



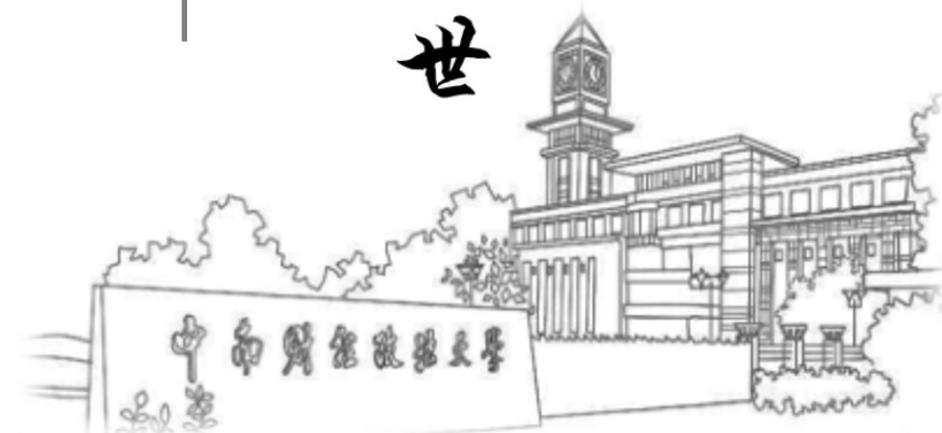
中南财经政法大学

ZHONGNAN UNIVERSITY OF ECONOMIC AND LAW

Financial Markets

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Treasury Bill Discount Rate

- Last lecture we use the following euqation to calculate discount rate:

$$i_{discount} = \frac{F - P}{F} \times \frac{360}{n}$$

- Recall: previously in lecture 3, we calculate the current price of the one-year **discount bond** using the following equation:

$$P = \frac{F}{1 + i}$$

Does $i = i_{dicount}$?

Chapter 12: The Bond Market

Chapter Preview

The last chapter discussed the money market. From this chapter, we will focus on another market: capital market.

Capital market are for securities with an original maturity that is greater than one year.

In this chapter, we focus on longer-term securities: bonds.

Bonds are like money market instruments, but they have maturities that exceed one year. These include Treasury bonds, corporate bonds, mortgages, and the like.

Chapter Preview

Topics include:

1. Purpose of the Capital Market
2. Capital Market Participants
3. Capital Market Trading
4. Types of Bonds
5. Treasury Notes and Bonds
6. Municipal Bonds
7. Corporate Bonds
8. Financial Guarantees for Bonds
9. Current Yield Calculation
10. Finding the Value of Coupon Bonds
11. Investing in Bonds

Purpose of the Capital Market

- Firms and individuals use the **money markets** to warehouse funds for short periods of time until a more important need or a more productive use for the funds arises.
- Firms and individuals use the **capital markets** for long-term investments.
- The primary reason that individuals and firms choose to borrow long-term is to reduce the risk that interest rates will rise before they pay off their debt.
- However, this reduction in risk comes at a cost, can you guess what it is?
- Best known capital market securities: Stocks and bonds

Capital Market Participants

- Primary issuers of securities:
 - Governments: bond issuers
 - Corporations: bond and stock issuers
 - The distribution of a firm's capital between debt and equity is called its capital structure.
- Largest purchasers of securities: you and me (households)
 - directly way
 - indirectly way: deposit funds in financial institutions

Capital Market Trading

- Primary market
 - Initial Public Offering (IPO)
 - Primary market transactions
- Secondary market
 - Over-the-counter
 - Organized exchanges (i.e., NYSE, SSE)

Types of Bonds

- *Bonds* are securities that represent debt owed by the issuer to the investor, and typically have specified payments on specific dates.
- The **par**, **face**, or **maturity** value of the bond (yes, they all mean the same thing) is the amount that the issuer must pay at maturity.
- The coupon rate is the rate of interest that the issuer must pay, and this periodic interest payment is often called the coupon payment. Coupon rate is usually fixed and does not fluctuate with market interest rates.
- Types of bonds we will examine include long-term government bonds (T-bonds), municipal bonds, and corporate bonds.

