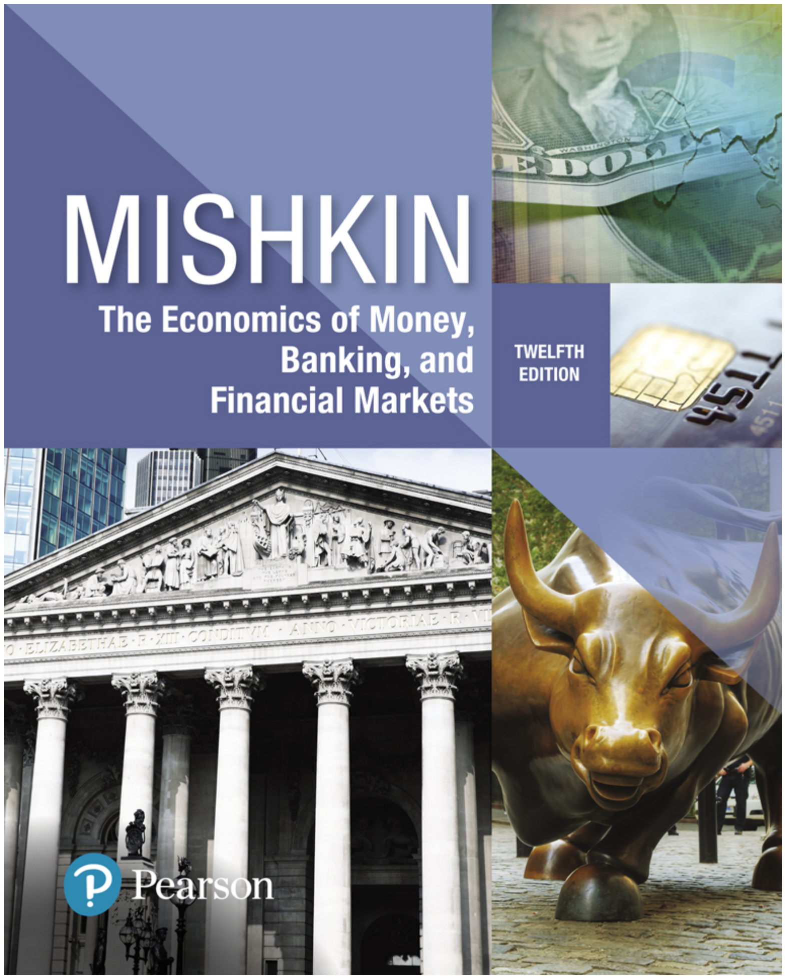
The Economics of Money, Banking, and Financial Markets

Twelfth Edition



Chapter 6

The Risk and Term Structure of Interest Rates

Preview

- In this chapter, we examine the sources and causes of fluctuations in interest rates relative to one another and look at a number of theories that explain these fluctuations.

