



金程教育
GOLDEN FUTURE

专业·领先·增值

专业来自101%的投入!

CFA一级培训项目

Fixed Income



单晨玮

金程教育资深培训师

Topic Weightings in CFA Level I

Study Session 1	Ethics & Professional Standards	15
Study Session 2-3	Quantitative Methods	12
Study Session 4-6	Economic Analysis	10
Study Session 7-10	Financial Statement Analysis	20
Study Session 11	Corporate Finance	7
Study Session 12	Portfolio Management	7
Study Session 13-14	Equity Analysis	10
Study Session 15-16	Fixed Income Analysis	10
Study Session 17	Derivative Investments	5
Study Session 18	Alternative Investments	4
	Total:	100

2-200

101% Contribution Breeds Professionalism



Framework of Fixed Income

➤ Study Session 15 — Basic Concepts

- R51 Fixed-Income Securities: Defining Elements
- R52 Fixed-Income Markets: Issuance, Trading, and Funding
- R53 Introduction to Fixed-Income Valuation
- R54 Introduction to Asset-Backed Securities

➤ Study Session 16 — Analysis of Risk

- R55 Understanding Fixed-Income Risk and Return
- R56 Fundamentals of Credit Analysis

3-200

101% Contribution Breeds Professionalism



Framework

- Basic features of a bond
- Bond indenture
 - Legal information
 - Collateral
 - Credit enhancements
 - Covenants
 - Tax
- Structure of a bond's cash flows
 - Principal repayment structures
 - Coupon payment structures
- Bonds with contingency provisions
 - Callable bonds
 - Puttable bonds
 - Convertible bonds

4-200

101% Contribution Breeds Professionalism



Basic Features of A Bond

- **Issuer/borrower:** 债券发行人，实际上为资金需求者
 - Supranational organizations
 - ✓ Issued by organizations that operate globally such as the World Bank, the European Investment Bank, and the International Monetary Fund (IMF).
 - Sovereign (national) governments
 - ✓ A prime example is U.S. Treasury bonds, but many countries issue sovereign bonds.
 - Non-sovereign (local) governments
 - ✓ Issued by government entities that are not national governments, such as the state of California or the city of Toronto.
 - Quasi-government entities
 - ✓ Not a direct obligation of a country's government or central bank. An example is the Federal National Mortgage Association (Fannie Mae).
 - Companies (i.e., corporate issuers)
 - ✓ Divided into those issued by financial companies and those issued by nonfinancial companies

5-200

101% Contribution Breeds Professionalism



Basic Features of A Bond

- **Bondholder:** 债券持有人，实际上为资金的供给者
- **Maturity date:** the date on which the principal is to be repaid
- **Term to maturity(tenor):** the time remaining until maturity once a bond has been issued
 - Money market securities: securities with maturities at issuance (original maturity) of one year or less
 - Capital market securities: securities with original maturities that are longer than one year
 - Perpetual bonds: have no stated maturity date., make periodic int. payment but no promise to repay the principal, such as consols issued by the sovereign government in the United Kingdom, have no stated maturity date
- Bondholders are exposed to **credit risk**:
 - Issuer failing to make full and timely payments of interest and/or repayments of principal.
 - ✓ From the issuer's perspective, an investment-grade credit rating generally allows easier access to bond markets, especially in conditions of limited credit, and at lower interest rates than does a non-investment-grade credit rating.

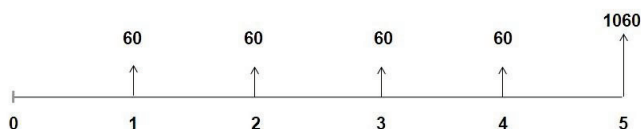
6-200

101% Contribution Breeds Professionalism



Basic Features of A Bond

- **Par value//face value/ maturity value:** 面值，多数债券面值为1000
 - **Coupon rate:** 息票率，决定每期支付的利息
 - Plain vanilla bond/conventional bond: a bond with fixed coupon rate
 - Zero-coupon bond/pure discount bond: a bond pays no interest prior to maturity
 - **Payments currency**
 - Dual-currency bond: makes coupon interest payments in one currency and principal repayment maturity in another currency.
 - Currency option bond: gives bondholders a choice of which of two currencies they would like to receive their payments in.
- An example:**
- 6% coupon rate, 5 years matures from today, 1000 face value, **annual** payments (how about semi-annual payments?)



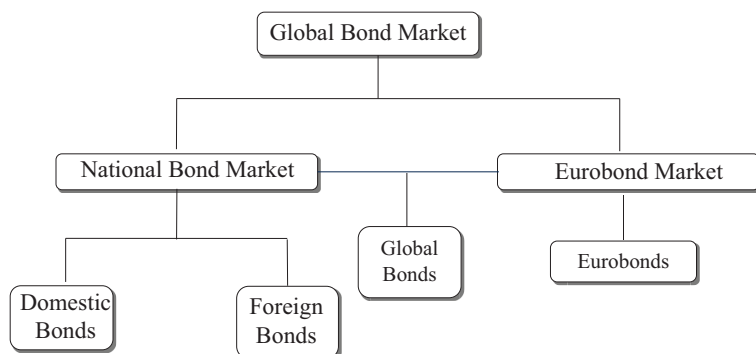
7-200

101% Contribution Breeds Professionalism



Bond Market

- **Sectors of the bond market**



8-200

101% Contribution Breeds Professionalism



Bond Market

- **Domestic bonds:** issued by a firm domiciled in a country and also traded in that country's currency.
- **Foreign bonds:** Bonds sold in a country and denominated in that country's currency by an entity from another country (*foreign country*) are referred to as foreign bonds.
- **Eurobonds:** issued outside the jurisdiction of any one country and denominated in a currency different from the currency of the countries in which they are sold.
 - **Registered bonds:** the ownership is recorded by either name or serial number.
 - **Bearer bonds** (majority of form of Eurobonds): trustee does not keep records of the ownership of the bonds so that the ownership is evidenced by possessing the bonds.
 - ✓ More attractive to those seeking to avoid taxes.
- **Global bonds:** Eurobonds that trade in the national bond market of a country other than the country that issues the currency the bond is denominated in, and in the Eurobond market.

9-200

101% Contribution Breeds Professionalism



Basic Features of A Bond

- **Trust deed:** legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders.
- In the United states and Canada, it is called **bond indenture**.
 - The indenture is written in the name of the issuer and references the features of the bond issue, such as
 1. The principal value for each bond
 2. The interest rate or coupon rate to be paid
 3. The dates when the interest payments will be made
 4. The maturity date when the bonds will be repaid
 5. Whether the bond issue comes with any contingency provisions.
 6. Information regarding the funding sources for the interest payment and principal repayments
 7. Collaterals: assets or financial guarantees underlying the debt obligation above and beyond the issuer's promise to pay.
 8. Credit enhancements: provisions that may be used to reduce the credit risk of the bond issue.
 9. Covenants: Covenants are clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or prohibited from performing.

10-200

101% Contribution Breeds Professionalism



Legal and Regulatory Issues Addressed in A Trust Deed

- Other legal and regulatory issue addressed in a trust deed include:
1. **Legal information** about the entities issuing the bond
 2. Any assets(*collateral*) pledged to support repayment of the bond.
 3. Any additional features that increase the probability of repayment (*credit enhancements*)
 4. **Covenants**
 5. **Tax**

11-200

101% Contribution Breeds Professionalism



Legal and Regulatory Issues Addressed in A Trust Deed

- **Legal information about issuing entities**
- **Sovereign bonds:** issued by the treasury of the issuing country.
 - **Corporate bonds:** issued by well-known corporation, by a subsidiary, or by a holding company.
 - **Securitized bonds:** issued by a separate legal entity created for the purpose of owning specific assets which is called special purpose entities(SPEs) in U.S, and special purpose vehicles(SPVs) in Europe.
 - ✓ SPVs is bankruptcy remote because the assets can provide cash flows to support the payment of the bond even if the company defaults.
 - ✓ The transfer of assets by the sponsor is considered a legal sale; once the assets have been securitized, the sponsor no longer has ownership rights.
 - ✓ Any party making claims following the bankruptcy of the sponsor would be unable to recover the assets or their proceeds.
 - ✓ Benefit of securitization:
 - ◆ Lowers or removes the wall between ultimate investors and originating borrowers.
 - ◆ Securitization reduces liquidity risk in the financial system
 - ◆ Securitization enables innovations in investment products

12-200

101% Contribution Breeds Professionalism



Legal and Regulatory Issues Addressed in A Trust Deed

➤ Source of repayment proceeds:

Types of bond	Source of repayment
Supranational organizations	<ul style="list-style-type: none"> • repayment of previous loans • paid-in capital from its members
Sovereign bonds	<ul style="list-style-type: none"> • Tax revenues • Print money
Non-sovereign debt	<ul style="list-style-type: none"> • General taxing authority of issuer • Cash flows of the financed project (revenues) • Special taxes or fees
Corporate bonds	<ul style="list-style-type: none"> • Cash flows from operations
Securitizations	<ul style="list-style-type: none"> • Cash flows generated by one or more underlying financial assets.

13-200

101% Contribution Breeds Professionalism

Legal and Regulatory Issues Addressed in a Trust Deed

➤ Asset or collateral backing: a way to reduce credit risk.

- Unsecured bonds: represent a claim to the overall assets and cash flows of issuer.
- Secured bonds: backed by a claim to a specific assets of a corporation.
 - ✓ Assets pledged to support a bond issue are referred to collateral
- Unsecured bonds are paid after secured bonds in the event of default.
- In many jurisdictions, **debentures** are unsecured bonds, with no collateral backing assigned to the bondholders.

➤ Types of collateral backing:

Types of bond	Collateral backing
Collateral trust bonds	<ul style="list-style-type: none"> • Financial assets
Equipment trust certificates	<ul style="list-style-type: none"> • Specific types of equipment or physical assets (e.g. railroad cards, oil drilling)
Mortgage-backed securities (MBS)	<ul style="list-style-type: none"> • Mortgage loans
Covered bond	<ul style="list-style-type: none"> • A segregated pool of assets called a “covered pool”

14-200

101% Contribution Breeds Professionalism

Legal and Regulatory Issues Addressed in a Trust Deed

➤ Credit enhancement: a variety of provisions used to reduce the credit risk of a bond issue.

• Internal credit enhancement:

- ✓ **Overcollateralization:** the collateral pledged has a value greater than the par value of the debt issued
- ✓ **Excess spread:** the yield on the financial assets supporting the debt is greater than the yield promised on the bonds issued.
- ✓ Divide a bond into **tranches** with different seniority of claims: any losses of assets supporting a securitized bond are first absorbed by the bonds with the lowest seniority, then the bonds with the next-lowest priority of claims. — waterfall structure

15-200

101% Contribution Breeds Professionalism

Legal and Regulatory Issues Addressed in a Trust Deed

● External credit enhancement:

- ✓ Surety bond: issued by insurance companies and are a promise to make up any shortfall in the cash available to service the debt.
- ✓ Bank guarantee: similar to surety bond, the major difference is that it issued by a bank.
- ✓ Letter of credit: a promise to lend money to the issuing entity if it does not have enough cash to make the promised payments on the covered debt.

➤ Limitation of External credit enhancement:

- while external credit enhancements increase the credit quality of debt issues and decrease the yields, deterioration of credit quality of the guarantor will also reduce the credit quality of the covered issue.
- Surety bonds, bank guarantees, and letters of credit expose the investor to third-party (or counterparty) risk, the possibility that a guarantor cannot meet its obligations.

- A **cash collateral account** mitigates this concern because the issuer immediately borrows the credit-enhancement amount and then invests that amount, usually in highly rated short-term commercial paper. Because this is an actual deposit of cash rather than a pledge of cash, a downgrade of the cash collateral account provider will not necessarily result in a downgrade of the bond issue backed by that provider.

16-200

101% Contribution Breeds Professionalism

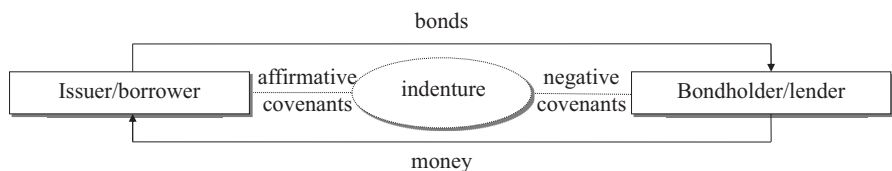


Legal and Regulatory Issues Addressed in a Trust Deed

➤ Affirmative VS. negative covenants

- **Affirmative covenants:** are typically administrative in nature.

- ✓ Frequently used affirmative covenants include what the issuer will do with the proceeds from the bond issue and **the promise of making the contractual payments**.
- ✓ The issuer may also promise to
 - ◆ Comply with all laws and regulations
 - ◆ Maintain its current lines of business
 - ◆ Insure and maintain its assets, and pay taxes as they come due
 - ◆ These types of covenants typically do not impose additional costs to the issuer and do not materially constrain the issuer's discretion regarding how to operate its business.



17-200

101% Contribution Breeds Professionalism



Legal and Regulatory Issues Addressed in a Trust Deed

- **Negative covenants:** frequently costly and do materially constrain the issuer's potential business decisions.

- The purpose of negative covenants is to protect bondholders from such problems as the dilution of their claims, asset withdrawals or substitutions, and suboptimal investments by the issuer. Examples of negative covenants include the following:
 - ✓ Restrictions on debt regulate the issue of additional debt.
 - ✓ **Negative pledges** prevent the issuance of debt that would be senior to or rank in priority ahead of the existing bondholders' debt.
 - ✓ **Restrictions on prior claims** protect unsecured bondholders by preventing the issuer from using assets that are **not collateralized** (called unencumbered assets) to become collateralized.
 - ✓ **Restrictions on distributions to shareholders** restrict dividends and other payments to shareholders such as share buy-backs (repurchases).
 - ✓ **Restrictions on asset disposals** set a limit on the amount of assets that can be disposed by the issuer during the bond's life.
 - ✓ **Restrictions on investments** constrain risky investments by blocking speculative investments.
 - ✓ **Restrictions on mergers and acquisitions** prevent these actions unless the company is the surviving company or unless the acquirer delivers a supplemental indenture to the trustee expressly assuming the old bonds and terms of the old indenture.

18-200

101% Contribution Breeds Professionalism



Taxation of Bond Income

➤ Tax consideration:

- Interest income paid to bondholders is taxed as ordinary income at the same rate as wage and salary income.
 - ✓ Municipal debts is most often exempt from federal income tax and from the income tax of the state.
 - ✓ The tax status of bond income may also depend on where the bond is issued and traded.
- Capital gain or loss: due to sell a coupon bond prior to maturity
 - ✓ Capital gains are taxed at a lower rate than ordinary income.
 - ✓ Long-term CG: capital gains on the sale of an asset that has been owned for more than the minimum amount of time, which is taxed at an even lower rate.
- **Original issue discount (OID) bonds**: a portion of the discount from par at issuance is treated as taxable interest income each year.
 - ✓ This tax treatment also allows that the tax basis of the OID bond is increased each year by the amount of interest income recognized, so there is no additional capital gains tax liability at maturity.
 - ✓ Pure-discount bonds: a portion of the discount from par at issuance is treated as taxable interest income.
- Premium bonds: part of the premium can be used to reduced the taxable portion of interest payments.

19-200

101% Contribution Breeds Professionalism



Cash Flow Structure

➤ Principal repayment structures

- **Plain vanilla bond/bullet bonds**: periodic interest payments and principal is paid at maturity.
 - ✓ Balloon payment: the final payment includes a lump sum in addition to the final period's interest.
- **Example**: principal=\$1,000, maturity=5 years, coupon rate=6%, discount rate=6%, annual payment.

<u>Bullet Bond</u>				
Year	Investor Cash Flows	Interest Payment	Principal Repayment	Outstanding Principal at the End of the Year
0	-\$1,000.00			\$1,000.00
1	60.00	\$60.00	\$0.00	1,000.00
2	60.00	60.00	0.00	1,000.00
3	60.00	60.00	0.00	1,000.00
4	60.00	60.00	0.00	1,000.00
5	1,060.00	60.00	1,000.00	0.00

20-200

101% Contribution Breeds Professionalism



Cash Flow Structure

- **Amortizing loan**: periodic

payments include both interest and some repayment of principal.

- ✓ **Fully amortizing**: principal is fully paid off when the last periodic payment is made.

<u>Fully Amortized Bond</u>				
Year	Investor Cash Flows	Interest Payment	Principal Repayment	Outstanding Principal at the End of the Year
0	-\$1,000.00			
1	237.40	\$60.00	\$177.40	\$822.60
2	237.40	49.36	188.04	634.56
3	237.40	38.07	199.32	435.24
4	237.40	26.11	211.28	223.96
5	237.40	13.44	223.96	0.00

- ✓ **Partially amortizing**: the final payment includes just the remaining unamortized principal amount at bond maturity.

<u>Partially Amortized Bond</u>				
Year	Investor Cash Flows	Interest Payment	Principal Repayment	Outstanding Principal at the End of the Year
0	-\$1,000.00			
1	201.92	\$60.00	\$141.92	\$858.08
2	201.92	51.48	150.43	707.65
3	201.92	42.46	159.46	548.19
4	201.92	32.89	169.03	379.17
5	401.92	22.75	379.17	0.00

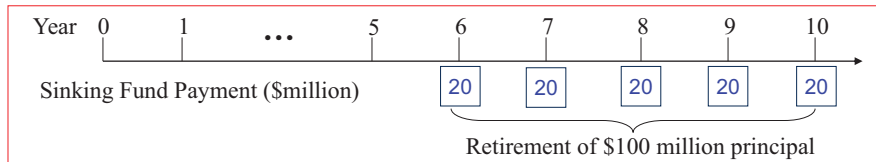
21-200

101% Contribution Breeds Professionalism



Cash Flow Structure

- The sinking fund provision is used to reduce the **credit risk** of the issuer.
- **Sinking fund provision:** requires the issuer to retire a portion of a bond issue at specific times during the bonds' life.
 - There may be a period during which no sinking fund redemptions are made.
 - The amount of redemptions could decline/increase each year.
 - **Doubling option/accelerated sinking fund:** allow company to redeem twice the amount required by the sinking fund provision.
- **Example:**
 - ABC Inc. issue a 10-year bond with a par value of \$100 million.
 - The bond has a sinking fund provision, which requires that ABC Inc. retire \$20 million of the principal every year beginning in the sixth year.