Types of Bonds: Sample Corporate Bond

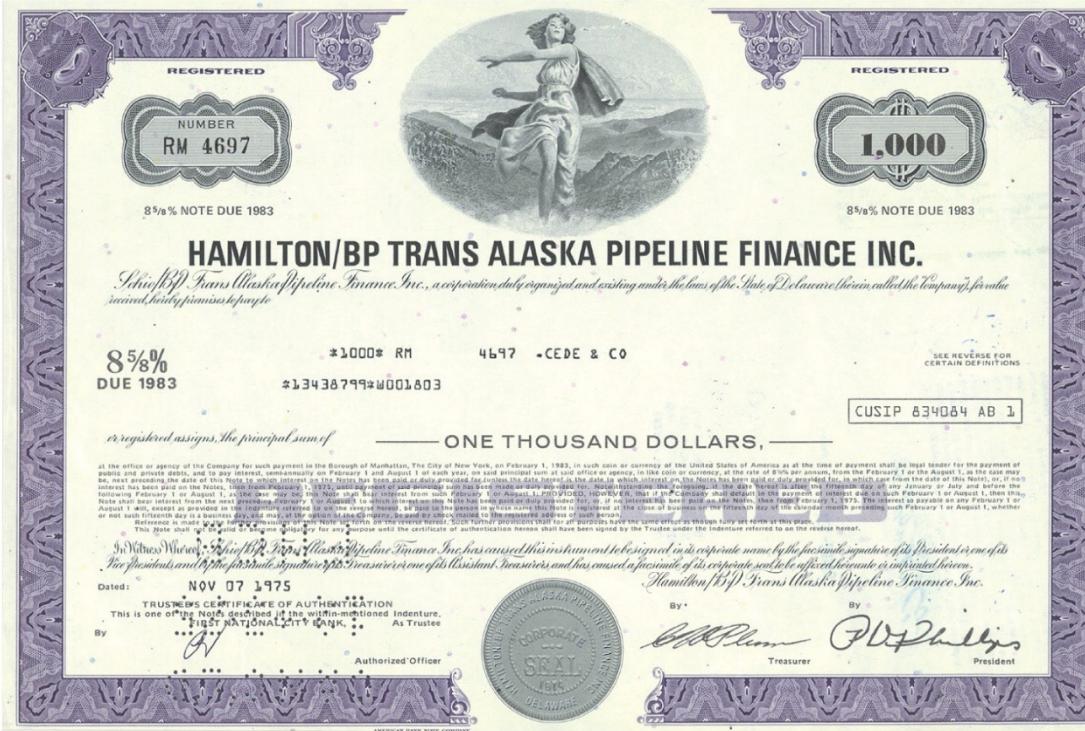


FIGURE 12.1 Hamilton/BP Corporate Bond

Treasury Notes and Bonds

- The U.S. Treasury issues notes and bonds to finance its operations.
- The following table summarizes the maturity differences among the various Treasury securities.

TABLE 12.1 Treasury Securities

| Type | Maturity |
|---------------|------------------|
| Treasury bill | Less than 1 year |
| Treasury note | 1 to 10 years |
| Treasury bond | 10 to 30 years |

Treasury Bond Interest Rates

- No default risk since the Treasury can print money to payoff the debt
- Very low interest rates, often considered the risk-free rate (although inflation risk is still present)
- The next two figures show historical rates on Treasury bills, bonds, and the inflation rate

Treasury Bond Interest Rates: Inflation vs. Bond

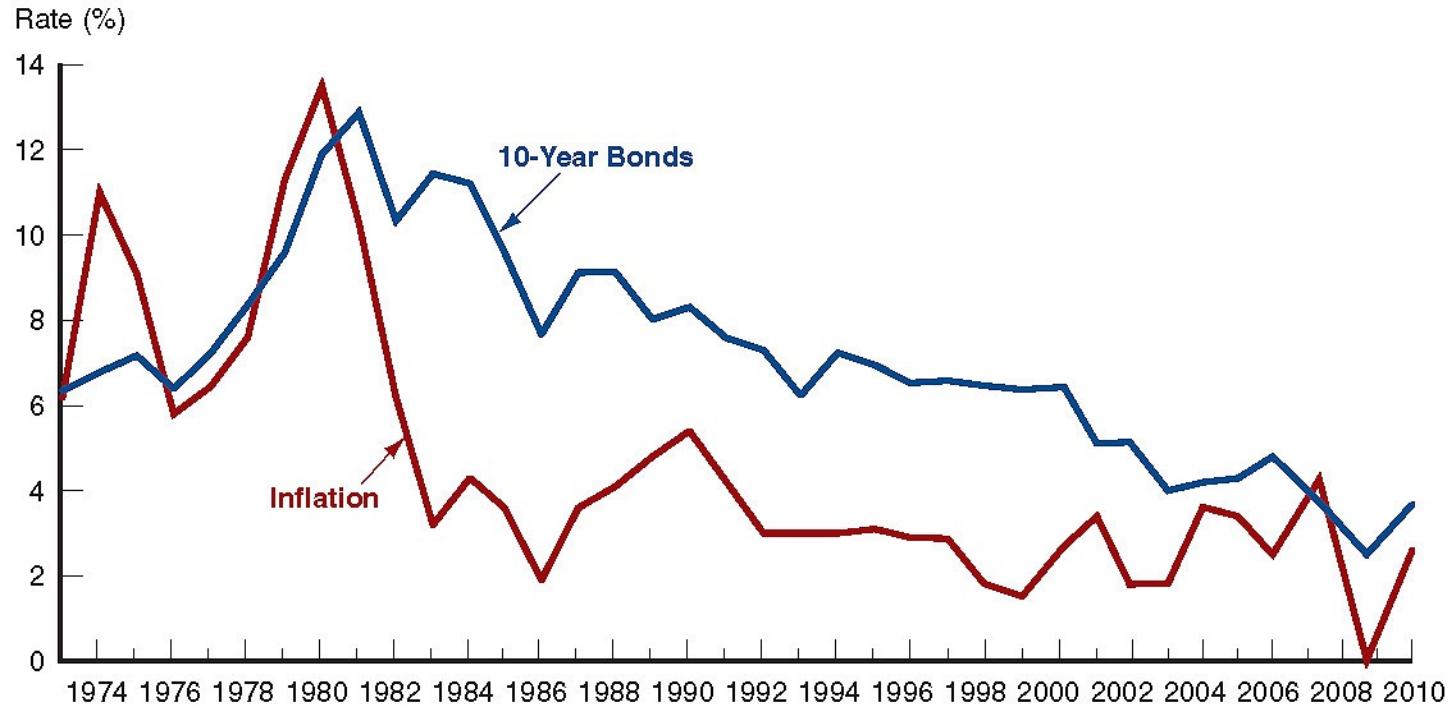


FIGURE 12.2 Interest Rate on Treasury Bonds and the Inflation Rate, 1973–2010
(January of each year)

Sources: <http://www.federalreserve.gov/releases> and <ftp://ftp.bls.gov/pub/special.requests/cpi/cpiai.txt>

Treasury Bond Interest Rates: Bill vs. Bond

1. In most years, the rate of the treasury bill is below that on the 20-year bond.
2. Short-term rates are more volatile than long-term rates.

