KAPLAN SCHWESER

# Fixed Income

## Basic Features of Debt Securities

**Issuer**
- Sovereign governments
- Non-sovereign governments
- Supranational entities
- Quasi-government entities
- Corporations
- Special purpose entities

**Maturity**
- *Money market:* Original maturity one year or less
- *Capital market:* Original maturity longer than one year
- *Tenor:* Time remaining until maturity

**Coupon**
- Annual interest as a percent of par value
- Fixed or floating rate
- *Periodicity:* Coupon frequency (typically semiannual or annual)
- *Zero-coupon bond:* Issued at pure discount, pays face value at maturity

**Par (face) Value**
- Amount borrowed by issuer
- *Premium:* Price > par value
- *Discount:* Price < par value

**Currency**
- Denomination in which issuer will pay interest and repay principal
- *Dual-currency bond:* Pays interest in one currency and principal in another currency
- *Currency option:* Bondholder has choice of currencies in which to be paid

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# Legal, Regulatory, Tax Considerations

**Indenture (Trust Deed)**
- Contract between issuer and bondholders
- Administered by trustee
- Affirmative covenants: Actions issuer is required to take
- Negative covenants: Restrictions on issuer's actions

**Issuing Entities and Sources of Repayment**
- Governments: Taxes or revenues from projects
- Corporations: Issuer may be parent company or subsidiary
- Special purpose entity: Bankruptcy remote from originating corporation

**National Bond Market**
- *Domestic bonds:* Home currency, domestic issuer
- *Foreign bonds:* Home currency, foreign issuer

**Eurobonds**
- Issued outside jurisdiction of any one country
- Denominated in currency other than that of market in which bonds are sold
- *Global bonds:* Eurobonds that also trade in a national bond market

**Taxation of Fixed-Income Securities**
- Interest taxed as ordinary income
- Capital gains may be taxed at lower rate
- Original issue discount: Price increase to par is considered interest income

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# Fixed Income Cash Flows

**Fixed-Rate Bonds**
- *Bullet structure:* Periodic interest payments, all principal repaid at maturity
- *Fully amortizing:* Equal periodic payments include interest and principal
- *Partially amortizing:* Periodic payments include interest and principal, remaining principal repaid at maturity
- *Sinking fund:* Part of bond issue is redeemed periodically

**Floating-Rate Bonds**
- Coupon rate increases and decreases with market interest rates
- Coupon = reference rate ± margin
- Reference rate typically LIBOR, must match frequency of rate resets
- May have *cap* and/or *floor*
- *Variable rate note:* Margin is not fixed
- *Inverse floater:* Coupon rate changes in opposite direction to market interest rates

**Other Coupon Structures**
- *Index-linked:* Coupon or principal adjusted based on published index
- *Step-up coupon:* Coupon rate increases on a schedule (bonds are typically callable)
- *Deferred coupon:* Payments do not begin immediately after issuance

**Inflation-Linked Bonds (Linkers)**
- *Interest-indexed:* Coupon rate adjusted for inflation, principal remains fixed
- *Capital indexed:* Principal adjusted for inflation, coupon rate remains fixed (e.g., TIPS in U.S.)

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# Contingency Provisions

**Callable Bonds**
- Issuer may repay principal early at call price, typically par or a premium
- Call dates specified in indenture
- *Call protection:* Period after issuance during which bonds are not callable
- Higher yield compared to same bond without embedded call, unless bond has a *make-whole provision*

**Putable Bonds**
- Bondholder may sell bond back to issuer at put price, typically par
- Lower yield compared to same bond without embedded put

**Convertible Bonds**
- Bondholder may exchange bond for specified number of shares of common stock
- Lower yield compared to same bond without conversion feature
- *Contingent convertible* (CoCo): Converts automatically if specified event occurs

**Styles of Embedded Options**
- *American:* Callable any time after first call date
- *European:* Callable only on call date
- *Bermuda:* Callable on specified dates after first call date

