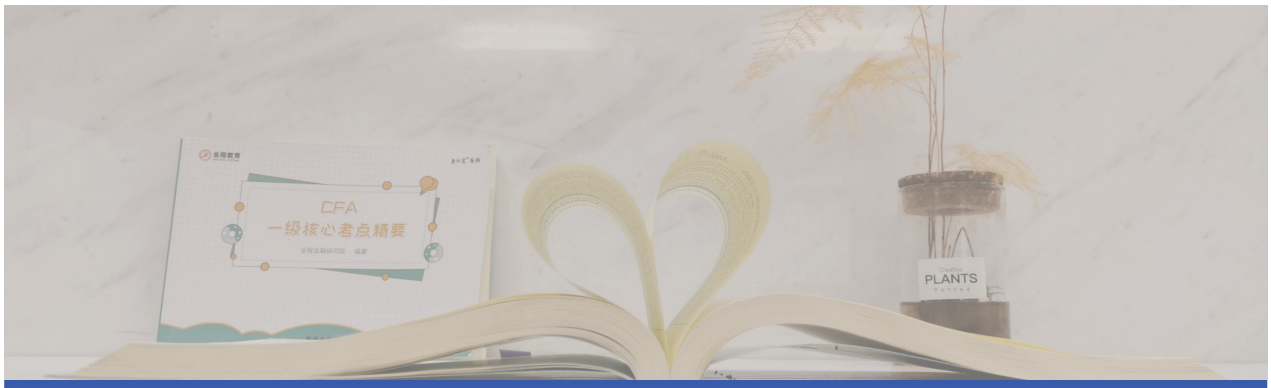


Fixed Income

CFA一级强化班

讲师：林正

林正
6年授课，4000+授课课时

学位证书

- 金程教育资深培训师
- 英国Essex大学硕士
- CFA持证人
- PMP（Project Management Professional）持证人

服务客户

- 中国银行、中国建设银行、民生银行、平安证券、杭州联合银行、杭州银行、国泰君安证券、苏州元禾控股等。

工作背景

- 曾历任某外资银行支行行长，总行战略项目经理，十二年的外企银行工作资历，积累了丰富的金融实战经验。
- 现为金程教育资深培训师，熟悉CFA考试重点，CFA全级别授课。

Fixed Income

1. Fixed-Income Instrument Features
2. Fixed-Income Cash Flows and Types
3. Fixed-Income Issuance and Trading
4. Fixed-Income Markets for Corporate Issuers
5. Fixed-Income Markets for Government Issuers
6. Fixed-Income Bond Valuation: Prices and Yields
7. Yield and Yield Spread Measures for Fixed-Rate Bonds
8. Yield and Yield Spread Measures for Floating-Rate Instruments
9. The Term Structure of Interest Rates: Spot, Par, and Forward Curves

Framework

Fixed Income

10. Interest Rate Risk and Return
11. Yield-Based Bond Duration Measures and Properties
12. Yield-Based Bond Convexity and Portfolio Properties
13. Curve-Based and Empirical Fixed-Income Risk Measures
14. Credit Risk
15. Credit Analysis for Government Issuers
16. Credit Analysis for Corporate Issuers
17. Fixed-Income Securitization
18. Asset-Backed Security (ABS) Instrument and Market Features
19. Mortgage-Backed Security (MBS) Instrument and Market Features

Framework

Module

Fixed-Income Instrument Features

1. Bond Indentures and Covenants

Bond Indentures and Covenants

- Collateral
- Affirmative and negative covenants

Bond Indentures and Covenants

- **Collateral backing: a way to reduce credit risk**
  - **Unsecured bonds (No collateral):**
    - ✓ **Solo source**: a claim to **operating cash flows** of issuer.
    - ✓ Corporate bonds for issuers of higher credit quality are usually unsecured.
  - **Secured bonds:**
    - ✓ **Primary source：** operating cash flow
    - ✓ **Secondary source:** backed by **a claim to a specific assets** of a corporation.
    - ✓ Corporate issuers with less stable operating cash flows usually face more credit provisions and restrictions and may offer investors a legal claim (or lien or pledge) on specific assets.
  - Unsecured bonds are paid after secured bonds in the event of default. In many jurisdictions, **debentures** are unsecured bonds, with no collateral backing assigned to the bondholders.

Bond Indentures and Covenants

- **Covenants**
  - **Affirmative covenants**: are **typically administrative** in nature.
    - ✓ Frequently used affirmative covenants include what the issuer will do with the proceeds from the bond issue and the promise of making the contractual payments.
    - ✓ **The issuer may promise to**
      - ☐ Comply with all laws and regulations;
      - ☐ Maintain its current lines of business;
      - ☐ Insure and maintain its assets, and pay taxes as they come due;
    - ✓ Other affirmative covenant examples include a ***pari passu clause*** and ***cross-default clause***.
    - ✓ These types of covenants typically ***do not impose additional costs*** to the issuer and ***do not materially constrain*** the issuer's discretion regarding how to operate its business.

Bond Indentures and Covenants

- **Covenants (cont.)**
  - **Negative covenants**: frequently ***costly*** and ***do materially constrain*** the issuer's potential business decisions.
  - The purpose of negative covenants is to protect bondholders. Examples of negative covenants include the following:
    - ✓ **Restrictions on debt** regulate the issue of additional debt (maximum acceptable debt usage ratios).
    - ✓ **Negative pledges** prevent the issuance of debt that would be senior to or rank in priority ahead of the existing bondholders' debt.
    - ✓ **Restrictions on prior claims** protect unsecured bondholders by preventing the issuer from using assets that are **not collateralized** (called unencumbered assets) to become collateralized.
    - ✓ **Restrictions on distributions to shareholders** restrict dividends and other payments to shareholders such as share buy-backs (repurchases).

Bond Indentures and Covenants

- **Covenants (cont.)**
  - The purpose of negative covenants is to protect bondholders. Examples of negative covenants include the following:
    - ✓ **Restrictions on asset disposals** set a limit on the amount of assets that can be disposed by the issuer during the bond's life.
    - ✓ **Restrictions on investments** constrain risky investments by blocking speculative investments.
    - ✓ **Restrictions on mergers and acquisitions** prevent these actions unless the company is the surviving company or unless the acquirer delivers a supplemental indenture to the trustee expressly assuming the old bonds and terms of the old indenture.

Bond Indentures and Covenants

- **Covenants (cont.)**
  - **Incurrence test**
    - ✓ Bondholders are protected by a set of covenants which closely monitor certain financial ratios and restrict its ability to pay dividends to shareholders, repurchase shares, and / or take on additional debt unless tighter financial restrictions are met.
    - ✓ For example
      - Incurrence Test: Test is met if issuer has Interest Coverage Ratio greater than 3.0× for each financial reporting period.

Example

Bond Indentures and Covenants

- An analyst reviews a corporate bond indenture that contains these two covenants:

  1 The borrower will pay interest semiannually and principal at maturity.

  2 The borrower will not incur additional debt if its debt-to-capital ratio is more than 50%.

  What types of covenants are these?

  A. Covenant 1 is affirmative, and Covenant 2 is negative.

  B. Both are affirmative covenants.

  C. Covenant 1 is negative, and Covenant 2 is affirmative.

- Correct Answer：A
- Paying interest and principal is one of the most common affirmative covenants. Negative covenants set forth certain limitations and restrictions on the borrower's activities.

Summary

Fixed-Income Instrument Features

Bond Indentures and Covenants

Bond Indenture, Source of repayment proceeds, Covenants

Module

Fixed-Income Cash Flows and Types

1. Fixed-Income Cash Flow Structures
2. Fixed-Income Contingency Provisions
3. Legal, Regulatory, and Tax Considerations

Fixed-Income Cash Flow Structures

- Common cash flow structures

Fixed-Income Cash Flow Structures

- **Cash flow structures**
  - **Plain vanilla bond/bullet bond**: periodic interest payments and principal is paid at maturity.
  - **Amortizing loan:** periodic payments include both interest and some repayment of principal.
    - ✓ Face **lower credit risk**
    - ✓ **Fully amortizing:** principal is fully paid off when the last periodic payment is made.
    - ✓ **Partially amortizing:** the final payment includes just the remaining unamortized principal amount at bond maturity.
  - Calculate the periodic payment (A):

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

    - ✓ r=market int rate per period
    - ✓ Principal=principal amount of loan or bond

Fixed-Income Cash Flow Structures

Fully Amortized Bond

Year	Investor Cash Flows	Interest Payment	Principal Repayment	Outstanding Principal at the End of the Year
0	–$1,000.00			
1	402.12	$100.00	$302.12	$697.89
2	402.12	69.79	332.33	365.56
3	402.12	36.56	365.56	0.00

Partially Amortized Bond

Year	Investor Cash Flows	Interest Payment	Principal Repayment	Outstanding Principal at the End of the Year
0	–$1,000.00			
1	341.69	$100.00	$241.69	$758.31
2	341.69	75.83	265.86	492.45
3	541.69	49.24	492.45	0.00

Fixed-Income Cash Flow Structures

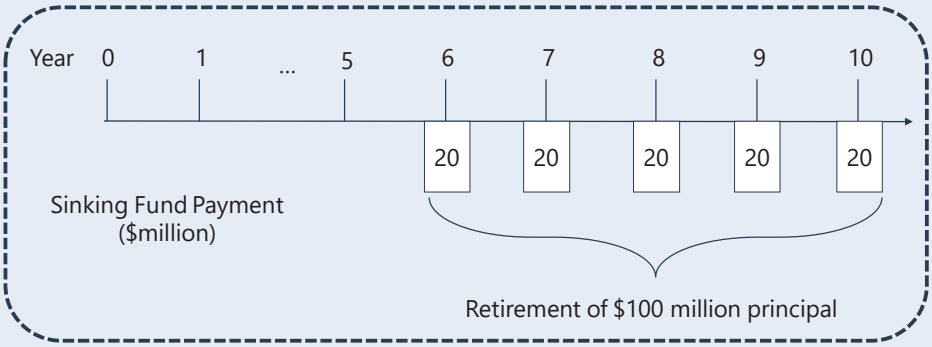
- **Cash flow structures**
  - Two **additional** bond amortization arrangements
  - **Waterfall structures**, which are commonly used in asset-backed securities (ABS) and mortgage-backed securities (MBS).
  - **Sinking fund provisions**: provide for the repayment of principal through a series of payments over the life of the issue.
    - ✓ Originally, a sinking fund was a specified cash reserve that was segregated from the rest of the issuer's business for the purpose of repaying the principal.
    - ✓ More generally today, a sinking fund arrangement specifies the portion of the bond's principal outstanding, perhaps 5%, that must be repaid each year throughout the bond's life or after a specified date.

Fixed-Income Cash Flow Structures

Example

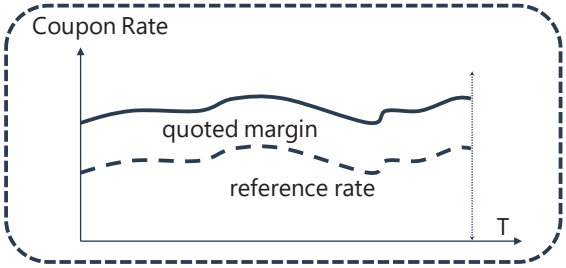
ABC Inc. issue a 10-year bond with a par value of $100 million.

The bond has a sinking fund provision, which requires that ABC Inc. retire $20 million of the principal every year beginning in the sixth year.



Fixed-Income Cash Flow Structures

- **Floating-Rate Notes (FRN)**



Coupon rate = reference rate ± quoted margin

- Such as:
  - MRR
- It is a constant value.
- Mainly credit spread.

Fixed-Income Cash Flow Structures

- **Floating-Rate Notes (FRN)**
  - The coupon rate determined at the coupon reset date is the rate that the issuer promises to pay at the next coupon date.
    - ✓ The new 1-year rate at that time will determine the rate of interest paid at the end of the next year. Most floater pay quarterly and are based on a quarterly (90-day) reference rate.
    - ✓ The reference rate must **match the frequency** with which the coupon rate on the bond is reset.

Example

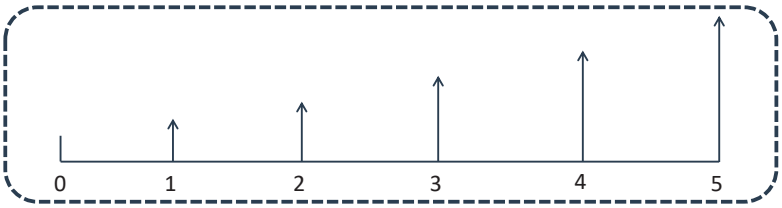
Assume that the coupon rate of a FRN that makes semi-annual interest payments in June and December is expressed as the six-month MRR + 150 bps. Suppose that in December 20X0, the six-month MRR is 3.25%.

Correct Answer:

The interest rate that will apply to the payment due in June 20X1 will be 4.75% (=3.25% + 1.50%).

Fixed-Income Cash Flow Structures

- **Step-Up Coupon Bonds:** may be fixed or floating, increases by specified margins at specified dates.



  - The step-up coupon allows bondholders to receive a higher coupon, in line with the higher market interest rates.
  - An increase in bond coupon rates can be viewed as a protection against the increase in market interest rates which is due to the decrease in issuer's credit rating.

Fixed-Income Cash Flow Structures

- **Credit-Linked Notes**
  - Coupon rate will go up (down) by a certain amount if the credit rating of the issuer falls (improves).
- **Leveraged Loan**
  - credit spread that adjusts based on change of credit quality, such as leverage and interest coverage ratios.
- **Pay-in-Kind (PIK) Bonds**
  - Allow the issuer to make the coupon payment by increasing the principal amount of the outstanding bonds, essentially paying bond interest with more bonds.
- **Deferred coupon bonds: interest payments are deferred for a specified number of years.**
  - Financing for a firm financing a large project that will not be completed and generating revenue for some period of time after bond issuance.
  - Zero-coupon bonds: one type of deferred coupon bond.

Fixed-Income Cash Flow Structures

- **Index-Linked Bonds (Linkers)**
  - Has its coupon payments and/or principal repayment linked to a specified index.
  - **Inflation-linked bonds**: are an example of index-linked bonds.
  - **Nominal rate bond:** The fixed interest and principal payments of a standard bond are nominal cash flows whose purchasing power declines with inflation.
  - **Real rate bond:** The interest rate a bondholder receives net of inflation is the real interest rate, which is approximately equal to the nominal interest rate minus the rate of inflation.

