

## Chapter 5 Bonds & Their Valuation

- Definition and Example of a Bond
- How to Value Bonds
- Bond Concepts
- Bankruptcy

## Bond Terms

- Bond definition
- Indenture
- Primary market / secondary market
- Par value
- Coupon rate and coupon payment
- Maturity date and maturity value
- Call provision
- Debenture / Secured Debt
- Zero coupon bonds
- Junk bonds
- Bearer bonds
- Sinking fund provision
- Warrants

## The Bond Indenture

- Contract between the company and the bondholders and includes
  - The basic terms of the bonds
  - The total amount of bonds issued
  - A description of property used as security, if applicable
  - Sinking fund provisions
  - Call provisions
  - Details of protective covenants

## Bond Issue Terms

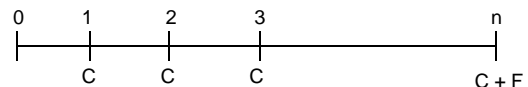
|                   |                                     |  |
|-------------------|-------------------------------------|--|
| Issue amount      | \$20 million                        | Bond issue total face value is \$20 million                                    |
| Issue date        | 12/15/98                            | Bonds offered to the public in December 1998                                   |
| Maturity date     | 12/31/18                            | Remaining principal is due December 31, 2018                                   |
| Face value        | \$1,000                             | Face value denomination is \$1,000 per bond                                    |
| Coupon interest   | \$100 per annum                     | Annual coupons are \$100 per bond  |
| Coupon dates      | 6/30, 12/31                         | Coupons are paid semiannually  |
| Offering price    | 100                                 | Offer price is 100% of face value  |
| Yield to maturity | 10%                                 | Based on stated offer price  |
| Call provision    | Callable after 12/31/03             | Bonds are call protected for 5 years after issuance                            |
| Call price        | 110 before 12/31/08, 100 thereafter | Callable at 110 percent of par value through 2008. Thereafter callable at par. |
| Trustee           | United Bank of Florida              | Trustee is appointed to represent bondholders                                  |
| Security          | None                                | Bonds are unsecured debenture  |
| Rating            | Moody's A1, S&P A+                  | Bond credit quality rated upper medium grade by Moody's and S&P's rating       |

## Corporate Bond Ratings

| Moody's   | Duff & Phelps | S&P's | Credit Rating Description                        |
|---|---------------|-------|--|
| <b>Investment-Grade Bond Ratings</b>            |               |       |  |
| Aaa   | 1             | AAA   | Highest credit rating, maximum safety            |
| Aa1   | 2             | AA+   | High credit quality, investment-grade bonds      |
| Aa2   | 3             | AA    |  |
| Aa3   | 4             | AA-   |  |
| A1  | 5             | A+    | Upper-medium quality, investment grade bonds     |
| A2  | 6             | A     |  |
| A3  | 7             | A-    |  |
| Baa1  | 8             | BBB+  | Lower-medium quality, investment grade bonds     |
| Baa2  | 9             | BBB   |  |
| Baa3  | 10            | BBB-  |  |
| <b>Speculative-Grade Bond Ratings</b>           |               |       |  |
| Ba1   | 11            | BB+   | Low credit quality, speculative-grade bonds      |
| Ba2   | 12            | BB    | Very low credit quality, speculative-grade bonds |
| Ba3   | 13            | BB-   |  |
| B1  | 14            | B+    |  |
| B2  | 15            | B     | Extremely low credit standing, high-risk bonds   |
| B3  | 16            | B-    |  |
| <b>Extremely Speculative-Grade Bond Ratings</b> |               |       |  |
| Caa   | 17            | CCC+  | Extremely speculative                            |
|   |               | CCC   |  |
|   |               | CC-   |  |
|   |               | CC    |  |
| Ca  |               | C     | Bonds in default                                 |
| C   |               | D     |  |

## Bond Valuation

- Bond value is the present value of all expected cash flows
- Two sources:
  - coupon interest & principal repayment



where: C = coupon interest and  
F = face value

### Bond Valuation continued

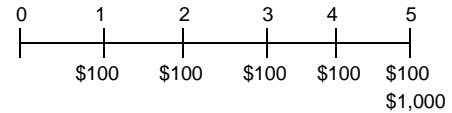
$$\text{Bond Value} = V_B = \sum_{t=1}^n \frac{C}{(1+r)^t} + \frac{F}{(1+r)^n}$$

$$\text{Bond Value} = C (\text{PVIFA}_{r,t}) + F (\text{PVIF}_{r,t})$$

$$\text{Bond Value} = C \left[ \frac{1 - \frac{1}{(1+r)^t}}{r} \right] + \frac{F}{(1+r)^t}$$

