Money and Banking

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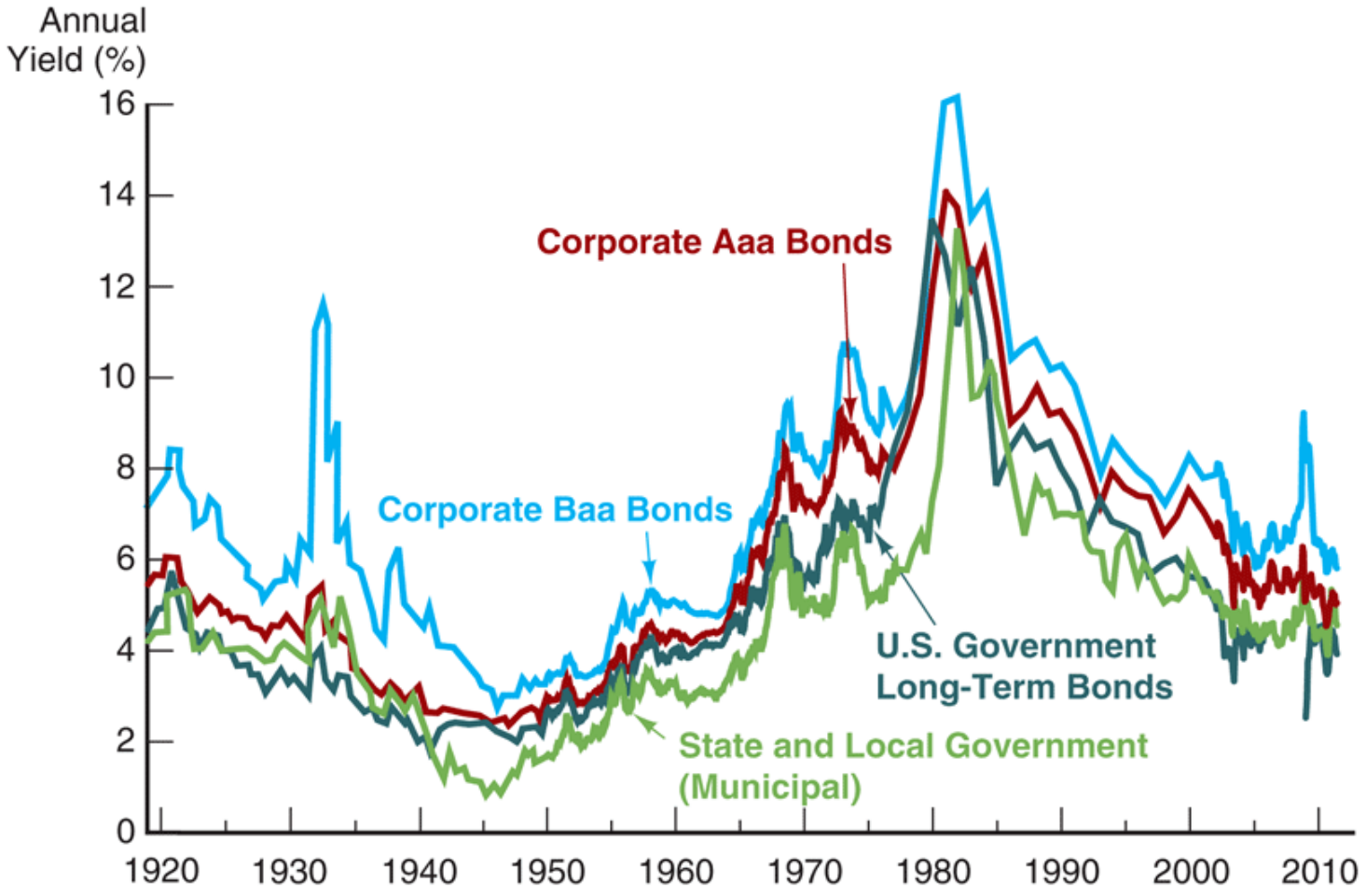
Lecture 5 The Risk and Term Structure of Interest Rate



Default Risk

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

- **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 or simply just print more money).