Fixed-Income Cash Flow Structures

- **Different structure of inflation-index bonds**
  - **Interest-indexed bonds**: fixed nominal principal amount at maturity, and index-linked coupon rate during the bond's life.
  - **Capital-indexed bonds**: pay a fixed coupon rate, principal amount that increases in line with increases in the index during the bond's life.
    - ✓ **Treasury Inflation-Protected Securities (TIPS):** pay semiannual coupons, at maturity.
      - If adjusted par value (per bond) is greater than $1,000 at maturity, the holder receives the adjusted par value as the maturity payment.
      - If the adjusted par value is less than $1,000 (due to deflation), holders receive $1,000 at maturity as this is the minimum repayment amount.

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

Example

Fixed-Income Cash Flow Structures

- Calculate the periodic payment
  - 1) Fully amortized bond is a 5 year, 3.2% semiannual coupon bond with par value of USD300.
  - 2) If partially amortized with USD150 balloon payment at maturity, and others amortized.

- Correct Answer:
  - 1) A=32.7
  - 2) A=18.75

Fixed-Income Contingency Provisions

- Callable Bonds
- Putable Bonds

Fixed-Income Contingency Provisions

- **Callable Bonds**
  - **Call provisions** are beneficial to the issuer.
  - Issuer would exercise the call when 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 **(reinvestment risk).**
  - Callable bond offers a **higher** yield (lower price) than identical non-callable bond.
    - ✓ **Value of callable bonds = value of identical pure (non-callable) bonds - call option value**
    - ✓ If the YTM **rises above** the coupon rate, there is little incentive for the issuer to use the call feature. the callable bond behaves much like a non-callable equivalent.
    - ✓ As a callable bond's YTM **falls below** its coupon rate, its price is effectively capped at the fixed call price, while the price of a non-callable bond will continue to rise.

Fixed-Income Contingency Provisions

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

Fixed-Income Contingency Provisions

- **Putable Bonds**
  - Are beneficial to the **bondholders.**
  - Investor would exercise when 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.
  - Putable bonds have a lower yield and higher price than similar non-putable bonds.
    - ✓ **Value of putable bonds = value of identical pure(non-putable) bonds + put option value.**

Example

Fixed-Income Contingency Provisions

- Callable and putable bond prices with the same coupon rate will behave most like an option-free equivalent bond when their YTMs are, respectively:

  A. above the coupon rate and below the coupon rate.

  B. below the coupon rate and above the coupon rate.

  C. both near the coupon rate.

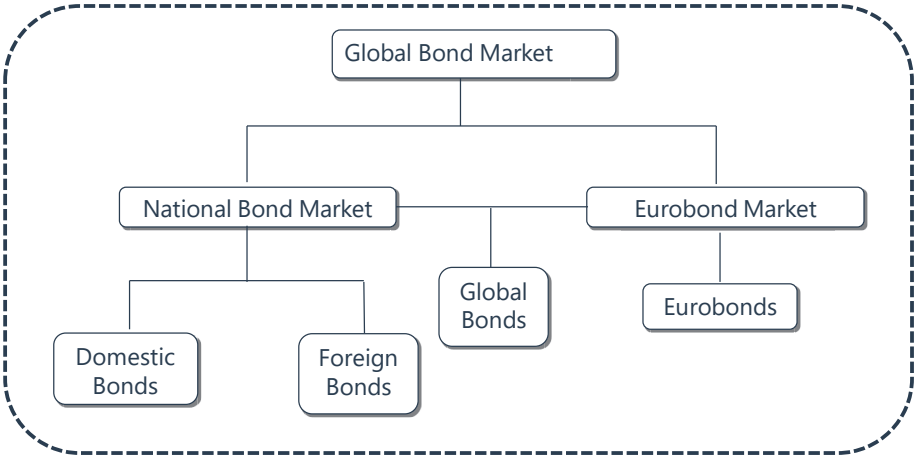
- Correct Answer：A

Legal, Regulatory, and Tax Considerations

- Global bond market

Legal, Regulatory, and Tax Considerations

- **Sectors of the global bond market**



Legal, Regulatory, and Tax Considerations

- **Domestic bonds:** Bonds issued by a firm domiciled in a country and also traded in that country's currency.
- **Foreign bonds:** Bonds sold in a country and denominated in that country's currency by an entity from another country (foreign country).
  - For example, "Panda bonds" in China, "Yankee bonds" in the United States.
- **Eurobonds:** 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.
  - In the past, Eurobonds typically were **bearer bonds**. Trustee does not keep records of the ownership of the bonds, only the clearing system knew who is the bond holder.
  - Eurobonds, domestic bonds, and foreign bonds are now **registered bonds** for which ownership is recorded by either name or serial number.
- **Global bonds:** Issued simultaneously in the Eurobond market and in at least one domestic bond market.

Example

Sectors of the Global Bond Market

- 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.

- Correct Answer：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.

Summary

Fixed-Income Cash Flows and Types

Legal, Regulatory, and Tax Considerations

Global bond market

Module

Fixed-Income Markets for Corporate Issuers

1. Short-Term Funding Alternatives
2. Repurchase Agreements
3. Long-Term Corporate Debt

Short-Term Funding Alternatives

Short-Term Funding Alternatives

- **Short-term funding alternatives available to corporations**
  - 1. Bank loan:
    - ✓ Lines of credit
      - Uncommitted bank lines of credit,
      - Committed bank lines of credit, and
      - Revolving credit agreements, or revolvers.
    - ✓ Secured Loans and factoring
  - 2. (unsecured) Commercial paper

Short-Term Funding Alternatives

- **Bank loan**
  - **1). 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.

Short-Term Funding Alternatives

- **Bank loan**
  - **2). Committed bank lines of credit (Regular line)**
    - ✓ 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.
    - ✓ 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.

Short-Term Funding Alternatives

- **Bank loan**
  - **3). 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.
  - **4).Secured Loans and Factoring**
    - ✓ **Secured loans** (asset-based loans): Loans in which the lender requires the company to provide collateral in the form of an asset.
      - Companies that **lack sufficient credit quality** to qualify for unsecured loans might arrange for secured loans.
    - ✓ **Factor**: Firms sell accounts receivable to a lender, typically at a substantial discount.

Short-Term Funding Alternatives

- **Commercial paper:** short term, unsecured, low rate (issued by corporations of high credit quality) debt.
  - 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.
  - There is very little secondary trading of commercial paper.
  - ***Reissued or rolled over*** when it matures.
    - ✓ **Rollover risk**: a risk that the issuer will be unable to issue new paper at maturity;
  - **Backup lines of credit/ liquidity enhancement/backup liquidity lines**: a type of credit enhancement provided by a bank to a issuer of commercial paper
    - ✓ To ensure that the issuer will have sufficient liquidity to repay maturing commercial paper if rolled over is not available.

Short-Term Funding Alternatives

- **Short-term funding available to financial institutions**
  - **Deposits**
    - ✓ **Checking accounts**
    - ✓ **Saving deposits** often have a stated term
      - **Negotiable CDs:** CDs are available in domestic bond markets as well as in the Eurobond market. Most CDs have maturities shorter than one year and pay interest at maturity
    - ✓ **Operational deposits:** generated by clearing, custody, and cash management activities are also a relatively stable source of funding
  - **Interbank Market**
    - ✓ Involves short-term borrowing and lending among financial institutions on a secured or unsecured basis.
    - ✓ **Interbank funds:** are unsecured loaned between banks for periods of one day to a year.
    - ✓ **Central bank funds market**: allowing banks with a surplus of funds to lend to others.
      - The interest rate at which central bank funds are bought (i.e., borrowed) and sold (i.e., lent) is known as the central bank funds rate.

Short-Term Funding Alternatives

- **Short-term funding available to financial institutions**
  - **Commercial paper**
    - ✓ Banks and other financial institutions also commonly use a **secured form** of commercial paper issuance known as asset-backed commercial paper (ABCP).
      - First, a bank agrees to transfer short-term loans to an SPE in exchange for cash.
      - Second, the SPE issues ABCP to investors with a backup credit liquidity line **provided by the bank.**

Repurchase Agreements

- Repurchase agreements

Repurchase Agreements

- **Repurchase (repo) Agreement:** an institution sells a security with a commitment to buy it back at a later date at a specified price.
  - **Repurchase price**: is greater than the selling price and accounts for the interest charged by the buyer.
  - **Repo rate**: is the interest rate on a repurchase agreement. The repo rate is lower when:
    - ✓ Repo term is shorter.
    - ✓ Credit quality of the collateral security is higher.
    - ✓ Collateral security is delivered to the lender.
    - ✓ Interest rate for alternative sources of funds are lower.

Repurchase Agreements

- **Repurchase (repo) Agreement:** an institution sells a security with a commitment to buy it back at a later date at a specified price.
  - **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 uniqueness: collateral security is in high demand or low supply.

Repurchase Agreements

- **Initial margin:** the provision of collateral in excess of the cash exchanged.
  - Initial Margin $= \frac{\text{Security Price}_0}{\text{Purchase Price}_0}$
  - Haircut$= \frac{\text{Security Price}_0 - \text{Purchase Price}_0}{\text{Security Price}_0}$
  - Variation margin$=(\text{Initial margin} \times \text{Purchase Price}_t) - \text{Security Price}_t$
    - ✓ Security price decline required a cash borrower to provide additional collateral to the seller.
    - ✓ Security price increase leads to overcollateralized, resulting in releasing a of notes with value of variation margin.

Repurchase Agreements

- **Credit risk** is present even if the collateral is a highly rated sovereign bond.
  - **Lender**: When the price of the collateral has fallen.
  - **Borrower**: When the price of the collateral has risen.
- **Repurchase (repo) Agreements**
  - Repurchase agreements are not regulated by the Federal Reserve;
  - Collateral position of the lender in a repo is better in the event of bankruptcy of the dealer; (liquidity)
  - **Overnight repo**: the term of a repurchase agreement is one day;
  - **Term repo**: the agreement is for more than one day.

Repurchase Agreements

- **Example:** Assume that today (t = 0) the current US 5-year Treasury note trades at par USD100,000,000. The security buyer takes delivery of the US Treasury note today and pays the security seller USD80,000,000. If we assume a repo term of 180 days (360 days/year) and an annual interest rate (or repo rate) of 2%,
  - **Calculate** purchase price, repurchase price, initial margin and associated haircut.
  - **Calculate** the variation margin five days after trade inception if the price of the five-year US Treasury note rises to 103% of the security's USD100 million face value.
  - According to calculation result, **specify** next action step.

Repurchase Agreements

- **Solution**
  - Purchase price = 80mio
  - Repurchase price= USD80mio × [1 + (2% × 180/360)] = USD808mio.
  - Initial Margin = Security price$_0$/purchase price$_0$=100mio / 80mio =1.25
  - Haircut=(Security price$_0$-purchase price$_0$)/security price$_0$=(100mio-80mio)/100mio = 20%
  - Variation margin = (Initial margin × Purchase price$_t$) − Security price$_t$ =(1.25 ×80.022) -103=-2.9725mio
    - ✓ Purchase price= Purchase price0×[1+（2%×5/360）] = 80mio ×1.000278 = 80.022mio
    - ✓ Overcollateralization of the loan by USD2.9725mio, allowing the cash borrower (security seller) to request the release of five-year US Treasury notes with a face value of USD2.886 million (USD2.9725mio/1.03).

Repurchase Agreements

- **Repurchase Agreement Applications and Benefits**
  - From a security buyer's perspective, a repo offers a **short-term** cash investment on a collateralized basis with minimal liquidity or default risk.
  - Central banks are also active participants in the repo market to conduct monetary policy.
  - Security buyer enters a repo not only to lend cash for interest but also to use the security for another use. For instance, a **hedge fund** may take a short position in a security, with a view that its price will decline.
    - ✓ **Reverse repo agreement**: cash lending counterparty.
- **Risks Associated with Repurchase Agreements**
  - Default risk: primarily exposure
  - **Bilateral repos**: Repos executed directly between two parties.
  - **Triparty repo**: use a third-party agent for the transaction.
    - ✓ providing access to a larger collateral pool and multiple counterparties
    - ✓ specializing in the valuation and safekeeping of assets

Long-Term Corporate Debt

- Long-term funding of investment-grade versus high-yield corporate issuers

Long-Term Corporate Debt

- **Similarities between** Long-Term Investment-Grade and High-Yield Issuance
  - Under normal market conditions, longer maturities are associated with both higher interest rates (yields-to-maturity on government bonds) and higher credit spreads for a given issuer.
  - Trade-offs for both investors and issuers exists.
    - ✓ **Investor:** may be attracted to the higher YTM of the longer bond. By investing in a bond whose maturity exceeds its planned investment horizon, the investor takes on the price risk of selling what will be a two-year bond in five years' time.
    - ✓ **Issuer:** may be attracted to the lower YTM of a potential three-year issuance to fund a five-year project. However, in doing so, issuer assumes rollover risk.