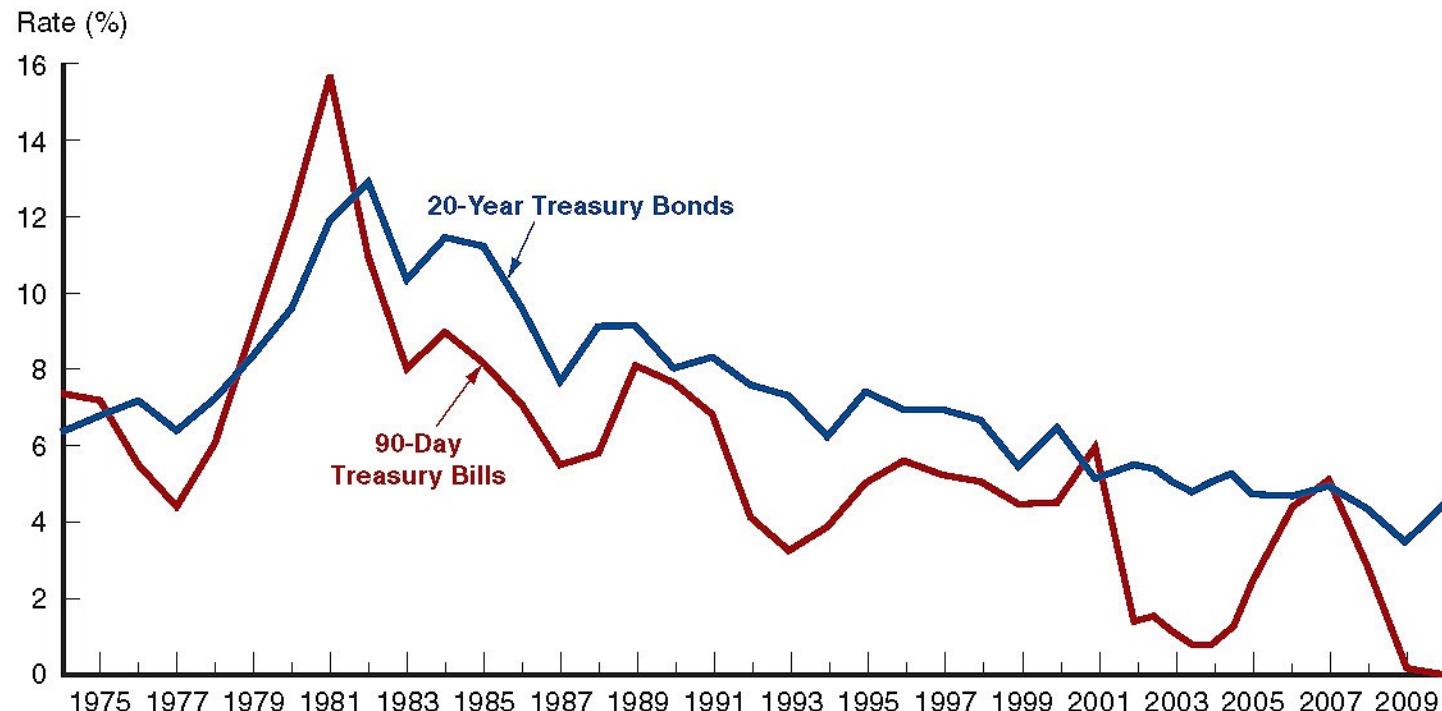
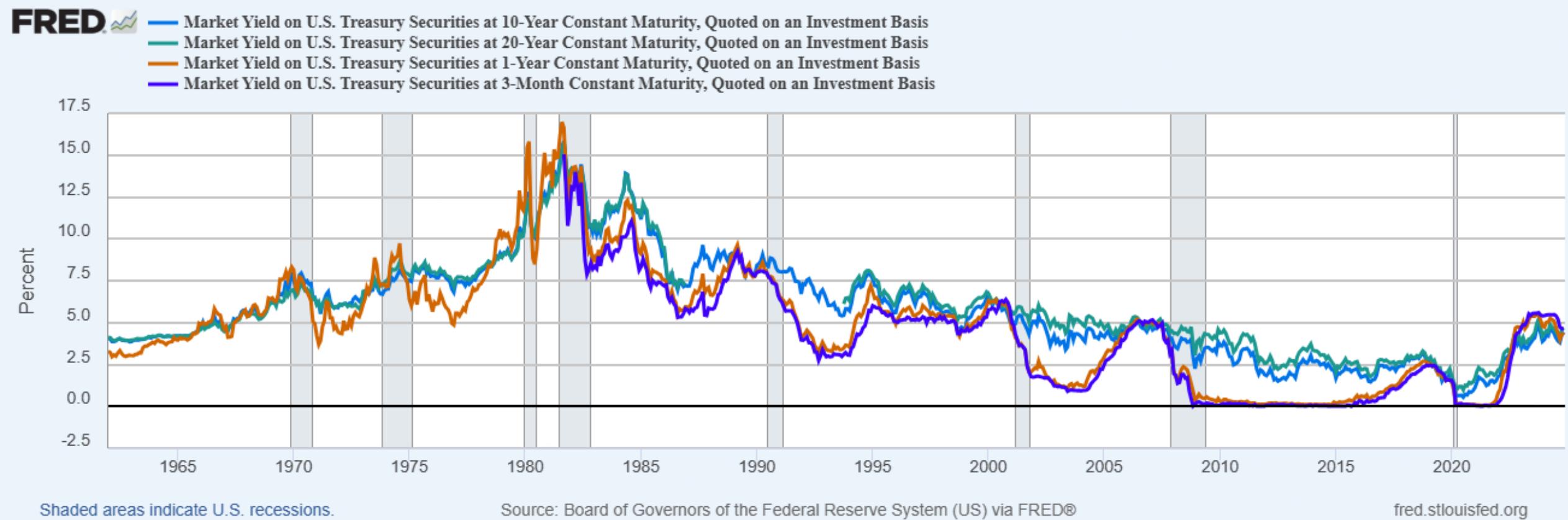


