



# **Introduction to Global Securities Market**

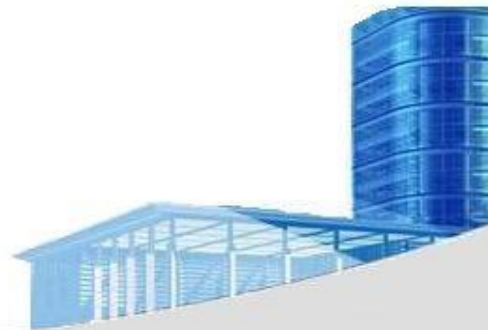
## **国际证券市场简介**

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# Learning Objectives

- **Through this course the students will understand the fundamental concepts about Fixed Income Securities, Fixed Income Market and Trading flow. It will also help the students to learn how the Fixed Income market works in real world through examples and discussion.**





## 推荐教材或主要参考书

1.

Name: 债券市场 分析和策略

Author: **Frank J.Fabozzi**

Publisher: 北京大学出版社

Language: **English**

Date: **2006-1**

ISBN: **7-301-09657-7**

2.

Name: 固定收入证券市场及其衍生产品

Author: Suresh M. Sundaresan

Publisher: 北京大学出版社

Language: **English**

Date:

ISBN: **7-301-05963-9**





# The useful websites

> [Http://www.bondmarkets.com](http://www.bondmarkets.com)

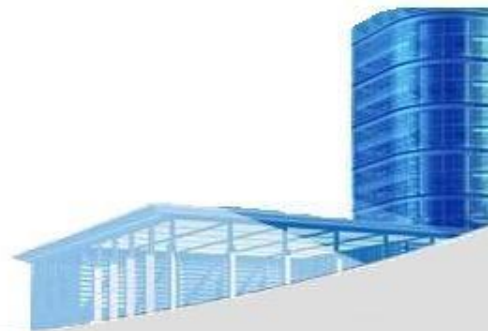
- The Bond Market Association website contains very useful data concerning fixed-income markets, research reports, market practices, and regulator developments.

> [Http://www.bloomberg.com](http://www.bloomberg.com)

- Excellent websites for financial news, fixed income data including yield curve, stock quotes, and interest rates.

> [Http://www.chinabond.com.cn](http://www.chinabond.com.cn)

- China bond market website contain lots of China treasury bond, and corporate bond market data, research reports and regulator information.





# Agenda

## **Fixed Income Overview**

- 1. Fixed Income Concept and Key Terminologies**
- 2. Fixed Income Securities**

## **Fixed Income Market**

- 3. Fixed Income Market Type and Characters**
- 4. U.S. and China Fixed Income Market**

## **Fixed Income Basic Pricing**

- 5. Fixed Income Basic Pricing**
- 6. Measure of Bond Price Volatility**

## **Fixed Income Trading**

- 7. Fixed Income Trading Process**
- 8. U.S. Fixed Income Trading**





# Fixed Income Overview





# Basic Characteristics of Bonds

## > Bond Parties

- The Issuer Who Is Borrowing Money
- The Investors Who Lend the Money
- A contract between an issuer and an investor

## > Maturity Date

- Is the day on which the issuer must pay the principal (face amount) of the bond to the investor
- The investor will also receive his last semiannual interest payment at this time
- Maturities typically vary from 10 years to as long as 100 years

## > Par Value

- Is the amount that the issuer agrees to pay the investor when the bond matures; also called the Principal or Face Amount
- Is Easily Traded in the Bond Market





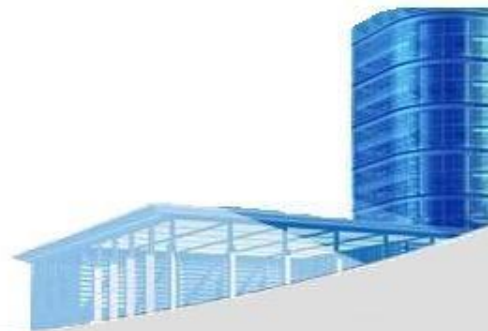
# Basic Characteristics of Bonds

## > Prices

- The price of a bond is usually stated as a percentage of its par value. For example, a bond with a price of 100 is selling for 100% of its par value or \$1,000
- A bond with a price of 90 is selling at a discount equal to 90% of par value or \$900 (90% X \$1,000)
- A bond with a price of 110 is selling at a premium equivalent to 110% of its par value or \$1,100 (110% X \$1,000)

## > Coupon Rate (息票利率)

- Until the bond matures, the issuer agrees to pay the investor a stated amount of interest called the coupon rate (nominal yield)
- Set at the time the bond is issued and remains fixed for the life of the bond
- Stated interest rate multiplied by the bond's par value: 10% bond; \$100 (10% X \$1,000)
- **Bonds usually pay interest semiannually unless specified otherwise**







# Overview of Bond Features

- > **Type of Issues** – federal government, agencies, municipal government, and corporations.
- > **Par Value** – also know as “face value” which is the value return to the investor when the bond matures.
  - bonds often trade above or below par. Buying below par is a discount, above par is premium.
- > **Coupon rate** – Interest rate that the bond issuer promises to pay to the bondholder.
  - Fixed coupon bond
  - Zero-coupon bond – makes zero coupon payments; investors receive par value at the maturity date, but receive no interest payments until then; typically issued at prices considerably below par value
  - Floating-rate bonds (reference rate + quoted margin) : 3 month Libor + 20 Basic Points
- > **Term to Maturity** – Due date of the bond for repayment.
  - Short term: bond with a maturity of between one and five years.
  - Intermediate term: bond with a maturity between five and 12 years.
  - Long term: bond with a maturity more than 12 years.





# Overview of Bond Features

- > **Amortization (分期偿还) Feature** – The principal repayment of a bond issue can call for the principal repaid over the life of the bond.
  - Amortization Schedule: automobile loan and home mortgage loan.
- > **Embedded Options (嵌入式选择权)**
  - Call provision – the issuer has right to retire the debt, fully or partially, before maturity.
  - Put provision – the bondholder has the right to sell the issue back to the issuer at par value on designated dates.
  - Convertible bond – the bondholder has right to exchange the bond for a specified number of shares of common stock.
  - Exchangeable bond – bondholder to exchange the issue for a specified number of common stock shares of a corporate different from the issuer of bond.





# Example

- > Use the following information to answer questions 1-3.
- > An investor purchased an 8% bond which matures in 10 years at 95.
- > 1. How much did the investor pay for this bond?
  - \$9.95
  - \$95
  - \$950
  - \$9,500
- > 2. This bond was purchased at a:
  - Discount
  - Premium
- > 3. How much will the investor receive when the bond mature?
  - \$800
  - \$950
  - \$1,040
  - \$1,080





# Example

- > **A zero-coupon bond would be an appropriate investment for which of the following investors?**
  - A retired person who needs regular income to supplement social security
  - Someone who needs a lump sum in 10 years to pay off the balloon mortgage on his house





# Calculating Returns on Fixed-Income Securities

## > There are four ways to represent a bond's yield:

- Nominal yield (the stated, fixed coupon)
- Current yield
- Yield to maturity
- Yield to call

## > Nominal Yield

- is the stated rate of interest that the issuer promises to pay the bondholder
- Fixed at issuance and will not change

## > Current Yield

- Measures the interest that the investor receives from the bond compared to its current market price
- $\text{Current Yield} = \text{Annual Interest Payment} / \text{Current Market Price}$





# Calculating Returns on Fixed-Income Securities

## > Yield to Maturity

- Measures the investor's total overall return
- Most widely quoted type of yield for bonds
- Represents the overall rate of return if the bond is purchased at today's market price and held to maturity date and assumes the reinvestment and compounding of interest

## > Yield to Call

- Takes into account a bond's cash flow through its first call date
- It is calculated the same way as yield to maturity, except that it reflects the bond's interest payments until is called, rather than when it matures





## Relation between coupon, yield and price

- > Coupon rate  $<$  required yield  $\rightarrow$  price  $<$  par (discount bond)
  - > Coupon rate = required yield  $\rightarrow$  price = par
  - > Coupon rate  $>$  required yield  $\rightarrow$  price  $>$  par (premium bond)
- 
- > Premium Bond
  - > Coupon Rate  $>$  Current Yield  $>$  Yield to Maturity
- 
- > Discount Bond
  - > Coupon Rate  $<$  Current Yield  $<$  Yield to Maturity





# Calculating Returns on Fixed-Income Securities

- > Use the following information to answer questions 1 through 3.
- > 1. An investor purchased an 8% Lemon Country Bond at 80.
- > What is the bond's nominal yield?
  - 6%
  - 8%
  - 9%
  - 10%
- > 2. What is the bond's current yield?
  - 6%
  - 8%
  - 9%
  - 10%
- > 3. The yield to maturity will be:
  - The same as the nominal and current yield
  - Greater than the current yield
  - Less than the current yield
  - Less than both the current and nominal yields







# Risks Associated with Bonds

- > Interest Rate Risk
- > Reinvestment Risk
- > Call Risk
- > Credit Risk
- > Inflation Risk
- > Exchange-Rate Risk
- > Liquidity Risk
- > Volatility Risk





# Risks Associated with Bonds

- > Interest risk is the risk that a bond's market price will decrease if interest rates increase.
- > Long-term bonds are more vulnerable to interest-rate risk than short-term bonds.
- > For a bond selling at a discount, the nominal yield (coupon) is less than the current yield, which is less than the yield to maturity
- > For a bond selling at a premium, the nominal yield (coupon) is more than the current yield, which is more than the yield to maturity
  
- > Which of the following securities is likely to decrease the most in price if interest rates rise?
  - A bond maturing in 2 years
  - A bond maturing in 15 years





# Risks Associated with Bonds

- > **As interest rates increase, the value of existing bonds decreases; vice versa, as interests decrease, the value of existing bonds increases.**
  
- > **An investor recently invested \$100,000 in bonds. What will happen to the value of his portfolio if interest rates increase?**
  - It will decrease
  - It will remain the same
  - It will increase
  - It cannot be determined from the information given





# Credit Risk

- > **Credit risk is a major risk in purchasing fixed-income securities**
- > **It is the risk that the issuer may default and may not be able to meet its obligations to pay interest and principal to the bondholders**





# U.S. Treasury Securities

- > Issued by the U.S. Department of the Treasury and are backed by the full faith and credit of the U.S. government. Market participants view them as having no credit risk.
- > Interest rates on Treasury securities are benchmark interest rates throughout the U.S. economy.
- > Two factors : volume and liquidity.
- > **Types of Treasury Securities**
  - Fixed-principal securities: Treasury bills, Treasury notes and Treasury bonds.
  - Inflation-Indexed securities, also Treasury inflation protection securities (TIPS)
- > **Stripped Treasury Securities**
  - STRIPS (Separate Trading Registered Interest and Principal Securities) program.
  - The zero-coupon Treasury securities created under the STRIPS program.





