Chapter 10

Bond Prices and Yields (Cont'd)

10.2 BOND PRICING

Perpetuity

A constant stream of identical cash flows with no end. The formula for determining the present value of a perpetuity is as follows

$$PV = \frac{C}{(1+r)^1} + \frac{C}{(1+r)^2} + \frac{C}{(1+r)^3} \ldots = \frac{C}{r}$$

Bond Pricing

$$P_B = \sum_{t=1}^{T} \frac{C_t}{(1+r)^T} + \frac{\textbf{Par Value}}{(1+r)^T}$$

P_B = Price of the bond

C_t = interest or coupon payments

T = number of periods to maturity

r = semi-annual discount rate or the semi-annual yield to maturity

Price of 8%, 10-yr. with yield at 6%

$$P_B = 40 \times \sum_{t=1}^{20} \frac{1}{(1.03)^t} + 1000 \times \frac{1}{(1.03)^{20}}$$

$$P_B = 1{,}148.77$$

Coupon = 4%*1,000 = 40 (Semiannual)

Discount Rate = 3% (Semiannual)

Maturity = 10 years or 20 periods

Par Value = 1,000

Bond Prices & Yields

a) Bond Price for a corporate bond:

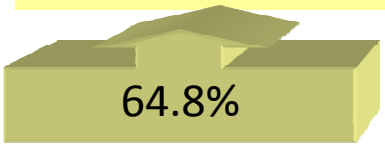
C = Coupon = 10%, interest rate = ytm = r = 12%, Maturity = N or T = 10 years, P = price, Par = $1,000

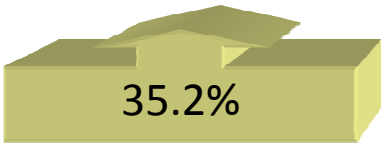
What is the bond's price using semiannual compounding?

$$P = \left\{ \sum_{T=1}^{2N} \frac{½\$C}{(1+½r)^{T}} \right\} + \frac{Par}{(1+½r)^{2N}}$$

$$P = \left\{ \sum_{T=1}^{20} \frac{\$50}{(1.06)^{T}} \right\} + \frac{\$1,000}{(1+.06)^{20}}$$

$$P = \{\$573.50\} \quad + \quad \$311.80 = \$885.30$$





Bond Pricing Between Coupon Dates

- The flat price or quoted price assumes the bond is purchased on a coupon payment date.

- If the bond buyer purchases a bond between payment dates the buyer's invoice price = flat price + accrued interest.

Bond Pricing Between Coupon Dates

$$\text{Accrued Interest} = \frac{\text{Annual Coupon\$}}{2} + \frac{\text{Days since last coupon payment}}{\text{Days between coupon payments}}$$

- A bond has a flat price of $925.30 and an annual coupon of $42.50. 160 days have passed since the last coupon payment and there are 182 days separating the coupon payments. What is the bond's invoice price?

$$\text{Accrued Interest} = \frac{\$42.50}{2} + \frac{160}{182} = \$18.68$$

$$\text{Invoice price} = \text{Flat Price} + \text{Accrued Interest}$$

$$\text{Invoice price} = \$925.30 + \$18.68 = \$943.98$$

10.3 BOND YIELDS

Bond Prices and Yields

- Prices and Yields (required rates of return) have an inverse relationship
- When yields get very high the value of the bond will be very low
- When yields approach zero, the value of the bond approaches the sum of the cash flows

Promised Yield to Maturity (YTM)

- YTM is the discount rate that makes the present value of a bond's payments equal to its price
- Find the YTM for a 8% coupon, 30-year bond selling at $1,276.76

$$P = \left\{ \sum_{T=1}^{2N} \frac{½\$C}{(1+½r)^{T}} \right\} + \frac{Par}{(1+½r)^{2N}}$$

$$\$1{,}276.76 = \left\{ \sum_{T=1}^{60} \frac{\$40}{(1+½r)^{T}} \right\} + \frac{\$1{,}000}{(1+½r)^{60}}$$

