

## 6. Fixed Income

### 6.1. Basic Features of A Fixed-Income Security

#### 6.1.1. 重要知识点

##### 6.1.1.1. 描述 basic features of a fixed-income security

- **Issuer**
  - Supranational organizations
  - Sovereign (national) governments
  - Non-sovereign (local) governments
  - Quasi-government entities
  - Companies (i.e., corporate issuers)
- **Maturity:** the date when the issuer is obligated to redeem the bond by paying the outstanding principal amount.
- **Tenor:** the time remaining until the bond's maturity date.
- **Term to maturity**
  - Money market securities: fixed-income securities with maturities at issuance (original maturity) of one year or less.
  - Capital market securities: fixed-income securities with original maturities that are longer than one year.
  - Perpetual bonds: the consols issued by the sovereign government in the United Kingdom, which have no stated maturity date.
- **Par value/face value/ maturity value/principal/redemption value**
- **Coupon rate and frequency**
- **Seniority**
- **Contingency Provisions**
- **Yield Measures**
  - Current yield: Equal to the bond's annual coupon divided by the bond's price and expressed as a percentage.
  - Yield-to-maturity: The internal rate of return (IRR) calculated using the bond's price and its expected cash flows to maturity (usually quoted as an annual rate).
- **Yield Curves**

#### 6.1.2. 基础题

**Q-1.** A sovereign bond which has a maturity of 15 years can be described as a:

1-70

- A. perpetual bond.
- B. pure discount bond.
- C. capital market security.

## 6.2. Bond Indentures and Covenants

### 6.2.1. 重要知识点

#### 6.2.1.1. 描述 functions of a bond indenture

- Describes the form of the bond, the obligations of the issuer, and the rights of the bondholders.

#### 6.2.1.2. Sources of repayment:

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

#### 6.2.1.3. 区分 negative covenants 和 affirmative covenants

- **Negative covenants:** frequently costly and do materially constrain the issuer's potential business decisions.
  - Restrictions on asset disposals.
  - Negative pledges
  - Restrictions on prior claims.
- **Affirmative covenants:** are typically administrative in nature.
  - Comply with all laws and regulations;

- Maintain its current lines of business;
- Insure and maintain its assets, and pay taxes as they come due.

### 6.2.2. 基础题

**Q-2.** Which of the following content is included in negative bond covenants. The issuer is:

- A. required to pay taxes as they come due.
- B. prohibited from investing in risky projects.
- C. required to maintain its current lines of business.

## 6.3. Cash Flow Structure

### 6.3.1. 重要知识点

#### 6.3.1.1. Principal repayment structure

##### ➤ Principal repayment structure

###### ■ Bullet structure

- ◆ periodic interest payment(coupon payments) over the life of the bond.
- ◆ entire principal value at maturity.

###### ■ Amortizing structure: repay part of principal at each payment date.

- ◆ fully amortizing structure: equally periodic payment (interest + principal).
- ◆ partially amortizing structure: a balloon payment at maturity, which repays the remaining principal as a lump sum.

$$\text{◆ } A = \frac{r \times \text{Principal}}{1 - (1+r)^{-N}}$$

###### ■ Sinking fund provision

- ◆ requires the issuer to retire a portion of a bond issue at specified times during the bonds' life.
- ◆ The issuer can usually repurchase the bonds at the market price, at par, or at a specified sinking fund price, whichever is the lowest.

##### ➤ Coupon payment structure

###### ■ Floating-rate notes: coupon rates that are adjusted based on a reference rate such as LIBOR.

- ◆ Coupon rate = reference rate  $\pm$  quoted margin
- ◆ The coupon rate determined at the coupon reset date is the rate that the issuer promises to pay at the next coupon date.
- ◆ Inverse floaters (also called reverse floaters) have coupon rates that move

in the opposite direction from the change in the reference rate.

- **Step-up coupon bonds:** may be fixed or floating, increasing by specified margins at specified dates.
- **Credit-linked coupon bond:** has a coupon that changes when the bond's credit rating changes.
- **Leveraged Loan:** credit spread that adjusts based on change of credit quality, such as leverage and interest coverage ratios.
- **Pay-in-kind (PIK) bond:** allows the issuer to pay interest in the form of additional amounts of the bond issue rather than as a cash payment.
- **Deferred coupon bonds (split coupon bond):** interest payments are deferred for a specified number of years.
- **Index-linked bond:** has its coupon payments and/or principal repayment linked to a specified index.
  - ◆ **Interest-indexed bonds:** pay a fixed nominal principal amount at maturity, and the inflation adjustment applies to the interest payments only.
  - ◆ **Capital-indexed bonds:** pay a fixed coupon rate but it is applied to a principal amount that increases in line with increases in the index during the bond's life.
- **Principal protected bonds:** promise to pay at least the principal at maturity.

### 6.3.2. 基础题

**Q-3.** Relative to a fully amortized bond, the coupon payments of an otherwise similar partially amortized bond are:

- A. lower or equal.
- B. equal.
- C. higher or equal.

**Q-4.** An investor is least likely exposed to reinvestment risk from owning a(n):

- A. amortizing security.
- B. zero-coupon bond.
- C. callable bond.

**Q-5.** A 10-year, capital-indexed bond linked to the Consumer Price Index (CPI) is issued with a coupon rate of 8% and a par value of 1,000. The bond pays interest semi-annually.

During the first six months after the bond's issuance, the annualized CPI increases by 6%. On the first coupon payment date, the bond's:

- A. coupon rate increases to 11%.
- B. coupon payment is equal to 41.2.
- C. principal amount increases to 1,100.

**Q-6.** Which of the following coupon structures provides an issuer the most flexibility in servicing debt?

- A. Floating-rate notes
- B. Credit-linked bonds
- C. Payment-in-kind bonds

**Q-7.** If an issuer is required to retire a specified portion of the bond's principal each year, the bond most likely:

- A. is callable.
- B. is a step-up note.
- C. has a sinking fund provision.

## 6.4. Contingency Provisions

### 6.4.1. 重要知识点

#### 6.4.1.1. Callable bond

➤ **Call option:** allow the issuer to redeem bonds at a specified call price.

$$V_{\text{callable bond}} = V_{\text{pure bond}} - V_{\text{call option}}$$

##### ■ 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:** sometimes referred to as continuously callable, for which the issuer has the right to call a bond at any time starting on the first call date;
- ◆ **European style:** the issuer has the right to call a bond only once on the call date;

- ◆ **Bermuda style:** the issuer has the right to call bonds on specified dates following the call protection period.
- **Make-whole call provision:** requires the issuer to make a lump-sum payment to the bondholders based on the present value of the future coupon payments and principal repayment not paid because of the bond being redeemed early.

#### 6.4.1.2. Putable bond

- **Put option:** allow the bondholder to sell bonds back to the issuer at a specified put price

$$V_{\text{putable bonds}} = V_{\text{pure bonds}} + V_{\text{put option}}$$

##### ■ 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.

#### 6.4.1.3. Convertible bond

- **Conversion option:** (benefit bondholders) allow the bondholder to exchange bonds for a specified number of shares of the issuer's common stock.
- **Conversion price:** the price per share at which the convertible bond can be converted into shares.
- **Conversion ratio:** the number of common shares that each bond can be converted into.
- **Conversion value:** parity value, the current share price multiplied by the conversion ratio.

#### 6.4.1.4. Warrants and contingent convertible bond

- **Warrants:** (benefit bondholders) entitles the bondholder to buy the underlying stock of the issuing company at a fixed exercise price until the expiration date.
- **Contingent convertible bonds ("CoCos"):** bonds that convert from debt to common equity automatically if a specific event occurs.
  - Banks must maintain specific levels of equity financing. If a bank's equity falls below the required level, CoCos are automatically converted to common stocks.

#### 6.4.2. 基础题

**Q-8.** Relative to an otherwise similar option-free bond, which of the following statement is correct?

- A. callable bond will trade at a higher price.

- B. putable bond will trade at a higher price.
- C. convertible bond will trade at a lower price.

**Q-9.** If a bank wants the ability to retire debt prior to maturity in order to take advantage of lower borrowing rates, it most likely issues a:

- A. callable bond.
- B. putable bond.
- C. convertible bond.

**Q-10.** The number of common shares a convertible bond can be converted into is the:

- A. conversion price.
- B. conversion value.
- C. conversion ratio

## 6.5. Sectors of the Bond Market

### 6.5.1. 重要知识点

#### 6.5.1.1. Sectors of the bond market

- The places where fixed-income securities are issued and traded
  - **National bond market**
    - ◆ **Domestic bond:** Bonds issued by entities that are incorporated in that country.
    - ◆ **Foreign bond:** 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.
  - **Eurobond market**
    - ◆ **Eurobond:** Type of bond issued internationally, outside the jurisdiction of the country in whose currency the bond is denominated. Bonds issued and traded on the Eurobond market.
  - **Global bonds:** issued simultaneously in the Eurobond market and in at least one domestic bond market.

### 6.5.2. 基础题

**Q-11.** A South Korean electronics company issued bonds denominated in US dollars in the United States and registered with the SEC. These bonds are most likely known as a

- A. Foreign bond.
- B. Eurobond.
- C. Global bond.

## 6.6. Taxation of Bond Income

### 6.6.1. 重要知识点

#### 6.6.1.1. Tax consideration

- **Interest income:** taxed as ordinary income at the same rate as wage and salary income.
  - Interest income from bonds issued by municipal government: tax-exempt.
- **Capital gain:** gain or loss between purchase price and selling price.
  - **税率高低比较:** 利息税税率高于资本利得税税率。
- **Original issue discount (OID) bonds:** a portion of the discount from par at issuance is treated as taxable interest income each year.
  - This allows investors to increase their cost basis in the bonds so that at maturity, they face no capital gain or loss.
  - **Pure-discount bonds:** a portion of the discount from par at issuance is treated as taxable interest income.
  - **Premium bonds:** allow investors to deduct a prorated portion of the amount paid in excess of the bond's par value from their taxable income every tax year until maturity.

### 6.6.2. 基础题

**Q-12.** Ted Nguyen is an investor domiciled in a country with an original issue discount tax provision. He purchases a zero-coupon bond at a deep discount to par value with the intention of holding the bond until maturity. At maturity, he will most likely face:

- A. neither a capital loss nor gain.
- B. a capital loss.
- C. a capital gain.

## 6.7. Primary Market and Secondary Market

### 6.7.1. 重要知识点

#### 6.7.1.1. Primary market

- **Public offering:** Primary bond markets are markets in which issuers initially sell bonds to investors to raise capital.
- **Underwritten offering:** with the investment bank or syndicate purchasing the entire issue and selling the bonds to dealers.
  - ◆ Grey market (“when issued” market): is a forward market for bonds about to be issued.
- **Best efforts offering:** the investment bank only serves as a broker.
- **Auction:** commonly used by issuing government debts.
- **Shelf registration:** allows certain authorized issuers to offer additional bonds to the general public without having to prepare a new and separate offering circular for each bond issue.
- **Private placement:** sale of an entire issue to a qualified investor or a group of investors, which are typically large institutions.

#### 6.7.1.2. Secondary markets

- **Secondary markets:** also called the “aftermarket,” are where existing securities are traded among investors.
- **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)
- **Distressed debt: Bonds of issuers believed to be very close to or in bankruptcy**
  - Typically trades in the secondary market at a price well below par, because bondholders are unlikely to receive all promised future interest and principal payments.
  - Distressed debt is traded until either the issuer has liquidated its assets or restructure its outstanding bonds.

### 6.7.2. 基础题

- Q-13.** In major developed bond markets, newly issued sovereign bonds are most often sold to the public via a(n):

- A. auction.
- B. private placement.
- C. best efforts offering.

## 6.8. Short-Term Funding Alternatives

### 6.8.1. 重要知识点

#### 6.8.1.1. External Loan Financing

- **Uncommitted bank lines of credit**
  - The least reliable form of bank borrowing for a company.
  - A bank offers a certain principal amount (“credit line”) for a pre-determined maximum maturity, charging a base or market reference rate (MRR) plus an issuer-specific spread.
  - The most flexible and least costly means of external funding.
  - Require minimal capital reserves until they are drawn down and used, but banks reserve the right to refuse to honor any request for use of the line.
  - Do not require the company to pay any compensation other than interest on balances outstanding to the bank.
- **Committed bank lines of credit**
  - A more reliable source of financing than uncommitted lines because they involve a formal written commitment.
  - Require more bank capital than uncommitted lines, although commitments of less than a year (usually 364 days) minimize a bank’s capital requirement.
  - Regular lines are unsecured and pre-payable without penalty.
  - Unlike uncommitted lines, regular lines usually involve upfront costs in the form of a commitment fee (such as 0.50%).
  - Can form a syndicate to reduce capital needed.
- **Revolving credit agreements (revolvers)**
  - The most reliable source of short-term bank funding.
  - Multiyear credit commitments and lenders typically seek protections.
  - have similar features to regular lines and may also include optional medium-term loan features.
- **Secured Loans and Factoring**

#### 6.8.1.2. Commercial paper

- It is a source of funding for working capital and seasonal demands for cash. It is also a source of bridge financing—that is, interim financing that provides funds until

permanent financing can be arranged.