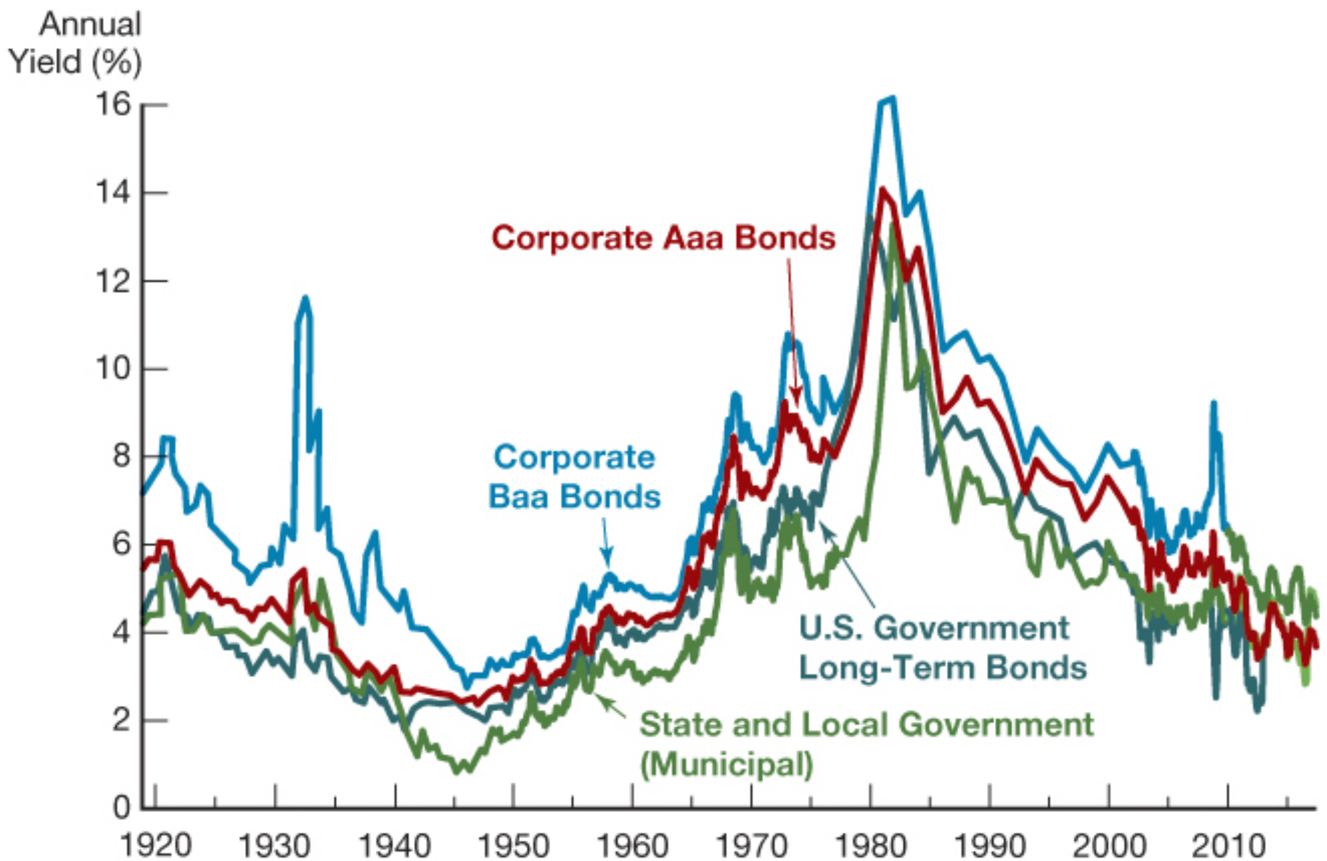
Learning Objectives

- Identify and explain three factors explaining the risk structure of interest rates.
- List and explain the three theories of why interest rates vary across maturities.

Risk Structure of Interest Rates (1 of 3)

- Bonds with the same maturity have different interest rates due to:
  - Default risk
  - Liquidity
  - Tax considerations

Figure 1 Long-Term Bond Yields, 1919–2017



Sources: Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics, 1941–1970*; Federal Reserve Bank of St. Louis FRED database: http://research.stlouisfed.org/fred2

Risk Structure of Interest Rates (2 of 3)

- **Default risk**: probability that the issuer of the bond is unable or unwilling to make interest payments or pay off the face value
  - U.S. Treasury bonds are considered default free (government can raise taxes).
  - **Risk premium**: the spread between the interest rates on bonds with default risk and the interest rates on (same maturity) Treasury bonds