### Example

- Assume we have a 10% coupon bond with 5 years to maturity and 12% yield.
- Annual interest payment is \$100 per year
- Find the present value of these cash flows



### Example continued

$$V_B = \$100 (\text{PVIFA}_{12\%, 5\text{yrs}}) + \$1,000 (\text{PVIF}_{12\%, 5\text{yrs}})$$

Now use the same numbers, but change r to 10%  
 $V_B =$

### Another example

- Assume you own a 25 year bond with a 10% coupon and a 16% yield, what is it's value?

$V_B =$

- Now assume you own a 25 year bond with a 10% coupon and a 8% yield (inflation falls), what is it's value?

$V_B =$

### Another example

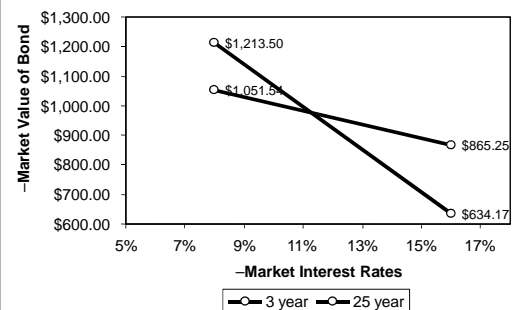
- Now assume you own a 3 year bond with a 10% coupon and a 16% yield, what is it's value?

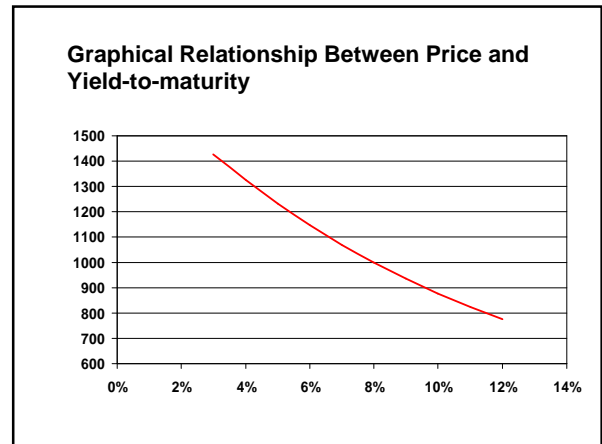
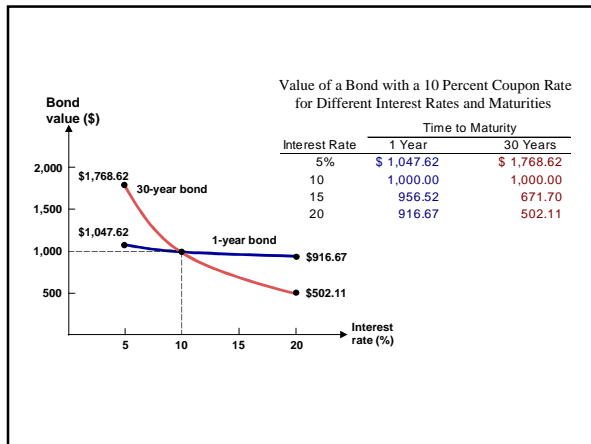
$V_B =$

- Now assume you own a 3 year bond with a 10% coupon and a 8% yield (inflation falls), what is it's value?

$V_B =$

–Relationship Between Bond's Market Price, Market Interest Rate, and Maturity





**Important points to remember:**

- Coupon never changes, but  $r$  changes with the risk-free rate, risk premium, inflation, and bond prices.
- Discount
- Premium
- Par Value Bonds

### Bond Risk

- Interest Rate Risk
- Reinvestment Rate Risk
- Default Risk

### Yield to Maturity

- We can look up a bond's price in the WSJ, we know the coupon, and time to maturity, but we want to know the yield to maturity ( $r$  or YTM) or return on the bond.
- Use the same formula, but solve for YTM:

$$V_B = \sum_{t=1}^n \frac{C}{(1 + YTM)^t} + \frac{F}{(1 + YTM)^n}$$

$$V_B = C (PVIFA_{YTM,t}) + F (PVIF_{YTM,t})$$

$$V_B = C \left[ \frac{1 - \frac{1}{(1 + YTM)^t}}{YTM} \right] + \frac{F}{(1 + YTM)^t}$$