Long-Term Corporate Debt

- **Differences between** IG and HY Issuance
  - IG
    - ✓ lower risk premium, significant proportion of the YTM is attributed to the government benchmark yield.
    - ✓ relatively standardized debt instruments, few or no restrictive covenants
    - ✓ **high degree of flexibility in choosing debt maturities**
  - High-yield issuers are characterized by a higher expected likelihood of financial distress
    - ✓ higher proportion of a bond's YTM attributed to an issuer-specific spread.
    - ✓ Given the higher chance of default, these instruments are more equity-like in nature (i.e., uncertain cash flows)
    - ✓ Analysts place a greater emphasis on the potential loss given default and the protections and secondary repayment sources that are available.
    - ✓ As a result, investors generally impose more constraints on high-yield issuers.
      - Issuers in the high-yield market often seek to **retain financial flexibility** by borrowing under **leveraged loans with prepayment features** or **issuing bonds with contingency features**.
      - **Except: fallen Angels, outstanding debt has IG bond feature**

Long-Term Corporate Debt

- **Differences between** IG and HY Issuance

	Bond Features	Analytical Approach
AAA	Lower YTM proportion due to credit spreads	
AA	Fewer issuer restrictions	Use **financial ratios and credit ratings** to determine if/when IG issuer's likelihood of default will change
A	Unlikely to default	
BBB	**Bond-like cash flows**	
BB		
B	**Equity-like cash flows**	
CCC	Higher YTM proportion due to credit spreads	
CC, C, D	Issuer restrictions and/or bonds secured by assets	Consider **likelihood of default and potential loss given default** given covenants, restrictions and/or security
	More likely to default	

Summary

Fixed-Income Markets for Corporate Issuers

Long-Term Corporate Debt

Similarities between Long-Term Investment-Grade and High-Yield Issuance

Differences between IG and HY Issuance

Module

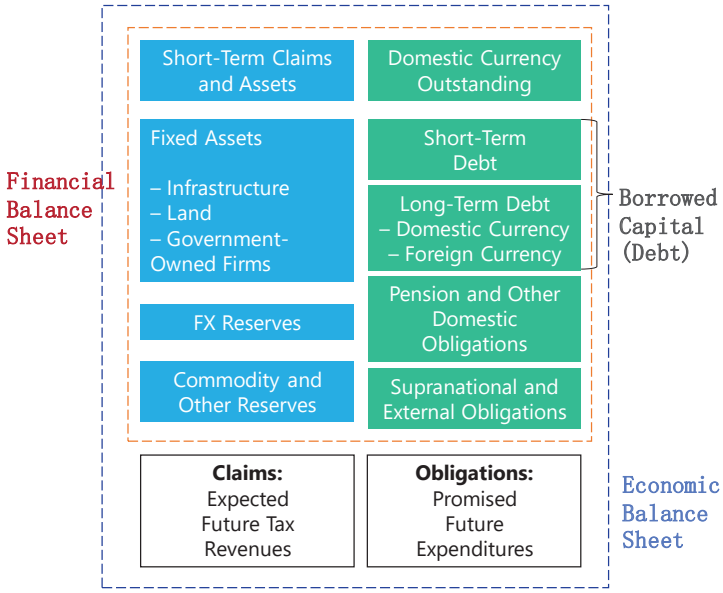
Fixed-Income Markets for Government Issuers

Sovereign Debt

- Sovereign Debt

Sovereign Debt

- **Government "Balance Sheet".**
  - Public sector financial accounting standards vary widely and are often prepared **using cash, rather than accrual-based, principles**, typically excluding such items as the depreciation of fixed public goods, such as federal highways, or the accrual of unfunded liabilities, such as government pension obligations.

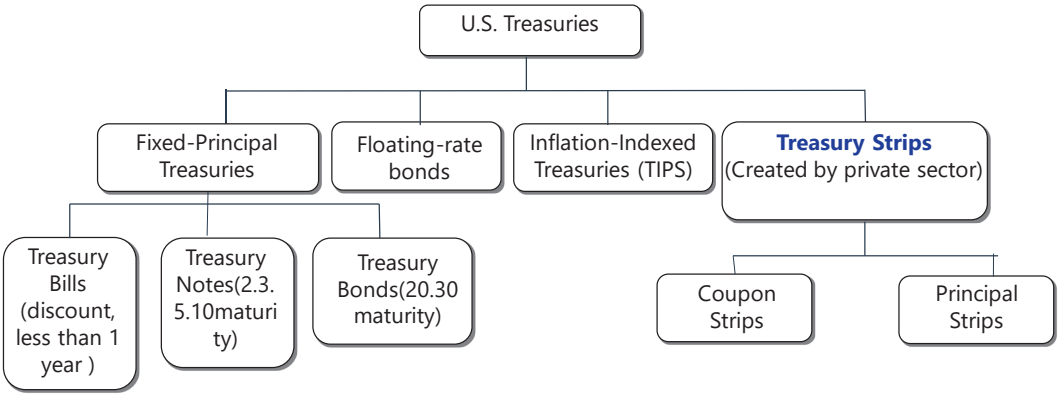


Sovereign Debt

- **Key distinction: difference between developed market and emerging market sovereign issuers.**
  - Developed market (DM) sovereign issuers
    - ✓ DMs are characterized by a strong, stable, well-diversified domestic economy.
    - ✓ Broad-based individual and business tax cash flows, resulting in stable and transparent fiscal policy.
    - ✓ DM fixed-income securities are denominated in a major currency commonly held in reserve by foreign governments.
  - Emerging market (EM) sovereign issuers
    - ✓ Higher growth but less stable and less well-diversified economies subject to greater fluctuations over the economic cycle.
    - ✓ EM sovereign debt securities are often denominated in a **restricted domestic currency**, or one with limited convertibility into other currencies due to illiquidity.

Sovereign Debt

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



Sovereign Debt

- **Treasury Strips:** zero coupon securities of various maturities.
  - **Coupon Strips**: created from coupon payments stripped from the original security.
  - **Principal Strips:** bond (maturities of 20-30 years) and note (maturities of 2.3.5 and 10 years) principal payment with the coupons stripped off.
- **On-the-Run Issues**
  - Most Recently Auctioned
  - More Actively Traded
  - More Liquid
  - Market prices of on-the-run issues provide better information about current market yields.
- **Off-the-Run Issues:** replaced by a more recently auctioned issue.

Sovereign Debt

- Once a government debt **auction** is announced, prospective investors submit **competitive or non-competitive bids.**
  - A non-competitive bidder agrees to accept the price determined at auction and always receives securities.
  - A competitive bidder specifies an acceptable price and number of securities to be purchased.
    - ✓ A competitive bid process: either a **single**-price auction or **multiple-price** auction. Single-price auction results in **lower cost of funds** and **broad distribution among investors**.
- A **single-price auction process** has four phases:
  - The auction is announced by the government debt management office.
  - Dealers, institutional investors, and individuals make bids.
  - All non-competitive bids are accepted while competitive bids are **ranked starting at the lowest yield (highest bond price)**. Competitive bidders who bid higher than this yield **(stop yield)** do not purchase any securities.
  - Securities are delivered to the non-competitive and winning competitive bidders in exchange for proceeds.

Module

Fixed-Income Bond Valuation: Prices and Yields

1. Bond Pricing
2. Relationships between Bond Prices and Bond Features

Bond Pricing

- Yield to Maturity (YTM)
- Flat price, Accrued interest, and Full price
- Matrix Pricing

Bond Valuation Process

- **The general procedure for valuing fixed-income securities is to take the present values of all the expected cash flows and add them up to get the value of the security.**
  - Estimate the cash flows
  - Determinate the appropriate discount rate
  - Calculate the present value of the estimated cash flows

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

Yield to Maturity (YTM)

- **YTM/yield to redemption/redemption yield**
  - Internal rate of return, market discount rate or required yield when pricing
- **Critical assumptions**
  - Hold the bond until maturity;
  - Full, timely coupon, principal payments (no default);
  - Coupons are reinvested at original YTM.
- **Calculation: iteration, back out**
  - **Annual-coupon bond**

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

  - **Semiannual-coupon bond**

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

Yield to Maturity (YTM)

- **Valuation of a zero-coupon bond**

$$\text{Bond value} = \frac{\text{Par value}}{(1+\frac{\text{YTM}}{2})^{2N}}$$

Example

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

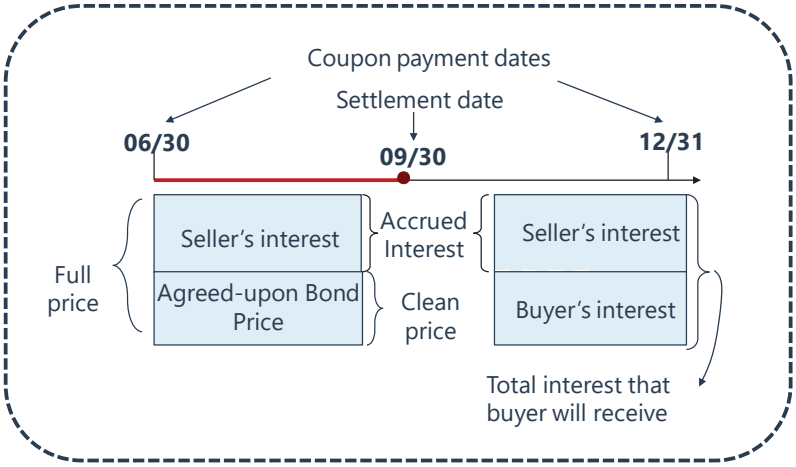
Correct Answer:

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

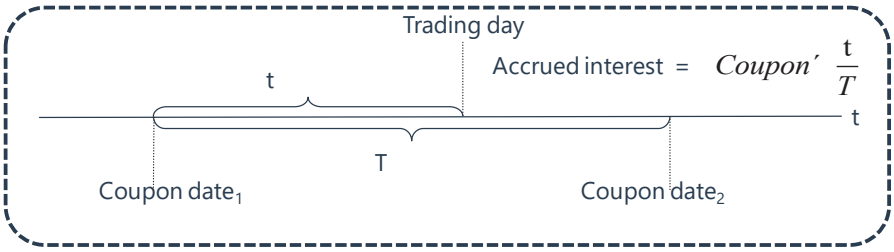
Flat price, Accrued interest, and Full price

- **Accrued Interest:** the interest received by the seller when a bond trades between coupon dates.
- **Clean(flat) Price:** the agreed upon price of the bond, also called **quoted price**.
- **Full Price (or dirty price):** the amount that the buyer pays to the seller, which equals the clean price plus any accrued interest.
  - **Full Price = Clean Price +Accrued Interest**

Flat price, Accrued interest, and Full price



Flat price, Accrued interest, and Full price



Example

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

Correct Answer:

AI=(1000 × 10%/2) × (1-58/183)=50 × (1-0.3169)=34.155

Example

Flat price, Accrued interest, and Full price

- 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:
  - Semiannual coupon: 8% p.a.
  - 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.

- Correct Answer: C.

$$\text{PV} = \frac{4}{(1+0.03)^1} + \frac{4}{(1+0.03)^2} + \frac{4}{(1+0.03)^3} + \frac{4}{(1+0.03)^4} + \frac{104}{(1+0.03)^5} = 104.58$$

$$\text{PV}^{\text{full}} = 104.58 \times 1.03^{76/180} = 105.89$$

Matrix Pricing

- **Matrix pricing**
  - Some fixed-rated bonds are **not actively traded** bonds, based on more frequently traded comparable bonds.
    - ✓ These comparable bonds have similar times-to-maturity, coupon rates, and credit quality.
  - Matrix pricing is also used in **underwriting new bonds** to get an estimate of the required yield spread over the benchmark rate.
  - The benchmark rate typically is the yield-to-maturity on a government bond having the same, or close to the same, time-to-maturity.
  - The spread is the difference between the yield-to-maturity on the new bond and the benchmark rate, this spread is sometimes called the **spread over the benchmark.**

Matrix Pricing

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

Example

Estimate the YTM of a non-traded 5%, 4-year annual-pay bond, find two bonds with similar credit quality

- 3-year annual-pay, 4% coupon bond: YTM=3.68%
- 6-year annual-pay, 5% coupon bond: YTM=5.17%

Correct Answer:

Using linear interpolation:

YTM of the non-traded bond=3.68+[(4-3)/(6-3) × (5.17-3.68)]=4.18%

Relationships between Bond Prices and Bond Features

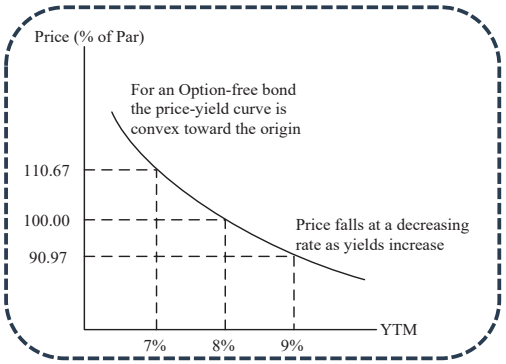
- The relationships among a bond's price, coupon rate, maturity, and yield-to-maturity

Relationships between Bond Prices and Bond Features

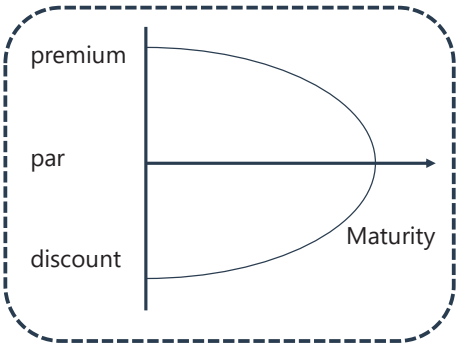
- **Inverse effect:** The bond price is inversely related to the market discount rate. When the market discount rate increases, the bond price decreases.
- **Coupon effect:** For two bonds with different coupons but are otherwise identical, a **lower-**coupon bond has a **greater** percentage price change than a higher-coupon bond when their market discount rates change by the same amount.
- **Maturity effect:** 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.
- **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.

Relationships between Bond Prices and Bond Features

- **Convexity effect**
  - 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.



Relationships between Bond Prices and Bond Features



Par value = $1000, Maturity = 3 years, coupon rate =4%, semi-annual payment.

Time of Maturity	YTM=2%	YTM=4%	YTM=6%
3.0 years	1,057.95	1,000.00	945.83
2.5	1,048.53	1,000.00	954.20
2	1,039.02	1,000.00	962.83
1.5	1,029.41	1,000.00	971.71
1.0	1,019.70	1,000.00	980.87
0.5	1,009.90	1,000.00	990.29
0	1,000.00	1,000.00	1,000.00

Summary

Fixed-Income Bond Valuation: Prices and Yields

Relationships between Bond Prices and Bond Features

Inverse Relationship, Coupon Effect

Maturity Effect , Constant-Yield Price Trajectory

Module

Yield and Yield Spread Measures for Fixed-Rate Bonds

1. Yield Measures for Fixed-Rate Bonds
2. Yield spread

Yield Measures for Fixed-Rate Bonds

- Annual Yields for Varying Compounding Periods
- Yield Measures for Fixed-Rate Bonds

Yield Measures for Fixed-Rate Bonds

- **Effective annual rate**: has a periodicity of one because there is just one compounding period in the year.

$$\text{effective annual rate}=(1+\frac{\text{YTM}}{\text{m}})^{\text{m}}-1$$

  - An effective annual rate has a periodicity of one because there is just one compounding period in the year.
    - ✓ For annual-pay bond: effective yield equal to YTM.
  - Convert an **annual percentage rate** for m periods per year (APR_m), to an annual percentage rate for n per year (APR_n)

$$(1+\frac{\text{APR}_{\text{m}}}{\text{m}})^{\text{m}}=(1+\frac{\text{APR}_{\text{n}}}{\text{n}})^{\text{n}}$$

  - **Semiannual bond basis yield/semiannual bond equivalent yield**: an annual yield having a periodicity of two.
    - ✓ A semiannual bond basis yield is the yield per semiannual period times two.
      - E.g., if a bond yield is 2% per semiannual period, its annual yield is 4% when stated on a semiannual bond basis.

