Lecture 5: Treasury and Corporate Debt Markets

Table of contents

1 Learning Objectives

At the end of this lecture you should be able to:

- Describe the different types of U.S. Treasury securities—including fixed-principal notes and bonds, Treasury Inflation-Protected Securities (TIPS) and stripped securities—and explain how they are issued, traded and quoted.
- Explain the Treasury auction process and the functioning of the Treasury secondary market.
- Distinguish among major federal agency securities—Fannie Mae, Freddie Mac, the Federal Farm Credit Bank System, the Federal Agricultural Mortgage Corporation (Farmer Mac), the Federal Home Loan Bank System and the Tennessee Valley Authority—and summarize their roles and risks.
- Understand the seniority of debt in a corporation's capital structure and how bankruptcy law affects creditor rights.
- Interpret corporate debt ratings and explain how bond covenants and call provisions protect or disadvantage investors.
- Compare the characteristics of medium-term notes, commercial paper, bank loans (including syndicated loans and collateralized loan obligations) and high-yield bonds.
- Evaluate default risk, downgrade risk and credit spread risk for corporate debt instruments.

- Use examples to compute price quotes, accrued interest, yields and credit spreads for treasury bills, corporate bonds and commercial paper.

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2 1 Treasury Securities

The U.S. Treasury issues securities to finance government operations and to manage the national debt. Treasury securities are regarded as default-free because they are backed by the full faith and credit of the U.S. government. There are two broad types of Treasury securities: **fixed-principal (nominal) securities** and **Treasury inflation-protected securities (TIPS)**. A third category—**stripped Treasury securities**—is created in the secondary market.

2.1 1.1 Fixed-Principal Treasury Securities

Fixed-principal securities include **Treasury bills, notes and bonds**.
• **Treasury bills (T-bills)** are zero-coupon securities that mature in one year or less. Because they do not pay periodic interest, they are sold at a discount from par and return the full face value at maturity.
• **Treasury notes** have maturities of two to ten years and pay semiannual coupons.
• **Treasury bonds** have maturities of more than ten years and also pay semiannual coupons.

2.1.1 Example 1 — Pricing a Treasury Bill

A 13-week Treasury bill with face value \$10,000 is quoted at a discount yield of 4.75%. The price is calculated using the bank discount yield formula:

$$P = F\left(1 - \frac{r_d \times t}{360}\right),$$

where F is face value, r_d is the discount yield and t is the maturity in days. With $t = 91$ days, the bill price is

$$P = 10{,}000\left(1 - \frac{0.0475 \times 91}{360}\right) \approx 9{,}881.46.$$

The investor's bank discount return is $10{,}000 - 9{,}881.46 = 118.54$.

2.2 1.2 Treasury Inflation-Protected Securities (TIPS)

TIPS protect investors from inflation by adjusting the principal based on changes in the Consumer Price Index (CPI). Coupons are paid semiannually on the inflation-adjusted principal. At maturity, the investor receives the greater of the inflation-adjusted principal or the original principal. TIPS therefore offer both real return and inflation protection.
In periods of rising inflation, TIPS prices typically outperform nominal Treasuries; when inflation expectations decline, TIPS may underperform nominal securities.

2.2.1 Example 2 — TIPS Principal Adjustment

Consider a \$1,000 TIPS with 3% annual coupon. Over the first six months, the CPI index increases by 1%. The adjusted principal after six months is \$1,000 $\times(1 + 0.01) =$ \$1,010.
The semiannual coupon payment is

$$\text{Coupon} = 0.03/2 \times 1{,}010 = 15.15.$$

If inflation cumulatively rises 3% by maturity, the principal will be \$1{,}030 and investors will receive the greater of \$1,030 or \$1,000.

2.3 1.3 The Treasury Auction Process

The Treasury sells new securities through competitive and non-competitive auctions.
• In a **competitive bid**, dealers and institutional investors submit the quantity and yield they are willing to accept. The bids are ranked from the lowest yield (highest price) to the highest yield; securities are awarded to the lowest yields until the issue is sold.
• In a **non-competitive bid**, investors submit the quantity they desire up to a maximum (e.g. \$5 million). They agree to accept the yield determined by the competitive auction and are guaranteed to receive their requested quantity.

The U.S. Treasury has shifted most auctions to a single-price format: all winning bids receive securities at the highest accepted yield (which corresponds to the lowest accepted price). Investors can place bids directly through TreasuryDirect, banks or brokers.

