

## Fixed Income

## 固定收益证券

Level I



## 王牌陈讲CFA

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- 中考、高考、研究生一路以第1名身份保送
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- 以全优成绩通过CFA三个级别考试；一天时间以全优成绩同时通过FRM两个级别考试

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- 逾12年教龄，CFA/FRM培训界的教父级人物，学员遍布全球



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## 王牌陈讲CFA

极速串讲 一级固收



## 债券的基本概念



## 1. 债券的本质

- What is the essence of bonds?

### I. A kind of securities

- Investor / buyer (bondholder)  
vs. Issuer / seller
- Primary market, secondary market
- Market risk

### II. Creditor-debtor relationship

- Lender / creditor  
vs. Borrower / debtor
- Collateral
- Credit risk

## 2. 债券的关键要素

### ① Issuer

#### Private sector

- Companies
- Special purpose entity (SPE)

#### Government sector

- Supranational organizations
- Sovereign (national) governments
- Non-sovereign (local) governments
- Quasi-government entities

## 2. 债券的关键要素

### ② Maturity (vs. tenor, time to maturity)

- Money market securities:  $\leq$  one year
- Perpetual bond: no stated maturity date

- Capital market securities:  $>$  one year

### ③ Par Value , Face Value

### ④ Coupon

- Coupon rate (nominal rate)
- Coupon frequency: coupon payments may be made annually, semi-annually, quarterly, or monthly, etc.

### ⑤ Seniority (priority of repayment)

- senior debt  $>$  junior debt (subordinated debt)

### ⑥ Contingency provisions

- Bonds with embedded option

### ⑦ Yield measures

- ◆  $\text{current yield} = \text{annual coupon} \div \text{bond's price}$

### ⑧ Yield curves

## 3. 债务人的还款来源

- Sovereign bonds: tax revenues, print currency

- Local government debt: general taxing authority, cash flows of the project funded

- Corporate bonds: operating cash flows

- Unsecured bonds are solely repaid by the operating cash flow
  - High-credit-quality issuers usually issues unsecured bonds
- Secured bonds are backed by specific assets, a claim on the assets as a secondary source of debt repayment

- Asset-backed security (ABS): repaid by the cash flows from the underlying asset pool

## 4. 债券条款

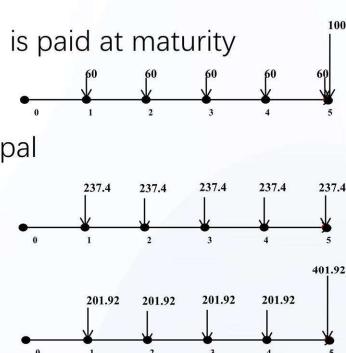
- Affirmative covenants:** required to do
  - Use of proceeds from the bond issue
  - Timely financial reporting
  - **Pari passu clause:** treat the investors with similar seniority in the same way
  - **Cross default clause:** borrowers are considered in default if they default on another debt obligation
  
- Negative covenants:** prohibited from doing
  - Restrictions on dividend paying, shares repurchase
  - **Negative pledge clause:** limitations on issuance of debt with higher seniority

4-1

7

## 5. 债券本金的现金流结构

- Conventional bond's** periodic interest payments and principal is paid at maturity
  - **Bullet bond, plain vanilla bond**
  
- Amortizing bond** has a periodic repayment schedule of principal
  - **Fully amortized bond:** has a schedule that reduces outstanding principal to zero by the maturity date
  - **Partially amortized bond:** only a portion of the principal is repaid by the maturity date
    - **Balloon payment risk**
  
- Sinking fund provision:** the issuer plans to **set aside funds over time** to retire the bond early based on the contract terms
  - Sinking funds **reduce credit risk** while **increasing reinvestment risk** due to a reduction of principal outstanding prior to maturity



5-1

8

## 6. 债券票息的现金流结构

- Fixed coupon**
  - **Fixed rate coupon bond** pays a **fixed periodic coupon**
  - **Deferred coupon bonds** pay no interest for the first few years and have a higher coupon paid later through maturity
    - **Zero-coupon bond** can be thought as an extreme form
  
- Floating coupon**
  - **Floating-rate notes** do not have a fixed coupon, and coupon rate is linked to an external reference rate, such as MRR
    - ◆ **coupon rate = reference rate + quoted margin (spread)**
      - Reference rate **reset periodically**, quoted margin is usually **constant**
      - Coupon payments are **paid in arrears**

6-1

9

## 6. 债券票息的现金流结构

### □ Floating coupon

- **Step-up coupon bond:** coupon increases by specified margins at specified dates
- **Credit-linked notes:** coupon changes when the bond's credit rating changes
- **Index-linked bond:** coupon payments are linked to a specific index
  - **Inflation-linked bond:** coupon payments are linked to an inflation index
  - eg. **Treasury inflation protection securities (TIPS)**
    - Principle protected (change with inflation)
    - Coupon rate does not change
- **Payment-in-kind (PIK) coupon bonds:** issuer pays interest in the form of additional amounts of the bond issue rather than as a cash payment

## 7.1 可赎回债券

- **Callable bond** gives the **issuer** the right to **redeem** all or part of the bond before the specified maturity date
  - **Call price** is the price to redeem the bond
  - The **price appreciation** is limited
- Call provisions are **beneficial to the issuer**, which can protect issuers against decline in interest rate, and investors face **more reinvestment risk**
- The callable bond will have **higher yield** and **lower price**
  - ◆  $V_{\text{callable bond}} = V_{\text{straight bond}} - V_{\text{call option}}$
- **Bond with make-whole call option:** A make-whole call is a contingency feature under which issuers can buy bonds back at a price usually based on the **yield-to-maturity of a sovereign bond** of similar maturity **plus a predetermined spread**
  - The call price is usually **higher than** the bond's current market price

## 7.2 可回售债券

- **Putable bond** gives the **bondholders** the right to **sell** the bond back to the issuer at a pre-determined price on specified dates
  - **Put price** is the price to sell back the bond
  - Putable bond has a **floor feature**
- Put provisions are **beneficial to the investors**, which can protect investor against increase in interest rate
- The putable bond will have **lower yield** and **higher price**
  - ◆  $V_{\text{putable bond}} = V_{\text{straight bond}} + V_{\text{put option}}$

## 7.3 可转换债券

- **Convertible bond** gives **bondholder the right** to exchange the bond for a specified number of common shares in issuing company
  - Hybrid security with both debt and equity features
- Conversion provisions are **beneficial to bondholder**
  - If share prices increase, bondholders can exchange the bond for shares of issue company
  - If share prices decrease, bondholders can receive coupon and principal payment of the bond
- Investors will ask **lower yield**, and pay **higher price**
  - ◆  $V_{\text{convertible bond}} = V_{\text{straight bond}} + V_{\text{call option on equity}}$
  - ◆ **Conversion price = bond's par value / conversion ratio**
  - ◆ **Conversion value = stock market price × conversion ratio**

## 7.4 或有可转换债券

- **Contingent convertible bonds (CoCos)**: convert to common equity automatically if a specific event occurs
  - For banks, CoCos convert debt into equity to **increase its capital** and **reduce the bank's likelihood of default**
  - CoCos offer bond investor a **higher yield**

## 7.5 认股权证

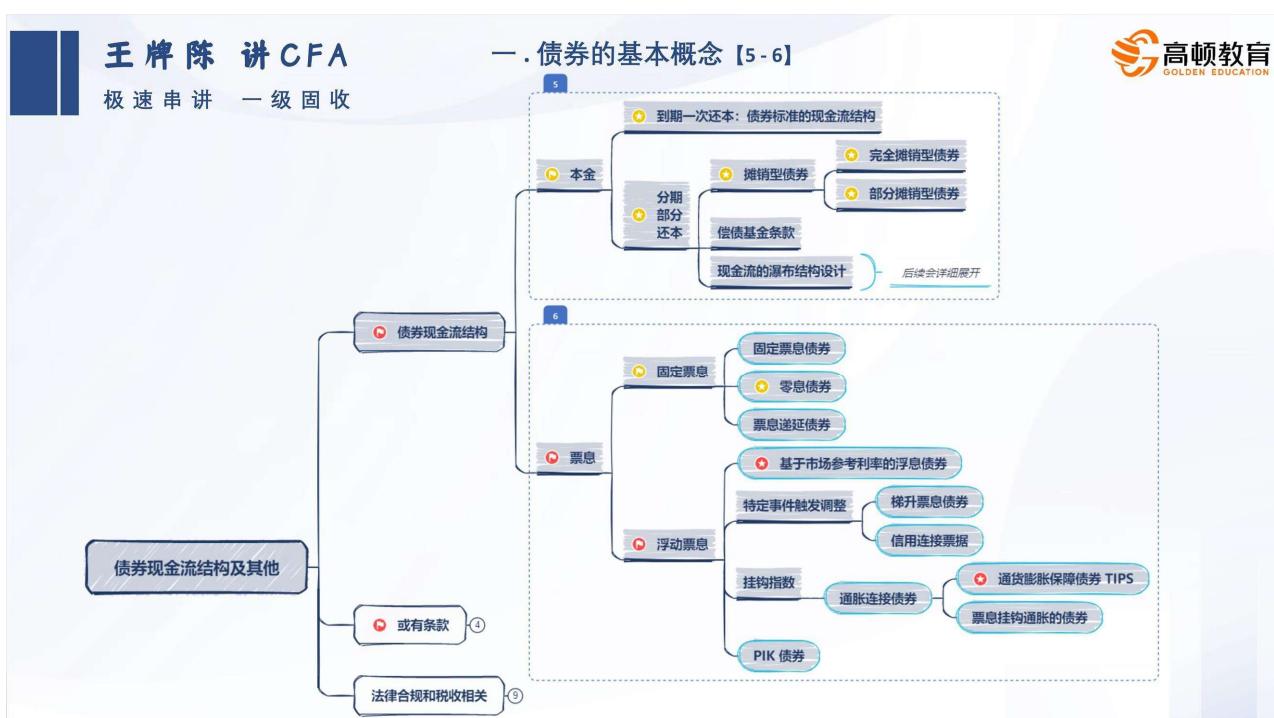
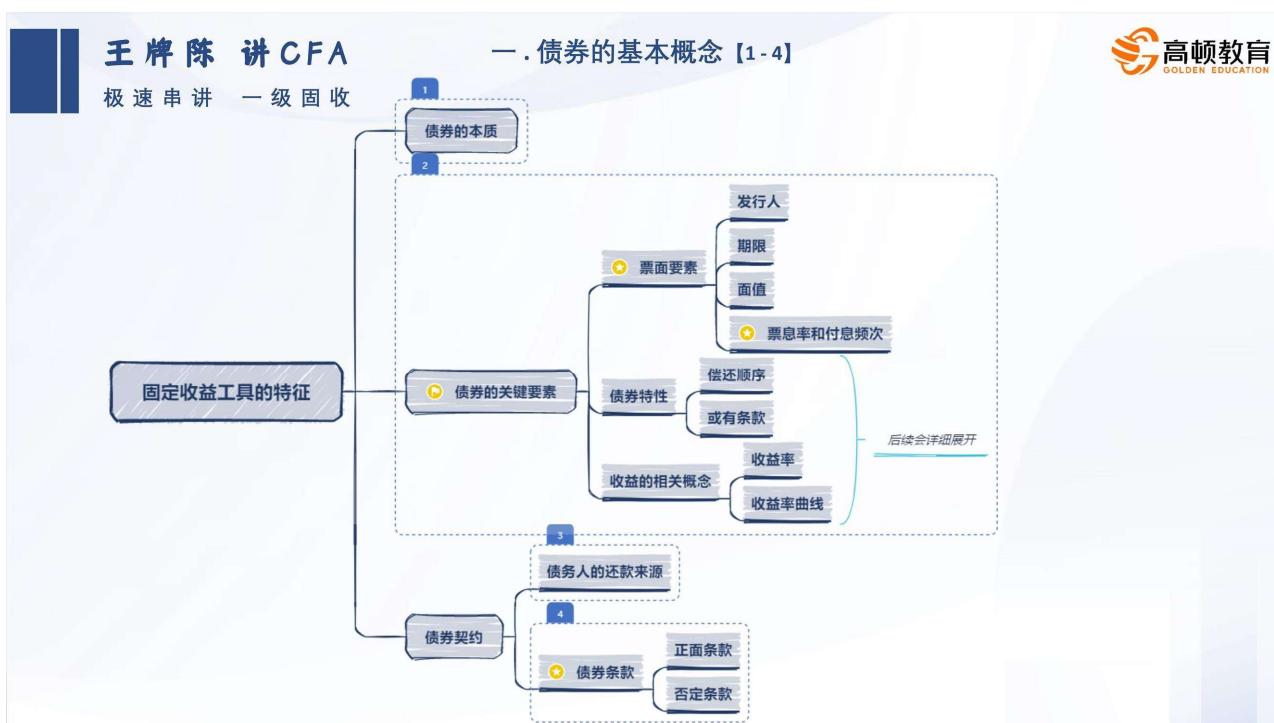
- **Warrant** entitles the holder to buy the underlying stock of the issuing company at fixed exercise price until expiration date
  - An attached option **rather than** an embedded option