**Warrants**
- Bondholder may purchase common shares at specified exercise price, but retains bond
- Lower yield compared to same bond without warrants

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# Primary and Secondary Markets

**Primary Market**
- *Public offerings*: underwritten, best efforts, auctions
- *Private placements*
- *Grey market:* Bonds traded on when-issued basis

**Corporate Debt**
- *Bank loans:* Bilateral (one bank), syndicated (multiple banks)
- *Commercial paper:* Maturity < 270 days in U.S.; maturity < 365 days for Eurocommercial paper
- *Bonds:* Term maturity structure or serial bond issue
- *Medium-term notes:* Buyer specifies desired maturity

**Structured Financial Instruments**

Change risk profile of debt securities (often by combining debt security with a derivative security)
- Asset-backed securities, collateralized debt obligations
- Yield enhancement—credit-linked notes
- Capital protected instruments, participation instruments, leveraged instruments

**Secondary Market**
- Previously issued bonds
- Most bonds trade in dealer/OTC market; some are exchange-traded
- Settlement: T+2 or T+3 for corporate bonds; T+1 or same day for government bonds; same-day for money market securities

**Repurchase Agreements**
- Source of borrowing for dealers
- Sell bond to counterparty, agree to buy back at higher price
- Repo rate = implied interest rate
- Repo margin (haircut): Percent difference between loan amount and bond value

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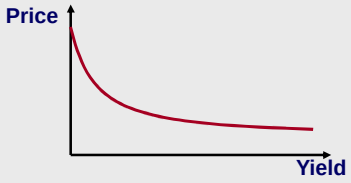
# Fixed Income Valuation

**Price-Yield Relationship**

- Price = PV of future cash flows, discounted at YTM
- YTM↑, price ↓
- YTM ↓, price ↑
- Convex relationship




**Relationships Among Bond Features**

- If coupon rate > YTM, price > par value
- If coupon rate < YTM, price < par value

Other things equal:

- Lower coupon rate increases duration; zero-coupon bonds have greatest duration
- Longer maturity increases duration

Capital gains/losses are measured relative to *constant-yield price trajectory*

**Matrix Pricing**

- Bonds with same credit quality
- Average YTM for each maturity
- Adjust for maturity differences with linear interpolation

**Price Quotations**

- Full (invoice, dirty) price for semiannual = price at last coupon × (1 + YTM/2) $^{\text{days/182}}$
- Full price – Accrued interest = Flat price
- Accrued interest = coupon times portion of coupon period since last coupon (e.g., days/182)
- 30/360 for corporate, actual/actual for government

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# Spot and Forward Rates

**Spot and Forward Rates**

- *Spot rate:* Discount rate for single payment in the future
- *Forward rate:* Rate today for a loan to be made in the future

**Spot Rates From Forward Rates**

Example:

$s_1$ = 3%, 1y1y = 5%, 2y1y = 6%

$(1+s_3)^3 = (1+s_1)\times(1+1y1y)\times(1+2y1y)$

$s_3 = (1.03 \times 1.05 \times 1.06)^{1/3} - 1 = 4.66\%$

Can value bond using forward or spot rates

**Forward Rates From Spot Rates**

Example: To calculate 2y1y:

$(1 + s_3)^3 = (1 + s_2)^2 \times (1 + 2y1y)$

$2y1y = 1.14639 / 1.0815 - 1 = 1.06 = 6\%$

**Yield Curve (Term Structure)**

- Shows similar rates over various maturities
- Spot yield curve (strip curve, zero curve)
- Coupon yield curve
- Par bond yield curve: Derived from spot yield curve