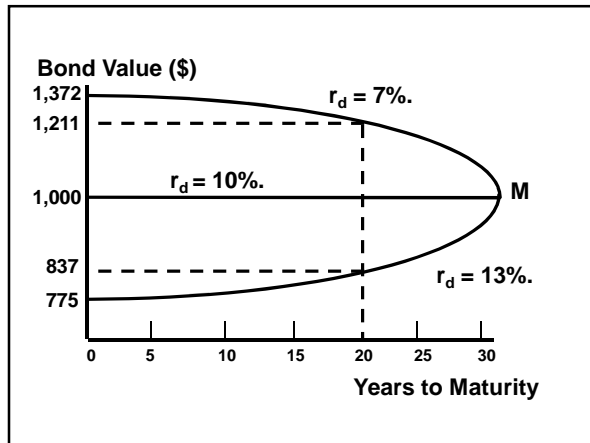
### Yield to Maturity

- How do you solve for YTM?  
Trial & Error or Financial Calculator
- Example: You own a 4 year, 6% coupon bond, currently selling for \$845. What is the YTM?  
It must be above 6%, why?  
Because it is selling at a discount, so interest rates went up.

### Example continued

### YTM with Annual Coupons

- Consider a bond with a 10% annual coupon rate, 15 years to maturity and a par value of \$1000. The current price is \$928.09.
- Will the yield be more or less than 10%?



### Yield to Call

- Many bonds are now callable. If interest rates go (up or down?) the bonds are likely to be called.
- If a bond is callable, the YTM is not as important. A 20 year bond may be called in 5 years.
- How do you solve for YTC?
- The same way as YTM, except "t" changes and F changes to CP, call premium.

### Example - Yield to Call

You own a \$950 bond with an 8% coupon that can be called in 5 years at par, plus one year's interest. What is the YTC?

By trial and error or financial calculator,  
YTC =

### Current Yield

- Many investors are interested in the bond's current yield.
- This is the coupon payment divided by the current closing price.

$$CY = C / V_B$$

A bond that has a 10% coupon and closes at \$900, has a current yield of

$$CY =$$

### Semiannual Interest

Bonds normally pay interest every 6 months, semiannually.

To adjust for semiannual interest, double the number of periods and halve the interest rate.

$$V_B = \sum_{t=1}^n \frac{C/2}{(1+r/2)^{2t}} + \frac{F}{(1+r/2)^{2n}}$$

$$V_B = C/2 (PVIFA_{r/2,2t}) + F (PVIF_{r/2,2t})$$

$$V_B = C/2 \left[ \frac{1 - \frac{1}{(1+r/2)^{2t}}}{r/2} \right] + \frac{F}{(1+r/2)^{2t}}$$

### Example - Semiannual Interest

You own a 14% coupon bond with 20 years to maturity that has a 10 yield. What is the value of this bond?

$V_B =$

$V_B =$

### Another Example - Semiannual Interest

You own a 10% coupon bond with 5 years to maturity that has a 12% yield. What is the value of this bond?

$V_B =$

### Zero-Coupon Bonds – Pure Discount Bonds

- No periodic interest payments
- Full YTM derived from the difference between purchase price and par value
- Cannot sell for more than par value
- Also called zeroes or deep discount bonds
- Examples:
  - Treasury Bills and principal only Treasury strips

### Zero-Coupon Bonds Example

$$\text{Value}_{\text{Zero}} = FV / (1 + R)^T$$

You own a zero with 20 years to maturity and a 10% yield. What is its value today?

$$\text{Value}_{\text{Zero}} = FV / (1 + R)^T$$

$\text{Value}_{\text{Zero}} =$

### Bankruptcy

- Two main chapters of Federal Bankruptcy Act:
  - Chapter 11, Reorganization
  - Chapter 7, Liquidation
- Typically, company wants Chapter 11, creditors may prefer Chapter 7.
- If company can't meet its obligations, it files under Chapter 11. That stops creditors from foreclosing, taking assets, and shutting down the business.
- Company 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."
  - Otherwise, judge will order liquidation under Chapter 7.

- If the company is liquidated, here's the payment priority:
  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

- 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.