Yield Measures for Fixed-Rate Bonds

Example

Suppose a three-year, 5% semiannual coupon payment corporate bond priced at 104 per 100 of par value has a YTM of 3.582%. Convert 3.582% from a periodicity of 2 to a periodicity of 4 and 12, respectively.

Correct Answer:

Convert 3.582% from a periodicity of 2 to a periodicity of 4:

$$\left(1+\frac{3.582\%}{2}\right)^2=\left(1+\frac{APR_4}{4}\right)^4, APR_4=3.566\%$$

Convert 3.582% from a periodicity of 2 to a periodicity of 12:

$$\left(1+\frac{3.582\%}{2}\right)^2=\left(1+\frac{APR_{12}}{12}\right)^{12}, APR_{12}=3.556\%$$

Yield Measures for Fixed-Rate Bonds

- **Current yield (income or interest yield):** Not consider capital gains/loss or reinvestment income.

$$\text{current yield}=\frac{\text{sum of coupon payments received over the year}}{\text{flat bond price}}$$

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

- **Simple yield:** It is the sum of the coupon payments plus the straight-line amortized share of the gain or loss, divided by the flat price.

Yield Measures for Fixed-Rate Bonds

- **Street convention yield:** Yield measures that neglect weekends and holidays are quoted on what is called street convention.
  - The street convention yield-to-maturity is the internal rate of return on the cash flows assuming the payments are made on the scheduled dates.
    - ✓ This assumption simplifies bond price and yield calculations and commonly is used in practice.
- **True yield:** Internal rate of return on the cash flows using the actual calendar of weekends and bank holidays.
  - The true yield is never higher than the street convention yield because weekends and holidays delay the time to payment.
  - The difference is **typically small**, no more than a basis point or two.

Yield Measures for Fixed-Rate Bonds

- **Yield to call (put)** is calculated as a YTM but with the number of periods until the call (put) price substituted for the number of periods to maturity and the maturity value.
- **Yield to Worst:** the **worst** yield outcome of any that are possible given the call provisions of the bond.
  - Provide the **most conservative** assumption for the rate of return to investor.
- **Other yield measure for embedded option bond**
  - **Option-adjusted price**: the investor bears the call risk (the bond issuer has the option to call), so the embedded call option **reduces** the value of the bond from the investor's perspective. The investor pays a **lower price** for the callable bond than if it were option-free.
    - ✓ The option-adjusted price is used to calculate the **option-adjusted yield**.

Example

Yield Measures for Fixed-Rate Bonds

- 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%.

- Correct Answer: C.
  - 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（%）

Summary

Yield and Yield Spread Measures for Fixed-Rate Bonds

Yield Measures for Fixed-Rate Bonds
Periodicity and Annualized Yields
Yield Measures for Fixed-Rate Bonds

Yield spread

- G-spread
- I-spread
- Z-spread
- Option-adjusted spread

Yield spread

- **Yield spreads**
  - **Benchmark spread**: the yield spread over a specific benchmark
    - ✓ difference between the yield-to-maturity and the benchmark yield
  - **G-spread**: the benchmark is actual or interpolated government bond yield
    - ✓ Bearing risk relative to the sovereign bond
  - **Interpolated spread (I-spread)**: the benchmark is swap rate
  - **Zero-volatility spread (Z-spread)**: constant and zero volatility
    - ✓ Z-spread is what must be added to each benchmark spot rate to make the present value of a bond's cash flows equal its price
  - **Option-adjusted spread (OAS):** Z spread adjusted for embedded options.
    - ✓ Callable bond: OAS = Z spread – Option value in basis points
      - OAS_{call} < Z spread
    - ✓ Putable bond: OAS > Z spread

Example

Yield spread

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

- Both bonds pay annual interest. The current 3-year EUR interest rate swap benchmark is 2.42%. The G-spread on the U.K. corporate bond is closest to:

  A. 264 bps.
  B. 285 bps.
  C. 300 bps .

- Answer: B

Summary

Yield and Yield Spread Measures for Fixed-Rate Bonds

Yield spread

G-spread, I-spread

Z-spread, Option-adjusted spread

Module

Yield and Yield Spread Measures for Floating-Rate Instruments

1. Yield measures for floating-rate notes
2. Yield Measures for Money Market Instruments

Yield measures for floating-rate notes

- Yield and yield spread measures for floating-rate instruments

Yield Measures for Floating-Rate Notes

- **Coupon rate = reference rate + quoted margin**
  - **Quoted margin:** margin used to calculate the bond coupon payments.
- **Discount rate = reference rate + required margin (or discount margin)**
  - **Required/discount margin**: margin required to return the FRN to its par value at each reset date.
    - ✓ Selling at par(credit unchanged): required margin = quoted margin;
    - ✓ Selling at discount(downgrade of credit): quoted margin < required margin;
    - ✓ Selling at premium(upgrade of credit): quoted margin > required margin.

Example

Yield Measures for Floating-Rate Notes

- A three-year floating-rate note pays six-month MRR of –0.25% plus 300 bp. The floater is priced at 99 per 100 of par value. Assuming the 30/360 day-count convention and evenly spaced periods, the discount margin for the floater is closest to:

  A. 301 bps.

  B. 351 bps.

  C. 335bps.

- Correct Answer: C.
  - Using the information provided, the periodic PMT is equal to.
  - PV = –99, FV = 100, PMT = 1.375, and N = 6, we solve for the I/Y= 1.55%, i.e. YTM = 3.1%
  - DM = 3.1%-(-0.25%)=3.35 %

Yield Measures for Money Market Instruments

- Yield measures for money market instruments

Yields Measures for Money Market Instruments

- **Yield measures for money market instruments**
  - **Discount yield:** (e.g., U.S. Treasury bills, commercial paper)

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

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

$$PV = \frac{FV}{(1 + \frac{Days}{Year} \times AOR)} \quad \Rightarrow \quad AOR = (\frac{Year}{Days}) \times (\frac{FV - PV}{PV})$$

    - ✓ Both discount basis and add-on yields in the money market are quoted as simple annual interest and can be based on a **360-day** or **365-day basis**.
    - ✓ **Bond equivalent yield (investment yield) for money market security:** yield stated on a 365-day add-on rate basis.
    - ✓ DR **understates** the rate of return to an investor and **understates** the funding cost of issuer.

Example

Yields Measures for Money Market Instruments

- A treasury bill has a maturity of 180 days, par value of $1,000, and a discount yield of 0.9%. Its market price and the add-on yield based on 365-day are:

- Correct answer:

  Its market price based on 365-day:

$$PV = FV \times (1 - \frac{Days}{Year} \times DR) = 1000 \times (1 - \frac{180}{365} \times 0.9\%) = 995.56$$

  Its annualized add-on yield based on a 365-day year:

$$PV = \frac{FV}{\left(1 + \frac{Days}{Year} \times AOR\right)} = \frac{1000}{1 + \frac{180}{365} \times AOR} = 995.56$$

$$AOR = 0.9043\%$$

  This add-on yield based on a 365-day year is referred to as the bond equivalent yield for money market security.

Summary

Yield and Yield Spread Measures for Floating-Rate Instruments

Yield Measures for Money Market Instruments

Discount yield, Add-on yield

Module

The Term Structure of Interest Rates: Spot, Par, and Forward Curves

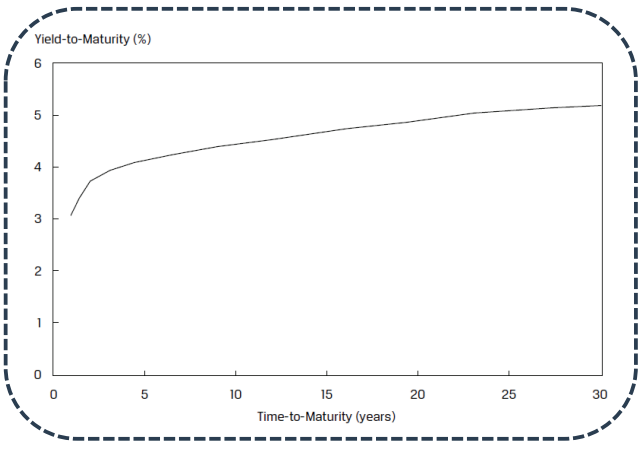
1. Maturity Structure of Interest Rates and Spot Rates
2. Par and Forward Rates

Maturity Structure of Interest Rates and Spot Rates

- Spot rates and the spot curve
- Calculate the price of a bond using spot rates

Maturity Structure of Interest Rates and Spot Rates

- **Yield curve** shows the **term structure of interest rates** by displaying yields across different maturities.
- **Spot curve:** a yield curve for single payments in the future, such as zero-coupon bonds or stripped Treasury bonds.
  - Spot curve for U.S. Treasury bonds is called the **zero-curve** or **strip curve.**



Maturity Structure of Interest Rates and Spot Rates

- **Spot rates**: Yields-to-maturity on a series of default-risk-free zero-coupon bonds..
- **The no-arbitrage price** of a bond is calculated using spot rates.

$$\text{no-arbitrage price} = \frac{\text{CPN}_1}{(1+Z_1)} + \frac{\text{CPN}_1}{(1+Z_2)^2} + \ \ldots\ldots + \frac{\text{CPN}_N + Par}{(1+Z_N)^N}$$

Maturity Structure of Interest Rates and Spot Rates

- Suppose that the one-year spot rate is 2%, the two-year spot rate is 3%, and the three-year spot rate is 4%. Then, the price of a three-year bond that makes a 5% annual coupon payment is 102.960.

$$\frac{5}{(1.02)^1} + \frac{5}{(1.03)^2} + \frac{105}{(1.04)^3} = 4.902 + 4.713 + 93.345 = 102.96$$

- Using the basic bond pricing formula, the yield-to-maturity is 3.935%:

$$\frac{5}{(1.03935)^1} + \frac{5}{(1.03935)^2} + \frac{105}{(1.03935)^3} = 4.811 + 4.629 + 93.52 = 102.96$$

Par and Forward Rates

- Par Rates from Spot Rates
- Forward Rates from Spot Rates
- Bond Pricing with Forward Rates
- Compare the spot curve, par curve, and forward curve

Par and Forward Rates

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

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

Example

Assuming a 3-year annual-pay bond with spot rates of 2.6%, 3.2%, 3.9% , its coupon payment satisfies:

$$\frac{PMT}{1.026} + \frac{PMT}{(1.032)^2} + \frac{PMT+100}{(1.039)^3} = 100$$

Correct Answer:

PMT=3.86, par rate=3.86%

Par and Forward Rates

- **Forward yield curve** shows the future rates for bonds or money market securities for the same maturities for annual periods in the future.
- **Forward Rates:** is the interest rate on a bond or money market instrument traded in a forward market. Marginal return for extending the time-to-maturity for an additional period.
  - E.g. The int. of a 1-year loan that would be made 2 years from now;
  - Notation: 2y1y rate of a 1-year loan to be made 2 years from now.
- **Relationship Between Forward Rates and Spot Rates**

$$(1+\mathrm{Z_N})^{\mathrm{N}} = (1+\mathrm{Z_1})(1+1\mathrm{y}1\mathrm{y})\ldots(1+(\mathrm{N}-1)\mathrm{y}1\mathrm{y})$$

- **Valuation Using Forward Rates**

$$\text{bond value} = \frac{CF_1}{(1+Z_1)} + \frac{CF_2}{(1+Z_1)(1+1\mathrm{y}1\mathrm{y})} + \ldots\ldots + \frac{CF_N}{(1+Z_1)(1+1\mathrm{y}1\mathrm{y})\ldots(1+(\mathrm{N}-1)\mathrm{y}1\mathrm{y})}$$

Par and Forward Rates

- **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

Maturity Structure of Interest Rates and Spot Rates

- Suppose that the one-year spot rate is 2%, the two-year spot rate is 3%, and the three-year spot rate is 5.123%. Then, the price of a three-year bond that makes a 5% annual coupon payment is 100.

$$\frac{5}{(1.02)^1}+\frac{5}{(1.03)^2}+\frac{105}{(1.05123)^3}=4.902+4.713+90.385=100$$

  - PR_3 (5%) < S_3 (5.123%)
  - When spot curve is upward sloping, par curve **lies below** spot curve.

Maturity Structure of Interest Rates and Spot Rates

- Suppose that the one-year spot rate is -4%, the two-year spot rate is -3%, the price of a three-year bond that makes a -2% annual coupon payment is 100.
- Calculate three-year spot rate.

$$\frac{-2}{(1-4\%)^1}+\frac{-2}{(1-3\%)^2}+\frac{98}{(1-2.0268\%)^3}=-2.0833-2.1256+104.2089=100$$

  - Three-year spot rate is -2.0268%
  - PR_3 (-2%) > S_3 (-2.0268%)
  - When spot curve is **upward sloping but negative rates**, par curve **lies above** spot curve.

Example

Par and Forward Rates

- Assuming the following spot and forward rates:
  - Current 1-year spot rate is 1.88%.
  - One-year forward rate one year from today is 2.77%.
  - One-year forward rate two years from today is 3.54%.
  - One-year forward rate three years from today is 4.12%.