Figure 2 Response to an Increase in Default Risk on Corporate Bonds

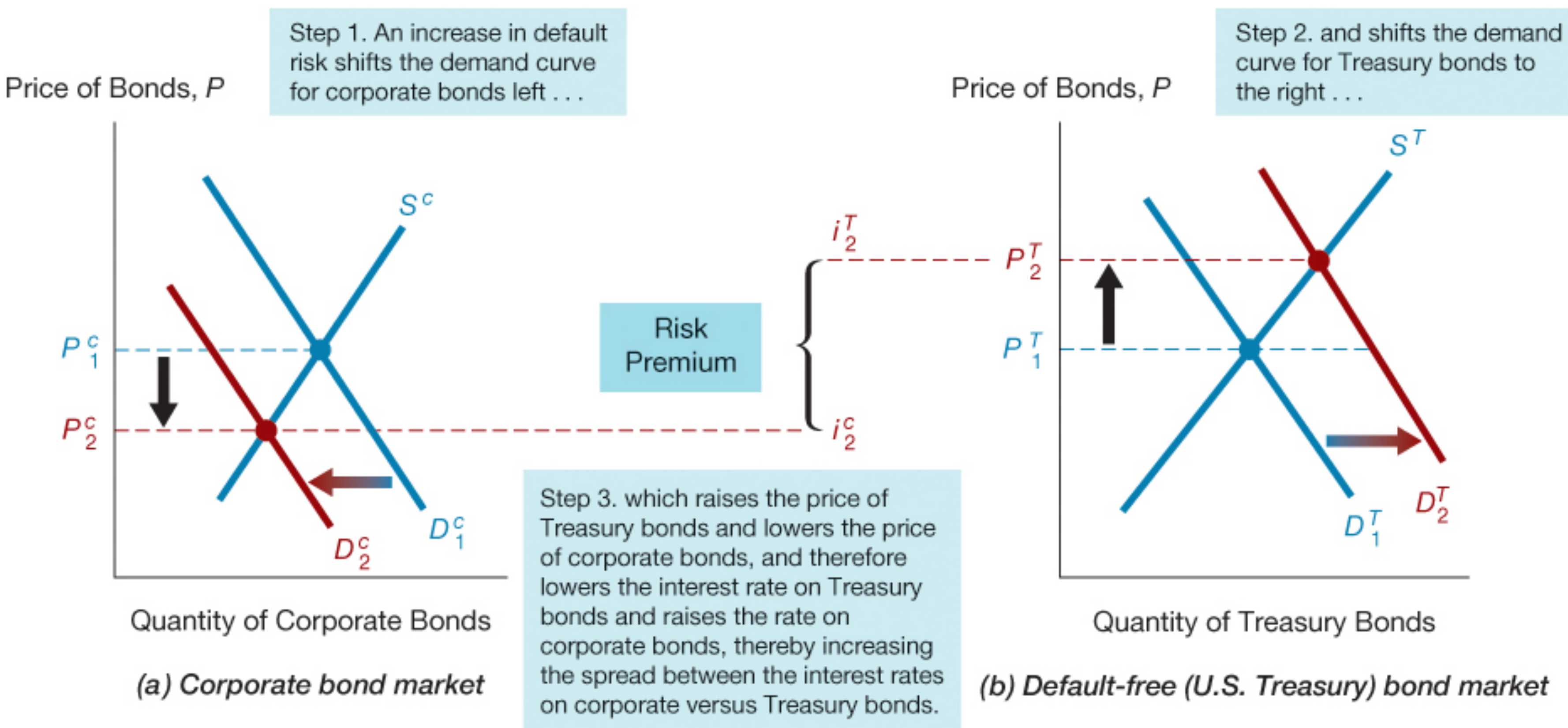


Table 1 Bond Ratings by Moody's, Standard and Poor's, and Fitch (1 of 2)

Moody's	Rating Agency S&P	Fitch	Definitions
Aaa	AAA	AAA	Prime Maximum Safety
Aa1	AA+	AA+	High Grade High Quality
Aa2	AA	AA	
Aa3	AA–	AA–	
A1	A+	A+	Upper Medium Grade
A2	A	A	
A3	A–	A–	
Baa1	BBB+	BBB+	Lower Medium Grade
Baa2	BBB	BBB	
Baa3	BBB–	BBB–	
Ba1	BB+	BB+	Noninvestment Grade

Table 1 Bond Ratings by Moody's, Standard and Poor's, and Fitch (2 of 2)

Moody's	Rating Agency S&P	Fitch	Definitions
Ba2	BB	BB	Speculative
Ba3	BB–	BB–	
B1	B+	B+	Highly Speculative
B2	B	B	
B3	B–	B–	
Caa1	CCC+	CCC	Substantial Risk
Caa2	CCC	—	In Poor Standing
Caa3	CCC–	—	
Ca	—	—	Extremely Speculative
C	—	—	May Be in Default
—	—	D	Default

Pearson

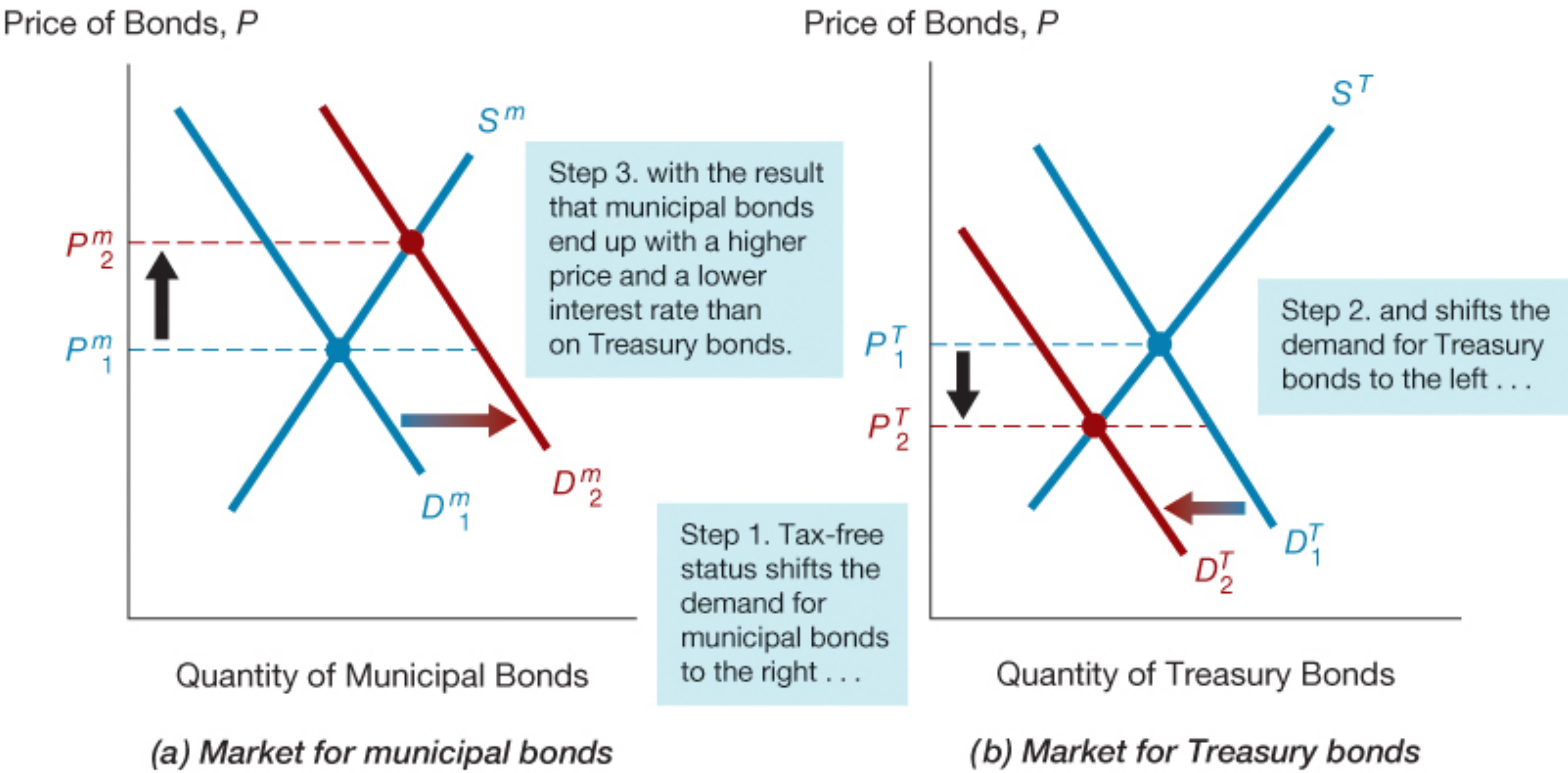
The Global Financial Crisis and the Baa–Treasury Spread