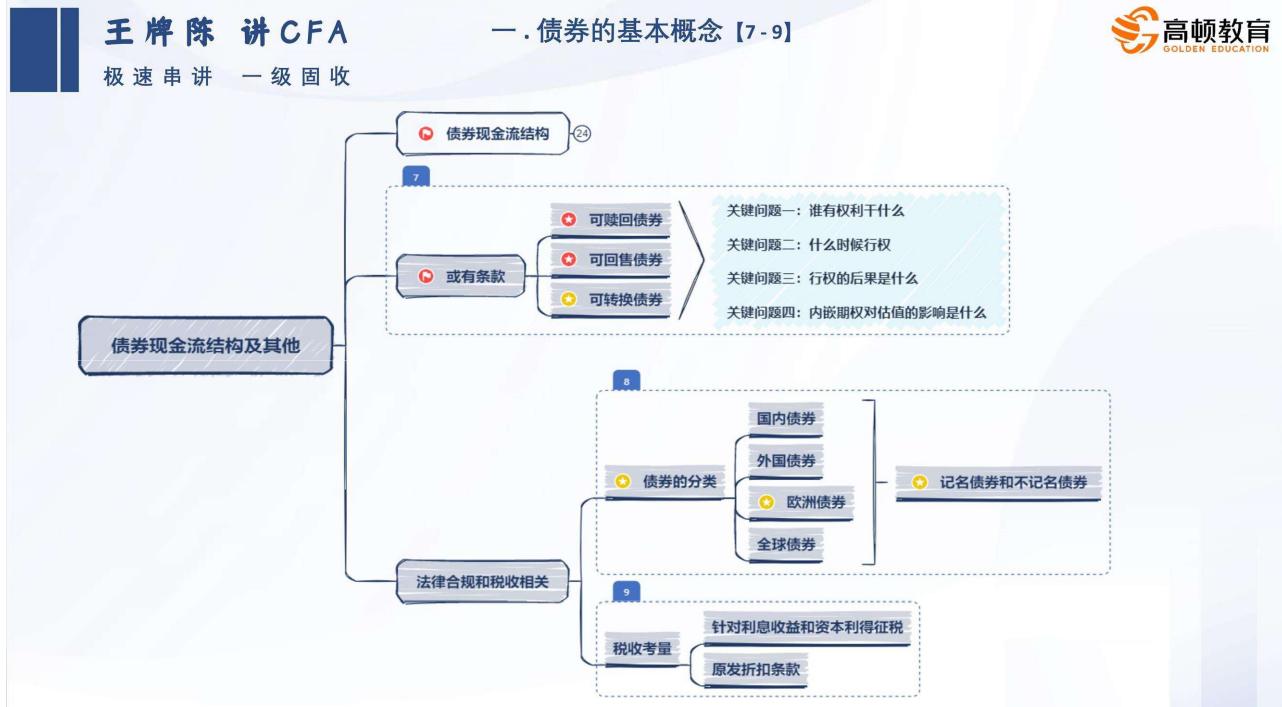
## 8. 基于币种的债券分类

- **Domestic bonds** are issued by **entities that are incorporated in that country**
- **Foreign bonds** are issued by **entities that are incorporated in another country**
- **Eurobonds** are issued **outside the jurisdiction of any single country**, are usually **unsecured**, and may be denominated in any currency, including the issuer's domestic currency (Eurodollar bond / Euroyen bond)
- **Global bonds** are issued **simultaneously in the Eurobond market and in at least one domestic bond market**
- In the past, Eurobonds typically were **bearer bonds**, meaning that the trustee **did not keep records** of who owned the bonds; only the clearing system knew who the bond owners were
- Eurobonds, domestic bonds, and foreign bonds are now **registered bonds** for which ownership **is recorded by either name or serial number**

## 9. 税费相关

- The income portion (interest) is generally taxed at the ordinary income tax rate
  - Tax-exempt securities are exception
- Capital gain or loss is usually treated differently from taxable income
  - In some countries, there is a different tax rate for long-term and short-term capital gains
- Original issue discount (OID) tax treatment: OID is the difference between the par value and the original issue price for bonds issued at discount
  - With OID tax provision: a prorated portion of the OID is treated as taxable interest income each year, and no capital gain tax payment at maturity
  - Without OID tax provision: OID is treated as capital gain at maturity





## 二

# 债券的发行



## 10. 债券的分类

- Classification by **issuer**
  - **Governments:** lowest credit risk (highest credit rating)
    - Treasury-bills / Treasury-notes / Treasury-bonds
- Classification by **credit quality**
  - Investment grade / Speculative grade (high yield bond, junk bond)
- Classification by **maturity**
  - For issuer
    - Commercial paper for short-term or seasonal working capital needs
    - Intermediate-term debt for medium-term investments
    - Long-term debt for capital investments
  - For investor: match **investment time horizons** with fixed-income instruments

## 11. 债券指数

- Comparing **fixed-income index** and **equity indexes**
  - Fixed-income indexes have **far more constituent securities** than equity indexes
  - Fixed-income indexes have **higher turnover** (rebalance more) than equity indexes
  - Most fixed-income indexes are weighted by **market value of outstanding debt** like equity indexes
  
- Type of fixed-income indexes
  - **Aggregate indexes:** with a **vast number** of constituents
    - E.g., Bloomberg Barclay Global aggregate index
  - **Narrower indexes:** with a relatively small number of constituents **based on certain criteria**, such as sector, credit quality, geography, ESG considerations
    - E.g., J.P. Morgan Emerging Markets Bond Index

11-1

22

## 12. 1 债券一级市场

- **Primary bond market** is the market in which issuers first sell bonds to investors
  - **Public offering:** any member of the public may buy the bonds
    - **Underwritten offering:** the investment bank (underwriter) guarantees the sale of the bond issue at an offering price, and takes the risk associated with selling the bonds
    - **Syndicated offering:** a group, or syndicate, of investment banks
    - **Best efforts offering:** the investment bank only serves as a broker and sells the bond issue for a commission
    - **Auctions:** an issuing mechanism that involves bidding and helpful for price discovery
    - **Reopening** increases the size of an existing bond with a price may be different from par
    - **Shelf registration:** issuer prepares a single, all-encompassing offering circular that describes a range of future bond issuances, all under the same document
  - **Private placement:** only a selected group of investors may buy the bonds

12-1

23

## 12. 2 债券二级市场

- **Secondary bond market** is the market in which existing bonds are subsequently traded among investors
  - **Organized exchange** provides a place where buyers and sellers can meet to arrange their trades
  - **OTC markets:** buy and sell orders initiated from various locations
    - Dealers will post bid and ask price
    - The bid-ask spreads are narrower for the following bonds
      - I. on-the-run
      - II. developed market sovereign bonds
      - III. frequent corporate issuers
  
- For firms in distress, the **distressed debt** may still be tradable, providing equity-like return
  - The trading price is far below the par value

12-2

24

## 13.1 非金融机构的短期融资

- **Lines of credit (unsecured external loan financing)**
  - **Uncommitted lines of credit:** most flexible and least costly for borrowers, but more uncertainty than other ways
  - **Committed (regular) lines of credit:** a more reliable funding source with a formal written commitment
  - **Revolving credit agreements (revolvers):** most reliable funding source
- **Secured external loan financing**
  - **Secured loans (asset-based loans):** the company is required to provide collateral in the form of an asset
  - **Factoring arrangement:** firms sell accounts receivable to a lender at a substantial discount
- **External security-based financing**
  - **Commercial paper** is a short term, unsecured promissory note
    - It's generally repaid by a new issue of commercial paper, aka, **roll over**

13-1

25

## 13.2 非金融机构的长期融资

- For long-term corporate bonds, it is necessary to compare the **investment-grade** and **high-yield issuers**
  - Similarities: bonds with longer maturity have higher yields and higher credit spreads for a given issuer

Differences	Investment-grade	High-yield
<b>Cash Flows</b>	Bond-like	Equity-like
<b>Common Type</b>	Unsecured	Secured
<b>Issuer Restrictions</b>	Fewer	More
<b>YTM Proportion Due to Credit Spreads</b>	Lower	Higher

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26

## 13.3 金融机构的短期融资

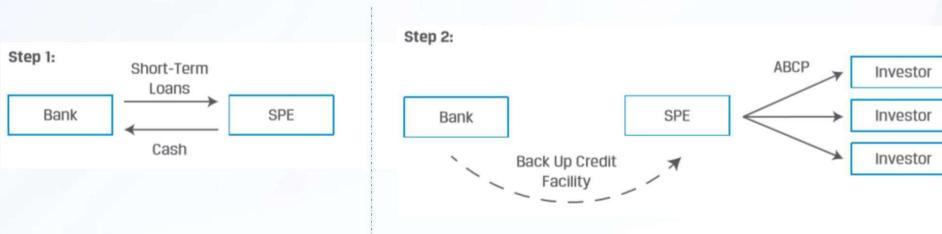
- **Household (or retail) and commercial deposits** are the primary short-term funding sources for commercial banks
  - **Checking accounts / demand deposits** have no stated maturity, pays little interests
  - **Saving deposits:** have a pre-determined maturity and interest rate
  - **Certificate of deposits (CD)**
    - **Non-negotiable CD:** the initial depositor receives the payment at maturity
    - **Negotiable CD:** a depositor can sell the CD in the open market before maturity
- **Interbank market** (may be secured basis, or unsecured basis)
  - **Central bank funds:** banks with reserve surplus loan money to banks with reserve shortage at the central bank funds rate
  - **Discount window lending** from central bank, who serves as the last resort

13-3

27

## 13.3 金融机构的短期融资

- Commercial paper can also be the short-term funding sources for banks
  - Unsecured and rollover risk
- Asset-backed commercial paper (ABCP) is secured form of commercial paper
  - ABCP is one of the off-balance-sheet financing alternatives
    - The role for the bank: SPE sponsor and backup credit provider

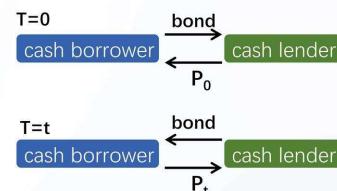


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28

## 14. 回购协议

- Repurchase agreement (Repo) is the sale of a security with a simultaneous agreement by the seller to buy it back at an agreed-on price (repurchase price) on a future date (repurchase date)
  - A repo can be viewed as a collateralized loan
  - **Overnight repo:** the term is one day      ■ **Term repo:** the term is more than one day
  - **General collateral repo:** use a specific group of securities as collateral
  - In a repo transaction, the seller of the security (cash borrower) retains ownership of the security over the repo term, as well as the interest and actual coupon paid by the security
- Reverse repo: view through the cash lending counterparty