# U.S. Treasury Securities

- > Treasury STRIPS do not pay interest periodically
- > T-bonds mature in more than 10 years, carrying high interest-rate risk
- > Jessica just received an inheritance from her Uncle Sam. She plans to use the money for a down payment on a house in six months, but she wants to earn some interest on the money in the meantime. Which of the following investments would be suitable for her?
  - Treasury bills
  - Treasury STRIPS
  - Treasury bonds
  - Common stocks





# U.S. Treasury Securities

- > Interest paid on U.S. Treasury securities is taxable at the federal level, but exempt from state and local income taxes
- > Treasury notes have initial maturities ranging from two to ten years
- > Treasury bonds are issued with maturities of more than 10 years
- > Price Quote
  - As a percentage of their par value, in increments of 1/32nds of par
  - Example, if a US government bond is quoted at 97.08, its price is equivalent to 97 8/32 (97.25% of \$1,000 par value) or \$972.50

Note: Other bonds (e.g. corporate bonds) are quoted in increments of 1/8<sup>th</sup>.





# U.S. Treasury Securities

## > Price Quote

- > A U.S. government bond is selling in the market at 98.08. The dollar value of this bond is:
- \$980.25
  - \$980.80
  - \$982.50
  - \$9,808.00







# U.S. Treasury Securities

- > **Considered the safest type of fixed-income investment, suitable for the most conservative investors**
- > **The Treasury currently sells T-bills that mature in 4-week, 13-week, 26-week and 52-week maturities**
- > **It does not sell T-bills that mature in 2 years**
  
- > **All the following characteristics are true of Treasury bills EXCEPT:**
  - They are sold at a discount from their face value
  - Investors can purchase T-Bills that mature in two years
  - T-Bills are negotiable securities that trade in the secondary market
  - They are direct obligations of the U.S. Treasury





# Treasury Inflation Protection Securities

- > Inflation adjusted principal, for example:
- > A TIPS, coupon rate is 3.5%, annual inflation is 3%. An investor purchases on Jan 1 \$100,000 par value of this issue.
- > The semiannual inflation rate is 1.5%.
- > The inflation-adjusted principal at the end of the first six-month period is
- >  $\$100,000 * (1 + 1.5\%) = \$101,500$ .
- > The coupon payment is  $101,500 * 1.75\% = \$1,776.25$
- > An inflation-adjusted principal is defined in terms of the ratio of the reference CPI.





# Corporate Securities

## > **Corporate Bond Instruments:**

- Corporate bond
- Medium-term notes
- Commercial paper
- Asset-backed securities

## > **Corporate Bond**

- Investment Grade
- High-Yield Debt.





# Types of Corporate Bonds

- > Secured
  - **Mortgage Bonds:** secured by a first or second mortgage on real property, giving the bondholders a lien on the property
  - **Equipment Trust Certificates:** secured by a specific piece of equipment that is owned by the company and used in its business; usually issued by transportation companies (railroads, airlines, and shipping companies) to finance new pieces of equipment
  - **Collateral Trust Bonds:** secured by third-party securities owned by the issuer; these securities are placed in escrow as collateral for the bonds
- > All debt issued by a corporation is backed by the full faith and credit of the issuer
- > Secured bonds are additionally backed by specific corporate **assets**





# Corporate Bonds

- > Price Quote
- > Quoted in the market at a dollar price (percentage of par), in points and eights of a point
- > For example, a corporation bond is offered at 94 5/8. What is the cost for each \$1,000 bond?

$$5/8 = 0.625$$

$$94 \frac{5}{8} \rightarrow 94.625 \rightarrow 94.625\%$$

$$94.625\% \times \$1,000 = \$946.25$$





# Types of Corporate Bonds

- > Unsecured
  - Secured only by the corporation's good faith and credit
  - These unsecured securities are called notes and debentures
  
- > **Debentures are:**
  - Unsecured corporate bonds
  - Municipal bonds
  - Mortgage bonds
  - High-yield bonds





# Convertible Bonds

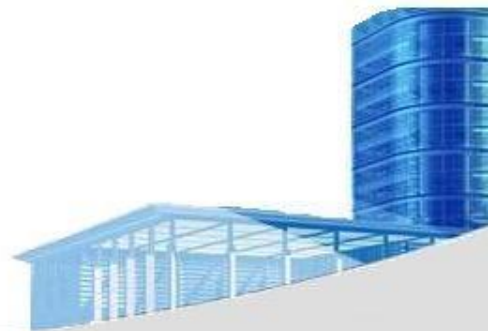
- > Allow the investor to convert the bonds into shares of the company's common stocks, at a predetermined ratio
- > The conversion price is set at the time the bond is issued
- > Conversion Ratio = Par Value of Bond/Conversion Price
- > Example, if ABC Company issues 10% convertible subordinated debentured with a conversion price of \$40, the conversion)
  
- > **Convertible bonds can be converted into:**
  - Subordinated debentures
  - Common stock
  - Equipment trust certificates
  - Warrants





# Convertible Bonds

- > **XYZ convertible debentures are convertible into 20 shares of XYZ Corporation common stock. If the bonds were selling in the market at \$980, what would the common stock have to be selling at to be at parity?**
- \$20
  - \$45
  - \$49
  - \$50







# Convertible Bonds

## > Arbitrage

- A technique that involves profiting from price differentials in the same or similar security
- These are the times when the market price of the convertible bonds does not reflect the value of the common stock that would be received if the bond were converted into stock

## > A technique used to profit from price differentials in the same security is known as:

- Arbitrage
- Dilution
- Forced conversion
- Tender offer





# Retirement Methods

- > **Redemption at Maturity**
- > **Earlier Redemption through a “Call”**
  - Interest Rates Have Declined and Issuer Wants to Refinance
- > **Refunding Funds**
  - Replace an old bond issue with a new one, often at a lower interest cost.
- > **Sinking Funds**
  - a Plan to Retire A Portion of the Outstanding Bonds Each Year
- > **Conversion to Common Stock**
  - Convertible Bonds





# Credit Assessment

- > **Most corporate bonds are given a credit rating by S&P, and Moody and Fitch Rating Service.**
- > **Bonds rated BBB or higher by S&P, Baa or higher by Moody's, are considered investment-grade bonds.**
- > **Bonds rated below these levels are considered to be high yield bonds.**





# Corporate Bond Rating

> Moody's S&P Fitch

Aaa Alaa AAA

Aa1 AA+ AA+

Aa2 AA Alaa

Aa3 AA- AA-

A1 A+ A+

A2 A Alaa

A3 A- A-

Baa1 BBB+ BBB+

Baa2 BBB Alaa

Baa3 BBB- BBB-

Ba1 BB+ BB+

Ba2 BB Alaa

Ba3 BB- BB-

B1 B+ B+

B2 B Alaa

B3 B- B-

Brief Definition

Gilt edge, prime, maximum safety

Very high grade, high quality

Upper medium grade

Lower medium grade





# Corporate Bond Rating

- > Securities that are rated Aaa to Baa or AAA to BBB are called Investment Grade securities and are suitable for most investors
- > Ba or BB and below are considered speculative
- > The lower the rating, the greater the chance of default
- > Bonds that are rated below Baa or BBB are also known as high-yield or junk bonds
  
- > Bonds that are rated BB or below are called:
  - Short-term bonds
  - Zero-coupon bonds
  - High-yield bonds
  - Callable bonds





# Corporate Bond Rating

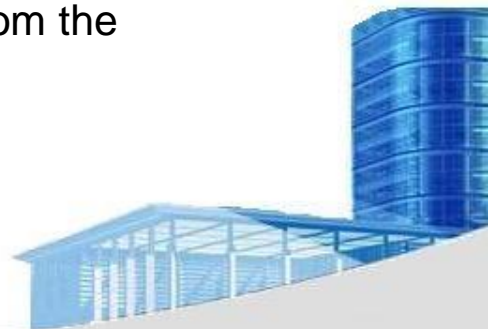
- > Rating organizations are primarily concerned with the risk of default.
- > A high rating indicates a low risk of default
- > Rating organizations are primarily concerned with the risk of:
  - Declining purchasing power
  - Market price fluctuation
  - Default
  - Illiquidity





# Call Provisions

- > **A provision that allows the issuer, at its option, to redeem the bonds before they are due to mature**
- > **The investor receives the principal in full plus any accrued interest; any future interest payments stop**
- > **Call provision usually benefit the issuer, which has the option of calling in the bonds when interest rates decline**
- > **Call Risk**
  - Once called, the bondholders are unlikely to be able to reinvest their money for the same return that they were previously receiving unless they are prepared to increase the level of credit risk
- > **Call Protection**
  - To protect investors, callable bonds often contain a restriction on how soon the call feature can be exercised, typically 5 to 10 years from the date of issue





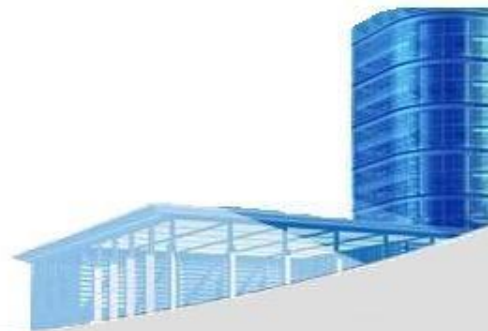
# Call Provisions

## > Call Premium

- For callable bonds, the issuer will usually need to pay the investors more than the par value of the bonds in order to compensate them for the call risk
- This is known as a call premium

## > A bond is purchased that is callable at 105 in five years. How much will the investor receive if the bond is called after five years?