- Backup lines of credit/ liquidity enhancement/backup liquidity lines: a type of credit enhancement provided by a bank to a issuer of commercial paper
- Commercial paper issued in the international market is known as Eurocommercial paper (ECP). Although similar to United States commercial paper (USCP), typical ECP transaction sizes are much smaller and less liquid than the USCP market.
- Asset-backed commercial paper (ABCP): loans or receivables are sold to a special purpose entity (SPE) that issues debt and makes interest and principal payments from asset cash flows.

### 6.8.2. 基础题

**Q-14.** Which of the following statements regarding the US commercial paper is most accurate?

- A. requires the issuer to pledge collateral.
- B. requires the issuer to have a backup line of credit.
- C. has a maturity ranging from a few days up to two years.

## 6.9. Repurchase Agreements

### 6.9.1. 重要知识点

#### 6.9.1.1. Repurchase agreement/repos)

- **Repurchase agreement (repos):** is the sale of a security with a simultaneous agreement by the seller to buy the same security back from the purchaser at an agreed-on price and future date.
- **Reverse repo agreement:** taking the opposite side of a repurchase transaction, lending funds by buying the collateral security.
- **Repo rate:** 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 (haircut):** the difference between the market value of the security used as collateral and the value of the loan.
  - The repo 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
- Advantage of 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)
- Initial margin: the provision of collateral in excess of the cash exchanged.

$$\text{Initial Margin} = \frac{\text{Security Price}_0}{\text{Purchase Price}_0}$$

$$\text{Haircut} = \frac{\text{Security Price}_0 - \text{Purchase Price}_0}{\text{Security Price}_0}$$

$$\text{Variation margin} = (\text{Initial margin} \times \text{Purchase Price}_t) - \text{Security Price}_t$$

### 6.9.2. 基础题

**Q-15.** The higher the level of repo margin:

- The higher the quality of the collateral.
- The higher the credit quality of the counterparty.
- The longer the length of the repurchase agreement.

## 6.10. Bonds Issued by Government, Nonsovereign Governments, Government Agencies, and Supranational Entities

### 6.10.1. 重要知识点

#### 6.10.1.1. Sovereign government bond, non-sovereign government bond, government agency bonds and supranational bonds

- **Sovereign bonds:** are backed by the "full faith and credit" of the national government.
- Highly rated sovereign bonds denominated in local currency are virtually free of credit risk.
  - Denominated in the local currency or a foreign currency.
    - ◆ Credit ratings are higher for a sovereign's local currency bonds
- **Nonsovereign government bonds:** issued by governments but not the national government.
- 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.
- **Agency bonds (quasi-government bonds):** issued by entities created by national government and may be explicitly or implicitly backed by government.
- **Supranational bonds:** issued by supranational agencies (multilateral agencies, e.g., the IMF, the World Bank) those operate across national.
  - Highly rated supranational agencies, such as the World Bank, frequently issue large-size bond issues that are often used as benchmarks issues when there is no liquid sovereign bond available.
  - E.g., World bank, the IMF, the Asian Development Bank.

### 6.10.2. 基础题

**Q-16.** Compared with sovereign bonds, the yield of non-sovereign bonds with similar characteristics most likely is:

- Lower.
- The same.
- Higher.

**Q-17.** The bond issued by a multilateral agency such as the International Monetary Fund (IMF) can be regarded as a:

- Sovereign bond.
- Supranational bond.
- Quasi-government bond.

## 6.11. Bond Valuation with YTM

### 6.11.1. 重要知识点

#### 6.11.1.1. Bond valuation with YTM

➤ **Critical assumptions:**

- hold the bond until maturity.
- full, timely coupon, principal payments (no default).
- coupons are reinvested at original YTM.

➤ 对于年付息 1 次、剩余期限为 N 年的债券，

$$\text{price} = \frac{\text{coupon}}{(1 + \text{YTM})} + \frac{\text{coupon}}{(1 + \text{YTM})^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1 + \text{YTM})^N}$$

➤ 对于年付息 2 次、剩余期限为 N 年的债券，

$$\text{price} = \frac{\text{coupon}}{(1 + \frac{\text{YTM}}{2})} + \frac{\text{coupon}}{(1 + \frac{\text{YTM}}{2})^2} + \dots + \frac{\text{coupon} + \text{principal}}{(1 + \frac{\text{YTM}}{2})^N}$$

➤ **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.

➤ Value of a zero-coupon bond

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

### 6.11.2. 基础题

**Q-18.** An investor who owns a bond with a 9% coupon rate that pays interest semiannually and matures in three years is considering its sale. If the required rate of return on the bond is 11%, the price of the bond per 100 of par value is closest to:

- A. 95.00.
- B. 95.11.
- C. 105.15.

**Q-19.** A bond with 20 years remaining until maturity is currently trading for 111 per 100 of par value. The bond offers a 5% coupon rate with interest paid semiannually. The bond's annual yield-to-maturity is closest to:

- A. 2.09%.

B. 4.18%.

C. 4.50%.

**Q-20.** A three-year, semiannual-pay bond with a \$100 par value and a 5% coupon rate is purchased for \$108. One year later, if the yield to maturity has decreased by 100 basis points, the change in the value of this bond is closest to:

A. \$0.57.

B. \$1.42.

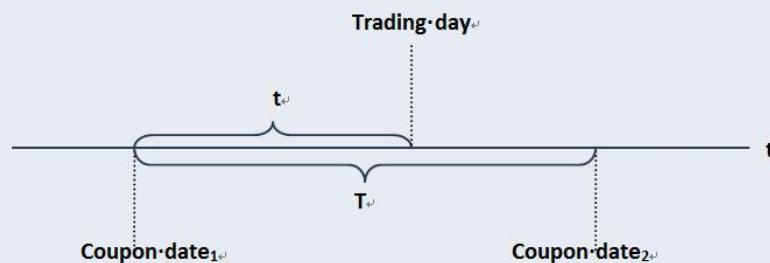
C. \$2.08.

## 6.12. Flat Price, Accrued Interest and Full Price

### 6.12.1. 重要知识点

#### 6.12.1.1. Flat price, accrued interest full price

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



$$\blacksquare \quad \text{accrued interest} = \text{coupon} \times \frac{t}{T}$$

- **Clean price (or flat price):** the price quoted by bond dealers.  
➤ **Full price (or dirty price, or invoice price):** the amount that the buyer pays to the seller, which equals the clean price plus any accrued interest.

$$\text{Full Price} = \text{Clean Price} + \text{Accrued Interest}$$

### 6.12.2. 基础题

**Q-21.** Bond A, described in the exhibit below, is sold for settlement on 21 June 2015. The full price that bond A will settle at on 21 June 2015 is closest to:

- Annual coupon: 8%
- Coupon payment frequency: semiannual
- Interest payment date: 5 April and 5 October

- Maturity date: 5 October 2017
  - Day count convention:30/360
  - Annual yield-to-maturity:6%
- A. 104.58.  
B. 105.26.  
C. 105.89.

**Q-22.** The full price of a 6% fixed-rate semiannual-pay bond is \$102. Assuming a 30/360 day-count interest convention, if 90 days have passed since the last interest payment, the bond's flat price is closest to:

- A. \$98.00  
B. \$100.50  
C. \$103.50

## 6.13. Matrix Pricing

### 6.13.1. 重要知识点

#### 6.13.1.1. Matrix pricing

- Matrix pricing: estimate the market discount rate and price based on the quoted or flat prices of more frequently traded comparable bonds.
- Linear interpolation can be used when the maturities between the valued bond and the traded bond are different.

### 6.13.2. 基础题

**Q-23.** An analyst needs to assign a value to an illiquid three-year, 5.0% annual coupon payment corporate bond. The analyst identifies two corporate bonds that have similar credit quality: One is a two-year, 6.0% annual coupon payment bond priced at 106.500 per 100 of par value, and the other is a four-year, 5.0% annual coupon payment bond priced at 106.250 per 100 of par value. Using matrix pricing, the estimated price of the illiquid bond per 100 of par value is closest to:

- A. 105.763.  
B. 106.375.  
C. 106.775.

**Q-24.** Matrix pricing is most likely used to estimate the price of a bond that:

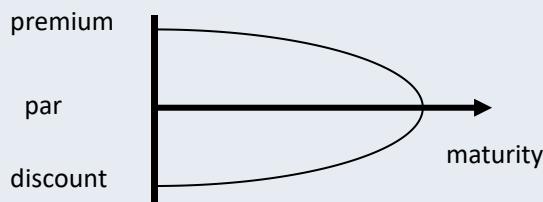
- A. is highly liquid.
- B. is newly underwritten.
- C. has unknown credit quality.

## 6.14. Relationship Between Price and Time

### 6.14.1. 重要知识点

#### 6.14.1.1. Relationship between price and time

- As maturity approaching, the bond's price moves to the principal.



- **Inverse effect:** The bond price is inversely related to the market discount rate. When the market discount rate increases, the bond price decreases.
- **Coupon effect:** For the same time-to-maturity, a lower-coupon bond has a greater percentage price change than a higher-coupon bond when their market discount rates change by the same amount.
- **Maturity effect:** Generally, for the same coupon rate, a longer-term bond has a greater percentage price change than a shorter-term bond when their market discount rates change by the same amount.
- **Convexity effect:** For the same coupon rate and time-to-maturity, the percentage price change is greater (in absolute value, meaning without regard to the sign of the change) when the market discount rate goes down than when it goes up.

### 6.14.2. 基础题

**Q-25.** Assume a bond with a 10% coupon rate, paid annually and 3 years to maturity. When a discount rate of 8%, the value of the bond today is \$105.15. One day later, the discount rate increases to 12%. Assuming the discount rate remains at 12% over the remaining life of the bond, the price of the bond between today and maturity will:

- A. Decreases then remains unchanged
- B. Increases then decreases
- C. Decreases then increases

## 6.15. Yield Measures for Fixed-Rate Bonds

### 6.15.1. 重要知识点

#### 6.15.1.1. Yield measures

- Yield measures for fixed-rate bonds
  - The effective yield of a bond depends on its periodicity, or annual frequency of coupon payments.

$$\text{Effective yield} = \left(1 + \frac{\text{YTM}}{m}\right)^m - 1$$

- ◆ For annual-pay bond: effective yield = YTM
- ◆ For bonds with greater periodicity, the effective yields is greater than YTM
- Convert an annual percentage rate for m periods per year ( $\text{APR}_m$ ), to an annual percentage rate for n per year ( $\text{APR}_n$ )

$$\left(1 + \frac{\text{APR}_m}{m}\right)^m = \left(1 + \frac{\text{APR}_n}{n}\right)^n$$

- Current yield is the ratio of a bond's annual coupon payment to its price.
  - current yield =  $\frac{\text{sum of coupon payment received over the year}}{\text{flat bond price}}$
- For a callable/putable bond, a yield-to-call/yield-to-put may be calculated using each of the call/put dates and prices. The lowest of these yields and YTM is a callable bond's yield-to-worst.

### 6.15.2. 基础题

**Q-26.** A bond with 6 years remaining until maturity is currently trading for 99 per 100 of par value. The par value of the bond is 1000. The bond offers a 4% coupon rate with interest paid semiannually. The bond is first callable in 3 years at 101 per 100 of par value, the bond's annual yield-to-call is closest to:

- A. 2.34%.
- B. 4.36%.
- C. 4.68%.

**Q-27.** A five-year semiannual bond has a yield to maturity of 8%. Converted to a quarterly periodicity, the yield to maturity is closest to:

- A. 1.98%.
- B. 3.96%.

C. 7.92%.

## 6.16. Yield Spread

### 6.16.1. 重要知识点

#### 6.16.1.1. Yield spread

- **Yield spread:** is the difference in yield between different fixed income securities.
  - **Benchmark spread:** the yield spread over a specific benchmark, usually measured in basis points.
  - **G-spread:** the benchmark is government bond yield.
  - **Interpolated spread/I-spread:** the benchmark is swap rate.
  - **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.
- **Option-adjusted spread (OAS):** is the Z-spread minus the theoretical value of the embedded call option.
  - Callable bond: ZS>OAS
  - Putable bond: ZS<OAS

### 6.16.2. 基础题

**Q-28.** A 3-year, U.K. Government Benchmark Bond is issued with a coupon rate of 2% and a price of 100.25. A 3-year, U.K. Government Corporate Bond is issued with a coupon rate of 5% and a price of 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. 285 bps.
- B. 264 bps.
- C. 300 bps.