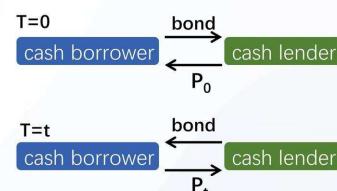


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29

## 14. 回购协议

- ◆  $\text{purchase price}_0 \times (1 + (t \text{ days}/360) \times \text{repo rate}) = \text{repurchase price}_t$
- The repo rate is higher when:
  - The repo term is longer
  - Credit quality of the collateral security is lower
  - Collateral security is not delivered to the lender
  - Collateral security is in low demand or high supply
  - Money market interest rates are higher
- ◆ **Initial margin** = bond price<sub>0</sub> / purchase price<sub>0</sub>
  - ◆ **Haircut** = (bond price<sub>0</sub> – purchase price<sub>0</sub>) / bond price<sub>0</sub>
- ◆ **Variation margin** = initial margin × purchase price<sub>n</sub> – bond price<sub>n</sub>
  - ◆ **Purchase price<sub>n</sub>** = purchase price<sub>0</sub> × (1 + (n days/360) × repo rate)



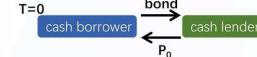
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30

## 14. 回购协议

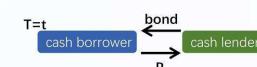
### □ Repo applications

- Cash borrower • finance the ownership of a security
- Cash lender (reverse repo) • Earn short-term income by secured lending



### □ Risks in repo

- Borrow the security to sell short
- **Default risk**
- **Collateral risk:** collateral can't be quickly liquidated under a default
- **Margining risk:** margin requirements can't be met timely
- **Legal risk:** legal rights under repo agreements can't be enforced
- **Netting and settlement risk:** misfunctions in netting or settlement process



### □ Triparty Repo: while triparty agents do not change the credit risk relationship between repo participants in the event of default, they create cost efficiencies

by providing access to a larger collateral pool and multiple counterparties, as well as specializing in the valuation and safe-keeping of assets

## 15.1 国债的相关概念

### □ Sovereign bonds are issued by national governments and backed by the taxing authority

- On-the-run and off-the-run
- Domestic debt and external debt
- Direct currency risk: for bonds issued in domestic currency, including internal and external debts

Indirect currency risk: for bonds issued in foreign currency

### □ According to Ricardian equivalence theorem, a government's choice of debt maturity is irrelevant in determining the present value of future tax cash flows

### □ Government's choice on bond maturity

- Shorter maturity leads to lower borrowing costs but introduces more rollover risk
- Distribute across maturities to decrease interest rate risk and reduce rollover risk

## 15.2 国债的发行和交易

### □ Sovereign bond issuance

- **Single-price auction:** all successful bidders receive the same price, leads to lower borrowing costs and broader distribution of investors
  - All non-competitive bids are accepted
  - Only the competitive bids with low enough yields (high enough prices) will be accepted

- **Multiple-price auction:** bidders receive their respective bid prices and have a narrower distribution

### □ Sovereign bond investors have non-economic objectives

- The Federal reserve uses Treasuries in monetary policy

## 16. 非主权政府发行的债券

### □ Quasi-government bonds / agency bonds

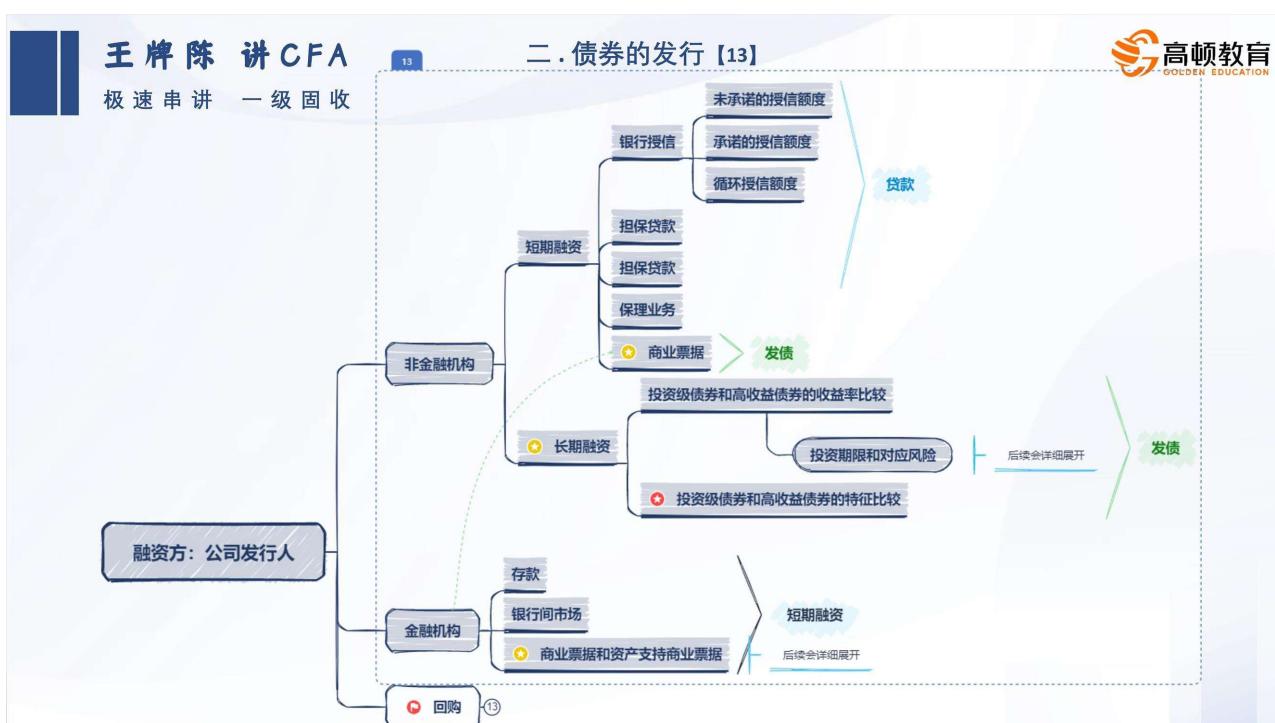
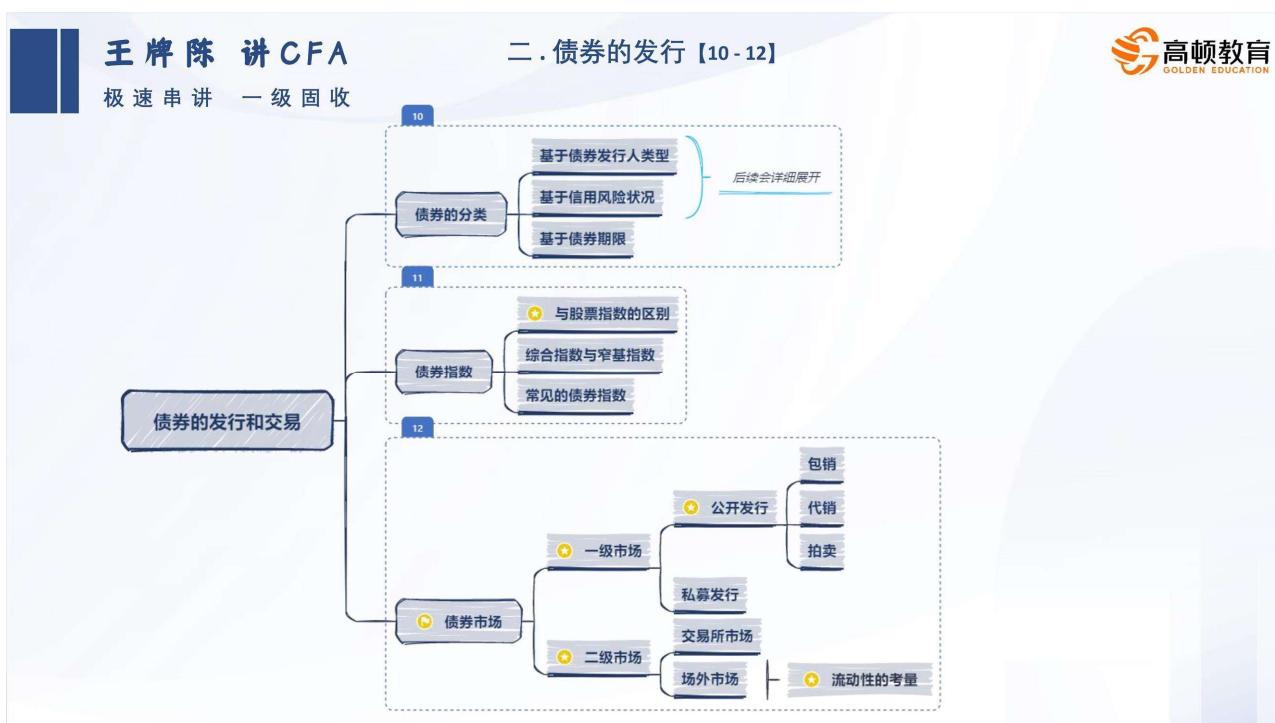
- Issued by entities created by national government, e.g., Ginnie Mae
- Issued by Government Sponsored Enterprises (GSEs), e.g., Fannie Mae, Freddie Mae

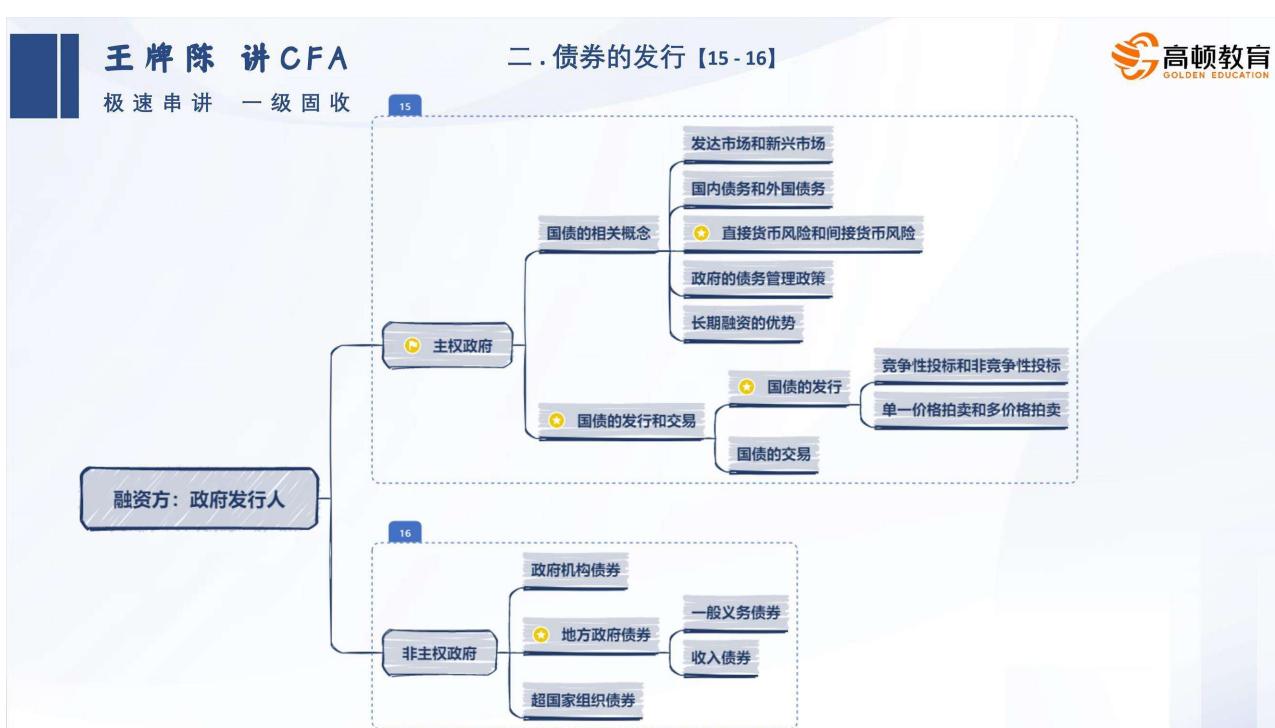
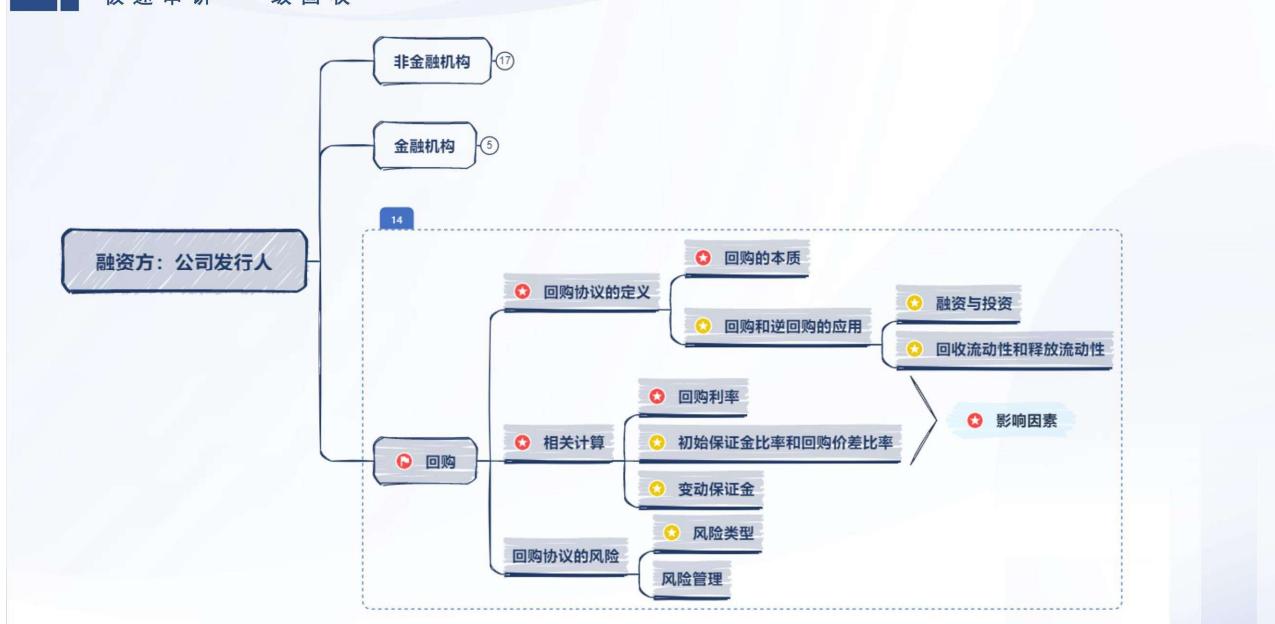
### □ Local government bonds