2.4 1.4 Secondary Market for Treasuries

Treasuries are actively traded in the over-the-counter (OTC) market, with primary dealers providing liquidity. Price quotes are typically expressed as a percentage of par in **32nds of a point**. For example, a quote of `101-16+` means 101 and 16/32 plus 1/64, or 101.515625% of par.

2.4.1 Example 3 — Quoting a Treasury Note

A 10-year Treasury note is quoted at `98-24`. This means the price is 98 and 24/32 of par:

$$\text{Price} = 98 + \frac{24}{32} = 98.75\% \text{ of } 1000 = 987.50.$$

If the coupon is 5% (paying \$25 every six months), the yield to maturity can be solved using the bond yield formula (see Lecture 2).
The price–yield relationship remains inverse and convex (see Figure 1) but at very low yields, price volatility increases dramatically for long-maturity bonds.

2.5 1.5 Price Quotes for Treasury Bills

Since T-bills are zero-coupon securities, the yield is quoted on a discount basis. However, investors often compute the **bond equivalent yield (BEY)** to compare T-bills to coupon securities.
The BEY converts the bank discount yield r_d into an annualized yield based on the actual days to maturity:

$$\text{BEY} = \frac{\text{Face} - \text{Price}}{\text{Price}} \times \frac{365}{t}.$$

This yield is higher than the discount rate because it is calculated on the price rather than par and uses a 365-day year.

2.6 1.6 Quotes on Treasury Coupon Securities

Coupon securities are quoted in **32nds of a point**. Accrued interest is added to determine the **dirty price**.
Accrued interest is calculated as:

$$\text{Accrued Interest} = \frac{\text{Number of days since last coupon}}{\text{Days in coupon period}} \times \text{Coupon Payment}.$$

Investors pay the dirty price (full price) when purchasing a bond; the quoted price is the clean price. The difference is settled between buyer and seller.

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3 2 Stripped Treasury Securities (STRIPS)

Separate Trading of Registered Interest and Principal Securities (STRIPS) are created by "stripping" the coupons and principal of a Treasury security into individual zero-coupon securities. STRIPS are not issued by the Treasury; they are created by dealers who hold Treasury notes or bonds in escrow and sell the separate coupon and principal components.

3.1 2.1 Tax Treatment

STRIPS accrue interest (phantom income) each year even though no cash coupon is paid. Investors must pay taxes on this imputed interest, making STRIPS less attractive for taxable accounts. They are often held in tax-deferred accounts or by institutions not subject to tax.

3.2 2.2 Reconstituting a Bond

The opposite of stripping is **reconstitution**—combining a set of STRIPS with the same underlying security to reassemble a synthetic Treasury bond. Dealer demand for specific STRIPS and reconstitution arbitrage keeps STRIPS prices aligned with comparable coupon Treasuries.

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4 3 Federal Agency Securities

Agency securities are issued by federal agencies or government-sponsored enterprises (GSEs). They often carry an implicit government guarantee but vary in credit quality and liquidity.

4.1 3.1 Fannie Mae and Freddie Mac

The Federal National Mortgage Association (**Fannie Mae**) and the Federal Home Loan Mortgage Corporation (**Freddie Mac**) are GSEs that buy and securitize residential mortgages. They issue **agency debt** to finance mortgage purchases and **mortgage-backed securities (MBS)** backed by pools of mortgages. Agency debt typically trades at a slight spread over Treasuries due to minimal credit risk but lower liquidity. After their 2008 conservatorship, Fannie and Freddie's obligations effectively carry federal backing.

4.2 3.2 Federal Farm Credit Bank System

The Federal Farm Credit Banks provide credit to farmers and agribusinesses. Consolidated systemwide bonds, discount notes and medium-term bonds finance lending. Because Farm Credit is a network of borrower-owned cooperatives, its debt has GSE status.

4.3 3.3 Federal Agricultural Mortgage Corporation (Farmer Mac)

Farmer Mac guarantees and purchases agricultural and rural mortgages. It issues discount notes and medium-term bonds. Farmer Mac debt carries GSE status but is less liquid than Fannie/Freddie debt.

4.4 3.4 Federal Home Loan Bank System

The Federal Home Loan Banks (FHLBs) provide liquidity to member banks through advances. The system finances itself with consolidated bonds and discount notes. FHLB debt is considered very safe and trades close to Treasuries.