- Starting in August 2007, the collapse of the subprime mortgage market led to large losses among financial institutions. As a consequence, many investors began to doubt the financial health of corporations with low credit ratings such as Baa and even the reliability of the ratings themselves. The perceived increase in default risk for Baa bonds made them less desirable at any given price.

Risk Structure of Interest Rates (3 of 3)

- **Liquidity**: the relative ease with which an asset can be converted into cash
  - Cost of selling a bond
  - Number of buyers/sellers in a bond market
- **Income tax considerations**
  - Interest payments on municipal bonds are exempt from federal income taxes.

Figure 3 Interest Rates on Municipal and Treasury Bonds



Pearson

Effects of the Obama Tax Increase on Bond Interest Rates

- In 2013, Congress approved legislation favored by the Obama administration to increase the income tax rate on high-income taxpayers from 35% to 39%. Consistent with supply and demand analysis, the increase in income tax rates for wealthy people helped to lower the interest rates on municipal bonds relative to the interest rate on Treasury bonds.

Term Structure of Interest Rates (1 of 4)

- Bonds with identical risk, liquidity, and tax characteristics may have different interest rates because the time remaining to maturity is different

Term Structure of Interest Rates (2 of 4)

- **Yield curve**: a plot of the yield on bonds with differing terms to maturity but the same risk, liquidity, and tax considerations
  - **Upward-sloping**: long-term rates are above short-term rates
  - **Flat**: short- and long-term rates are the same
  - **Inverted**: long-term rates are below short-term rates

Term Structure of Interest Rates (3 of 4)

The theory of the term structure of interest rates must explain the following facts:

