# Economics of Financial Markets – Lecture 4

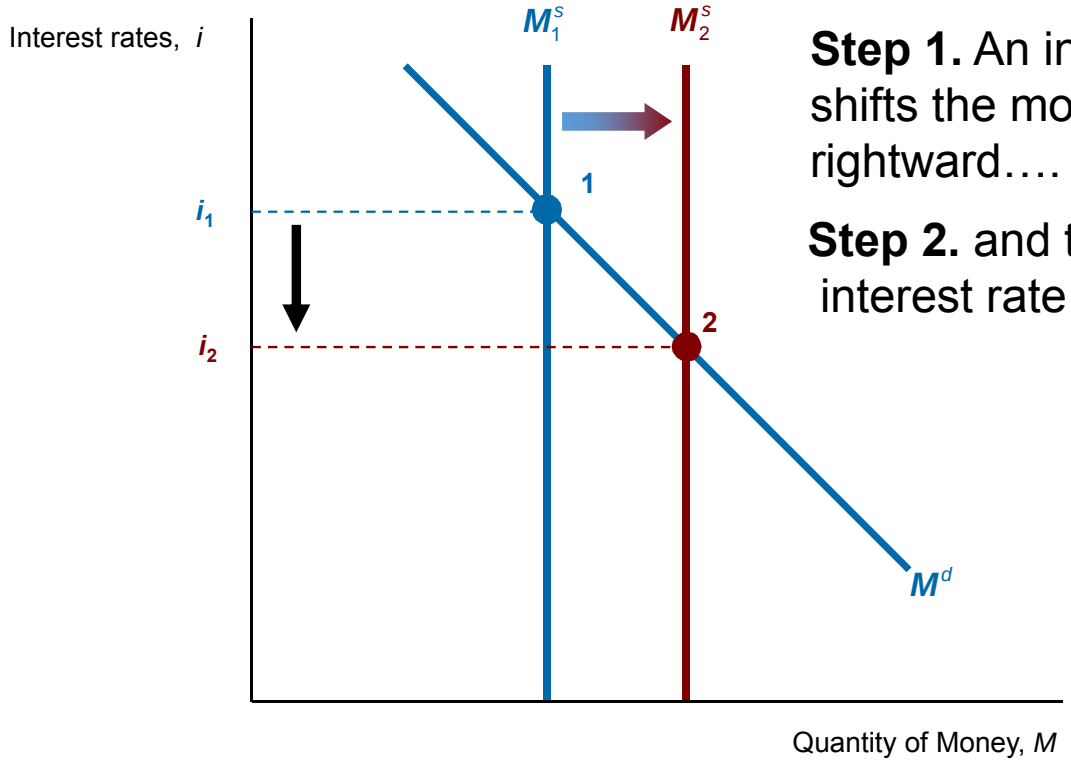
Shino Takayama

School of Economics

# Announcement

- On August 23, August 30 and September 6, my consultation hours will be from 11:00 to noon on Thursday (not 3:00 to 4:00).
- There will be a room change for some students for midsemester examination. So, please be careful about the future announcement.
- If you do not have a group assignment, please stay after the lecture so that you can get to know others and make a group.