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# Yield Measures

**Fixed Coupon Bonds**

- *Yield-to-maturity (YTM)* assumes bond held to maturity, no default, cash flows can be reinvested at YTM, flat yield curve
- *Effective yield* is compound rate of return
- *Semiannual-bond basis* YTM = 2 × semiannual discount rate
- *Street convention* uses stated coupon dates; *true yield* uses actual coupon dates
- *Current yield* = annual cash flows / bond price
- *Simple yield* adjusts current yield for amortization of premium or discount
- *Yield to call (YTC)* may be calculated to each call date and price; lowest of YTCs or YTM is *yield-to-worst*
- *Option-adjusted yield* removes effect of embedded option from YTM

**Floating-Rate Notes**

- *Quoted margin* is number of basis points added to reference rate
- *Required margin* or *discount margin* is number of basis points required to return price to par at reset date
- If quoted margin < required margin, FRN will be priced at discount
- If quoted margin > required margin, FRN will be priced at premium
- Change in credit quality can cause required margin to be different from quoted margin

**Money Market Yields**

- Discount basis or add-on yields
- 360-day or 365-day years
- *Bond-equivalent yield* is add-on yield using 365-day year

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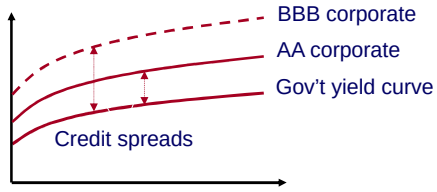
# Yield Spreads

**Spread Considerations**

- Credit spread: Depends on credit rating and economic conditions
- Embedded **call** option will widen spread
- Embedded **put** or **conversion** option will narrow spread
- Greater liquidity or larger issue narrows spread




**Risk Premium:** Taxation, Liquidity, Credit Risk

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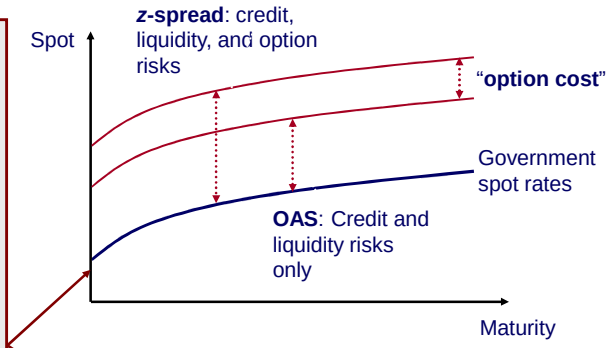
# Yield Spread Measures

**Four Spread Measures**

1. **G-spread**
   = $YTM_{Corporate} - YTM_{Government}$
2. **I-spread:** Basis points over swap rate
3. ***Zero-volatility/z-spread***
   Parallel to government spot rates to get model bond price = actual bond price
4. ***Option-adjusted spread***
   Similar to process of zero-volatility spread but eliminating option cost




**Option-Adjusted Spread**

- Use for bonds with embedded options
- Option cost in basis points = z-spread – OAS
- Option cost > 0 for callables and < 0 for putables

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# Asset-Backed Securities

**Seller**
- Sells financial assets to SPV for cash
- May remain servicer

**Servicer**
- Collects payments from borrowers
- Acts on delinquent accounts

**Special Purpose Entity (SPE)**
- Issues asset-backed securities
- Buys financial assets from seller
- Bankruptcy remote from seller

**Asset-Backed Securities (ABS)**
Bonds backed by pool of financial assets held by SPE

**Pass-through securities**
Cash flows from asset pool (interest, principal) paid pro rata to ABS holders

**Waterfall structure**
Tranches with differing priorities of claims to cash flows from asset pool

**Collateralized debt obligations (CDOs)**
- Bonds backed by managed pool of loans, bonds, MBS, ABS, other CDOs
- Not an MBS—investor cash flow comes from trading debt securities, senior, subordinated, and equity (most risky) tranches
- **Synthetic CDO:** Backed by pool of credit default swaps

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# Asset-Backed Securities

**Agency Residential MBS**
- **GNMA:** Government agency; MBS backed by full faith and credit of U.S. government
- **FNMA, FHLMC:** Government-sponsored enterprises; no explicit guarantee by U.S. government
- Pools may only include conforming loans (e.g., maximum loan-to-value ratio, minimum documentation)
- Issue pass-through securities

