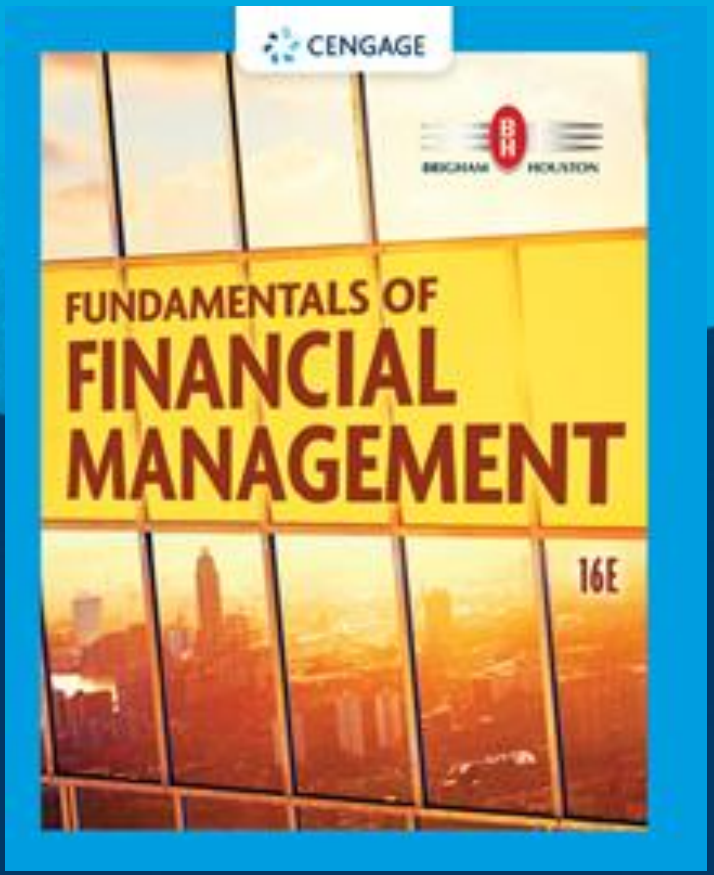
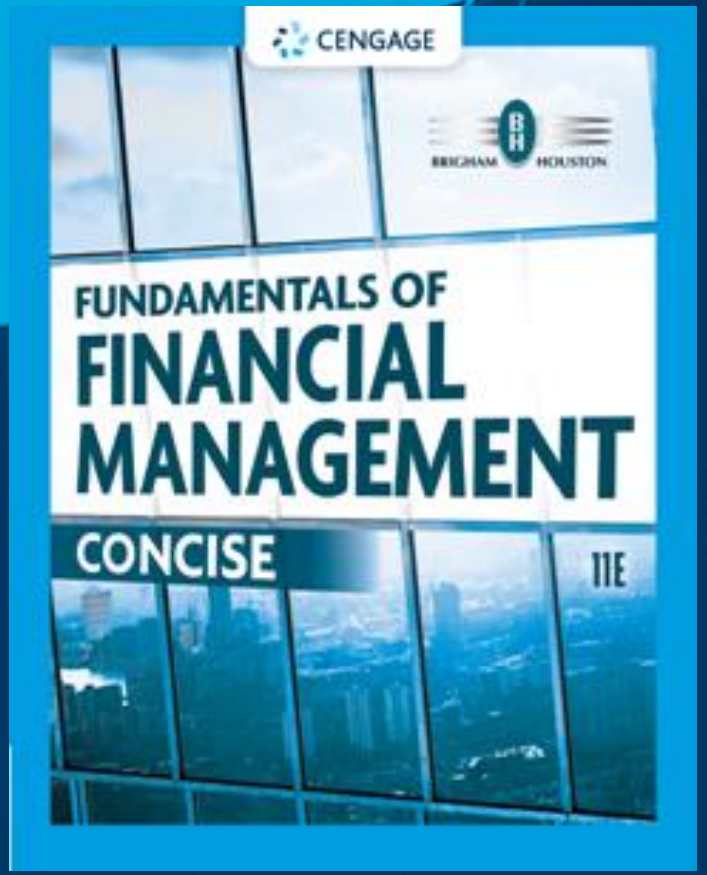




Chapter 6

Interest Rates

Interest Rates Overview

- Cost of Money and Interest Rate Levels
- Determinants of Interest Rates
- The Term Structure and Yield Curves
- Using Yield Curves to Estimate Future Interest Rates

What four factors affect the level of interest rates?