# Review: Response to a Change in the Money Supply




**Step 1.** An increases in the money supply shifts the money supply curve rightward….

**Step 2.** and the equilibrium interest rate falls.

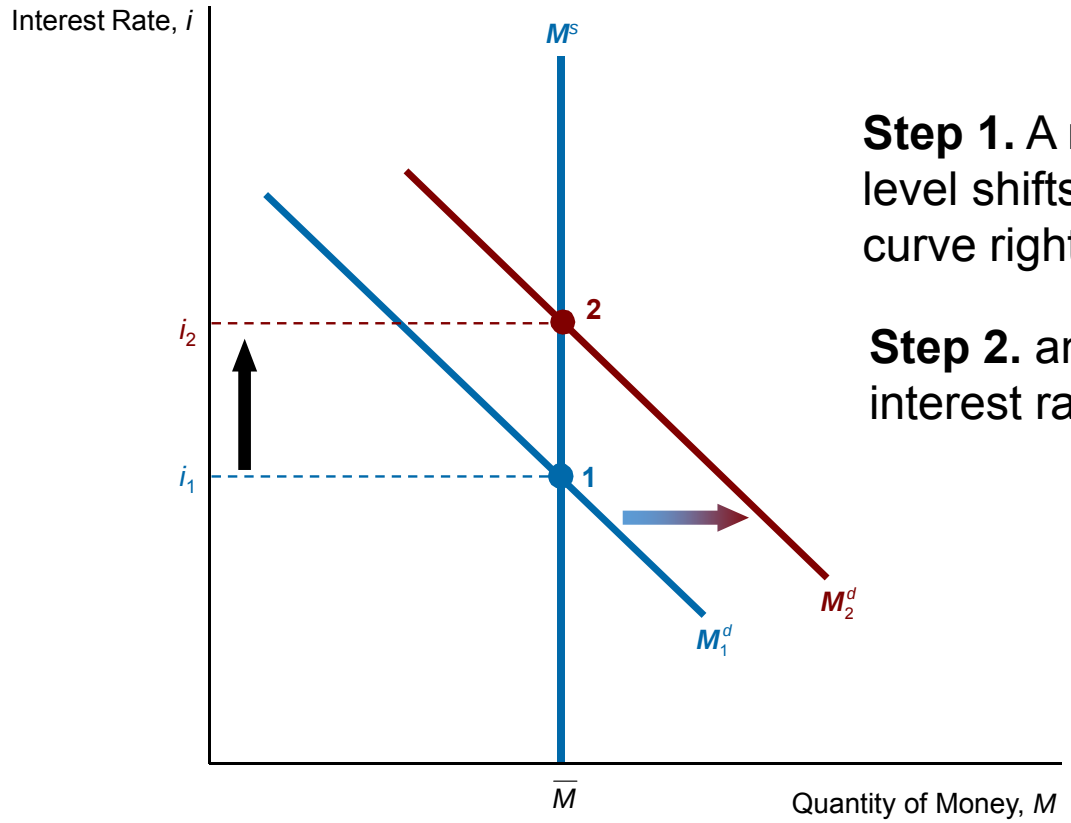
# The Liquidity Effect

- Liquidity preference framework leads to the conclusion that an **increase** in the **money supply** will **lower** interest rates.
- See Figure 10.
- This is a direct effect from shifting the money supply curve.

# Review from Last Week

- Shifts in the demand for money:
  - **Income Effect**: a higher level of income causes the demand for money at each interest rate to increase and the money demand curve to shift to the right
  - **Price-Level Effect**: a rise in the price level causes the demand for money at each interest rate to increase and the money demand curve to shift to the right

# Figure 9 Response to a Change in Income or the Price Level




**Step 1.** A rise in income or the price level shifts the money demand curve rightward . . .

**Step 2.** and the equilibrium interest rate rises.

# The Income Effect

- **The income effect**: Interest rates **rise** because increasing the money supply is an **expansionary** influence on the economy (the demand curve shifts to the right).
- To increase money supply, the Central Bank may increase its ongoing purchases of securities from private banks (so that the money supply, which is, or increases its lending to commercial banks by decreasing "window-discount" rate.
- Then private banks can lend more to investors.
- Investors can purchase capitals and then produce more.
- In the long-run, total output increases, and income increases.
- Interest rates rise.

## Price-Level Effect and

- **Price-Level effect** predicts an increase in the money supply leads to a **rise** in interest rates in response to the **rise** in the price level (the demand curve shifts to the **right**).
- **Expected-Inflation effect** shows an **increase** in interest rates because an **increase** in the **money supply** may lead people to expect a **higher** price level in the future (the demand curve shifts to the right).