- Issued by government below the national level such as provinces, regions, states, and cities
- General obligation bonds (GO bonds) and revenue bonds

### □ Supranational bonds

- Issued by supranational organizations, such as world bank, with strong financial support from member states





## 17.1 在发行日或付息日对债券估值

### □ Pricing bond with market discount rate

- Bond price is the **present value** of the promised cash flows

$$\text{◆ } PV = \text{PMT}_1 / (1 + r)^1 + \text{PMT}_2 / (1 + r)^2 + \dots + (\text{PMT}_N + \text{FV}_N) / (1 + r)^N$$

- Market discount rate ( $r$ ) is the **discount rate** used in the PV calculation, the **required rate of return by investors** given the risk of the investment in the bond

### □ When coupon rate < discount rate, bond is **priced at discount**

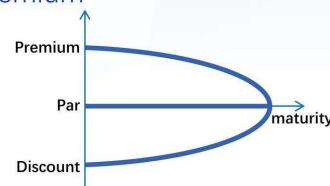
When coupon rate = discount rate, bond is **priced at par**

When coupon rate > discount rate, bond is **priced at premium**

### □ Constant-yield price trajectory illustrates the change

of bond price over time if **the yield keeps constant**

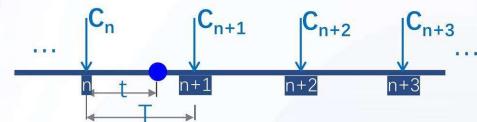
- “Pull to par” effect



## 17.2 在两个付息日之间对债券估值

### □ Dirty price (full price) is the amount that the **buyer pays to the seller**

$$\text{◆ } PV^{\text{Full}} = \frac{C_{n+1}}{(1 + r)^{1 - \frac{t}{T}}} + \frac{C_{n+2}}{(1 + r)^{2 - \frac{t}{T}}} + \dots + \frac{C_{n+N} + \text{Par}}{(1 + r)^{N - \frac{t}{T}}} \\ = \left[ \frac{C_{n+1}}{(1 + r)^1} + \frac{C_{n+2}}{(1 + r)^2} + \dots + \frac{C_{n+N} + \text{Par}}{(1 + r)^N} \right] \times (1 + r)^{\frac{t}{T}}$$



### ■ Day count conventions

- **Actual/actual** is most common for **government bonds**
- **30/360** is often used for **corporate bonds**

### 1. Accrued interest is the proportional share of the next coupon payment

$$\text{◆ } AI = (t / T) \times \text{coupon}$$

### 2. Clean price (flat price) is the quoted upon price of the bond

$$\text{◆ } PV^{\text{Flat}} = PV^{\text{Full}} - AI$$

## 18. 到期收益率

### □ Yield-to-maturity (YTM) is the **internal rate of return** on the cash flow

- If the **market price of a bond** is known, the valuation equation can be used to calculate its **YTM**

$$\text{◆ } \text{Price}_0 = \text{PMT}_1 / (1 + \text{YTM})^1 + \text{PMT}_2 / (1 + \text{YTM})^2 + \dots + (\text{PMT}_N + \text{FV}_N) / (1 + \text{YTM})^N$$

### □ 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

### □ If the **investor's actual return** is just equal to **YTM**, there are some assumptions

1. The issuer makes **full** and **timely** coupon and principal payments
2. The investor hold the bond **until maturity**
3. The investor is able to **reinvest** coupon payments at **YTM**

## 19. 债券估值与债券特征

- Inverse relationship
  - intrinsic value & required yield
  - market price & yield-to-maturity
- Coupon effect: the lower a bond's coupon, the greater the bond price's sensitivity to changes in yield
- Maturity effect: a longer-term bond has a greater percentage price change than a shorter-term bond when the market discount rates change by the same amount
  - Exceptions to the maturity effect exist but are rare in practice: they occur only for low-coupon (but not zero-coupon), long-term bonds trading at a discount
- Convexity effect: non-linear relationship between bond price and yield

19-1

43

## 20. 矩阵定价法

- Matrix pricing is commonly used for valuation of the not actively traded bond is estimated by using the market prices of comparable but more frequently traded bonds
  - Comparable bonds
    - similar times-to-maturity
    - similar coupon rates
    - similar credit quality
  - Linear interpolation can be used when the maturities between the valued bond and the traded bond are different
- Matrix pricing is also used to estimate the yield spread over the government benchmark bond with the same or similar time-to-maturity

20-1

44

## 21. 付息频次和年化收益

- ◆ Rate per period ( $r$ ) = stated annual yield ( $R_s$ ) ÷ periodicity ( $n$ )
- Stated annual yield ( $R_s$ ) is also known as annual percentage rate (APR)
  - If the coupon is paid semiannually, the annual percentage rate is also called semiannual bond basis yield, or semiannual bond equivalent yield
- ◆ Effective annual rate (EAR) =  $(1 + r)^n - 1 = (1 + R_s / n)^n - 1$ 
  - $PV \times (1 + EAR) = FV$
  - $PV \times (1 + r)^n = FV$
  - $PV \times (1 + APR / n)^n = FV$
- ◆  $(1 + APR_m / m)^m = (1 + APR_n / n)^n$ 
  - Compounding more frequently at a lower annual rate

21-1

45

## 22.1 收益率的粗略测算

- **Current yield** equals to total coupon payments received over the year divided by flat price
  - It is a crude measure of return, which focuses solely on interest income, **ignoring** the frequency of coupon payments, time value of money, and accrued interest
- **Simple yield** is the sum of **annual coupon payment** plus **straight-line amortization of discount or premium**, divided by the **flat price**

## 22.2 日期计数方式

- **Street convention yield** is the IRR on cash flow assuming the payments are made on the **scheduled dates**, and **neglect** the delay because of weekends and holidays
- **True yield** is the IRR on the cash flows **accounting for** actual calendar of weekends and holidays
  - True yield will **never be higher than** street convention yield

## 22.3 含权债券的收益率

- **Yield to call (YTC)** is the IRR on cash flows assuming the call option is exercised
  - **Yield to first call**, **yield to second call** ... ...
- **Yield to worst (YTW)** is the **lowest** of the sequence of YTCs and YTM

## 23.1 债券收益率的组成

- The **YTM** can be separated to two components
  1. **Benchmark rate** captures the **macroeconomic factors** (e.g., GDP, CPI)
  2. **Yield spread over benchmark** captures the **microeconomic factors** (credit, liquidity, tax)

## 23.2 收益率基差

- **G-spread** is the spread over an **actual or interpolated government bond** of same tenor
- **I-spread** is the yield spread of a specific bond over the **standard swap rate** in that currency of the same tenor
  - Issuers will use the I-spread to determine the **relative cost of fixed-rate bonds** versus floating-rate alternatives, such as a bank loan or commercial paper
  - Investors use it as a measure of a **bond's credit risk**

## 23.3 基于收益率曲线的基差

- **Zero volatility spread (Z-spread, static spread)** is a **constant yield spread** over a **government spot curve**
- ◆  $P_0 = C_1 / (1 + s_1 + Z)^1 + C_2 / (1 + s_2 + Z)^2 + \dots + (C_N + \text{Par}) / (1 + s_N + Z)^N$

## 23.4 经调整期权影响后的基差

- **Option-adjusted spread (OAS)** is the yield spread that **remove** the influence of embedded option
- ◆ **OAS = Z spread – option value (%)**
  - **Callable bond**: option value > 0  $\Rightarrow$  OAS < Z spread
  - **Putable bond**: option value < 0  $\Rightarrow$  OAS > Z spread

## 24.1 浮息债券的估值模型

### □ Floating-rate notes (FRNs or floaters)

$$V_0 = \frac{\frac{(MRR + QM)}{m} \times \text{par}}{(1 + \frac{MRR + DM}{m})^1} + \frac{\frac{(MRR + QM)}{m} \times \text{par}}{(1 + \frac{MRR + DM}{m})^2} + \dots + \frac{\frac{(MRR + QM)}{m} \times \text{par} + \text{par}}{(1 + \frac{MRR + DM}{m})^{m \times N}}$$

$m$  is the **periodicity** of the floating-rate note, the number of payment periods per year

### ■ Coupon rate = market reference rate (MRR) + quoted margin (QM)

- **Quoted margin** is the specified yield spread over the reference rate, that compensate investor for the difference in the credit risk of the issuer and that implied by the reference rate
- **Quoted margin** is usually not changed during the maturity

### ■ Discount rate = market reference rate (MRR) + discount margin (DM)

- **Discount margin**, also known as the **required margin**, is the spread required by investors, which **may be changed** during the maturity

## 24.2 浮息债券的折溢价状态

### □ In practice, most FRNs are issued at par value

#### ■ At issuance date, quoted margin (QM) = discount margin (DM)

#### 1. If the discount margin (DM) to be the same as the quoted margin (QM)

- Between coupon dates, its flat price will be at a **premium** or **discount** to par value if MRR goes, respectively, **down** or **up**
- On each coupon reset date, the floater will **be priced at par value**
  - The flat price is “**pulled to par**” as the **next reset date** nears

#### 2. Changes in the discount margin usually come from changes in the issuer's credit risk

- If DM is **higher (lower)** than QM, FRN will be priced at a **discount below (premium over)** the par value
  - The amount of the **discount (premium)** is the **total present value of the shortage (excess) interest payment each period**

## 25. 货币市场工具的折扣率和附加率

### □ Discount rates or add-on rates are used for quoted money market rates

- **Discount rates** usually used for **commercial paper, Treasury bills, bankers' acceptances**

- **Add-on rates** usually used for **bank certificates of deposit, repos, market reference rate**

- **Bond Equivalent Yield (BEY)** is a MM rate stated on a **365-day AOR basis**

$$\blacklozenge PV = FV \times (1 - \text{days/year} \times DR) \quad \blacklozenge DR = (FV - PV) / FV \times \text{year/days}$$

$$\blacklozenge FV = PV \times (1 + \text{days/year} \times AOR) \quad \blacklozenge AOR = (FV - PV) / PV \times \text{year/days}$$