- \$800
- \$950
- \$1,000
- \$1,050







# Call Premium

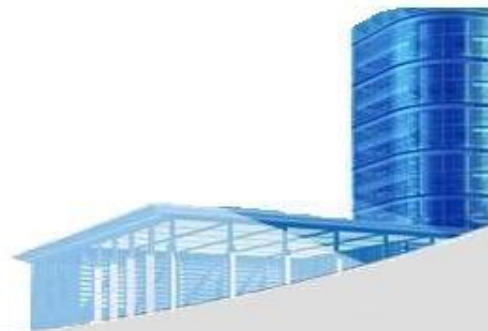
- > **The amount of money that the issuer must pay the owner of the bond when the bond is called**
- > **The amount is above the par value of the bond**
- > **Issuers usually call outstanding bonds when interest rates have dropped and they are able to issue new bonds at lower rates of interest**
  
- > **The call premium of a bond refers to the amount:**
  - An investor must pay to buy a callable bond
  - The issuer must pay to exercise the call privilege
  - The issuer must add to the semiannual interest payments to offset the call feature
  - Added to the price at issuance to compensate for the call privilege





# Agency Securities

- > Debt instruments issued both by federal agencies and by government-sponsored enterprises
- > Not direct obligations of the U.S. government
- > Securities issued by federal agencies are backed by the full faith and credit of the U.S. government (e.g. Government National Mortgage Association)
- > Government-sponsored enterprise securities are NOT backed by the U.S. government. However, their default risk is considered to be minimal
- > Low credit risk





# Agency Securities

- > **Some examples of government-sponsored enterprise are:**
  - Federal Farm Credit Banks (FFCBs)
  - Federal Home Loan Banks (FHLBs)
  - Student Loan Marketing Association (SLMA or Sallie Mae)
  
- > **All the following securities are backed by the U.S. government EXCEPT:**
  - Government National Mortgage Association Certificates
  - Treasury bills
  - Student Loan Marketing Association certificates
  - Treasury bonds





# Municipal Securities

- > **Municipal securities are issued by state and local governments.**
- > **Most municipal bonds outstanding are tax-exempt for interest payments.**
- > **Types and Features of Municipal Securities**
  - General Obligation Bonds is secured by the issuer's unlimited taxing power
  - Revenue Bonds is secured by the revenue of issuers, such as Airport Revenue Bonds, University Revenue Bonds, Hospital Revenue Bonds, Public Power Revenue Bonds.





# Asset-Backed Securities

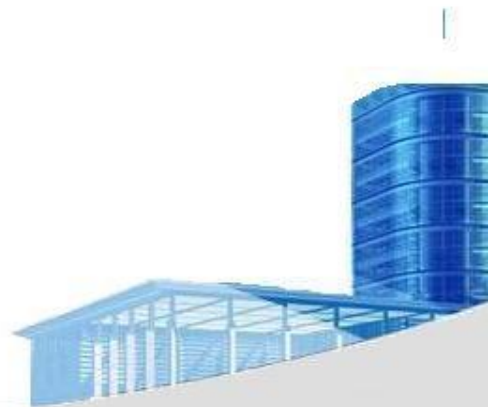
- > **Asset-backed securities (ABS) are bonds or notes collateralized by the cash flows from a specified pool of underlying assets.**
- > **The financial institutions that originate the loans sell a pool of cash-flow-producing assets to a specially created third party that is called a special-purpose vehicle (SPV). The SPV sells the pools loans to a trust, which issues interest-bearing securities that can achieve a credit rating separate from the financial institution that originates the loan.**





# Types of Asset-Backed Securities

- > Home Equity Loans
- > Autos
- > Credit Cards
- > Student Loans
- > Stranded Cost Utilities





# Mortgage Backed Securities

- > **A MBS is an instrument whose cash flow depends on the cash flows of an underlying pool of mortgages such as the purchase of homes or other real estate.**
- > **Three types of MBS:**
  - Mortgage pass-through securities
  - Collateralized Mortgage obligations
  - Stripped mortgage-backed securities
- > **Key Associations**
  - Government National Mortgage Association (GNMA) backed by the National Housing Act 1970 – Ginnie Mac
  - Federal National Mortgage Association (FNMA) - Fannie Mae (房利美)
  - Federal Home Loan Mortgage Corporation (FHLMC) – Freddie Mac (房地美)





# Types of Mortgage-Backed Securities

## > **Pass-through securities**

- The bondholder normally receives some portion of the bond's principal and interest back each month, and may receive additional cash flow from prepayments.

## > **Collateralized Mortgage Obligations (CMOs)**

- Allow for the creation of bonds with a wide range of risk and return characteristics.
- Sequentials
- PACs (Planned Amortization Class)
- TACs (Targeted Amortization Class)

## > **Stripped Mortgage-back securities**



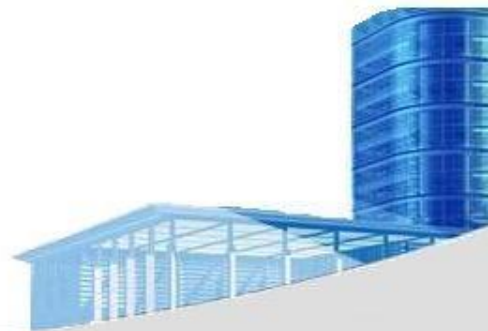




# Types of Mortgage-Backed Securities

## > Pass-through certificates

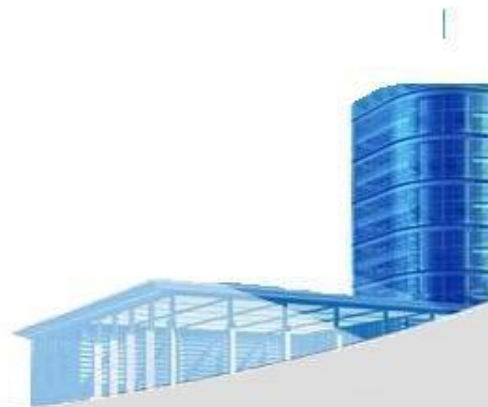
- The most common security issued by government agencies
- To create a pass-through certificate, the agency purchases a pool of mortgages
- Interests in the pool are sold to investors as pass-through certificates
- Each certificate represents an undivided interest in the pool, which entitles the owner to a share in the cash flow generated by the pooled mortgages
- The pass-through payment includes interest and principal
- Fully negotiable
- Investors may sell them to other investors after they are issued





# Types of Mortgage-Backed Securities

- > **Pass-through certificates**
  
- > **Monthly payments from GNMA pass-through certificates represent:**
  - Interest
  - Principal
  - Interest and Principal
  - The performance of the mortgage pool





# Types of Mortgage-Backed Securities

- > **Pass-through certificates**
  - Would provide investors with a monthly income
- > **Treasury STRIPS are a form of zero-coupon bonds that do not pay any income until they mature**
- > **Treasury notes pay interest twice a year**
- > **Common stock do not always pay dividends and, if they do, they are usually paid quarterly**
  
- > **Which of the following securities would you recommend to investors who need monthly income?**
  - Treasury STRIPS
  - GNMA pass-through certificates
  - Treasury notes
  - Common stocks





# Money-Market Securities

- > Short-term debt securities (one year or less)
- > Issuers include the US government, government agencies, banks, and corporations
- > Borrowing and lending periods range from overnight to a few months, but may be as long as one year
- > Examples
  - **Commercial Paper**
  - **Bankers' Acceptances**
  - **Negotiable Certificates of Deposit**
  - **Federal Funds**
  - **Money-Market Funds**
  - **Repurchase Agreements (Repos)**





# Money-Market Securities

- > **Commercial Paper**
  - **For short-term financing, unsecured corporate debt**
  - **Matures in 270 days or less**
  - **Issued at a discount**
  - **Usually issued by corporations with high credit ratings and it's considered very safe**
  - **The minimum denomination is typically \$100,000**
- > **Bankers' Acceptance**
  - **Used to facilitate foreign trade**
  - **Actively traded and are considered quite safe since they are secured both by the issuing bank and by the goods originally purchased by the importer**