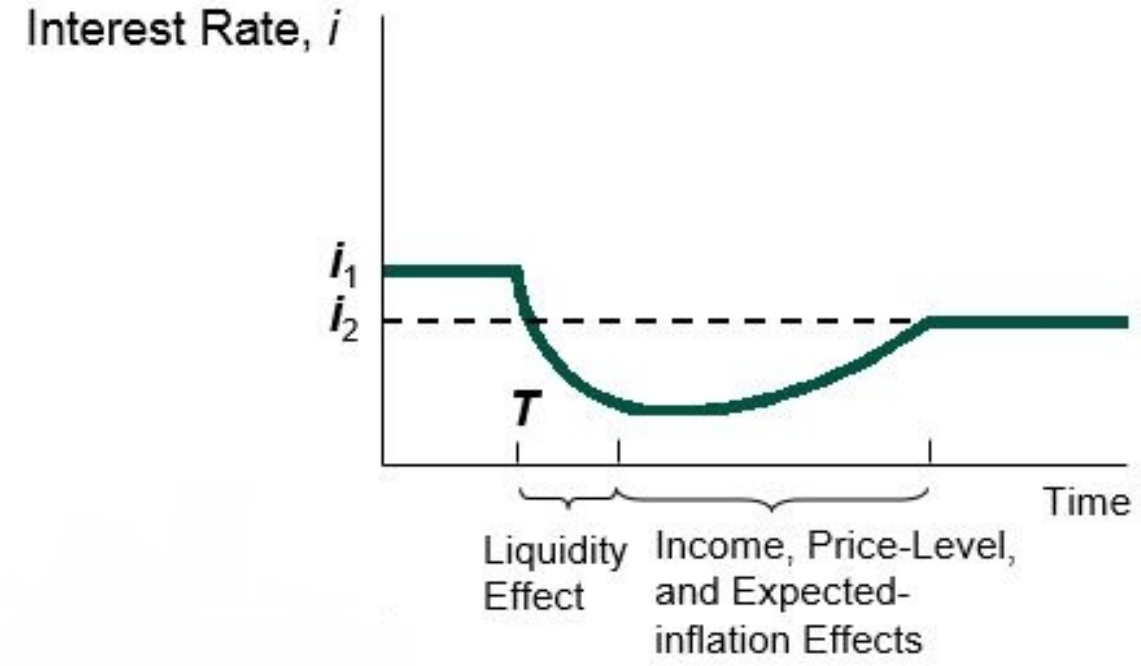
# In summary,

- When money supply increases,

| Effect | Change | Interest Rates |
|---|---|---|
| Liquidity Effect | Money Supply Shifts to Right | Fall |
| Income Effect | Income Increases | Rise |
| Price-Level Effect | Price Increases | Rise |
| Expected-Inflation Effect | Expectation for Higher Prices | Rise |

# Pattern (a)

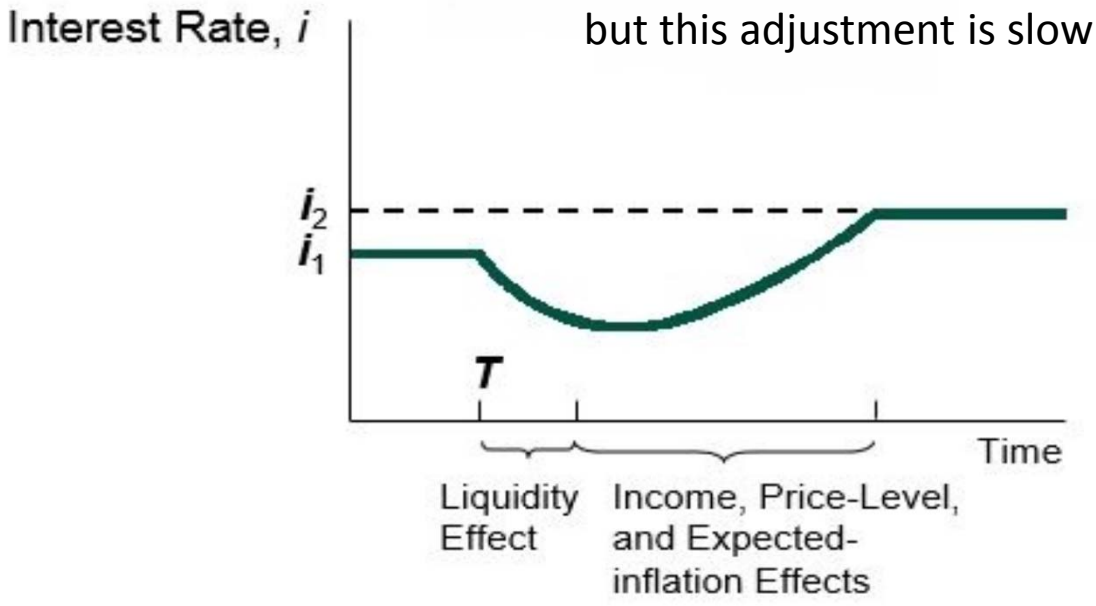
Liquidity effect larger than other effects



# Pattern (b)

Liquidity effect smaller than other effects

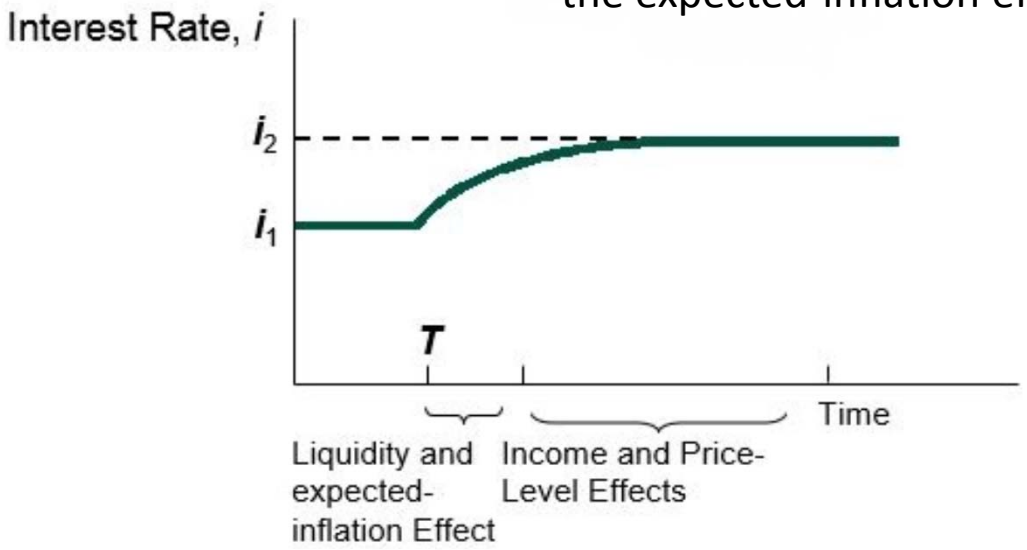
Eventually other effects raises inflation rates, but this adjustment is slow in this case.