**Q-29.** The yield spread of a specific bond relative to the standard swap rate in that currency of the same tenor is most likely:

- A. I-spread.
- B. Z-spread.
- C. G-spread.

## 6.17. Yield Measure for Floating-Rate Instruments

### 6.17.1. 重要知识点

#### 6.17.1.1. Yield measures

- Floating-rate note yields
  - The margin used to calculate the bond coupon payments is called the quoted margin.
  - The margin used to calculate the return of the FRN to its par value is called the required margin (discount margin).
    - ◆ 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
  - FRN pricing model

$$\text{◆ } PV = \frac{\frac{(MRR+QM) \times FV}{m}}{\left(1 + \frac{MRR+DM}{m}\right)^1} + \frac{\frac{(MRR+QM) \times FV}{m}}{\left(1 + \frac{MRR+DM}{m}\right)^2} + \dots + \frac{\frac{(MRR+QM) \times FV}{m} + FV}{\left(1 + \frac{MRR+DM}{m}\right)^N}$$

- Yield for money market instruments
  - Yield quoted on a discount basis: quote on U.S. Treasury bills.
$$DR = \frac{\text{year}}{\text{days}} * \left( \frac{FV - PV}{FV} \right)$$
where DR is the yield quoted on a discount basis.
  - Yield quoted on an add-on basis: LIBOR, bank CD rates.
$$AOR = \frac{\text{year}}{\text{days}} * \left( \frac{FV - PV}{PV} \right)$$
where AOR is the yield quoted on an add-on basis. 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 for money market security is an add-on yield based on a 365-day year.

$$BEY = \frac{365}{\text{days}} * \left( \frac{FV - PV}{PV} \right)$$

where BEY is the bond equivalent yield.

#### 6.17.2. 基础题

**Q-30.** A 180-day commercial paper issue is quoted at a discount rate of 6.50% for a 360-day year. The bond equivalent yield for this instrument is closest to:

- A. 6.50%.
- B. 6.72%.
- C. 6.81%.

**Q-31.** An analyst evaluates the following information relating to floating rate notes (FRNs) issued at par value that have 6-month Libor as a reference rate:

Floating Rate Note	Quoted Margin	Discount Margin
X	0.60%	0.45%
Y	0.70%	0.70%
Z	0.80%	0.85%

Based only on the information provided, the FRN that will be priced at a discount on the next reset date is:

- A. FRN X.
- B. FRN Y.
- C. FRN Z.

**Q-32.** A floating-rate note pays six-month market reference rate plus 50 basis points. The interest payments are made in June and December. If the six-month market reference rate was 1.80% in June and 2.20% in December of the same year, the coupon rate paid in December of that year was closest to:

- A. 2.30%.
- B. 2.50%.
- C. 2.80%.

**Q-33.** Which of the following features of a floating -rate note most likely remains at a constant level until maturity?

- A. spread
- B. reference rate
- C. coupon payment

## 6.18. Yield Curve

### 6.18.1. 重要知识点

#### 6.18.1.1. Yield curve

- Yield curve: yield 与 maturity 之间的关系

- Spot curve: Yields-to-maturity on a series of default-risk-free zero-coupon bonds.
- Par curve (=par bond yield curve): shows the relationships between yields-to-maturity and time-to-maturity.
- Forward curve: shows the future rates for bonds or money market securities for the same maturities for annual periods in the future

#### 6.18.1.2. Arbitrage-free valuation

- The no-arbitrage price of a bond is calculated using spot rates:

$$\text{no-arbitrage price} = \frac{\text{CPN}_1}{(1+S_1)} + \frac{\text{CPN}_2}{(1+S_2)^2} + \dots \dots + \frac{\text{CPN}_N + \text{Par}}{(1+S_N)^N}$$

#### 6.18.1.3. Par and Forward Rates

- Par rate: a yield-to-maturity that makes the present value of a bond's cash flows equal to par (100% of face value).
- Calculate a par rate

$$100 = \frac{PMT}{(1+Z_1)} + \frac{PMT}{(1+Z_2)^2} + \frac{PMT + 100}{(1+Z_N)^N}$$

- Forward rate: is the interest rate on a bond or money market instrument traded in a forward market.
- Forward rate 与 spot rate 之间的转换公式

$$(1+Z_N)^N = (1+Z_1)(1+1y1y)\dots(1+(N-1)y1y)$$

- 使用 forward rate 计算 bond price

$$\begin{aligned} \text{bond value} &= \frac{CF_1}{(1+Z_1)} + \frac{CF_2}{(1+Z_1)(1+1y1y)} + \dots \\ &\quad + \frac{CF_N}{(1+Z_1)(1+1y1y)\dots(1+(N-1)y1y)} \end{aligned}$$

#### 6.18.1.4. Spot, Par, and Forward Curve Relationship

Spot Curve Shape	Par Curve	Forward Curve
Upward Sloping	Below spot curve	Above spot curve
Flat	Equal to spot curve	Equal to spot curve
Downward Sloping (Inverted)	Above spot curve	Below spot curve

#### 6.18.2. 基础题

**Q-34.** 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 (year)	Spot Rates
1	8%
2	9%
3	10%

- A. 98.56.
- B. 100.32.
- C. 102.53.

**Q-35.** A three-year spot rate of 8% is most likely the:

- A. yield to maturity on a coupon-paying bond maturing at the end of Year 3.
- B. coupon rate in Year 3 on a coupon-paying bond maturing at the end of Year 6.
- C. yield to maturity on a zero-coupon bond maturing at the end of Year 3.

**Q-36.** Using the following US Treasury forward rates, the value of a 2.5-year \$100 par value Treasury bond with a 6% coupon rate is closest to:

Period	Years	Forward
		Rate
1	0.5	1.50%
2	1	2.50%
3	1.5	3.30%
4	2	3.90%
5	2.5	4.30%

- A. \$104.19.
- B. \$107.03.
- C. \$109.87.

**Q-37.** An investor observes the following market information

One-year spot rate	1.3%
Two-year spot rate	2.2%

The implied one-year forward rate one year from now is closest to:

- A. 0.9%
- B. 1.8%
- C. 3.1%

## 6.19. Sources of Return from Investing in A Fixed-Rate Bond

### 6.19.1. 重要知识点

#### 6.19.1.1. 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)
- A point on the trajectory represents the carrying value of the bond at that time. The carrying value is the purchase price plus the amortized amount of the discount if the bond is purchased at a price below par value, while it is the purchase price minus the amortized amount of the premium if the bond is purchased at a price above par value.

#### 6.19.1.2. Annualized holding period return: calculated as the compound annual return earned from the holding period

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

#### 6.19.1.3. Relationship with investment horizon and YTM

- 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.
- 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.
- 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.
- 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.
- 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.

#### 6.19.1.4. Relationship with investment horizon and price risk, reinvestment risk

- **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

#### 6.19.1.5. Duration gap

- **Duration gap = Macaulay duration – investment horizon**
  - If investment horizon > Macaulay duration, then reinvestment risk dominates price risk, investor's risk is to lower interest rates.
  - If investment horizon = Macaulay duration, then reinvestment risk offsets price risk.
  - If investment horizon < Macaulay duration, then price risk dominates reinvestment risk, investor's risk is to higher interest rates.

### 6.19.2. 基础题

**Q-38.** An investor purchases a nine-year, 8% annual coupon payment bond at a price equal to par value. After the bond is purchased and before the first coupon is received, interest rates increase to 10%. The investor sells the bond after five years. Assume that interest rates remain unchanged at 10% over the five-year holding period. Assuming that all coupons are reinvested over the holding period, the investor's five-year horizon yield is closest to:

- A. 5.66%.
- B. 6.11%.
- C. 7.34%.

**Q-39.** Three option-free, semiannual-pay bonds have identical yields to maturity and the following characteristics:

Bond	Coupon Rate	Maturity
1	4.5%	10 years
2	5.5%	7 years
3	5.5%	10 years

The bond with the greatest reinvestment risk is:

- A. Bond 1
- B. Bond 2
- C. Bond 3

**Q-40.** A long-term bond investor with an investment horizon of 8 years invests in option-free, fixed-rate bonds with a Macaulay duration of 10.5. The investor most likely currently has a:

- A. positive duration gap and is currently exposed to the risk of lower interest rates.
- B. positive duration gap and is currently exposed to the risk of higher interest rates.
- C. negative duration gap and is currently exposed to the risk of higher interest rates.

**Q-41.** An investor holds a bond with the following characteristics:

Yield to maturity	8%
Modified duration	6.7

If the duration gap is zero, the investment horizon is closest to:

- A. 6.2 years.
- B. 7.2 years.
- C. 8.1 years.

**Q-42.** An investor purchased a 5-year bond at issuance for 98 per 100 of par value and held the bond for two years. Coupon payments were reinvested at the original yield to maturity. If the realized horizon yield is equal to the original yield to maturity, the investor most likely sold the bond at a price:

- A. below par.
- B. equal to par.
- C. above par.

## 6.20. Macaulay Duration

### 6.20.1. 重要知识点

#### 6.20.1.1. 定义、计算及解释 macaulay duration

- **Interest rate risk:** the price sensitivity to interest rate changes. More sensitive,

more possible price volatility.

- **Duration:** measures the sensitivity of the bond's full price to changes in interest rates.
- **Macaulay duration:** The average time period of cash flow returning weighted by discounted cash flow.

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

### 6.20.2. 基础题

**Q-43.** An investor buys a 6% annual payment bond with three years to maturity. The bond has a yield-to-maturity of 8% and is currently priced at 948.45806 per 1000 of par. The bond's Macaulay duration is closest to:

- A. 2.66.
- B. 2.83.
- C. 3.00.

## 6.21. Different types of Yield Duration

### 6.21.1. 重要知识点

#### 6.21.1.1. 定义、计算及解释 modified duration

- **Modified duration:** provides a linear estimate of the percentage price change for a bond given a 1% change in its yield-to-maturity.

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

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

#### 6.21.1.2. Money duration and PVBP

- Money duration: a measure of the percentage price change of a bond given a change in its yield-to-maturity and it is calculated as the annual modified duration times the full price of the bond

$$\text{Money duration} = \text{annual modified duration} \times \text{full price of bond}$$

$$\text{Money duration per 100 units of par value} = \text{annual modified duration} \times \text{full price of bond per 100 of par value}$$

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

$$PVBP = \frac{(PV_-) - (PV_+)}{2}$$

$$PVBP = P \times D \times 1\text{bp}$$

#### 6.21.1.3. Duration of perpetual bond and zero-coupon bond

- A **perpetuity or perpetual bond**: 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 of perpetuity or perpetual bond** =  $\frac{1 + YTM}{YTM}$
- Duration of zero-coupon bond is equal to time-to-maturity.

#### 6.21.1.4. Duration of Floating-Rate Notes and Loans

- Interest rate risk arises only between reset dates, because at the next reset date, coupon payments will adjust to the new MRR. Therefore, the Macaulay duration for a floating-rate note or bond is simply the fraction of a period remaining until the next reset date:

$$MacDur_{Floating} = \frac{(T - t)}{T}$$

- Floating-rate instruments typically have very low duration because coupon periods are typically less than six months in length. As a result, they are commonly used by investors to reduce duration in fixed-income portfolios.

#### 6.21.1.5. Duration 的影响因素

- Lower coupon means higher duration.
- Longer maturity means higher duration.
- Lower market yield means higher duration
- A put or call provision means lower duration

### 6.21.2. 基础题

**Q-44.** Which of the following statements is *least* accurate regarding the factors that affect the interest rate risk characteristics of an option-free bond?

- The longer the bond's maturity, the greater the bond's price sensitivity to changes in interest rates.
- The lower the coupon rate, the greater the bond's price sensitivity to changes in interest rates.
- The higher the yield, the greater the bond's price sensitivity to changes in interest rates.

**Q-45.** The option-free bonds issued by ALS Corp. are currently priced at 105.85. Based on a portfolio manager's valuation model, a 1bp increase in interest rates will result in the bond price falling to 105.75 whereas a 1bp decrease in interest rates will result in the bond price rising to 105.90. The price value of a basis point (PVBP) for the bonds is closest to:

- A. 0.025.
- B. 0.050.
- C. 0.075.

**Q-46.** An analyst gathers the following information on a bond:

Price	85.4734
Payment frequency	Annual
Time to maturity	5 years
Coupon	4%
Macaulay duration	4.5947

Modified duration is closest to:

- A. 4.2702.
- B. 4.4180.
- C. 4.7785.