**Non-agency Residential MBS**
- May include non-conforming loans
- **External credit enhancement:** Third-party guarantee
- **Internal credit enhancement:** Cash reserve funds, excess spread, overcollateralization, senior/subordinated structure

**Prepayment Risks**
- **Contraction risk:** Faster-than-expected prepayments (typically due to decreasing interest rates) result in earlier return of principal
- **Extension risk:** Slower-than-expected prepayments (typically due to increasing interest rates) result in later return of principal

**Collateralized Mortgage Obligations (CMOs)**
- Bonds backed by pools of MBS
- Tranches with differing exposure to contraction and extension risk
- **Sequential pay CMO:** Principal payments flow to each tranche in sequence until it is paid off
- **Planned amortization class (PAC) CMO:** Scheduled principal payments to PAC classes; contraction and extension risks absorbed by support tranches if prepayment rate remains within initial PAC collar

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# Asset-Backed Securities

**Analyzing Mortgage-Backed Securities**
- **Weighted average maturity** (WAM) and **weighted average coupon** (WAC) of all mortgages in pool
- **Weighted average life** < WAM due to prepayments
- Estimated prepayment rate stated relative to **PSA benchmark** (e.g., 150 PSA)
- **Single monthly mortality rate** (SMM): Percentage by which prepayments reduce month-end principal
- **Conditional prepayment rate** (CPR): Annualized measure of prepayments

**Commercial MBS**
- Backed by mortgages on commercial real estate
- Structured with tranches
- Non-recourse loans; must analyze credit risk of properties instead of borrowers
- **Loan-level call protection:** Prepayment lockout, penalty points, defeasance, yield maintenance charges

**Auto loan ABS**
- Typically 3 to 5 year auto loans
- Prepayments typically result from trade-ins, insurance claims
- ABS include credit enhancement

**Credit card ABS**
- Pool of revolving debt
- **Lockout period:** Interest paid to ABS holders, principal payments used to buy more credit card debt

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# Fixed-Income Risk and Return

**Sources of Return From Fixed Income Investing**

- Cash flows: Coupons, principal payments
- Reinvestment of cash flows
- Possible capital gain/loss if sold before maturity

**Market Price Risk and Reinvestment Risk**

Realized rate of return = YTM if held to maturity

For a short holding period,

market price risk **>** reinvestment risk

- YTM increases: Realized yield < YTM
- YTM decreases: Realized yield > YTM

For a long holding period,
reinvestment risk **>** market price risk

- YTM increases: Realized yield > YTM
- YTM decreases: Realized yield < YTM

**Macaulay Duration (years)**

Weighted-average time until bondholder receives cash flows

- If investment horizon = Mac Dur, market price risk and reinvestment risk just offset each other

**Modified Duration** (yield duration)

Mod Dur = Mac Dur / (1 + YTM)

Approx. ΔPrice = –Mod Dur × **Δyield**

**Approximate modified duration** =

$$\frac{V_- - V_+}{2 \times V_0 \times \Delta yield}$$

**Effective Duration (% x 100)**

Use change in benchmark curve

Approx. ΔPrice = –Eff Dur × **Δcurve**

Must use for bonds with options

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# Interest Rate Risk

**Two Approaches for a Bond Portfolio**

**Cash Flow Yield Approach**

- Calculate weighted-average periods of portfolio cash flows
- Generates an IRR of portfolio but won't work for a portfolio that contains bonds with embedded options

**Weighted-Average Duration Approach**

- Most common
- Duration = $w_1D_1 + w_2D_2 + w_3D_3 + \ldots$
- Approximate % change = –Dur × ΔYTM × 100
- More accurate for small changes in yield

**Price Value of a Basis Point (PVBP)**

- Change in price for a 1-basis point change in yield
- PVBP = | initial price – price after 1 bp change in yield |