# Pattern (c)

Liquidity effect smaller than other effects

The adjustment is immediate in this case and the expected-inflation effect operates rapidly.



# Key Point

- There are three possible cases as Patterns (a) to (c).
- For economic policy makers, it is important to decide which of the three cases is closest to reality.

# Preview

- Today, 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.

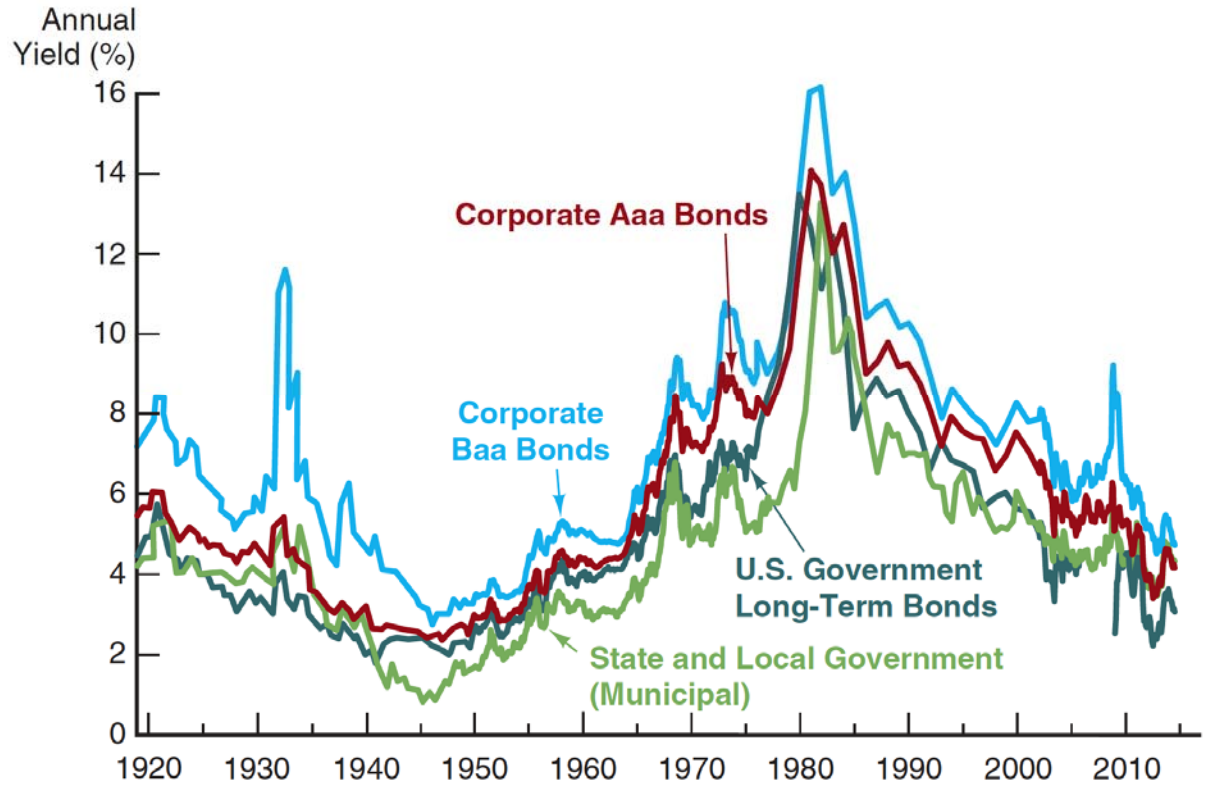
# Learning Objectives

- 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

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

# Figure 1 Long-Term Bond Yields, 1919–2014

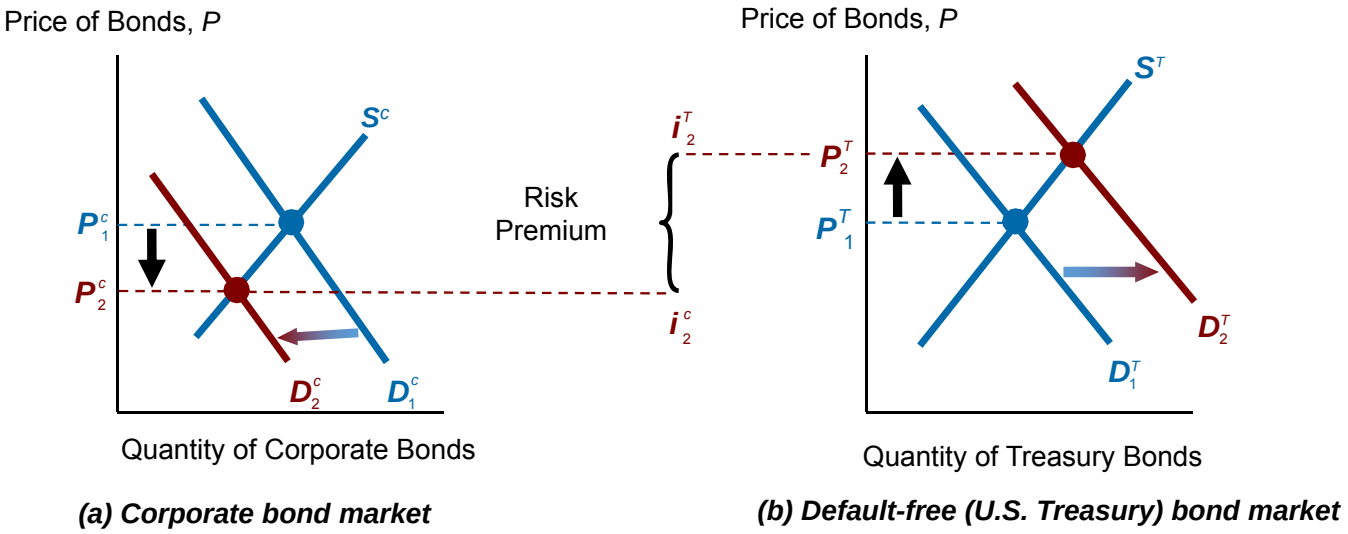



Sources: Board of Governors of the Federal Reserve System, *Banking and Monetary Statistics, 1941–1970*; Federal Reserve Bank of St. Louis FRED database: http://research.stlouisfed.org/fred2

# Risk Structure of Interest Rates

- **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