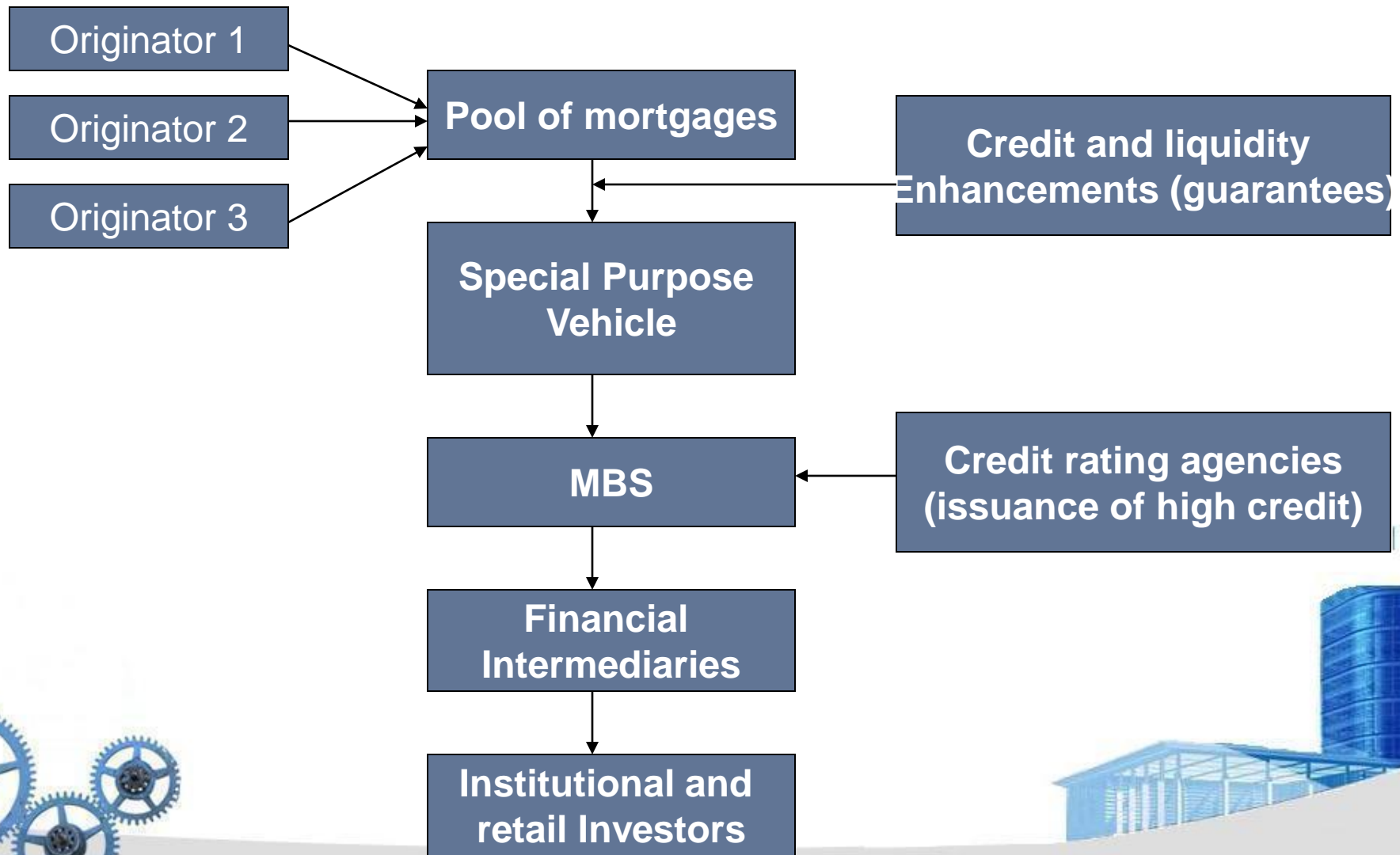
# Money-Market Securities

- > Short-term money-market instruments guaranteed (accepted) by a bank or trust company in order to provide manufacturers and exporters with capital to operate and which are traded in the secondary market at prices that are discounted from the face value are:
  - **Certificates of deposit**
  - **Bankers' acceptances**
  - **Commercial paper**
  - **ADRs**





# Concept of Securitization





# Fixed Income Market







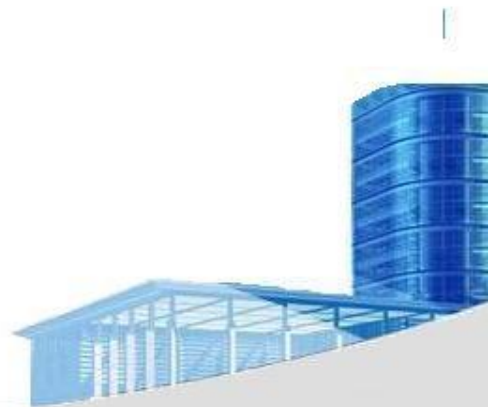
# Fixed Income Market Type

## > Money market

- defined as the market for financial assets that have original maturities of one year or less.

## > Bond market

- Is as the market for fixed income security that have maturities of more than one year.





# Fixed Income Market

- > **From issuers perspective, we can get six sectors:**
- > **Government sector**
  - Include Treasury bills, notes, and bonds, plays a key role in the valuation of securities and the determination of interest rates.
- > **Agency sector**
- > **Municipal sector**
  - State and local government issue bonds.
- > **Corporate sector**
- > **Asset-Backed sector**
- > **Mortgage Sector**





# Market Organization

## > Direct Search

- An arrangement in which buyers directly search and identify matching sellers without the benefit of one or more intermediaries.

## > Brokered Market

- When trading becomes more and more frequent, brokers may find it economical to intermediate ( for a fee) and match buyers and sellers at mutually agreed-upon terms.

## > Dealer Market

- Dealers may quote different bid-offer prices from the same security.
- Dealers, unlike brokers, also take outright positions in securities.
- Dealers are also exposed to the market risk on their inventories.

## > Auction Market

- Centralized markets in which all market participants interact simultaneously





# The Player in Bond Market

## Issuer of Bond Securities

Issuer:

1. Government and Agency
2. Corporate
3. Commercial Bank
4. States
5. Special-purpose Vehicles
6. Foreign Institutions

## Financial Intermediaries

Issuer:

1. Primary Dealers
2. Other Dealers
3. Investment Bank
4. Credit Rate Agencies
5. Credit and liquidity enhancer

## Institution and Retail Investors

Issuer:

1. Government
2. Pension fund
3. Insurance companies
4. Mutual fund
5. Commercial Bank
6. Household





# U.S. Treasury Market

- > **Maturities ranging from a few days to 30 years.**
- > **The Treasury securities are auctioned by the U.S. Treasury frequently. (Buyback)**
- > **On-the-run issues & Off-the-run issues**
- > **Their prices are quoted in fractions of  $1/32, 1/64$ . ( $1/32$  is referred to as a tick)**
- > **The flat price (the quoted price) plus the accrued interest is known as the full price or the invoice price.**
- > **Benchmark Maturities – 3m, 6m, 1Y, 2Y, 5Y, 10Y, 30Y**





# Corporate Bond Market

- > **Two key differences between the Treasury and corporate market**
  - Credit risk
    - Moody's, Standard & Poor's, and Fitch.
  - Smaller issues
    - A typical corporate issue is of the order of \$100 million to \$200 million, whereas a typical Treasury auction is of the order of \$10 billion to \$12 billion.
- > **Key corporate securities**
  - Price the new issues
  - Arrange the distribution
  - Call or sink features
- > **Trading**
  - A small number of bonds on NYSE
  - A substantial percentage in the dealer market
- > **Price transparency in Corporate bond Market**
  - Small, varying credit quality, tremendously contractual features, illiquid
  - TRACE





# Corporate Bond Market

## > TRACE (Trade Reporting and Compliance Engine)

- NASD members report over-the-counter ("OTC") secondary market transactions to NASD
- increased price transparency in corporate bonds.
- On January 23, 2001, SEC approved

## > TRACE Corporate Bond Data

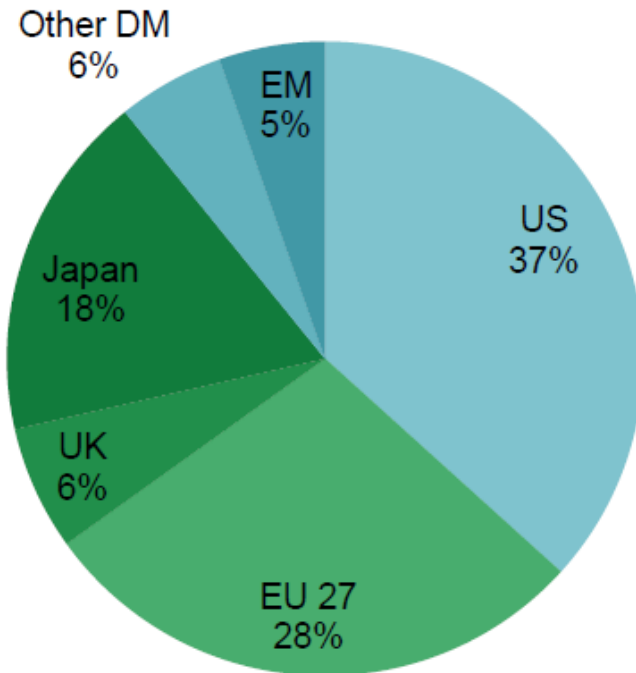
- Daily Report
  - <http://apps.nasdaq.com/regulatory%5Fsystems/traceaggregates/nasdaq/>
- Search Corporate Bond Trading
  - [http://www.nasdaqbondinfo.com/asp/bond\\_search.asp](http://www.nasdaqbondinfo.com/asp/bond_search.asp)



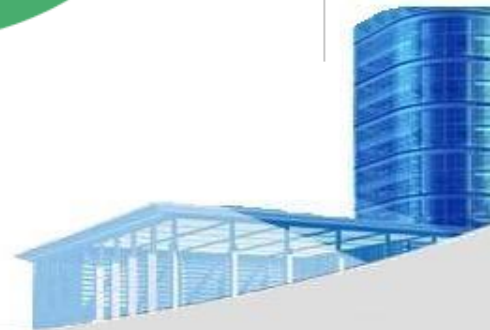
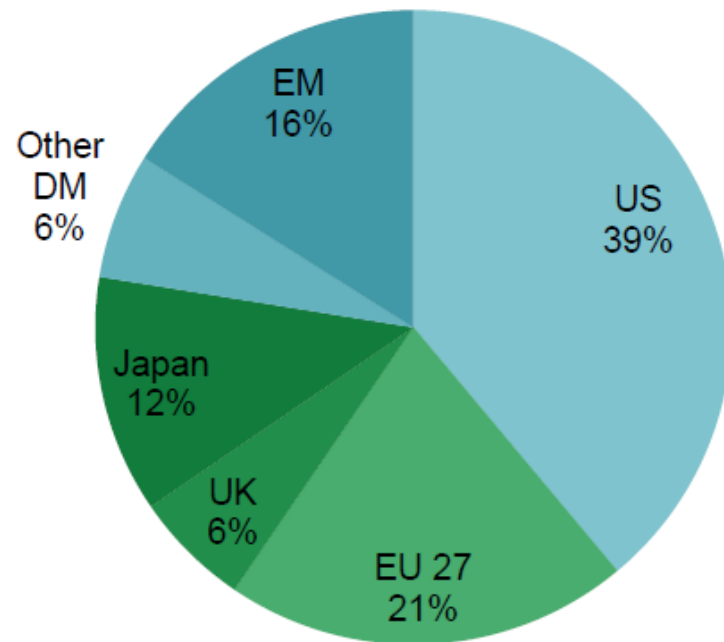