22-200

101% Contribution Breeds Professionalism



Cash Flow Structure

- **Sinking fund arrangement:**
 - Originally, a sinking fund was a specified cash reserve that was segregated from the rest of the issuer's business for the purpose of repaying the principal.
 - More generally today, a sinking fund arrangement specifies the portion of the bond's principal outstanding, perhaps 5%, that must be repaid each year throughout the bond's life or after a specified date.
 - ✓ Typically, the issuer will forward repayment proceeds to the bond's trustee. The trustee will then either redeem bonds to this value or **select by lottery the serial numbers** of bonds to be paid off.
 - ✓ Another type of sinking fund arrangement operates by **redeeming a steadily increasing amount** of the bond's notional principal (total amount) each year
 - ✓ Another common variation is for the bond issue to include a call provision. The issuer can usually **repurchase the bonds at the market price, at par, or at a specified sinking fund price**, whichever is the lowest.
 - ◆ The bonds to be retired are selected at **random based on serial number** to allocate the burden of the call provision fairly among bondholders.
 - The issuer can repurchase only a small portion of the bond issue.
 - Some indentures, however, **allow issuers to use a doubling option to repurchase double the required number of bonds.**

23-200

101% Contribution Breeds Professionalism



Cash Flow Structure

- **Advantages and disadvantages of sinking fund provision**
 - Advantages: less credit risk due to the periodic redemptions of the principal
 - Disadvantages: more reinvestment risk. when interest rate decreases, the market price is greater than the redemption price
 - ✓ First, investors face **reinvestment risk**, the risk associated with having to reinvest cash flows at an interest rate that may be lower than the current yield to maturity.
 - ◆ If the serial number of an investor's bonds is selected, the bonds will be repaid and the investor will have to reinvest the proceeds. If market interest rates have fallen since the investor purchased the bonds, he or she probably will not be able to purchase a bond offering the same return.
 - ✓ Another potential disadvantage for investors occurs if the issuer has the option to **repurchase bonds at below market prices.**
 - ◆ For example, an issuer could exercise a call option to buy back bonds at par on bonds priced above par. In this case, investors would suffer a loss.

24-200

101% Contribution Breeds Professionalism



Cash Flow Structure

➤ Coupon payment structures

- Floating-rate notes
- Deferred coupon bonds
- Step-up coupon bonds
- Credit-linked coupon bonds
- Payment-in-kind coupon bonds
- Index-linked bonds

25-200

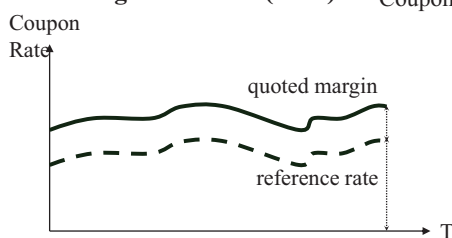
101% Contribution Breeds Professionalism

Cash Flow Structure

➤ Coupon payment structures

➤ Floating-Rate Notes (FRN)

$$\text{Coupon rate} = \text{reference rate} \pm \text{quoted margin}$$



- Such as:
- LIBOR;
 - U.S. Treasury yield

- It is a constant value.
- It is often quoted in basis point.
- Occasionally, the spread is not fixed, called **variable-rate note**.

- The most widely used reference rate for floating-rate bonds is the London Interbank Offer Rate (LIBOR).

- LIBOR are published daily for several currencies and for maturities of one day (overnight rates) to one year.
- There is no single "LIBOR rate" but rather a set of rates, such as "30-day U.S. dollar LIBOR" or "90-day Swiss franc LIBOR".
- The interbank offered rates are also used as reference rates for other debt instruments including mortgages, derivatives such as interest rate and currency swaps, and many other financial contracts and products.

26-200

101% Contribution Breeds Professionalism

Cash Flow Structure

- The coupon rate determined at the coupon reset date is the rate that the issuer promises to pay at the **next** coupon date.

- The new 1-year rate at that time will determine the rate of interest paid at the end of the next year. Most floaters pay quarterly and are based on a quarterly (90-day) reference rate.

✓ **Example:** coupon rate = 1-year LIBOR + 0.75%, if 1-year LIBOR is 2.3% at the beginning of the year, the bond will pay 2.3%+0.75%=3.05% of its par value at the end of the year.

- The reference rate must match the frequency with which the coupon rate on the bond is reset.

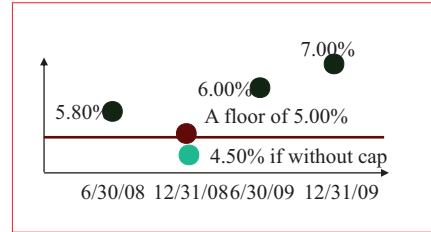
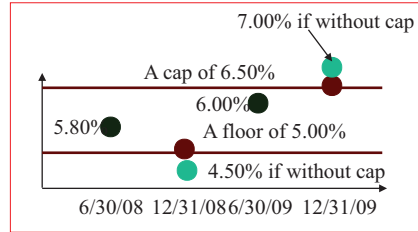
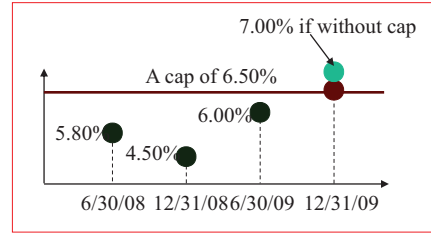
✓ **Example:** a bond denominated in euros with a coupon rate that is reset twice each year might use 6-month euro LIBOR as a reference rate.

27-200

101% Contribution Breeds Professionalism

Cash Flow Structure

- The upper limit is called the cap.
- The lower limit is called the floor.
- When a floating-rate security has both a upper limit and a lower limit, the feature is called a collar.



28-200

101% Contribution Breeds Professionalism

金程教育
GOLDEN FUTURE

Cash Flow Structure

- **Variable-rate note:** the quoted margin above the reference rate is not fixed.
- **Inverse floaters** (also called **reverse floaters**) have coupon rates that move in the opposite direction from the change in the reference rate.
 - When the reference rate increases, the coupon rate decreases and vice versa.
- **Example:** An inverse floater's coupon rate = $15\% - 2 \times (3\text{-month LIBOR})$.
Suppose the 3-month LIBOR is 3%, then the coupon rate for the next interest payment period is: Coupon rate = $15\% - 2 \times 3\% = 9\%$

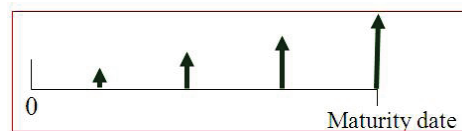
29-200

101% Contribution Breeds Professionalism

金程教育
GOLDEN FUTURE

Cash Flow Structure

- **Step-up coupon bonds:** have a coupon rate that increases over time.



- Have a call option that allows the firm to redeem the bond issue at a set price at each step-up date.
- new higher coupon rate > market yield of the call price → call the bonds
- An increase in bond coupon rates can be viewed as a protection against the increase in market interest rates which is due to the decrease in issuer's credit rating.

30-200

101% Contribution Breeds Professionalism

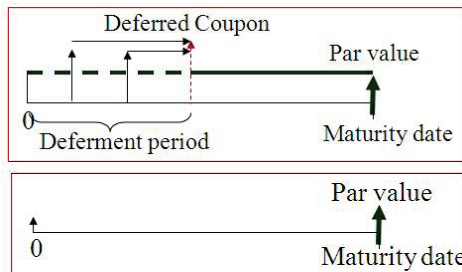
金程教育
GOLDEN FUTURE

Cash Flow Structure

➤ **Deferred coupon bonds/split coupon bond:** interest payments are deferred for a specified number of years.

- financing for a firm financing a large project that will not be completed and generating revenue for some period of time after bond issuance.
- Have tax advantages in some jurisdictions

➤ **Zero-coupon bonds:** no periodic coupon payments; always be traded at a discount—— one type of deferred coupon bond



31-200

101% Contribution Breeds Professionalism

Cash Flow Structure

- **Credit-linked coupon bond:** coupon rate will go up (down) by a certain amount if the credit rating of the issuer falls (improves).
- **Pay-in-kind (PIK) bond:** allows the issuer to make the coupon payment by increasing the principal amount of the outstanding bonds, essentially paying bond interest with more bonds.
- These bonds have higher yields because of a lower perceived credit quality from cash flow shortfalls or high leverage of the issuing firm.
- **Equity-linked notes (ELN):** no periodic interest payments, and the payment at maturity is based on an equity index.
- **Index-linked bond:** coupon payments and/or a principal value that is based on a commodity index.
- Inflation linked bonds/ linkers: payments are based on the change in an inflation index, e.g. CPI
 - If it will not pay less than their original par value at maturity, even when the index has decreases, which is called **principal protected bonds**

32-200

101% Contribution Breeds Professionalism

Cash Flow Structure

- Different structure of inflation-index bonds:
- **Index-annuity bonds:** fully amortizing with the periodic payments directly adjusted for inflation or deflation
 - **Indexed zero-coupon bonds:** the payment at maturity is adjusted for inflation.
 - **Interest-indexed bonds:** coupon rate is adjusted for inflation while the principal value remains unchanged.
 - **Capital-indexed bonds:** coupon rate remains constant, and principal value is increased by the rate of inflation. E.g. Treasury inflation Protected Securities (TIPS)
- TIPS: pay semiannual coupons, at maturity:
- If adjusted par value (per bond) is greater than \$1,000 at maturity, the holder receives the adjusted par value as the maturity payment.
 - If the adjusted par value is less than \$1,000 (due to deflation), holders receive \$1,000 at maturity as this is the minimum repayment amount.

$$\text{TIPS coupon payment} = \text{inflation-adjusted par value} \times \frac{\text{stated coupon rate}}{2}$$

33-200

101% Contribution Breeds Professionalism

Example

- Consider a \$1,000 par value TIPS with a 10% coupon rate. The CPI for the first half year is 3%, and the CPI for the second half year is 4% (both 3% and 4% are annual rates).

$$Coupon_1 = \$1000 \times (1 + 1.5\%) \times 10\% \div 2 = \$50.75$$

$$Coupon_2 = \$1000 \times (1 + 1.5\%) \times (1 + 2\%) \times 10\% \div 2 = \$51.77$$

34-200

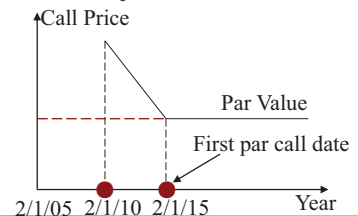
10% Contribution Breeds Professionalism

Bonds with Embedded Options

- **Call provisions** are *beneficial to the issuer*.
- Callable bond offers a higher yield (lower price) than identical noncallable bond
 - ✓ Value callable bond = value of identical noncallable bond - call option value
 - **Deferred call**: call provisions have a deferment period; that is, the issuer may not call the bond for a number of years until a specified first call date is reached.
- **Call price**: the price at which the issuer may retire the bond.
- **Call premium**: the amount by which the call price is above par.
- **First par call date**: the date at which the issue is first callable at par value

Example:

- A 20-year bond was issued on 2/1/2005.
- The first call date is 2/1/2010, and the call price is \$105.
- Then, the call price declines by \$1 a year till it reaches \$100 on 2/1/2015 (the first par call date).



35-200

10% Contribution Breeds Professionalism

Bonds with Embedded Options

- **If interest rates fall**
- Issuer can retire the bond paying high coupon rate, and replace it with lower coupon bonds.
 - When the bond is called, the proceeds can only be reinvested at a lower interest rate.
- **Three styles of exercise for callable bonds:**
- American style: can be called anytime after the first call date.
 - European style: can only be called on the call date specified.
 - Bermuda style: can be called on specified dates after the first call date, often on coupon payment dates.

36-200

10% Contribution Breeds Professionalism

Bonds with Embedded Options

- **Make-whole call provision:** the call price is not fixed but includes a lump-sum payment based on the present value of the future coupons the bondholder will not receive if the bond is called early, which is unlikely to be lower than the market value of the bond
 - To avoid the higher interest rates required on a callable bonds but still preserve the option to redeem bond early.
 - Make-whole provision does not put an upper limit on the bond value when interest rates fall.

37-200

101% Contribution Breeds Professionalism



Bonds with Embedded Options

- **Puttable bonds** are *beneficial to the bondholders*.
 - Puttable bonds have a lower yield and higher price than similar non-puttable bonds.
 - ✓ Value of puttable bonds = value of an identical nonputtable bonds + put option value.
 - If interest rates rise
 - ✓ The bondholders can sell the bond back to the issuer and get cash.
 - ✓ When the bond is put, the proceeds can be reinvested at a higher interest rate.

38-200

101% Contribution Breeds Professionalism



Bonds with Embedded Options

- **Convertible bonds** are *beneficial to the bondholders*.
- **Key terms of conversion provision:**
 - Conversion price: share price when the convertible bond can be converted into shares.
 - Conversion ratio: the number of common shares each bond can be converted into.
 - ✓ Conversion ratio = par value / conversion price
 - Conversion value: value of conversion bond if converted right now.
 - ✓ Conversion value = current share * conversion ratio
 - Conversion premium: difference between the convertible bond's price and conversion value
 - Conversion parity:
 - ✓ At parity: conversion value = convertible bond's price
 - ✓ Above parity: conversion value > convertible bond's price
 - ✓ Below parity: conversion value < convertible bond's price

39-200

101% Contribution Breeds Professionalism



Bonds with Embedded Options

- **Convertible bond** is a hybrid security with both debt and equity features (referred to as hybrid security). It gives bondholders the right to exchange the bond for a specified number of common shares in the issuing company.
 - If share prices increase
 - ✓ Bondholders can exchange the bond for a specific number of shares of issue company.
 - If share prices decrease
 - ✓ Bondholders can still receive coupon and principal payment of the straight bond.
 - ✓ The value of straight bond is the lowest price of the convertible bond.
- Two main advantages of issuer :
 - Reduce interest expense
 - Reduce debt of conversion option is exercised

40-200

101% Contribution Breeds Professionalism

Bonds with Embedded Options

- Generally, early conversion would eliminate the yield advantage of continuing to hold the convertible bond; investors would typically receive in dividends less than they would receive in coupon payments. For this reason, it is common to find convertible bonds that are also callable by the issuer on a set of specified dates.
 - If the convertible bond includes a call provision and the conversion value is above the current share price, the issuer may force the bondholders to convert their bonds into common shares before maturity.
 - For this reason, callable convertible bonds have to offer a higher yield and sell at a lower price than otherwise similar non-callable convertible bonds.

41-200

101% Contribution Breeds Professionalism

Example:

- Assume that a convertible bond issued in the U.S. has a par value of \$1,000,000 and is currently priced at \$1,100,000. The underlying share price is \$40,000 and the conversion ratio is 25:1. The conversion condition for this bond is:
 - A. Parity
 - B. Above parity
 - C. Below parity
- **Answer: C**
 - The conversion value of the bond is $\$40,000 \times 25 = \$1,000,000$. The price of the convertible bond is \$1,100,000. Thus, the conversion value of the bond is less than the bond's price, and this condition is referred to as below parity.

Below parity: conversion value < convertible bond's price

42-200

101% Contribution Breeds Professionalism

Bonds with Embedded Options

- **Warrants** are *beneficial to the bondholders*
 - Warrants is actually not an embedded option but rather an “attached” option.
 - Entitles the bondholder to buy the underlying stock of the issuing company at a fixed exercise price until the expiration date.
 - If Common share value of issuing company is *greater than* the fixed exercise price, the bondholder can buy the share at the fixed exercise price and still hold the bond.
 - The bond with warrants can be more attractive.
- **Contingent convertible bonds (“CoCos”)**
 - Can convert from debt to common equity automatically if a specific event occurs.
 - This type of bond has been issued by some European banks.
 - **Example:**
 - ✓ Banks must maintain specific levels of equity financing. If a bank’s equity falls below the required level, CoCos are automatically converted to common stock.
 - ✓ This has the effect of decreasing the bank’s debt liabilities and increasing its equity at the same time, which helps the bank to meet its minimum equity requirement.

43-200

101% Contribution Breeds Professionalism

Bonds with Embedded Options

Embedded options favor the **issuers:**

- The right to call the issue.
- The prepayment option.
- Accelerated sinking fund provision.
- The cap on a floater.

Embedded options favor the **bondholders:**

- Conversion provisions.
- The put option.
- The floor on a floater.