## 26.1 即期利率

- Spot rate ( $s_n$ ), or zero rates ( $z_n$ ) is the yield on zero-coupon bonds maturing at the date of each cash flow
- Pricing bonds with spot rates
  - ◆  $V_0 = C_1/(1+s_1)^1 + C_2/(1+s_2)^2 + \dots + (C_N + \text{Par})/(1+s_N)^N$

## 26.2 平价利率

- Par rate ( $PR_n$ ) is the coupon rate for bond of  $n$ -year maturity that would result in bond prices equal to the par values
  - ◆  $\text{Par} = (PR_n \times \text{Par})/(1+s_1)^1 + (PR_n \times \text{Par})/(1+s_2)^2 + \dots + (PR_n \times \text{Par} + \text{Par})/(1+s_n)^n$

## 26.3 远期利率

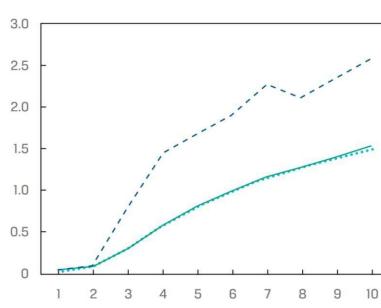
- Forward rate is the interest rate on a bond or money market instrument traded in a forward market
- $FR_{m,n}$  (my ny) means “ $m$  year into  $n$ -year rate”
  - The first number “ $m$ ” refers to when to start the forward contract
  - The second number “ $n$ ” refers to the tenor
- Implied forward rates (IFR) is the breakeven reinvestment rate
  - ◆  $(1+s_A)^A \times (1+IFR_{A,B-A})^{B-A} = (1+s_B)^B$
- Pricing bonds with forward rates
  - ◆  $V_0 = C_1/(1+s_1) + C_2/[(1+s_1) \times (1+y_1y_1)] + \dots + (C_N + \text{Par})/[(1+s_1) \times (1+y_1y_1) \times \dots \times (1+(N-1)y_1y_1)]$

## 27.1 利率曲线和利率的期限结构

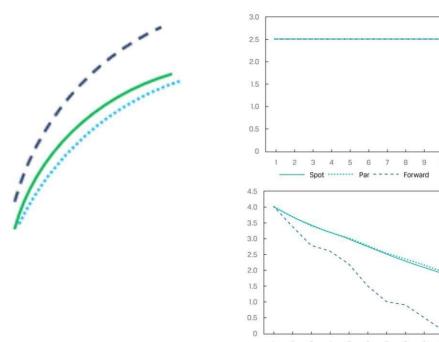
- Term structure of interest rates (maturity structure of interest rates)
  - Spot curve (zero curve, “strip” curve)
  - Par curve
  - Forward curve

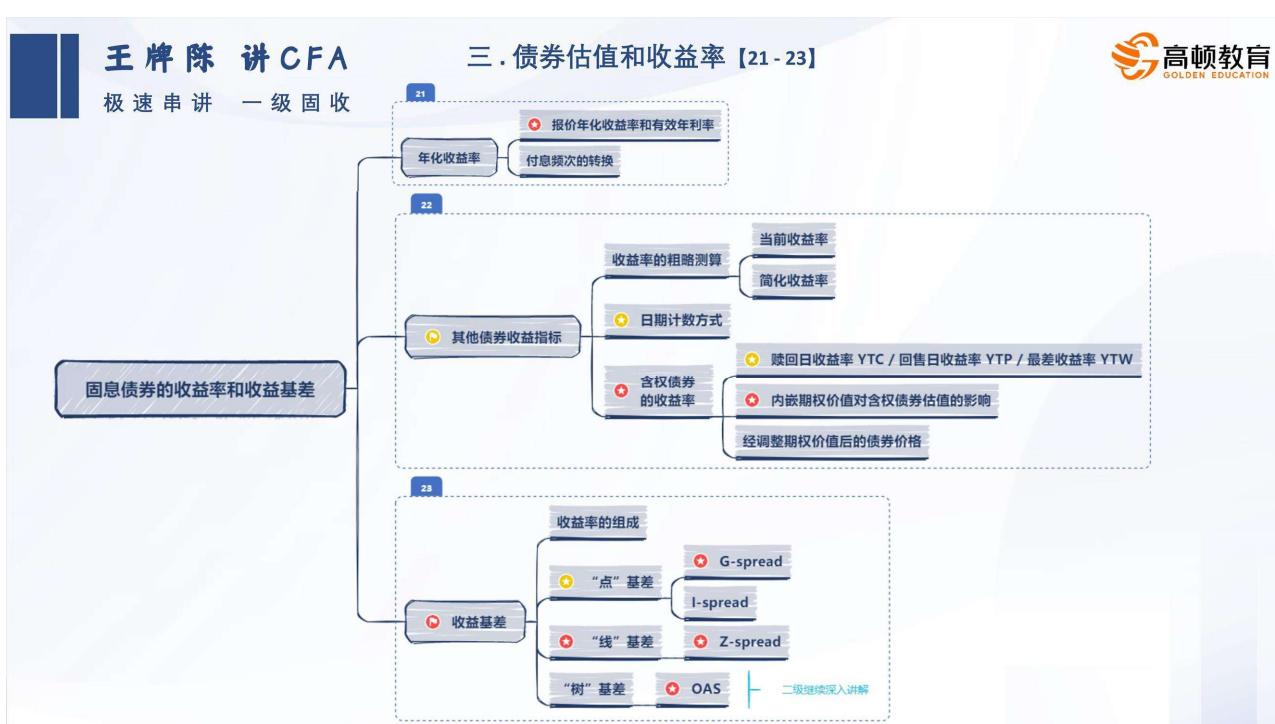
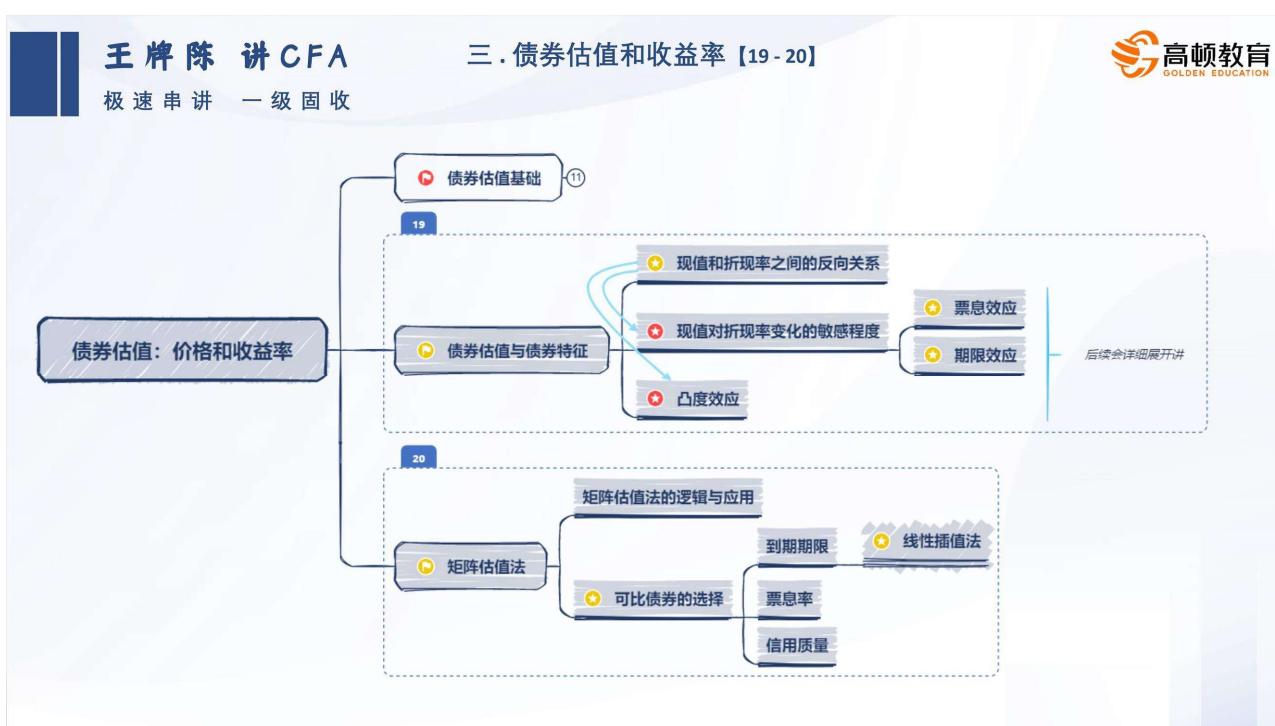
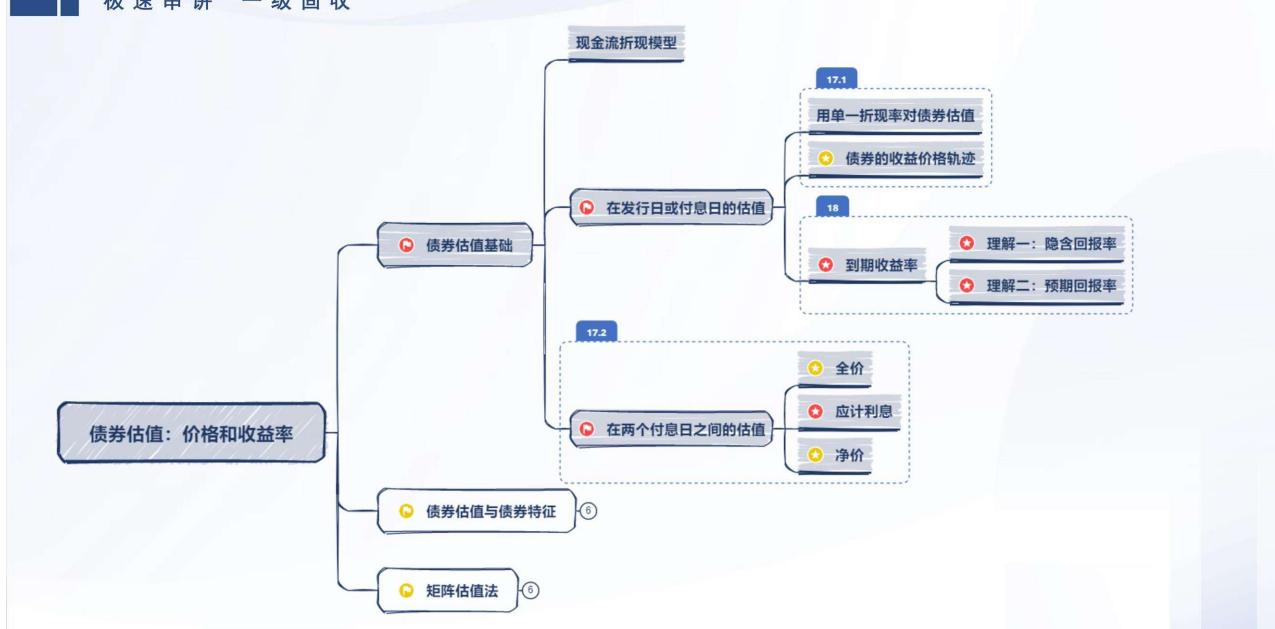
## 27.2 利率曲线之间的相对位置关系

- Normal market conditions



- Non-normal market conditions







# 四

## 债券投资的利率风险

### 28.1 债券投资回报收益的组成

- Sources of return from investing in a fixed-rate bond
  - 1. Promised coupon and principal payments
  - 2. Reinvestment of coupon payments
  - 3. Capital gain or loss on the sale of bond prior to maturity
    - It arises if a bond is sold at a price above / below constant-yield price trajectory

### 28.2 债券投资利率风险的组成

- Interest rate risk on bond investment is the risk that interest rate will change which affects the reinvestment of coupon payment and the market price if the bond is sold prior to maturity
  - 1. Coupon reinvestment risk: uncertainty about income from reinvesting coupon payments
    - It is good (bad) news when interest rates go up (down)
    - It matters more, when the investor has a long-term investment horizon
  - 2. Market price risk: uncertainty about bond price
    - It is bad (good) news when interest rates go up (down)
    - It matters more, when the investor has a short-term investment horizon

