FN312 Investment
Lecture 8 Bond Prices and Yields

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Reading:
Chapter 14

Outline

- Debt (Fixed-Income) Securities Characteristics
- Bond Pricing and Yield
- Impact of Default and Credit Risk on Bond Pricing

Bond Characteristics

- Bonds are debt that obligate issuers (borrowers) to bondholders (creditors)
  - *Face value*
  - *Coupon rate*
  - *Maturity*
  - *Indenture or contract between the issuer and the bondholder*
- Corporate Bonds
  - *Callable bonds:* Can be repurchased before the maturity date
  - *Convertible bonds:* Can be exchanged for shares of the firm's common stock
  - *Puttable Bonds:* Give the holder an option to retire or extend the bond
  - *Floating-rate bonds:* Have adjustable coupon rate

Bond Pricing and Yield

Bond Pricing

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

- 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

Example:

Price of a 30-year, 8% coupon bond (semi-annual payment). Market rate of interest is 10%

Bond Prices and Yields

- Prices and yields have an inverse relationship
- The bond price curve is convex

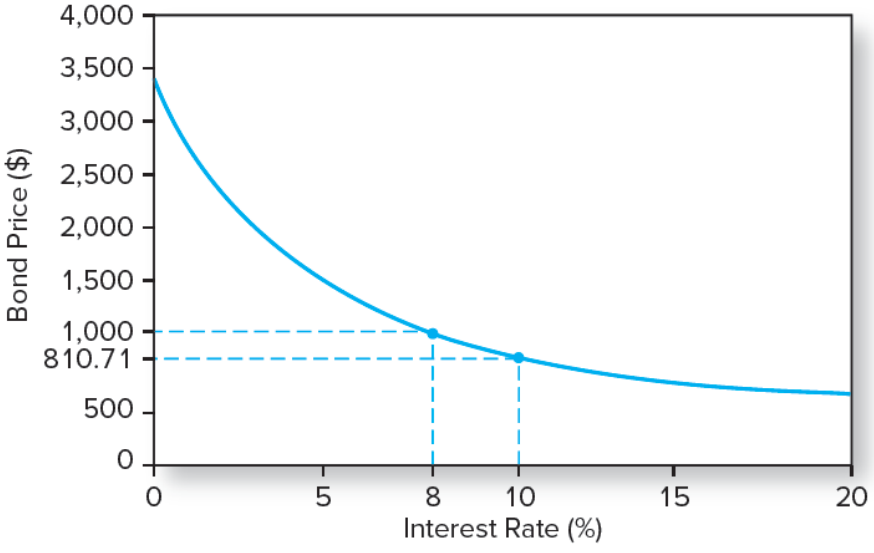


Figure 14.3 The inverse relationship between bond prices and yields. Price of an 8% coupon bond with 30-year maturity making semiannual payments

Bond Prices and Yields

- The longer the maturity

  => the more sensitive the bond's price to changes in market interest rates

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	875.35
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

Bond prices at different interest rates (8% coupon bond, coupons paid semiannually)

Bond Yields: Yield to Maturity

- Yield To Maturity

  = Interest rate that makes the present value of the bond's payments equal to its price.

- Solve the bond formula for *r* :

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

Bond Yields: Yield to Maturity – Example (1)

Suppose an 8% coupon (semi-annual payment), 30-year bond is selling for $1276.76.

- What is its average rate of return? (= bond equivalent yield)
- What is effective annual rate of this bond?
- Assume 2 percent of inflation, what is “real return of this bond”?

Bond Yields: Yield to Maturity – Example (2)

- A newly issued 20-year maturity, zero-coupon bond is issued with a yield to maturity of 8% and face value $1,000. Find the imputed interest income in: (*a*) the first year; (*b*) the second year; and (*c*) the last year of the bond's life.