44-200

101% Contribution Breeds Professionalism

Framework of Fixed Income

➤ Study Session 15 — Basic Concepts

- R51 Fixed-Income Securities: Defining Elements
- R52 Fixed-Income Markets: Issuance, Trading, and Funding
- R53 Introduction to Fixed-Income Valuation
- R54 Introduction to Asset-Backed Securities

➤ Study Session 16 — Analysis of Risk

- R55 Understanding Fixed-Income Risk and Return
- R56 Fundamentals of Credit Analysis

45-200

101% Contribution Breeds Professionalism

Framework

- Classification of fixed-income markets
- Issuing & Trading
- Funding

46-200

101% Contribution Breeds Professionalism金程教育
GOLDEN FUTURE

Classification of Global Fixed-Income Markets

- By type of issuer:
 - Government and government-related sector
 - ✓ Supranational (international) organizations
 - ✓ Sovereign (national) governments
 - ✓ Non-sovereign (local) governments
 - ✓ Quasi-government entities
 - Corporate sector
 - ✓ Financial company
 - ✓ Non-financial company
 - Securitized sector
 - ✓ securitization

47-200

101% Contribution Breeds Professionalism金程教育
GOLDEN FUTURE

Classification of Global Fixed-Income Markets

- Classification of fixed-income markets by type of issuer

Exhibit 1

Global Debt and Equity Outstanding by Sector at the End of December 2010

Sector	Amount (US\$ trillions)	Weight	Compound	Annual
			Annual	Annual
			Growth	Growth
			Rate	Rate
			1990–2009	2009–2010
Stock markets	\$54	26%	7.2%	5.6%
Bonds issued by governments	41	19	7.8	11.9
Bonds issued by financial companies	42	20	9.5	–3.3
Bonds issued by nonfinancial companies	10	5	6.7	9.7
Securitized debt instruments	15	7	12.7	–5.6
Bank loans	49	23	4.1	5.9

48-200

101% Contribution Breeds Professionalism金程教育
GOLDEN FUTURE

Classification of Global Fixed-Income Markets

- **By credit quality:**
 - Investment grade
 - ✓ Baa3 or above by Moody's Investors Service
 - ✓ BBB- or above by Standard & Poor's (S&P) and Fitch Ratings
 - Non-investment grade/high yield
 - ✓ Below investment grade
- **By original maturity:**
 - Money market securities
 - Capital market securities
- **By coupon structure:**
 - Floating-rate bonds
 - Fixed-rate bonds

49-200

101% Contribution Breeds Professionalism



Classification of Global Fixed-Income Markets

- **By currency**
 - Domestic bonds
 - Foreign bonds
 - Eurobonds
 - Global bonds
- **By geography**
 - Developed market
 - Emerging market
 - ✓ Emerging market bonds have higher yields than developed market
- **By other classification**
 - Indexing
 - Taxable statue

50-200

101% Contribution Breeds Professionalism



Classification of Global Fixed-Income Markets

- Classification by **currency denomination**

Exhibit 3 Amounts of International Bonds Outstanding by Currency Denomination at the End of December 2011

Currency	Amount (US\$ billions)	Weight
Euro (EUR)	\$9,665.9	46.0%
U.S. Dollar (USD)	6,900.8	32.9
British Pound Sterling (GBP)	2,052.3	9.8
Japanese Yen (JPY)	762.0	3.6
Swiss Franc (CHF)	393.4	1.9
Australian Dollar (AUD)	317.2	1.5
Canadian Dollar (CAD)	313.1	1.5
Swedish Krona (SEK)	103.0	0.5
Norwegian Krone (NOK)	86.4	0.4
Hong Kong Dollar (HKD)	63.5	0.3
Yuan Renminbi (CNY)	38.9	0.2
Other Currencies	305.0	1.5
Total	21,001.5	100.0%

51-200

101% Contribution Breeds Professionalism



Classification of Global Fixed-Income Markets

➤ Classification by Geography

Exhibit 4

Amount of Bonds Outstanding by Residence of Issuer and Type of Issuer at the End of December 2011 (US\$ billions)

Country	All Issuers		Government		Financial		Non-Financial	
	Amount	Global Weight	Amount	Sector Weight	Amount	Sector Weight	Amount	Sector Weight
United States	\$33,582	40%	\$12,954	39%	\$14,938	44%	\$5,690	17%
Japan	15,700	19	11,552	74	3,111	20	1,038	7
United Kingdom	5,275	6	2,040	39	2,537	48	699	13
Germany	4,383	5	2,079	47	2,175	50	129	3
France	4,382	5	1,910	44	1,947	44	525	12
Italy	3,686	4	2,078	56	1,492	40	116	3
Spain	2,307	3	871	38	1,416	61	19	1
Netherlands	2,246	3	401	18	1,730	77	116	5
Canada	1,899	2	1,178	62	399	21	322	17
Australia	1,847	2	479	26	1,186	64	182	10
Rest of the world	8,748	10	3,184	36	4,830	55	734	8
Total	\$84,055	100%	\$38,726	46%	\$35,761	43%	\$9,570	11%

52-200

101% Contribution Breeds Professionalism



Fixed-Income Indices

➤ **Fixed-income indices:** a multi-purpose tool used by investors and managers to describe a given bond market or sector, as well as to evaluate the performance of investments and investment managers.

- Index construction: security selection and index weighting

➤ Major types of fixed-income indices

- **Barclays Capital Global Aggregate Bond Index:** represents a broad-based measure of the global investment-grade fixed-rate bond market.
- **J.P Morgan Emerging Market Bond Index:** used to describe the emerging market
- **FTSE Bond Index Series:** set up to provide coverage of different classes of securities related to the government and corporate bond markets.

53-200

101% Contribution Breeds Professionalism



Investors in fixed-income securities

➤ Major categories of bond investors include central banks, institutional investors, and retail investors.

➤ The first two typically invest directly in fixed-income securities. In contrast, retail investors often invest indirectly through fixed-income mutual funds or exchange traded funds (ETFs).

- **Central banks** use open market operations to implement monetary policy. Open market operations refer to the purchase or sale of bonds, usually sovereign bonds issued by the national government.
- **Institutional investors**, including pension funds, some hedge funds, charitable foundations and endowments, insurance companies, and banks, represent the largest groups of investors in fixed-income securities.
- Another major group of investors is **sovereign wealth funds**, which are state-owned investment funds that tend to have very long investment horizons and aim to preserve or create wealth for future generations.
- **Retail investors** often invest heavily in fixed-income securities because of the attractiveness of relatively stable prices and steady income production.

54-200

101% Contribution Breeds Professionalism



Primary Market

- **Primary market:** sales of newly issued bonds
 - **Public offering:** bonds can be registered with securities regulators for sale to the public and is typically done with the help of an investment bank.
 - ✓ **Underwritten offering:** with the investment bank or syndicate purchasing the entire issue and selling the bonds to dealers.
 - ◆ **Grey market** (“when issued” market): Some bonds are traded on a when issued basis in what is called the **grey market**. Such trading prior to the offering date of the bonds provides additional information about the demand for and market clearing price (yield) for the new bond issue.
 - ✓ **Best efforts offering:** investment bank sells the bonds on a commission basis and do not commit to purchase the whole issue.
 - ✓ **Auction:** commonly used by issuing government debts.
 - ✓ **Shelf registration:** a bond issue is registered with securities regulators in its aggregate value with a master prospectus and can be issued over time when issuer needs to raise funds
- **Private placement:** sale of an entire issue to a qualified investor or a group of investors, which are typically large institutions.

55-200

101% Contribution Breeds Professionalism



Secondary Markets

- **Secondary markets:** trade of previously issued bonds.
 - **Exchange market:** transaction must obey the rules imposed by the exchange.
 - **OTC Dealer Market** (largest): dealers post bid and ask price.
 - ✓ Spread between bid and ask prices are narrower (wider) for liquid (less liquid) issues
 - **Electronic Trading Network** (growth)
- **Trade settlement:**
 - Corporate bonds: third trading day after trade date (T+3).
 - Government bonds: the next trading day after the trade date (T+1).
 - Money market securities: on the day of trade date (T+0).

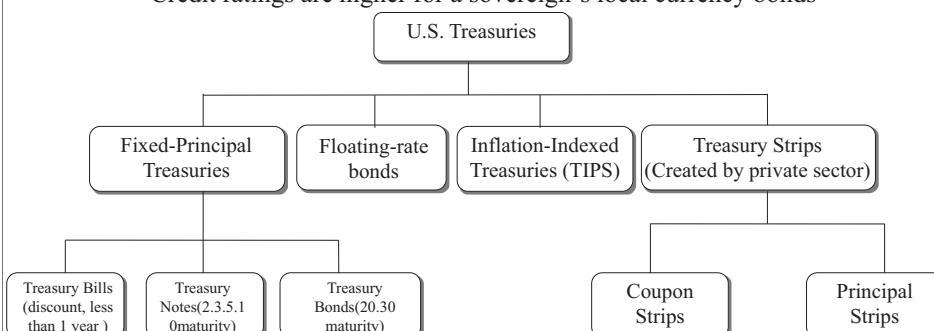
56-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **Sovereign bonds:** issued by national governments and backed by their tax power.
 - High credit ratings and essentially free of default risk.
 - Denominated in the local currency or a foreign currency.
 - ✓ Credit ratings are higher for a sovereign’s local currency bonds



57-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **Treasury Strips:** zero coupon securities of various maturities.
 - Coupon Strips (denoted as ci): created from coupon payments stripped from the original security.
 - Principal Strips: bond (maturities of 20-30years) and note (maturities of 2.3.5 and 10 years) principal payment with the coupons stripped off.

Example

- Which of the following statements regarding U.S. Treasury issues is **FALSE**?
 - A. Investment bankers strip the coupons from Treasury notes and bonds to create synthetic zero-coupon bonds.
 - B. A 5-year Treasury note could be stripped into 11 different zero coupon securities.
 - C. The U.S. Treasury issues **zero coupon notes**, but not bonds.
 - Correct answer: C
 - ✓ The Treasury does not issue zero-coupon notes or bonds. That is why STRIPS were created.

58-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **On-the-Run Issues**
 - Most Recently Auctioned
 - More Actively Traded
 - More Liquid
- **Off-the-Run Issues:** replaced by a more recently auctioned issue.
- Market prices of on-the-run issues provide better information about current market yields.

59-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **Nonsovereign government bonds:** issued by governments below the national level.
 - High credit quality, but lower than sovereign bonds
- **Municipal bond (in the U.S.)**
 - **GO (general obligation)/Tax-Backed Debt :** Support by taxing power of local government
 - ✓ Almost no credit risk
 - ✓ Require voter approval
 - **Revenue Bonds**
 - ✓ Supported only through revenues generated by projects.
 - ✓ Involve more risk, provide higher yield.

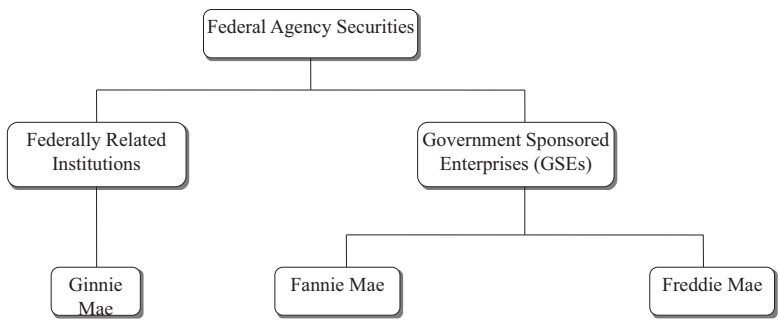
60-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **Agency/quasi-government bonds:** issued by entities created by national government and may be explicitly or implicitly backed by government.



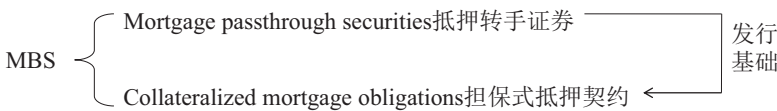
61-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

➤ Mortgage-Backed Securities



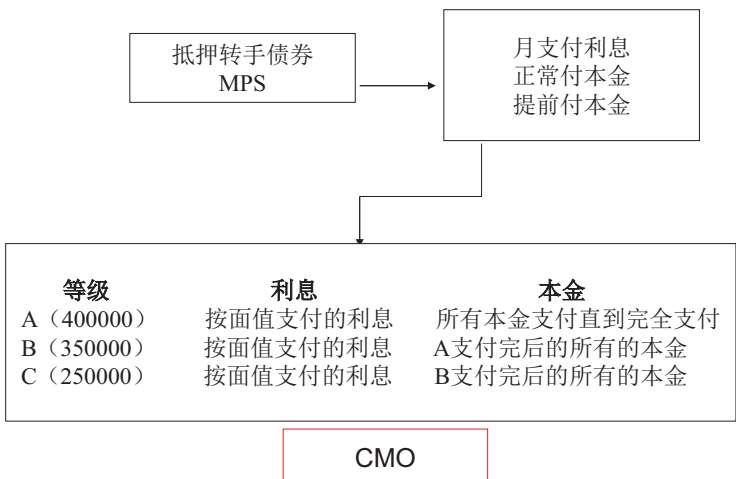
- **Mortgage passthrough securities:** created when one or more holders of mortgages form a collection of mortgages and sell shares or participation certificates in the pool.
- **Collateralized Mortgage Obligations:** created from mortgage passthrough certificates and referred as derivative mortgage-backed securities.

62-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds



63-200

101% Contribution Breeds Professionalism



Characteristics of Different Kinds of Bonds

- **Supranational bonds:** issued by supranational agencies (multilateral agencies) that operate across national.
 - high credit quality and can be very liquid, especially large issues of well-known entities.
 - E.g.World bank, the IMF, the Asian Development Bank.

64-200

101% Contribution Breeds Professionalism



Types of Corporation Debts

- **Bank debt:** bilateral loan & syndicated loan
 - Bilateral loan: involves only one bank
 - Syndicated loan: funded by several banks
- **Commercial paper:** short term, unsecured, low rate (issued by corporations of high credit quality) debt.
 - Exempt from registration, directly placed (sold directly by issuer) or dealer placed (sold to investor through agents/brokers).
 - There is very little secondary trading of commercial paper.
 - Reissued or rolled over when it matures.
 - **Rollover risk:** the risk that a company will not be able to sell new commercial paper to replace maturing paper.
 - **Backup lines of credit/ liquidity enhancement/backup liquidity lines:** a type of credit enhancement provided by a bank to a issuer of commercial paper to ensure that the issuer will have access to sufficient liquidity to repay maturing commercial paper if rolled over is not available.

65-200

101% Contribution Breeds Professionalism



Types of Corporation Debts

- U.S commercial paper Vs. Eurocommercial paper

Feature	U.S commercial paper	Eurocommercial paper
Currency	U.S dollar	Any currency
Maturity	Overnight to 270 days	Overnight to 364 days
Interest	Discount basis (pure discount security)	Interest-bearing basis (add-on yield)
Settlement	T+0	T+2
Negotiable	Can be sold to another	Can be sold to another

66-200

101% Contribution Breeds Professionalism



Types of Corporation Debts

➤ Corporate bonds

- Serial bond issue: with several maturity dates (known at issuance) and can be redeemed periodically.
- Term maturity structure: all the bonds maturing on the same date.

➤ Medium-term notes (MTNs):

- Various maturities(9 months to 100 years)
- Can be structured to meet an institution's specifications.
 - ✓ E.g. structured security: combination of the derivative and notes

67-200

101% Contribution Breeds Professionalism



Short-Term Funding Alternatives Available to Banks

➤ Customer deposits

- **Checking accounts:** provide transaction services and immediate availability of funds, but pay no interest.
- **Saving accounts:** pay interest and allow depositors to accumulate wealth in a very liquid form.
- **Money market mutual funds:** an intermediate between checking and saving accounts, pay interest.

➤ Negotiable CDs: typically have maturities of one, traded in the domestic market as well as Eurobond market.

➤ Central bank funds market: banks may buy or sell excess reserves deposited at central bank funds rates with their central banks.

- Central bank funds rates are strongly influenced by the effect of central bank's open market operations on the money supply and availability of short-term funds.

➤ Interbank funds: are unsecured loaned between banks for periods of one day to a year.

68-200

101% Contribution Breeds Professionalism



Repurchase Agreement

➤ Repurchase (repo) Agreement: an institution sells a security with a commitment to buy it back at a later date at a specified price.

- **Repurchase price:** is greater than the selling price and accounts for the interest charged by the buyer.
- **Repo rate:** is the interest rate on a repurchase agreement. The repo rate is lower when:
 - ✓ Repo term is shorter
 - ✓ Credit quality of the collateral security is higher
 - ✓ Collateral security is delivered to the lender
 - ✓ Interest rate for alternative sources of funds are lower
- **Repo margin/haicut:** the difference between the market value of the security used as collateral and the value of the loan. The rope margin is lower when:
 - ✓ Repo term is shorter
 - ✓ Credit quality of the collateral security is higher
 - ✓ Credit quality of the borrower is higher
 - ✓ Collateral security is in high demand or low supply.

69-200

101% Contribution Breeds Professionalism



Repurchase Agreement

➤ Repurchase (repo) Agreement

- Repurchase agreements are not regulated by the Federal Reserve.
- Collateral position of the lender in a repo is better in the event of bankruptcy of the dealer. (*liquidity*)
- **Overnight repo**: a repurchase agreement for one day.
- **Term repo**: an agreement covering a longer period.

➤ **Reverse repo agreement**: taking the opposite side of a repurchase transaction, lending funds by buying the collateral security.

➤ Example

- Consider a firm that enters into a repo agreement to sell a 4%, 12-year bond with a par value of \$1 million and a market value of \$970,000 for \$940,000 and to repurchase it 90 days later for \$947,050
- Repo rate = $947,050/940,000 - 1 = 0.75\%$
- Repo margin = $940,000/970,000 - 1 = -3.1\%$

70-200

101% Contribution Breeds Professionalism



Framework of Fixed Income

➤ Study Session 15 — Basic Concepts

- R51 Fixed-Income Securities: Defining Elements
- R52 Fixed-Income Markets: Issuance, Trading, and Funding
- R53 Introduction to Fixed-Income Valuation
- R54 Introduction to Asset-Backed Securities

➤ Study Session 16 — Analysis of Risk

- R55 Understanding Fixed-Income Risk and Return
- R56 Fundamentals of Credit Analysis

71-200

101% Contribution Breeds Professionalism



Framework

- Bond valuation
 - Bond pricing with a market discount rate
 - The value of a zero-coupon bond
- Yield-to-maturity
- The value change attributable to the passage of time
- Pricing bonds with spot rate
- Full price, clean price, accrued interest
- Matrix pricing
- Yield measure
 - Yield measures for fixed-rate bonds
 - Yield measures for floating-rate notes
 - Yield measures for money market instruments
- Yield curve
- Yield spread

72-200

101% Contribution Breeds Professionalism



Bond Valuation Process

- The general procedure for valuing fixed-income securities is to take the present values of all the expected cash flows and add them up to get the value of the security.

- Estimate the cash flows
- Determine the appropriate discount rate
- Calculate the present value of the estimated cash flows

$$P = \sum_{t=1}^n \frac{C_t}{(1+r)^t} + \frac{B}{(1+r)^n}$$

73-200

101% Contribution Breeds Professionalism

Example

- An investor buys a 25-year, 10 percent annual pay bond for \$900 planning to sell the bond **in 5 years** when he estimates **yields will be 9** percent. What is the estimate of the future price of this bond?

- A. \$964.
- B. \$1,091.
- C. \$1,000.

- Correct answer: B

- ✓ This is a Present Value problem 5 years in the future. Input into your calculator:

N = 20, PMT = 100, FV = 1000, I/Y = 9

CPT PV = 1,091.28

The \$900 purchase price is a distracter for this problem.

74-200

101% Contribution Breeds Professionalism

Bond Valuation Process

- **Value of a zero-coupon bond**

$$\text{bond value} = \frac{\text{maturity value}}{\left(1 + \frac{i}{2}\right)^{\text{number of years} \times 2}}$$

- **Example:**

- To find the value of a **8-year, \$1000** face value zero-coupon bond with a yield to maturity of **8 percent**.

- **Answer:**

N=8×2=16; FV=1000; I/Y=8/2=4; PMT=0; CPT→PV=533.9038

75-200

101% Contribution Breeds Professionalism

Yield to Maturity (YTM)

- Internal rate of return, implied market discount rate
- Critical assumptions:
 1. hold the bond until maturity
 2. full, timely coupon, principal payments (no default)
 3. coupons are reinvested at original YTM
- Calculation: iteration, back out

76-200

101% Contribution Breeds Professionalism



Yield to Maturity (YTM)

- Annual -coupon bond

$$\text{bond price} = \frac{CPN_1}{(1+YTM)} + \frac{CPN_2}{(1+YTM)^2} + \dots + \frac{CPN_N + Par}{(1+YTM)^N}$$

- Semiannual-coupon bond:

$$\text{bond price} = \frac{CPN_1}{(1+YTM/2)} + \frac{CPN_2}{(1+YTM/2)^2} + \dots + \frac{CPN_{2N} + Par}{(1+YTM/2)^{2N}}$$

- Example

Consider the purchase of an existing bond selling for \$1,020.78. This bond has 5 years to maturity, pays a 7% semiannual coupon. What is the bond's yield to maturity (YTM)?