4.5 3.5 Tennessee Valley Authority

The Tennessee Valley Authority (TVA) issues power bonds to fund its electricity generation projects. TVA is a corporate agency of the U.S. government; its bonds are not explicitly guaranteed but enjoy high credit quality.

4.5.1 Table 1 — Comparison of Major Federal Agency and GSE Debt

```
import pandas as pd

data = {
    "Issuer": ["Fannie Mae", "Freddie Mac", "Farm Credit", "Farmer Mac", "FHLB", "TVA"],
    "Purpose": [
        "Buy/securitize mortgages",
        "Buy/securitize mortgages",
        "Credit to farmers",
        "Guarantee agricultural mortgages",
        "Liquidity to member banks",
        "Power generation"
    ],
    "Securities": [
```

```
        "Agency debt, MBS",
        "Agency debt, MBS",
        "Consolidated bonds, notes",
        "Bonds, discount notes",
        "Consolidated bonds, notes",
        "Power bonds"
    ],
    "Credit Quality": [
        "Implicit guarantee",
        "Implicit guarantee",
        "GSE",
        "GSE",
        "GSE",
        "High but not guaranteed"
    ]
}
df = pd.DataFrame(data)
import numpy as np
df
```

	Issuer	Purpose	Securities	Credit Quality
0	Fannie Mae	Buy/securitize mortgages	Agency debt, MBS	Implicit guarantee
1	Freddie Mac	Buy/securitize mortgages	Agency debt, MBS	Implicit guarantee
2	Farm Credit	Credit to farmers	Consolidated bonds, notes	GSE
3	Farmer Mac	Guarantee agricultural mortgages	Bonds, discount notes	GSE
4	FHLB	Liquidity to member banks	Consolidated bonds, notes	GSE
5	TVA	Power generation	Power bonds	High but not guaranteed

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5 4 Corporate Debt Markets

Corporations finance operations through a mix of debt and equity. Debt instruments have varying seniority and protection for investors.

5.1 4.1 Seniority of Debt in a Corporation's Capital Structure

In bankruptcy, claims are paid in a specific order. **Senior secured debt** is backed by collateral and paid first. **Senior unsecured debt** comes next, followed by **subordinated debt**,

preferred stock and finally **common equity**. Understanding seniority helps investors assess recovery in default.

5.2 4.2 Bankruptcy and Creditor Rights

Under Chapter 11 reorganization, a firm continues operations while negotiating with creditors. Chapter 7 liquidation sells assets to repay creditors. Creditors may receive new securities, equity or cash. Debtor-in-possession financing can provide working capital and is senior to existing claims. The absolute priority rule guides distributions, but negotiations often alter outcomes.

5.3 4.3 Corporate Debt Ratings

Rating agencies (Moody's, S&P, Fitch) evaluate default risk. Ratings range from **investment grade** (e.g. AAA, A, BBB) to **speculative grade** (BB and below). A downgrade increases borrowing costs and may trigger covenant violations. Credit rating transitions and spreads are key drivers of portfolio returns.

5.4 4.4 Corporate Bonds

5.4.1 Provisions for Early Redemption

- **Call provisions** allow issuers to redeem bonds before maturity, usually at a premium. Investors demand higher yields to compensate for call risk.
- **Sinking funds** require issuers to retire a portion of debt each year, reducing default risk but creating reinvestment risk.
- **Make-whole calls** compensate investors by discounting the remaining payments at a spread over Treasuries, providing fair value at redemption.

5.4.2 Covenants

Bond indentures include **affirmative covenants** (e.g. timely payment, maintaining insurance) and **negative covenants** (e.g. limitations on additional debt, restrictions on asset sales). Covenants protect bondholders by restricting issuer actions that could reduce credit quality.

5.4.3 Special Structures for High-Yield Corporate Bonds

High-yield (below-investment-grade) bonds often feature structures such as **payment-in-kind (PIK) toggles**, which allow issuers to pay coupons in additional bonds rather than cash; **incremental secured debt capacity** giving issuers flexibility to incur more debt; and **equity clawbacks** allowing a portion of bonds to be redeemed with proceeds from equity offerings. Investors evaluate covenants and collateral when pricing high-yield deals.

5.4.4 Accrued Interest and Trading

Corporate bonds trade in the OTC market at negotiated prices. Like Treasury notes, the quoted price is the clean price; accrued interest is added to determine the full price. Settlement is typically T+2. The secondary market is less liquid for lower-rated issues.

5.4.5 Private-Placement Market

Corporations may issue debt privately to a small number of institutional investors. Private placements avoid SEC registration but often include restrictive covenants and higher yields.