FIGURE 12.3 Interest Rate on Treasury Bills and Treasury Bonds, 1974–2010
(January of each year)

Source: <http://www.federalreserve.gov/releases>

Treasury Bond Interest Rates: Bill vs. Bond



Treasury Bonds: Recent Innovation

- Treasury Inflation-Protected Securities (TIPS)
 - The interest rate does not change throughout the term of the security
 - However, the principal amount is tied to the current rate of inflation to protect investor purchasing power
 - At maturity, the securities are redeemed at: MAX {inflation-adjusted principal, par amount at original issue}
- Treasury STRIPS
 - STRIPS: Separate Trading of Registered Interest and Principal Securities
 - The coupon and principal payments are “stripped” from a T-Bond and sold as individual zero-coupon bonds.

Treasury Bonds: Agency Bonds

- Although not technically Treasury securities, agency bonds are issued by government-sponsored enterprises (GSE), such as FNMA, and FHLMC
- The debt has an “implicit” guarantee that the U.S. government will not let the debt default. This “guarantee” was clear during the 2008 bailout...
- Let us take a look at the following case to see what is the problem with GSEs.

The 2007–2009 Financial Crisis: Bailout of Fannie and Freddie

- Both Fannie and Freddie managed their political situation effectively, allowing them to engage in risky activities, despite concerns raised.
- By 2008, the two had purchased or guaranteed over \$5 trillion in mortgages or mortgage-backed securities.
- Part of this growth was driven by their Congressional mission to support affordable housing. They did this by purchasing subprime and Alt-A mortgages.
- As these mortgages defaults, large losses mounted for both agencies. The final outcome remains unknown.

Municipal Bonds

- Issued by local, county, and state governments, used to finance public interest projects
- Two types of municipal bonds:
 - **General obligation bonds:** the issuer promises to use every resource available to repay the bond as promised.
 - **Revenue bonds:** backed by the cash flow of a particular revenue-generating project.
- We should compare tax-free municipal interest rate with:
$$\text{taxable interest rate} \times (1 - \text{marginal tax rate})$$

Municipal Bonds: Example

Suppose the rate on a corporate bond is 9% and the rate on a municipal bond is 6.75%. Your marginal tax rate is 28%. Which should you choose?

Find the equivalent tax-free rate (ETFR):

$$\text{ETFR} = 9\% \times (1 - \text{MTR}) = 9\% \times (1 - 0.28) = 6.48\% < 6.75\%$$

So, we should choose the municipal bond.

Municipal Bonds: Quiz

Question:

Suppose the rate on a corporate bond is 9% and the rate on a municipal bond is 6.75%. Which should you choose?

Hint:

Tax-free municipal interest rate = taxable interest rate \times (1 – marginal tax rate)

Municipal Bonds: Quiz

Solution:

Find the marginal tax rate:

$$6.75\% = 9\% \times (1 - \text{MTR}), \text{ or } \text{MTR} = 25\%$$

If you are in a marginal tax rate above 25%, the municipal bond offers a higher after-tax cash flow.

Municipal Bonds: Comparing Revenue and General Obligation Bonds

This figure shows the volume of general obligation bonds and revenue bonds issued from 1984 through 2009.

Note that general obligation bonds represent a higher percentage in the latter part of the sample.