- A. 9.26%.
- B. 10.05%.
- C. 6.51%.
- Correct answer: C
 - ✓ N = 10, PMT = 35, PV = -1,020.78, FV = 1,000, CPT → I/Y=3.253%
 - ✓ YTM=3.253%*2=6.506%

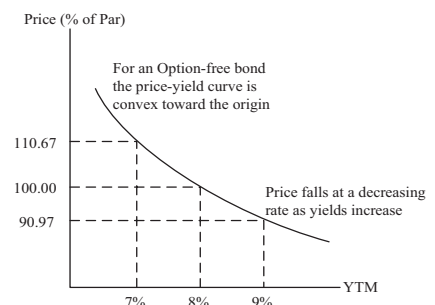
77-200

101% Contribution Breeds Professionalism



Relationships Between Price and Yield

- A bond's price and YTM are inversely related.
- A bond will be priced at a discount (premium) to par value if coupon rate is less (more) than its YTM.
- For a given change in yield, the percentage price increase is greater than the percentage price decrease.

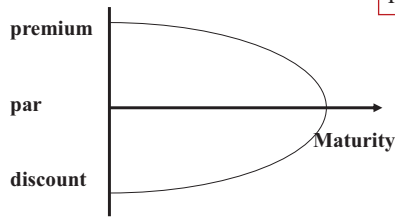


78-200

101% Contribution Breeds Professionalism



Relationships Between Price and Time



Par value = \$1000, Maturity = 3 years, coupon rate = 6%, semi-annual payment.

Time of Maturity	YTM=3%	YTM=6%	YTM=12%
3.0 years	\$1,085.40	\$1,000.00	\$852.48
2.5	1,071.74	1,000.00	873.63
1.5	1,057.82	1,000.00	896.05
1.0	1,029.34	1,000.00	945.00
0.5	1,014.78	1,000.00	971.69
0	1,000.00	1,000.00	1,000.00

Example: 3-year bond, coupon rate 10%, semi-annual, par 1000, buy at 8% today, after one-year, the rate change to 7%, the value change attributable to the passage of time?

$$\Delta P_t = P_t \text{ 8\%} - P_0 \text{ 8\%}$$

79-200

101% Contribution Breeds Professionalism



Example

- An 8% coupon bond with a par value of \$100 matures in 6 years and is selling at \$95.51 with a yield of 9%. Exactly one year ago this bond sold at a price of \$90.26 with a yield of 10%. The bond pays annual interest. The change in price **attributable to the change in maturity** is closest to:
 - A. \$0.54.
 - B. \$1.03.
 - C. \$4.22.
- Correct answer: B
 - The change in price attributable to moving to maturity = \$91.29 - \$90.26 = \$1.03

80-200

101% Contribution Breeds Professionalism



Example

- An analyst gathered the following information about two option-free bonds that each have a par value of \$1,000:
- | | Bond 1 | Bond 2 |
|---------------------|---------|----------|
| Time to maturity | 5 years | 10 years |
| Annual coupon rate | 5.0% | 7.0% |
| Discount rate today | 6.0% | 6.5% |
- If the discount rate does not change for either bond, one year from today, which of the following most likely describes the change in price for each bond?
 - A. Both Bond 1 and Bond 2 will decrease.
 - B. Both Bond 1 and Bond 2 will increase.
 - C. Bond 1 will increase and Bond 2 will decrease.
 - Correct answer: C

81-200

101% Contribution Breeds Professionalism



Valuation with Spot Rates

- **Spot rates:** are market discount rates for single payments to be made in the future.
- **The no-arbitrage price** of a bond is calculated using spot rates:

$$\text{no-arbitrage price} = \frac{CPN_1}{(1+S_1)} + \frac{CPN_2}{(1+S_2)^2} + \dots + \frac{CPN_N + \text{Par}}{(1+S_N)^N}$$

Example

- A 3-year bond offers a 10% coupon rate with interest paid annually. Assuming the following sequence of spot rates, the price of the bond is closest to:

Time-to-Maturity	Spot Rates
1 year	8.0%
2 years	9.0%
3 years	9.5%

- A. 96.98
- B. 101.46
- C. 102.95
- Correct answer: B

82-200

101% Contribution Breeds Professionalism

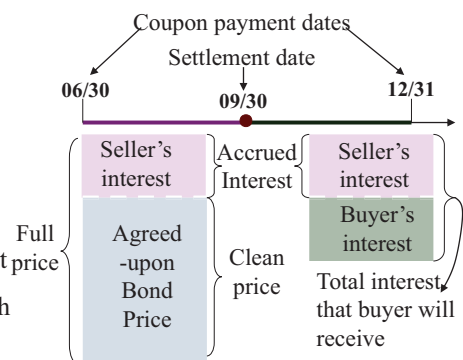


Accrued Interest

- **Accrued Interest:** the interest received by the seller when a bond trades between coupon dates.

- **Clean(flat) Price:** the agreed upon price of the bond.

- **Full Price** (or dirty price): the amount price that the buyer pays to the seller, which equals the clean price plus any accrued interest.



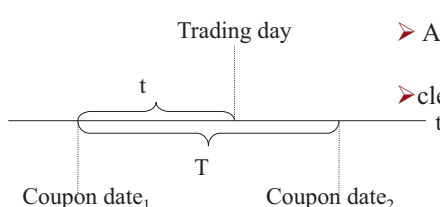
- Full Price = Clean Price + Accrued Interest

83-200

101% Contribution Breeds Professionalism



Accrued Interest



$$\text{Accrued interest} = \text{Coupon} \times \frac{t}{T}$$

$$\text{clean price} = \text{dirty price} - \text{accrued interest}$$

Example:

- 3-year bond, coupon rate 10%, par 1000, (semiannual) buy at 8%, the period between the settlement date and the next coupon period is 58 days, there are 183 days in the coupon period, what is accrued interest?

$$\text{AI} = (1000 \times 0.1/2) \times (1 - 58/183) = 50 \times (1 - 0.3169) = 34.155$$

84-200

101% Contribution Breeds Professionalism



Accrued Interest

$$PV^{Full} = \frac{PMT}{(1+r)^{1-t/T}} + \frac{PMT}{(1+r)^{2-t/T}} + \dots + \frac{PMT + FV}{(1+r)^{N-t/T}}$$

$$PV^{Full} = \left[\frac{PMT}{(1+r)^1} + \frac{PMT}{(1+r)^2} + \dots + \frac{PMT + FV}{(1+r)^N} \right] \times (1+r)^{t/T} = PV \times (1+r)^{t/T}$$

➤ Example:

- A 6% German corporate bond is priced for settlement on 18 June 2015. The bond makes semiannual coupon payments on 19 March and 19 September of each year and matures on 19 September 2026. The corporate bond uses the 30/360 day-count convention for accrued interest. Calculate the full price, the accrued interest, and the flat price per EUR100 of par value if the stated annual yields-to-maturity is 6.00%.

85-200

101% Contribution Breeds Professionalism



Accrued Interest

➤ Solution:

- The price at the beginning of the period is par value, as expected, because the coupon rate and the market discount rate are equal.

$$PV = \frac{3}{(1.0300)^1} + \frac{3}{(1.0300)^2} + \dots + \frac{3}{(1.0300)^{23}} = 100.000000$$

- The full price on 18 June is EUR101.472251.

$$PV^{Full} = 100.000000 \times (1.0300)^{89/180} = 101.472251$$

- The accrued interest is EUR1.483333, and the flat price is EUR99.988918.

$$\checkmark AI = 89/180 \times 3 = 1.483333$$

$$\checkmark PV^{flat} = 101.472251 - 1.483333 = 99.988918$$

86-200

101% Contribution Breeds Professionalism



Matrix Pricing

- **Matrix pricing:** a method of estimating the required YTM of bonds that are currently not traded or infrequently traded bonds according to the yields of traded bonds with the same credit quality.

- **Linear interpolation** can be used when the maturities between the valued bond and the traded bond are different.

Example:

- Estimate the YTM of a non-traded 4%, 5-year annual-pay bond

- 4-year annual-pay, 5% coupon bond: YTM=4.738%
- 6-year annual-pay, 4% coupon bond: YTM=5.232%
- 6-year annual-pay, 6% coupon bond: YTM=5.284%

Answer:

- Average YTM of 6-year bonds = $(5.232 + 5.284) / 2 = 5.258\%$

- Using linear interpolation:

$$YTM \text{ of the non-traded bond} = 4.738 + [(5-4)/(6-4)] \times (5.258 - 4.738) = 4.998\%$$

87-200

101% Contribution Breeds Professionalism



Yield Measures for Fixed-Rate Bonds

- **Periodicity of the annual rate:** an annualized and compounded yield on a fixed-rate bond depends on the assumed number of periods in the year.
- Typically, the periodicity matches the frequency of coupon payments.
 - The **periodicity of the annual market discount rate for a zero-coupon bond is arbitrary because there are no coupon payments.**
- **Effective yield:** Depends on its periodicity, or annual frequency of coupon payments.
- $$effective\ yield = (1 + \frac{YTM}{m})^m - 1$$
- An **effective annual rate** has a periodicity of one because there is just one compounding period in the year.
 - ✓ For annual-pay bond: effective yield equal to YTM
 - Convert an annual percentage rate for m periods per year (APR_m), to an annual percentage rate for n per year (APR_n):
$$(1 + \frac{APR_m}{m})^m = (1 + \frac{APR_n}{n})^n$$
 - **Semiannual bond basis yield(semiannual bond equivalent yield):** an annual yield having a periodicity of two.
 - ✓ A semiannual bond basis yield is the yield per semiannual period times two

88-200

101% Contribution Breeds Professionalism



Yield Measures for Fixed-Rate Bonds

- **Street convention yield:** Yield measures that neglect weekends and holidays are quoted on what is called street convention.
- The street convention yield-to-maturity is the internal rate of return on the cash flows assuming the payments are made on the scheduled dates.
- **True yield:** internal rate of return on the cash flows using the actual calendar of weekends and bank holidays.
- The true yield is never higher than the street convention yield because weekends and holidays delay the time to payment.
 - The difference is typically small, no more than a basis point or two.
- **Current yield(income or interest yield):** not consider capital gains/loss or reinvestment income
- $$current\ yield = \frac{sum\ of\ coupon\ payment\ received\ over\ the\ year}{flat\ bond\ price}$$
- **Simple yield:** It is the sum of the coupon payments plus the straight-line amortized share of the gain or loss, divided by the flat price.

Bond Selling at:	Relationship
Par	coupon rate = current yield = yield to maturity
Discount	coupon rate < current yield < yield to maturity
Premium	coupon rate > current yield > yield to maturity

89-200

101% Contribution Breeds Professionalism



Yield Measures for Fixed-Rate Bonds

- **Yield to call (put)** is calculated as a YTM but with the number of periods until the call (put) price substituted for the number of periods to maturity and the maturity value.
- **Yield to Worst:** the worst yield outcome of any that are possible given the call provisions of the bond.
- **Option-adjusted yield:** the required market discount rate whereby the price is adjusted for the value of the embedded option.
- For a callable bond: option-adjusted yield < YTM
 - For a putable bond: option-adjusted yield > YTM

90-200

101% Contribution Breeds Professionalism



Example

- Tony Ly is a Treasury Manager with Deeter Holdings, a large consumer products holding company. The Assistant Treasurer has asked Ly to calculate the current yield (CY) and the Yield-to-first Call (YTC) on a bond the company holds that has the following characteristics:

- 7 years to maturity
- \$1,000 face value
- 7.0% semi-annual coupon
- Priced to yield 9.0 percent
- **Callable at \$1,060 in two years**

If Ly calculates correctly, the CY and YTC are approximately:

- | | <u>CY</u> | <u>YTC</u> |
|----|-----------|------------|
| A. | 7.80% | 7.91% |
| B. | 7.80% | 15.82% |
| C. | 7.78% | 15.72% |
- Correct answer: B

91-200

101% Contribution Breeds Professionalism

Yield measures for floating-rate notes

- Coupon rate = reference rate + **quoted margin**
- **Quoted margin:** margin used to calculate the bond coupon payments
- Discount rate = reference rate + **required margin (or discount margin)**
- **Required/discount margin:** margin required to return the FRN to its par value at each reset date.
 - ✓ Selling at par(credit unchanged): required margin = quoted margin
 - ✓ Selling at discount(downgrade of credit): quoted margin < required margin
 - ✓ Selling at premium(upgrade of credit): quoted margin > required margin
- **Example**
- A floating-rate note has a quoted margin of +50 basis points and a required margin of +75 basis points. On its next reset date, the price of note will:
 - A. Equal to par value
 - B. Less than par value
 - C. Greater than par value
 - Correct answer: B

92-200

101% Contribution Breeds Professionalism

Example

- A two-year floating-rate note pays 6-month Libor plus 80 basis points. The floater is priced at 97 per 100 of par value. Current 6-month Libor is 1.00%. Assume a 30/360 day-count convention and evenly spaced periods. The discount margin for the floater in basis points (bps) is closest to:

- A. 180 bps
- B. 236 bps
- C. 420 bps

- Answer: B

93-200

101% Contribution Breeds Professionalism

Introduction to Fixed-Income Valuation

➤ Yield measures for money market instruments

- Discount yield: (e.g., U.S. Treasury bills)

$$PV = FV \times \left(1 - \frac{Days}{Year} \times DR\right)$$

- Add-on yield: (e.g., LIBOR, bank CD rates)

$$PV = \frac{FV}{\left(1 + \frac{Days}{Year} \times AOR\right)}$$

- Both discount basis and add-on yields in the money market are quoted as simple annual interest and can be based on a 360-day or 365-day basis.
- **Bond equivalent yield(investment yield) for money market security:** yield stated on a 365-day add-on rate basis.

94-200

101% Contribution Breeds Professionalism

Yield Curve

➤ Yield curve shows the term structure of interest rates by displaying yields across different maturities.

➤ Spot curve: a yield curve for single payments in the future, such as zero-coupon bonds or stripped Treasury bonds.

- Spot curve for U.S. Treasury bonds is called the zero-curve or strip curve.

➤ Yield curve for coupon bonds shows the YTM for coupon bonds at various maturities, which can be calculated by linear interpolation

➤ Par bond yield curve: shows the coupon rates for bonds of various maturities that would result in bond prices equal to their par values.

Example:

➤ Consider a 3-year annual-pay bond with spot rates of 1%, 2%, 3%, the coupon payment satisfies:

$$\frac{PMT}{1.01} + \frac{PMT}{(1.02)^2} + \frac{PMT+100}{(1.03)^3} = 100$$

Solution: PMT=2.96, par bond coupon rate=2.96%

➤ Forward yield curve shows the future rates for bonds or money market securities for the same maturities for annual periods in the future.

95-200

101% Contribution Breeds Professionalism

Forward Rates vs. Spot Rates

➤ Forward Rates: borrowing/lending rate for a loan to be made at some future date.

Marginal return for extending the time-to-maturity for an additional period

- E.g. The int. of a 1-year loan that would be made 2 years from now
- Notation: 2y1y rate of a 1-year loan to be made 2 years from now

➤ Relationship Between Forward Rates and Spot Rates

$$(1 + S_T)^T = (1 + S_1)(1 + 1y1y) \dots (1 + (T-1)y1y)$$

➤ Valuation Using Forward Rates

$$bond\ value = \frac{CF_1}{(1 + S_1)} + \frac{CF_2}{(1 + S_1)(1 + 1y1y)} + \dots + \frac{CF_n}{(1 + S_1)(1 + 1y1y) \dots (1 + (T-1)y1y)}$$

96-200

101% Contribution Breeds Professionalism

Yield Spread

- **Benchmark spread:** a yield spread relative to a benchmark bond.
 - **G-spread:** the benchmark is government bond yield
 - **Interpolated spread (I-spread):** the benchmark is swap rate
- **Zero-volatility spread (Z-spread):** the spread that must be added to each rate on the benchmark yield curve to make the present value of a bond equal to its price.
- **The difference between the GS and the ZS**
 - The steeper the benchmark spot rate curve, the greater the difference between the two spread measures.
 - ✓ There is no difference between the GS and ZS when the spot yield curve is flat.
 - The earlier bond principal is paid, the greater the difference between the two spread measures
- **Option-adjusted spread (OAS):** used for bonds with embedded options.
 - Callable bond: $ZS > OAS$
 - Puttable bond: $ZS < OAS$

97-200

101% Contribution Breeds Professionalism



Example

Bond	Coupon rate	Time-to-maturity	Price
U.K. Government Benchmark Bond	2%	3 years	100.25
U.K. Corporate Bond	5%	3 years	100.65

- Both bonds pay interest annually. The current three-year EUR interest rate swap benchmark is 2.12%. The G-spread in basis points (bps) on the U.K. corporate bond is closest to:
 - A. 264 bps.
 - B. 285 bps.
 - C. 300 bps .