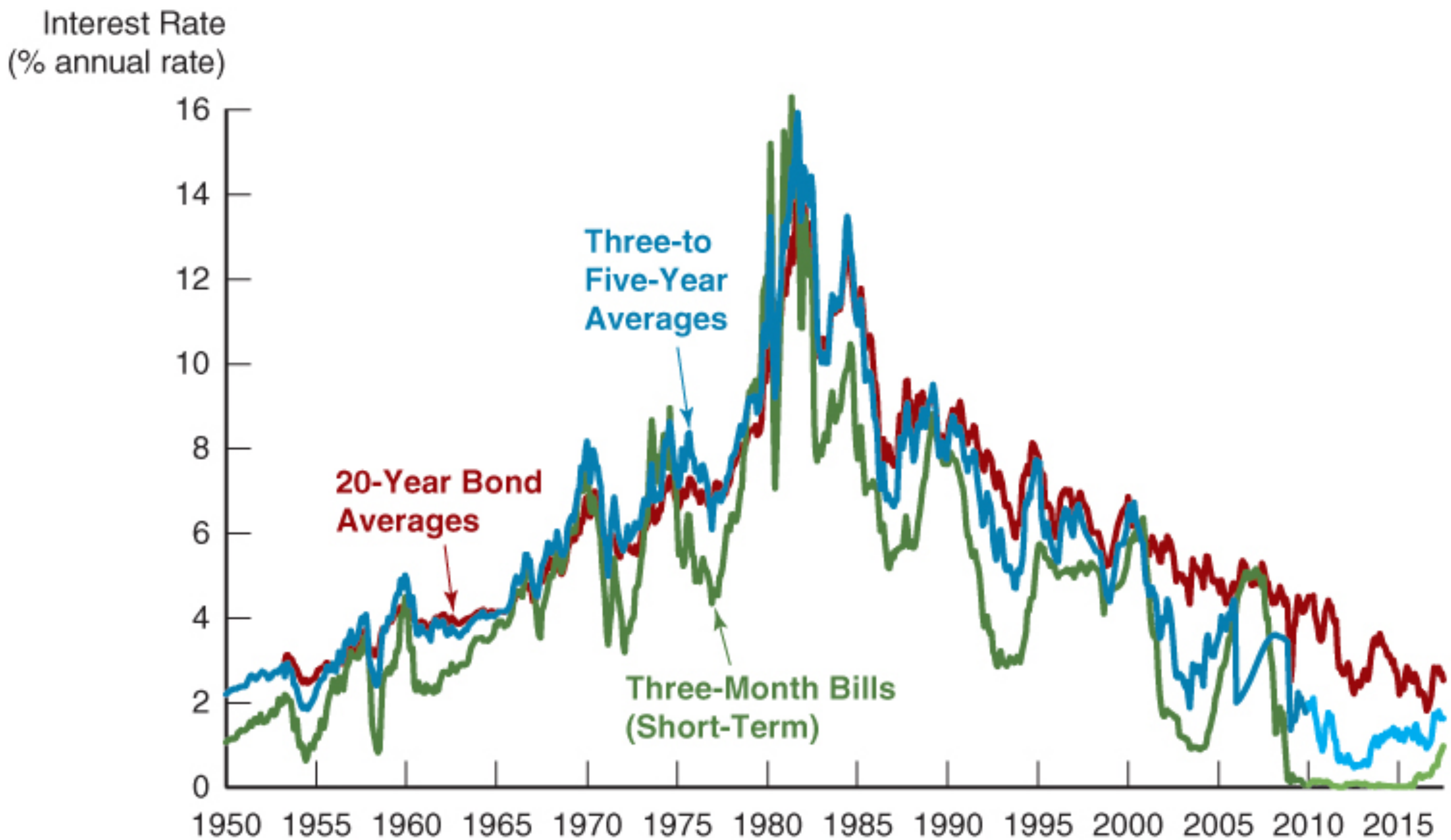
1. Interest rates on bonds of different maturities move together over time.
2. When short-term interest rates are low, yield curves are more likely to have an upward slope; when short-term rates are high, yield curves are more likely to slope downward and be inverted.
3. Yield curves almost always slope upward.

Term Structure of Interest Rates (4 of 4)

Three theories to explain the three facts:

1. Expectations theory explains the first two facts but not the third.
2. Segmented markets theory explains the third fact but not the first two.
3. Liquidity premium theory combines the two theories to explain all three facts.

Figure 4 Movements over Time of Interest Rates on U.S. Government Bonds with Different Maturities



Sources: Federal Reserve Bank of St. Louis FRED database: http://research.stlouisfed.org/fred2/

Expectations Theory (1 of 7)

- The interest rate on a long-term bond will equal an average of the short-term interest rates that people expect to occur over the life of the long-term bond.
- Buyers of bonds do not prefer bonds of one maturity over another; they will not hold
any quantity of a bond if its expected return
is less than that of another bond with a different maturity.
- Bond holders consider bonds with different maturities to be perfect substitutes.

Expectations Theory (2 of 7)

An example:

- Let the current rate on one-year bond be 6%.
- You expect the interest rate on a one-year bond to be 8% next year.
- Then the expected return for buying two one-year bonds averages (6% + 8%)/2 = 7%.
- The interest rate on a two-year bond must be 7% for you to be willing to purchase it.

Expectations Theory (3 of 7)

For an investment of \$1

i_t = today's interest rate on a one-period bond

i^e_{t+1} = interest rate on a one-period bond expected for next period

i_{2t} = today's interest rate on the two-period bond

Expectations Theory (4 of 7)

Expected return over the two periods from investing \$1 in the two-period bond and holding it for the two periods

$$(1 + i_{2t})(1 + i_{2t}) - 1$$

$$= 1 + 2i_{2t} + (i_{2t})^2 - 1$$

$$= 2i_{2t} + (i_{2t})^2$$

Since $(i_{2t})^2$ is very small

the expected return for holding the two-period bond for two periods is

$$2i_{2t}$$

Expectations Theory (5 of 7)