# Global Bond Market

**Global Bond Market Outstanding  
2010 - \$82.2 Trillion**



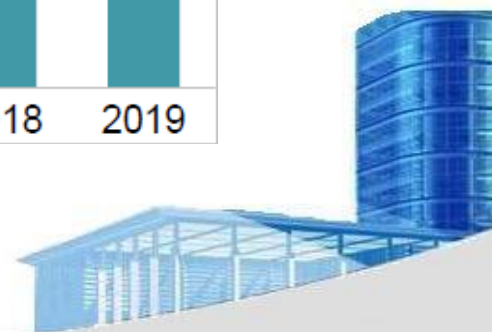
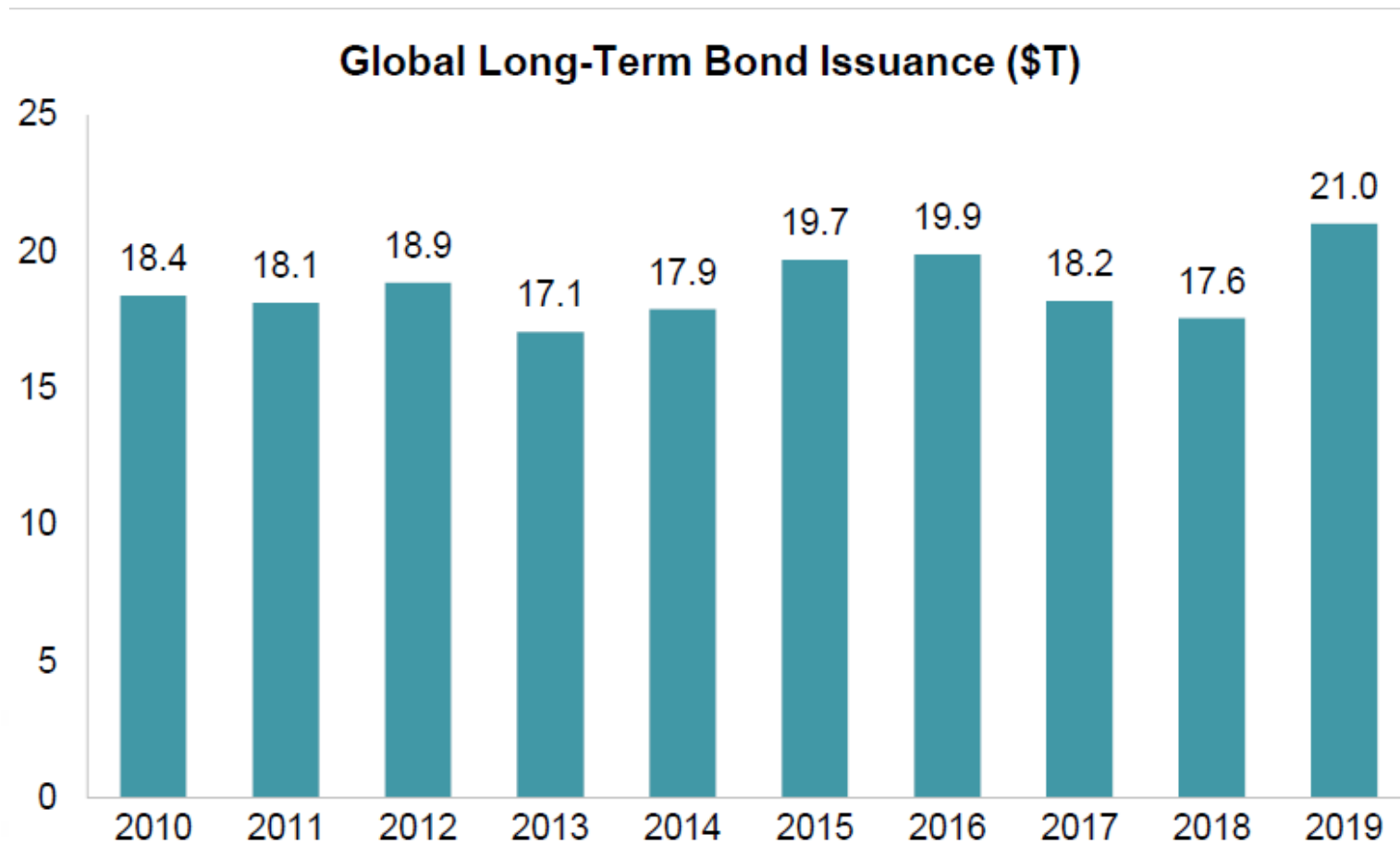
**Global Bond Market Outstanding  
2019 - \$105.9 Trillion**







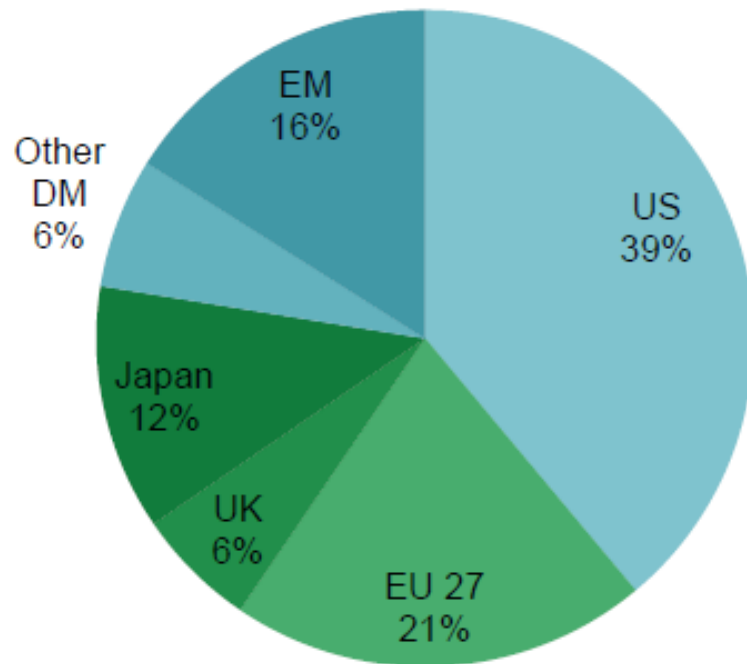
# Global Bond Market





# Global Bond Market

**Global Bond Market Outstanding  
2019 - \$105.9 Trillion**



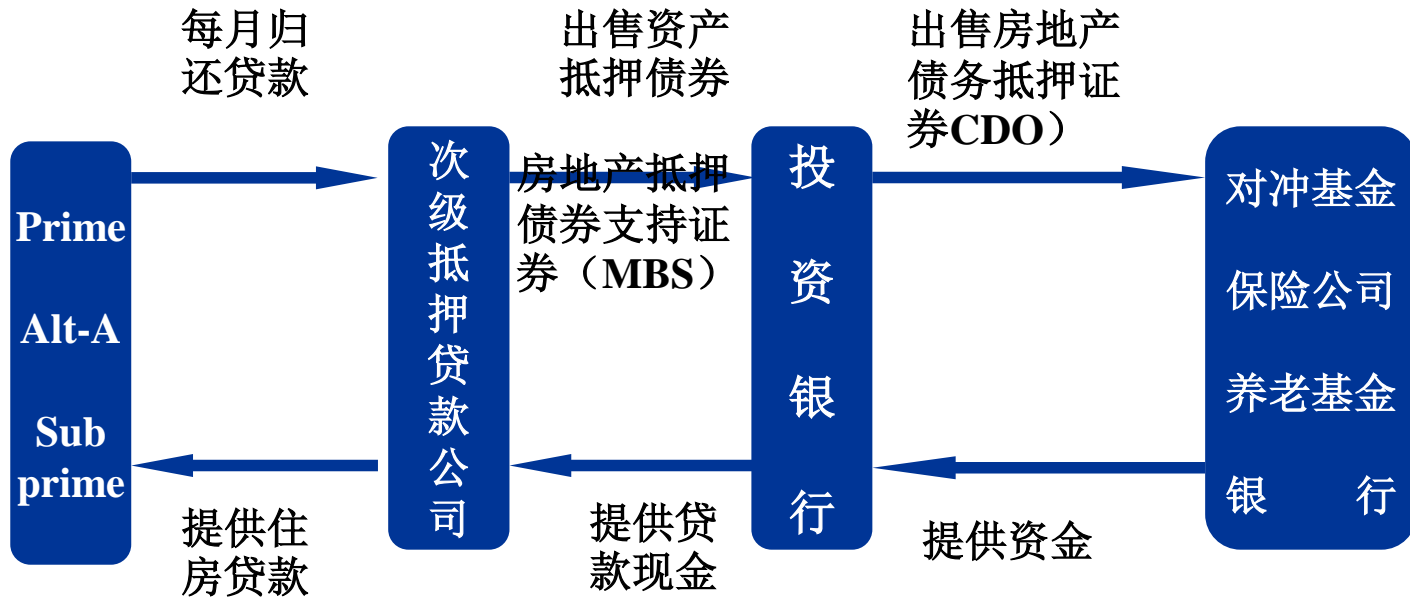
Source: Bank for International Settlements, SIFMA estimates

Note: EM = emerging markets, DM = developed markets





# Mortgage-backed Market





# Fixed Income Basic Pricing





# Price of Bonds

- > **An estimate of the expected cash flow**
  - Periodic coupon interest payments to maturity date
  - The par (or maturity) value at maturity
- > **An estimate of the appropriate required yield**
  - The required yield is determined by investigating the yield offered on comparable bonds in market.
- > **The formula:**

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

- P is the bond price
- C is the periodic coupon payment
- N is the number of years to maturity
- M is the (face value) payment at maturity
- r is the “risk-adjusted discount rate” (or yield to maturity, or IRR)





# But what if interest rates differ over time?

- > You can still calculate a YTM ( $y$ )
- > But it is a complex average of spot rates

$$P = \frac{C}{(1+r_1)} + \frac{C}{(1+r_2)^2} + \frac{C}{(1+r_3)^3} + \dots + \frac{C}{(1+r_N)^N} + \frac{M}{(1+r_N)^N}$$

- > Here, each *spot rate*  $r_n$  is the discount rate for a cash flow in year  $n$  that can be locked in today
- > E.g.,  $r_3$  (3-year spot rate) is the rate the market uses to value a single payment three years from today



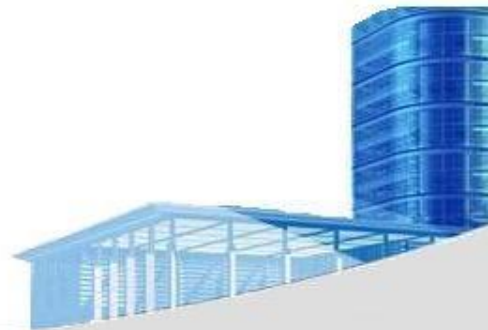


# Coupon bond example

- > Take a 3-year 10% coupon bond with face value = 1000, assuming annual coupon payments:
  - Spot rates:  $r_1=10\%$ ,  $r_2=12\%$ ,  $r_3=14\%$
  - Yield-to-Maturity

$$\text{Price} = \frac{100}{(1.10)} + \frac{100}{(1.12)^2} + \frac{1100}{(1.14)^3} = 913.1$$

$$\begin{aligned} 913.1 &= \frac{100}{(1+y)} + \frac{100}{(1+y)^2} + \frac{1100}{(1+y)^3} \\ &= \frac{100}{(1.137)} + \frac{100}{(1.137)^2} + \frac{1100}{(1.137)^3} \\ y &= 13.7\% \end{aligned}$$