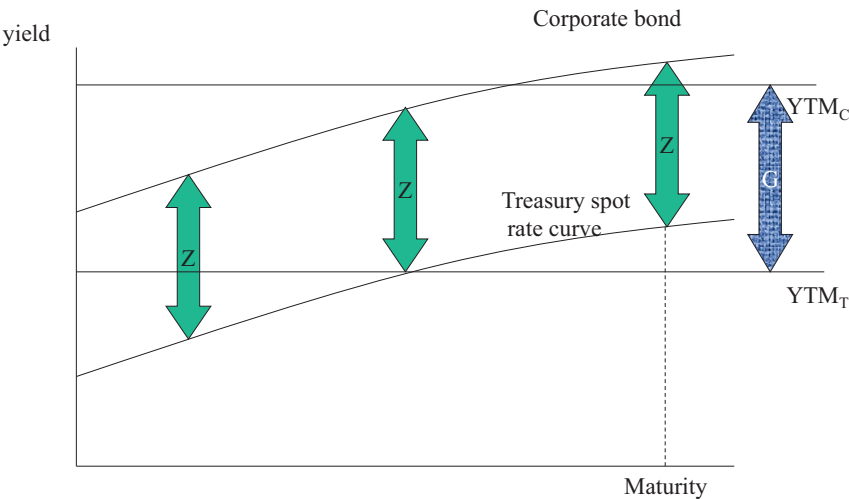
➤ Answer: B

98-200

101% Contribution Breeds Professionalism



Yield Spread

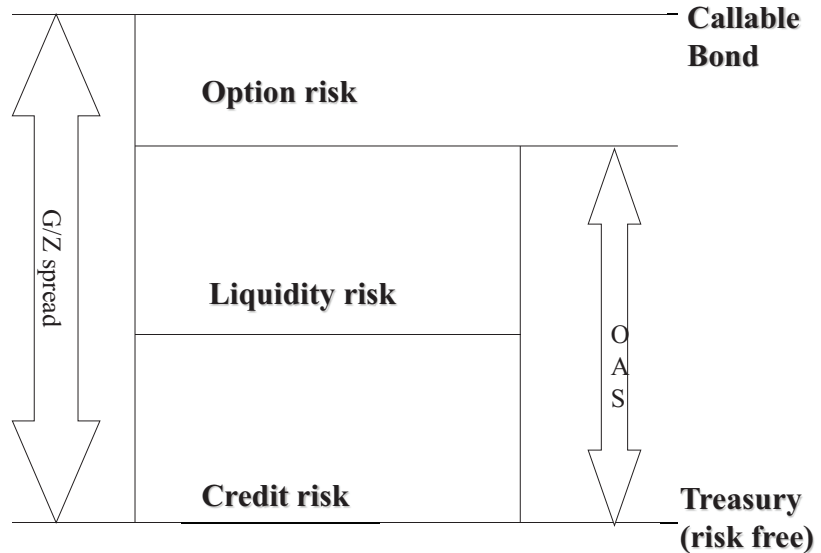


99-200

101% Contribution Breeds Professionalism



Yield Spread



100-200

101% Contribution Breeds Professionalism

金程教育
GOLDEN FUTURE

Framework of Fixed Income

➤ Study Session 15 — Basic Concepts

- R51 Fixed-Income Securities: Defining Elements
- R52 Fixed-Income Markets: Issuance, Trading, and Funding
- R53 Introduction to Fixed-Income Valuation
- R54 Introduction to Asset-Backed Securities

➤ Study Session 16 — Analysis of Risk

- R55 Understanding Fixed-Income Risk and Return
- R56 Fundamentals of Credit Analysis

101-200

101% Contribution Breeds Professionalism

金程教育
GOLDEN FUTURE

Framework

- Securitization
- Mortgage-Backed Securities (MBS)
 - Residential Mortgage Loans
 - Residential Mortgage-Backed Securities (RMBS)
 - ✓ Agency MBS
 - ◆ Mortgage passthrough security (MPS)
 - Weighted average maturity (WAM)
 - Weighted average coupon (WAC)
 - ◆ Prepayment risk
 - ◆ Structure of CMO
 - Sequential pay CMO
 - PAC & support tranche
 - Floating-rate tranche
 - ✓ Non-agency MBS
 - Commercial Mortgage-Backed Securities (CMBS)
- Non-Mortgage Asset-Backed Securities (ABS)
- Collateralized Debt Obligations (CDO)

102-200

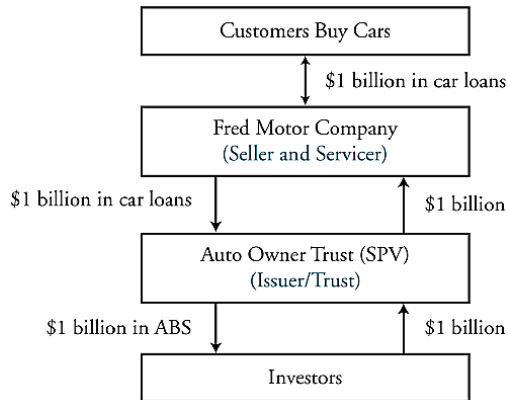
101% Contribution Breeds Professionalism

金程教育
GOLDEN FUTURE

Parties Involved in the Process of Securitization

➤ Parties involved in the process of securitization and their functions:

- The seller (Fred) originates the auto loans and sells the portfolio of loans to Auto Loan Trust, the SPE.
- The issuer/trust (Auto Loan Trust) is the SPE that buys the loans from the seller and issues ABS to investors.
- The servicer (Fred) services the loans.
- In this case, the seller and the servicer are the same entity (Fred Motor Company), but that is not always the case.



103-200

101% Contribution Breeds Professionalism



Structures of Securitizations

➤ **Credit tranching:** the ABS tranches will have different exposures to the risk of default of the assets underlying the ABS.

- With this structure, also called a **senior/subordinated structure**, the subordinated tranches absorb credit losses as they occur (up to their principal values).
- The level of protection for the senior tranche increases with the proportion of subordinated bonds in the structure.

➤ **Time tranching:**

- The first (sequential) tranche receives all principal repayments from the underlying assets up to the principal value of the tranche.
- The second tranche would then receive all principal repayments from the underlying assets until the principal value of this tranche is paid off.
- There are may be other tranches with sequential claims to remaining principal repayments.
- Both credit tranching and time tranching are often included in the same structure.

➤ Example:	Senior tranche	\$300,000,000	✓ Credit tranching: Tranche B is first to absorb any losses. (first-loss tranche)
	Subordinated Tranche A	\$80,000,000	✓ Time tranching: Senior tranche receives all principal repayments from the underlying assets.
	Subordinated Tranche B	\$30,000,000	
	Total	\$410,000,000	

104-200

101% Contribution Breeds Professionalism



Residential Mortgage Loans

➤ **Mortgage**

- A mortgage is a loan that is collateralized with a specific piece of real property, either residential or commercial.
- The interest rate on the loan is called the **mortgage rate** or contract rate.
- A conventional mortgage is the most common residential mortgage. The loan is based on the creditworthiness of the borrower and is collateralized by the residential real estate that it is used to purchase.

➤ Four important features of fixed-rate, level payment, fully amortized mortgage loans:

- The amount of the principal payment increases as time passes
- The amount of interest decreases as time passes
- The servicing fee also declines as time passes
- The ability of the borrower to prepay results in prepayment risk.

105-200

101% Contribution Breeds Professionalism



Residential Mortgage Loans

- Interest rate determination: mortgage rate or contract rate
 - **Fixed rate:** the mortgage rate remains the same during the life of the mortgages.
 - **Adjustable or variable rate:** The mortgage rate is reset periodically (daily, weekly, monthly, or annually).
 - ✓ indexed-referenced ARM: the determination of the new mortgage rate for an adjustable-rate mortgage(ARM)at the reset date is based on some reference rate or index
 - ✓ reviewable ARM: rate of ARM determined at the lender's discretion(reviewable ARM).
 - **Initial period fixed rate:** the mortgage rate is fixed for some initial period and is then adjusted.
 - ✓ Rollover or renegotiable mortgage: the adjustment calls for a fixed rate.(dominant in Canada, Denmark, Germany, the Netherlands, and Switzerland)
 - ✓ Hybrid mortgage: the mortgage starts out with a fixed rate and then becomes an adjustable rate after a specified initial term.(popular in the UK)
 - **Convertible:** the mortgage rate is initially either a fixed rate or adjustable rate. At some point, the borrower has the option to convert the mortgage into a fixed rate or an adjustable rate for the remainder of the mortgage's life.(almost half in Japan are convertible)

106-200

101% Contribution Breeds Professionalism



Residential Mortgage Loans

- Amortization schedule
 - Amortization loan:
 - ✓ **Fully amortizing loan:** the sum of all the scheduled principal repayments during the mortgage's life is such that when the last mortgage payment is made, the loan is fully repaid.
 - ◆ Most residential mortgage loans in the United States are fully amortizing loans.
 - ✓ **Partially amortizing loan:** the sum of all the scheduled principal repayments is less than the amount borrowed.
 - **Interest-only mortgage:** if no scheduled principal repayment is specified for a certain number of years

107-200

101% Contribution Breeds Professionalism



Residential Mortgage Loans

- Rights of the lender in a foreclosure
 - **Recourse loan:** the lender has a claim against the borrower for the shortfall between the amount of the mortgage balance outstanding and the proceeds received from the sale of the property.
 - ✓ Residual mortgage in most European countries are recourse loan
 - **Nonrecourse loan:** the lender does not have such a claim, so the lender can look only to the property to recover the outstanding mortgage balance.
 - ✓ In the United States, residential mortgages are typically non-recourse loans.
- **Strategic default:** the borrower has an incentive to default and allow the lender to foreclose on the property if the value of the property declines below the amount owed by the borrower, even if resources are available to continue to make mortgage payments

108-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

Government National Mortgage Association (Ginnie Mae)

- Federal-related institution, its guarantees carries the full faith and credit of the U.S. government

Federal Home Loan Mortgage Corporation (Freddie Mac)

- Freddie Mac and Fannie Mae are government sponsored enterprises. Their guarantee does not carry the full faith and credit of the government.

Federal National Mortgage Association (Fannie Mae)

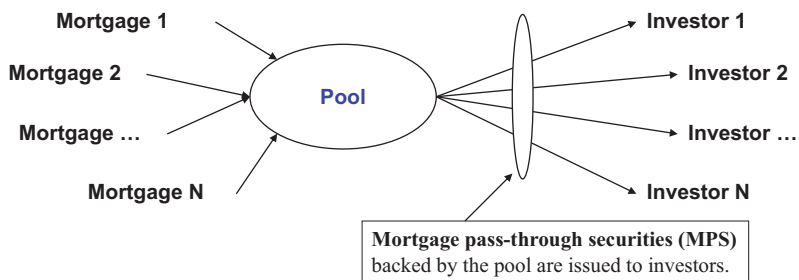
- The pass-through securities issued by Fannie and Freddie are called conventional pass-through securities

- If a loan satisfies the underwriting standards for inclusions as collateral for an agency MBS, it is called a *conforming mortgage*.
- *Nonconforming mortgage pass-through securities* are issued by thrifts, commercial banks, and private conduits

109-200

101% Contribution Breeds Professionalism

Residential Mortgage-Backed Securities



➤ Pass-through rate

- Pass-through rate is less than the mortgage rate on the underlying pool of mortgages by servicing and guaranteeing fees
- **Mortgage rate – Pass-through rate = Servicing fees**

110-200

101% Contribution Breeds Professionalism

Residential Mortgage-Backed Securities

- **Weighted average maturity (WAM):** the weighted maturities average of all the mortgages in the pool, each weighted by the relative outstanding mortgage balance to the value of the entire pool.
- **Weighted average coupon (WAC):** weight the mortgage rate of each mortgage loan in the pool by the percentage of the mortgage outstanding relative to the outstanding amount of all the mortgages in the pool.

Example——WAM and WAC:

Loan	Outstanding Mortgage Balance	Weight in Pool	Mortgage Rate	Months Remaining
1	\$125,000	22.12%	7.50 %	275
2	\$85,000	15.04 %	7.20 %	260
3	\$175,000	30.97 %	7.00 %	290
4	\$110,000	19.47 %	7.80 %	285
5	\$70,000	12.39 %	6.90 %	270
Total	\$565,000	100.00 %	7.28 %	279

- **Average life** is the weighted average time until both scheduled principal payments and expected prepayments are received.

111-200

101% Contribution Breeds Professionalism

Residential Mortgage-Backed Securities

➤ Prepayment risk

- The most important characteristic of pass-through securities is their **prepayment risk**.
- Prepayment will reduce the amount of interest the lender receives over the life of the loan, the likelihood of this situation is known as prepayment risk.
- Prepayments cause the timing and amount of cash flows from mortgage loans and MBS to be uncertain; they speed up principal repayments and reduce the amount of interest paid over the life of the mortgage.
- In order to reduce prepayment risk, some mortgages have prepayment penalties, which are intended to discourage prepayments when interest rates decline.

112-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

➤ Type of prepayment risk

- **Contraction risk** occurs as interest rates fall, prepayment rates increase, the security will have a shorter maturity than was anticipated at the time of purchase because of refinancing at now-available lower rate.
 - ✓ The proceeds received must now be invested at lower interest rates
 - ✓ Price appreciation is not as great as that of an otherwise identical bond that does not have a prepayment or call option
 - ✓ **Contraction risk** occurs as mortgage rates fall, prepayment rates increase, and the average life of the pass-through security decreases.

113-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

- **Extension risk** occurs as interest rates rise, prepayment rates slow, and the security becomes longer in maturity than anticipated at the time of purchase because investors are reluctant to give up the benefits of a contractual interest rate that now looks low.
 - ✓ The value of the security has fallen because interest rates are higher
 - ✓ Income they receive can potentially reinvest is typically limited to the interest payment and scheduled principal repayments
 - ✓ **Extension risk** occurs as mortgage rates rise, prepayment rates slow, and the average life of the pass-through security increase.

114-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

➤ Prepayment rates

- Two industry conventions have been adopted as benchmarks for prepayment rates: the **conditional prepayment rate (CPR)** and the **Public Securities Association (PSA)** prepayment benchmark.
 - ✓ CPR is **the annual rate** at which a mortgage pool balance is assumed to be prepaid during the life of the pool.
 - ✓ The PSA prepayment benchmark assumes that the monthly prepayment rate for a mortgage pool increases as it ages, or becomes seasoned.
 - ✓ The PSA benchmark is expressed as a monthly series of CPRs.

The PSA standard benchmark: 100% PSA

- CPR=0.2% for the first month after origination, increasing by 0.2% per month up to 30 months. For example, the CPR in month 14 is 2.8%.
- CPR=6% for months 30 to 360
- After 30 months, no prepayment rate is added.

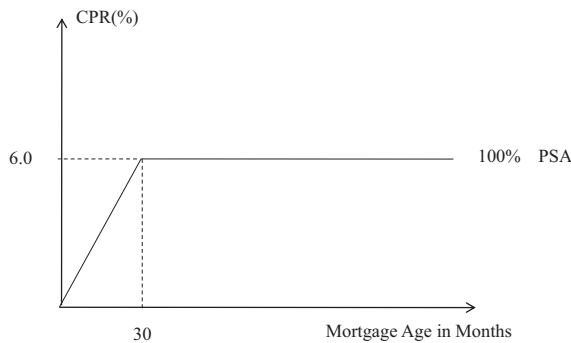
115-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

100 PSA



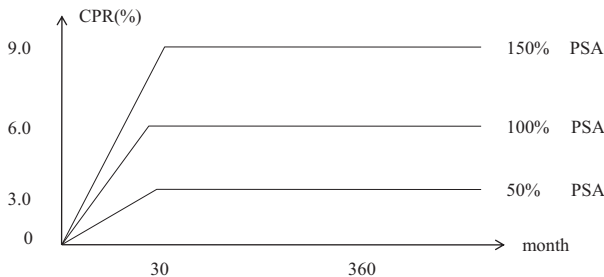
Remember that the CPRs are expressed as annual rates.

116-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities



- 50% PSA: one-half of the CPR prescribed by 100% PSA (prepayment rates slower than 100% PSA)
- 150% PSA: 1.5 times the CPR called for by 100% PSA (prepayment rates faster than 100% PSA)

117-200

101% Contribution Breeds Professionalism



Residential Mortgage-Backed Securities

➤ **Monthly prepayment rate:** single monthly mortality rate (SMM)

$$SMM = \frac{\text{Prepayment for month}}{(\text{Beginning mortgage balance for month} - \text{scheduled principal repayment for month})}$$

$$SMM = 1 - (1 - CPR)^{1/12}$$

- An SMM of 10% implies that 10% of a pool's beginning-of-month outstanding balance, **less scheduled payments**, will be prepaid during the month

➤ Example:

1. Compute the CPR and SMM for the 25th and 35th months, assuming 100 PSA.

- Solution:

$$CPR(\text{month } 25) = 6\% \times (25/30) = 5\%, \quad SMM = 1 - (1 - 0.05)^{1/12} = 0.004265$$

$$CPR(\text{month } 35) = 6\%, \quad SMM = 1 - (1 - 0.06)^{1/12} = 0.0051$$

2. Assume that you have invested in a mortgage pool with a \$100,000 principal balance outstanding at the beginning of the 25th month. The scheduled monthly principal payment for month 25 is \$28.61. Compute the prepayment for the 25th month.

- Solution: $\text{Prepayment}_{25} = 0.004265 \times (\$100,000 - \$28.61) = \426.38

118-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ *Creating collateralized mortgage obligations (CMOs)*

- **CMOs** are securities issued against pass-through securities for which the cash flows have been reallocated to different tranches.
- Each CMO tranche represents a different mixture of contraction and extension risk.
- Redistribution of the original passthrough securities' cash flows does not eliminate contraction and extension risk.

119-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ *Different types of CMOs*

➤ **1. Sequential Pay tranches**

- Each class of bonds is retired sequentially in sequential pay CMO.

$$\text{total CF} \rightarrow \frac{\text{total } P}{\text{total } I} \begin{matrix} \xrightarrow{2} \frac{P}{I}(A) \\ \xrightarrow{3} \frac{I}{P}(B) \\ \xrightarrow{1} \frac{P}{I}(B) \\ \xrightarrow{1} \frac{I}{I}(B) \end{matrix}$$

- Contraction and extension risk still exist with this structure, but they have been redistributed to some extent between the two tranches.
- The short tranche, which matures first, offers relatively more protection against extension risk. The other tranche provides more protection against contraction risk.

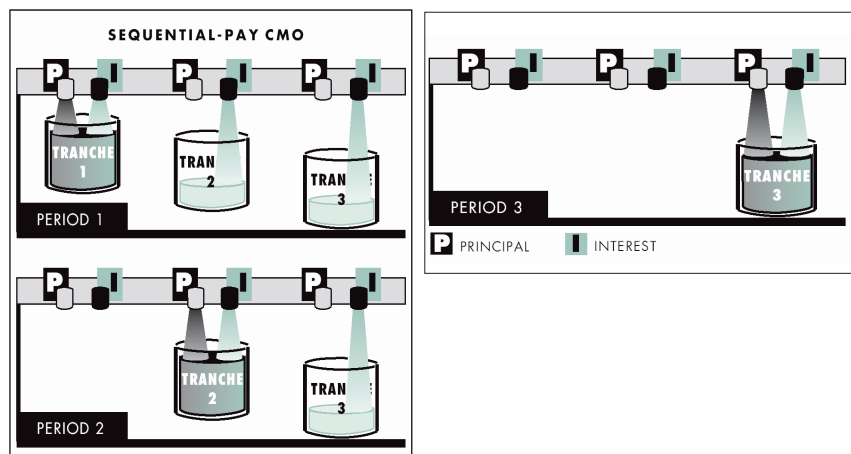
120-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ Sequential-pay CMO illustration



121-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ 2. Planned amortization class (PAC) CMO



- A PAC is a tranche that is amortized based on a sinking fund schedule that is established within a range of prepayment speeds called the initial PAC collar.
- There is a principal repayment schedule that must be satisfied.
- PAC bondholders have priority over all other classes in the CMO structure in receiving principal payments from the collateral.
- The greater certainty of the cash flow for the PAC bonds comes at the expense of the non-PAC tranches (support tranches). It is these tranches that absorb the prepayment risk.
- PAC tranches have protection against both extension risk and contraction risk, providing two-sided prepayment protection.