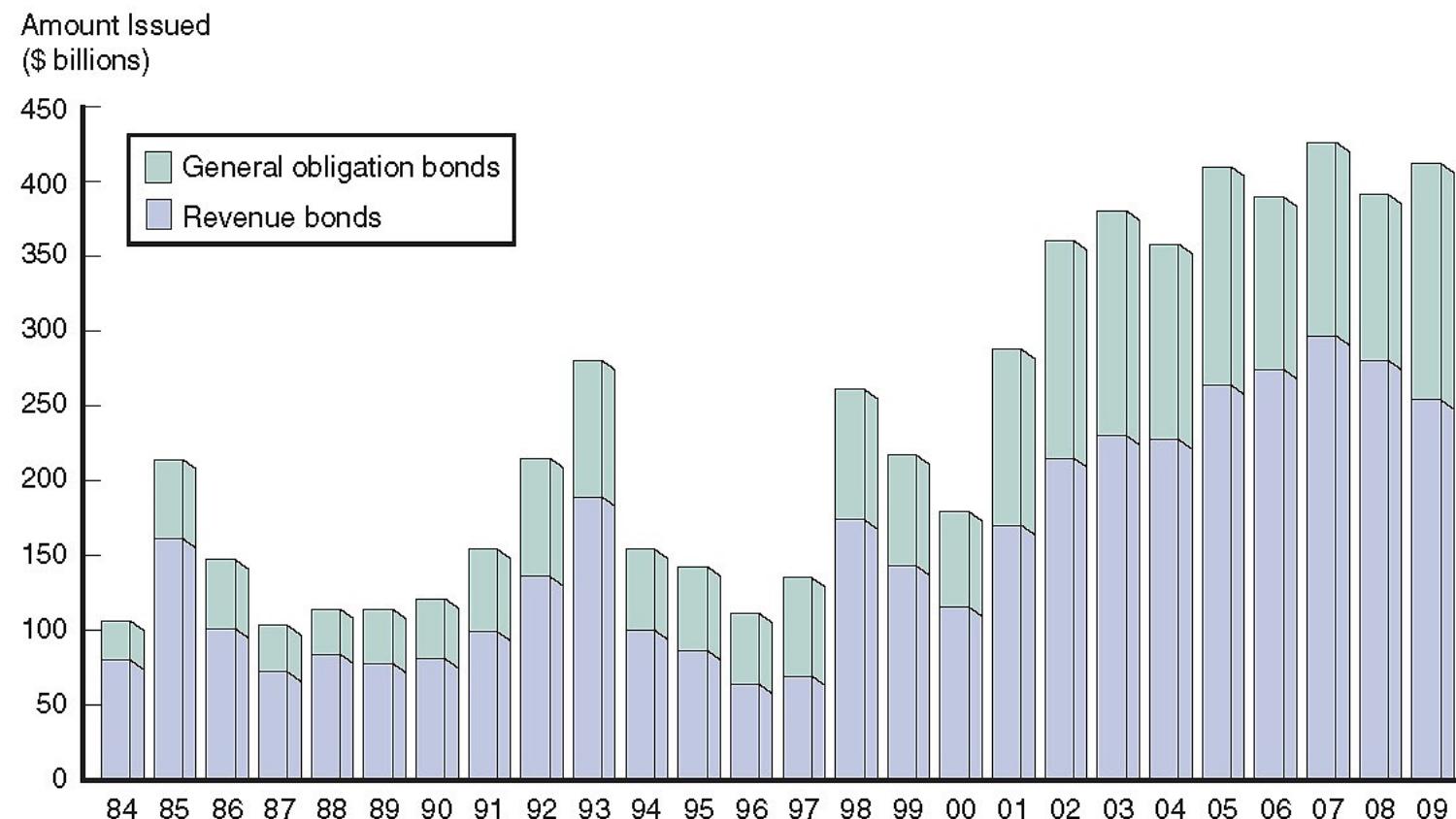


FIGURE 12.4 Issuance of Revenue and General Obligation Bonds, 1984–2009
(End of year)

Source: <http://www.federalreserve.gov/econresdata/releases/govsecure/current.htm> table 1.45 line 2,3

Corporate Bonds

- Used by large corporations to borrow funds for long periods of time.
- Typically have a face value of \$1,000, although some have a face value of \$5,000 or \$10,000. Pay interest semi-annually.
- Cannot be redeemed anytime the issuer wishes, unless a specific clause states this (call option).
- Degree of risk varies with each bond, even from the same issuer. Following suite, the required interest rate varies with level of risk.
- **Bond Indenture:** a contract that states the lender's rights and privileges and the borrower's obligations.

Corporate Bonds: Interest Rates

The figure shows the interest rate on various bonds from 1973–2009.

The degree of risk ranges from low-risk (AAA) to higher risk (BBB). Any bonds rated below BBB are considered sub-investment grade debt.