5.5 4.5 Medium-Term Notes (MTNs)

MTNs are debt securities with maturities ranging from 9 months to 30 years. Issuers register a program with the SEC and can issue notes on a continuous or episodic basis. MTNs offer flexibility in maturity, structure (fixed or floating rate) and currency. They are typically sold through agents to institutional investors.

5.6 4.6 Commercial Paper

Commercial paper is unsecured short-term borrowing (<270 days) used by corporations to finance working capital. It is issued at a discount and quoted on a discount basis like T-bills. There are two types: **direct paper**, sold by the issuer to investors; and **dealer paper**, sold through investment banks. Credit quality is paramount; lower-rated issuers may need to obtain a backup line of credit.

5.7 4.7 Bank Loans

5.7.1 Syndicated Bank Loans

Large loans are often arranged by a lead bank and sold to a syndicate of lenders. Syndicated loans are usually floating-rate instruments indexed to SOFR or another short-term rate plus a spread. They may be secured by collateral. Loan documents include covenants similar to those in bond indentures.

5.7.2 High-Yield Bonds versus Leveraged Loans

High-yield bonds typically have fixed coupons and longer maturities, while **leveraged loans** (a type of syndicated loan) have floating rates and rank senior to high-yield bonds in the capital structure. Leveraged loans are often secured and have covenants; high-yield bonds may be unsecured.

5.7.3 Collateralized Loan Obligations (CLOs)

CLOs are structured finance vehicles that hold pools of leveraged loans. They issue tranches of securities with varying seniority and credit risk. CLOs provide diversification for loan investors and help banks manage risk. The senior tranches typically carry investment-grade ratings, while the equity tranche absorbs first losses.

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6 5 Default, Downgrade and Credit Spread Risk

6.1 5.1 Default Rates and Recovery Rates

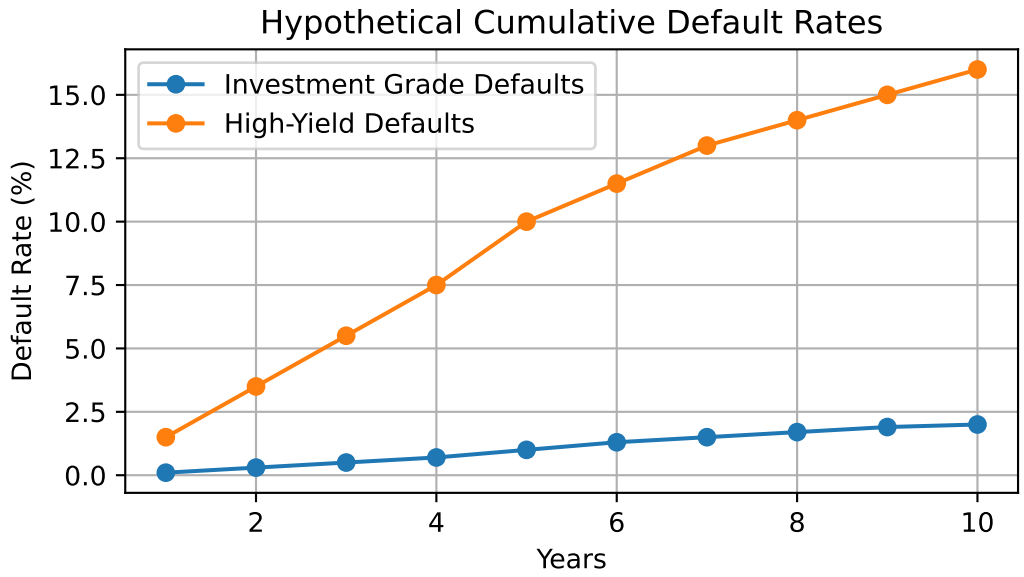
Default risk refers to the probability that an issuer fails to make timely interest or principal payments. **Recovery rate** measures the percentage of face value recovered in default. Investment-grade bonds have low default rates, while high-yield bonds have higher default rates but also higher yields to compensate. Recovery rates vary by seniority and collateral—secured debt often recovers 70–90 cents on the dollar, while subordinated debt may recover less than 30 cents.