**Money Duration**

Mod Dur × full price of bond

**Term structure of yield volatility**—Relation between yield volatility and maturity

- Yield volatility and duration/convexity both contribute to bond price volatility
- Downward sloping: Short-term yields more volatile than long-term yields
- Bond with lower duration but more yield volatility could have more price risk

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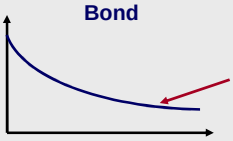
# Interest Rate Risk

**Option-Free Bond**

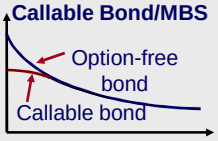


**Interest rate risk = price volatility**

Note the slope is getting flatter from left to right: This is **positive convexity**

- Prices rise at increasing rate as yields fall
- Prices fall at decreasing rate as yields rise

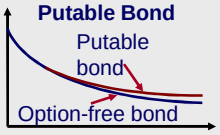
**Callable Bond/MBS**




Moving from left to right, note **negative convexity** at low yields (but positive convexity at higher yields)

- Price compression: As yields ***fall,*** prices ***rise*** at a decreasing rate

**Putable Bond**




As for an option-free bond, curve exhibits **positive convexity** at all yields

- Price compression: As yields ***rise,*** prices ***fall*** at a decreasing rate

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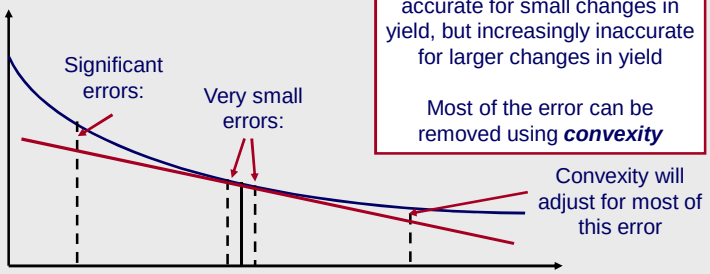
# Interest Rate Risk

**Convexity Improves the Picture**

Duration estimate is quite accurate for small changes in yield, but increasingly inaccurate for larger changes in yield

Most of the error can be removed using ***convexity***




- Approximate convexity = $[V_- + V_+ - 2V_0] / [(\Delta YTM)^2 V_0]$
- Combining duration and convexity, percentage change in full bond price: %Δ full bond price = –annual modified duration (ΔYTM) + ½ annual convexity $(\Delta YTM)^2$