**Step 1.** An increase in default risk shifts the demand curve for corporate bonds left . . .
**Step 2.** and shifts the demand curve for Treasury bonds to the right . . .

**Step 3.** which raises the price of Treasury bonds and lowers the price of corporate bonds, and therefore lowers the interest rate on Treasury bonds and raises the rate on corporate bonds, thereby increasing the spread between the interest rates on corporate versus Treasury bonds.

Table 1 Bond Ratings by Moody's, Standard and Poor's, and Fitch

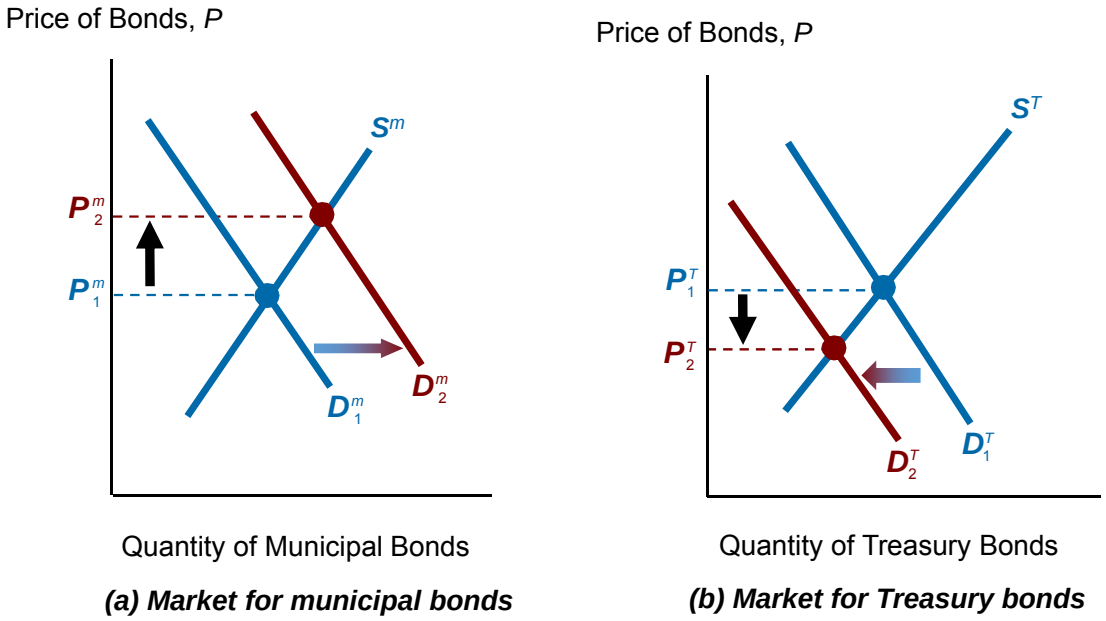
**TABLE 1** Bond Ratings by Moody's, Standard and Poor's, and Fitch

| Rating Agency | | | |
|---|---|---|---|
| **Moody's** | **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 |
| 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 |
| — | — | DDD | Default |
| — | — | D | |
| — | D | D | |

# Risk Structure of Interest Rates

- **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




**Step 1.** Tax-free status shifts the demand for municipal bonds to the right . . .

**Step 2.** and shifts the demand for Treasury bonds to the left . . .

**Step 3.** with the result that municipal bonds end up with a higher price and a lower interest rate than on Treasury bonds.