The value of a 4-year, 3.75% annual-pay, $100 par value bond is *closest* to:

A. $101.618
B. $102.637
C. $99.677

- Correct answer: B
  - Bond value = $\frac{3.75}{1.0188}+\frac{3.75}{1.0188\times1.0277}+\frac{3.75}{1.0188\times1.0277\times1.0354}+\frac{103.75}{1.0188\times1.0277\times1.0354\times1.0412}$ = 102.637

Summary

The Term Structure of Interest Rates: Spot, Par, and Forward Curves

Par and Forward Rates

Par Rates from Spot Rates, Forward Rates from Spot Rates

Bond Pricing with Forward Rates, Compare the spot curve, par curve, and forward curve

Module

Interest Rate Risk and Return

1. Investment Horizon and Interest Rate Risk
2. Macaulay Duration

Investment Horizon and Interest Rate Risk

- Interest Rate Risk
- Duration Gap

Investment Horizon and Interest Rate Risk

- **Two offsetting types of interest rate risk**
  - **Coupon reinvestment risk**: uncertainty about income from reinvesting coupon payments.
    - ✓ Increases with a higher coupon rate and a longer investment horizon.
  - **Price risk**: uncertainty about a bond price
    - ✓ Bond price will fall as interest increase, therefore negative price risk.
    - ✓ increase in interest rates is beneficial for coupon reinvestment, has positive reinvestment risk.
- These risks offset each other: an **increase** in YTM **decreases** a bond's price but **increases** its reinvestment income.
  - Short investment horizon: longer duration
    - ✓ 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

Investment Horizon and Interest Rate Risk

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

Investment Horizon and Interest Rate Risk

- **Duration gap**

$$\text{Duration gap} = \text{Mac. D} - \text{investment horizon}$$

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

Example

Investment Horizon and Interest Rate Risk

- 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.

- Correct answer: 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.

Macaulay Duration

- Macaulay Duration

Macaulay Duration

- **Macaulay duration (Mac.D)** is the weighted average of the time to receipt of the bond's cash flows, where the weights of each cash flow in the calculation are each cash flow's share of the bond's full price.
  - **Mac.D**

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

Example

Macaulay Duration

- 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.

- Correct answer: B

period	Cash flow	Present value	weight	Period × weight
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

Example

Macaulay Duration

- Consider a bond that has three years remaining to maturity and a coupon of 4% paid semiannually and is priced at 100. The bond's annualized Macaulay duration is closest to:

  A. 2.801 years.

  B. 2.857 years.

  C. 3.000 years.

- Correct answer: B

period	Cash flow	Present value	weight	Period × weight
1	2	1.961	0.0196	0.01961
2	2	1.922	0.0192	0.03845
3	2	1.885	0.0189	0.05654
4	2	1.848	0.0185	0.07391
5	2	1.811	0.0181	0.09057
6	102	90.573	0.9057	5.43438
		100	1.000000	5.71346
Annualized Mac.D				2.857

Example

Macaulay Duration

- Consider a bond that has five years remaining to maturity, a coupon of 0.5% paid annually, and a yield-to-maturity of –0.20%. Assume it is 91 days into the first coupon period and a 30/360 basis. The bond's annualized Macaulay duration is closest to:

  A. 4.2371.

  B. 4.5054.

  C. 4.6987.

- Correct answer: C

period	Time to Receipt	Cash flow	Present value	weight	Period × weight
1	0.7472	0.5	0.5007	0.0048	0.0036
2	1.7472	0.5	0.5018	0.0048	0.0085
3	2.7472	0.5	0.5028	0.0049	0.0133
4	3.7472	0.5	0.5038	0.0049	0.0182
5	4.7472	100.5	101.4597	0.9806	4.6550
			103.4687	1.000000	4.6987

Summary

Interest Rate Risk and Return

Macaulay Duration

Macaulay Duration

Module

Yield-Based Bond Duration Measures and Properties

1. Different types of Yield Duration
2. Properties of Duration

Different types of Yield Duration

- Modified duration
- Money duration
- Price value of a basis point (PVBP)

Different types of Yield Duration

- **Duration** measures the sensitivity of the bond's **full price** to changes in interest rates.
  - **Yield duration (with respect to the bond's own YTM)： underlying CF are certain**
    - ✓ **MD (Modified duration)**

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

    - ✓ **Approximate modified duration**

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

Different types of Yield Duration

- **Money duration/dollar duration:** linear approximation of the bond price change. Usually used to measure a 1% change in yield.
  - Money duration=annual MD * full price of bond
  - $\%\Delta PV^{Full} \approx -MoneyDur \times \Delta yield$
- **Price value of a basis point (PVBP)**: is the money change in full price of a bond when its YTM changes by one basis point (0.01%).

$$PVBP = P \times D \times 1bp \qquad PVBP = \frac{V_- - V_+}{2}$$

Different types of Yield Duration

- **Duration of Perpetuity**
  - 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.
    - ✓ Mac. D= (1 + r)/r, as N approaches infinity.

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

$$\frac{dP}{dy} = -\frac{1}{y} \times \frac{C}{y} = -\frac{1}{y} \times P = -MD \times P$$

$$MD = \frac{1}{y}$$

$$Mac.D = \frac{1+y}{y}$$

Different types of Yield Duration

- **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.

Example

If there are 180 days in the coupon period and 57 days have passed since the last coupon, the Macaulay duration is:

Correct Answer:

$$MacDur_{Floating} = \frac{(180-57)}{180} = 0.683333$$

Example

Different types of Yield Duration

- An annual-pay coupon bond has a coupon rate of 14% and six years to maturity. The bond is currently trading at par. Assuming a 25bps change in yield, the bond's approximate modified duration is *closest* to:

A. 0.392.
B. 3.888.
C. 3.970.

- Correct answer: B
  - V_- = 100.979
    - ✓ N = 6; PMT = 14.00; FV = 100; I/Y = 13.75; CPT → PV = –100.979
  - V_+ = 99.035
    - ✓ I/Y = 14.25; CPT → PV = –99.035
  - V_0 = 100.000
  - Δy = 0.0025
  - Approximate modified duration = $\frac{V_- - V_+}{2V_0 \Delta YTM} = \frac{100.979-99.035}{2\times100\times0.0025} = 3.888$

Properties of Duration

- How a bond's maturity, coupon, and yield level affect its interest rate risk

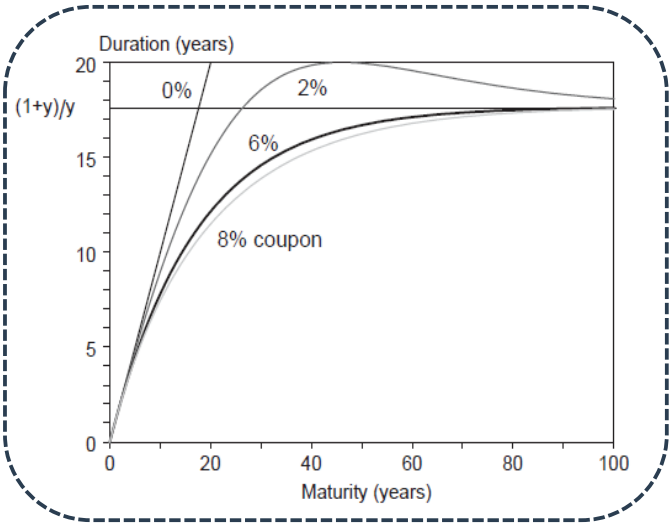
Properties of Duration

- **Coupon effect:** 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.
- **Maturity effect:** 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.

Properties of Duration

- **Effects of bond characteristics on duration**
  - Longer maturity, higher duration;
  - Lower coupon, higher duration;
  - Lower market yield, higher duration;
  - Bond with embedded options (callable bond & putable bond) has lower duration.
- **注:**
  - $D_{perpetuity} = (1+y)/y$
  - $D_{zero\text{-}coupon\ bond} = M_{zero\text{-}coupon\ bond}$
  - $D_{discount} > D_{premium}$
  - $D_{discount}$ 随着时间的变化先增加后减小，并不是时间越长，duration越大。

Properties of Duration



Example

Properties of Duration

- Which of the following bonds (similar except for yield and maturity) has the *least* Mac.D? A bond with:
  - A. 6% yield and 10-year maturity.
  - B. 5% yield and 10-year maturity.
  - C. 5% yield and 20-year maturity.

- Correct Answer: A.
  - Other things equal, Mac.D is less when yield is higher and when maturity is shorter. The bond with the highest yield and shortest maturity must have the lowest Mac.D.

Summary

Yield-Based Bond Duration Measures and Properties

Properties of Duration

How a bond's maturity, coupon, and yield level affect its interest rate risk

Module

Yield-Based Bond Convexity and Portfolio Properties

1. Convexity
2. Portfolio Duration and Convexity

Convexity

- Convexity
- Convexity adjustment

Convexity

- **Convexity** is a measure of the curvature of the price-yield curve.
  - Convexity is a complementary risk metric that measures the **second-order (non-linear) effect** of yield changes on option-free fixed-rate bond price. Modified duration measures the first-order (linear) effect.

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

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

Convexity

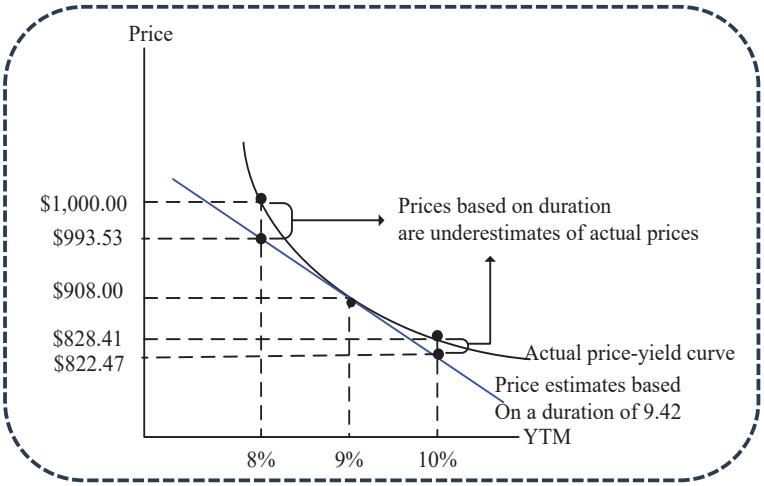
- **Convexity**
  - The **convexity adjustment** is always positive when convexity is positive.

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

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

  - ✓ Money convexity of the bond is the annual convexity multiplied by the full price.
  - ✓ **Convexity adjustment is most useful** for large yield changes, because duration provides a good measure for small yield changes.

Convexity



Convexity

- **Convexity properties**
  - 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. For two bonds with the same duration, the one with the greater dispersion of cash flows has greater convexity.

Example

Convexity

- A bond has an MD of 7 and a reported convexity of 0.55. Assuming a decline in yield of 100 basis points, the estimated percentage change in the bond's price is closest to:

  A. 8.89%.

  B. 7.28%.

  C. 9.05%.

- Correct answer: B
  - Total estimated price change = (duration effect + convexity effect)
  - $\Delta P/P = -7 \times (-1\%) + 0.5 \times 55 \times (-1\%)^2 = 0.07 + 0.0028 = 0.0728$

Portfolio Duration and Convexity

- Portfolio Duration
- Portfolio Convexity

Portfolio Duration and Convexity

- **Portfolio duration:**
  - **Method 1**: the weighted average of time to receipt of the aggregate cash flows.
    - ✓ This method is better ***theoretically but difficult to use in practice*****.**
  - **Method 2:** Using the weighted averages of the durations and convexities of the individual bonds that make up the portfolio

$$\textbf{Portfolio duration} = w_1D_1 + w_2D_2 + \ldots\ldots + w_nD_n$$

$$\textbf{Portfolio convexity} = w_1C_1 + w_2C_2 + \ldots\ldots + w_nC_n$$

    - ✓ ***Commonly used*** by fixed-income portfolio managers. The main advantage is easily used.
    - ✓ The shares of overall portfolio **market value** are the weights.
    - ✓ **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).**

Example

Portfolio Duration and Convexity

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

Bond	Maturity	Market Value	Book Value	Coupon	Yield-to-Maturity	MacD
A	6 years	200,000	185,000	2.00%	6%	5.56
B	10 years	100,000	80,000	2.40%	5%	8.24
C	15 years	100,000	100,000	5.00%	5%	10.68

- The bond portfolio's MD is closest to:

A. 7.13.

B. 8.08.

C. 8.20.

- Correct Answer: A.

Summary

Yield-Based Bond Convexity and Portfolio Properties

Portfolio Duration and Convexity

Portfolio Duration, Portfolio Convexity

Module

Curve-Based and Empirical Fixed-Income Risk Measures

1. Curve Duration and Convexity

Curve Duration and Convexity

- Effective duration
- Effective convexity

Curve Duration and Convexity

- **Curve Duration and Convexity**
  - Yield duration and convexity assume a bond's cash flows are **certain**.
  - However, if a bond has contingency features, such as embedded options, as with a callable bond, then future cash flows are **uncertain** since option exercise depends on the level of market interest rates relative to coupon interest being paid.
    - ✓ do not have well-defined yields-to-maturity, so Macaulay and modified durations are **not** appropriate interest rate risk measures for such bonds.
    - ✓ Effective duration: measure of interest rate risk is the sensitivity of the bond's price to a change in a **benchmark yield curve**, such as the government par curve.

Curve Duration and Convexity

- **Effective duration**

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

- **Effective Convexity**

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

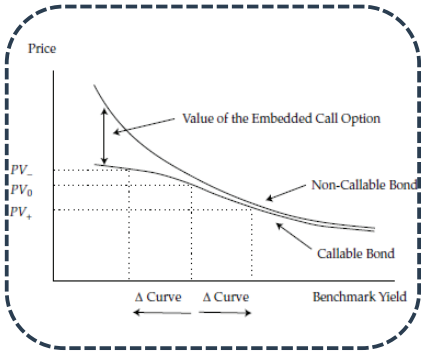
- Effective duration and effective convexity can be used to estimate the percentage change in a bond's full price for a given shift in the benchmark yield curve (Δcurve)

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

Curve Duration and Convexity

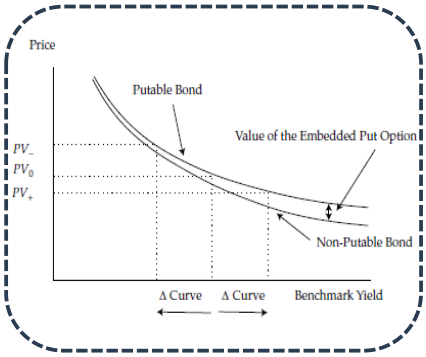
Callable

- ➢ High yield →unlikely call, → positive convexity.
- ➢ Yield decline → may call the bond →**negative convexity.**



Putable

- ➢ price/yield relationship will be **more convex** when yield increase.