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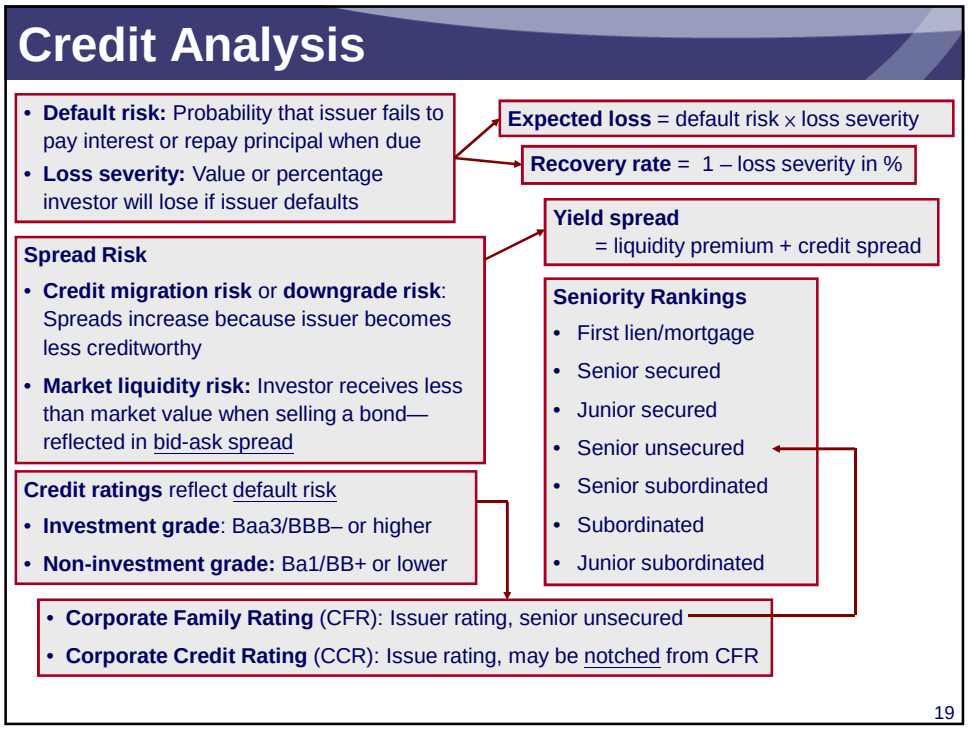
Credit Analysis
• Default risk: Probability that issuer fails to pay interest or repay principal when due
• Loss severity: Value or percentage investor will lose if issuer defaults
Expected loss = default risk x loss severity
Recovery rate = 1 – loss severity in %
Yield spread
= liquidity premium + credit spread
Spread Risk
• Credit migration risk or downgrade risk: Spreads increase because issuer becomes less creditworthy
• Market liquidity risk: Investor receives less than market value when selling a bond—reflected in bid-ask spread
Seniority Rankings
• First lien/mortgage
• Senior secured
• Junior secured
• Senior unsecured
• Senior subordinated
• Subordinated
• Junior subordinated
Credit ratings reflect default risk
• Investment grade: Baa3/BBB– or higher
• Non-investment grade: Ba1/BB+ or lower
• Corporate Family Rating (CFR): Issuer rating, senior unsecured
• Corporate Credit Rating (CCR): Issue rating, may be notched from CFR
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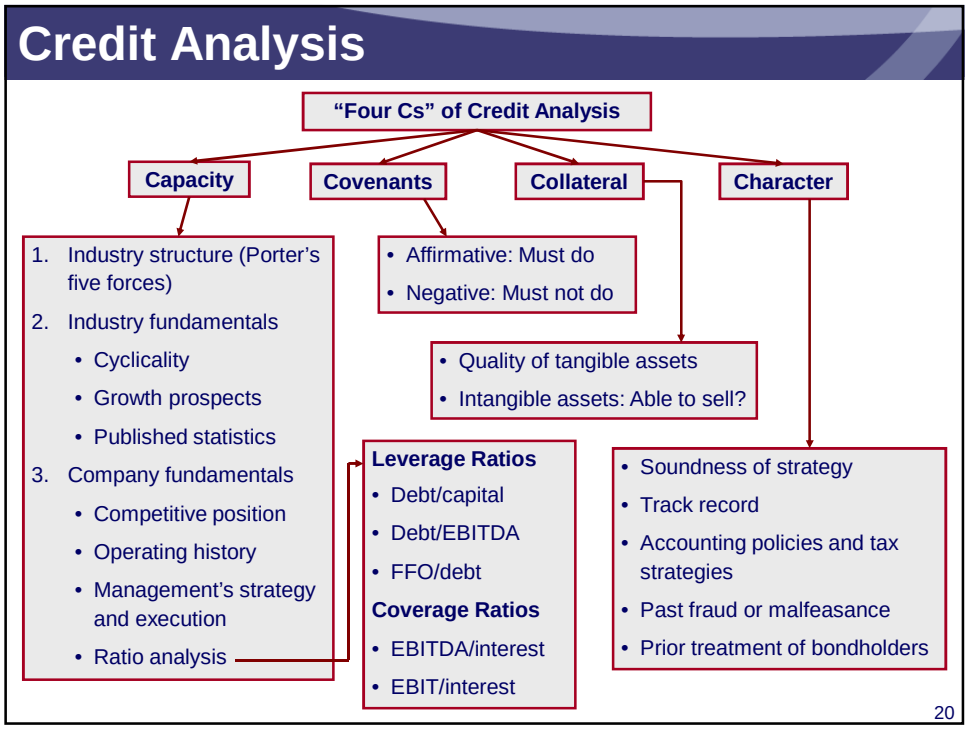
Credit Analysis
"Four Cs" of Credit Analysis
Capacity
Covenants
