

Slide 1

**CHAPTER 7**  
**Bonds and Their Valuation**

- Key features of bonds
- Bond valuation
- Measuring yield
- Assessing risk

7-1

---

---

---

---

---

---

---

---

Slide 2

**What is a bond?**

- A long-term debt instrument in which a borrower agrees to make payments of principal and interest, on specific dates, to the holders of the bond.

7-2

---

---

---

---

---

---

---

---

Slide 3

**Bond markets**

- Primarily traded in the over-the-counter (OTC) market.
- Most bonds are owned by and traded among large financial institutions.
- Full information on bond trades in the OTC market is not published, but a representative group of bonds is listed and traded on the bond division of the NYSE.

7-3

---

---

---

---


---

---

---

---

Slide 4



### Key Features of a Bond

- Par value – face amount of the bond, which is paid at maturity (assume \$1,000).
- Coupon interest rate – stated interest rate (generally fixed) paid by the issuer. Multiply by par value to get dollar payment of interest.
- Maturity date – years until the bond must be repaid.
- Issue date – when the bond was issued.
- Yield to maturity - rate of return earned on a bond held until maturity (also called the “promised yield”).

7-4

---

---

---

---


---

---

---

---

Slide 5



### Effect of a call provision

- Allows issuer to refund the bond issue if rates decline (helps the issuer, but hurts the investor).
- Borrowers are willing to pay more, and lenders require more, for callable bonds.
- Most bonds have a deferred call and a declining call premium.

7-5

---

---

---

---


---

---

---

---

Slide 6



### What is a sinking fund?

- Provision to pay off a loan over its life rather than all at maturity.
- Similar to amortization on a term loan.
- Reduces risk to investor, shortens average maturity.
- But not good for investors if rates decline after issuance.

7-6

---

---

---

---


---

---

---

---

Slide 7

 **How are sinking funds executed?**

- Call x% of the issue at par, for sinking fund purposes.
  - Likely to be used if  $r_d$  is below the coupon rate and the bond sells at a premium.
- Buy bonds in the open market.
  - Likely to be used if  $r_d$  is above the coupon rate and the bond sells at a discount.

7-7

---

---

---

---


---

---

---

---

Slide 8

 **The value of financial assets**

0                      1                      2                      ...                      N

|-----|-----|-----|-----|-----|

Value                      CF<sub>1</sub>                      CF<sub>2</sub>                      ...                      CF<sub>N</sub>

Value =  $\frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \dots + \frac{CF_N}{(1+r)^N}$

7-8

---

---

---

---


---

---

---

---

Slide 9

 **Other types (features) of bonds**

- Convertible bond – may be exchanged for common stock of the firm, at the holder's option.
- Warrant – long-term option to buy a stated number of shares of common stock at a specified price.
- Puttable bond – allows holder to sell the bond back to the company prior to maturity.
- Income bond – pays interest only when interest is earned by the firm.
- Indexed bond – interest rate paid is based upon the rate of inflation.

7-9

---

---

---

---

---

---

---

---

Slide 10

What is the opportunity cost of debt capital?

- The discount rate ( $r_d$ ) is the opportunity cost of capital, and is the rate that could be earned on alternative investments of equal risk.

$$r_d = r^* + IP + MRP + DRP + LP$$

7-10

---

---

---

---

---

---

---

---

Slide 11

What is the value of a 10-year, 10% annual coupon bond, if  $r_d = 10\%$ ?

Timeline: 0 | 1 | 2 | ... | n  
 $V_B = ?$  | 100 | 100 | ... | 100 + 1,000

$$V_B = \frac{\$100}{(1.10)^1} + \dots + \frac{\$100}{(1.10)^{10}} + \frac{\$1,000}{(1.10)^{10}}$$

$$V_B = \$90.91 + \dots + \$38.55 + \$385.54$$

$$V_B = \$1,000$$

7-11

---

---

---

---

---

---

---

---

Slide 12

Using a financial calculator to value a bond

- This bond has a \$1,000 lump sum (the par value) due at maturity ( $t = 10$ ), and annual \$100 coupon payments beginning at  $t = 1$  and continuing through  $t = 10$ , the price of the bond can be found by solving for the PV of these cash flows.