Bond Yields: YTM vs. Current Yield

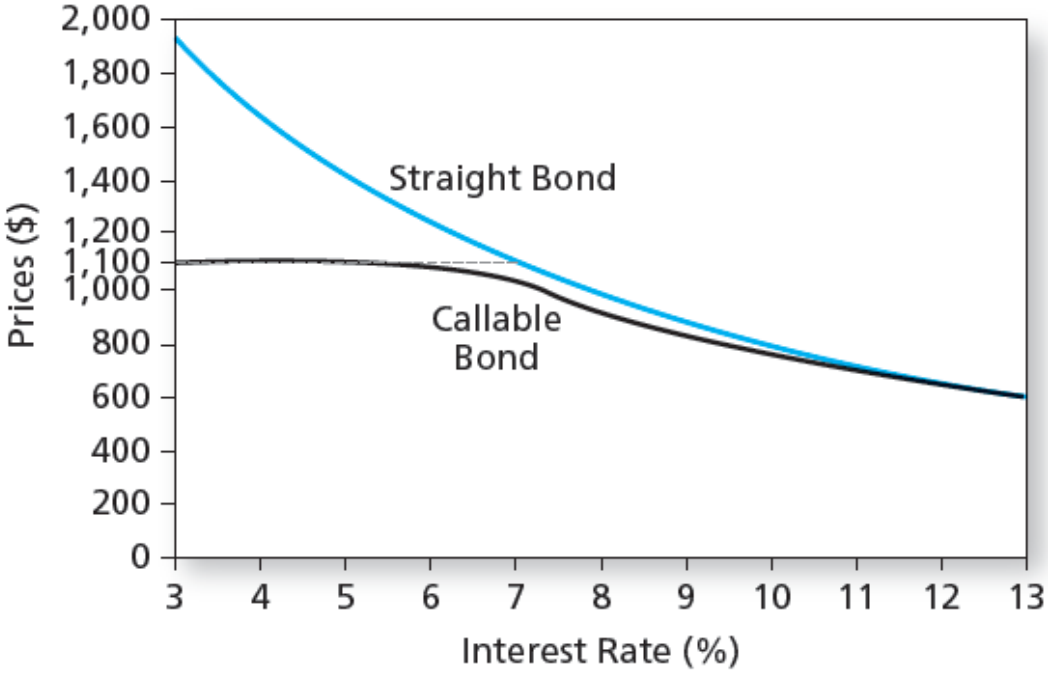
- **Yield to Maturity**
  - Bond's internal rate of return
  - Assumes that all bond coupons can be reinvested at the YTM
- **Current Yield =**
- **Relationship among:**

Coupon rate vs Current yield vs YTM

- **Premium Bonds:**
- **Discount Bonds:**

Bond Yields: Yield to Call

- **Low Interest Rates:** The price of the callable bond is flat since the risk of repurchase or call is high
- **High Interest Rates:** The price of the callable bond converges to that of a normal bond since the risk of call is negligible



Bond Yields: Yield to Call - Example

Suppose the 8% coupon, 30-year maturity bond sells for $1,150 and is callable in 10 years at a call price of $1,100. Its yield to maturity and yield to call would be calculated using the following inputs:

	Yield to Call	Yield to Maturity
Coupon payment	$40	$40
Number of semiannual periods	20 periods	60 periods
Final payment	$1,100	$1,000
Price	$1,150	$1,150

Bond Yields: Yield to Call – Example (2)

- A 30-year maturity, 8% coupon bond paying coupons semiannually is callable in five years at a call price of $1,100. The bond currently sells at a yield to maturity of 7% (3.5% per half-year).
  - *What is the yield to call?*
  - *What is the yield to call if the call price is only $1,050?*
  - *What is the yield to call if the call price is $1,100 but the bond can be called in two years instead of five years?*