## 29.1 麦考利久期的性质

- Macaulay duration is a holding period for a bond that **balances** coupon reinvestment gain (loss) and price loss (gain) for a one-time instantaneous "parallel" shift in the yield curve once the bond purchase is settled
  - ◆ Duration gap = Macaulay duration – investment horizon

## 29.2 麦考利久期的计算

- Macaulay duration is the **weighted average time** to receipt of the bond's promised payments, where the **weights** are the shares of the full price that correspond to each of the bond's promised future payments
  - Macaulay duration is measured in terms of time periods
    - ◆  $\text{MacDur} = \sum [(\text{PV of CF}_i / \text{total PV of CF}) \times i] = \sum [(\text{PV of CF}_i / \text{PV of bond}) \times i]$

29-1

61

## 30.1 修正久期的性质

- Modified duration is used to determine the **percent change** of a bond's **full price** when there is a **100-basis-point** (1 percent) change in its YTM
- Modified duration provides **linear estimate** of the **percentage price change** for a bond given a change in its YTM
  - ◆  $\Delta P^{\text{full}} / P^{\text{full}} \approx -\text{ModDur} \times \Delta \text{Yield}$

## 30.2 修正久期的估算

- Approximate modified duration
  - ◆  $\text{ModDur} \approx (P_- - P_+) / (2 \times P_0 \times \Delta \text{Yield})$

30-1

62

## 31.1 麦考利久期和修正久期之间的关系

$$\text{◆ } \text{ModDur} = -1/(1 + r_{\text{period}}) \times \text{MacDur}$$

## 31.2 几类特殊债券的麦考利久期

- Zero-coupon bond's Macaulay duration is equal to its **maturity**
- Perpetual bond
  - ◆  $\text{MacDur} = (1 + r_{\text{period}}) / r_{\text{period}}$
- A floating-rate instrument has a Macaulay duration that reflects the time to the next coupon reset date

31-1

63

## 32.1 美元久期

- Money duration (dollar duration) is a measure of the price change in units of currency given a change in its YTM
  - ◆  $\text{MoneyDur} = \text{ModDur} \times \text{Price}^{\text{Full}}$

## 32.2 基点价值

- Price value of a basis point, PVBP (price value of an 01, PV01), (dollar value of 1 bp, DV01), (basis point value, BPV) is the money change in full price of a bond when its YTM changes by one basis point (0.01%)
  - ◆  $\text{PVBP} = \text{MoneyDur} \times 0.0001$
  - ◆  $\text{PVBP} = (\text{P}_+ - \text{P}_-) / 2$  •  $P_-$  and  $P_+$  are the full prices calculated by decreasing and increasing the YTM by one basis point

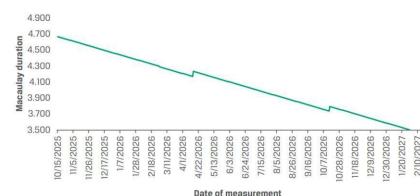
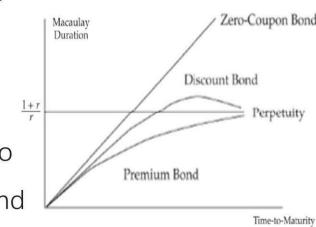
32-1

64

## 33. 久期的性质

- A lower-coupon bond has a higher duration and more interest rate risk than a higher-coupon bond
- A lower yield-to-maturity increases the weighted average of the time to receipt of cash flow and thus increases duration
- Longer times-to-maturity typically correspond to higher duration
  - The implication is that for long-dated bonds trading at a discount to par, interest rate risk could be lower than that of a shorter-term bond
- For a constant yield-to-maturity, the Macaulay duration decreases smoothly as time passes and then jumps upward after the coupon is paid, which creates a "saw-tooth" pattern

$$\text{MacDur} = \left\{ \frac{1+r}{r} - \frac{1+r + [N \times (c-r)]}{c \times [(1+r)^N - 1] + r} \right\} - \frac{t}{T}$$

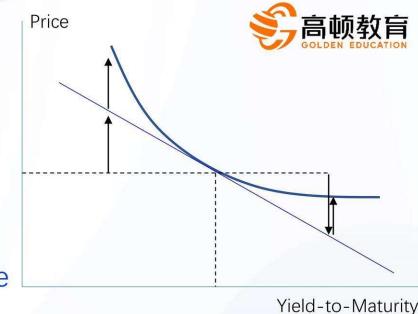


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65

## 34.1 凸度的概念和好处

- The more curved the price-yield curve, the worse the only-duration-based estimate of the price change
  - Money duration estimates the change in the bond price along the straight line tangent to the curved line
- The more convex bond outperforms the less convex: for the same decrease (increase) in YTM, the more convex bond appreciates more (depreciates less) in price
  - If the positive attribute is priced in, the more convex bond would have a higher price and a lower YTM
- Convexity is the "second-order" effect of the price-yield curve
  - ◆  $\text{Convexity} = \frac{1}{P} \times \frac{d^2P}{dy^2}$
  - ◆  $\text{ModDur} = \frac{1}{P} \times \frac{dP}{dy}$



34-1

66

## 34.2 凸度的性质

- The factors that lead to greater convexity are the same as for duration
  - longer time-to-maturity      ■ lower coupon rate      ■ lower yield-to-maturity
- For bonds with same duration, the one that has the greater dispersion of cash flows has the greater convexity

## 34.3 债券价格变动的估计

- ◆  $\Delta P/P \approx -\text{ModDur} \times \Delta \text{Yield} + 1/2 \times \text{Convexity} \times \Delta \text{Yield}^2$
- ◆  $\Delta P \approx -\text{MoneyDur} \times \Delta \text{Yield} + 1/2 \times \text{MoneyCon} \times \Delta \text{Yield}^2$ 
  - Money convexity (MoneyCon) = Convexity  $\times P^{\text{Full}}$

Money duration (MoneyDur) = Modified duration  $\times P^{\text{Full}}$

## 34.4 凸度的计算和估计

- ◆ Convexity =  $\sum [w_t \times t \times (t + 1/n) \times (1+r)^{-n}]$       MacDur =  $\sum [w_t \times t]$
- ◆ Convexity  $\approx (P_- + P_+ - 2 \times P_0) / (P_0 \times \Delta \text{Yield}^2)$       ModDur  $\approx (P_- - P_+) / (2 \times P_0 \times \Delta \text{Yield})$

## 35. 投资组合的久期和凸度

- Two methods to calculate the portfolio duration and convexity
  1. Using the weighted average of time to receipt of the aggregate cash flows
    - Theoretically correct, but difficult to use in practice
  2. Using the weighted averages of the durations and convexities of the individual bonds
    - The method becomes more accurate when differences in the yields-to-maturity on the bonds are smaller and when the yield curve is flat
    - These measures of portfolio duration and convexity implicitly assume that yields of all maturities change by the same amount in the same direction, a parallel shift in the yield curve

## 36.1 有效久期和有效凸度的概念

- Effective duration and effective convexity are the risk measures to reflect the sensitivity of bond's price to a change in a benchmark yield curve
  - They measure interest rate risk in terms of a parallel shift in the benchmark yield curve ( $\Delta$ curve)
    - The government par curve is usually used as the benchmark yield curve

## 36.2 有效久期和有效凸度的估算

- ◆  $\Delta P/P \approx -\text{EffDur} \times \Delta \text{curve} + 1/2 \times \text{EffCon} \times \Delta \text{curve}^2$ 
  - ◆ EffDur  $\approx (P_- - P_+) / (2 \times P_0 \times \Delta \text{curve})$
  - ◆ EffCon  $\approx (P_- + P_+ - 2 \times P_0) / (P_0 \times \Delta \text{curve}^2)$

## 36.3 有效久期和有效凸度的应用范围

- Effective duration and effective convexity should be used for bonds with embedded option due to uncertain future cash flow and absence of well-defined YTM
- Effective duration and effective convexity may also be useful with option-free bonds
  - Small differences may arise between a bond's effective duration and its modified duration
    - The difference narrows when the time-to-maturity is shorter, the bond is priced closer to par value, and the yield curve is flatter; the difference disappears only in the rare circumstance of a flat yield curve

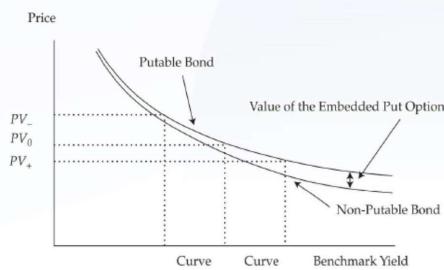
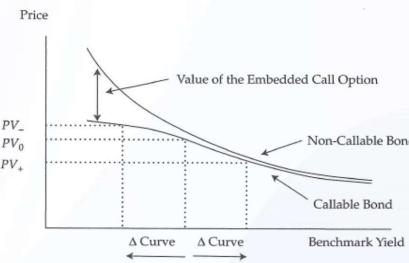
36-2

70

## 36.4 含权债券的有效久期和有效凸度

- Callable bonds
  - Embedded call option leads to lower effective duration, especially when interest rates are low
  - Callable bonds may have negative convexity (concavity), especially when interest rates are low
- Putable bond
  - Embedded put option leads to lower effective duration, especially when interest rates are high
  - Putable bonds often have higher positive convexity, especially when interest rates are high

36-3



71

## 37. 关键利率久期

- Key rate duration (partial duration) is a measure of a bond's sensitivity to a change in the benchmark yield curve at a specific maturity segment
  - ◆ 
$$\text{KeyRateDur}_k = \frac{\frac{\Delta P}{P}}{\Delta r_k} = \frac{1}{P} \times \frac{\Delta P}{\Delta r_k} = \frac{1}{P} \times \frac{\partial P}{\partial r_k}$$
  - ◆  $\Delta P/P \approx -\text{KeyRateDur}_k \times \Delta r_k$
  - It is useful to identify "shaping risk" for a bond (e.g., the yield curve becoming steeper or flatter or twisting), so it is useful to measure bond's sensitivity to nonparallel shift of the benchmark yield curve
- The sum of key rate durations is equal to the effective duration
  - ◆  $\sum \text{KeyRateDur}_k = \text{EffDur}$

37-1

72

## 38. 实证久期和实证凸度

- Analytical duration (convexity) is estimated using mathematical formulas
  - Estimates of the impact of benchmark yield changes on bond prices using analytical duration implicitly assume the government bond yields and spreads are independent variables and are uncorrelated
- Empirical duration (convexity) is calculated through statistical methods and historical data
  - Statistical estimate that accounts for correlation between yield spreads and benchmark yield-to-maturity changes under different economic scenarios
- Under stressed market
  - Government bond: empirical duration  $\approx$  analytical duration
  - Corporate bond: empirical duration  $<$  analytical duration