- Production opportunities
- Time preferences for consumption
- Risk
- Expected inflation

“Nominal” vs. “Real” Rates

- r = represents any nominal rate
- r* = represents the “real” risk-free rate of interest. Like a T-bill rate, if there was no inflation. Typically ranges from 1% to 4% per year.
- r_{RF} = represents the rate of interest on Treasury securities.

Determinants of Interest Rates

- r = r* + IP + DRP + LP + MRP
- r = required return on a debt security
- r* = real risk-free rate of interest
- IP = inflation premium
- DRP = default risk premium
- LP = liquidity premium
- MRP = maturity risk premium

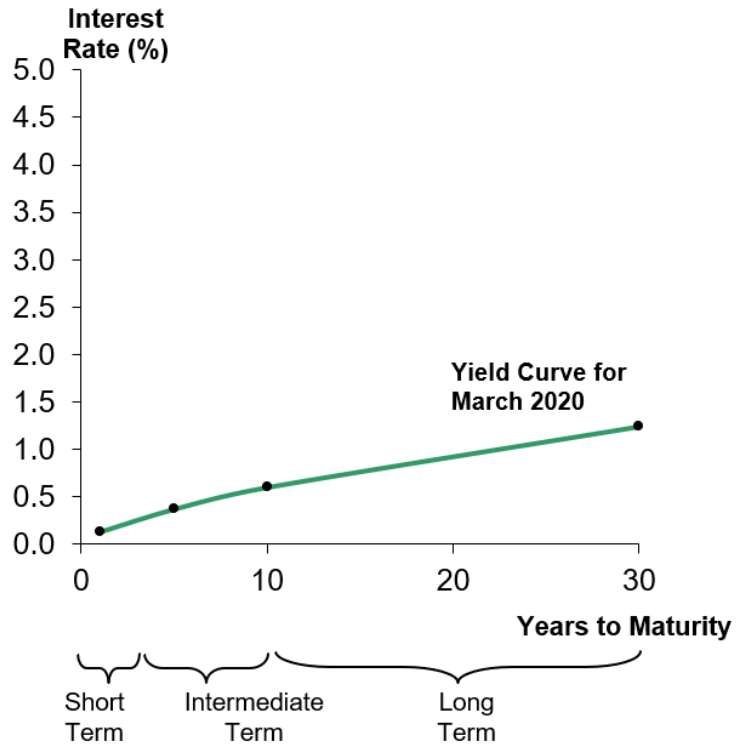
Premiums Added to r* for Different Types of Debt

	IP	MRP	DRP	LP
S-T Treasury	✓			
L-T Treasury	✓	✓		
S-T Corporate	✓		✓	✓
L-T Corporate	✓	✓	✓	✓

Yield Curve and the Term Structure of Interest Rates

- Term structure: relationship between interest rates (or yields) and maturities.
- The yield curve is a graph of the term structure.
- The March 2020 Treasury yield curve is shown at the right.

Yield Curve for March 2020



Constructing the Yield Curve: Inflation (1 of 2)

- Step 1: Find the average expected inflation rate over Years 1 to N:

$$IP_N = \frac{\sum_{t=1}^{N} INFL_t}{N}$$

Constructing the Yield Curve: Inflation (2 of 2)

- Assume inflation is expected to be 5% next year, 6% the following year, and 8% thereafter.

$$IP_1 = 5\% / 1 = 5.00\%$$
$$IP_{10} = [5\% + 6\% + 8\%(8)] / 10 = 7.50\%$$
$$IP_{20} = [5\% + 6\% + 8\%(18)] / 20 = 7.75\%$$

- Must earn these IPs to break even vs. inflation; these IPs would permit you to earn r* (before taxes).