INPUTS	10	10	100	1000
	N	I/YR	PMT	FV
OUTPUT			-1000	

7-12

---

---

---

---

---

---

---

---

Slide 13

The same company also has 10-year bonds outstanding with the same risk but a 13% annual coupon rate

- This bond has an annual coupon payment of \$130. Since the risk is the same the bond has the same yield to maturity as the previous bond (10%). In this case the bond sells at a premium because the coupon rate exceeds the yield to maturity.

INPUTS	10	10	130	1000
	N	I/YR	PMT	FV
OUTPUT				
				-1184.34

7-13

---

---

---

---

---

---

---

---

Slide 14

The same company also has 10-year bonds outstanding with the same risk but a 7% annual coupon rate

- This bond has an annual coupon payment of \$70. Since the risk is the same the bond has the same yield to maturity as the previous bonds (10%). In this case, the bond sells at a discount because the coupon rate is less than the yield to maturity.

INPUTS	10	10	70	1000
	N	I/YR	PMT	FV
OUTPUT				
				-815.66

7-14

---

---

---

---

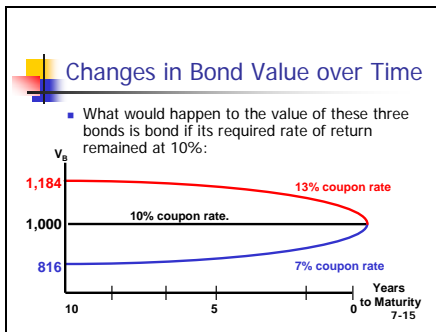
---

---

---

---

Slide 15




---

---

---

---

---

---

---

---

Slide 16

### Bond values over time

- At maturity, the value of any bond must equal its par value.
- If  $r_d$  remains constant:
  - The value of a premium bond would decrease over time, until it reached \$1,000.
  - The value of a discount bond would increase over time, until it reached \$1,000.
  - A value of a par bond stays at \$1,000.

7-16

---

---

---

---

---

---

---

---

Slide 17

What is the YTM on a 10-year, 9% annual coupon, \$1,000 par value bond, selling for \$887?

- Must find the  $r_d$  that solves this model.

$$V_b = \frac{INT}{(1+r_d)^1} + \dots + \frac{INT}{(1+r_d)^N} + \frac{M}{(1+r_d)^N}$$
$$\$887 = \frac{90}{(1+r_d)^1} + \dots + \frac{90}{(1+r_d)^{10}} + \frac{1,000}{(1+r_d)^{10}}$$

7-17

---

---

---

---

---

---

---

---

Slide 18

### Using a financial calculator to solve for the YTM

- Solving for I/YR, the YTM of this bond is 10.91%. This bond sells at a discount, because  $YTM > \text{coupon rate}$ .

INPUTS	10	-887	90	1000
	N	PV	PMT	FV
OUTPUT	10.91			

7-18

---

---

---

---

---

---

---

---

Slide 19

Find YTM,  
if the bond price is \$1,134.20

- Solving for I/YR, the YTM of this bond is 7.08%. This bond sells at a premium, because  $YTM < \text{coupon rate}$ .

INPUTS	10	-1134.2	90	1000	
	N	I/YR	PV	PMT	FV
OUTPUT	7.08				

7-19

---

---

---

---

---

---

---

---

Slide 20

Definitions

Current yield (CY) =  $\frac{\text{Annual coupon payment}}{\text{Current price}}$

Capital gains yield (CGY) =  $\frac{\text{Change in price}}{\text{Beginning price}}$

Expected total return =  $YTM = \left( \begin{matrix} \text{Expected} \\ \text{CY} \end{matrix} \right) + \left( \begin{matrix} \text{Expected} \\ \text{CGY} \end{matrix} \right)$

7-20

---

---

---

---

---

---

---

---

Slide 21

An example:  
Current and capital gains yield

- Find the current yield and the capital gains yield for a 10-year, 9% annual coupon bond that sells for \$887, and has a face value of \$1,000.

Current yield =  $\$90 / \$887$   
=  $0.1015 = 10.15\%$

7-21

---

---

---

---

---

---

---

---

Slide 22

### Calculating capital gains yield

YTM = Current yield + Capital gains yield

$$\begin{aligned} \text{CGY} &= \text{YTM} - \text{CY} \\ &= 10.91\% - 10.15\% \\ &= 0.76\% \end{aligned}$$

Could also find the expected price one year from now and divide the change in price by the beginning price, which gives the same answer.

7-22

---

---

---

---

---

---

---

---

Slide 23

### What is interest rate (or price) risk?

Does a 1-year or 10-year bond have more interest rate risk?