$$r = 3\%$$

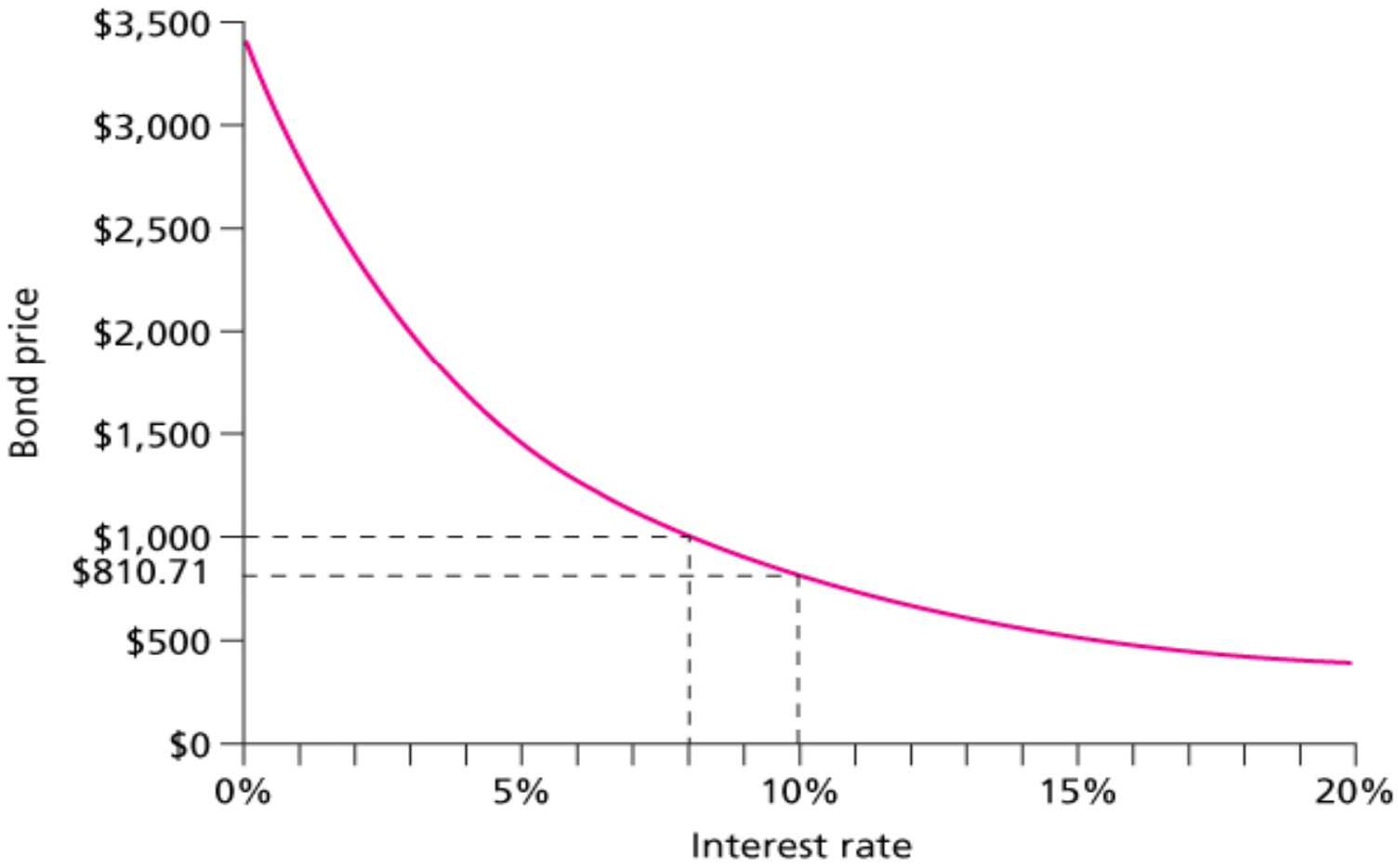
- Assumption of this calculation?

Calculating YTM using TI-83/TI-84 Calculator:

8% coupon, 3-year bond selling at $961.63:

To calculate the YTM, go to the Finance menu and bring up the TVM Solver. We can find the YTM by solving for I%. Enter 6 into N, -961.63 into PV, 40 into PMT, and 1,000 into FV. Now, scroll up to I% and then press ALPHA ENTER. You should find that the YTM is 4.75%.

Figure 10.3 The Inverse Relationship Between Bond Prices and Yields



Interest Rate Risk is Greater for Longer Maturity Bonds

Time to Maturity	Bond Price at Given Market Interest Rate				
	2%	4%	6%	8%	10%
1 year	$1,059.11	$1,038.83	$1,019.13	$1,000.00	$981.41
10 years	1,541.37	1,327.03	1,148.77	1,000.00	875.38
20 years	1,985.04	1,547.11	1,231.15	1,000.00	828.41
30 years	2,348.65	1,695.22	1,276.76	1,000.00	810.71

Alternative Measures of Yield

- Current Yield
  - Annual dollar coupon divided by the price
- Yield to Call
  - Call price replaces par
  - Call date replaces maturity
- Holding Period Yield
  - Considers actual reinvestment rate on coupons
  - Considers any change in price if the bond is sold prior to maturity

Premium Bonds:

Coupon Rate > Current Yield > YTM

Discount Bonds:

Coupon Rate < Current Yield < YTM

Yield to Call Illustrated