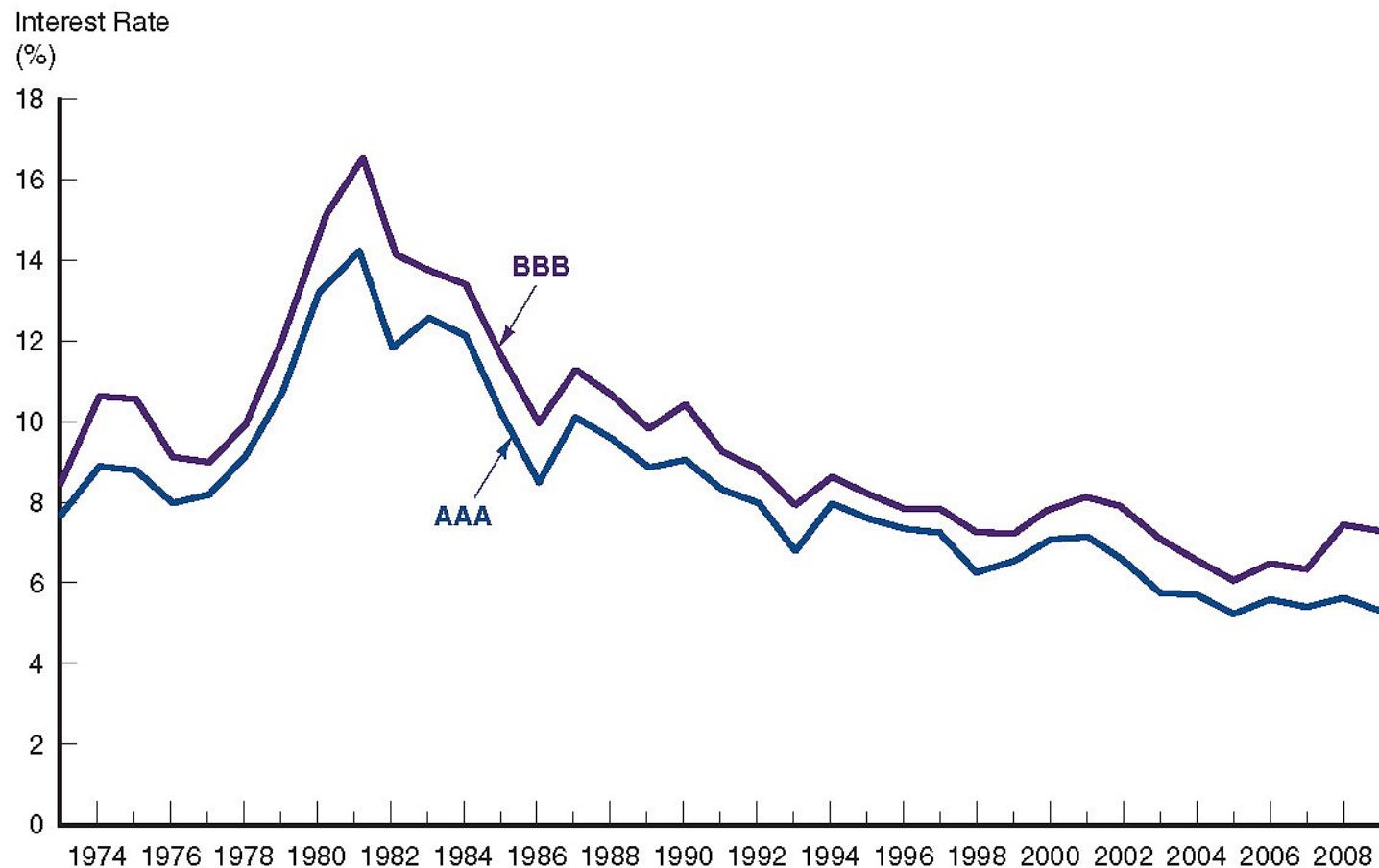


FIGURE 12.5 Corporate Bond Interest Rates, 1973–2009 (End of year)

Corporate Bonds: Characteristics of Corporate Bonds

- Registered Bonds
 - Replaced “bearer” bonds
 - IRS can track interest income this way
- Restrictive Covenants
 - Included in the bond indenture
 - Mitigates conflicts with shareholder interests
 - May limit dividends, new debt, ratios, etc.
 - Typically, the interest rate is lower the more restrictions are placed through these covenants.

Corporate Bonds: Characteristics of Corporate Bonds

- Call Provisions: gives the issuers the right to force the holder to sell the bond back
- Why does call provisions exist?
 - Reason 1: interest rate fall enough and the bond price rise above the call price, firm will call the bond
 - Reason 2: mechanism to adhere to a sinking fund provision
 - Reason 3: firms want to retire a bond issue to meet the interest of the stockholders
 - Reason 4: alter capital structure

Corporate Bonds: Characteristics of Corporate Bonds

- Conversion
 - Some debt may be converted to equity
 - Similar to a stock option, but usually more limited
 - Issuing convertible bonds is one way firms avoid sending a negative signal to the market

Corporate Bonds: Types of Corporate Bonds

- **Secured Bonds:** bonds with collateral attached
 - Mortgage bonds
 - Equipment trust certificates
- **Unsecured Bonds:** bonds backed only by the general creditworthiness of the issuers.
 - Debentures: have lower priority than secured bonds
 - Subordinated debentures: have even lower priority than debantures
- **Variable-rate Bonds:** interest rate on these securities is tied to another market interest rate, such as Treasury bond. These bonds can be secured or unsecured.

Corporate Bonds: Types of Corporate Bonds

- Junk Bonds
 - Debt that is rated below BBB
 - Often, trusts and insurance companies are not permitted to invest in junk debt
 - Michael Milken developed this market in the mid-1980s, although he was subsequently convicted of insider trading

Corporate Bonds: Debt Ratings

This slide explains in further details the rating scale for corporate debt. The rating scale is for Moody's. Both Standard and Poor's and Fitch have similar debt rating scales.

TABLE 12.2 Debt Ratings

| Standard and Poor's | Moody's | Average Default Rate (%) [*] | Definition |
|------------------------|---------|--|--|
| AAA | Aaa | 0.00 | Best quality and highest rating. Capacity to pay interest and repay principal is extremely strong. Smallest degree of investment risk. |
| AA | Aa | 0.02 | High quality. Very strong capacity to pay interest and repay principal and differs from AAA/Aaa in a small degree. |
| A | A | 0.10 | Strong capacity to pay interest and repay principal. Possess many favorable investment attributes and are considered upper-medium-grade obligations. Somewhat more susceptible to the adverse effects of changes in circumstances and economic conditions. |
| BBB | Baa | 0.15 | Medium-grade obligations. Neither highly protected nor poorly secured. Adequate capacity to pay interest and repay principal. May lack long-term reliability and protective elements to secure interest and principal payments. |
| BB | Ba | 1.21 | Moderate ability to pay interest and repay principal. Have speculative elements and future cannot be considered well assured. Adverse business, economic, and financial conditions could lead to inability to meet financial obligations. |
| B | B | 6.53 | Lack characteristics of desirable investment. Assurance of interest and principal payments over long period of time may be small. Adverse conditions likely to impair ability to meet financial obligations. |

Corporate Bonds: Debt Ratings

| | | | |
|------------|-----|-------|---|
| CCC | Caa | 24.73 | Poor standing. Identifiable vulnerability to default and dependent on favorable business, economic, and financial conditions to meet timely payment of interest and repayment of principal. |
| CC | Ca | 24.73 | Represent obligations that are speculative to a high degree. Issues often default and have other marked shortcomings. |
| C | C | 24.73 | Lowest-rated class of bonds. Have extremely poor prospects of attaining any real investment standard. May be used to cover a situation where bankruptcy petition has been filed, but debt service payments are continued. |
| CI | | | Reserved for income bonds on which no interest is being paid. |
| D | | | Payment default. |
| NR | | | No public rating has been requested. |
| (+) or (-) | | | Ratings from AA to CCC may be modified by the addition of a plus or minus sign to show relative standing within the major rating categories. |

*Average default rates are for data Moody's computed for defaults within one year of having given the rating for the period 1970–2001.