Summary

Curve-Based and Empirical Fixed-Income Risk Measures

Curve Duration and Convexity

Effective duration, Effective convexity

Module

Credit Risk

1. Sources of Credit Risk

Sources of Credit Risk

- The Cs of Credit Analysis
- Measure Credit risk

Sources of Credit Risk

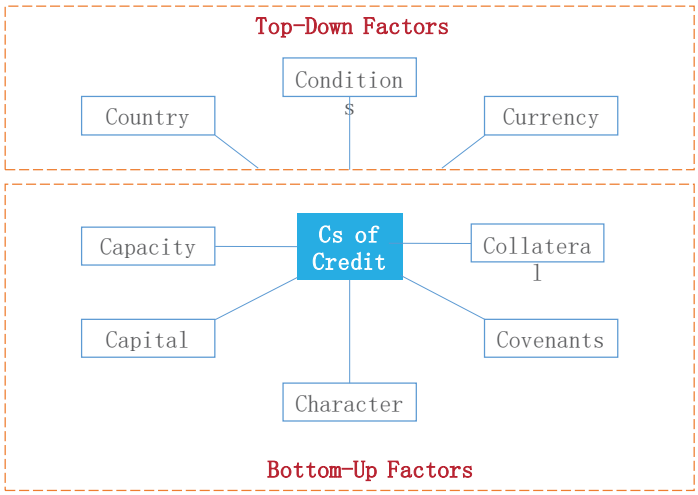
- **Credit risk:** expected economic **loss** under a potential borrower default over the life of the contract.
- **Default:** A borrower that fails to meet its promised interest and/or principal payment obligations under a bond or loan contract
- **Five of these criteria** are related to the specific 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.

Sources of Credit Risk

- **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**.

Sources of Credit Risk

- **The Cs of Credit Analysis**



Sources of Credit Risk

- **Credit risk** is the risk of loss resulting form the borrower (issuer of debt) failing to make full and timely payments of interest and/or principal. It has two components.
  - **Default risk**, or **probability of default**, is the probability that a borrower defaults
  - **Loss severity**, or **loss given default,** in the event of default, is the portion of a bond's value (including unpaid interest) an investor loses.
- **Expected loss = Default probability × Loss given default × (Expected Exposure-Collateral)**
  - Loss severity given default = 1 – Recovery rate
  - **Recovery rate** is the percentage of the principal amount recovered in the event of default.
- 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 ≈ POD × LGD, where LGD = EE × (1 – RR)

Example

Sources of Credit Risk

- A EUR500,000 loan has the following characteristics:
  - Probability of default 5%
  - Collateral EUR100,000
  - Recovery rate 90%
  - Expected exposure EUR400,000
- The expected loss for this loan in event of default is:

A. EUR1,500
B. EUR2,000.
C. EUR20,000.

Example

Sources of Credit Risk

- Correct Answer: A
  - We solve for expected loss (EL) as follows:
  - EL = POD × (EE – Collateral) × (1 – RR).
  - Since probability of default (POD) is 5%, expected exposure (EE) is EUR400,000, collateral is EUR100,000, and the recovery rate (RR) is 90%:
  - EL = EUR1,500 = 0.05 × (400,000 – 100,000) × (1 – 0.9).

Summary

Credit Risk

Sources of Credit Risk

The Cs of Credit Analysis, Credit risk

Module

Credit Analysis for Government Issuers

1. Sovereign Credit Analysis
2. Non-Sovereign Credit Risk

Sovereign Credit Analysis

- Qualitative Factors
- Quantitative Factors

Sovereign Credit Analysis

- **Qualitative Factors:**
  - **1. Government Institutions & Policy**
    - ✓ 1) This factor addresses the role of sovereign government institutions and policies in **improving political and economic stability. (ability to pay)**
    - ✓ 2) In addition to a sovereign government's ability to pay, we must also consider its **willingness to pay.**
      - Willingness is important because principle of **sovereign immunity**
        - It is difficult for investors to force a sovereign government to declare bankruptcy or liquidate its assets to settle debt claims as would be the case for a corporate issuer.

Sovereign Credit Analysis

- **Qualitative Factors:**
  - **2. Fiscal Flexibility**
    - ✓ Sovereign governments are also evaluated on how well they establish and maintain **fiscal discipline** over time and under different economic conditions, such as reduce deficit.
  - **3. Monetary Effectiveness**
    - ✓ **Central bank independence** from the public Treasury **reduces the likelihood** that a sovereign government will **monetize their domestic debt**, driving domestic inflation higher and reducing the external value of the domestic currency.
      - Simply print money to purchase gov debt.
  - **4. Economic Flexibility**
    - ✓ available to tax and service debt is usually the primary source of debt repayment.
    - ✓ Key factors important in gauging creditworthiness include not only the size of an economy and level of per capital income, but also the degree of **economic diversification** and **economic growth potential.**

Sovereign Credit Analysis

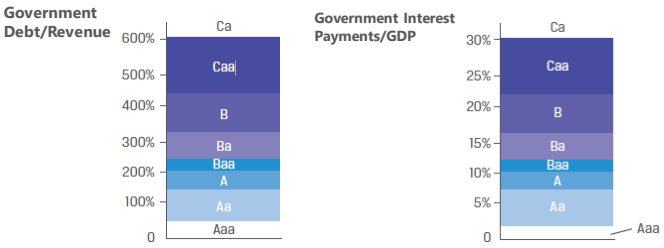
- **Qualitative Factors:**
  - **5. External Status**
    - ✓ A key distinction for the creditworthiness of a sovereign government is whether its domestic currency is considered to be a **reserve currency**
      - That is fully convertible and frequently held by foreign central banks and other investors as a portion of their foreign exchange reserves.
      - minimizes the likelihood of sovereign default and increases a government's ability to sustain budget deficits and a higher level of debt.

Sovereign Credit Analysis

- **Quantitative Factors:**
  - **1. Fiscal Strength**
    - ✓ **Debt burden:** both its current and expected future debt burden
      - **higher** debt burden ratio is associated with **lower** credit quality
    - ✓ Debt affordability
      - Debt coverage, with a **higher** ratio also a sign of **lower** credit quality

Fiscal Strength

Debt Burden	Debt Affordability
Debt to GDP: General Government Debt / GDP	*Interest to GDP:* Government Interest Payments / GDP
Debt to Revenue: *General Government Debt* / *Revenue*	*Interest to Revenue:* Government Interest Payments / Revenue



Sovereign Credit Analysis

- **Quantitative Factors:**
  - **2. Economic Growth and Stability**
    - ✓ The **economy's size** as measured by **GDP** as well as its **per capita income** are important factors in gauging a country's economic prospects.
    - ✓ **Economic growth** levels as well as their **variability** also important.

Economic Growth and Stability

Growth and Volatility	Size and Scale
Average Real GDP Growth: $\frac{\text{Real GDP}_t - \text{Real GDP}_{t-1}}{\text{Real GDP}_{t-1}}$	Size of Economy: GDP in PPP terms
Real GDP Growth Volatility: Standard Deviation (Real GDP)	Per Capita GDP: $\frac{\text{GDP}}{\text{Population}}$

Sovereign Credit Analysis

- **Quantitative Factors:**
  - **3. External Stability**
    - ✓ focus on the relative size of external debt as compared to available sources of repayment.
      - Country with **reserve currency** exhibit **greater** external stability.
      - For **non-reserve currency**, key factor is its **external liquidity and solvency.** That is, the short- and long-term ability to generate **sufficient, stable, diversified foreign currency cash inflows** is important.

External Stability

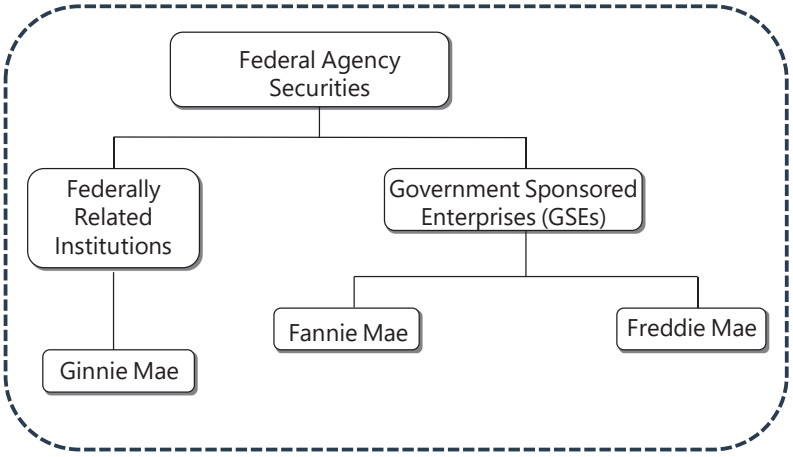
Currency Reserves	External Debt
FX Reserves to GDP: FX Reserves / GDP	*External Debt Burden:* LT External Debt / GDP
Reserve Ratio: *FX Reserves* / *External Debt*	*External Debt Due:* External Debt Due in 12m / GDP

Non-Sovereign Credit Risk

- Types of Non-Sovereign Government Debt

Non-Sovereign Credit Risk

- **1. Agencies:** issued by entities created by national government and may be explicitly or implicitly backed by government.



Non-Sovereign Credit Risk

- **2. Government Sector Banks and Development Financing Institutions**
  - Similar to agencies, these institutions are usually created or supported by the sovereign government and enjoy a similar rating.
- **3. Supranational Issuers**
  - issued by supranational agencies (multilateral agencies) that operate across national.
  - High credit quality and can be very liquid, especially large issues of well-known entities.
  - E.g. World bank, the IMF, the Asian Development Bank.

- **4. Regional Government Issuers**
  - These include provincial, state, and local governments, referred to as municipal bonds in the US and most often as local authority bonds elsewhere.
  - 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.
      - Debt service coverage ratio (DSCR): a measure of revenue available to cover principal and interest payments. Higher, safer.

Summary

Credit Analysis for Government Issuers

Non-Sovereign Credit Risk

Non-Sovereign Government Debt

Module

Credit Analysis for Corporate Issuers

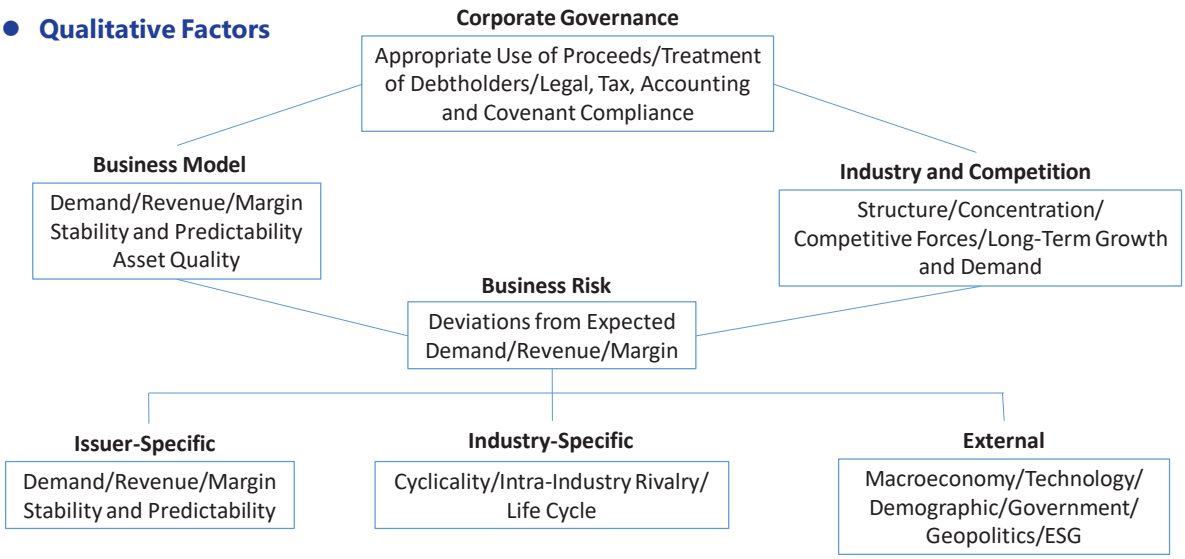
1. Corporate Credit Analysis
2. Seniority Rankings, Recovery Rates, and Credit Ratings

Corporate Credit Analysis

- Qualitative and quantitative factors
- Financial ratios used in credit analysis

Corporate Credit Analysis

- **Qualitative Factors**

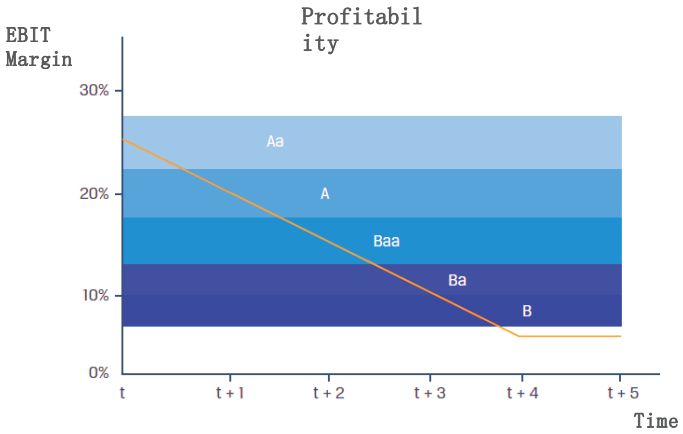


Corporate Credit Analysis

- **Corporate Governance**
  - Management's past track record in the treatment of bondholders is an important consideration. For example, if management pursued business or financial strategies that resulted in major credit rating downgrades—such as an overleveraged debt-financed acquisition, a large debt-financed special dividend to shareholders, or a major debt-financed stock buyback program—credit analysts should look closely at the borrower's character.
  - Credit analysts should also evaluate accounting policies. Aggressive accounting policies mask the performance and the risk of the underlying business and are potential warning flags to the true character of the business and its leaders. Examples may include the use of significant off-balance-sheet financing, the preference for capitalizing versus immediately expensing items, and early and premature revenue recognition. Perhaps the **most important red flag** is **changing auditors or CFOs frequently.** These potential warning flags, as well as any evidence of fraud or malfeasance, may signal other behaviors or actions that may adversely impact an issuer's creditworthiness.