Collateral
Character
1. Industry structure (Porter's five forces)
2. Industry fundamentals
• Cyclicality
• Growth prospects
• Published statistics
3. Company fundamentals
• Competitive position
• Operating history
• Management's strategy and execution
• Ratio analysis
• Affirmative: Must do
• Negative: Must not do
• Quality of tangible assets
• Intangible assets: Able to sell?
Leverage Ratios
• Debt/capital
• Debt/EBITDA
• FFO/debt
Coverage Ratios
• EBITDA/interest
• EBIT/interest
• Soundness of strategy
• Track record
• Accounting policies and tax strategies
• Past fraud or malfeasance
• Prior treatment of bondholders
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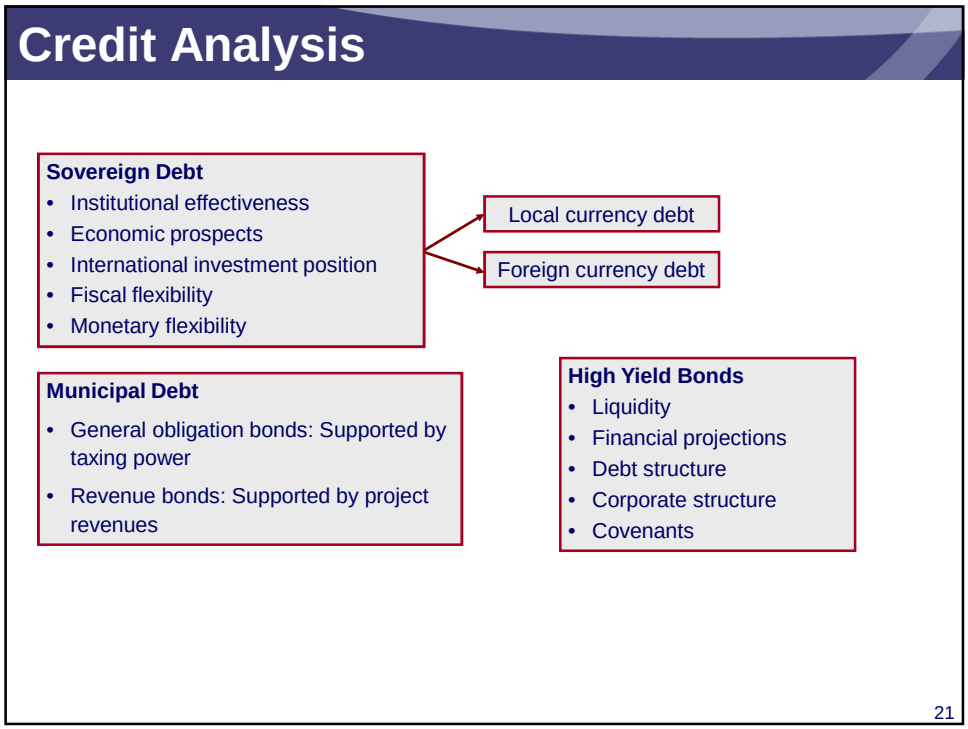
Credit Analysis
Sovereign Debt
• Institutional effectiveness
• Economic prospects
• International investment position
• Fiscal flexibility
• Monetary flexibility
Local currency debt
Foreign currency debt
Municipal Debt
• General obligation bonds: Supported by taxing power
• Revenue bonds: Supported by project revenues
High Yield Bonds
• Liquidity
• Financial projections
• Debt structure
• Corporate structure
• Covenants
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