If two one-period bonds are bought with the $1 investment

$$(1+i_t)(1+i^e_{t+1})-1$$

$$1+i_t+i^e_{t+1}+i_t(i^e_{t+1})-1$$

$$i_t+i^e_{t+1}+i_t(i^e_{t+1})$$

$i_t(i^e_{t+1})$ is extremely small

Simplifying we get

$$i_t+i^e_{t+1}$$

Expectations Theory (6 of 7)

Both bonds will be held only if the expected returns are equal

$$2i_{2t} = i_t + i_{t+1}^e$$

$$i_{2t} = \frac{i_t + i_{t+1}^e}{2}$$

The two-period rate must equal the average of the two one-period rates

For bonds with longer maturities

$$i_{nt} = \frac{i_t + i_{t+1}^e + i_{t+2}^e + \ldots + i_{t+(n-1)}^e}{n}$$

The *n*-period interest rate equals the average of the one-period interest rates expected to occur over the *n*-period life of the bond

Expectations Theory (7 of 7)

- Expectations theory explains:
  - Why the term structure of interest rates changes at different times.
  - Why interest rates on bonds with different maturities move together over time (fact 1).
  - Why yield curves tend to slope up when short-term rates are low and slope down when short-term rates are high (fact 2).
- Cannot explain why yield curves usually slope upward (fact 3)

Segmented Markets Theory

- Bonds of different maturities are not substitutes at all.
- The interest rate for each bond with a different maturity is determined by the demand for and supply of that bond.
- Investors have preferences for bonds of one maturity over another.
- If investors generally prefer bonds with shorter maturities that have less interest-rate risk, then this explains why yield curves usually slope upward (fact 3).

Liquidity Premium & Preferred Habitat Theories (1 of 2)

- The interest rate on a long-term bond will equal an average of short-term interest rates expected to occur over the life of the long-term bond plus a liquidity premium that responds to supply and demand conditions for that bond.
- Bonds of different maturities are partial (not perfect) substitutes.

Liquidity Premium Theory

$$i_{nt} = \frac{i_t + i^e_{t+1} + i^e_{t+2} + \ldots + i^e_{t+(n-1)}}{n} + l_{nt}$$