**Q-47.** An analyst gathers the following information about an option-free bond:

Par value	\$1,000,000
Current market value	\$912,575
Duration	2.4

If yields are expected to decrease by 150 basis points, the expected price change for the bond is closest to:

- A. \$25,000
- B. \$33,000
- C. \$37,000

**Q-48.** An analyst gathers the following information about three option-free bonds:

Bond	Coupon Rate	Maturity (years)
1	3%	8
2	5%	8

3	5%	4
---	----	---

All else being equal, the bond with the greatest interest rate risk is most likely:

- A. Bond 1
- B. Bond 2
- C. Bond 3

**Q-49.** An analyst observes the following information for an option-free bond:

Price per 100 of Par Value	Yield to Maturity
100.90	7.45%
101.80	6.75%
103.35	6.05%

If the bond trades at 101.80 per 100 of par value, its approximate modified duration is closest to:

- A. 1.72.
- B. 2.25.
- C. 3.44.

## 6.22. Convexity

### 6.22.1. 重要知识点

#### 6.22.1.1. Approximate convexity and effective convexity

➤ **Approximate convexity:** a measure of the curvature of the price-yield curve.

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

$$\text{Convexity} = \frac{1}{(1+y)^2} \sum_{t=1}^n w_t \times t \times (t+1)$$

#### 6.22.1.2. Measurement of Interest Rate Risk

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

$$\Delta P = [-MoneyDur \times (\Delta y)] + [0.5 \times MoneyConv \times (\Delta y)^2]$$

#### 6.22.1.3. Convexity 的影响因素

- Bond features that lead to greater convexity are the same as for duration. A fixed-rate bond will have greater convexity:
- the longer its time-to-maturity
  - the lower its coupon rate
  - the lower its yield-to-maturity
  - Another factor is the dispersion of cash flows, meaning the degree to which

payments are spread out over time.

### 6.22.2. 基础题

**Q-50.** The option-free bonds of Argus Corporation have a duration of eight years. When interest rates rise by 100 bps, the bond's price declines by 7.9%. When interest rates fall by 100 bps, however, the price rises by 8.2%. The asymmetrical price change is most likely caused by the:

- A. coupon effect.
- B. maturity effect.
- C. convexity effect.

**Q-51.** A bond has a modified duration of 10 and convexity of 75 that is currently trading for 85 per 100 of par value. If the bond's yield to maturity decreases by 50 bps, the expected percentage price change is closest to:

- A. 4.90%.
- B. 5.09%.
- C. 5.20%.

**Q-52.** A bond is currently trading for 100.94 per 100 of par value. If the bond's yield-to-maturity (YTM) rises by 20 basis points, the bond's full price is expected to fall to 100.67. If the bond's YTM decreases by 20 basis points, the bond's full price is expected to increase to 101.28. The bond's approximate convexity is closest to:

- A. 0.34
- B. 35.00
- C. 173.37

**Q-53.** The annualized convexity of a three-year, 3.2% (semiannual) coupon bond priced at par at issuance on 1 August 2025 and maturing on 1 August 2028 is closest to:

Three-Year, 3.2% Semiannual Bond at Issuance	
Fixed coupon	3.2%
Periods per year	2
Price (per 100 Par Value)	100
Yield-to-Maturity (%)	3.2%

- A. 7.2831.
- B. 9.6506.
- C. 38.6022.

## 6.23. Portfolio Duration and Convexity

### 6.23.1. 重要知识点

#### 6.23.1.1. Portfolio duration and convexity

- Calculate the weighted average of durations of bonds in the portfolio.

$$\text{Portfolio duration} = w_1D_1 + w_2D_2 + \dots + w_nD_n$$

$$\text{Portfolio convexity} = w_1C_1 + w_2C_2 + \dots + w_nC_n$$

- 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)

### 6.23.2. 基础题

**Q-54.** Using the information below, and prices are per 100 of par value. The bond portfolio's money duration is closest to:

bond	Full price	Market value	Modified duration
A	95.00	180,000	7.5
B	85.00	100,000	5.5
C	90.00	120,000	10

- A. 686.40
- B. 707.50
- C. 735.60

**Q-55.** One limitation as to why using the average duration of the bonds in a portfolio does not properly reflect that portfolio's yield curve risk is that the approach assumes:

- A. a parallel shift in the yield curve.
- B. all the bonds have the same discount rate.
- C. a non-parallel shift in the yield curve.

## 6.24. Curve Duration and Convexity

### 6.24.1. 重要知识点

#### 6.24.1.1. 定义、计算及解释 effective duration 和 effective convexity

- **Effective duration:** a linear estimate the percentage change in price given a 1% change in a benchmark yield curve.

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

- **Effective convexity:** appropriate for bonds with embedded options.

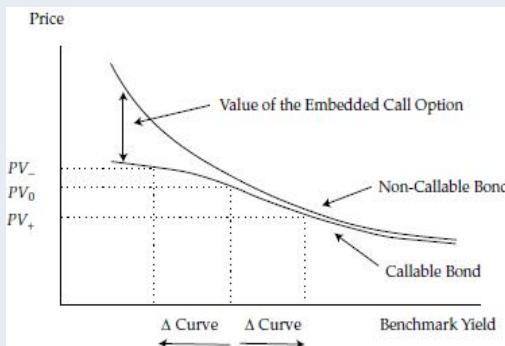
$$\text{Effective convexity} = \frac{V_- + V_+ - 2V_0}{(\Delta \text{curve})^2 V_0}$$

#### 6.24.1.2. Measurement of Interest Rate Risk

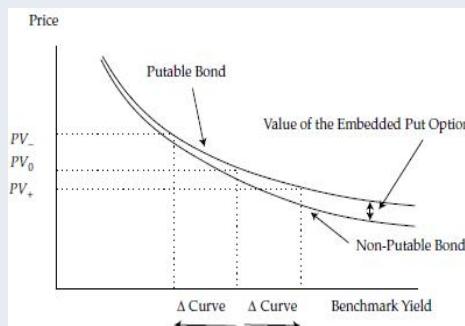
$$\% \Delta PV^{Full} \approx (-EffDur \times \Delta \text{Curve}) + \left[ \frac{1}{2} \times EffCon \times (\Delta \text{Curve})^2 \right]$$

#### 6.24.1.3. callable and putable convexity

- **For callable bond,** the effective convexity may be negative if yield is lower.



- **For putable bond,** the effective convexity may be higher than that of comparable pure bond.



### 6.24.2. 基础题

33-70

**Q-56.** Which of the following is a curve duration measure?

- A. Macaulay duration
- B. Money duration
- C. Effective duration

**Q-57.** A fixed-income security's current price is \$103.25. The manager estimates that the price will rise to \$106.75 if interest rates decrease 0.35% or fall to \$102.10 if interest rates increase 0.35%. The security's effective duration is *closest* to:

- A. 6.22.
- B. 6.43.
- C. 6.51.

**Q-58.** Assuming no change in the credit risk of a bond, the presence of an embedded put option:

- A. reduces the effective duration of the bond.
- B. increases the effective duration of the bond.
- C. does not change the effective duration of the bond.

**Q-59.** Which of the following most likely exhibits negative convexity?

- A. An option-free bond
- B. A callable bond
- C. A putable bond.

## 6.25. Key Rate Duration & Empirical Duration

### 6.25.1. 重要知识点

#### 6.25.1.1. Key Rate Duration

- 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.
- In contrast to effective duration, key rate durations help identify "**shaping risk**" for a bond—that is, a bond's sensitivity to changes in the shape of the benchmark yield curve. (such as: yield curve becoming **steeper or flatter**).
  - For parallel shifts in the benchmark yield curve, key rate durations will indicate the same interest rate sensitivity as effective duration.
  - For parallel shifts in the benchmark yield curve, key rate durations will

indicate the same interest rate sensitivity as effective duration.

$$\text{Key Rate Duration}^k = -\frac{\Delta P/P}{\Delta y_k}$$

$$\sum_{k=1}^n \text{Key Rate Duration}^k = \text{Effective Duration}$$

#### 6.25.1.2. Empirical Duration

- **Analytical duration:** To estimate duration and convexity statistics using mathematical formulas.
- **Empirical duration:** Professionals often use historical data in statistical models that incorporate various factors affecting bond prices to calculate empirical duration estimates. (**consider correlation between benchmark yields and spreads**)
  - **For a government bond** (with little or no credit risk): we would expect analytical and empirical duration to be similar because benchmark yield changes largely drive bond prices.
  - **For high-yield bond:** Since credit spreads and benchmark yields are negatively correlated under a market stress scenario, wider credit spreads will partially or fully offset the decline in government benchmark yields, resulting in lower empirical duration estimates than analytical duration estimates.

#### 6.25.2. 基础题

**Q-60.** Empirical duration is likely the best measure of the impact of yield changes on portfolio value, especially under stressed market conditions, for a portfolio consisting of:

- A. 100% sovereign bonds of several AAA rated euro area issuers.
- B. 100% covered bonds of several AAA rated euro area corporate issuers.
- C. 25% AAA rated sovereign bonds, 25% AAA rated corporate bonds, and 50% high-yield (i.e., speculative-grade) corporate bonds, all from various euro area sovereign and corporate issuers.

**Q-61.** The key rate duration best measures a bond's sensitivity to a change in the:

- A. level of the yield-to-maturity.
- B. slope of the yield-to-worst curve.
- C. shape of the benchmark yield curve.

## 6.26. Sources of Credit Risk

### 6.26.1. 重要知识点

#### 6.26.1.1. Credit risk and credit-related risk

- **Credit risk:** the risk associated with losses stemming from the failure of a borrower to make timely and full payments of interest or principal. Credit has two components:
  - **Default risk:** the probability that a borrower fails to pay interest or repay principal when due.
  - **Loss severity, or loss given default:** is the portion of a bond's value (including unpaid interest) an investor loses, in the event of default.
- Expected loss = Default probability × Loss given default × (Expected Exposure-Collateral)
  - Loss severity given default = 1 – Recovery rate
- One way to interpret the **expected loss** on a fixed-income security for a given period is to compare it to the compensation an investor expects for taking on the **credit risk** of a borrower over that period, which is the **credit spread**.
  - Credit Spread  $\approx$  POD × LGD, where LGD = EE × (1 – RR)

#### 6.26.1.2. The Cs of Credit Analysis

- **Five of these criteria** are related to the specific bottom-up factors applicable to an individual borrower.
  - **Capacity** refers to the ability of the borrower to make its debt payments on time.
  - **Capital** addresses other company resources available that reduce reliance on debt.
  - **Collateral** refers to the quality and value of the assets supporting the issuer's indebtedness.
  - **Covenants** are the legal terms of debt agreements that an issuer must comply with.
  - **Character** refers to the quality of management and the willingness of repay indebtedness.
- **The remaining three criteria** involve general top-down factors that apply to all borrowers to a greater or lesser extent.
  - **Conditions** refers to the general economic, competitive, and business environment faced by all borrowers that may affect their ability to service or refinance debt.

- **Country** involves the geopolitical environment as well as the legal and political system faced by all issuers in a jurisdiction that may affect debt payment.
- **Currency** affects issuers whose cash flows are affected by exchange rate changes or who borrow in a currency outside of their jurisdiction, such as sovereign issuers with foreign currency debt.

### 6.26.2. 基础题

**Q-62.** For corporate bonds, the components of credit risk most likely include:

- A. default risk and liquidity risk.
- B. default risk and loss severity.
- C. loss severity and liquidity risk.

## 6.27. Credit Rating

### 6.27.1. 重要知识点

#### 6.27.1.1. Credit rating

- Three major credit ratings agencies: Moody's, S&P, Fitch
- Different credit ratings: Triple A, investment grade(BBB 及以上), non-investment grade(BB+及以下)
- **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.

#### 6.27.1.2. Credit Rating Considerations: Solo reliance on crediting rating has several pitfalls

- 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 in a rating agency's forward-looking analysis.

### 6.27.2. 基础题

**Q-63.** An analyst is concerned that a bond might be downgraded one category by Fitch Ratings and become non-investment grade. The current rating of this bond is most likely:

- A. A-.

- B. BBB-.
- C. BB.

**Q-64.** Which of the following statements about credit ratings is most accurate?

- A. Litigation risk is difficult to capture in credit ratings
- B. Market pricing of credit risk tends to lag credit rating changes
- C. Rating stability is greater for lower-rated credits than for higher-rated credits

## 6.28. Factors Impacting Yield Spreads

### 6.28.1. 重要知识点

#### 6.28.1.1. Credit spread risk

- Credit spread risk is the risk of greater expected loss due to changes in credit conditions as a result of macroeconomic, market, and/or issuer-related factors.
  - Macroeconomic Factors.
    - ◆ As the business cycle improves, credit spreads narrow and investors are willing to assume more credit risk. A deteriorating credit cycle will cause credit spreads to widen.
  - Market Factors.
    - ◆ Market liquidity risk: refers to the transaction costs associated with selling a bond. This is the risk that the price at which investors can actually transact may differ from the price indicated in the market.
  - Issuer-Specific Factors: financial performance.
    - ◆ Debt coverage refers to the sufficiency of a borrower's resources or cash flows to make necessary interest and principal payments.
    - ◆ Leverage measures a borrower's relative reliance on debt versus other sources of financing.