Source: *Federal Reserve Bulletin*.

Financial Guarantees for Bonds

- Some debt issuers purchase *financial guarantees* to lower the risk of their debt.
- The guarantee provides for timely payment of interest and principal, and are usually backed by large insurance companies.
- Essentially, the credit rating of the insurer is substituted for the credit rating of the issuer.

Financial Guarantees for Bonds

- As it turns out, not all guarantees actually make sense!
 - In 1995, JPMorgan created the credit default swap (CDS), a type of insurance on bonds.
 - In 2000, Congress removed CDSs from any oversight.
 - By 2008, the CDS market was over \$62 trillion!
 - 2008 losses on mortgages lead to huge payouts on this insurance (e.g. AIG).
- What is CDS?

Say you decide to buy a TESLA bond and want to insure yourself against any losses that might occur should TESLA have problems. You can buy a CDS from a variety of sources that would provide this protection.

Bond Yield Calculations

- Bond yields are quoted using a variety of conventions, depending on both the type of issue and the market.
- We will examine the current yield calculation that is commonly used for long-term debt.
- **Current Yield** is defined as the yearly coupon payment divided by the price of the security:

$$i_c = \frac{C}{P}$$

where i_c = current yield, P = price of the coupon bond, C = yearly coupon payment

Recall: Yield to Maturity

Yield to maturity: the interest rate that equates the present value of cash flow payments received from a debt instrument with its value today

A **fixed-payment loan** has the same cash flow payment every period throughout the life of the loan. The yield to maturity in a fixed-payment loan is:

$$LV = \frac{FP}{1 + i} + \frac{FP}{(1 + i)^2} + \cdots + \frac{FP}{(1 + i)^n}$$

Where

LV = loan value

FP = fixed yearly payment

n = number of years until maturity

i = yield to maturity

Recall: Yield to Maturity on a Perpetuity

Perpetuity or Consol: a perpetual coupon bond with no maturity and on repayment of principal that makes fixed coupon payment of \$C forever.

The price of a perpetuity is easy to calculate (why?):

$$P_c = \frac{C}{i_c}$$

Where

P_c = price of the perpetuity

C = yearly payment

i_c = yield of maturity

Bond Current Yield Calculation: QUIZ

What is the current yield for a bond with a face value of \$1,000, a current price of \$921.01, and a coupon rate of 10.95%?

Bond Current Yield Calculation: QUIZ

What is the current yield for a bond with a face value of \$1,000, a current price of \$921.01, and a coupon rate of 10.95%?

Answer:

$$i_c = C / P = \$109.50 / \$921.01 = 11.89\%$$

Note: C (coupon) = $10.95\% \times \$1,000 = \109.50

Bond Current Yield vs. Yield to Maturity

- Yield to Maturity

The interest rate that equates the present value of cash flows received from a debt instrument with its value today.

- For a perpetuity, the current yield equals the yield to maturity.
- When the bond price is at par, the current yield equals the yield to maturity.
- The current yield and the yield to maturity always move together.

Some math won't hurt....

- The current yield better approximates the yield to maturity when the bond's price is nearer to the bond's par value
- The current yield better approximates the yield to maturity when the maturity of the bond is long

$$P = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \cdots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

$$i_c = \frac{C}{P}$$

Bond Current Yield vs. Yield to Maturity

- This approximation becomes worse when the bond's price is further from the bond's par value and the bond's maturity is shorter.
- Regardless of whether the current yield is a good approximation of the yield to maturity, a change in the current yield always signals a change in the same direction of the yield to maturity.

Finding the Value of Coupon Bonds

- Bond pricing is, in theory, no different than pricing any set of known cash flows. Once the cash flows have been identified, they should be discounted to time zero at an appropriate discount rate.
- Bond prices still fluctuate because not everyone agrees about what the future cash flows are going to be.
- The table on the next slide outlines some of the terminology unique to debt, which may be necessary to understand to determine the cash flows.

Finding the Value of Coupon Bonds

TABLE 12.3 Bond Terminology

| | |
|----------------------|---|
| Coupon interest rate | The stated annual interest rate on the bond. It is usually fixed for the life of the bond. |
| Current yield | The coupon interest payment divided by the current market price of the bond. |
| Face amount | The maturity value of the bond. The holder of the bond will receive the face amount from the issuer when the bond matures. <i>Face amount</i> is synonymous with <i>par value</i> . |
| Indenture | The contract that accompanies a bond and specifies the terms of the loan agreement. It includes management restrictions, called covenants. |
| Market rate | The interest rate currently in effect in the market for securities of like risk and maturity. The market rate is used to value bonds. |
| Maturity | The number of years or periods until the bond matures and the holder is paid the face amount. |
| Par value | The same as <i>face amount</i> . |
| Yield to maturity | The yield an investor will earn if the bond is purchased at the current market price and held until maturity. |

Finding the Value of Coupon Bonds

Let's use a simple example to illustrate the bond pricing idea.

