make the decision to for example buy a stock or borrow money today. Financial decision making thus involves costs and benefits that occur at different points in time.

Something important to take in mind is that just like you cannot compare apples to pears, you can also not compare Euros to Dollars. It is intuitive that in order to compare the Time Values of different currencies we will need an exchange rate. When we want to compare the value of money for different places in time we will need a time exchange rate, this is called a discount rate.

There are some concepts that are very important for the chapters that will be discussed.

- Compounding is moving the money to what you have today through time, by compounding the future value of your money can be calculated. Formula for the Future Value at a certain time  $n$  of a cash flow  $C$  given a discount rate  $r$ :

$$FV_n = Cx(1+r)$$

- Discounting is moving the money that you will have at some time in the future to the present. By discounting we can calculate how much we can spend now. Formula for the Present Value of a cash flow  $C_n$  that you have at some point in the future  $n$  given a discount rate  $r$ :

$$PV = C_n \frac{1}{(1+r)^n} = \frac{C_n}{(1+r)^n}$$

- By using a time line discounts and compounding can be calculated easily. The present value of your future earnings is calculated by summing up all the separate present values from your future earnings:

$$PV = \frac{\text{cash flow 1}}{(1+r)^n} + \frac{\text{cash flow 2}}{(1+r)^n} \text{ etc.}$$

- Useful cash flow patterns are:
  - Perpetuity: perpetuity is an everlasting cash flow. These cash flows are not unrealistic, they exist for example when you put your money on the bank or when you buy a stock or a bond. The present value of a perpetuity is calculated by:

$$PV = \frac{C}{r}$$

- Annuity: an annuity is a fixed cash flow for a fixed number of periods. It can be calculated by adding up all the present values of future money. However, for large periods of time it is easier to use the annuity formula:

$$PV_0 = C \frac{1}{r} \left( 1 - \frac{1}{(1+r)^N} \right)$$

- Growing cash flow patterns are for example the case when a firm grows, also the dividends then often grow.

1. Constant growth for perpetuity:  $PV_0 = \frac{C}{r-g}$

2. Constant growth for annuity:  $PV_0 = C \frac{1}{r-g} \left( 1 - \left( \frac{1+g}{1+r} \right)^N \right)$

## Bond Valuation

A bond is basically a promise to pay back money. A simple example would be when you lend 800 from your parents to buy some fancy laptop, with a contract to give it back in five years. For corporations, bonds are part of the corporation's long-term liabilities or debt. There is a distinction between corporate bonds and government bonds. A practical example of a situation in which a corporation wants to issue bonds is when it wants to buy another company and needs a very large sum of money. The company can obtain this money by issuing bonds on which the corporation has to pay some compensation.

Useful bond language key pieces of jargon you will have to know for studying the bonds market:

- Maturity: how long will it take until the money will be paid back
- Yields: market determined interest rate
- Investment grade debt: a type of rating to show quality
- Coupon: different interest rate than a yield, periodic interest payment on a bond

A bond can be valued by the formula:

$$P = \frac{CPN_1}{(1+r_1)} + \frac{CPN_2}{(1+r_2)^2} + \dots + \frac{CPN_N}{(1+r_N)^N} + \frac{FVN}{(1+r_N)^N}$$

In this formula: CPN is the coupon, FV the face value and N the maturity.

From this formula we can derive two things:

1. We can calculate the value of r, at a given price of the bond. This r is called the Yield to Maturity or just Yield
2. We can also calculate the price when we know the value of r. The price is equal to the present values of the future coupons plus the present value of the face value of the bond. This can be done by using a given yield to maturity or by using spot rates.

Only when the market rate is equal to the CPN rate, the face value is the same as the price. Furthermore, there exists an inverse relationship between price and yield. When the prices go up, yields go down. This inverse relationship is not equal for all bonds, price sensitiveness for yield values differs for bonds. There are some rules for price sensitivity:

- The longer the maturity, the more sensitive to yield the bond is.
- The lower the coupon, the more sensitive to yield the bond is.

Default means that a company cannot pay the promised money back. You are defaulting on your debt when you do not fulfill your obligation, this can be pay nothing, pay less, pay later et cetera. Default risks are higher for companies than for governments, therefore also the yields payed by the cooperation are higher. The difference between the high cooperation default risk and the lower government default risk is called the spread. The spread is measured in basis points, 1% is equal to 100 base points. The risks of bonds and thus the spread is determined by rating agencies that give a credit rate of a cooperation or government. Investment grade debt is considered of high quality, speculative debt on the other hand is considered of low quality.