#### 6.28.1.2. The Price Impact of Spread Changes

- Spread risk: the effect on prices and returns from changes in spreads.
- The price impact can be approximated (a **small**, instantaneous change in yield spread):
  - $\% \Delta PV_{Full} = -\text{AnnModDur} \times \Delta \text{Spread}$
- The price impact can be approximated (**larger** spread changes)
  - $\% \Delta PV_{Full} = -(\text{AnnModDur} \times \Delta \text{Spread}) + \frac{1}{2} \text{AnnConvexity} \times (\Delta \text{Spread})^2$
- **Reported convexity:** For option-free bonds, convexity should be scaled so it has the same order of magnitude as duration squared and the spread change is expressed

as a decimal.

### 6.28.2. 基础题

**Q-65.** For a bond with a modified duration of 6 and a reported convexity of 0.50, which of the following changes in credit spread would result in a price decrease closest to 7.4%?

- A. -1.3%
- B. 1.3%
- C. 2.1%

**Q-66.** All else being equal, an investment-grade bond issuer most likely has:

- A. less market liquidity risk than a below-investment-grade issuer.
- B. the same market liquidity risk as a below-investment-grade issuer.
- C. greater market liquidity risk than a below-investment-grade issuer.

## 6.29. Credit Analysis for Government Issuers

### 6.29.1. 重要知识点

#### 6.29.1.1. Sovereign Credit Analysis

- Qualitative Factors
  - Government Institutions & Policy
  - Fiscal Flexibility
  - Monetary Effectiveness
  - Economic Flexibility
  - External Status
- Quantitative Factors
  - Fiscal Strength
  - Economic Growth and Stability
  - External Stability

#### 6.29.1.2. Non-Sovereign Credit Risk

- Agencies: issued by entities created by national government and may be explicitly or implicitly backed by government.
- Government Sector Banks and Development Financing Institutions
- Supranational Issuers
- Regional Government Issuers

- Municipal debt
  - ◆ GO bonds
    - ✓ backed by the taxing authority of the issuing municipality.
    - ✓ The credit analysis has some similarities to sovereign analysis.
  - ◆ Revenue 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.

### 6.29.2. 基础题

**Q-67.** The creditworthiness of sovereign and other government borrowers is based upon qualitative and quantitative factors. Which of the following is not a qualitative factor?

- A. Monetary Effectiveness
- B. Fiscal Flexibility
- C. Economic Growth and Stability

**Q-68.** Gulf Metro, a special purpose vehicle of the Government of India, issued retail bonds for the purpose of financing mass rapid transport infrastructure in Bombay. Interest and principal payments are supported by the cash flows of the mass rapid transport system and a credit guarantee of the Government of India. This bond is an example of:

- A. an agency bond.
- B. a general obligation (GO) bond.
- C. a revenue bond.

## 6.30. Corporate Credit Analysis

### 6.30.1. 重要知识点

#### 6.30.1.1. Corporate Credit Analysis

- Qualitative Factors
- Corporate Governance

- Business Model
- Industry and Competition
- Business Risk
- Issuer-Specific
- Industry-Specific
- External
- Quantitative Factors
  - Macroeconomy
  - Industry
  - Event Risk
  - Balance Sheet
  - Income Statement
  - Cash Flow Statement

#### **6.30.1.2. Financial ratios used in credit analysis**

- **Profitability:** strong and stable earnings are important in generating the cash flows that are a primary source of debt repayment. Typically focus on operating profits and recurring revenues as opposed to non-recurring or one-time gains. Such as EBIT margin.
- **Coverage:** comparing periodic income to debt service. Greater coverage means that debt investors benefit from higher income or cash flows from which fixed debt obligations can be paid. Such as EBIT to Interest Expense, EBITDA to Interest Expense.
- **Leverage,** such as Debt to EBITDA or Debt to Capital, FCF to debt, lower leverage, higher credit quality.
- **Liquidity:** often consider availability of short-term resources to pay interest or principal and committed line of bank credit.

#### **6.30.2. 基础题**

**Q-69.** Which of the following is a characteristic of higher corporate creditworthiness?

- A. higher liquidity.
- B. Higher leverage.
- C. Lower coverage.

#### **6.31. Seniority Rankings of Corporate Debt**

### 6.31.1. 重要知识点

#### 6.31.1.1. Seniority rankings of corporate debt

- Priority of claims: in the event of default, unsecured debt holders claim rank below (i.e., get paid after) those of secured creditors.
  - Secured debt: the debtholder has a direct claim on certain assets and their associated cash flows.
  - Unsecured debt is often referred to as debentures. Unsecured bondholders have only a general claim on an issuer's assets and cash flow.
  - General seniority ranking for debt repayment priority
    - ◆ First lien or first mortgage
    - ◆ Senior secured debt
    - ◆ Junior secured debt
    - ◆ Senior unsecured debt
    - ◆ Senior subordinated debt
    - ◆ Subordinated debt
    - ◆ Junior subordinated debt
- All debt within the same category is said to rank pari passu, or have same priority of claims

#### 6.31.1.2. Pari Passu

- All creditors at the same level of the capital structure are treated as one class; thus, a senior unsecured bondholder whose debt is due in 30 years has the same pro rata claim in bankruptcy as one whose debt matures in six months. This provision is referred to as bonds ranking pari passu ("on an equal footing") in right of payment.

#### 6.31.1.3. Issuer credit rating and issue ratings

- Issuer credit rating (corporate family ratings): a debt issuer's overall creditworthiness and typically apply to a firm's senior unsecured debt.
- Issue ratings (corporate credit rating): credit risk of a specific debt issue

#### 6.31.1.4. Notching

- Notching: assign different ratings to bonds of the same issuer by rating agencies
  - 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.

#### 6.31.1.5. Structural subordination

- **Structural subordination:** Arises in a holding company structure when the debt of

operating subsidiaries is serviced by the cash flow and assets of the subsidiaries before funds can be passed to the holding company to service debt at the parent level.

#### **6.31.1.6. Cross default provision**

- **Cross default provision:** Provisions whereby events of default such as non-payment of interest on one bond on all outstanding debt; implies the same default probability for all issues.

#### **6.31.2. 基础题**

**Q-70.** The Zera Company has borrowed capital by issuing a number of different securities. Which of the following most likely ranks the highest with respect to priority of payments?

- A. Subordinated loan
- B. Third lien debt
- C. Senior unsecured bond

**Q-71.** Which of the following three companies will most likely have notching issues, when they issue corporate bonds?

- A. Company A with AAA rating
- B. Company B with AA rating
- C. Company C with BBB rating

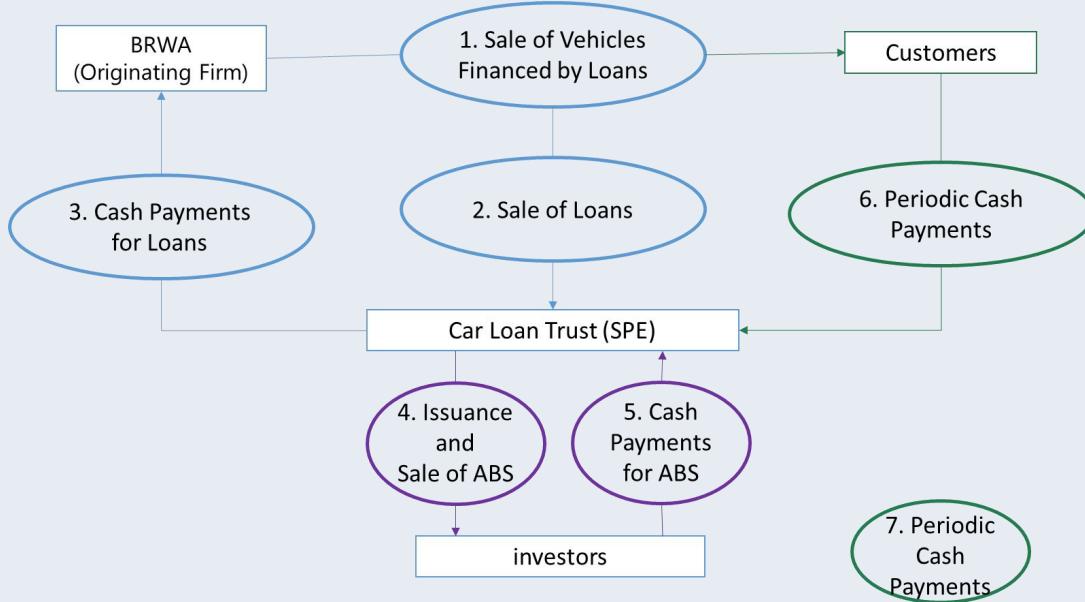
**Q-72.** A bond issuer's credit rating most likely applies to the bond issuer's:

- A. senior secured debt
- B. senior unsecured debt
- C. junior subordinated debt

#### **6.32. Securitization Process and Advantages**

##### **6.32.1. 重要知识点**

### 6.32.1.1. Securitization process



### 6.32.1.2. Benefits of securitization

- Benefits to Issuers
  - Cheaper way to raise funds than a corporate bond issue secured by the same collateral;
  - Selling illiquid assets and operate more efficiently, then improving their profitability;
  - Earning loan origination fees;
  - Reducing capital requirements for loans that are sold to investors;
  - Enable bank to expand lending origination beyond their balance sheets.
- Benefits to Investors
  - Allowing investors to tailor interest rate and credit risk exposures to suit their specific risk, return, and maturity needs.
  - Increasing exposure to the risk-return characteristics of a wider range of underlying assets, easier to make asset liability match.
- Benefits of SPV in securitization: sell the loan to SPV instead of using it as collateral
  - Protect investors from the issuer's bankruptcy.
  - Securitization can have lower credit cost than a corporate bond secured by the same collateral.
  - Funding cost of issuing an asset-backed bond is less than that of issuing a corporate bond.

### 6.32.2. 基础题

**Q-73.** A BBB rated corporation wishes to issue debt to finance its operations at the lowest cost possible. If it decides to sell a pool of receivables into a special purpose vehicle (SPV), its primary motivation is most likely to:

- A. receive a guaranty from the SPV to improve the corporation's credit rating.
- B. allow the corporation to retain a first lien on the assets of the SPV.
- C. segregate the assets into a bankruptcy-remote entity for bondholders.

**Q-74.** In the securitization process, which of the following is most likely a third party to the transaction? The:

- A. special purpose entity.
- B. seller of the collateral.
- C. rating agencies.

## 6.33. Covered Bonds

### 6.33.1. 重要知识点

#### 6.33.1.1. Covered Bonds

- Covered bonds are senior debt obligations issued by a financial institution and backed by a segregated pool of assets that typically consist of commercial or residential mortgages or public sector assets.
- Advantages
  - Dual recourse nature;
  - Strict eligibility criteria;
  - Dynamic cover pool;
  - Redemption regimes in the event of sponsor default.
- As a result, covered bonds usually carry lower credit risks and offer lower yields than otherwise similar ABS.

### 6.33.2. 基础题

**Q-75.** In the event of default, bondholders in covered bonds most likely have recourse against:

- A. the issuing financial institution only.
- B. the underlying asset pool only.
- C. both the issuing financial institution and the underlying asset pool.

**Q-76.** Which statement about covered bonds is least accurate?

- A. Covered bonds provide investors with dual recourse, to the cover pool and also to the issuer.
- B. Covered bonds usually carry higher credit risks and offer higher yields than otherwise similar ABS.
- C. Covered bonds have a dynamic cover pool, meaning sponsors must replace any prepaid or non-performing assets.

## 6.34. ABS Structures to Address Credit Risk

### 6.34.1. 重要知识点

#### 6.34.1.1. Internal and External Credit Enhancement

##### ➤ Internal credit enhancements

- **Subordination/credit tranching:** Creating more than one bond class or tranche and ordering the claim priorities for ownership or interest in an asset between the senior/subordinated(junior) tranches. In the event of default, the proceeds from liquidating assets will first be used to repay the most senior creditors.
- **Reserve funds:** provide credit support by paying for possible future losses
  - ◆ Cash reserve fund: deposit of cash provided to the SPV from the proceeds of the sale of the loan pool by the entity seeking to raise funds
  - ◆ Excess spread amount
    - ✓ allocation into an account of any amount resulting from monthly funds remaining after paying out the interest to the bond classes
- **Overcollateralization:** the process of posting more collateral than is needed to obtain or secure financing.