where l_{nt} is the liquidity premium for the n-period bond at time t

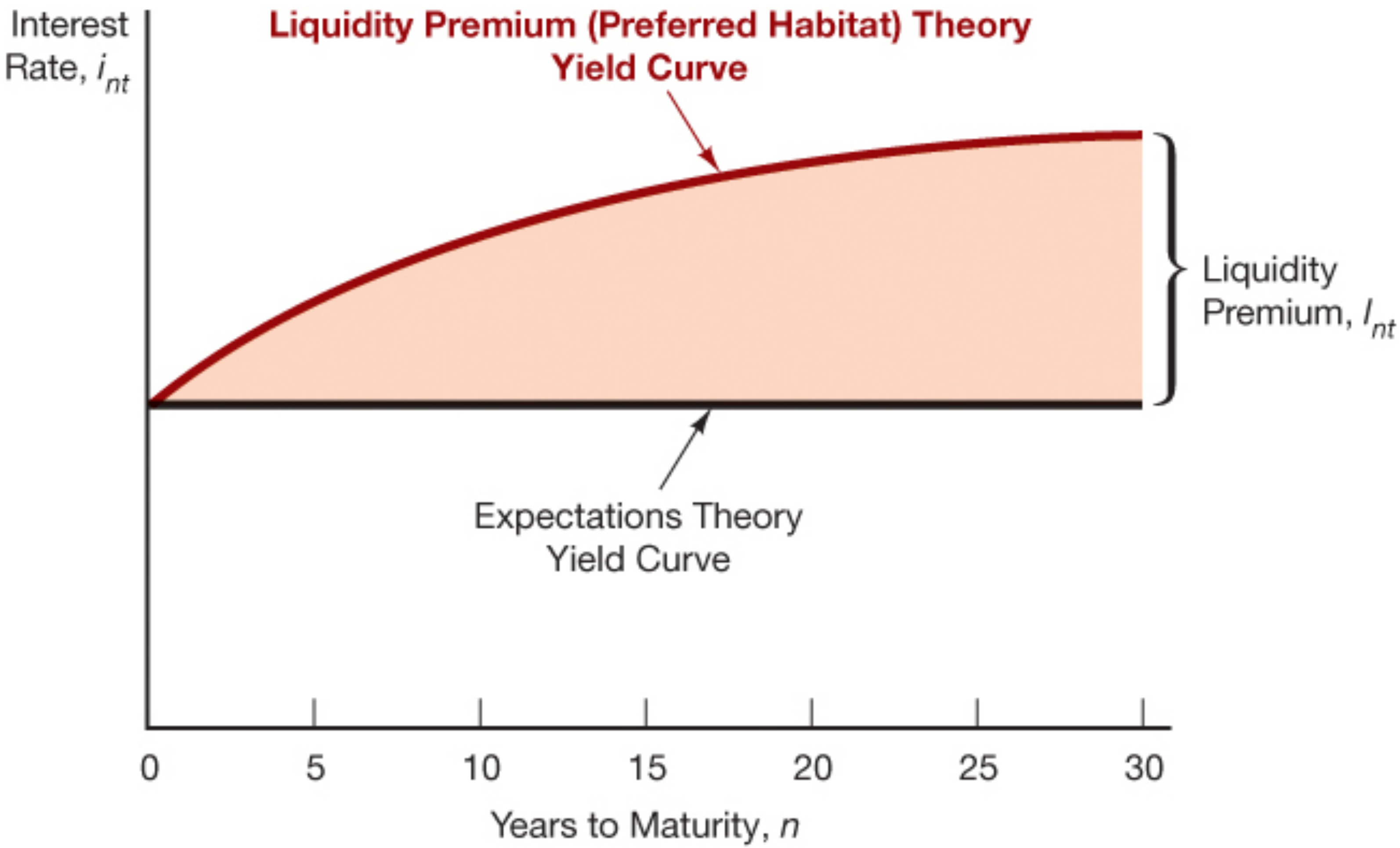
l_{nt} is always positive

Rises with the term to maturity

Preferred Habitat Theory

- Investors have a preference for bonds of one maturity over another.
- They will be willing to buy bonds of different maturities only if they earn a somewhat higher expected return.
- Investors are likely to prefer short-term bonds over longer-term bonds.

Figure 5 The Relationship Between the Liquidity Premium (Preferred Habitat) and Expectations Theory



Liquidity Premium & Preferred Habitat Theories (2 of 2)

- Interest rates on different maturity bonds move together over time; explained by the first term in the equation
- Yield curves tend to slope upward when short-term rates are low and to be inverted when short-term rates are high; explained by the liquidity premium term in the first case and by a low expected average in the second case
- Yield curves typically slope upward; explained by a larger liquidity premium as the term to maturity lengthens

Figure 6 Yield Curves and the Market's Expectations of Future Short-Term Interest Rates According to the Liquidity Premium (Preferred Habitat) Theory