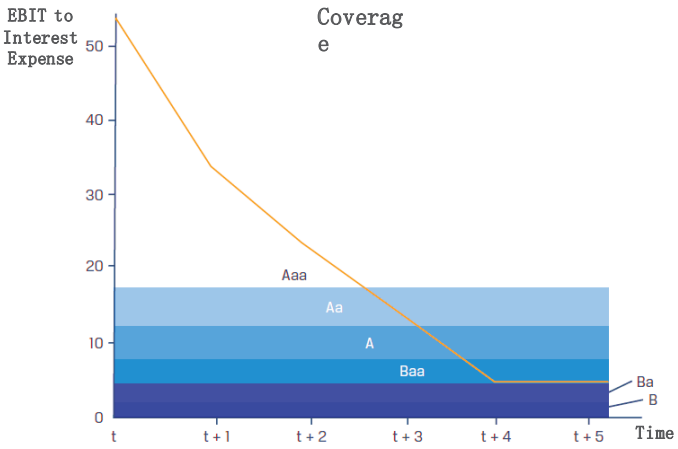
Corporate Credit Analysis

- **Financial ratios used in credit analysis**
  - **1. 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.**



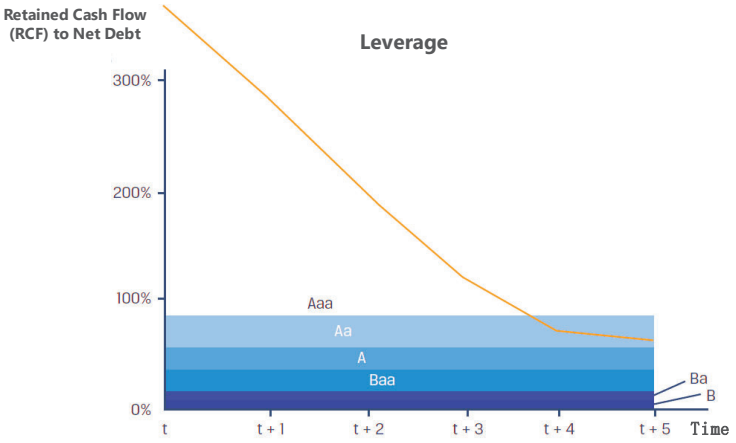
Corporate Credit Analysis

- **Financial ratios used in credit analysis**
  - **2. 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.**



Corporate Credit Analysis

- **Financial ratios used in credit analysis**
  - **3. Leverage,** such as **Debt to EBITDA or Debt to Capital, FCF to debt,** lower leverage, higher credit quality.
  - **4. Liquidity:** often consider availability of short-term resources to pay interest or principal and committed line of bank credit.



Seniority Rankings, Recovery Rates, and Credit Ratings

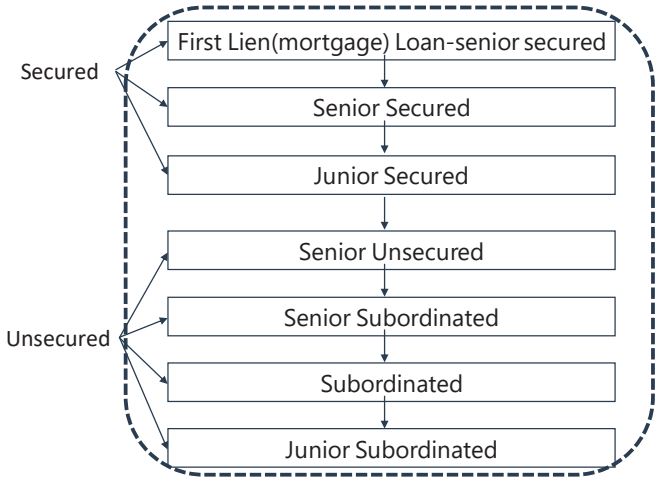
- Seniority rankings
- Recovery Rates
- Issuer and Issue Ratings

Seniority Rankings, Recovery Rates, and Credit Ratings

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

Seniority Rankings, Recovery Rates, and Credit Ratings

- **Seniority Ranking**



Seniority Rankings, Recovery Rates, and Credit Ratings

- **Priority of claims:** in the event of default, unsecured debtholders 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.
    - ✓ **First mortgage debt** refers to the pledge of a specific property (e.g., a power plant for a utility or a specific casino for a gaming company).
    - ✓ **First lien debt** refers to a pledge of certain assets that could include buildings but might also include property and equipment, licenses, patents, brands, and so on.
    - ✓ If the value of the pledged property is less than the amount of the claim, then the difference becomes a senior unsecured claim.
  - **Unsecured debt** is often referred to as debentures. Unsecured bondholders have only a general claim on an issuer's assets and cash flow.
    - ✓ Senior unsecured debt is the most common type of corporate bond.

Seniority Rankings, Recovery Rates, and Credit Ratings

- **Priority of claims is not always absolute.**
  - The priority of claims in bankruptcy:
    - ✓ secured creditors > unsecured creditors
    - ✓ senior creditors > junior creditors
  - In practice, however, more junior creditors and even shareholders may receive some consideration without more senior creditors being paid in full.
  - In the U.S., the bias is toward reorganization and recovery of companies in bankruptcy. In the UK, the bias is toward liquidation of companies in bankruptcy and maximizing value to the banks and other senior creditors.
  - Bankruptcy and bankruptcy laws are vary complex and can vary greatly by country.

Seniority Rankings, Recovery Rates, and Credit Ratings

- **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.
- **Cross default provisions** are provisions whereby events of default such as non-payment of interest on one bond trigger default on all outstanding debt; implies the same default probability for all issues.
- **Structural subordination**
  - When a corporation with a holding company structure has debt at both its parent holding company and operating subsidiaries, debt at the operating subsidiaries will get serviced by the cash flow and assets of the subsidiaries before funds can be passed ("upstreamed") to the holding company to service debt at that level.

Seniority Rankings, Recovery Rates, and Credit Ratings

- **Issuer credit rating**: address an obligor's overall creditworthiness – its ability and willingness to make timely payments of interest and principal on its debt.
  - Issuer credit rating usually applies to its senior unsecured debt.
- **Issue ratings** refer to specific financial obligations of an issuer and take into consideration such factors as ranking in the capital structure (e.g., secured or subordinated).
- **Notching** is a ratings adjustment methodology where specific issues from the same borrower may be assigned different credit ratings.
  - As a general rule, the higher the senior unsecured rating, the smaller the notching adjustment will be. For lower-rated credits, the risk of default is greater and thus the potential difference in loss from a lower (or higher) priority ranking is a bigger consideration in assessing an issue's credit riskiness. Thus, the rating agencies will typically apply larger rating adjustments.

Summary

Credit Analysis for Corporate Issuers

Seniority Rankings, Recovery Rates, and Credit Ratings

seniority rankings

recovery Rates

issuer and Issue Ratings

Module

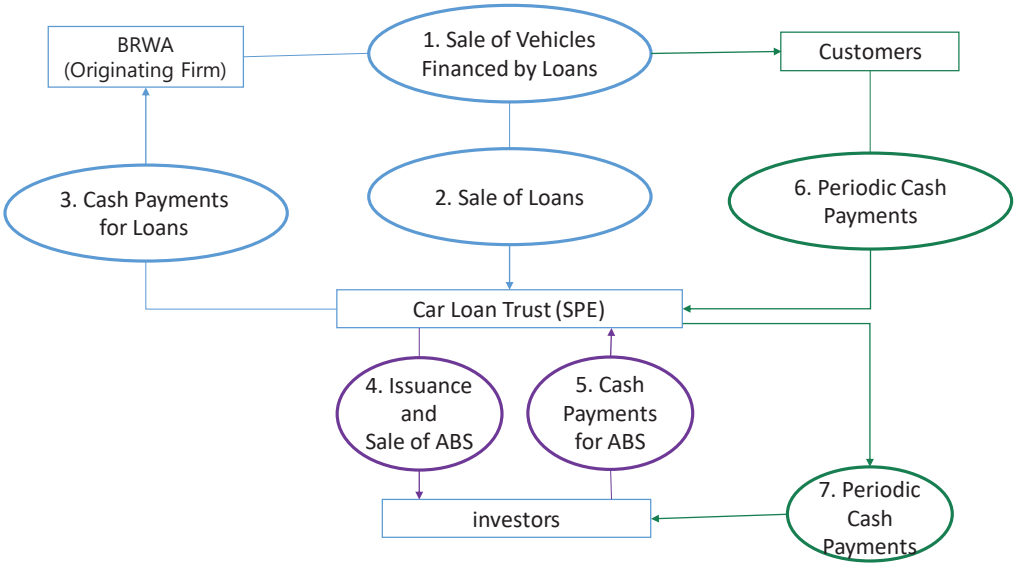
Fixed-Income Securitization

1. The Securitization Process

The Securitization Process

- Securitization Process
- Parties to a Securitization

The Securitization Process



The Securitization Process

- **Parties to a Securitization**
  - **Three main parties**:
    - ✓ The seller of the collateral（originator or depositor, e.g. Bank）
      - Purchase agreement
      - Prospectus: structure of the securitization, priority and amount of payment, credit enhancement
    - ✓ The SPE（issuer）
    - ✓ The servicer of the loans

The Securitization Process

- **Benefits of SPE in securitization: sell the loan to SPE instead of using it as collateral**
  - Protect investors from the seller's bankruptcy
    - ✓ SPE is a **bankruptcy-remote** vehicle.
      - Assets belong to the SPE, not to the entity that sold the assets to the SPE in exchange for funds
    - ✓ The only credit risk that the investors face is the risk that the borrowers default on their loans.
      - Thus, lower cost compared with corporate bond when issued by same collateral.

Summary

Fixed-Income Securitization

The Securitization Process

Securitization Process

Parties to a Securitization

Module

Asset-Backed Security (ABS) Instrument and Market Features

1. ABS Structures to Address Credit Risk
2. Non-Mortgage Asset-Backed Securities
3. Collateralized Debt Obligations

ABS Structures to Address Credit Risk

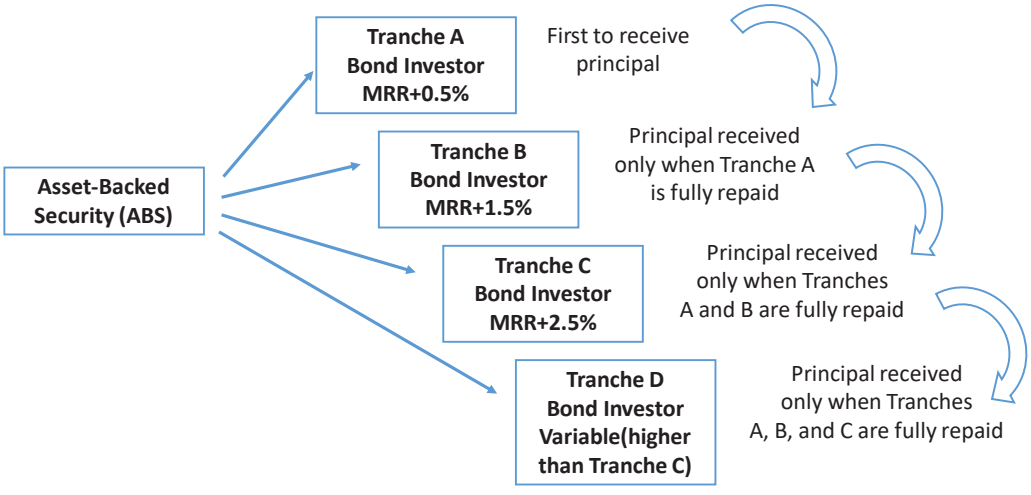
- Credit Enhancement
- Credit Tranching

ABS Structures to Address Credit Risk

- **Credit enhancement:** a variety of provisions used to reduce the credit risk of a bond issue.
  - **Internal credit enhancement**
    - ✓ **Overcollateralization:** the process of posting more collateral than is needed to obtain or secure financing;
    - ✓ **Reserve accounts** or **reserve funds:** provide credit support by paying for possible future losses.
      - **Cash reserve fund:** deposit of cash that can be used to absorb losses.
      - **Excess spread:** difference between the coupon on the underlying collateral and the coupon paid on the securities.
    - ✓ **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.

ABS Structures to Address Credit Risk

- **Credit tranching**:



ABS Structures to Address Credit Risk

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

ABS Structures to Address Credit Risk

- **Limitation of External credit enhancement:**
  - While external credit enhancements increase the credit quality of debt issues and decrease the yields, deterioration of credit quality of the guarantor will also reduce the credit quality of the covered issue.
  - Surety bonds, bank guarantees, and letters of credit expose the investor to **third-party (or counterparty) risk**, the possibility that a guarantor cannot meet its obligations.
  - A **cash collateral account** mitigates this concern because the issuer immediately borrows the credit-enhancement amount and then invests that amount, usually in highly rated short-term commercial paper. Because this is an actual deposit of cash rather than a pledge of cash, a downgrade of the cash collateral account provider will not necessarily result in a downgrade of the bond issue backed by that provider.