##### ➤ External credit enhancements

- **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.

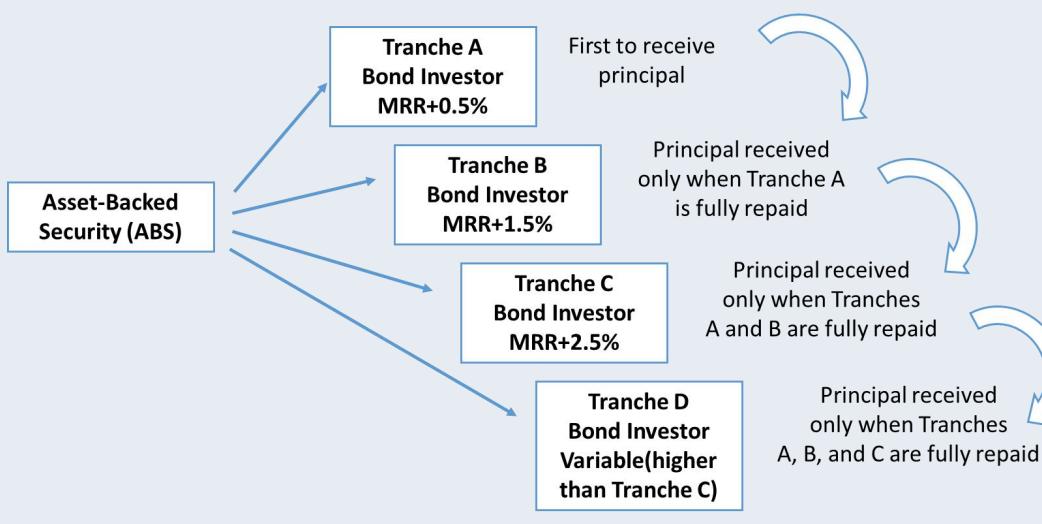
##### ➤ Limitation of external credit enhancement:

- 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:** the issuer immediately borrows the credit enhancement amount and then invests that amount usually in highly rated short-term commercial paper. A cash collateral account mitigates investors' exposure to the third-party risk, which is the possibility that a guarantor cannot meet its obligation.

#### 6.34.1.2. Credit tranching



#### 6.34.2. 基础题

**Q-77.** Which of the following internal credit enhancement involves creating different bond classes to share any losses caused by defaults in the collateral pool?

- A. Overcollateralization.
- B. Cash reserve fund.
- C. Subordination.

### 6.35. Non-Mortgage Asset-Backed Securities

#### 6.35.1. 重要知识点

##### 6.35.1.1. Credit card receivable-backed securities

- **Non-amortizing loans**, do not involve scheduled principal repayment. But in non-amortizing collateral pool, it would happen after lockout period.
- Cash flow:
  - Finance charges collected, Fees, Principal repayments.

- Lockout periods: cash flow paid out based on finance charges collected and fee.
- After lockout periods: principal no longer reinvested but paid to investors.

#### **6.35.1.2. Solar ABS**

- Many specialty finance companies have begun to offer specialized home improvement financing options: solar loans or solar leases.
- Solar loans allow consumers to borrow the cost of purchasing and the system from an installer.
- Solar leases involve renting the solar equipment directly from a solar company.
- Institutional investors have become interested in purchasing solar ABS as these structures offer the opportunity to contribute to sustainability while generating attractive risk-adjusted yields.
- An additional feature is that the proceeds are directed to financing green or environmentally friendly projects.
- Because solar loans facilitate environmentally sustainable benefits through the installation of a renewable and efficient energy source, they may qualify as green bonds. For institutional investors looking for environmental, social, and governance (ESG) or climate finance investment alternatives, solar ABS can offer an attractive investment alternative.
- Usually, solar loan borrowers are prime borrowers that own their homes and have good payment records.
- Many solar ABS contain a pre-funding period, which allows the trust to acquire during a certain period of time after the close of the transaction additional qualifying transactions that meet certain eligibility criteria.

#### **6.35.2. 基础题**

**Q-78.** Which of the following is least likely a feature of a credit card receivable ABS?

- A. An early amortization provision
- B. Amortizing collateral
- C. A lockout period

**Q-79.** Which of the following about solar ABS is incorrect?

- A. a pre-funding period is used by solar ABS post-transaction.
- B. solar loans combine multiple liens to lower default risk.
- C. collateral remains on the balance sheet.

## 6.36. CDO

### 6.36.1. 重要知识点

#### 6.36.1.1. CDO

➤ Collateralized debt obligation (CDO)

Corporate bonds	Collateralized bond obligation (CBO)
Emerging market bonds	
Leveraged Bank loans	Collateralized loan obligation (CLO)
ABS, RMBS, CMBS and other CDOs	Structured finance CDOs
A portfolio of credit default swaps	Synthetic CDOs

➤ Structure of CDO transaction

Senior tranche	Highest credit ratings
Mezzanine tranche	Credit ratings between senior and subordinated bond classes
Subordinate/equity tranche	Receive the residual cash flow

➤ Generic CLO Structure

- These tranches include senior, mezzanine, and subordinated/junior/equity tranches.
  - ✓ Investors in senior or mezzanine bond classes earn a potentially higher yield than comparable corporate bonds offer.
  - ✓ Investors in equity tranches take on equity-like risks with the potential to earn returns comparable to equities.
- Asset pool quality ongoing monitoring
  - ✓ The collateral manager must continually meet various performance tests and collateral limits for the underlying collateral. If the manager fails pre-specified tests, a provision is triggered that requires the payoff of the principal to the senior bond class until the tests are met.
- This process effectively deleverages the CLO because the cheapest funding source for the CLO, the senior bond class, is reduced.

### 6.36.2. 基础题

**Q-80.** From the perspective of a CDO manager, an arbitrage collateralized debt obligation most likely differs from a traditional asset-backed security because it involves the:

- A. pooling of debt obligations.
- B. active management of the collateral.
- C. creation of a special purpose entity.

**Q-81.** Which of the following statements about collateralized loan obligations (CLOs) is accurate?

- A. Purchases of a CLO's collateral are funded by issuing equity.
- B. Recourse against both the collateral pool, and the original issuers.
- C. Investors in senior or mezzanine bond classes typically earn a higher yield than comparable corporate bonds offer.

## 6.37. Mortgage Loans

### 6.37.1. 重要知识点

#### 6.37.1.1. Mortgage loans

- **Foreclosure:** allows the lender to take possession of the mortgaged property and then sell it in order to recover funds toward satisfying the debt obligation
- **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.
- **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.
- **Strategic default:** A strategic default is *less likely* in a recourse provision because the lender can seek restitution from the borrower's other assets and/or income in an attempt to recover the shortfall.

#### 6.37.1.2. Loan-to-value ratio(LTV)

- The higher the LTV, the lower the borrower's equity, vice versa.
- Lower LTV, more equity the borrower has

#### 6.37.1.3. Debt-to-income ratio (DTI)

- DTI = monthly debt payments / monthly pre-tax gross income.
- To measure an individual's ability to manage monthly payments and repay debts.

#### 6.37.1.4. Agency RMBS

- Guaranteed by a federal agency: These RMBS carry the full faith and credit of the government, essentially a guarantee with respect to timely payment of interest and repayment of principal.
- Guaranteed by government-sponsored enterprises (GSEs): RMBS issued by GSEs do not carry the full faith and credit of the government, but rather the GSEs' guarantee of the timely payment of interest and principal for the securities. The GSE's charge a fee for this guarantee.

#### 6.37.1.5. Non-Agency RMBS: Issued by private entities and thus not guaranteed by a federal agency or a GSE.

- These private pass-throughs or private label MBS gained credit enhancement through pool insurance, letters of credit, guarantees, or subordination.

### 6.37.2. 基础题

**Q-82.** Relative to a non-recourse mortgage loan, in a recourse mortgage loan the:

- A. lender can change the interest rate charged.
- B. borrower does not have a strategic default option.
- C. borrower is not liable for any shortfall between the property sale proceeds and the loan amount.

### 6.38. Residential Mortgage-Backed Securities (RMBS)

#### 6.38.1. 重要知识点

##### 6.38.1.1. Mortgage Pass-Through Securities

- Mortgage pass-through security: a security created when one or more holders of mortgages form a pool of mortgages and sell shares or participation certificates in the pool.
  - **Pass-through rate:** mortgage pass-through security's coupon rate
    - ✓ Pass-through rate(net interest or net coupon)=mortgage rate on the underlying pool of mortgages –Servicing and other fees
  - **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.

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

#### 6.38.1.2. Time Tranching

- **Prepayment:** Any payment toward the repayment of principal that is in excess of the scheduled principal repayment.
- **Prepayment risk:** Uncertainty that the timing of the actual cash flows will be different from the scheduled cash flows as set forth in the loan agreement due to the borrowers' ability to alter payments, usually to take advantage of interest rate movements.
- **Contraction risk**
  - 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.
- **Extension risk**
  - 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.

#### 6.38.1.3. Collateralized Mortgage Obligations (CMO)

- **CMOs** are securities issued against mortgage pass-through securities (MPS) for which the cash flow have been reallocated to different tranches.
- Each CMO tranche represents a different mixture of contraction and extension risk.
- Redistribution of the original pass-through securities' cash flows does not eliminate contraction and extension risk.
- **Sequential pay tranches**
  - Each class of bonds is retired sequentially in sequential pay CMO.
  - The CMO structure with sequential-pay tranches allows investors concerned about extension risk to invest in shorter-term tranches and those concerned about contraction risk to invest in the longer-term tranche

Tranche	Contraction risk	Extension risk
A (sequential pay)	HIGH	LOW
B (sequential pay)		
C (sequential pay)		

↑                            ↓

D (sequential pay)	LOW	HIGH
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➤ **Planned amortization class (PAC) CMO**

- Have greater predictability of the cash flows for PAC tranches because a principal repayment schedule must be satisfied.
- PAC bondholders have priority over all other classes in the CMO structure in receiving principal repayments 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.

### 6.38.2. 基础题

**Q-83.** When interest rates decrease, mortgage-backed securities most likely exhibit increased:

- extension risk.
- contraction risk.
- reinvestment risk.

**Q-84.** All else being equal, the prepayment protection of a planned amortization class (PAC) tranche is most likely:

- less than the prepayment protection of a support tranche
- the same as the prepayment protection of a support tranche
- greater than the prepayment protection of a support tranche

## 6.39. CMBS

### 6.39.1. 重要知识点

#### 6.39.1.1. CMBS characteristics

- CMBS are no recourse loans;
- Therefore, analysis of CMBS securities focuses on the property and not the borrower

$$\text{Debt-to-service coverage (DSC) ratio} = \frac{\text{net operating income}}{\text{debt service}}$$

$$\text{Loan-to-value ratio} = \frac{\text{loan amount}}{\text{property value}}$$

#### 6.39.1.2. CMBS basic structure

➤ **Call protection (loan level)**

- ◆ **Prepayment lockout.** is a contractual agreement that prohibits any prepayments during a specified period of time.
- ◆ **Defeasance.** The borrower provides sufficient funds for the servicer to invest in a portfolio of government securities that replicates the cash flows that would exist in the absence of prepayments.
  - ✓ The cost of assembling such a portfolio is the cost of defeasing the loan that must be repaid by the issuer.
- ◆ **Prepayment penalty points.** Predetermined penalties that a borrower who want to refinance must pay.

➤ **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 (extension risk)
- The lender may modify the original loan terms and charge a higher interest rate, called “workout period”.

### 6.39.2. 基础题

**Q-85.** Credit risk is a factor for commercial mortgage-backed securities because they are backed by mortgage loans that:

- A. are non-recourse.
- B. have limited call protection.
- C. have no prepayment penalty points.

**Q-86.** In the context of commercial mortgage-backed securities (CMBS) which of the following mechanisms is most likely a structural call protection?

- A. Sequential-pay tranches
- B. Defeasance
- C. Prepayment lockouts

# Solutions

55-70

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## 6. Fixed Income

### 6.1. 基础题

#### Q-1. Solution: C.

A capital market security has an original maturity longer than one year.

A perpetual bond does not have a stated maturity date. Thus, the sovereign bond, which has a maturity of 15 years, cannot be a perpetual bond. A pure discount bond is a bond issued at a discount to par value and redeemed at par. Some sovereign bonds (e.g., Treasury bills) are pure discount bonds, but others are not.

#### Q-2. Solution: B.

Prohibiting the issuer from investing in risky projects restricts the issuer's potential business decisions. This restriction is referred to as negative bond covenants.