- Interest rate risk is the concern that rising  $r_d$  will cause the value of a bond to fall.

$r_d$	1-year	Change	10-year	Change
5%	\$1,048	+ 4.8%	\$1,386	+38.6%
10%	1,000		1,000	
15%	956	- 4.4%	749	-25.1%

The 10-year bond is more sensitive to interest rate changes, and hence has more interest rate risk.

7-23

---

---

---

---

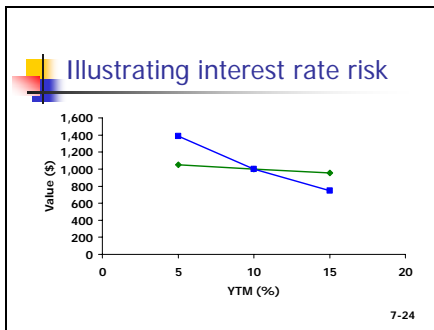
---

---

---

---

Slide 24




---

---

---

---


---

---

---

---

Slide 25

 **What is reinvestment rate risk?**

- Reinvestment rate risk is the concern that  $r_d$  will fall, and future CFs will have to be reinvested at lower rates, hence reducing income.

*EXAMPLE: Suppose you just won \$500,000 playing the lottery. You intend to invest the money and live off the interest.*

7-25

---

---

---

---


---

---

---

---

Slide 26

 **Reinvestment rate risk example**

- You may invest in either a 10-year bond or a series of ten 1-year bonds. Both 10-year and 1-year bonds currently yield 10%.
- If you choose the 1-year bond strategy:
  - After Year 1, you receive \$50,000 in income and have \$500,000 to reinvest. But, if 1-year rates fall to 3%, your annual income would fall to \$15,000.
- If you choose the 10-year bond strategy:
  - You can lock in a 10% interest rate, and \$50,000 annual income.

7-26

---

---

---

---


---

---

---

---

Slide 27

 **Conclusions about interest rate and reinvestment rate risk**

	Short-term AND/OR High coupon bonds	Long-term AND/OR Low coupon bonds
Interest rate risk	Low	High
Reinvestment rate risk	High	Low

- **CONCLUSION: Nothing is riskless!**

7-27

---

---

---

---

---

---

---

---

Slide 28

**Semiannual bonds**

1. Multiply years by 2 : number of periods = 2N.
2. Divide nominal rate by 2 : periodic rate (I/YR) =  $r_d / 2$ .
3. Divide annual coupon by 2 : PMT = ann cpn / 2.

INPUTS	2N	$r_d / 2$	OK	cpn / 2	OK
	N	I/YR	PV	PMT	FV
OUTPUT					

7-28

---

---

---

---

---

---

---

---

Slide 29

What is the value of a 10-year, 10% semiannual coupon bond, if  $r_d = 13\%$ ?

1. Multiply years by 2 :  $N = 2 * 10 = 20$ .
2. Divide nominal rate by 2 :  $I/YR = 13 / 2 = 6.5$ .
3. Divide annual coupon by 2 :  $PMT = 100 / 2 = 50$ .

INPUTS	20	6.5		50	1000
	N	I/YR	PV	PMT	FV
OUTPUT	- 834.72				

7-29

---

---

---

---

---

---

---

---

Slide 30

Would you prefer to buy a 10-year, 10% annual coupon bond or a 10-year, 10% semiannual coupon bond, all else equal?

The semiannual bond's effective rate is:

$$EFF\% = \left(1 + \frac{I_{nom}}{M}\right)^M - 1 = \left(1 + \frac{0.10}{2}\right)^2 - 1 = 10.25\%$$

10.25% > 10% (the annual bond's effective rate), so you would prefer the semiannual bond.

7-30

---

---

---

---

---

---

---

---

Slide 31

If the proper price for this semiannual bond is \$1,000, what would be the proper price for the annual coupon bond?

- The semiannual coupon bond has an effective rate of 10.25%, and the annual coupon bond should earn the same EAR. At these prices, the annual and semiannual coupon bonds are in equilibrium, as they earn the same effective return.

INPUTS	10	10.25	100	1000
	N	I/YR	PV	FV
OUTPUT			-984.80	

7-31

---

---

---

---

---

---

---

---

Slide 32

A 10-year, 10% semiannual coupon bond selling for \$1,135.90 can be called in 4 years for \$1,050, what is its yield to call (YTC)?