38-1

73

## 小结：久期和凸度

对利率风险的衡量

分析

实证

收益率 变动

收益曲线 平行移动

收益曲线 非平行移动



38-2

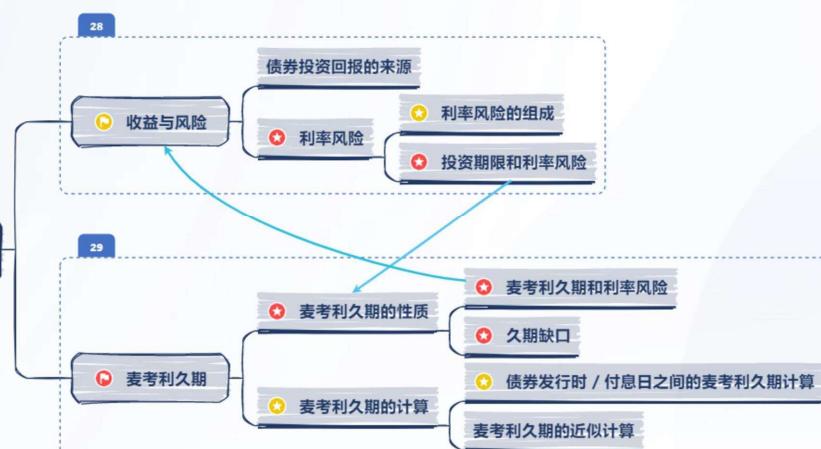
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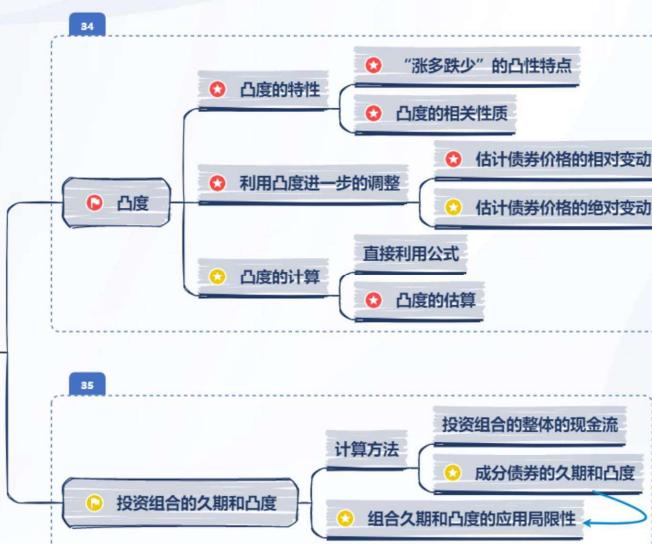
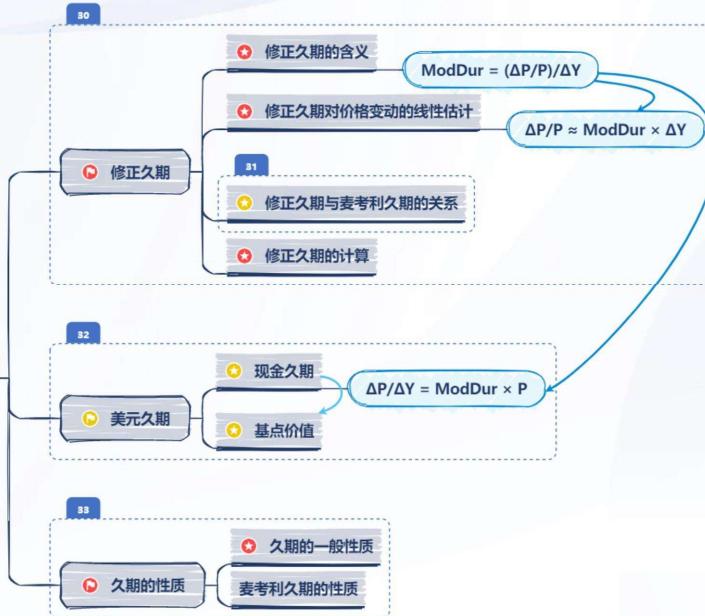
王牌陈讲CFA

四. 债券投资的利率风险【28 - 38】

极速串讲 一级固收

利率风险和投资收益





## 五

## 债券投资的信用风险

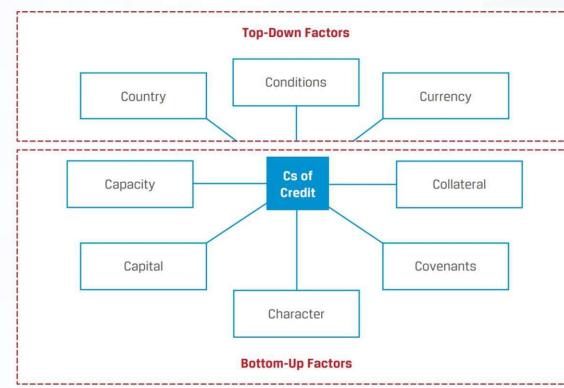


## 39.1 信用风险的概念和基本计量

- 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
- ◆ Expected loss (EL) = probability of default (POD) × loss given default (LGD)
- 1. Expected loss may be expressed in currency terms
  - ◆ LGD = expected exposure (EE) × loss severity
    - ◆ Expected exposure (exposure at default, EAD) = loan or bond face value + accrued interests – current market value of available collateral
    - ◆ Loss severity = 1 – recovery rate (RR)
- 2. Expected loss may be expressed in percentage of exposure
  - ◆ LGD = loss severity = 1 – recovery rate (RR)
  - Compare credit spread with expected loss (= POD × LGD), to check whether the investor is fairly compensated

## 39.2 信用风险的分析框架

- POD is driven by an issuer's ability to service debt based on both qualitative and quantitative factors, including profitability, coverage, and leverage
- For investors in unsecured investment-grade bonds or loans with a high LGD, the greatest risk of expected loss arises due to a rise in POD
- High-yield investors expecting a greater likelihood of default seek to minimize EL by seeking covenant restrictions and/or security to lower LGD



## 40. 信用评级

- The **rating agencies** independently assess issuer credit risk on a forward-looking basis using quantitative and qualitative analysis
  - **Credit migration risk / downgrade risk** means that bond issuer's creditworthiness deteriorates to a lower rating, causing the yield spreads wider and the prices lower
- Rating agencies will typically provide both **issuer and issue ratings**
  - **Notching:** credit ratings on issues can be moved up or down from the issuer rating
    - Issuer rating is usually applied to its senior unsecured debt
    - The higher the senior unsecured rating, the smaller the adjustment will be
- Risks in relying on agency ratings
  - Credit ratings tend to be sticky and lag market pricing of credit risk
  - Some risks are difficult to capture in credit ratings
  - Ratings may involve miscalculations or unforeseen changes not fully captured

40-1

82

## 41. 信用利差

- **Yield spread** is relative to a comparable, default-free bond
  - Yield spread is composed of the credit spread and liquidity premium
- Factors that influence yield spreads include:
  - Macroeconomic factors: e.g., a deteriorating credit cycle
  - Market factors: e.g., market liquidity declines
  - Issuer-specific factors: e.g., issuer's financial performance
- The yield spread difference between investment-grade (IG) bond ratings is generally narrower than the difference between IG and high-yield (HY)
- The spread change in spread for IG bonds is narrower than that for HY bonds
- The price impact from changes in spread is driven by two main factors, modified duration and convexity, as well as the magnitude of spread change
  - ◆  $\Delta P^{\text{Full}} / P^{\text{Full}} \approx -\text{ModDur} \times \Delta \text{spread} + 1/2 \times \text{Con} \times \Delta \text{spread}^2$

41-1

83

## 42. 1 主权政府发行人的信用风险分析

- **Government issuers vs. corporate issuers**
  - In contrast to corporations that fund working capital and fixed assets to generate profits, sovereign and other government issuers use debt to conduct fiscal policy, supply public goods and services, and fund other government expenditures
  - While companies primarily rely on operating cash flow to repay debt, governments use tax revenues and other government revenues, such as tariffs and fees, to pay interest and principal
- The credit analysis combines qualitative and quantitative factors in evaluating a government's ability and willingness to pay
  - 1. **Qualitative factors**
    - Government institutions and policy
    - External status
    - Fiscal flexibility
    - Monetary effectiveness
    - Economic flexibility

42-1

84

## 42.1 主权政府发行人的信用风险分析

### 2. Quantitative factors

#### ■ Fiscal strength

- ① **debt burden**
  - $\text{Debt to GDP} = \text{general government debt} / \text{GDP}$
  - $\text{Debt to Revenue} = \text{general government debt} / \text{revenue}$
- ② **debt affordability**
  - $\text{Interest to GDP} = \text{government interest payments} / \text{GDP}$
  - $\text{Interest to Revenue} = \text{government interest payments} / \text{revenue}$

#### ■ Economic growth and stability

- ① **growth and volatility**
  - $\text{Real GDP Growth} = (\text{real GDP}_t - \text{real GDP}_{t-1}) / \text{real GDP}_{t-1}$
  - Real GDP Growth Volatility
- ② **size and scale**
  - Size of Economy: GDP in PPP (Purchasing Power Parity) terms
  - Per Capita GDP =  $\text{GDP} / \text{population}$

## 42.1 主权政府发行人的信用风险分析

### 2. Quantitative factors

#### ■ External stability

- ① **currency reserves**
  - $\text{FX Reserves to GDP} = \text{FX reserves} / \text{GDP}$
  - Reserve Ratio = FX reserves / external debt
- ② **external debt**
  - $\text{External Debt Burden} = \text{LT external debt} / \text{GDP}$
  - $\text{External Debt Due} = \text{external debt due in 12m} / \text{GDP}$

## 42.2 非主权政府发行人的信用风险分析

### □ Municipal debts are debts issued by local governments

- **General obligation (GO) bonds:** are unsecured bonds issued by local government and supported by the taxing authority of the issuer
- **Revenue bonds:** issued for specific project financing (e.g., toll roads, bridges, airports)
  - Higher risk than GO bonds because they are dependent on a single source of revenue

## 43. 企业发行人的信用风险分析

### □ Qualitative factors in assessing a firm's creditworthiness

- Business model
- Corporate governance
- Industry and competition
- Business risk

### □ Quantitative factors in assessing a firm's creditworthiness

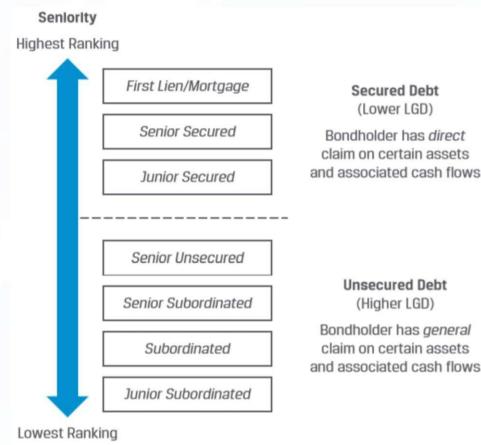
- **Profitability**
  - $\text{EBIT Margin} = \text{operating income} / \text{revenue}$
- **Leverage**
  - $\text{EBIT to Interest Expense} = \text{operating income} / \text{interest expense}$
- **Coverage**
  - $\text{Debt to EBITDA} = \text{debt} / \text{EBITDA}$
  - $\text{RCF to Net Debt} = \text{retained cash flow (RCF)} / (\text{debt} - \text{cash and marketable securities})$

## 44. 债务偿还顺序

- Seniority ranking refers to the priority of payment, or priority of claims

- All creditors at the same debt seniority level are treated as one class
- Recovery rates vary by seniority ranking based upon the priority of claims

- Priority of claims is not always absolute



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#### 五. 债券投资的信用风险 [39 - 44 ]

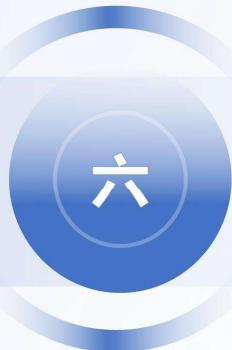


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#### 五. 债券投资的信用风险 [39 - 44 ]





## 资产证券化

### 45. 资产证券化的基本步骤和优势

- **Asset-backed securities (ABS)** are securities **backed by** and **repaid from** a pool of assets
- **Securitization** is the process to move assets from the owner of the assets into a **special purpose vehicle (SPV)**, then issue ABS backed by cash flows of the assets
  - SPV buys the assets and issues ABS and is a bankruptcy-remote vehicle
- Benefits of securitization
  - For **originators**: selling illiquid assets **improves profitability** and **capital efficiency**
  - For borrowers: **lower funding costs** due to **disintermediation**
  - For investors: access asset classes **matching** their risk, return, and maturity profiles that are otherwise not directly available (**tranching**)
  - For markets: provide funding alternatives beyond traditional tools

### 46. 信用增强机制

- **Credit enhancement provisions** are used to mitigate the credit risk in securitization
  1. **External credit enhancement**
    - Financial guarantees by banks or insurance companies
    - Letters of credit
    - Cash collateral accounts
  2. **Internal credit enhancement**
    - **Overcollateralization**: post more collateral than the bonds issued
    - **Excess spread**: more cash flow received from the underlying pool than payments to security holders
    - **Subordination / credit tranching**: more than one bond tranche and these tranches differ in losses sharing

## 47.1 担保债券的概念

- **Covered bonds** issuers create a specific pool of mortgage loans on the balance sheet of the bank, and this pool then **serves as collateral** ("cover") for bonds issued by the bank
  - Covered bonds are the simplest securitization structure
  - Should the issuing bank default on a covered bond issue, investors can use the collateral underlying the pool to receive payment
- Covered bonds are **not considered full securitizations**
  - The underlying assets are **not transferred** to a separate independent SPE but rather remain on the issuing bank's balance sheet
  - Covered bond investors **receive payment directly from the bank** and not from the cash flow generated by the specific pool of mortgage loans