122-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

Tranche		Contraction risk	Extension risk
A	 Sequential pay CMO	HIGH	LOW
B			
C			
D			
		LOW	HIGH
Tranche		Prepayment risk	
A	 PAC tranches	LOW	
B			
C			
D			
E			
F			
Support (broken or busted PAC)		HIGH	

123-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

Average Life Variability of PAC I Tranche vs. Support Tranche

PSA Speed	PAC I Tranche	Support Tranche
0	13.2	24.0
50	8.8	21.2
100	6.5	17.1
150	6.5	13.3
200	6.5	10.4
250	6.5	5.2
300	6.5	2.9
350	5.9	2.4
400	5.4	1.8
450	4.6	1.5
500	4.2	1.2

124-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ Support tranche

- Support tranches are included in a structure with PAC tranches specifically to provide prepayment protection for the PAC tranches.
- The extent of prepayment risk protection provided by a support tranche increases as its par value increases relative to its associated PAC tranche.
- The certainty of PAC bond cash flow comes at the expense of increased risk to the support tranches.
- When the support tranches will eventually be paid off, and the principal will then go to the PAC holders, and the PAC is referred to as **a broken or busted PAC**. Essentially, the PAC tranche becomes an ordinary sequential pay structure.

Tranche	Notional	Prepayment risk
PAC I	20 m	Lowest
PAC II	40 m	
Support tranche	30 m	Highest

125-200

101% Contribution Breeds Professionalism



Collateralized Mortgage Obligations (CMO)

➤ 3. Floating-rate tranche

● Floater and inverse floater

Tranche	Notional	Coupon rate
A	52 m	9%
B	9 m	9%
C	39 m	9%
Total	100 m	9%

Tranche	Notional	Coupon rate
A	52 m	9%
B	9 m	9%
Floater	26 m	LIBOR + 50 bp
Inverse floater	13 m	26% - 2LIBOR

- Constructing a floater and an inverse floater combination from any of the fixed-rate tranches in a CMO structure.
 - ✓ Floating rate tranche pays a higher rate when interest rates go up
 - ✓ The inverse floater pays a lower rate when interest rate go up

126-200

101% Contribution Breeds Professionalism



Non-agency RMBS

- Non-agency RMBS: RMBS issued by entities other than Ginnie Mae, Fannie Mae, and Freddie Mae
- Differences between Agency and Non-agency securities
 - Agency securities: CMOs are created from pools of passthrough securities.
 - Non-agency securities: CMOs are created from unsecuritized mortgage loans.
 - Non-agency securities have no explicit or implicit government guarantee of payment of interest and principal as agency securities have.
 - All non-agency securities are credit enhanced: external and internal.

127-200

101% Contribution Breeds Professionalism



Non-agency RMBS

- Non-agency RMBS require one or more credit enhancement
 - **Internal credit enhancements**
 - ✓ **Senior/subordinated structure**: the subordinated bond classes(junior bond classes or non-senior bond classes) provide credit support for the senior bond classes
 - ◆ **Shifting interest mechanism**: locks out subordinated bond classes from receiving payments for a period of time if the credit enhancement for senior tranches deteriorates because of poor performance of the collateral
 - ✓ **Reserve funds**: provide credit support by paying for possible future losses
 - ✓ **Overcollateralization**: the value of the collateral exceeds the amount of the par value of the outstanding bond classes issued by SPV
 - **External credit enhancements**: Credit support in the case of defaults resulting in losses in the pool of loans is provided in the form of a financial guarantee by a third party to the transaction.
 - ✓ The most common third party financial guarantors are monoline insurance companies, referred to as a monoline insurer.

128-200

101% Contribution Breeds Professionalism



Commercial mortgage-backed securities (CMBS)

➤ Commercial mortgage-backed securities (CMBS)

Warm-up——CMBS

Commercial mortgage-backed securities (CMBS) are backed by income-producing real estate, typically in the form of:

- ✓ Apartments (multi-family)
- ✓ Warehouses (industrial use)
- ✓ Shopping centers
- ✓ Office buildings
- ✓ Health care facilities
- ✓ Senior housing
- ✓ Hotel/resort properties

- CMBS are **no recourse loans**; the lender can only look to the collateral (income-producing property) as means to repay a delinquent loan;
- The residential mortgage lender can use only the proceeds from the sale of the property for repayment and has no recourse to the borrower for any unpaid balance.
- Therefore, analysis of CMBS securities focuses on the property and not the borrower
- Debt-to-service coverage ratio

$$= \frac{\text{net operating income}}{\text{debt service}}$$
- Loan-to-value ratio

$$= \frac{\text{current mortgage amount}}{\text{current appraised value}}$$

129-200

101% Contribution Breeds Professionalism



Commercial mortgage-backed securities (CMBS)

➤ Basic CMBS structure

➤ 1. Call protection

- **Loan-level call protection**
 - ✓ **Prepayment lock out.** For a specific period of time (typically two to five years), the borrower is prohibited from prepaying the mortgage loan.
 - ✓ **Defeasance.** Should the borrower insist on making payments on the mortgage loan, the mortgage loan can be defeased, which means the loan proceeds are received by the loan servicer and invested in U.S. Treasury securities, essentially creating cash collateral against the loan.
 - ✓ **Prepayment penalty points.** A penalty fee may be charged if the borrower prepays the mortgage loan.
 - ◆ In many cases, this penalty fee is quoted as a 5-4-3-2-1, which means the penalty fee is 5% of the principal amount of the loan in the first year, and 1% of the principal amount if repaid in the fifth year of the mortgage.
 - ✓ **Yield maintenance charges.** The borrower is charged the amount of interest lost by the lender should the loan be prepaid.
- **CMBS-level call protection**
 - ✓ CMBS loan pools are segregated into tranches with a specific sequence of repayment.
 - ✓ Those tranches with a higher priority for prepayment or collateral position will have a higher credit rating than lower priority tranches.

130-200

101% Contribution Breeds Professionalism



Commercial mortgage-backed securities (CMBS)

➤ Basic CMBS structure

2. Balloon maturity provisions

- Balloon loans require substantial principal payment at the end of the term of the loan
- If the borrower fails to make the balloon payment, the borrower is in default. (**balloon risk**)
- Balloon risk is a type of **extension risk**.

131-200

101% Contribution Breeds Professionalism



Non-Mortgage Asset-backed Securities (ABS)

Non-Mortgage Asset-backed Securities (ABS)

➤ 1. Auto Loan ABS

- Auto loan market is tiered based on the credit quality of the borrowers.
 - ✓ Short-term nature
 - ✓ Major issuers of auto loans have tended to follow prudent underwriting standards
- Auto loans prepay if the cars sold, traded in, repossessed, stolen, wrecked, or the loan is paid off from insurance proceeds, the borrower may simply use excess cash to prepay
- Refinancing is not a major factor contributing to prepayment
 - ✓ Loan balances are small, the automobile's value may depreciate faster in early years
 - ✓ Prepayment is more predictable and less dependent on interest rate change

132-200

101% Contribution Breeds Professionalism



Non-Mortgage Asset-backed Securities

- **2. Credit Card Receivable-backed securities:** credit card receivables are used as collateral for the issuance, **non-amortizing loans**.
- For a pool of credit receivables, the cash flows consist of:
 - ✓ **Finance charges collected:** represent the periodic interest the credit card borrower is charged on the unpaid balance after the grace period.
 - ✓ **Fees:** include late payment fees and any annual membership fees.
 - ✓ **Principal repayments:** “early amortization” or “rapid amortization” provisions included to safeguard the credit quality of the issue.
 - **Lockout periods:** cash flow paid out based only on finance charges collected and fees.
 - ✓ **After lockout periods:** principal no longer reinvested but paid to investors.

133-200

101% Contribution Breeds Professionalism



Collateralized debt obligation (CDO)

➤ Collateralized debt obligation (CDO)

- A collateralized debt obligation (CDO) is a security backed by a diversified pool of one or more of the following types of debt obligations:

U.S. domestic high-yield corporate bonds	Collateralized bond obligation (CBO)
Structured financial products	
Emerging market bonds	
Bank loans	Collateralized loan obligation (CLO)
Special situation loans and distressed debt	

• A structure of a CDO

Senior tranche	At least A
Mezzanine tranche	BBB but no less than B
Subordinate/equity tranche	Receive the residual cash flow

- ✓ In typical structure, one or more of the tranches is a **floating-rate security**.
- ✓ Asset manager uses **interest rate swap** to deal with the mismatch.

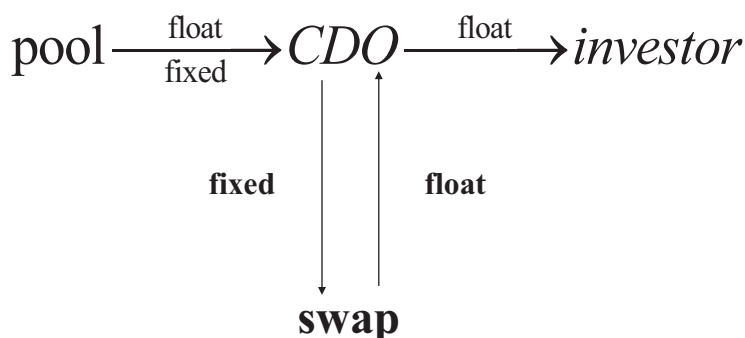
134-200

101% Contribution Breeds Professionalism



Collateralized debt obligation (CDO)

➤ CDO Transaction:



135-200

101% Contribution Breeds Professionalism



Framework of Fixed Income

➤ Study Session 15 — Basic Concepts

- R51 Fixed-Income Securities: Defining Elements
- R52 Fixed-Income Markets: Issuance, Trading, and Funding
- R53 Introduction to Fixed-Income Valuation
- R54 Introduction to Asset-Backed Securities

➤ Study Session 16 — Analysis of Risk

- R55 Understanding Fixed-Income Risk and Return
- R56 Fundamentals of Credit Analysis

136-200

101% Contribution Breeds Professionalism



Framework

- Annualized holding period return
- Interest rate risk
 - Duration
 - Convexity
 - Duration gap

137-200

101% Contribution Breeds Professionalism



Source of Return

- **Three sources of return:**
 - Coupon and principal payments
 - Reinvestment of coupon payments
 - Capital gain or loss if bond is sold before maturity
- **Total return:** future value of reinvested coupon interest payments and the sale price (par value if the bond is held to maturity)
- **Annualized holding period return:** calculated as the compound annual return earned from the holding period .

$$\text{annualized holding period return} = \left(\frac{\text{total return}}{\text{bond price}} \right)^{1/n} - 1$$

138-200

101% Contribution Breeds Professionalism



Illustration on sources of return

- Assumption:
- A bond makes all of its promised coupon and principal payments on time (i.e., we are not addressing credit risk).
 - The interest rate earned on reinvested coupon payments is the same as the YTM on the bond.
- There are five results to gain from the analysis presented here.
1. An investor who holds a fixed-rate bond to maturity will earn an annualized rate of return equal to the YTM of the bond when purchased.
 2. An investor who sells a bond prior to maturity will earn a rate of return equal to the YTM at purchase if the YTM at sale has not changed since purchase.
 3. If the market YTM for the bond, our assumed reinvestment rate, increases (decreases) after the bond is purchased but before the first coupon date, a buy-and-hold investor's realized return will be higher (lower) than the YTM of the bond when purchased.
 4. If the market YTM for the bond, our assumed reinvestment rate, increases after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is lower (higher) than the YTM at bond purchase if the bond is held for a short period.
 5. If the market YTM for the bond, our assumed reinvestment rate, decreases after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is lower (higher) than the YTM at bond purchase if the bond is held for a long period.

139-200

101% Contribution Breeds Professionalism



Illustration on sources of return

1. An investor who holds a fixed-rate bond to maturity will earn an annualized rate of return equal to the YTM of the bond when purchased.
 - We will illustrate this calculation (and the first result listed earlier) with a 6% annual-pay three-year bond purchased at a YTM of 7% and held to maturity.
 - ✓ With an annual YTM of 7% the bond's purchase price is \$973.76.

$$N = 3; I/Y = 7; PMT = 60; FV = 1,000; CPT PV = -973.76$$
 - At maturity, the investor will have received coupon income and reinvestment income equal to the future value of an annuity of three \$60 coupon payments calculated with an interest rate equal to the bond's YTM. This amount is
 - ✓ $60(1.07)^2 + 60(1.07) + 60 = \192.89 or

$$N = 3; I/Y = 7; PV = 0; PMT = 60; CPT: FV = -192.89$$
 - The amount earned from reinvestment of the coupons as $192.89 - 3(60) = \$12.89$
 - the investor's rate of return over the three-year holding period is:

$$\text{annualized holding period return} = (1,000 + 192.89) / 973.76^{1/3} - 1 = 7\%$$

140-200

101% Contribution Breeds Professionalism



Illustration on sources of return

2. An investor who sells a bond prior to maturity will earn a rate of return equal to the YTM at purchase if the YTM at sale has not changed since purchase.
 - Using the 6% three-year bond from our earlier examples, we can demonstrate this for an investor with a two-year holding period (investment horizon).
 - When the bond is purchased at a YTM of 7% (for \$973.76), we have:
 - Price at sale: (at end of year 2, YTM = 7%):
 - ✓ $1,060 / 1.07 = 990.65$ or
 - ✓ $N = 1; I/Y = 7; FV = 1,000; PMT = 60; CPT: PV = -990.65$
 - Coupon interest and reinvestment income For two years:
 - ✓ $60(1.07) + 60 = \$124.20$
 - ✓ $N = 2; I/Y = 7; PV = 0; PMT = 60; CPT FV = -124.20$
 - Investor's annual compound rate of return over the two-year holding period is:

$$\left(\frac{124.20 + 990.65}{973.76} \right)^{1/2} - 1 = 7\%$$

141-200

101% Contribution Breeds Professionalism



Illustration on sources of return

3. If the market YTM for the bond, our assumed reinvestment rate, *increases (decreases)* after the bond is purchased but before the first coupon date, a buy-and-hold investor's realized return will be *higher (lower)* than the YTM of the bond when purchased.

- For a three-year 6% bond purchased at par (YTM of 6%), first assume that the YTM and reinvestment rate increases to 7% after purchase but before the first coupon payment date. The bond's annualized holding period return is calculated as:

- Coupons and reinvestment interest:

$$\checkmark 60(1.07)^2 + 60(1.07) + 60 = \$192.89$$

$$\checkmark N = 3; I/Y = 7; PV = 0; PMT = 60; CPT: FV = -192.89$$

- Investor's annual compound holding period return:

$$\left(\frac{1192.89}{1000}\right)^{1/3} - 1 = 6.06\%$$

which is greater than the 6% YTM at purchase.

142-200

101% Contribution Breeds Professionalism



Illustration on sources of return

- If the YTM decreases to 5% after purchase but before the first coupon date, we have the following.

- Coupons and reinvestment interest:

$$\checkmark 60(1.05)^2 + 60(1.05) + 60 = \$189.15$$

$$\checkmark N = 3; I/Y = 5; PV = 0; PMT = 60; CPT: FV = -189.15$$

- Investor's annual compound holding period return:

$$\left(\frac{1189.15}{1000}\right)^{1/3} - 1 = 5.94\%$$

which is less than the 6% YTM at purchase.

- Note that in both cases, the investor's rate of return is between the YTM at purchase and the assumed reinvestment rate (the new YTM).

143-200

101% Contribution Breeds Professionalism



Illustration on sources of return

4. If the market YTM for the bond, our assumed reinvestment rate, *increases* after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is *lower (higher)* than the YTM at bond purchase if the bond is held for a *short* period.

- Consider a three-year 6% bond purchased at par by an investor with a one-year investment horizon. If the YTM *increases from 6% to 7%* after purchase and the bond is sold after one year, the rate of return can be calculated as follows.

- Bond price just after first coupon has been paid with YTM = 7%:

$$\checkmark N = 2; I/Y = 7; FV = 1,000; PMT = 60; CPT: PV = -981.92$$

- There is no reinvestment income and only one coupon of \$60 received so the holding period rate of return is simply:

$$\left(\frac{981.92 + 60}{1000}\right) - 1 = 4.19\%$$

which is *less than* the YTM at purchase.

144-200

101% Contribution Breeds Professionalism



Illustration on sources of return

5. If the market YTM for the bond, our assumed reinvestment rate, *decreases* after the bond is purchased but before the first coupon date, a bond investor will earn a rate of return that is *lower (higher)* than the YTM at bond purchase if the bond is held for a *long* period.

- If the YTM *decreases to 5%* after purchase and the bond is sold at the end of one year, the investor's rate of return can be calculated as follows.
- Bond price just after first coupon has been paid with YTM = 5%:

$$\checkmark N = 2; I/Y = 5; FV = 1,000; PMT = 60; CPT: PV = -1,018.59$$

$$\left(\frac{1018.59 + 60}{1000} \right) - 1 = 7.86\%$$

which is *greater than* the YTM at purchase.

145-200

101% Contribution Breeds Professionalism



Interest Rate Risk

➤ Two types of interest rate risk

- **Coupon reinvestment risk:** uncertainty about income from reinvesting coupon payments.
 - ✓ Increases with a higher coupon rate and a longer investment horizon.

- **Market price risk:** uncertainty about a bond price

➤ These risks *offset each other*: an *increase* (decrease) in YTM *decreases* (increases) a bond's price but *increases* (decreases) its reinvestment income.

- Short investment horizon:

✓ market price risk > reinvestment risk

✓ annualized holding period return is *negatively* related with YTM

- long investment horizon:

✓ market price risk < reinvestment risk

✓ annualized holding period return is *positively* related with YTM

146-200

101% Contribution Breeds Professionalism



Interest Rate Risk

➤ Interest risk

- 利率风险：即债券价格对利率变化的敏感程度，价格对利率变化越敏感，价格波动的可能性就越高
- 通常用久期duration来衡量利率风险，久期越高，利率风险越高

$$\text{duration} = - \frac{\text{percentage change in bond price}}{\text{yield change in percent}}$$

- Exercise: A bond has a duration of 7.2, if the yield decreases from 8.3% to 7.9%, calculate the approximate percentage change in the bond price

$$\text{Percentage price change} = - \text{duration} \times \text{yield change in \%}$$

147-200

101% Contribution Breeds Professionalism



Duration

➤ **Duration:** a measure of a bond's interest rate risk or sensitivity of a bond's full price to a change in its yields.