#### Q-3. Solution: C.

Except at maturity, the principal repayments are lower for a partially amortized bond than for an otherwise similar fully amortized bond. Consequently, the principal amounts outstanding and, therefore, the amounts of interest payments are higher for a partially amortized bond than for a fully amortized bond, all else equal. The only exception is the first interest payment, which is the same for both repayment structures. This is because no principal repayment has been made by the time the first coupon is paid.

#### Q-4. Solution: B.

There are no interim cash flows for a zero-coupon bond until the maturity.

#### Q-5. Solution: B.

Capital-indexed bonds pay a fixed coupon rate that is applied to a principal amount that increases in line with increases in the index during the bond's life. If the consumer price index increases by 6%, the coupon rate remains unchanged at 8%, but the principal amount increases by  $6\%/2=3\%$  and the coupon payment is based on the inflation-adjusted principal amount. On the first coupon payment date, the inflation-adjusted principal amount is  $1,000 \times (1 + 0.03) = 1,030$  and the semi-annual coupon payment is equal to  $(0.08 \times 1,030) / 2 = 41.20$ .

#### Q-6. Solution: C.

An issuer concerned about potential cash flow problems in the future might seek to add a payment-in-kind (PIK) feature to a loan or bond. PIK features allow an issuer to pay periodic

interest in the form of an increase in the bond or loan principal outstanding rather than as a cash payment. This feature is most frequently used by firms with relatively high reliance on debt financing and are usually associated with a higher interest rate to compensate investors assuming greater principal risk.

**Q-7. Solution: C.**

A sinking fund provision requires retirement of a portion of the bond's principal every year, rather than retirement of the entire issue at maturity.

**Q-8. Solution: B.**

A put feature is beneficial to the bondholders. Thus, the price of a putable bond will typically be higher than the price of an otherwise similar non-putable bond.

**Q-9. Solution: A.**

Callable bonds give issuers the ability to retire debt prior to maturity. The most compelling reason for them to do so is to take advantage of lower borrowing rates.

**Q-10. Solution: C.**

Because the conversion ratio is the number of common shares that each bond can be converted into.

**Q-11. Solution: A.**

Bonds issued by entities that are incorporated in another country are called foreign bonds. Therefore, the bonds issued by a South Korean company in the United States are known as foreign bonds.

**Q-12. Solution: A.**

An original issue discount tax provision allows the investor to increase the cost basis of the bond, so when the bond matures, the investor faces no capital gain or loss.

**Q-13. Solution: A.**

In major developed bond markets, newly issued sovereign bonds are sold to the public via an auction.

**Q-14. Solution: B.**

Because credit rating agencies often require that commercial paper issuers secure a backup line of credit from banks.

**Q-15. Solution: C.**

The longer the length of the repurchase agreement, the higher the repo margin (haircut).

**Q-16. Solution: C.**

Non-sovereign bonds usually trade at a higher yield and lower price than sovereign bonds with similar characteristics. The higher yield is because of the higher credit risk associated with non-sovereign issuers relative to sovereign issuers, although default rates of local governments are historically low and their credit quality is usually high. The higher yield may also be a consequence of non-sovereign bonds being less liquid than sovereign bonds with similar characteristics.

**Q-17. Solution: B.**

The IMF is a multilateral agency that issues supranational bonds.

**Q-18. Solution: A.**

The bond price is closest to 95.00. The bond has six semiannual periods. Half of the annual coupon is paid in each period with the required rate of return also being halved. The price is determined in the following manner:

$$N=6, I/Y=5.5, PMT=4.5, FV=100$$

$$CPT(PV)=95$$

**Q-19. Solution: B.**

The formula for calculating this bond's yield-to-maturity is:

$$N=40, PV=-111, PMT=2.5, FV=100$$

$$CPT(I/Y)=2.09(%)$$

$$2.09*2=4.18(%)$$

**Q-20. Solution: A**

Using calculator inputs,  $N = (3 \times 2) = 6$ ,  $PMT = (5\% \div 2) \times 100 = \$2.5$ ,  $FV = \$100$ ,  $PV = \$108$ , Solve for  $I$ , is equal to 1.114% semi-annually, or 2.228% on an annual basis.

If the yield to maturity decreases by 100 bps, the price of the bond after one year is computed as:

$$N = 4, PMT = \$2.5, FV = \$100, I = [(2.228\% - 1\%) \div 2] = 0.614\%, \text{ Solve } PV, \text{ is equal to } \$107.43.$$

Therefore, the change in value of the bond =  $\$108.00 - \$107.43 = \$0.57$ .

**Q-21. Solution: C.**

$$PV = \frac{4}{(1 + 0.03)^1} + \frac{4}{(1 + 0.03)^2} + \frac{4}{(1 + 0.03)^3} + \frac{4}{(1 + 0.03)^4} + \frac{104}{(1 + 0.03)^5} = 104.58$$
$$PV_{full} = 104.58 \times 1.03^{76/180} = 105.89$$

**Q-22. Solution: B.**

Accrued Interest=100\*6%/2\*(180-90)/180=1.5

Clean Price= Full Price- Accrued Interest=102-1.5=100.5

**Q-23. Solution: A.**

The first step is to determine the yields-to-maturity on the observed bonds. The required yield on the two-year, 6.0% bond priced at 106.500 is 2.622%. The required yield on the four-year, 5.0% bond priced at 106.250 is 3.306%.

Applying the method of linear interpolation, the YTM of a bond with three-year maturity and same credit ranking is  $(2.622\% + 3.306\%) / 2 = 2.964\%$ , then calculate the price, which is 105.763.

Some fixed-rate bonds are not actively traded. Therefore, there is no market price available to calculate the rate of return required by investors. The same problem occurs for bonds that are not yet issued. In these situations, it is common to estimate the market discount rate and price based on the quoted or flat prices of more frequently traded comparable bonds. These comparable bonds have similar times-to-maturity, coupon rates, and credit quality. This estimation process is called matrix pricing.

**Q-24. Solution: B**

Because for bonds that are not yet issued it is common to estimate the market discount rate and price based on the quoted or flat prices of more frequently traded comparable bonds. These comparable bonds have similar times-to-maturity, coupon rates, and credit quality. This estimation process is called matrix pricing.

**Q-25. Solution: C.**

If the discount rate increases to 12% from 8%, the price of a bond decreases. At a discount rate of 12%, the bond sells at a discount to face value. As a discount bond approaches maturity, it will increase in price over time until it reaches par at maturity.

**Q-26. Solution: C.**

C is correct. The yield-to-call is 4.68%, the formula for calculating this bond's yield-to -call is:

N=6, PV=-990, PMT=20, FV=1010

CPT (I/Y)=2.338 (%)

YTC=I/Y\*2=4.68 (%)

**Q-27. Solution: C**

Because  $(1 + \text{APR}_2/2)^2 = (1 + \text{APR}_4/4)^4$  for annual percentage rates using semiannual and quarterly basis (APR<sub>2</sub> and APR<sub>4</sub>, respectively). This gives  $(1 + 0.08/2)^2 = (1 + \text{APR}_4/4)^4 \Leftrightarrow \text{APR}_4/4 = 1.98\%$  and  $\text{APR}_4 = 4 \times 1.98\% = 7.92\%$ .

**Q-28. Solution: A.**

Solution 1 : Yield-to-maturity on the U.K. corporate bond:

$$100.65 = \frac{5}{(1+r)^1} + \frac{5}{(1+r)^2} + \frac{105}{(1+r)^3}, r = 0.04762 \text{ or } 476 \text{ bps}$$

Yield-to-maturity on the U.K. government benchmark:

$$100.25 = \frac{2}{(1+r)^1} + \frac{2}{(1+r)^2} + \frac{102}{(1+r)^3}, r = 0.01913 \text{ or } 191 \text{ bps}$$

The G-spread is 476-191=285 bps

Solution 2: FV=100, PV=-100.25, N=3, PMT=2%×100=2, CPT, I/Y=1.91, r<sub>treasury</sub>=191bps

FV=100, PV=-100.65, N=3, PMT=5%×100=5, CPT, I/Y=4.76, r<sub>bond</sub>=476bps

The G-spread is r<sub>bond</sub> - r<sub>treasury</sub> =285 bps

**Q-29. Solution: A.**

The I-spread, or interpolated spread, is the yield spread of a specific bond over the standard swap rate in that currency of the same tenor. The yield spread in basis points over an actual or interpolated government bond is known as the G-spread. The Z-spread (zero-volatility spread) is the constant spread that is added to each spot rate so that the present value of the cash flows matches the price of the bond.

**Q-30. Solution: C.**

$$PV = 100 \times \left(1 - \frac{180}{360} \times 0.0650\right) = 96.75$$

$$\text{BEY} = \frac{365}{180} \times \frac{100 - 96.75}{96.75} = 6.81\%$$

**Q-31. Solution: C.**

FRN Z will be priced at a discount on the next reset date because the quoted margin of 0.80% is less than the discount or required margin of 0.85%. The discount amount is the present value of the extra or "excess" interest payments of 0.05% (0.85% - 0.80%). FRN Y will be priced at par value on the next reset date since there is no difference between the quoted and discount margins. FRN X will be priced at a premium since the quoted margin is greater than the required margin.

**Q-32. Solution: A.**

Because the applicable interest rate in December is the six-month market reference rate in June plus the 50 basis point margin =  $1.80\% + 0.50\% = 2.30\%$ .

**Q-33. Solution: A.**

The credit spread is set at the time of FRN issuance, is usually constant over the bond's life, and is expressed in basis points (bps), or hundredths of a percentage point.

**Q-34. Solution: B.**

The bond price is closest to 100.32.

$$PV = (10 / 1.08) + (10 / (1.09)^2) + (110 / (1.10)^3) = 100.32$$

**Q-35. Solution: C.**

A spot rate is defined as the yield to maturity on a zero-coupon bond maturing at the date of that cash flow.

**Q-36. Solution: B.**

The value of the bond is

$$\begin{aligned} & \frac{3}{(1 + 0.015/2)} + \frac{3}{(1 + 0.015/2) * (1 + 0.025/2)} \\ & + \frac{3}{(1 + 0.015/2) * \left(1 + \frac{0.025}{2}\right) * (1 + 0.033/2)} \\ & + \frac{3}{(1 + 0.015/2) * \left(1 + \frac{0.025}{2}\right) * \left(1 + \frac{0.033}{2}\right) * (1 + 0.039/2)} \\ & + \frac{3 + 100}{(1 + 0.015/2) * \left(1 + \frac{0.025}{2}\right) * \left(1 + \frac{0.033}{2}\right) * \left(1 + \frac{0.039}{2}\right) * (1 + 0.043/2)} \\ & = \$107.03 \end{aligned}$$

**Q-37. Solution: C.**

$$(1 + 2.2\%)^2 = (1 + 1.3\%)(1 + 1y1y)$$

$$1y1y = 3.1\%$$

**Q-38. Solution: C.**

$$PV = \frac{8}{1.1^1} + \frac{8}{1.1^2} + \frac{8}{1.1^3} + \frac{108}{1.1^4} = 93.66$$

$$\text{Coupon & coupon reinvestment} = 8 \times 1.1^4 + 8 \times 1.1^3 + 8 \times 1.1^2 + 8 \times 1.1^1 + 8 = 48.84$$

$$100 = \frac{93.66 + 48.84}{(1+r)^5}, r = 0.0734$$

**Q-39. Solution: C.**

Bond 3 has the highest coupon and the longest maturity. The bond with the highest coupon and the longest maturity will have the greatest reinvestment risk. Bond 3 has a higher coupon than Bond 1 and a longer maturity than Bond 2. "Coupon reinvestment risk increases with a higher coupon rate and a longer reinvestment time period."

**Q-40. Solution: B.**

The duration gap is the bond's Macaulay duration minus the investment horizon, which is positive in this case. A positive duration gap implies that the investor is currently exposed to the risk of higher interest rates.

**Q-41. Solution: B.**

Because we use the fact that  $\text{ModDur} = \text{MacDur} / (1 + r)$  to calculate the Macaulay duration of the bond:  $\text{MacDur} = 6.7 \times (1 + 8\%) = 7.24$ . Because the duration gap is equal to the bond's Macaulay duration minus the investment horizon the investment horizon is closest to 7.2 years.

**Q-42. Solution: A.**

because the realized horizon yield matches the original yield-to-maturity if (1) coupon payments are reinvested at the same interest rate as the original yield-to-maturity, and (2) the bond is sold at a price on the constant-yield price trajectory, which implies that the investor does not have any capital gains or losses when the bond is sold. Since the bond is sold prior to maturity, the bond would have to be sold at a price greater than 98 but less than 100.