47-1

94

## 47.2 担保债券的特点

- The investors in the covered bonds have **dual recourse** in case of bankruptcy
  1. on the ringfenced loans in the pool that underlie the covered bond transaction
  2. on the unencumbered assets of the issuing institution
- The **dynamic nature of the cover pool** means the assets in the pool are **monitored by a third party** for performance and adherence to underwriting standards
- Covered bond transactions typically involve collateral underlying the transaction which exceeds the face value of the issued bonds, referred to as **overcollateralization**
- The **loan to value (LTV)** on the loans included in the transactions must meet certain standards to be eligible for inclusion in the pool
- Covered bonds have **redemption regimes** to deal with default
  - Hard-bullet: trigger bond default and accelerate bond payments if investors aren't paid in time
  - Soft-bullet: delay the bond default and set a new maturity date
  - Conditional pass-through: convert to pass-through securities after the original schedule

47-2

95

## 48.1 信用卡应收账款支持证券

- **Credit card receivable ABS** are backed by credit card receivables, which are **non-amortizing loans**
- **Cash flows** in credit card ABS
  1. **Interest and fees**: paid to security holders periodically
  2. **Principal repayments**: **reinvested during lockout period (revolving period)** and paid to investors after lockout period ends
    - "Early amortization" or "rapid amortization" provisions are included to safeguard the credit quality of the issue

## 48.2 太阳能装置资产支持证券

- **Solar ABS** are backed by solar loans or leases
  - Solar loans are collateralized by the solar equipment
- Contains **pre-funding period** allowing the trust to acquire additional transactions in post-transaction period
- For institutional investors with **ESG concerns**, solar ABS can offer an attractive investment alternative

48-1

## 48.3 债务抵押证券

- **Collateralized debt obligation (CDO)** is a generic term to describe a security backed by a diversified pool of debt obligations, e.g., **CLO (collateralized loan obligation)**
- The **collateral manager** is required to buy and sell debt obligations for and from the CDO portfolio
- Structure of a CDO includes senior, mezzanine, and subordinated /equity bond classes
  - Senior and mezzanine tranches earn **bond-like returns**, and the investors may earn a potentially **higher yield** than comparable corporate bonds
  - **Equity tranche** earns more **equity-like returns**
    - A CDO is a **leveraged transaction**, where equity tranche holders use borrowed funds (the bond classes issued) to generate a return above the funding cost

48-2

97

## 49. 房产按揭贷款

- A **mortgage loan** is secured by the collateral of a specified real estate property that obliges the borrower to make a **predetermined** series of payments to the lender
  - **Foreclosure** allows the lender to take possession of the mortgaged property and then sell it in order to recover funds if the borrower defaults
- ◆ **Loan-to-value ratio (LTV) = amount of the mortgage / property's value**
- ◆ **debt-to-income ratio (DTI) = monthly debt payments / monthly pre-tax gross income**
- Types of mortgage loans: prime|subprime | recourse|non-recourse | conforming|non-conforming
- **Prepayment option** entitle the **borrower** to prepay all or part of the **outstanding mortgage principal** prior to the **scheduled due date** that the principal must be repaid
- **Prepayment risk** is the uncertainty that the **actual cash flows** will be different from the **scheduled cash flows** due to the borrowers' prepayment
  - **Contraction risk (extension risk)** is the risk that the borrower might pay back the money borrowed more quickly (**more slowly**) than anticipated

49-1

98

## 50.1 机构和非机构住房贷款支持证券

- **Residential MBS (RMBS)** are backed by a pool of **residential mortgage loans**
  - **Agency RMBS** are guaranteed by a **federal agency** or **government-sponsored enterprises (GSE)**
  - **Non-agency RMBS** are issued by private entities and are **not guaranteed** by a federal agency or a GSE
    - To obtain a favorable credit rating, non-agency RMBS often require one or more credit enhancements

## 50.2 按揭贷款支持转手证券

- **Mortgage pass-through security (MPS)** is a security created when holders of mortgages form a pool of mortgage loans and sell shares or participation certificates in the pool
  - **Waterfall** is the structure adopted in a securitization transaction
- **Weighted average coupon rate (WAC)**
  - **Pass-through rate (net interest, net coupon)**
- **Weighted average maturity (WAM)**
  - **Weighted average life (WAL)**

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## 50.3 抵押担保债券

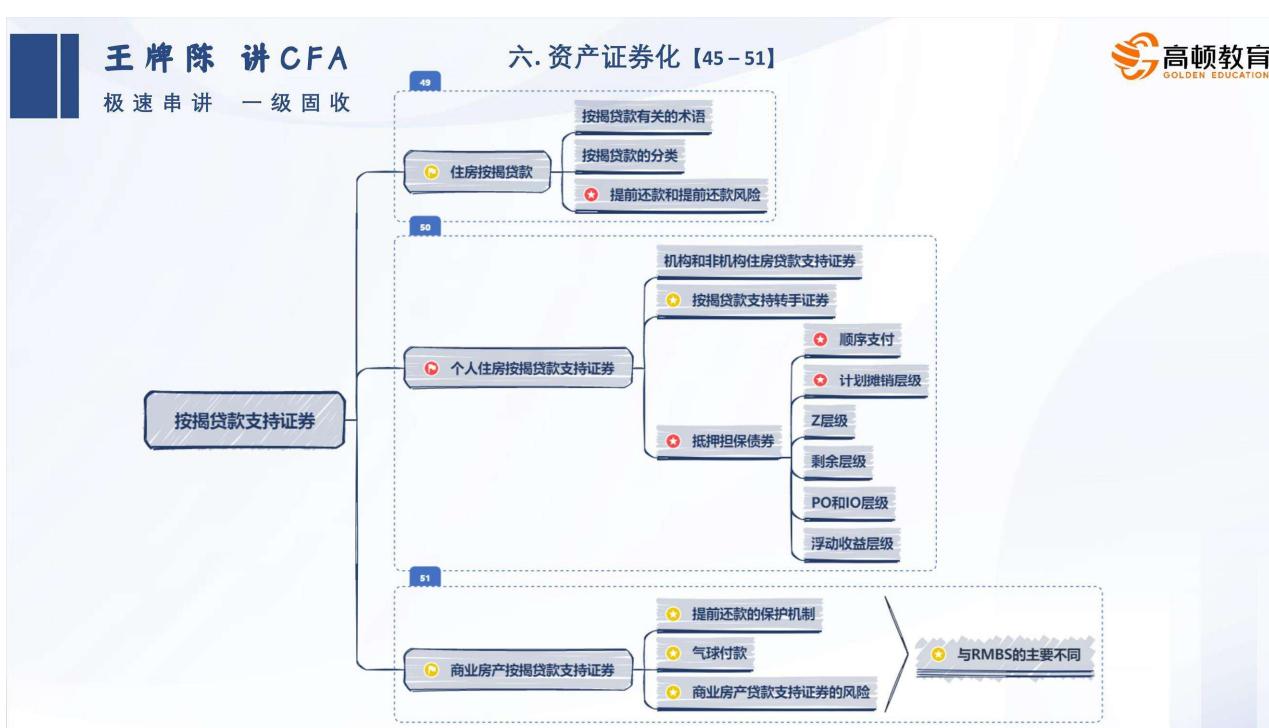
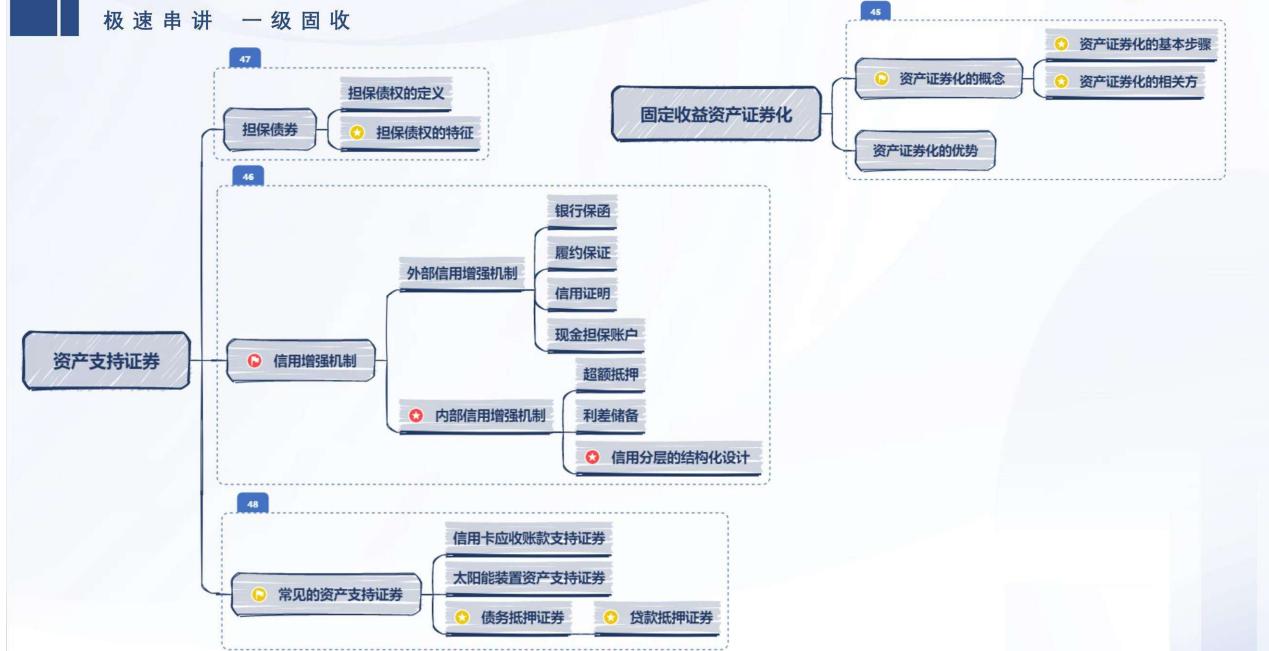
- Collateralized mortgage obligations (CMO) is backed by mortgage pass-through security, and is structured to redistribute the cash flows to different bond classes or tranches and creates securities that have exposures to different risks
- 1. Sequential-pay CMO: each class of bond (the tranches) would be retired sequentially
  - Contraction and extension risk still exist with this structure, but they have been redistributed to between the tranches
- 2. Planned amortization class (PAC) tranches offer greater predictability of the cash flows as long as prepayment rate is within a specified band
  - If the prepayment rate is within the specified range, all prepayment risk is absorbed by the support tranche
  - The extent of prepayment risk protection provided by a support tranche increases as its par value increases relative to its associated PAC tranche

## 50.3 抵押担保债券

- 3. Z-Tranches do not pay interest payments until a pre-set date, when both principal and accrued interest payments start
  - During the accrual period at each payment date, the principal value of the Z-tranche is credited by the stated coupon rate
  - Typically, Z-tranches are the last tranche in a series of sequential or PAC and companion tranches
- 4. Residual tranches collect any remaining cash flow from the pool after all the obligations to the other tranches are met.
- 5. Principal-Only (PO) securities pay only the principal repayments from the pool  
Interest-Only (IO) securities pay their holders only the interest payments from the pool
- 6. Floating-rate tranches are constructed by a floater and an inverse floater combination

## 51. 商业房产贷款支持证券

- Commercial mortgage-backed securities (CMBS)
  - Consist of only a few underlying commercial mortgages, which have concentration risk
    - The commercial mortgage loans are collateralized on income producing property
  - Measures of credit quality
    - ◆ Loan-to-value ratio (LTV)
    - ◆ Debt service coverage (DSC) = net operating income (NOI) / debt service
- CMBS investors have considerable call protection, which differs from RMBS and results in CMBS trading more like corporate bond
- CMBS investors face “balloon risk” because commercial mortgages may be balloon loans
  - The borrower may not be able to make the balloon payment due to failure to refinance or sell the property to generate sufficient funds.
  - Balloon risk is a type of extension risk



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但请坚持到底脚踏实地