# Zero coupon bond example

> Price of 3-year zero coupon bond with face value = 1000

– Spot rates:  $r_1=10\%$ ,  $r_2=12\%$ ,  $r_3=14\%$

– Yield-to-Maturity

$$\text{Price} = \frac{1000}{(1.14)^3} = 675$$

$$675 = \frac{1000}{(1+y)^3}$$
$$y = 14\%$$

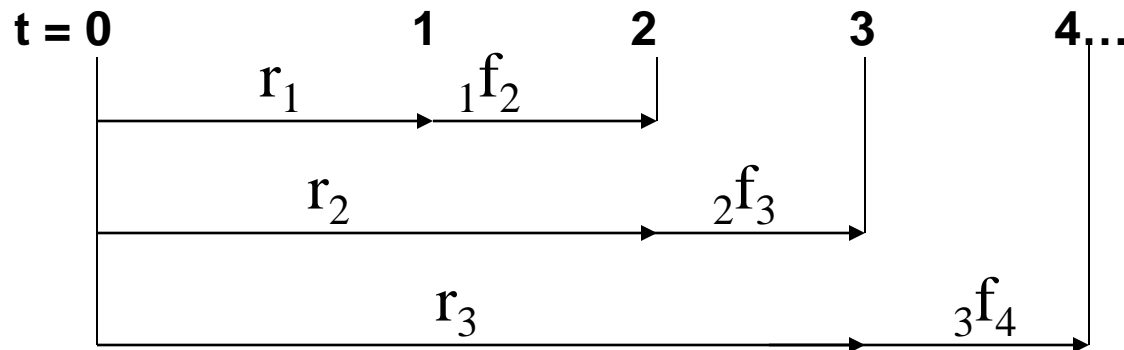




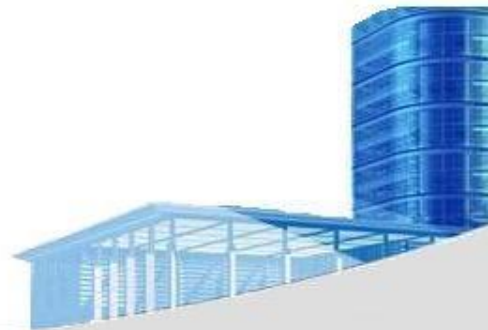


# Forward Rates

- > Forward rates of interest are implicit in the term structure of interest rates



- > Note the notation:  ${}_3f_4$  means “the forward rate from period 3 to period 4.”
- > When the beginning subscript is omitted, it is understood that the forward rate is for one period only:  ${}_3f_4 = f_4$ .





## Example: Forward rates

> What one-year forward rates are implied by the following spot rates?

Maturity Year	Spot Rate ( $r_t$ )	Forward Rate ( $f_t$ )
1	4.0%	—
2	5.0%	6.01%
3	5.5%	6.507%

$$(1 + r_2)^2 = (1 + r_1)(1 + f_2)$$

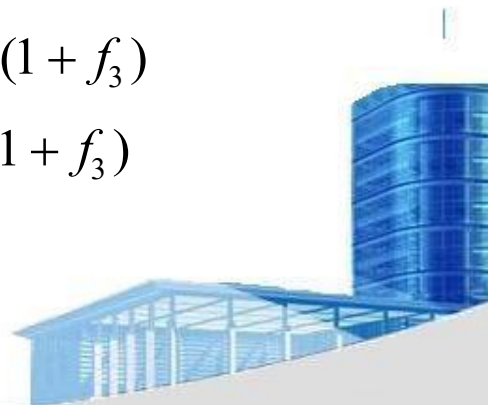
$$(1.05)^2 = (1.04)(1 + f_2)$$

$$f_2 = 6.01\%$$

$$(1 + r_3)^3 = (1 + r_2)^2(1 + f_3)$$

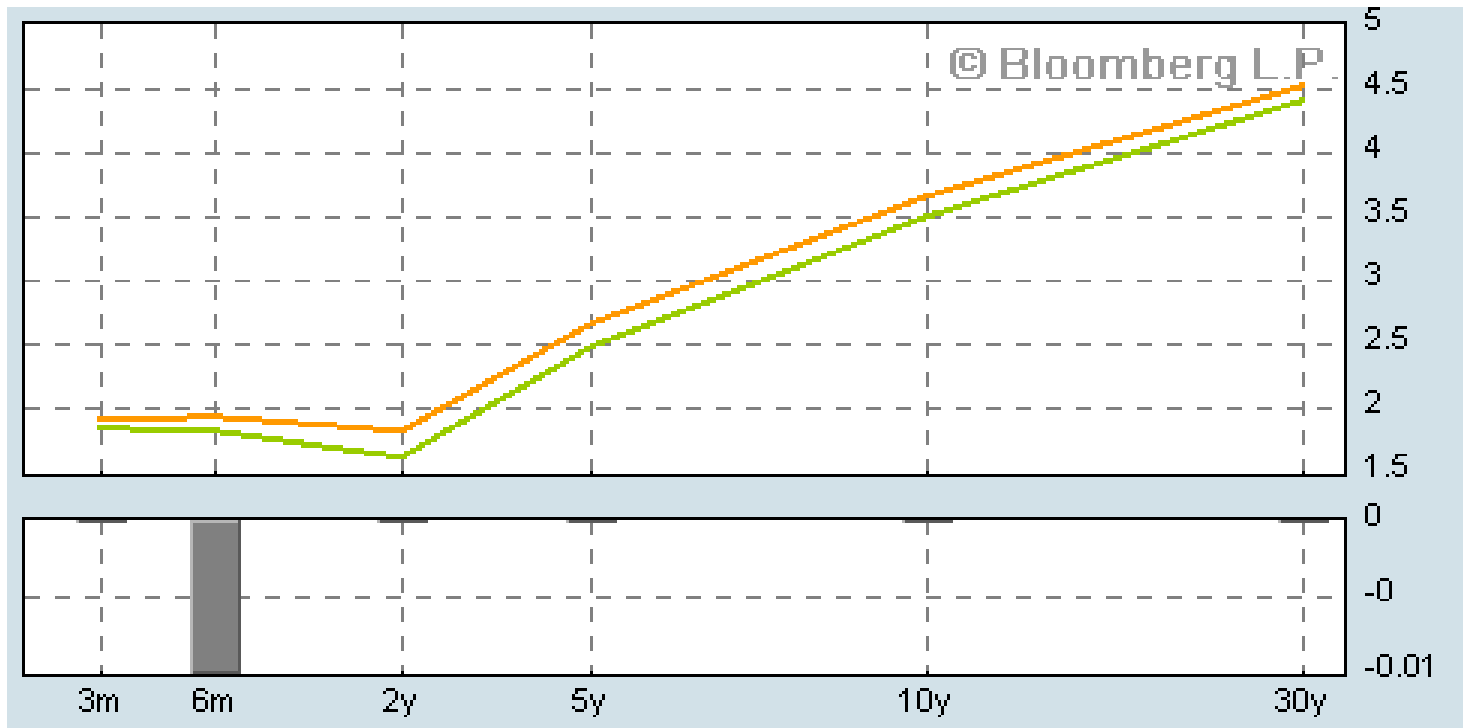
$$(1.055)^3 = (1.05)^2(1 + f_3)$$

$$f_3 = 6.507\%$$





# The term structure of interest rates



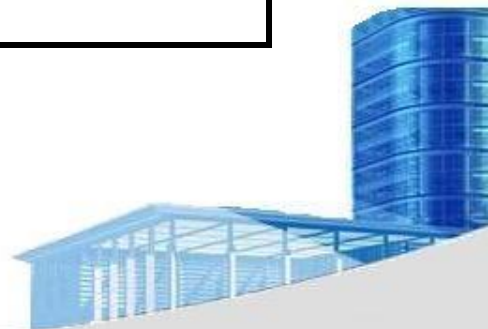


# Bond prices and spot rates

> From bond prices to spot rates

Face Value	Times to Maturity	Annual coupon	Bond Price
100	0.5	0	95.02
100	1.0	0	90.09
100	1.5	8	96.04

> \*Coupons are paid semi-annually.





# Bond prices and spot rates

> 6-month spot rate:

$$\frac{100}{(1 + r_{0,0.5})^{1/2}} = 95.02 \quad \Rightarrow \quad r_{0,0.5} = 10.75\% pa \text{ with annual compounding}$$

> 1-year spot rate:

$$\frac{100}{(1 + r_{0,1})} = 90.09 \quad \Rightarrow \quad r_{0,1} = 11.00\% pa \text{ with annual compounding}$$

> 1.5-year spot rate:

$$\frac{4}{(1 + 0.1075)^{1/2}} + \frac{4}{1 + 0.11} + \frac{104}{(1 + r_{0,1.5})^{3/2}} = 96.04 \quad \Rightarrow \quad r_{0,1.5} = 11.25\% pa$$

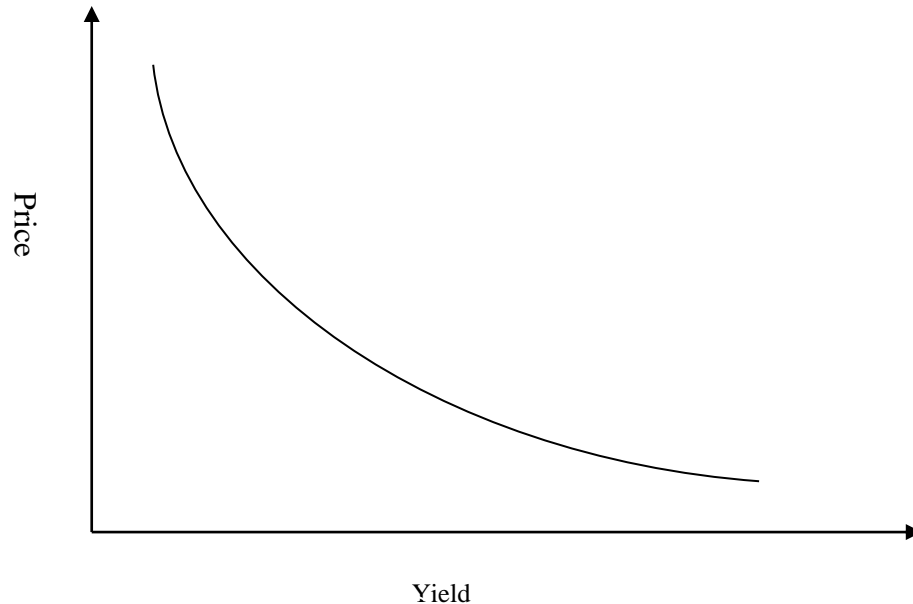
with annual compounding





# Price-Yield Relationship

- > The price changes in the opposite direction from the change in the required yield. This shape is referred to as convex.