**Q-43. Solution: B.**

period	Cash flow	Present value	weight	Period × weight
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1	60	55.55556	0.058575	0.058575
2	60	51.44033	0.054236	0.108471
3	1060	841.46218	0.887190	2.661570
		948.45806	1.000000	2.828617

**Q-44. Solution: C.**

Option-free bonds have positive convexity. The higher the yield to maturity, the lower the duration (and thus the lower the interest rate risk).

**Q-45. Solution: C.**

The bond's PVBP is computed using

$$PVBP = \frac{(PV_-) - (PV_+)}{2}$$

$$\frac{105.90 - 105.75}{2} = 0.075$$

**Q-46. Solution: A.**

Modified duration is Macaulay duration divided by 1 plus yield per period. Macaulay duration is provided in the table, so YTM is calculated as follows:

$$N = 5. PV = -85.4734. PMT = 4. FV = 100. CPT I/Y = 7.6\%. \text{ModDur} = \frac{4.5947}{1.076} = 4.2702$$

**Q-47. Solution: B.**

$$\text{Duration} = -(\Delta P/P)/\Delta y$$

$$\Delta P = -\text{Duration} * \Delta y * P = -2.4 * (-0.015) * 912,575 = 32,852.70$$

**Q-48. Solution: A.**

For two bonds with different coupons but are otherwise identical, a lower-coupon bond has a greater percentage price change than a higher-coupon bond when their market discount rates change by the same amount. For two bonds with different time-to-maturity but are otherwise identical, a longer-term bond has a greater percentage price change than a shorter-term bond when their market discount rates change by the same amount.

**Q-49. Solution: A**

**A is Correct** because the approximate modified duration of a bond is calculated as follows:

$$\begin{aligned} \text{ApproxModDur} &= ((PV_-) - (PV_+)) / (2 \times (\Delta \text{Yield}) \times PV_0) \\ &= (103.35 - 100.90) / (2 \times 0.0070 \times 101.80) \end{aligned}$$

$$= 2.45 / 1.4252 = 1.7191 \approx 1.72.$$

**Q-50. Solution: C.**

A fall in interest rates will result in a higher percentage rise in the bond's price compared with the percentage fall in the bond's price when interest rates rise by the same amount.

**Q-51. Solution: B.**

The expected percentage price change for a bond can be estimated as follows:

$$\% \Delta P^{\text{Full}} \approx (-\text{AnnModDur} \times \Delta \text{Yield}) + [0.5 \times \text{AnnConvexity} \times (\Delta \text{Yield})^2]$$

$$\% \Delta P^{\text{Full}} \approx (-10 \times -0.005) + [0.5 \times 75 \times (-0.005)^2] = 5.09\%$$

**Q-52. Solution: C.**

$$\text{approximate convexity} =$$

$$[101.28 + 100.67 - (2 * 100.94)] / (0.002^2 * 100.94) = 173.37$$

**Q-53. Solution: B.**

Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	Col. 6 = Col. 2 × (Col. 2 + 1) × Col. 5 × (1 + YTM/2)^(-2)
Period	Time to Receipt	Cash Flow	Present Value	Weight	Convexity of Cash Flows
1	1.0	1.6	1.5748	0.0157	0.0304
2	2.0	1.6	1.5500	0.0155	0.0901
3	3.0	1.6	1.5256	0.0153	0.1779
4	4.0	1.6	1.5016	0.0150	0.2906
5	5.0	1.6	1.4779	0.0148	0.4301
6	6.0	101.6	92.3701	0.9237	37.5831
<b>Annualized Convexity</b>					9.6506

**Q-54. Solution: B.**

$$\text{Money Duration of Bond A} = 7.5 \times 95.00 = 712.50$$

$$\text{Money Duration of Bond B} = 5.5 \times 85.00 = 467.50$$

$$\text{Money Duration of Bond C} = 10 \times 90.00 = 900$$

The total market value of the bond portfolio is  $180,000 + 100,000 + 120,000 = 400,000$ .

The portfolio duration is  $712.50 \times (180,000/400,000) + 467.50 \times (100,000/400,000) + 900 \times (120,000/400,000) = 707.50$ .

**Q-55. Solution: A.**

A limitation to using the average duration approach in calculating portfolio duration is that it assumes all interest rates across the yield curve change by the same amount and, therefore, each bond's price changes by the same percentage.

**Q-56. Solution: C**

Because effective duration is a curve duration statistic in that it measures interest rate risk in terms of a parallel shift in the benchmark yield curve.

**Q-57. Solution: B.**

The effective duration is defined as:

$$\frac{(PV_-) - (PV_+)}{2 * (\Delta Curve) * (PV_0)}$$

Effective duration =  $(106.75 - 102.10)/(2 \times 0.0035 \times 103.25) = 6.43$

**Q-58. Solution: A.**

The presence of an embedded put option reduces the effective duration of the bond, especially when rates are rising. If interest rates are low compared with the coupon rate, the value of the put option is low and the impact of the change in the benchmark yield on the bond's price is very similar to the impact on the price of a non-putable bond. But when benchmark interest rates rise, the put option becomes more valuable to the investor. The ability to sell the bond at par value limits the price depreciation as rates rise. The presence of an embedded put option reduces the sensitivity of the bond price to changes in the benchmark yield, assuming no change in credit risk.

**Q-59. Solution: B.**

A callable bond exhibits negative convexity at low yield levels and positive convexity at high yield levels.

**Q-60. Solution: C.**

Empirical duration is the best measure—better than analytical duration—of the impact of yield changes on portfolio value, especially under stressed market conditions, for a portfolio consisting of a variety of different bonds from different issuers, such as the portfolio described in Answer C.

In this portfolio, credit spread changes on the high-yield bonds may partly or fully offset yield changes on the AAA rated sovereign bonds and spread changes on the AAA rated corporate bonds; this interaction is best captured using empirical duration. The portfolios described in Answers A and B consist of the same types of bonds from similar issuers—sovereign bonds from similar-rated sovereign issuers (A) and covered bonds from similar-rated corporate issuers (B)—so empirical and analytical durations should be roughly similar in each of these portfolios.

**Q-61. Solution: C**

Because key rate duration (or partial duration) is a measure of a bond's sensitivity to a change in the benchmark yield curve at a specific maturity segment. In contrast to effective duration, key rate durations help identify 'shaping risk' for a bond—that is, a bond's sensitivity to changes in the shape of the benchmark yield curve (e.g., the yield curve becoming steeper or flatter).

**Q-62. Solution: B.**

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. Credit risk has two components. The first is known as default risk, or default probability. The second component is loss severity (also known as 'loss given default').

**Q-63. Solution: B.**

Because BBB– is the lowest rating for investment grade bonds. A one-category downgrade (from BBB– to BB+) would make the bond non-investment grade.

**Q-64. Solution: A.**

Credit ratings tend to be sticky and lag market pricing of credit risk. Some risks are difficult to capture in credit ratings, examples include litigation risk, environmental risk, and natural disasters. Ratings may involve miscalculations or unforeseen changes not fully captured in a rating agency's forward-looking analysis.

**Q-65. Solution: B.**

$$\begin{aligned}\% \Delta PV^{\text{Full}} &= -(\text{AnnModDur} \times \Delta \text{Spread}) + \frac{1}{2} \text{AnnConvexity} \times (\Delta \text{Spread})^2 \\ &= -(6 \times 0.013) + \frac{1}{2}(50) \times (0.013)^2 = -0.074 \text{ or } -7.4\%\end{aligned}$$

The spread change is inversely related to the price effect, with a spread increase leading to a fall in bond price. Note that since duration was 6, we had to rescale the convexity from 0.50 to 50.

**Q-66. Solution: A**

Because market liquidity risk is the risk that the price at which investors can actually transact—buying or selling—may differ from the price indicated in the market. The lower the quality of the issuer, the higher the market liquidity risk.

**Q-67. Solution: C.**

The qualitative factor is economic flexibility, not economic growth and stability.

**Q-68. Solution: C.**

The funding is for the development of a specific mass rapid project for Bombay, and the repayment is supported by the revenue of the mass rapid transport line. While the bonds also have a sovereign guarantee to provide credit enhancement, the primary source of repayment is mass transit revenue.

**Q-69. Solution: A.**

All else held equal, a company with higher liquidity has a greater ability to meet its short-term obligations, including debt interest and principal.

**Q-70. Solution: B.**

Third lien debt is secured debt. It has a secured interest in the pledged assets and ranks higher than all other unsecured debts.

**Q-71. Solution: C.**

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.

**Q-72. Solution: B.**

An issuer rating usually applies to its senior unsecured debt and addresses an obligor's overall creditworthiness.

**Q-73. Solution: C.**

A key motivation for a corporation to establish a SPV is to separate it as a legal entity. In the case of bankruptcy for the corporation, the SPV is unaffected because it is not a subsidiary of the corporation. Given this arrangement, the SPV can achieve a rating as high as AAA and borrow at lower rates than the corporation.

**Q-74. Solution: C.**

In the securitization process, the seller of the collateral, the special purpose entity, and the servicer of the loan are the main parties. All other parties, including independent accountants, lawyers/attorneys, trustees, underwriters, rating agencies, and financial guarantors are third parties to the transaction.

**Q-75. Solution: C**

Because a covered bond is a debt obligation backed by a segregated pool of assets called a “cover pool” In the event of default, bondholders have recourse against both the financial institution and the underlying asset pool.

**Q-76. Solution: B.**

Covered bonds usually carry lower credit risks and offer lower yields than otherwise similar ABS. The reason is, among other factors, covered bonds provide investors with dual recourse, to the cover pool and also to the issuer. Moreover, covered bonds have a dynamic cover pool, meaning sponsors must replace any prepaid or non-performing assets.

**Q-77. Solution: C.**

Subordination or credit tranching in the securitization transaction involves creating more than one bond class or tranche, and the bond classes differ in how they share any losses resulting from defaults in the collateral pool.

**Q-78. Solution: B.**

A credit card receivable ABS is an example of an ABS with a non-amortizing collateral. A credit card receivable ABS may require early amortization of the principal if certain events occur. Such an early amortization provision would safeguard the credit quality of the issue. And a credit card receivable ABS would typically have a lockout period during which the cash flow that is paid out to security holders is based only on finance charges collected and fees.

**Q-79. Solution: C.**

The collateral of solar ABS removed from balance sheet. A pre-funding period is used by solar ABS post transaction to acquire additional qualifying assets that meet certain eligibility criteria. Solar loans combine multiple liens to lower default risk.

**Q-80. Solution: B.**

Unlike a traditional asset-backed security, an arbitrage collateralized debt obligation involves active management because the CDO manager buys and sells debt obligations with the objective of paying off different classes of bondholders as well as generating a high return for the subordinated/equity tranche and the manager.

**Q-81. Solution: C.**

Investors in senior or mezzanine bond classes earn a potentially higher yield than comparable corporate bonds offer. CLO collateral purchases rely on funds obtained from the issuance of debt. Recourse is limited to the collateral pool, with minimal recourse to the original issuers.

**Q-82. Solution: B.**

There are recourse and non-recourse mortgage loans. In a non-recourse loan, the lender does not have a claim against the borrower and thus can look only to the property to recover the outstanding mortgage balance. In a recourse loan, the lender can seek to recover any shortfall from the sale of the property to cover the mortgage loan. The borrower, therefore, has a strategic default option only in non-recourse loans; for example, if the mortgage is greater than the property value, he may select to default without further personal obligation.

**Q-83. Solution: B.**

Because contraction risk is the risk that when interest rates decline, actual prepayments will be higher than forecasted because homeowners will refinance at now-available lower interest rates. Thus, a security backed by mortgages will have a shorter maturity than was anticipated at the time of purchase. Holding a security whose maturity becomes shorter when interest rates decline has two adverse consequences for investors. First, investors must reinvest the proceeds at lower interest rates. Second, if the security is prepayable or callable, its price appreciation is not as great as that of an otherwise identical bond that does not have a prepayment or call option. Increased contraction risk occurs when interest rates decline.

**Q-84. Solution: C.**

PAC tranches offer greater predictability and stability of the cash flows. These tranches make scheduled and fixed principal payments over a predetermined time period to their investors if the prepayment levels in the pool are within a certain maximum and minimum range. If the prepayment rate is within the specified range, all prepayment risk is absorbed by the support tranche.

**Q-85. Solution: A.**

Because commercial mortgage loans are non-recourse loans, the lender can only look to the income-producing property backing the loan for interest and principal repayment. If there is a default, the lender looks to the income-producing property backing the loan for interest and principal repayment. If there is a default, the lender looks to the proceeds from the sale of the property for repayment and has no recourse against the borrower for any unpaid mortgage loan balance.

**Q-86. Solution: A.**

A structural call protection can be achieved in a CMBS when it is structured to have sequential-pay tranches by credit rating.