- The bond's yield to maturity can be determined to be 8%. Solving for the YTC is identical to solving for YTM, except the time to call is used for N and the call premium is FV.

INPUTS	8	-1135.90	50	1050
	N	I/YR	PV	FV
OUTPUT		3.568		

7-32

---

---

---

---

---

---

---

---

Slide 33

**Yield to call**

- 3.568% represents the periodic semiannual yield to call.
- $YTC_{NOM} = r_{NOM} = 3.568\% \times 2 = 7.137\%$  is the rate that a broker would quote.
- The effective yield to call can be calculated
  - $YTC_{EFF} = (1.03568)^2 - 1 = 7.26\%$

7-33

---

---

---

---


---

---

---

---

Slide 34



If you bought these callable bonds, would you be more likely to earn the YTM or YTC?

- The coupon rate = 10% compared to YTC = 7.137%. The firm could raise money by selling new bonds which pay 7.137%.
- Could replace bonds paying \$100 per year with bonds paying only \$71.37 per year.
- Investors should expect a call, and to earn the YTC of 7.137%, rather than the YTM of 8%.

7-34

---

---

---

---


---

---

---

---

Slide 35



When is a call more likely to occur?

- In general, if a bond sells at a premium, then (1) coupon >  $r_d$ , so (2) a call is more likely.
- So, expect to earn:
  - YTC on premium bonds.
  - YTM on par & discount bonds.

7-35

---

---

---

---


---

---

---

---

Slide 36



Default risk

- If an issuer defaults, investors receive less than the promised return. Therefore, the expected return on corporate and municipal bonds is less than the promised return.
- Influenced by the issuer's financial strength and the terms of the bond contract.

7-36

---

---

---

---


---

---

---

---

Slide 37

 **Types of bonds**

- Mortgage bonds
- Debentures
- Subordinated debentures
- Investment-grade bonds
- Junk bonds

7-37

---

---

---

---


---

---

---

---

Slide 38

 **Evaluating default risk:  
Bond ratings**

	Investment Grade				Junk Bonds			
Moody's	Aaa	Aa	A	Baa	Ba	B	Caa	C
S & P	AAA	AA	A	BBB	BB	B	CCC	C

- Bond ratings are designed to reflect the probability of a bond issue going into default.

7-38

---

---

---

---

---

---

---

---

Slide 39

 **Factors affecting default risk and bond ratings**

- Financial performance
  - Debt ratio
  - TIE ratio
  - Current ratio
- Bond contract provisions
  - Secured vs. Unsecured debt
  - Senior vs. subordinated debt
  - Guarantee and sinking fund provisions
  - Debt maturity

7-39

---

---

---

---


---

---

---

---

Slide 40



### Other factors affecting default risk

- Earnings stability
- Regulatory environment
- Potential antitrust or product liabilities
- Pension liabilities
- Potential labor problems
- Accounting policies

7-40

---

---

---

---


---

---

---

---

Slide 41



### Bankruptcy

- Two main chapters of the Federal Bankruptcy Act:
  - Chapter 11, Reorganization
  - Chapter 7, Liquidation
- Typically, a company wants Chapter 11, while creditors may prefer Chapter 7.

7-41

---

---

---

---


---

---

---

---

Slide 42



### Chapter 11 Bankruptcy

- If company can't meet its obligations ...
  - It files under Chapter 11 to stop creditors from foreclosing, taking assets, and closing the business and it has 120 days to file a reorganization plan.
  - Court appoints a "trustee" to supervise reorganization.
  - Management usually stays in control.
- Company must demonstrate in its reorganization plan that it is "worth more alive than dead".
  - If not, judge will order liquidation under Chapter 7.

7-42

---

---

---

---


---

---

---

---

Slide 43

 **Priority of claims in liquidation**

1. Secured creditors from sales of secured assets.
2. Trustee's costs
3. Wages, subject to limits
4. Taxes
5. Unfunded pension liabilities
6. Unsecured creditors
7. Preferred stock
8. Common stock

7-43

---

---

---

---


---

---

---

---

Slide 44

 **Reorganization**

- In a liquidation, unsecured creditors generally get zero. This makes them more willing to participate in reorganization even though their claims are greatly scaled back.
- Various groups of creditors vote on the reorganization plan. If both the majority of the creditors and the judge approve, company "emerges" from bankruptcy with lower debts, reduced interest charges, and a chance for success.

7-44

---

---

---

---

---

---

---

---