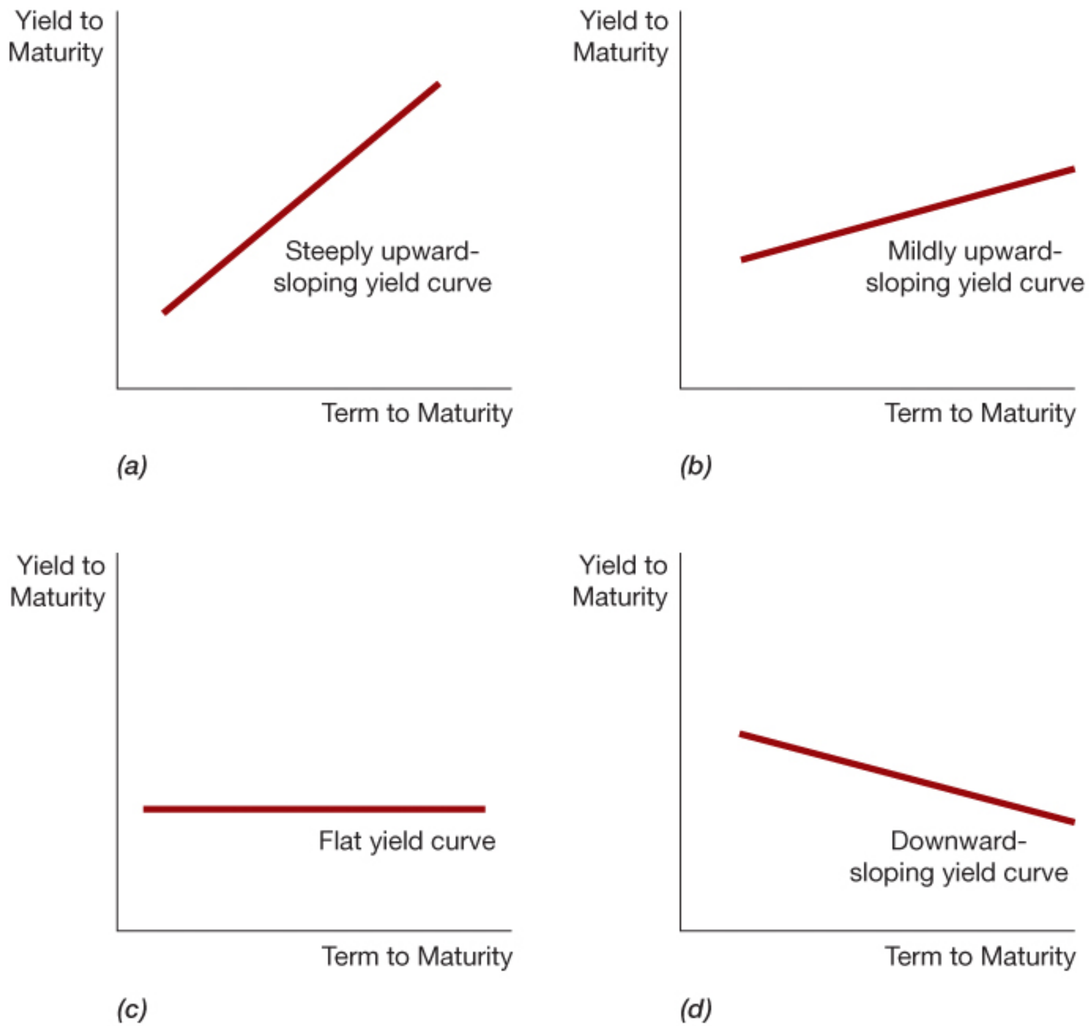
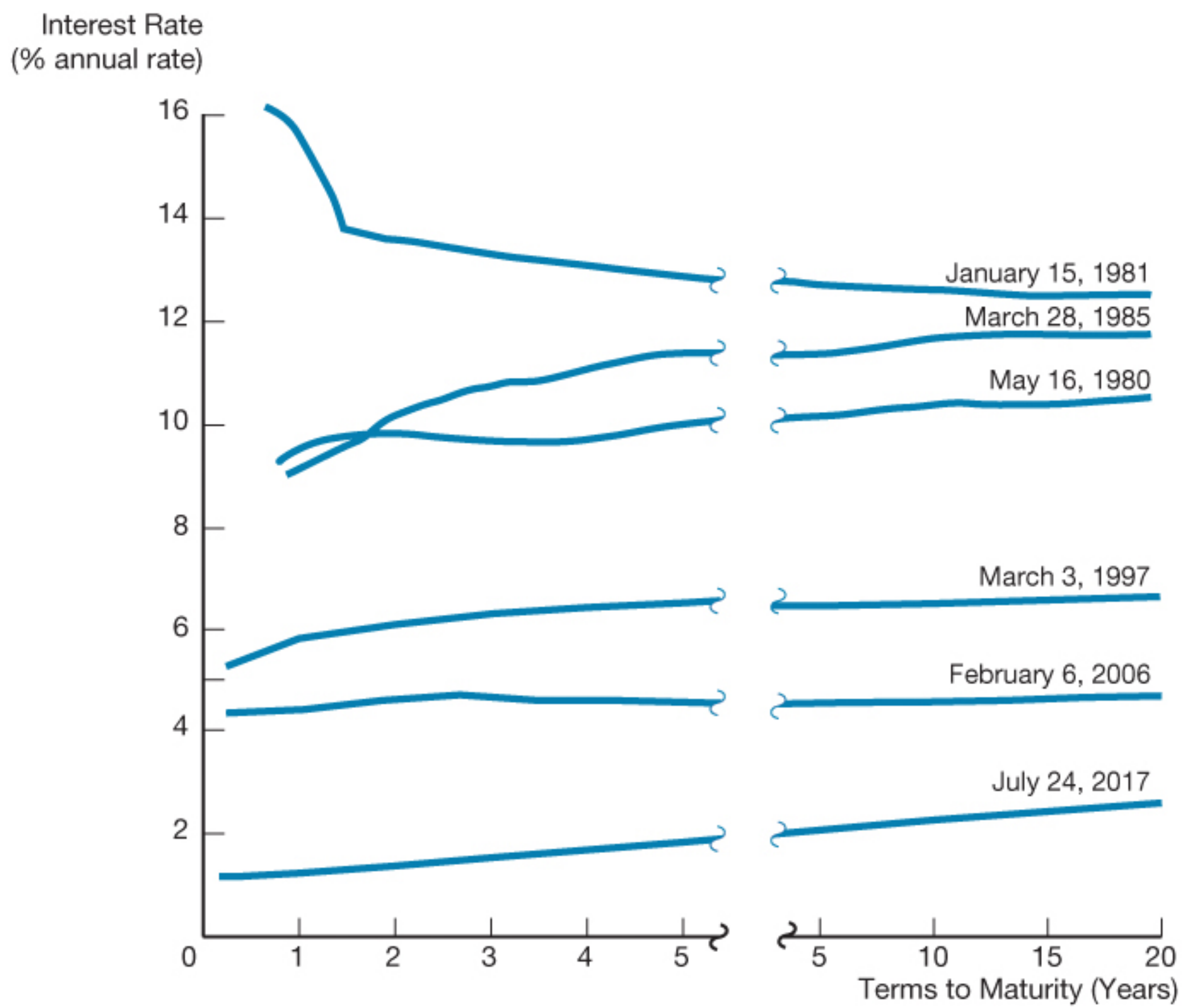


Figure 7 Yield Curves for U.S. Government Bonds



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