Corporation Finance

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- Notes #6 – Chapter 6: Valuating Bonds

What is a Bond and What are its Features?

Definition (*Bond*)

A bond is a security that obligates the issuer to make interest and principal payments to the holder on specified dates.

Bond Terminology

- **Bond Certificate**: States the terms of the bond

- **Maturity Date**: Final repayment date

- **Term**: The time remaining until the repayment date

- **Coupon**: Promised interest payments

- **Face Value**: Nominal amount used to compute the interest payments

Repayment Schemes

- **Zero-coupon bonds**: Pay no coupons prior to maturity.

- **Coupon bonds**: Pay a stated coupon at periodic intervals prior to maturity.

- **Annuity**: Pay a regular fixed amount each payment period. Principal repaid over time rather than at maturity.

Who Issue Bonds?

- **US Government (Treasuries)**
  - **T-bills** : 4,13,16-week maturity, zero coupon bonds
  - **T-notes** : 2,3,5,10 year, semi-annual coupon bonds
  - **T-bonds** : 20 & 30-year, semi-annual coupon bonds
- **Foreign Governments**

Who Issue Bonds?

- **Municipalities**
  - Maturities from one month to 40 years, semiannual coupons
  - Exempt from federal taxes (sometimes state and local as well).
  - Generally two types: Revenue bonds (e.g. to build an airport) vs General Obligation bonds
  - Riskier than government bonds (e.g., Detroit – paid back 14 cents on the dollar.)

- **Corporations**

Coupon Bonds

- **Coupon Rate**: Determines the amount of each coupon payment, expressed as an APR

- **Coupon Payment (*CPN*)**

$$CPN = \frac{Coupon\ Rate \times Face\ Value}{\#\ Coupon\ Payments\ per\ Year}$$

- **Example**: If the Face Value is $1,000 and the coupon rate is 5% paid semi-annually, then

$$CPN = \frac{5\% \times \$1,000}{2} = \$25.$$

  That means that the bond holder receives $25 every six months until the date of maturity.

Coupon Bond Valuation

- The price of a bond is the present value of all cash flows generated by the bond (i.e. coupons and face value) discounted at the required rate of return

$$Price = \frac{CPN}{(1+r)^1} + \frac{CPN}{(1+r)^2} + \cdots + \frac{CPN}{(1+r)^t} + \frac{Face\ Value}{(1+r)^t}$$

- Note that t is the number of periods (not necessarily years).

Example

Example: *What is the price of a 7.25 % annual coupon bond, with a $1,000 face value, which matures in 3 years? Assume a required return of 0.35%.*

$$CPN = \frac{7.25\% \times \$1,000}{1} = \$72.5.$$

$$Price = \frac{72.5}{(1+.0035)^1} + \frac{72.5}{(1+.0035)^2} + \frac{72.5}{(1+.0035)^3} +$$

$$\frac{1,000}{(1+.0035)^3} = \$1,205.56.$$

Example

Example: *Assume the same bond as in the previous example. What is the price of the bond if the required rate of return is 7.25%?*
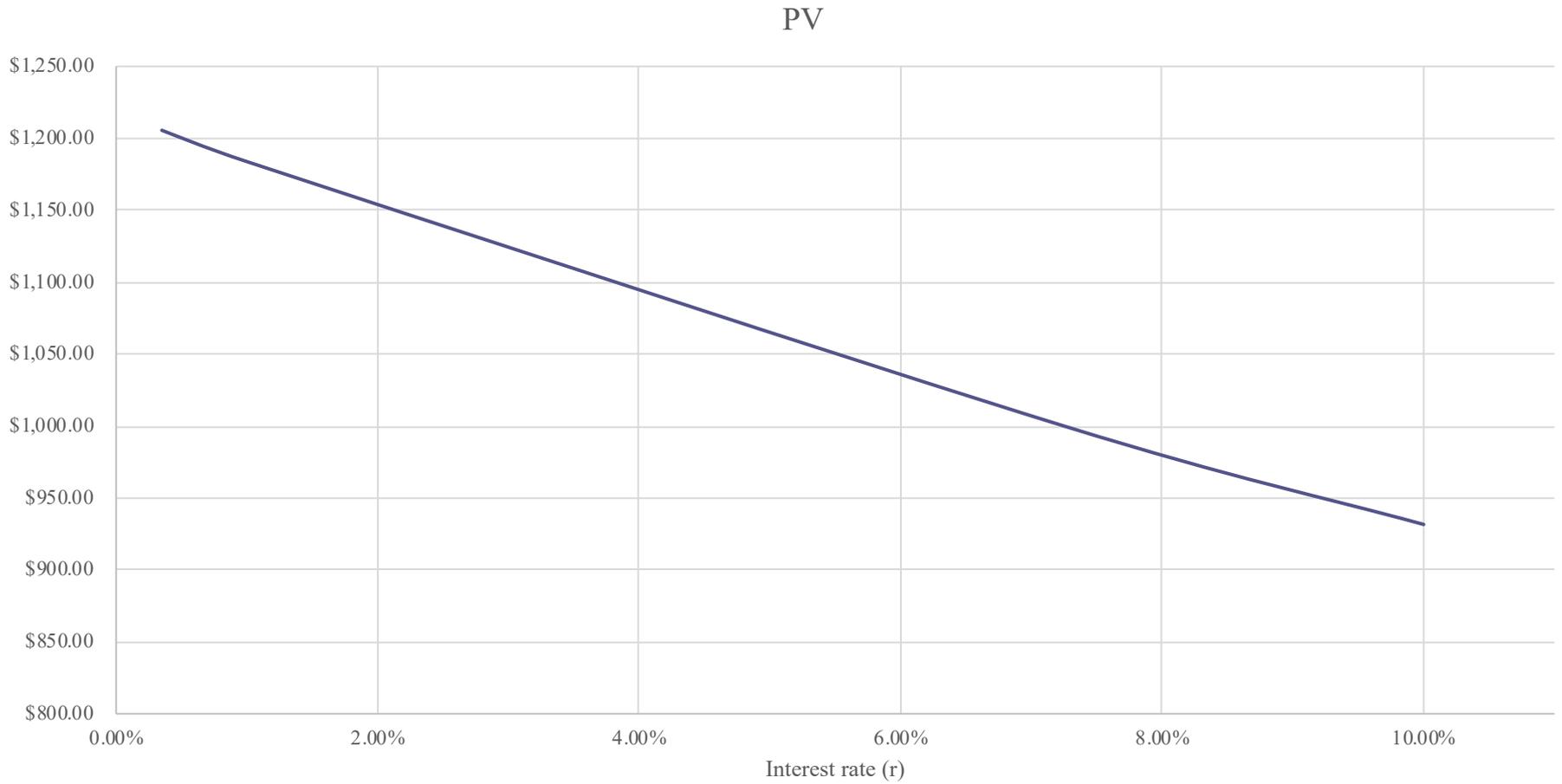
$$Price = \frac{72.5}{(1+.0725)^1} + \frac{72.5}{(1+.0725)^2} + \frac{72.5}{(1+.0725)^3} +$$