- Yield duration: sensitivity of the bond price with respect to the bond's own yield-to-maturity (Macaulay duration, modified duration, money duration, PVBP)

✓ **Macaulay duration**

$$\text{Macaulay duration} = \frac{\sum_{t=1}^n t \times PVCF_t}{\sum_{t=1}^n PVCF_t (= P_0)} = \sum_{t=1}^n [t \times (PVCF_t / P_0)]$$

✓ **Modified duration**

$$\text{Modified duration} = \frac{\text{Macaulay duration}}{1 + \text{periodic market yield}}$$

✓ **Approximate modified duration**

$$\text{Approximate modified duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta YTM}$$

$$\Delta P / P \approx -\text{ModDur} \times \Delta YTM$$

- Curve duration: sensitivity of the bond price (or more generally, the market value of a financial asset or liability) with respect to a benchmark yield curve effective duration.(used for bonds with embedded option)

$$\text{Effective duration} = \frac{V_- - V_+}{2 \times V_0 \times \Delta \text{curve}}$$

148-200

101% Contribution Breeds Professionalism



Money Duration and PVBP

➤ **Money duration/dollar duration**

Money duration=annual modified duration * full price of bond

➤ Money duration expressed as money duration per 100 of bond par value

Money duration per 100 units of par value

=annual modified duration * full price of bond per 100 of par value

➤ **Price value of a basis point (PVBP):** is the money change in full price of a bond when its YTM changes by one basis point(0.01%)

$$\text{PVBP} = [(V_- - V_+) / 2]$$

149-200

101% Contribution Breeds Professionalism



Example

➤ Calculate the money duration on a coupon date of a \$2 million par value bond that has a modified duration of 7.42 and a full price of 101.32, expressed for the whole bond and per \$100 of face value.

➤ Answer:

- The money duration for the bond is modified duration times the full value of the bond:

$$7.42 \times \$2,000,000 \times 1.0132 = \$15,035,888$$

- The money duration per \$100 of par value is:

$$7.42 \times 101.32 = \$751.79$$

150-200

101% Contribution Breeds Professionalism



Duration

➤ Interpreting duration:

- Duration is the **slope** of the price-yield curve at the bond's current YTM. (the first derivative of the price-yield curve with respect to yield, but it's not absolutely right for such description)
- Duration is a weighted average of time (in years) until cash flow will be received. The weights are the proportions of the total bond value that each cash flow represents.
- Duration is the approximate percentage change in price of 1% change in yield. (price sensitivity)

151-200

101% Contribution Breeds Professionalism

Effective duration and modified duration

- The modified duration: conventional yield duration statistic, measures sensitivity of the bond price with respect to the bond's own yield-to-maturity.
- Effective duration: curve duration, measures the price sensitivity with respect to changes in the U.S. Treasury par curve.
 - For a traditional option-free bond:
 - ✓ The modified duration and effective duration on a traditional option-free bond are not identical.
 - ✓ The difference narrows when the yield curve is flatter, the time-to-maturity is shorter, and the bond is priced closer to par value (so that the difference between the coupon rate and the yield-to-maturity is smaller).
 - ✓ The modified duration and effective duration on an option-free bond are identical only in the rare circumstance of an absolutely flat yield curve.

152-200

101% Contribution Breeds Professionalism

Duration

- A **perpetuity or perpetual bond (consol)**: a bond that does not mature. There is no principal to redeem. The investor receives a fixed coupon payment forever, unless the bond is callable. Non-callable perpetuities are rare.
 - ✓ Macaulay duration = $(1 + r)/r$, as N approaches infinity
- Zero coupon bond: $\text{Macaulay Duration (of a zero-coupon bond)} = t$
- The Macaulay and modified duration statistics for a fixed-rate bond depend primarily on the coupon rate, yield-to-maturity, and time-to-maturity.
 - ✓ A **higher coupon rate or a higher yield-to-maturity** reduces the duration measures.
 - ✓ A **longer time-to-maturity usually leads to a higher duration.**
 - ◆ It always does so for a bond priced at a premium or at par value.
 - ◆ But if the bond is **priced at a discount, a longer time-to-maturity** might lead to a lower duration.
 - This situation only occurs if the coupon rate is low (but not zero) relative to the yield and the time-to-maturity is long
 - ✓ **Bond with embedded options (callable bond & puttable bond) has lower duration.**

153-200

101% Contribution Breeds Professionalism

Duration

➤ Effects of bond characteristics on duration:

- Longer maturity, higher duration.
- Lower coupon, higher duration.
- Lower market yield, higher duration
- Bond with embedded options (callable bond & puttable bond) has lower duration.

➤ 注:

- $D_{\text{perpetuity}} = (1 + \text{YTM}) / \text{YTM}$
- $D_{\text{zero-coupon bond}} = M_{\text{zero-coupon bond}}$
- $D_{\text{discount}} > D_{\text{premium}}$
- D_{discount} 随着时间的变化先增加后减小，并不是时间越长，duration越大。

154-200

101% Contribution Breeds Professionalism



Portfolio duration

➤ Portfolio duration:

- **Method 1:** the weighted average of time to receipt of the aggregate cash flows.
 - ✓ The yield measure for calculating portfolio duration with this approach is the **cash flow yield**, the IRR of the bond portfolio.
 - ✓ This method is better theoretically but difficult to use in practice.
 - ◆ the cash flow yield is not commonly calculated for bond portfolios
 - ◆ the amount and timing of future coupon and principal payments are uncertain if the portfolio contains callable or puttable bonds or floating-rate notes
 - ◆ interest rate risk is usually expressed as a change in benchmark interest rates, not as a change in the cash flow yield
 - ◆ the change in the cash flow yield is not necessarily the same amount as the change in the yields-to-maturity on the individual bonds
 - For instance, if the yields-to-maturity on the two zero-coupon bonds in this portfolio both increase or decrease by 10 bps, the cash flow yield increases or decreases by only 9.52 bps.

155-200

101% Contribution Breeds Professionalism



Portfolio duration

- **Method 2:** The Macaulay and modified durations for the portfolio are calculated as the weighted average of the statistics for the individual bonds. The shares of overall portfolio market value are the weights.

$$\text{Portfolio duration} = w_1 D_1 + w_2 D_2 + \dots + w_n D_n$$

- ✓ The **main advantage to the second approach** is that it is easily used as a measure of interest rate risk.
- ✓ **Limitations:** the measure of portfolio duration implicitly assumes a **parallel shift in the yield curve**.
 - ◆ A parallel yield curve shift implies that all rates change by the same amount in the same direction.
 - ◆ In reality, interest rate changes frequently result in a steeper or flatter yield curve. (**non-parallel shifts** → **key rate duration**)

156-200

101% Contribution Breeds Professionalism



Example

- A bond portfolio consists of the following three fixed-rate bonds. Assume annual coupon payments and no accrued interest on the bonds. Prices are per 100 of par value.

Bond	Maturity	Market Value	Price	Coupon	Yield-to-Maturity	Modified Duration
A	6 years	170,000	85.0000	2.00%	4.95%	5.42
B	10 years	120,000	80.0000	2.40%	4.99%	8.44
C	15 years	100,000	100.0000	5.00%	5.00%	10.38

- The bond portfolio's modified duration is closest to:

- A. 7.62
B. 8.08
C. 8.20

- **Answer: A**

157-200

101% Contribution Breeds Professionalism



Convexity

- **Convexity** is a measure of the curvature of the price-yield curve.

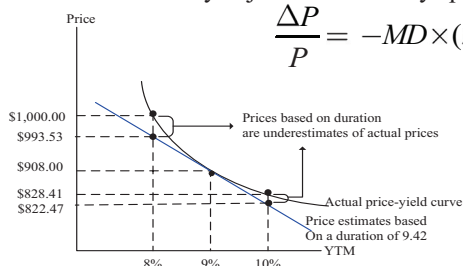
$$\text{approximate convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta \text{YTM})^2 V_0}$$

- Effective Convexity:

$$\text{effective convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta \text{curve})^2 V_0}$$

- The convexity adjustment is always positive when convexity is positive

$$\frac{\Delta P}{P} = -MD \times (\Delta y) + [0.5 \times \text{Conv} \times (\Delta y)^2]$$



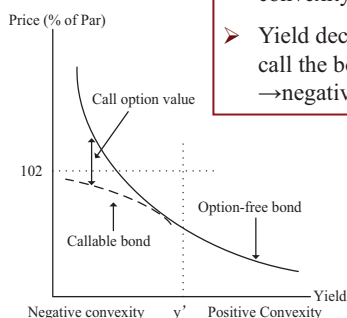
158-200

101% Contribution Breeds Professionalism



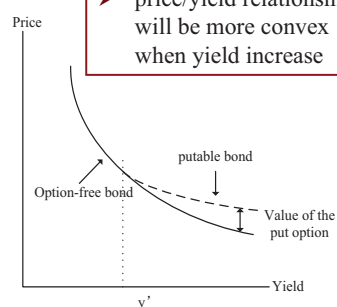
Effective Convexity

Callable



- High yield → unlikely call, → positive convexity
➤ Yield decline → may call the bond → negative convexity

Puttable



- price/yield relationship will be more convex when yield increase

159-200

101% Contribution Breeds Professionalism



Example

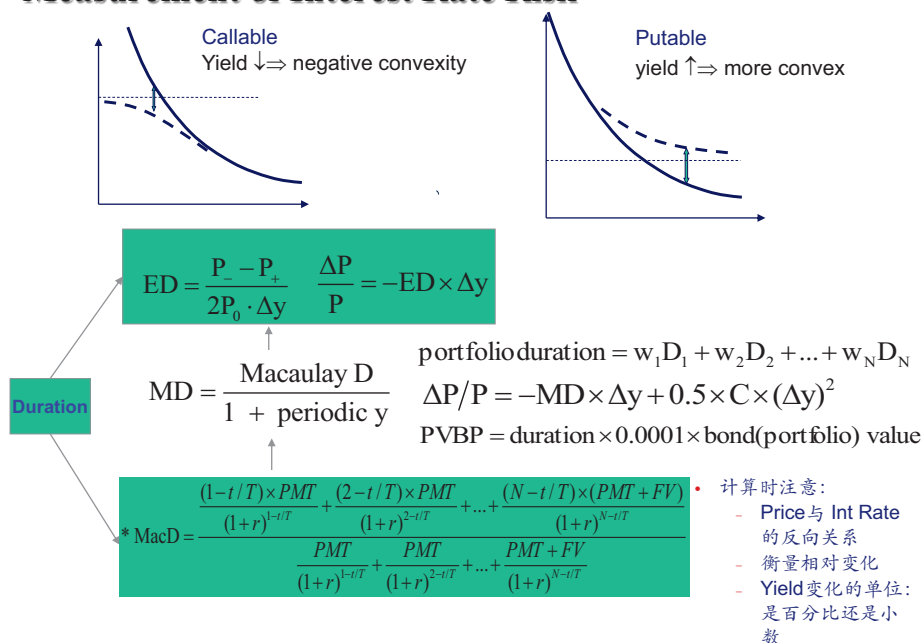
- An analyst accurately calculates that the price of an option-free bond with percent coupon would experience a **12 percent change** if market **yields increase 100 basis points**. If market yields **decrease** 100 basis points, the bond's price would likely:
- Increase by 12%
 - Increase by less than 12%
 - Increase by more than 12%
- Correct answer: C

160-200

101% Contribution Breeds Professionalism



Measurement of Interest Rate Risk



Term structure of yield volatility

- **Term structure of yield volatility:** the relationship between maturity and yield volatility.
- In calculation of duration and convexity, the yield curve is assumed to be parallel shift.
 - **Shorter-term bond may be have more price volatility than a longer bond** with a greater duration because of the greater yield volatility of the shorter-term yield
- The importance of yield volatility in measuring interest rate risk is that bond price changes are products of two factors:
- (1) the impact per basis-point change in the yield-to-maturity and
 - (2) the number of basis points in the yield-to-maturity change.

162-200

101% Contribution Breeds Professionalism



Holding period return, Duration, and Investment Horizon

- Macaulay duration may be interpreted as the investment horizon for which a coupon reinvestment risk and market price risk just offset each other, assuming there's a one-time parallel shift in the yield curve that occurs before the next coupon payment date.
- Relationships among interest rate risk, Macaulay duration, and investment horizon:
 1. if investment horizon > Macaulay duration, then reinvestment risk dominates price risk, investor's risk is to lower interest rates.
 2. if investment horizon = Macaulay duration, then reinvestment risk offsets price risk
 3. if investment horizon < Macaulay duration, then price risk dominates reinvestment risk, investor's risk is to higher interest rates.
- **Duration gap:**

Duration gap = Macaulay duration – investment horizon

 - **Positive gap** exposes the investor to market price risk from increasing interest rates
 - **Negative gap** exposes the investor to reinvestment risk from decreasing interest rates

163-200

101% Contribution Breeds Professionalism



Credit and liquidity Spread

- YTM on a corporate bond includes a government benchmark yield and a spread.
- For an option-free bond, the same duration and convexity measures apply for both a change in benchmark yield and a change in spread. (source of change includes change in inflation, real int. rate, credit risk, liquidity)
- Bond's spread has two components:
 - Premium for credit risk
 - Premium for lack of liquidity
- The impact on a bond's value of a change in spread:

$$\% \Delta \text{bond value} = - \text{duration} (\Delta \text{spread}) + \frac{1}{2} \text{convexity} (\Delta \text{spread})^2$$

164-200

101% Contribution Breeds Professionalism



Framework of Fixed Income

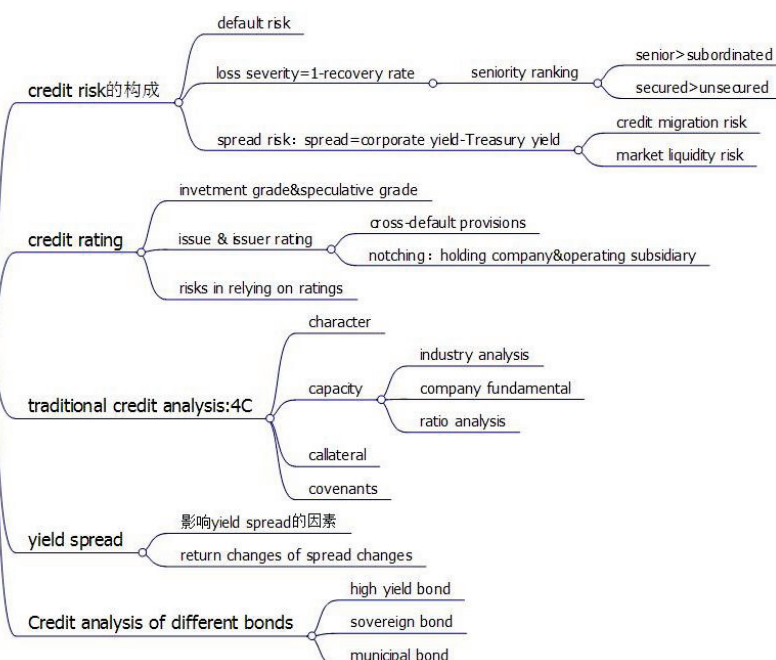
- **Study Session 15 — Basic Concepts**
 - R51 Fixed-Income Securities: Defining Elements
 - R52 Fixed-Income Markets: Issuance, Trading, and Funding
 - R53 Introduction to Fixed-Income Valuation
 - R54 Introduction to Asset-Backed Securities
- **Study Session 16 — Analysis of Risk**
 - R55 Understanding Fixed-Income Risk and Return
 - R56 Fundamentals of Credit Analysis

165-200

101% Contribution Breeds Professionalism



R56



Fundamentals of Credit Analysis

- **Credit risk** is the risk of loss resulting from the borrower (issuer of debt) failing to make full and timely payments of interest and/or principal. It has two components.
 - **Default risk**, or default probability, is the probability that a borrower defaults – that is, fails to meet its obligation to make full and timely payments of principal and interest, according to the terms of the debt security.
 - **Loss given default**, or loss severity, in the event of default, is the portion of a bond's value (including unpaid interest) an investor loses.
- Expected loss = Default probability * Loss severity given default
 - Loss severity given default = 1 – Recovery rate
 - **Recovery rate** is the percentage of the principal amount recovered in the event of default.

167-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Spread risk**: Corporate bonds and other “credit-risky” debt instruments typically trade at a yield premium, or spread, to bonds that have been considered “default-risk free”.
 - Yield spreads, expressed in basis points, widen based on two primary factors:
 - ✓ A decline in an issuer's creditworthiness, sometimes referred to as credit migration or downgrade risk
 - ✓ An increase in market liquidity risk.
- Spread risk is the possibility that a bond's spread will widen due to one or both of these factors.
 - **Credit migration (or downgrade) risk**: this is the risk that a bond issuer's creditworthiness deteriorates, or migrates lower, leading investors to believe the risk of default is higher and thus causing the yield spreads on the issuer's bonds to widen and the price of its bonds to fall.
 - **Market liquidity risk**: this is the risk that the price at which investors can actually transact may differ from the price indicated in the market.
 - ✓ Two main issuer-specific factors that affect market liquidity risk:
 - ◆ The size of the issuer.
 - ◆ The credit quality of the issuer.

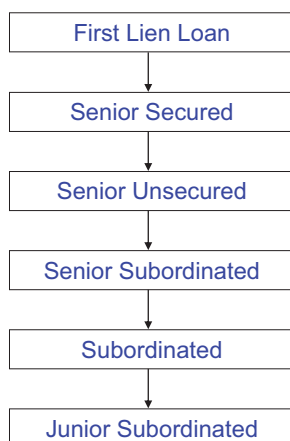
168-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Capital Structure:** the composition and distribution across operating units of a company's debt and equity, including bank debt, bonds of all seniority rankings, preferred stock, and common equity.
- **Seniority Ranking**



169-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Secured debt:** the debtholder has a direct claim – a pledge from the issuer – on certain assets and their associated cash flows.
 - **First mortgage debt** refers to the pledge of a specific property (e.g., a power plant for a utility or a specific casino for a gaming company).
 - **First lien debt** refers to a pledge of certain assets that could include buildings but might also include property and equipment, licenses, patents, brands, and so on.
- **Unsecured debt** is often referred to as debentures. Unsecured bondholders have only a general claim on an issuer's assets and cash flow.
- **Priority of claims:** in the event of default, unsecured debtholders claim rank below (i.e., get paid after) those of secured creditors.