# 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

- 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

- **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

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

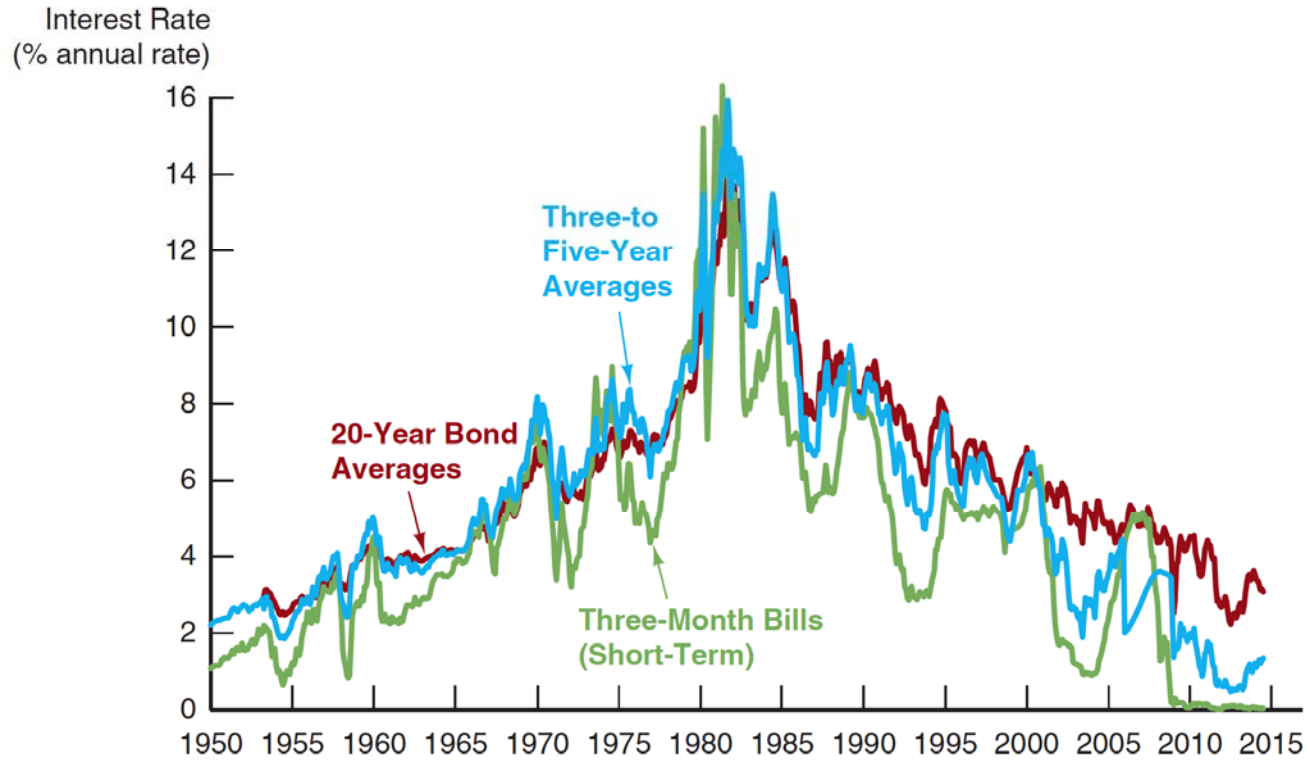
1. Interest rates on bonds of different maturities move together over time.
2. When short-term interest rates are low, yield curves are more likely to have an upward slope; when short-term rates are high, yield curves are more likely to slope downward and be inverted.
3. Yield curves almost always slope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

# Term Structure of Interest Rates

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

- 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: An Example

- We consider the following two investment strategies

1. Purchase a one-year bond, and when it matures in one year, purchase another one-year bond;
2. Purchase a two-year bond, and hold it until maturity.

- Because both strategies must have the same expected return, the interest rate on the two-year bond must equal the average of the two one-year interest rates.

# Expectations Theory: 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: More General Case

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

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

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

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

$$2i_{2t} = i_t + i^e_{t+1}$$

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

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

For bonds with longer maturities

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

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

The relationship between the one-year interest rates and two, three, four, and five-year bond's interest rate is

| Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|
| 5% | 6% | 7% | 8% | 9% |
| 5% | (5+6)/2 = 5.5% | (5+6+7)/3 = 6% | (5+6+7+8)/4 = 6.5% | 7% (see below) |

On the five-year bond, it will be

$$7\% = \frac{5\%+6\%+7\%+8\%+9\%}{5}$$

# Three Facts

1. Interest rates on bonds with different maturities move together over time.
2. Yield curves tend to have an upward slope when short-term interest rates are low and be inverted when short-term rates are high.
3. Yield curves usually slope upward.