Constructing the Yield Curve: Maturity Risk (1 of 2)

- Step 2: Find the appropriate maturity risk premium (MRP). For this example, the following equation will be used to find a security's appropriate maturity risk premium.

$$MRP_t = 0.1\% (t - 1)$$

Constructing the Yield Curve: Maturity Risk (2 of 2)

- Using the given equation:

$$MRP_1 = 0.1\% \times (1-1) = 0.0\%$$
$$MRP_{10} = 0.1\% \times (10-1) = 0.9\%$$
$$MRP_{20} = 0.1\% \times (20-1) = 1.9\%$$

- Notice that since the equation is linear, the maturity risk premium is increasing as the time to maturity increases, as it should be.

Add the IPs and MRPs to r* to Find the Appropriate Nominal Rates

- Step 3: Adding the premiums to r*.

$$r_{RF,\,t} = r^* + IP_t + MRP_t$$

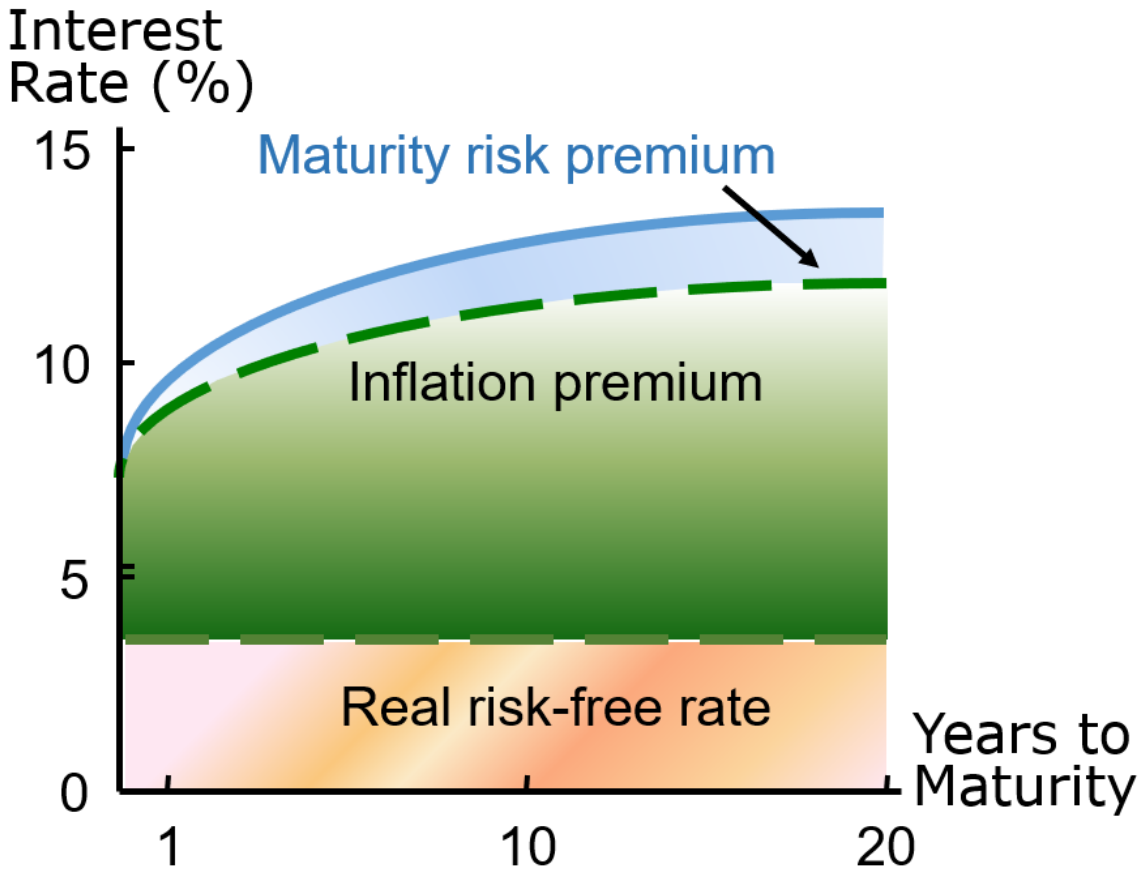
- Assume r* = 3%,

$$r_{RF,1} = 3\% + 5\% + 0.0\% = 8.0\%$$

$$r_{RF,10} = 3\% + 7.5\% + 0.9\% = 11.4\%$$

$$r_{RF,20} = 3\% + 7.75\% + 1.9\% = 12.65\%$$

Hypothetical Yield Curve



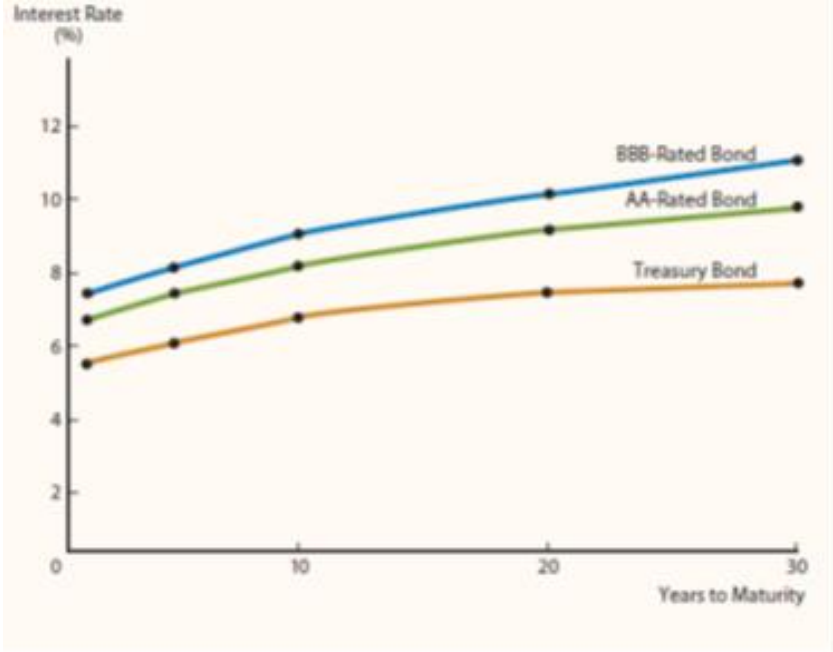
- An upward-sloping yield curve.
- Upward slope due to an increase in expected inflation and increasing maturity risk premium.

Relationship Between Treasury Yield Curve and Yield Curves for Corporate Issues

- Corporate yield curves are higher than that of Treasury securities, though not necessarily parallel to the Treasury curve.
- The spread between corporate and Treasury yield curves widens as the corporate bond rating decreases.
- Since corporate yields include a default risk premium (DRP) and a liquidity premium (LP), the corporate bond yield spread can be calculated as:

$$\text{Corporate bond yield spread} = \text{Corporate bond yield} - \text{Treasury bond yield}$$
$$= \text{DRP} + \text{LP}$$

Illustrating the Relationship Between Corporate and Treasury Yield Curves



	Interest Rate		
	Treasury Bond	AA-Rated Bond	BBB-Rated Bond
1 year	5.5%	6.7%	7.4%
5 years	6.1	7.4	8.1
10 years	6.8	8.2	9.1
20 years	7.4	9.2	10.2
30 years	7.7	9.8	11.1

Pure Expectations Theory

- The pure expectations theory contends that the shape of the yield curve depends on investors' expectations about future interest rates.
- If interest rates are expected to increase, L-T rates will be higher than S-T rates, and vice-versa. Thus, the yield curve can slope up, down, or even bow.