$$\frac{1,000}{(1+.0725)^3} = \$1,000.$$

Example

Example: *Assume the same bond as in the previous example. What is the price of the bond if the required rate of return is 10%?*

$$Price = \frac{72.5}{(1+.1)^1} + \frac{72.5}{(1+.1)^2} + \frac{72.5}{(1+.1)^3} + \frac{1,000}{(1+.1)^3} = \$931.61$$

Example

PV vs. Interest rate (r)

Bond Yields

Definition (Yield To Maturity): _Interest rate for which the present value of the bond's payments equals the price. YTM is expressed as APR._

- An investor takes the price of the bond as given. Then he decides if to buy it or not. Therefore, the YTM would give the investor an indication of the return from buying the bond. Then the investor can compare it to other investment opportunities and can easily decide if the return (YTM) is sufficient.

Bond Yields

- How to calculate the Yield to Maturity (YTM = r): If you are given the price of a bond (PV) and the coupon rate, the yield to maturity can be found by solving for r the following equation:

$$Price = \frac{CPN}{(1+r)^1} + \frac{CPN}{(1+r)^2} + \cdots + \frac{CPN}{(1+r)^t} + \frac{Face\ Value}{(1+r)^t}$$

Bond Yields

Example: What is the YTM of a 10.0% annual coupon bond, with a $1,000 face value, which matures in 3 years? The market price of the bond is $1,136.16.

■

$$1,136.16 = \frac{100}{(1+r)^1} + \frac{100}{(1+r)^2} + \frac{1,100}{(1+r)^3}$$

■ use Excel (the function is RATE) to get YTM=5%.

Bonds: Zero-Coupon Bond

- Does not make coupon payments

- Always sells at a discount (a price lower than face value), so they are also called pure discount bonds

- ***Example***: Treasury Bills are U.S. government zero-coupon bonds with a maturity of up to one year.

Bonds: Zero-Coupon Bond

Suppose that a one-year, risk-free, zero-coupon bond with a $1,000 face value has an initial price of $966.18. The cash flows would be:

```
      0                          1
      |                          |
      |--------------------------|------------
  -966.18                      1,000
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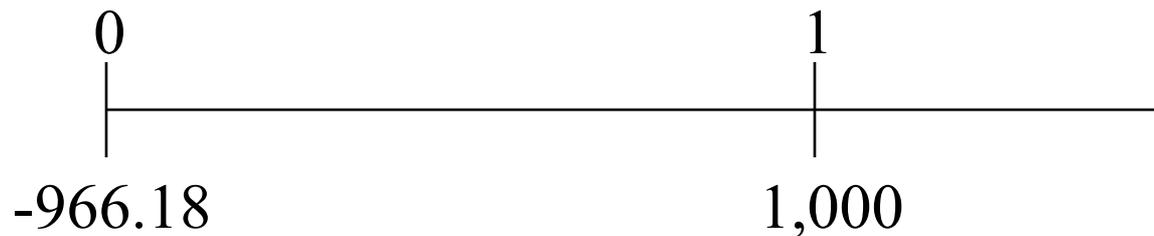
- Although the bond pays no interest, your compensation is the difference between the initial price and the face value.

Yield to Maturity (YTM)

__Definition__ (YTM): The discount rate that sets the present value of the promised bond payments equal to the current market price of the bond.

- Price of a Zero-Coupon bond

$$Price = \frac{Face\ Value}{(1 + YTM)^t}$$

Yield to Maturity (YTM)

- Price of a Zero-Coupon bond

$$Price = \frac{Face\ Value}{(1 + YTM)^t}$$

- For the one-year zero coupon bond:

$$966.18 = \frac{1,000}{(1 + YTM)^1}$$

- Thus, the YTM is 3.5%.

Bond Terminology

- **Discount**: A bond is selling at a discount if the price is less than the face value.

- **Par**: A bond is selling at par if the price is equal to the face value.

- **Premium**: A bond is selling at a premium if the price is greater than the face value.