## Relation between coupon, yield and price

- > Coupon rate  $<$  required yield  $\rightarrow$  price  $<$  par (discount bond)
- > Coupon rate  $=$  required yield  $\rightarrow$  price  $=$  par
- > Coupon rate  $>$  required yield  $\rightarrow$  price  $>$  par (premium bond)

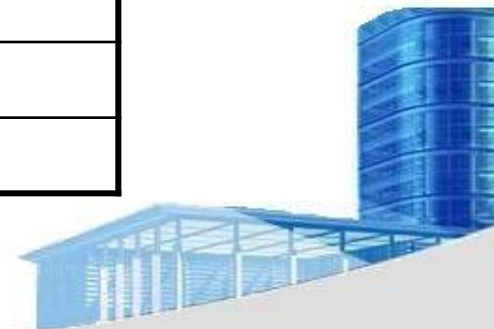




# Relationship between Bond price and Time if interest rates are unchanged

- > The price will move to par value at the maturity date.
- > For example: a 20-year 10% coupon bond.

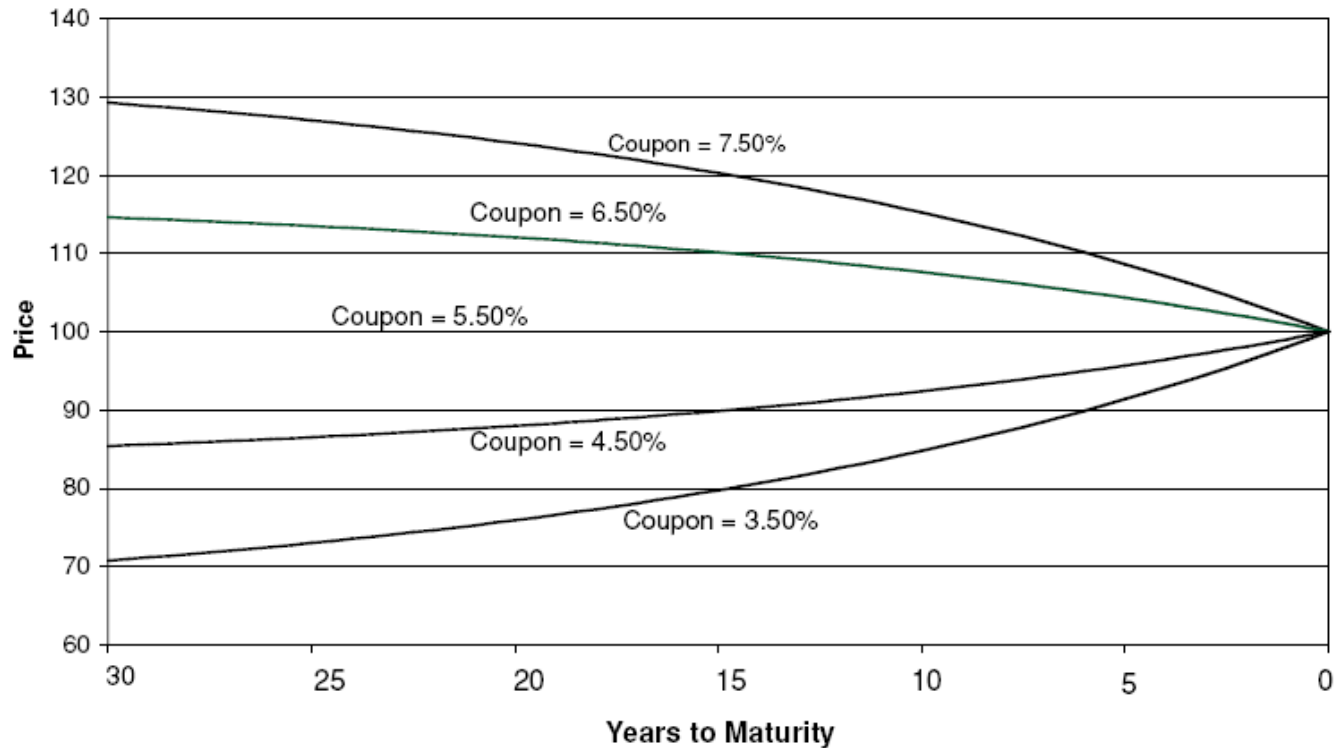
Year	Price of Discount Bond Selling to Yield 12%	Price of Premium Bond Selling to Yield 7.8%
20	849.54	1,221.00
15	862.35	1,192.54
10	885.30	1,150.83
5	926.40	1,089.67
3	950.83	1,057.85
2	965.35	1,040.02
1	981.67	1,020.78
0	1,000.00	1,000.00







# Relationship between Bond price and Time if interest rates are unchanged



**FIGURE 3.1** Prices of Bonds Yielding 5.5% with Various Coupons and Years to Maturity





# Yield of Bond

- > The general definition of yield is the return an investor will receive by holding a bond to maturity.
- > Current Yield calculates the percentage return that the annual coupon payment provides the investor.
- > 
$$\text{Current Yield} = \frac{\text{Annual Interest Paid}}{\text{Market Price}} * 100\%$$
- > If you purchased a bond with a par value of %100 for \$95.92 and it paid a coupon rate of 5%, the current yield is
- > 
$$= \frac{(0.05 * \$100)}{\%95.92} * 100\% = 5.21\%$$
- >





# Yield of Maturity

- > Yield to Maturity is the return that the investor will receive of all cash flows at a constant interest rate until the bond matures.
- >
- > Bond Price = 
$$\frac{\text{Cashflow1}}{(1+\text{yield})^1} + \frac{\text{Cashflow2}}{(1+\text{yield})^2} + \dots + \frac{\text{Last C}}{(1+\text{yield})^n}$$
- >
- > The yield to maturity is a interest rate that must be calculated through trial and error.





# Measures of Bond Price Volatility

- > Duration is a measure of price sensitivity to interest rates—that is, how much a bond's price changes in response to a change in interest rates.
- > Long-term bonds are more sensitive to interest rate movements than are short-term bonds
- > Macaulay duration
- > Modified duration
- > Effective duration
- > How to calculate a duration? – basic process





# How to calculate the duration? A example

> A 8% coupon bond with 2 years to maturity

	A	B	C	D	E	F	G
1			Time until		PV of CF		Column (C)
2			Payment		(Discount rate =		times
3		Period	(Years)	Cash Flow	5% per period)	Weight*	Column (F)
4	A. 8% coupon bond	1	0.5	40	38.095	0.0395	0.0197
5		2	1.0	40	36.281	0.0376	0.0376
6		3	1.5	40	34.554	0.0358	0.0537
7		4	2.0	1040	<u>855.611</u>	<u>0.8871</u>	<u>1.7741</u>
8	Sum:				964.540	1.0000	1.8852
9							
10	B. Zero-coupon	1	0.5	0	0.000	0.0000	0.0000
11		2	1.0	0	0.000	0.0000	0.0000
12		3	1.5	0	0.000	0.0000	0.0000
13		4	2.0	1000	<u>822.702</u>	<u>1.0000</u>	<u>2.0000</u>
14	Sum:				822.702	1.0000	2.0000
15							
16	Semiannual int rate:	0.05					
17							
18	*Weight = Present value of each payment (column E) divided by the bond price.						



# I. (Macaulay) duration

- > **Weighted average term to maturity**
  - Measure of average maturity of the bond's promised cash flows
- > **Duration formula:**

where:

$$D_m = \sum_{t=1}^T (t \times w_t)$$

$$w_t = \frac{PV(CF_t)}{PV(Bond)} = \frac{CF_t / (1+y)^t}{P}$$

- >  **$t$  is measured in years**

$$\sum_{t=1}^q w_t = 1$$





# Duration - The expanded equation

$$\begin{aligned} D_m &= \sum_{t=1}^T t \times w_t \\ &= \sum_{t=1}^T t \times \left[ \frac{\text{PV}(C_t)}{\text{PV}(\text{Bond})} \right] \\ &= \frac{1 \left[ \frac{C_1}{(1+y)^1} \right] + 2 \left[ \frac{C_2}{(1+y)^2} \right] + \dots + N \left[ \frac{C_N}{(1+y)^N} \right]}{\frac{C_1}{(1+y)^1} + \frac{C_2}{(1+y)^2} + \dots + \frac{C_N}{(1+y)^N}} \end{aligned}$$

- > Duration is shorter than maturity for all bonds except zero coupon bonds
- > Duration of a zero-coupon bond is equal to its maturity