# Expectations Theory

- 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). Historically if short-term interest rates increase today, they will tend to be higher in the future.
  - Why yield curves tend to slope up when short-term rates are low, and slope down when short-term rates are high (fact 2). If short-term interest rates start at a low level, people expect that it will rise in a near future.
- 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.
- The expected return from holding a bond of one maturity has no effect on the demand for a bond of another maturity.

# Segmented Markets Theory and Fact 3

- 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).
  - Remember that a price of bond and the interest rate have **negative** relationship.
  - The demand for the long-term bond is typically **lower** than the demand for the short-term bond.
  - Long-term bond has a **lower** price.
  - Long-term bond has a **higher** interest rate.

# Segmented Markets Theory and Facts 1 & 2

-  Fact 1
- Because in views the market for bonds of different maturities as completely segmented, there is no reason that a rise in the interest rate on a bond of one maturity would affect the interest rate on a bond of another maturity.
-  Fact 2
- Because it is not clear how the demand for and supply of short- versus long-term bonds change with the level of short-term interest rates, the theory does not explain why yield curves tend to slope upward when short-term interest rates are low.

# Liquidity Premium & Preferred Habitat Theories

- 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.
- The expected return on one bond does influence the expected return on a bond of a different maturity.
- Short-term securities are less risky compared to long-term rates due to the difference in maturity dates. Therefore investors expect a premium, or risk premium for investing in the risky security.

# 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 $t$

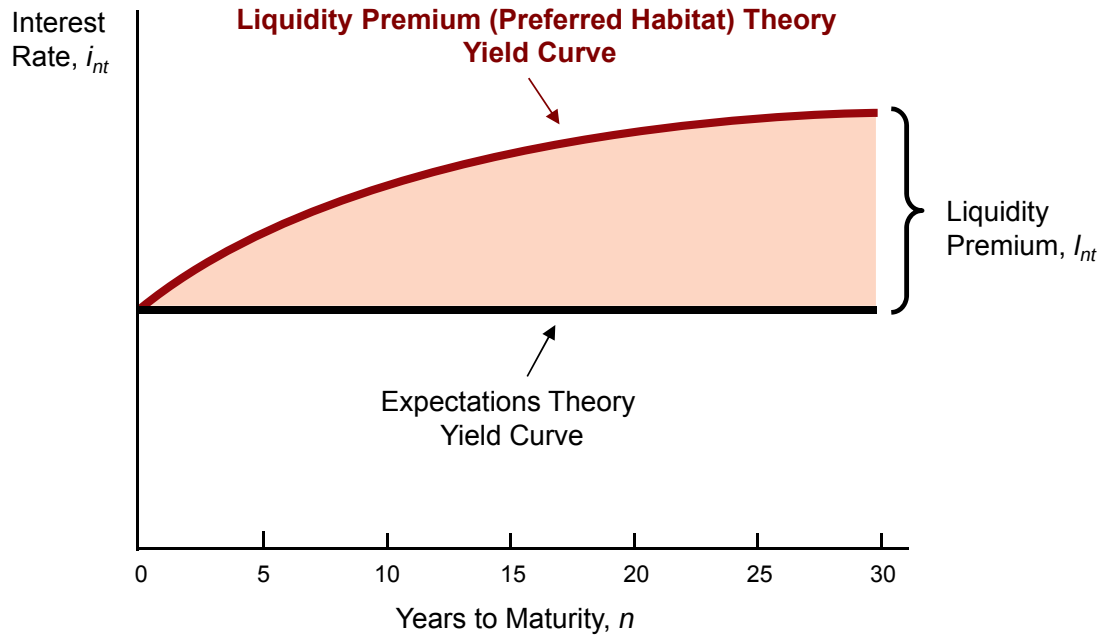
$l_{nt}$ is always positive

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.
- Risk-averse 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

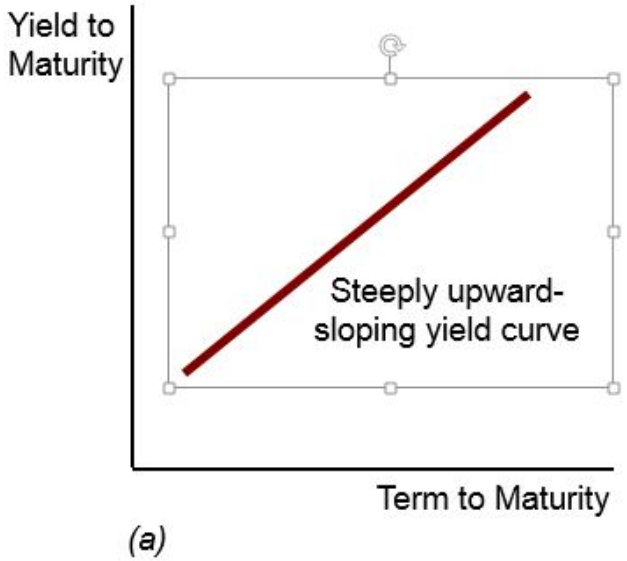


# Liquidity Premium & Preferred Habitat Theories

- 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
    1. When short-term interest rates are low, investors expect them to rise to some normal level, and thus averaged expected short-term rates are higher than the current level.
    2. When short-term interest rates are very low, with the additional boost of a positive liquidity premium, long-term interest rates will be substantially higher than current short-term rates.
- Yield curves typically slope upward; explained by a larger liquidity premium as the term to maturity lengthens