Assumptions of Pure Expectations

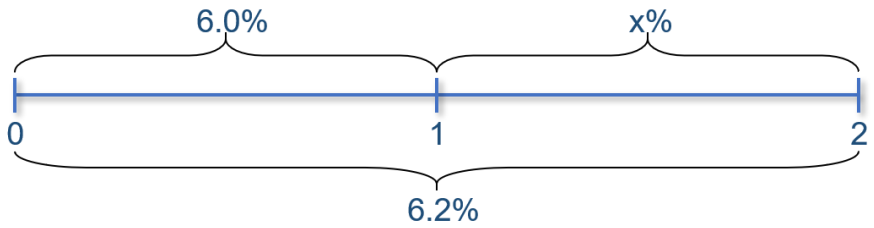
- Assumes that the maturity risk premium for Treasury securities is zero.
- Long-term rates are an average of current and future short-term rates.
- If the pure expectations theory is correct, you can use the yield curve to “back out” expected future interest rates.

An Example: Observed Treasury Rates and Pure Expectations

Maturity	Yield
1 year	6.0
2 years	6.2
3 years	6.4
4 years	6.5
5 years	6.5

- If the pure expectations theory holds, what does the market expect will be the interest rate on one-year securities, one year from now? Three-year securities, two years from now?

One-Year Forward Rate



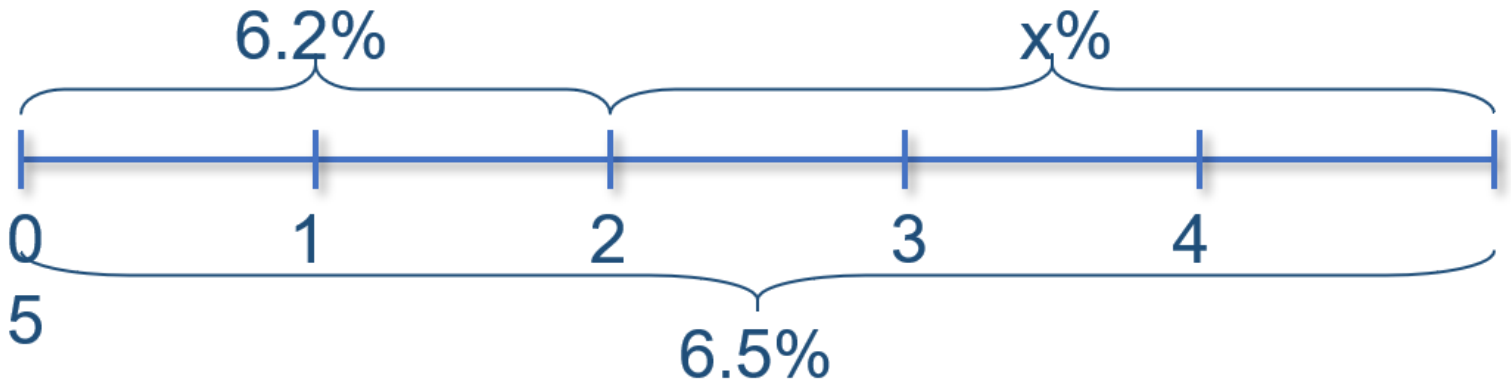
$$(1.062)^2 = (1.060)(1+X)$$

$$1.12784 / 1.060 = (1+X)$$

$$6.4004\% = X$$

- The pure expectations theory says that one-year securities will yield 6.4004%, one year from now.
- Notice, if an arithmetic average is used, the answer is still very close. Solve: 6.2% = (6.0% + X)/2, and the result will be 6.4%.

Three-Year Security, Two Years from Now



$$(1.065)^5 = (1.062)^2(1+X)^3$$

$$1.37009/1.12784 = (1+X)^3$$

$$6.7005\% = X$$

- The pure expectations theory says that three-year securities will yield 6.7005%, two years from now.

Conclusions About Pure Expectations

- Some would argue that the MRP ≠ 0, and hence the pure expectations theory is incorrect.
- Most evidence supports the general view that lenders prefer S-T securities, and view L-T securities as riskier.
  - Thus, investors demand a premium to persuade them to hold L-T securities (i.e., MRP > 0).

Macroeconomic Factors That Influence Interest Rate Levels

- Federal reserve policy
- Federal budget deficits or surpluses
- International factors
- Level of business activity