6.1.1 Figure 2 — Illustration of Cumulative Default and Recovery Rates

```
import numpy as np
import matplotlib.pyplot as plt

years = np.arange(1, 11)
default_rate_ig = np.array([0.1, 0.3, 0.5, 0.7, 1.0, 1.3, 1.5, 1.7, 1.9, 2.0])
default_rate_hy = np.array([1.5, 3.5, 5.5, 7.5, 10.0, 11.5, 13.0, 14.0, 15.0, 16.0])

plt.figure(figsize=(6,3))
plt.plot(years, default_rate_ig, label='Investment Grade Defaults', marker='o')
plt.plot(years, default_rate_hy, label='High-Yield Defaults', marker='o')
plt.title('Hypothetical Cumulative Default Rates')
plt.xlabel('Years')
plt.ylabel('Default Rate (%)')
plt.legend()
plt.grid(True)
plt.show()
```



The figure compares hypothetical cumulative default rates for investment-grade and high-yield bonds. Notice how default risk grows over time, particularly for speculative-grade issuers.

6.2 5.2 Corporate Downgrade Risk

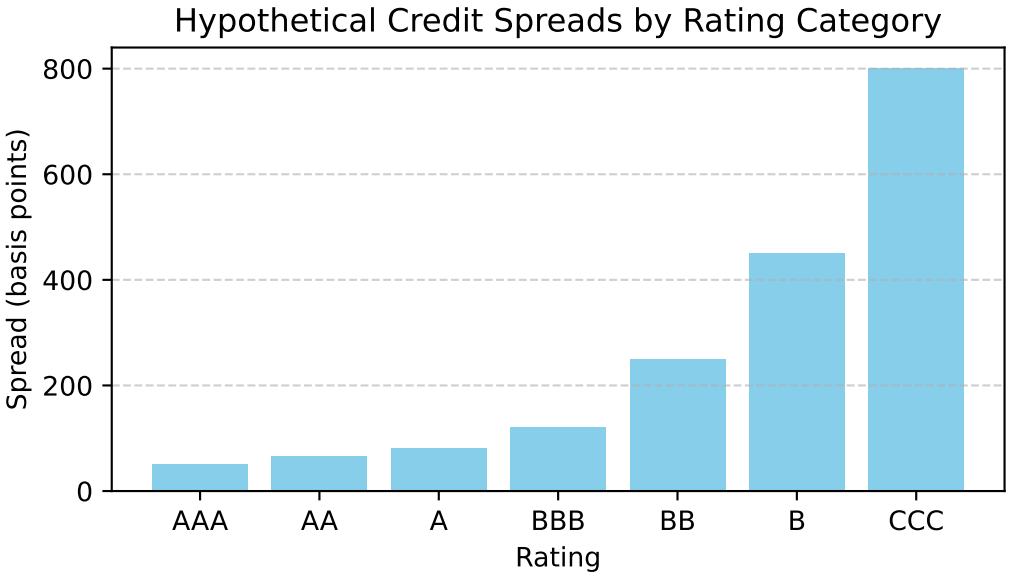
Downgrade risk is the risk that a credit rating agency lowers a bond's rating. Downgrades raise borrowing costs, depress prices and may cause forced selling by investors with rating restrictions (e.g. pension funds). Monitoring financial ratios, debt levels and industry trends helps investors anticipate downgrades.

6.3 5.3 Corporate Credit Spread Risk

Credit spreads measure the yield premium investors demand over Treasuries to compensate for default risk and liquidity risk. Spreads widen when investors perceive greater risk or reduced liquidity, leading to price declines for corporate bonds. Figure 3 plots hypothetical spreads across rating categories.

```
import matplotlib.pyplot as plt
ratings = ['AAA','AA','A','BBB','BB','B','CCC']
spreads = [50, 65, 80, 120, 250, 450, 800]  # basis points

plt.figure(figsize=(6,3))
plt.bar(ratings, spreads, color='skyblue')
plt.title('Hypothetical Credit Spreads by Rating Category')
plt.ylabel('Spread (basis points)')
plt.xlabel('Rating')
plt.grid(axis='y', linestyle='--', alpha=0.6)
plt.show()
```



Spreads are wider for lower-rated bonds. Changes in economic conditions or company fundamentals can cause spreads to widen or narrow, affecting bond prices.

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7 6 Conclusion

This lecture surveyed the spectrum of fixed-income instruments—from risk-free Treasuries to high-yield corporate bonds—and the factors that influence their prices and yields. Understanding how auctions work, how securities trade, and how credit risk is measured equips investors to navigate bond markets. The examples and graphs illustrate how yields, spreads and default rates are quantified, providing a foundation for more advanced topics such as bond portfolio management and risk modelling.