## II. Modified duration ( $D_m^*$ )

$$D_m^* = \frac{D_m}{1 + y}$$

- Direct measure of price sensitivity to interest rate changes
- Can be used to estimate *percentage price volatility* of a bond

$$\frac{\Delta P}{P} = -D_m^* \times \Delta y$$







# Derivation of modified duration

$$P = \sum_{t=1}^N \frac{C_t}{(1+y)^t}$$

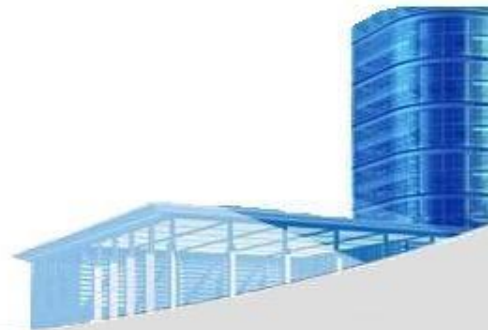
$$\frac{\partial P}{\partial y} = \frac{-1}{1+y} \sum_{t=1}^N \left( t \cdot \frac{C_t}{(1+y)^t} \right)$$

$$\frac{\partial P}{\partial y} = \frac{-D_m}{1+y} \cdot P = -D_m^* \cdot P$$

$$\frac{1}{P} \frac{\partial P}{\partial y} = -D_m^*$$

- > So  $D_m^*$  measures the sensitivity of the % change in bond price to changes in yield

$$D_m^* = \frac{D_m}{1+y}$$



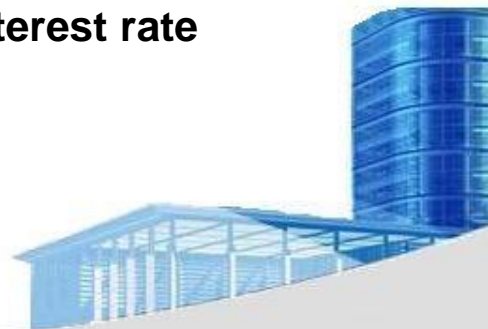


### III. An example

- > **Compare the price sensitivities of:**
  - Two-year 8% coupon bond with duration of 1.8853 years
  - Zero-coupon bond with maturity AND duration of 1.8853 years
- > **Semiannual yield = 5%**
- > **Suppose yield increases by 1 basis point to 5.01%**

	<i>Original Price</i>	<i>New Price</i>	<i>% Change</i>
Coupon bond	964.54	964.19	-.0189
Zero bond	831.96	831.61	-.0189

- > **Upshot: Equal duration assets are equally sensitive to interest rate movements**





## Another example

- > Consider a 3-year 10% coupon bond selling at **\$107.87** to yield 7%. Coupon payments are made annually.

$$PV(CF_1) = \frac{10}{(1.07)} = 9.35$$

$$PV(CF_2) = \frac{10}{(1.07)^2} = 8.73$$

$$PV(CF_3) = \frac{110}{(1.07)^3} = 89.79$$

$$\text{Price of bond} = 9.35 + 8.73 + 89.79 = 107.87$$

$$\begin{aligned}\text{Duration } (D_m) &= \left(1 * \frac{9.35}{107.87}\right) + \left(2 * \frac{8.73}{107.87}\right) + \left(3 * \frac{89.79}{107.87}\right) \\ &= 2.7458\end{aligned}$$





## Another example – page 2

- > **Modified duration of this bond:**

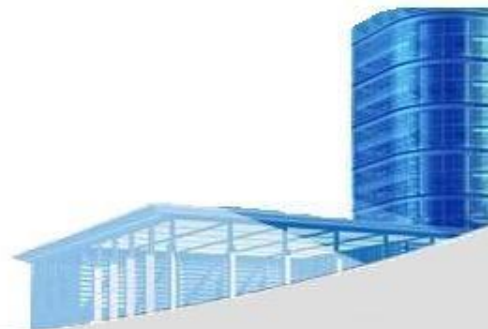
$$D_m^* = \frac{2.7458}{1.07} = 2.5661$$

- > **If yields increase to 7.10%, how does the bond price change?**
- > **The percentage price change of this bond is given by:**

$$\boxed{\frac{\Delta P}{P} \times 100 = -D_m^* \times \Delta y \times 100}$$

$$= -2.5661 \times .0010 \times 100$$

$$= -.2566$$





## Another example – page 3

> What is the predicted change in dollar terms?

$$\begin{aligned}\Delta P &= -\frac{.2566}{100} \times P \\ &= -\frac{.2566}{100} \times \$107.87 \\ &= -\$0.2768\end{aligned}$$

New predicted price:  $\$107.87 - .2768 = \text{\textcolor{red}{\$107.5932}}$

Actual dollar price (using PV equation):  $\$107.5966$

Good  
approximation!





# Duration – Basic Rules

- The duration of a zero-coupon bond equals its time to maturity
- Holding maturity constant, a bond's duration is higher when the coupon rate is lower
- Holding the coupon rate constant, a bond's duration generally increases with its time to maturity
- Holding other factors constant, the duration of a coupon bond is higher when the bond's yield to maturity is lower
- The duration of a level perpetuity is  $(1+y)/y$ . For example, at a 10% yield, the duration of a perpetuity that pays \$100 once a year forever will equal  $1.10/0.10 = 11$  years, but at an 8% yield it will equal  $1.08/0.08 = 13.5$  years





# Duration – Basic Rules

- > Bonds with a high duration will have a higher price fluctuation than bonds with a low duration.
- > Three factors determine how sensitive a bond's price is to changes in interest rate, term to maturity, coupon rate and yield to maturity.





# Summary: Steps for finding the predicted price change

- > Step 1: Find Macaulay duration of bond.
- > Step 2: Find modified duration of bond.
- > Step 3: Recall that when interest rates change, the change in a bond's price can be related to the change in yield according to the rule:

$$\frac{\Delta P}{P} \times 100 = -D_m^* \times \Delta y \times 100$$

- Find percentage price change of bond
  - Find predicted dollar price change in bond
  - Add predicted dollar price change to original price of bond
- ⇒ Predicted new price of bond







# Effective Duration

- > The modified duration of a bond measures its price sensitivity to a change in yield. It assumes that no change in expected cash flows will result from a change in market interest rates and is thus inappropriate as a measure of the interest rate risk borne by a mortgage-backed bond, whose cash flows are affected by rate changes because of the prepayment effect.
- > A more accurate measure of mortgage-based bonds' interest rate sensitivity is *effective duration*. Effective duration is based on *approximate duration*.

$$D_{app} = \frac{P_- - P_+}{2P_0 (\Delta rm)}$$

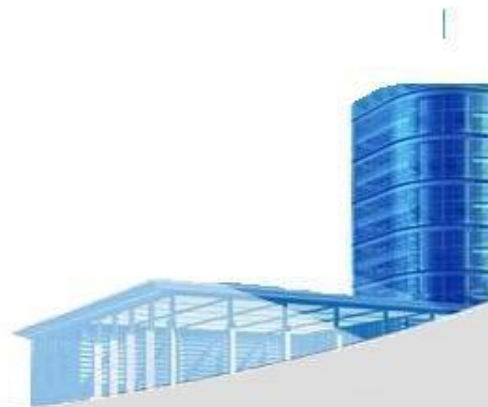
- > Where
- >  $P_0$  = the initial price of the bond
- >  $\Delta rm$  = the change in the yield of the bond
- >  $P_-$  = the estimated price of the bond if the yield decreases by  $\Delta rm$
- >  $P_+$  = the estimated price of the bond if the yield increases by  $\Delta rm$
- >  $P_-$  and  $P_+$  are obtained using a valuation model—such as a static cash flow model, a binomial model, or a simulation model—that incorporates the effect of a change in interest rates on the expected cash flows.





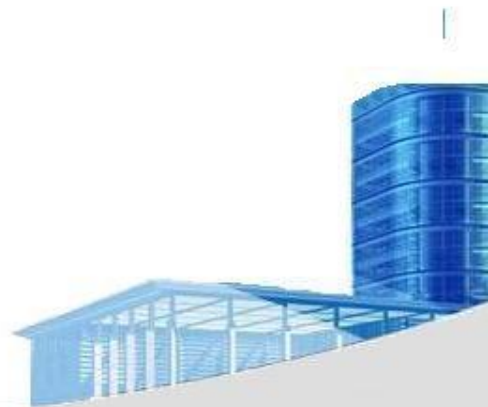
## IV. Why is duration a big deal?

- > **Simple summary statistic of effective average maturity**
- > **Measures sensitivity of bond price to interest rate changes**
  - Measure of bond price volatility
  - Measure of interest-rate risk
- > **Useful in the management of risk**
  - You can match the duration of assets and liabilities
  - Or hedge the interest rate sensitivity of an investment





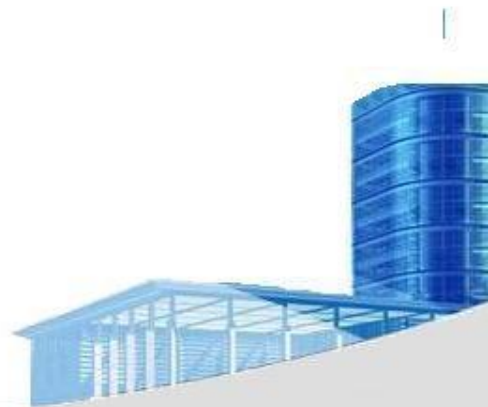
# Fixed Income Trading





# Fixed Income Trading

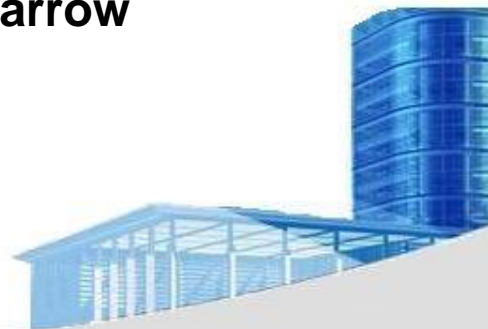
- > **Unregulated Market**
- > **Liquidity**
- > **Portfolio Diversification**
- > **Over the Counter**
- > **Institutional Dealers**
- > **Government Bonds / Treasury Bills**
- > **Fixed Income Mutual Fund**





# Trading for Fixed Income Securities

- > **For treasury securities, the secondary market is an over-the-counter market in which a group of U.S. government dealers offer continuous bid and ask prices on outstanding treasuries.**
- > **Treasury Securities:**
  - On-the-run issues : newly auctioned treasury securities, bid-offer spread are typically  $1/32$  to  $2/32$ .
  - Off-the-run issues : the seasoned issues in previous auctions.
- > **Treasury bills (T-Bills) are auctioned by the U.S. Treasury at periodic intervals. T-bills are among the most liquid and nominally riskless securities.**
- > **One of the most active and liquid markets in the world; it's an easy place to buy into or get out of because bid-ask spreads are very narrow**





# Corporate bond trading

- > For corporation bonds, the principal secondary market is the over-the-counter market. There is some trading on exchanges
- > The price quota of investment-grade corporate bond trading is based on the benchmark plus spread.
- > The price quota of high yield corporate bond trading is based on price.