What is the price of two-year, 10% coupon bond (semi-annual coupon payments) with a face value of \$1,000 and a required rate of 12%?

$$P = \frac{\frac{C}{2}}{1 + \frac{i}{2}} + \frac{\frac{C}{2}}{(1 + \frac{i}{2})^2} + \frac{\frac{C}{2}}{(1 + \frac{i}{2})^3} + \dots + \frac{\frac{C}{2}}{(1 + \frac{i}{2})^{2n}} + \frac{F}{(1 + \frac{i}{2})^{2n}}$$

Finding the Value of Coupon Bonds

Solution:

1. Identify the cash flows:

- \$50 is received every six months in interest
- \$1000 is received in two years as principal repayment

2. Find the present value of the cash flows (calculator solution):

- $N = 4$, $FV = 1000$, $PMT = 50$, $I = 6$
- Computer the PV. $PV = 965.35$

Investing in Bonds

- Bonds are the most popular alternative to stocks for long-term investing.
- Even though the bonds of a corporation are less risky than its equity, investors still have risk: *interest rate risk*, which is covered in chapter 3 in textbook *Financial Markets and Institutions*, or chapter 4 in textbook *The Economics of Money, Banking, and Financial Markets*.
- Do you still remember the definition of interest rate risk?

Note: don't confuse **Yield to Maturity** with **Market Rate**.

Investing in Bonds

The figure shows the amount of bonds and stock issued from 1983 to 2009.

Note how much larger the market for new debt is. Even in the late 1990s, which were boom years for new equity issuances, new debt issuances still outpaced equity by over 5:1.

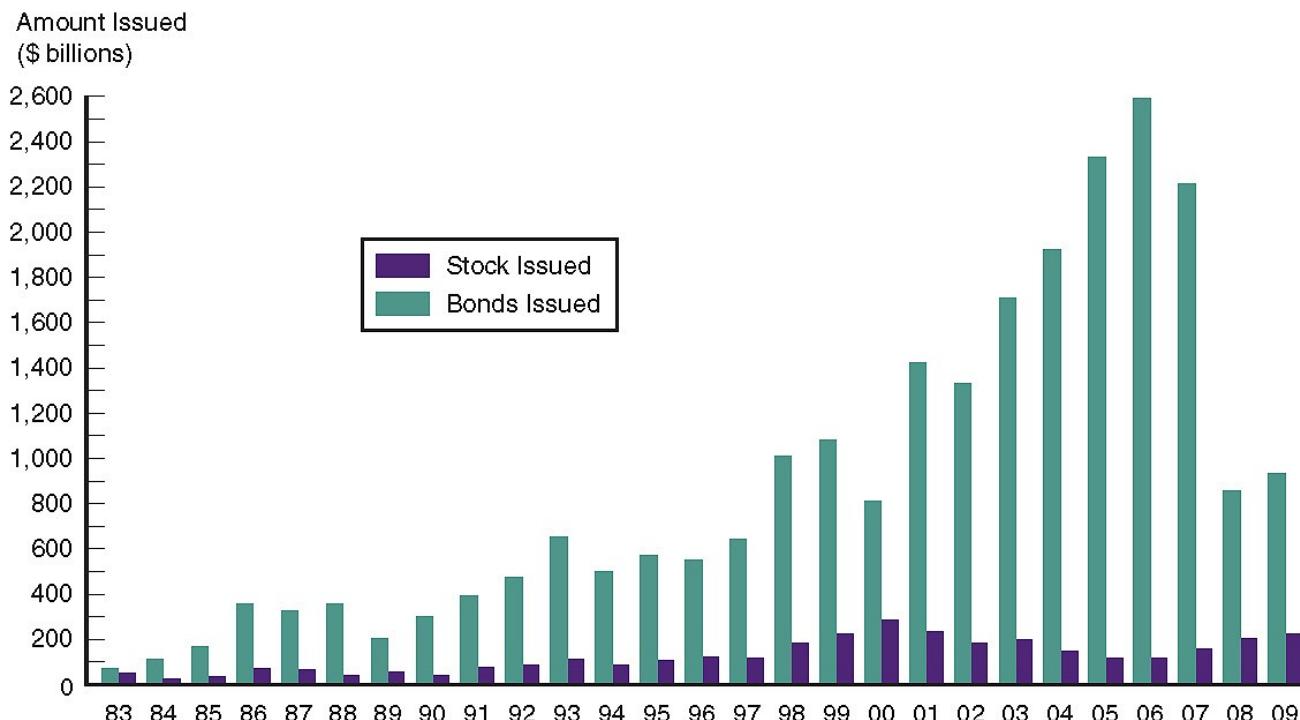


FIGURE 12.6 Bonds and Stocks Issued, 1983–2009

Source: <http://www.federalreserve.gov/econresdata/releases/corpsecure/current.htm> table 1.46 lines 2,8

Chapter Summary

- Purpose of the Capital Market: provide financing for long-term capital assets
- Capital Market Participants: governments and corporations issue bond, and we buy them
- Capital Market Trading: primary and secondary markets exist for most securities of governments and corporations
- Types of Bonds: includes Treasury, municipal, and corporate bonds
- Treasury Notes and Bonds: issued and backed by the full faith and credit of the U.S. Federal government
- Municipal Bonds: issued by state and local governments, tax-exempt, defaultable.

Chapter Summary

- Corporate Bonds: issued by corporations and have a wide range of features and risk
- Financial Guarantees for Bonds: bond “insurance” should the issuer default
- Bond Current Yield Calculation: how to calculate the current yield for a bond
- Finding the Value of Coupon Bonds: determining the cash flows and discounting back to the present at an appropriate discount rate
- Investing in Bonds: most popular alternative to investing in the stock market for long-term investments

Acknowledgment

Slides here are adopted from the official slides published by Pearson Education Ltd