170-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- To avoid unnecessary delays, bankruptcy negotiation and compromise among various claimholders may result in a reorganization plan that does not strictly conform to the original priority of claims.
- **Exercise:**
 1. Under which circumstance is a subordinated bondholder most likely to recover some value in a bankruptcy without a senior creditor getting paid in full? When:
 - A. absolute priority rules are enforced.
 - B. the various classes of claimants agree to it
 - C. the company is liquidated rather than reorganized
 2. In the event of bankruptcy, claims at the same level of the capital structure are:
 - A. on an equal footing, regardless of size, maturity, or time outstanding
 - B. paid in the order of maturity from shortest to longest, regardless of size or time outstanding.
 - C. paid on a first-in, first-out (FIFO) basis so that the longest-standing claims are satisfied first, regardless of size or maturity

171-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- For recovery rates, there are a few things worth noting:
- Recovery rates can vary widely by industry.
 - Recovery rates can also vary depending on when they occur in a credit cycle.
 - These recovery rates are averages.
 - Priority of claims is not always absolute.
 - ✓ The priority of claims in bankruptcy:
 - ◆ secured creditors > unsecured creditors
 - ◆ senior creditors > junior creditors
 - ✓ In practice, however, more junior creditors and even shareholders may receive some consideration without more senior creditors being paid in full.
 - ✓ In the U.S., the bias is toward reorganization and recovery of companies in bankruptcy. In the UK, the bias is toward liquidation of companies in bankruptcy and maximizing value to the banks and other senior creditors.
 - ✓ Bankruptcy and bankruptcy laws are vary complex and can vary greatly by country.

172-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

➤ Credit ratings

Moody's	S&P	Fitch	Summary Definition
Investment Grade—High Credit-Worthiness			
Aaa	AAA	AAA	Gilt edge, prime, maximum safety
Aa1	AA+	AA+	High grade, high-credit quality Upper medium grade Lower medium grade
Aa2	AA	AA	
Aa3	AA-	AA-	
A1	A+	A+	
A2	A	A	
A3	A-	A-	
Baa1	BBB+	BBB+	
Baa2	BBB	BBB	
Baa3	BBB-	BBB-	

173-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

➤ Credit ratings

Moody's	S&P	Fitch	Summary Definition
Speculative-Lower Credit-Worthiness			
Ba1	BB+	BB+	Low grade speculative
Ba2	BB	BB	
Ba3	BB-	BB-	
B1	B	B+	Highly speculative
B2	B	B	
B3	B	B-	

174-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

➤ Credit ratings

Moody's	S&P	Fitch	Summary Definition
Predominantly Speculative, Substantial Risk, or in Default			
Caa	CCC+ CCC	CCC+ CCC	Substantial risk, in poor standing
Ca	CC	CC	May be in default, very speculative
C	C	C	Extremely speculative
	CI		Income bonds-no interest being paid
		DDD	
	D	DD	Default

175-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Triple-A (Aaa or AAA):** highest quality, minimal credit risk, extremely low probabilities of default.
- **Double-A (Aa or AA):** high-quality grade, very low default risk.
- **Single-A:** supper-medium grade.
- Bonds rated Baa3/BBB- or higher are called “**investment grade**”.
- Bonds rated ba1 or lower by Moody’s and BB- or lower by S&P and Fitch have **speculative credit** characteristics and increasingly higher default risk.
- Bonds **rated D** by S&P and Fitch are already in default.
- For Moody’s, bonds **rated C** are likely, but not necessarily, in default.

176-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Issuer credit rating:** address an obligor’s overall creditworthiness – its ability and willingness to make timely payments of interest and principal on its debt.
 - Issuer credit rating usually applies to its senior unsecured debt.
- **Issue ratings** refer to specific financial obligations of an issuer and take into consideration such factors as ranking in the capital structure (e.g., secured or subordinated).
- Bonds in default are rated D by S&P and Fitch and are included in Moody’s lowest rating category, C. When a company defaults on one of its several outstanding bonds, provisions in bond indentures may trigger default on the remaining issues as well. Such a provision is called a **cross default provision**.

177-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Notching** is the practice by rating agencies of assigning different ratings to bonds of the same issuer.
 - Notching is less common for highly rated issuers than for lower-rated issuers. For lower-rated issuers, higher default risk leads to significant differences between recovery rates of debt with different seniority rankings, leading to more notching.
- **Structural subordination**
 - Subsidiary's debt covenant may restrict the transfer of cash or assets upstream to the parent company before the subsidiary's debt is serviced. Thus the parent company's bonds are effectively subordinated to the subsidiary's bonds.

178-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Risks in relying on agency ratings:**
 - **Credit ratings can be very dynamic.**
 - ✓ Creditworthiness can and does change – up or down – and that bond investors should not assume an issuer's credit rating will remain the same from time of purchase through the entire holding period.
 - **Rating agencies are not infallible.**
 - **Other types of so-called idiosyncratic or event risk are difficult to capture in ratings.**
 - **Ratings tend to lag market pricing of credit.**
 - ✓ Bond prices and credit spreads frequently move more quickly because of changes in perceived creditworthiness than rating agencies change their ratings (or even outlooks) up or down.
 - ✓ For certain speculative-grade credits, two bonds with similar ratings may trade at very different valuations.

179-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- The four Cs of credit analysis
 - **Capacity** refers to the ability of the borrower to make its debt payments on time.
 - **Collateral** refers to the quality and value of the assets supporting the issuer's indebtedness.
 - **Covenants** are the terms and conditions of lending agreements that the issuer must comply with.
 - **Character** refers to the quality of management.

180-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

(1) Capacity:

➤ Industry analysis

- Industry structure - Porter's five forces model
 - ✓ **Power of suppliers:** fewer supplier, greater credit risk
 - ✓ **Power of buyers/customers:** fewer buyers, greater credit risk
 - ✓ **Barriers to entry:** higher entry barriers, lower credit risk
 - ✓ **Substitution risk:** fewer substitutions, lower credit risk
 - ✓ **Level of competition:** heavier competition, greater credit risk
- Industry fundamentals
 - ✓ **Industry cyclical**
 - ◆ Cyclical industries tend to have more volatile earnings, revenues, and cash flows, which make them more risky than noncyclical industries.
 - ✓ **Industry growth prospects**
 - ◆ Creditworthiness is poorer for the weaker companies in a slow-growing or declining industry.
 - ✓ **Published industry statistics**
 - ◆ Published industry statistics can be a source for industry fundamentals and outlook.

181-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

(1) Capacity:

➤ Company fundamentals

- **Competitive position**
 - ✓ Market share changes over time and cost structure relative to peers are some of the factors to analyze.
- **Track record/operating history**
 - ✓ The performance of the company over different phases of business cycle, trends in margins and revenues, and current management's tenure.
- **Management's strategy and execution**
 - ✓ This includes the soundness of the strategy, the ability to execute the strategy, and the effects of management's decisions on bondholders.
- **Ratios and ratio analysis**

182-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Ratios and ratio analysis
 - ✓ **Profitability and cash flow measures**
 - ◆ **EBITDA**

EBITDA = operating income + dep. & amor.
 - **Drawbacks:** it does not adjust for capital expenditures and changes in working capital, which are necessary uses of funds for a going concern. Cash needed for these uses is not available to debt holders.
 - ◆ **Funds from operations (FFO)**

FFO = NI from continuing operations + dep. & amor. + deferred income taxes + other non-cash items
 - FFO is similar to cash flow from operations (CFO) except that FFO excludes changes in working capital.
 - ◆ **Free cash flow before dividends**

FCF before div. = NI + dep. & amor. – capital expenditure – increase (plus decrease) in non-cash working capital – non-recurring items
 - Free cash flow before dividends excludes non-recurring items.
 - ◆ **Free cash flow after dividend**

FCF after div. = FCF before div. – div.
 - If free cash flow after dividends is greater than zero, it represents cash that could be used to pay down debt or allowed to accumulate on the balance sheet. Either outcome is a form of deleveraging, a positive indicator for creditworthiness.

183-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Ratios and ratio analysis
 - ✓ **Leverage ratios**
 - ◆ **Debt/capital**
 - Capital = total debt + shareholders equity
 - A lower ratio indicates less credit risk.
 - If the financial statements list high values for intangible assets such as goodwill, an analyst should calculate a second debt-to-capital ratio adjusted for a writedown of these assets' after-tax value.
 - ◆ **Debt/EBITDA**
 - A higher ratio indicates higher leverage and higher credit risk.
 - This ratio is more volatile for firms in cyclical industries or with high operating leverage because of their high variability of EBITDA.
 - ◆ **FFO/debt**
 - Because this ratio divides a cash flow measure by the value of debt, a higher ratio indicates lower credit risk.

184-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- Ratios and ratio analysis
 - ✓ **Coverage ratios**
 - ◆ **EBITDA/interest expense**
 - A higher ratio indicates lower credit risk.
 - This ratio is used more often than the EBIT-to-interest expense ratio. Because depreciation and amortization are still included as part of the cash flow measure, this ratio will be higher than the EBIT version.
 - ◆ **EBIT/interest expense**
 - A higher ratio indicates lower credit risk.
 - This ratio is the more conservative measure because depreciation and amortization are subtracted from earnings.

185-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

(1) **Capacity:**

- Comments on issuer's liquidity
 - **Cash on the balance sheet**
 - ✓ Cash holdings provide the greatest assurance of having sufficient liquidity to make promised payments.
 - **Net working capital**
 - ✓ Working capital consumed billions of dollars in cash as accounts payable came due, when the companies most needed liquidity.
 - **Operating cash flow**
 - ✓ Analysts will project this figure out a few years and consider the risk that it may be lower than expected.
 - **Committed bank lines**
 - ✓ Committed but untapped lines of credit provide contingent liquidity in the event that the company is unable to tap other, potentially cheaper, financing in the public debt markets.
 - **Debt coming due and committed capital expenditures in the next one to two years**
 - ✓ Analysts will compare the sources of liquidity with the amount of debt coming due as well as with committed capital expenditures to ensure that companies can repay their debt and still invest in the business if the capital markets are somehow not available.

186-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

(2) Collateral:

➤ Intangible assets

- Patents are considered high-quality intangible assets because they can be more easily sold to generate cash flows as compared to other intangibles.
- Goodwill is not considered a high-quality intangible asset and is usually written down when the company performance is poor.

➤ Depreciation

- Low depreciation expense relative to capital expenditures may signal that management is not investing sufficiently in the company.
- The quality of the company's assets may be poor, which may lead to reduced operating cash flow and potentially high loss severity.

➤ Equity market capitalization

- A stock that trades below book value may indicate that company assets are of low quality.

➤ Human and intellectual capital

- These are difficult to value, but a company may have intellectual property that can serve as collateral.

187-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

(3) Covenants:

➤ Affirmative: obligated to do

- Include such duties as making interest and principal payments and filing audited financial statements on a timely basis.
- Require a company to redeem debt in the event of the company being acquired or to keep the ratio of debt to EBITDA below some prescribed amount.

➤ Negative: limited in doing

- Include a cap on the amount of cash that can be paid out to shareholders relative to earnings
- or perhaps a cap on the amount of additional secured debt that can be issued.

188-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

(4) character:

➤ Credit analysis can make judgments about management's character in the following ways:

- **Soundness of strategy**
 - ✓ Management's ability to develop a sound strategy.
- **Track record**
 - ✓ Management's past performance in executing its strategy and operating the company without bankruptcies, restructurings, or other distress situations that led to additional borrowing.
- **Accounting policies and tax strategies**
 - ✓ Use of inappropriate accounting policies and tax strategies, such as revenue recognition issues, policies leading to frequent restatements, and frequently changing auditors.
- **Fraud and malfeasance record**
 - ✓ Any record of fraud or other legal and regulatory problems.
- **Prior treatment of bondholders**
 - ✓ Benefits to equity holders at the expense of debt holders, through actions such as debt-financed acquisitions and special dividends, especially if they led to credit rating downgrades.

189-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Credit risk VS. return: yields and spreads
 - The higher the credit risk, the greater the return potential and the higher the volatility of that return.
 - Yield on corporate bond
 - = real risk-free interest rate
 - + expected inflation rate
 - + maturity premium
 - + liquidity premium
 - + credit spread
 - ✓ Yield spread = liquidity premium + credit spread

190-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- Factors affect the spreads on corporate bonds:
 - **Credit cycle**
 - ✓ The bond market perceives low aggregate credit risk and is generally bullish. Spreads narrow as the credit cycle improves
 - **Economic conditions**
 - ✓ Credit spreads narrow as the economy strengthens
 - **Financial market performance**
 - ✓ Credit spreads narrow in strong-performing markets overall, including the equity market.
 - **Broker-dealer capital**
 - ✓ Yield spreads are narrower when broker-dealers provide sufficient capital but can widen when market-making capital becomes scarce.
 - **General market demand and supply**
 - ✓ Credit spreads narrow in times of high demand for bonds.

191-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- Credit risk VS. return: yields and spreads
 - The return impact from spread changes is driven by two main factors:
 - ✓ The modified duration of the bond
 - ✓ The magnitude of the spread change
 - ◆ For **small spread changes**, the return impact (percent change in bond price) can be approximated by:
Return impact \approx - modified duration \times Δ spread
 - ◆ For **larger spread changes**, incorporating convexity improves the accuracy of return impact measurement:
Return impact \approx - modified duration \times Δ spread + 0.5 \times convexity \times (Δ spread)²
 - **Credit curves**: the plot of yield spreads for a given bond issuer across the yield curve.
 - ✓ typically upward sloping, with the exception of high premium-priced bonds and distressed bonds, where credit curves can be inverted because of the fear of default, when all creditors at a given ranking in the capital structure will receive the same recovery rate without regard to debt maturity.

192-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **High-yield corporate bonds:** rated below Baa3/BBB-
- Reasons for companies rated below investment grade:
 - Highly leveraged capital structure
 - Weak or limited operating history
 - Limited or negative free cash flow
 - Highly cyclical business
 - Poor management
 - Risky financial policies
 - Lack of scale and/or competitive advantages
 - Large off-balance-sheet liabilities
 - Declining industry

193-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Special considerations of high-yield credit analysis:
 - **Greater focus on issuer liquidity and cash flow**
 - ✓ Sources of liquidity, from strongest to weakest, are the following:
 - ◆ Cash on the balance sheet
 - ◆ Working capital
 - ◆ Operating cash flow
 - ◆ Bank credit facilities
 - ◆ Equity issuance
 - ◆ Asset sales
 - **Detailed financial projections**
 - ✓ Projecting future earnings and cash flows are important for revealing potential vulnerabilities to meet debt payments.

194-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Special considerations of high-yield credit analysis:
 - **Detailed understanding and analysis of the debt structure**
 - ✓ A high-yield issuer will often have at least some of the following types of obligations in its debt structure:
 - ◆ (Secured) bank debt
 - ◆ Second lien debt
 - ◆ Senior unsecured debt
 - ◆ Subordinated debt, which may include convertible bonds
 - ◆ Preferred stock
 - **Understanding of an issuer's corporate structure**
 - ✓ Subsidiaries' dividends are paid out of earnings after they satisfy of all their other obligations.
 - ✓ The parent's reliance on cash flow from its subsidiaries means that parent's debt is structurally subordinated to the subsidiaries' debt and have a lower recovery rating in default.
 - ◆ However, a parent company's credit rating may be superior to subsidiaries' ratings because the parent can benefit from having access to multiple cash flows from diverse subsidiaries.
 - ✓ Leverage ratios should be calculated at each of the debt-issuing entities, as well as a consolidated basis

195-200

101% Contribution Breeds Professionalism

Fundamentals of Credit Analysis

- Special considerations of high-yield credit analysis:
 - **Covenant analysis**
 - ✓ **Change of control put**
 - ◆ This covenant gives debt holders the right to require the issuer to buy back debt (typically for par value or a value slightly above par) in the event of an acquisition.
 - ◆ For investment grade bonds, a change of control put typically applies only if an acquisition of the borrower results in a rating downgrade to below investment grade.
 - ✓ **Restricted payments**
 - ◆ The covenant protects lenders by limiting the amount of cash that may be paid to equity holders.
 - ✓ **Limitations on liens**
 - ◆ The covenant limits the amount of secured debt that a borrower can carry.
 - ◆ Unsecured debt holders prefer the issuer to have less secured debt, which increases the recovery amount available to them in the event of default.
 - ✓ **Restricted versus unrestricted subsidiaries**
 - ◆ Restricted subsidiaries' cash flows and assets can be used to service the debt of the parent holding company

196-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Sovereign debt** is issued by national governments.
- **Sovereign credit analysis** is based on a combination of qualitative and quantitative factors:
 - A government's ability to pay
 - Its willingness to pay
 - ✓ The assessment of willingness is important because bondholders usually have no legal recourse if a national government refuses to pay its debts.

197-200

101% Contribution Breeds Professionalism



Fundamentals of Credit Analysis

- **Municipal debt**: general obligation (GO) bonds and revenue-backed bonds
 - **GO bonds**
 - ✓ backed by the taxing authority of the issuing municipality
 - ✓ The credit analysis has some similarities to sovereign analysis
 - **Revenue-backed bonds**
 - ✓ Support specific projects, such as toll roads, bridges, airports, and other infrastructure.
 - ✓ The creditworthiness comes from the revenues generated by usage fees and tolls levied.
 - ✓ Often have higher credit risk than GO bonds.
 - ✓ Analysis of revenue bonds is similar to those for analyzing corporate bonds.
 - ✓ **Debt service coverage ratio (DSCR)**: the ratio of the project's net revenue to the required interest and principal payments on the bonds.
 - ◆ Many revenue bonds include a covenant requiring a minimum DSCR to protect the lenders' interests.

198-200

101% Contribution Breeds Professionalism



计算知识点

1. TIPS
2. Valuation with a single yield
3. The value change attributable to the passage of time
4. Arbitrage-free bond valuation
5. Accrued interest and full price
6. Matrix pricing
7. Floating rate notes valuation
8. Discount rate, add on yield, and BEY
9. Spot rate and forward rate
10. Reinvestment income & annualized HPR
11. Duration: Macaulay duration, Modified duration, Approximate modified duration, Effective duration
12. Money duration & PVBP
13. Portfolio duration
14. Convexity: Approximate convexity & Effective convexity
15. Price change based on duration and convexity

199-200

101% Contribution Breeds Professionalism



It's not an end but just the beginning.

If there is anyone out there who still questions that China is a place where everything is possible, who wonders if the dream of our founders is alive in our time, who doubts what we can achieve, today is the answer.

It's an answer told by the days and the nights in which we shared our views.

Good luck to everybody!

200-200

101% Contribution Breeds Professionalism