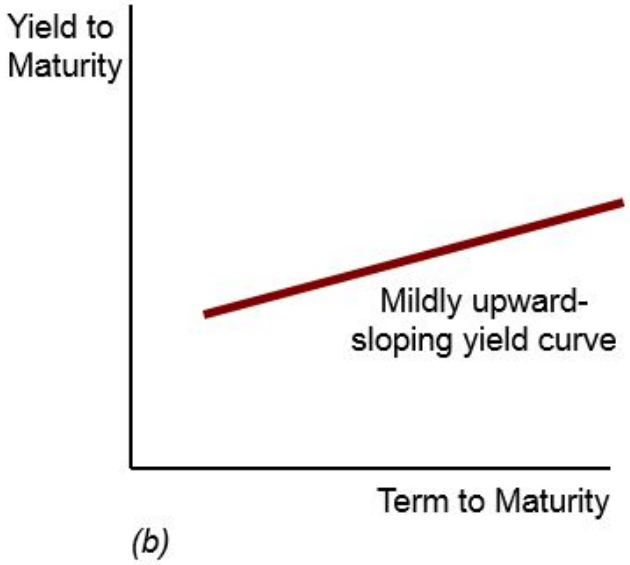
# Pattern (a) under Liquidity Premium & Preferred Habitat Theories

Short-term interest rates are expected to rise.



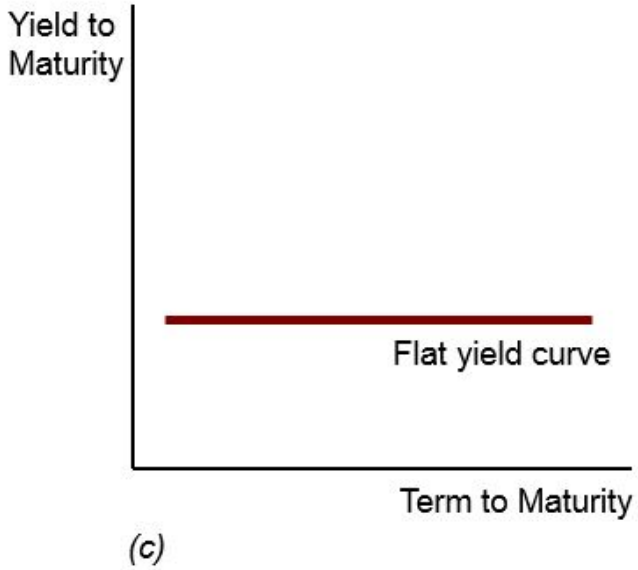
# Pattern (b) under Liquidity Premium & Preferred Habitat Theories

Short-term interest rates are not expected to rise or fall much in the future.



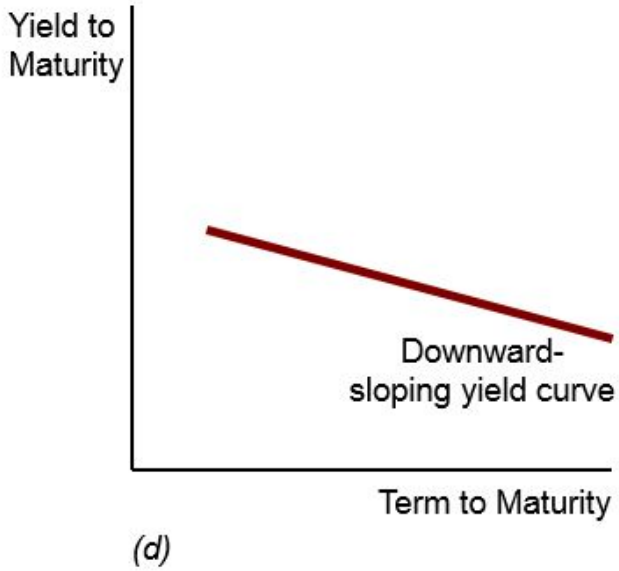
# Pattern (c) under Liquidity Premium & Preferred Habitat Theories

Short-term interest rates are expected to fall moderately.



# Pattern (d) under Liquidity Premium & Preferred Habitat Theories

Short-term interest rates are expected to fall sharply in the future.



# Figure 7 Yield Curves for U.S. Government Bonds