Non-Mortgage Asset-Backed Securities

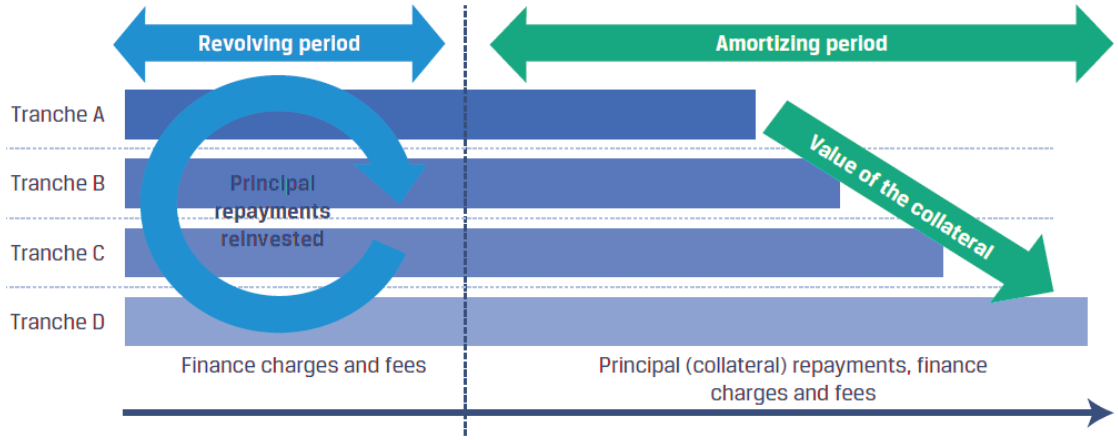
- Credit Card Receivable ABS
- Solar ABS

Non-Mortgage Asset-backed Securities

- **1. Credit Card Receivable ABS:** credit card receivables are used as collateral for the issuance
  - **Underlying asset pool**
    - ✓ **Non-amortizing loans,** do not involve scheduled principal repayment. But in non-amortizing collateral pool, it would happen after lockout period.
    - ✓ **Lockout periods (revolving period):** cash flow paid out based on finance charges and fees.
      - ☐ **After lockout periods:** principal no longer reinvested in acquiring new loans but paid to investors.
  - For a pool of credit receivables, the cash flows consist of
    - ✓ **Finance charges:** periodic interest charged on the unpaid balance after the grace period.
    - ✓ **Fees:** include late payment fees and any annual membership fees.
      - ☐ ABS generate **additional fee income from interest gap**.
    - ✓ **Principal repayments**
      - ☐ "Early amortization" or "rapid amortization" provisions require early principal amortization if specific events occurs, such as significantly defaults; which **decrease** the cost of default risk from credit card debt.

Non-Mortgage Asset-backed Securities

- **Example: Cash Flows from a Credit Card ABS**



Non-Mortgage Asset-backed Securities

- **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.
    - ✓ Sustainability: since the energy payment always exists

Non-Mortgage Asset-backed Securities

- **2. Solar ABS**
  - 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.

Non-Mortgage Asset-backed Securities

- **2. Solar ABS**
  - Usually, solar loan borrowers are prime borrowers that own their homes and have good payment records.
    - ✓ The loans can be **further collateralized** by a lien pledged on the **installed systems, on the property itself**, or **both**.
      - When the solar energy system loans are structured as **residential home improvement loans**, the solar ABS effectively securitizes **a subordinated (junior) mortgage on the property**.
      - Combine **multiple** liens to **lower** default risk.
  - 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.
    - ✓ investor benefit due to diversification benefits from a broader pool.

Collateralized Debt Obligations

- Collateralized debt obligations

Collateralized Debt Obligations

- **Overview of CDO with other securitized products**
  - A typical feature of CLO is that the collateral portfolio is **not finalized until after** the transaction closes. While the collateral manager **acquires most of the loans** before the transaction closes, there is a **subsequent ramp-up period** when additional assets are added to the collateral pool. After this period, the manager may **replace loans** in the portfolio as long as the new asset meets the portfolio selection criteria.

Collateralized Debt Obligations

- **CDO Structure**
  - In a CDO, the collateral pool are not static. There is a need for a **CDO manager**, also called "**collateral manager**", to buy and sell debt obligations for and from the CDO's collateral (that is, the portfolio of assets) to generate sufficient cash flows to meet obligations to the CDO bondholders.
  - These debt obligations are bond classes or tranches and include senior bond classes, mezzanine bond classes, and subordinated bond classes, often referred to as the residual or equity tranches.

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

Collateralized Debt Obligations

- **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.
      - The **residual/equity tranche plays a key role in whether a CLO is viable or not**; the CLO structure has to offer competitive returns for this tranche.

Collateralized Debt Obligations

- **Generic CLO Structure**
  - 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**.
      - One such test is an **overcollateralization test**, which helps to keep the principal value of the pool exceed the principal value of issued notes. If the principal value **declines below** the overcollateralization test **trigger value**, cash will be diverted away from **equity and junior** CLO debt tranches toward **senior debt tranche** investors.
    - ✓ This process effectively **deleverages** the CLO because the cheapest funding source for the CLO, the senior bond class, is reduced.

Collateralized Debt Obligations

	Covered Bonds	**CDO**	**MBS**	**Non-Mortgage ABS**
Collateral	Commercial or residential mortgages, or public sector assets	Leveraged bank loans (CLOs)	Commercial and residential mortgage loans	Credit card receivables (non-amortizing) and Solar lease/loan payments
Impact on Issuer Balance Sheet	Collateral remains on the balance sheet and ringfenced into a separate cover pool	Collateral removed from balance sheet	Collateral removed from balance sheet	Collateral removed from balance sheet
Number of Bond Classes	One bond class with its associated default exposure in its cover pool	Typically several	Typically several	Typically several
Collateral Pool	Unstable with ongoing collateral management	Unstable with ongoing collateral management	Stable	Unstable with ongoing collateral management; a pre-funding period is used by solar ABS post-transaction
Recourse	Dual recourse nature: first on the ringfenced loans in the cover pool and second on the unencumbered assets of the issuing institution	Single recourse nature	Single recourse nature	Single recourse nature

Summary

Asset-Backed Security (ABS) Instrument and Market Features

Collateralized Debt Obligations

Collateralized debt obligations

Module

Mortgage-Backed Security (MBS) Instrument and Market Features

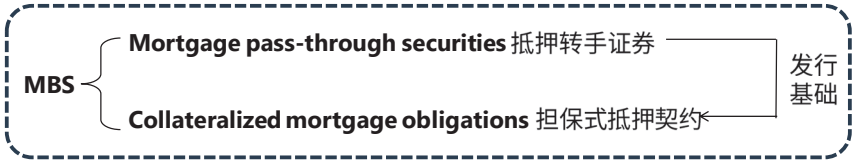
1. Residential Mortgage-Backed Securities (RMBS)
2. Commercial Mortgage-Backed Securities (CMBS)

Residential Mortgage-Backed Securities (RMBS)

- Mortgage Pass-Through Securities
- Collateralized mortgage obligations

Residential Mortgage-Backed Securities

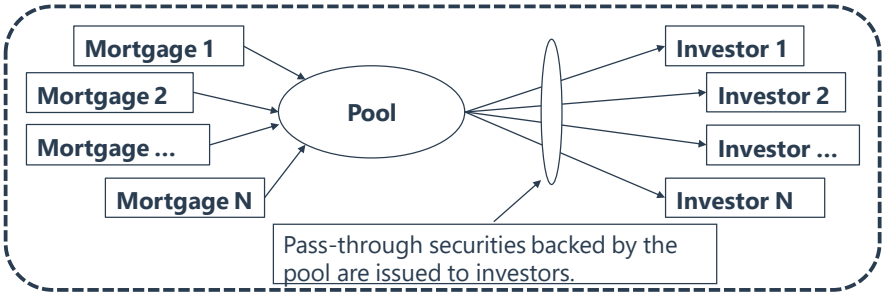
- **Mortgage-Backed Securities**



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

Residential Mortgage-Backed 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

Residential Mortgage-Backed Securities

- **Weighted average maturity (WAM):** the weighted maturities average of all the mortgages in the pool, each weighted by the relative outstanding mortgage balance to the value of the entire pool.
- **Weighted average coupon (WAC):** weight the mortgage rate of each mortgage loan in the pool by the percentage of the mortgage outstanding relative to the outstanding amount of all the mortgages in the pool.
- **Average life** is the weighted average time until both scheduled principal payments and expected prepayments are received.

Residential Mortgage-Backed Securities

- **Example– WAM and WAC**

Mortgage	Interest rate	Beginning Balance (BB)	Current Balance (CB)	Original Term (months)	Number of Months to Maturity (MM)
A	2.50%	EUR300,000	EUR238,000	240	180
B	3.30%	EUR420,000	EUR380,000	600	480
C	2.80%	EUR100,000	EUR87,000	288	240
D	4.00%	EUR280,000	EUR132,000	360	120
E	3.70%	EUR350,000	EUR312,000	384	312
		EUR1,450,000	EUR1,149,000		

$$\text{WAC} = 2.5\%\left(\frac{238,000}{1,149,000}\right) + 3.3\%\left(\frac{380,000}{1,149,000}\right) + 2.8\%\left(\frac{87,000}{1,149,000}\right) + 4\%\left(\frac{132,000}{1,149,000}\right) + 3.7\%\left(\frac{312,000}{1,149,000}\right) = 3.29\%$$

$$\text{WAM} = 180\left(\frac{238,000}{1,149,000}\right) + 480\left(\frac{380,000}{1,149,000}\right) + 240\left(\frac{87,000}{1,149,000}\right) + 120\left(\frac{132,000}{1,149,000}\right) + 312\left(\frac{312,000}{1,149,000}\right) = 313 \text{ months}$$

Residential Mortgage-Backed Securities

- **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.
  - **Time tranching:** Bond classes that posses different expected maturities.
    - ✓ The structure of a securitization that allow the redistribution of prepayment risk among bond classes.

Residential Mortgage-Backed Securities

- **Prepayment risk**
  - **Contraction risk** occurs as **interest rates fall**, **prepayment rates increase**, the security will have a **shorter maturity** than was anticipated at the time of purchase because of refinancing at now-available lower rate.
    - ✓ **Adverse consequence:** reinvestment risk, and reduced the potential price appreciation for the bond.
  - **Extension risk** occurs as interest rates **rise**, prepayment rates **slow**, and the security becomes **longer in maturity** than anticipated at the time of purchase because investors are reluctant to give up the benefits of a contractual interest rate that now looks low.
    - ✓ **Adverse consequence:** higher interest rate reduce the value of CF investor received. And Extension risk stretch out the payments the investor receive.

Residential Mortgage-Backed Securities

- **Creating 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.

Residential Mortgage-Backed Securities

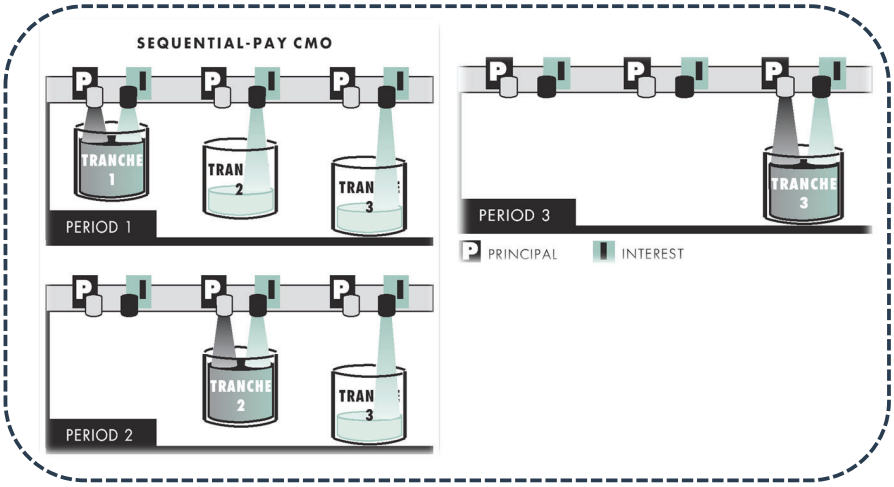
- **Different types of CMOs**
  - **1. Sequential Pay tranches**
    - ✓ Each class of bonds is retired sequentially in sequential pay **CMO.**

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

    - ✓ 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 tranches.

Residential Mortgage-Backed Securities

- **Different types of CMOs**
  - **1. Sequential Pay tranches**



Residential Mortgage-Backed Securities

  - **2. 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.

Commercial Mortgage-Backed Securities (CMBS)

- Commercial Mortgage-backed Securities

Commercial Mortgage-backed Securities

- **CMBS (Commercial mortgage-backed securities)** backed on commercial mortgages, such as
  - Multifamily properties (e.g., apartment buildings).
  - Office buildings, industrial properties (including warehouses).
  - Shopping centers; Hotels.
  - Health care facilities (e.g., senior housing care facilities).
- **Commercial mortgages** are **non-recourse loans**, the lender can look only to the income-producing property backing the loan for interest payments and principal repayments.
- Analysis of CMBS securities **focuses on the property and not the borrower.**
  - Debt-to-service coverage (DSC) ratio= $\frac{\text{net operating income}}{\text{debt service}}$
  - Loan-to-value ratio = $\frac{\text{loan amount}}{\text{property value}}$

Commercial Mortgage-backed Securities

- **Basic CMBS Structure – Call Protection**
  - A critical investment feature that distinguishes CMBS from RMBS is the protection against early prepayments available to investors' known as a **call protection**.
    - ✓ The call protection comes either at the **structure level** or at the **loan level**.
      - In fact, it is this protection that results in CMBS trading in the market more like corporate bonds than like RMBS.

Commercial Mortgage-backed Securities

- **Call protection at the structure level**
  - **Structural call protection** is achieved through **sequential-pay tranches** in the CMBS: A lower-rated tranche cannot be paid down until the higher-rated tranche is completely retired. Principal losses are always borne by the junior tranches first.
- **Call protection at the 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

Commercial Mortgage-backed Securities

- **Basic CMBS Structure - Balloon Maturity Provision**
  - Many commercial loans backing CMBS are balloon loans that require substantial principal payment at maturity of the loan through **a large "balloon" payment.**
  - If the borrower fails to make the balloon payment, the borrower is in default.
    - ✓ The risk that a borrower will not be able to make the balloon payment is called **balloon risk**.
    - ✓ Balloon risk is a type of extension risk.
  - Lender may modify the original loan terms and charge a higher interest rate, called "default interest rate" during the **workout period**.

Summary

Mortgage-Backed Security (MBS) Instrument and Market Features

Commercial Mortgage-Backed Securities (CMBS)

Commercial Mortgage-backed Securities

问题反馈

- 如果您认为金程**课程讲义/题库/视频**或其他资料中**存在错误，欢迎您告诉我们，**所有提交的内容我们会在最快时间内核查并给与答复。
- **如何告诉我们?**
  - 将您发现的问题通过扫描右侧二维码告知我们，具体的内容包含:
    - ✓ 您的姓名或网校账号
    - ✓ 所在班级
    - ✓ 问题所在科目(若未知科目，请提供章节、知识点和页码)
    - ✓ 您对问题的详细描述和您的见解
- **非常感谢您对金程教育的支持，您的每一次反馈都是我们成长的动力。**

求知无坦途。

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