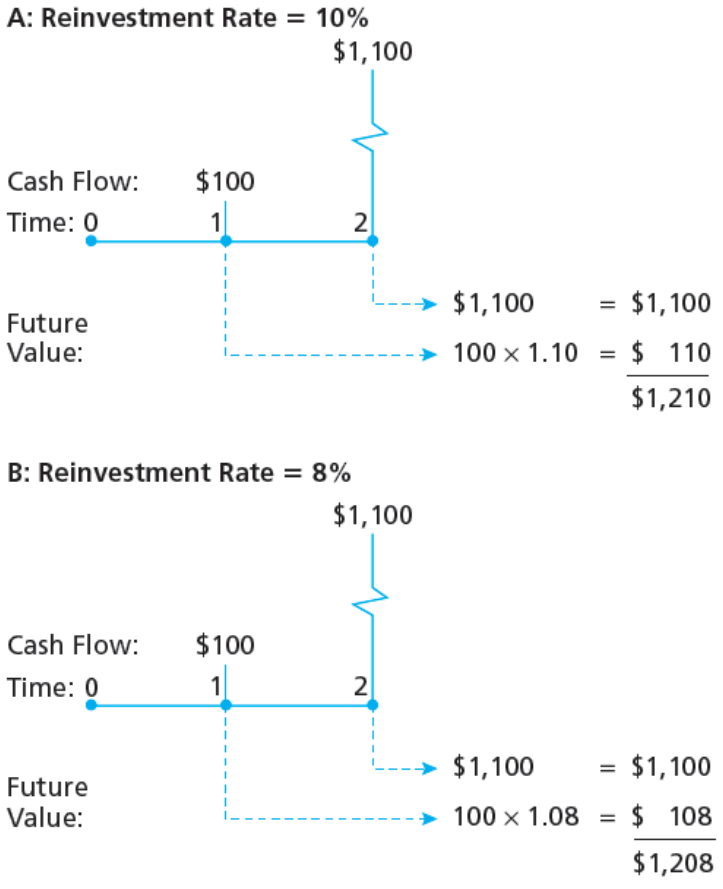
Bond Yields: Yield to Call – Example (3)

- Masters Corp. issued two bonds with 20-year maturities. Both bonds are callable at $1,050. The first bond was issued at a deep discount with a coupon rate of 4% and a price of $580 to yield 8.4%. The second bond was issued at par value with a coupon rate of 8.75%.
  - *What is the yield to maturity of the par bond? Why is it higher than the yield of the discount bond?*
  - *If you expect rates to fall substantially in the next two years, which bond has the higher expected rate of return?*
  - *In what sense does the discount bond offer "implicit call protection"?*

Bond Yields: Realized Yield versus YTM

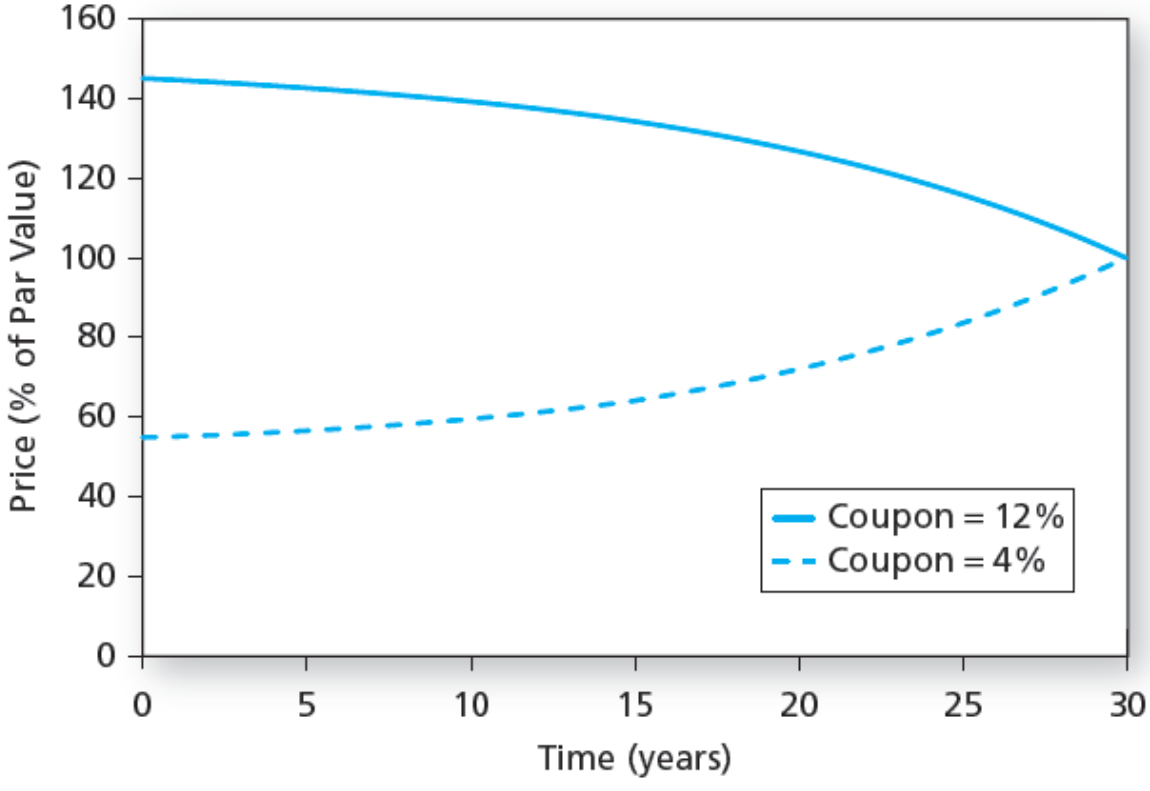
- Reinvestment Assumptions
- Holding Period Return
  - Changes in rates affect returns
  - Reinvestment of coupon payments
  - Change in price of the bond

1. What is realized compound return?
2. What if the reinvestment is not 10?



Prices over Time of 30-Year Maturity Bonds

Why?



Bond Prices Over Time: YTM vs. HPR

YTM	HPR
• It is the average return if the bond is held to maturity • Depends on coupon rate, maturity, and par value • All of these are readily observable	• It is the rate of return over a particular investment period • Depends on the bond's price at the end of the holding period, an unknown future value • Can only be forecasted

Bond Prices Over Time: YTM vs. HPR - Example

Consider a 30-year bond paying an annual coupon of $80 and selling at par value of $1,000. The bond's initial yield to maturity is 8%. If the yield remains at 8% over the year, the bond price will remain at par, so the holding-period return also will be 8%. But if the yield falls below 8%, the bond price will increase. Suppose the yield falls and the price increases to $1,050. What is holding period return?

The Price of a 30-Year Zero-Coupon Bond over Time

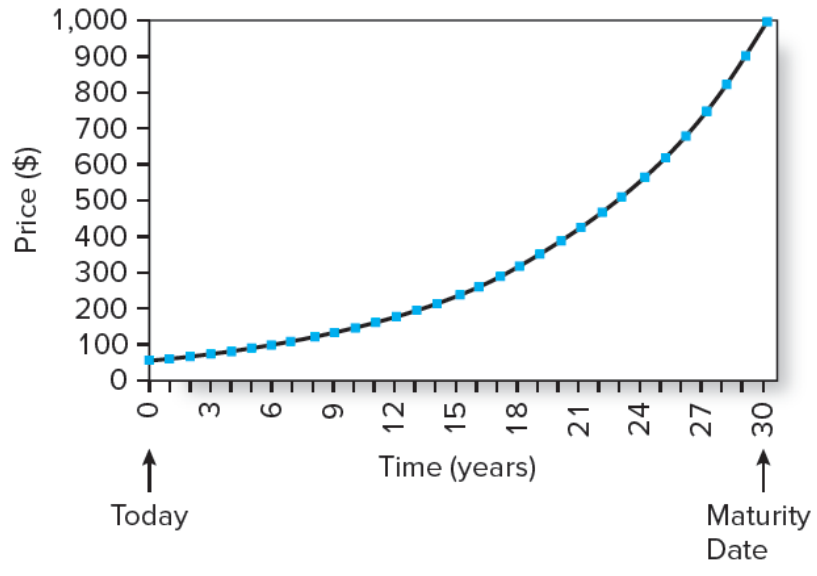


Figure 14.7 The price of a 30-year zero-coupon bond over time at a yield to maturity of 10%. Price equals $\$1{,}000/(1.10)^T$, where T is time until maturity.

Impact of Default and Credit Risk on Bond Pricing

Default Risk and Bond Pricing

- Rating companies
  - Moody's Investor Service, Standard & Poor's, Fitch
- Determinants of bond Safety
  - Coverage ratios
  - Leverage ratios, debt-to-equity ratio
  - Liquidity ratios
  - Profitability ratios
  - Cash flow-to-debt ratio

Default Risk and Bond Pricing

	Aaa	Aa	A	Baa	Ba	B	C
EBITA/Assets (%)	20.9%	15.6%	13.8%	10.9%	9.1%	7.1%	4.0%
Operating profit margin (%)	22.0%	17.1%	17.6%	14.1%	11.2%	8.9%	4.1%
EBITA to interest coverage (multiple)	28.9	15.1	9.7	5.9	3.5	1.7	0.6
Debt/EBITDA (multiple)	0.58	2.03	1.83	2.58	3.41	5.26	8.35
Debt/(Debt + Equity)	19.3%	50.2%	38.6%	46.2%	51.7%	72.0%	98.0%
Funds from operations/Total debt (multiple)	1.335	0.385	0.425	0.296	0.206	0.120	0.031
Retained cash flow/Net debt (multiple)	1.3	0.3	0.4	0.3	0.2	0.1	0.0

Table 14.3

Financial ratios by rating class

Note: EBITA is earnings before interest, taxes, and amortization. EBITDA is earnings before interest, taxes, depreciation, and amortization.
Source: Moody's Financial Metrics, *Key Ratios by Rating and Industry for Global Non-Financial Corporations,* December 2013.

- Altman Z-Score and Default Risk

$$Z = 3.1\frac{\text{EBIT}}{\text{Assets}} + 1.0\frac{\text{Sales}}{\text{Assets}} + .42\frac{\text{Equity}}{\text{Liabilities}} + .85\frac{\text{Ret. Earnings}}{\text{Assets}} + .72\frac{\text{Working Capital}}{\text{Assets}}$$

$$Z < 1.23 \rightarrow \text{Vulnerability to Bankruptcy}$$

$$Z > 2.90 \rightarrow \text{Considered Safe}$$

Default Risk and Bond Pricing: Bond Indentures

- ***Sinking funds*:** A way to call bonds early
- ***Subordination of future debt*:** Restrict additional borrowing
- ***Dividend restrictions*:** Force firm to retain assets rather than paying them out to shareholders
- ***Collateral:*** A particular asset bondholders receive if the firm defaults

YTM and Default Risk

- The risk structure of interest rates refers to the pattern of default premiums
- There is a difference between the yields based on *expected* cash flows and *promised* cash flows
- Default risk premium: the difference between the expected YTM and the promised YTM

YTM and Default Risk - Example

- A 10-year bond of a firm in severe financial distress has a coupon rate of 14% and sells for $900. The firm is currently renegotiating the debt, and it appears that the lenders will allow the firm to reduce coupon payments on the bond to one-half the originally contracted amount. The firm can handle these lower payments. What is (*a*) the stated and (*b*) the expected yield to maturity of the bonds? The bond makes its coupon payments annually.

Default Risk and CDS

- **Credit Default Swaps (CDS)**
  - Acts like an insurance policy on the default risk of a corporate bond or loan
  - Buyer pays annual premiums
  - Issuer agrees to buy the bond in a default or pay the difference between par and market values to the CDS buyer
  - Institutional bondholders used CDS to enhance creditworthiness of their loan portfolios, to manufacture AAA debt
  - Can also be used to speculate that bond prices will fall
    - This means there can be more CDS outstanding than there are bonds to insure

Question?