  - **Risk premium**: the spread between the interest rates on bonds with default risk and the interest rates on (same maturity) Treasury bonds

Default Risk and Risk Premium

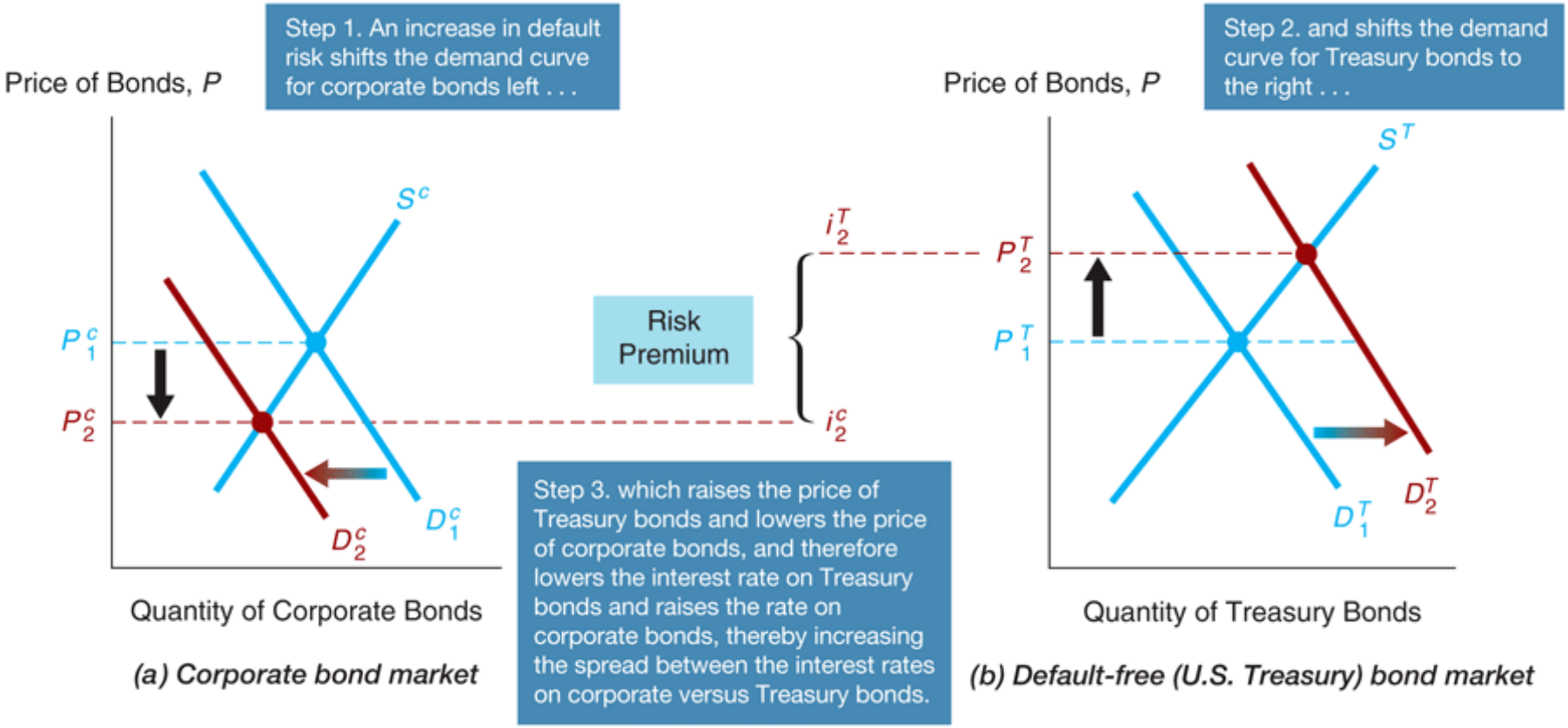


Figure 1 Bond Ratings

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

Rating			
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
—	—	DD	—
—	D	D	

Bonds rated below BAA are called **junk bond**.

Default Risk and Risk Premium

- **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

  - Risk premium rises as liquidity decreases (*risk and liquidity premium*)

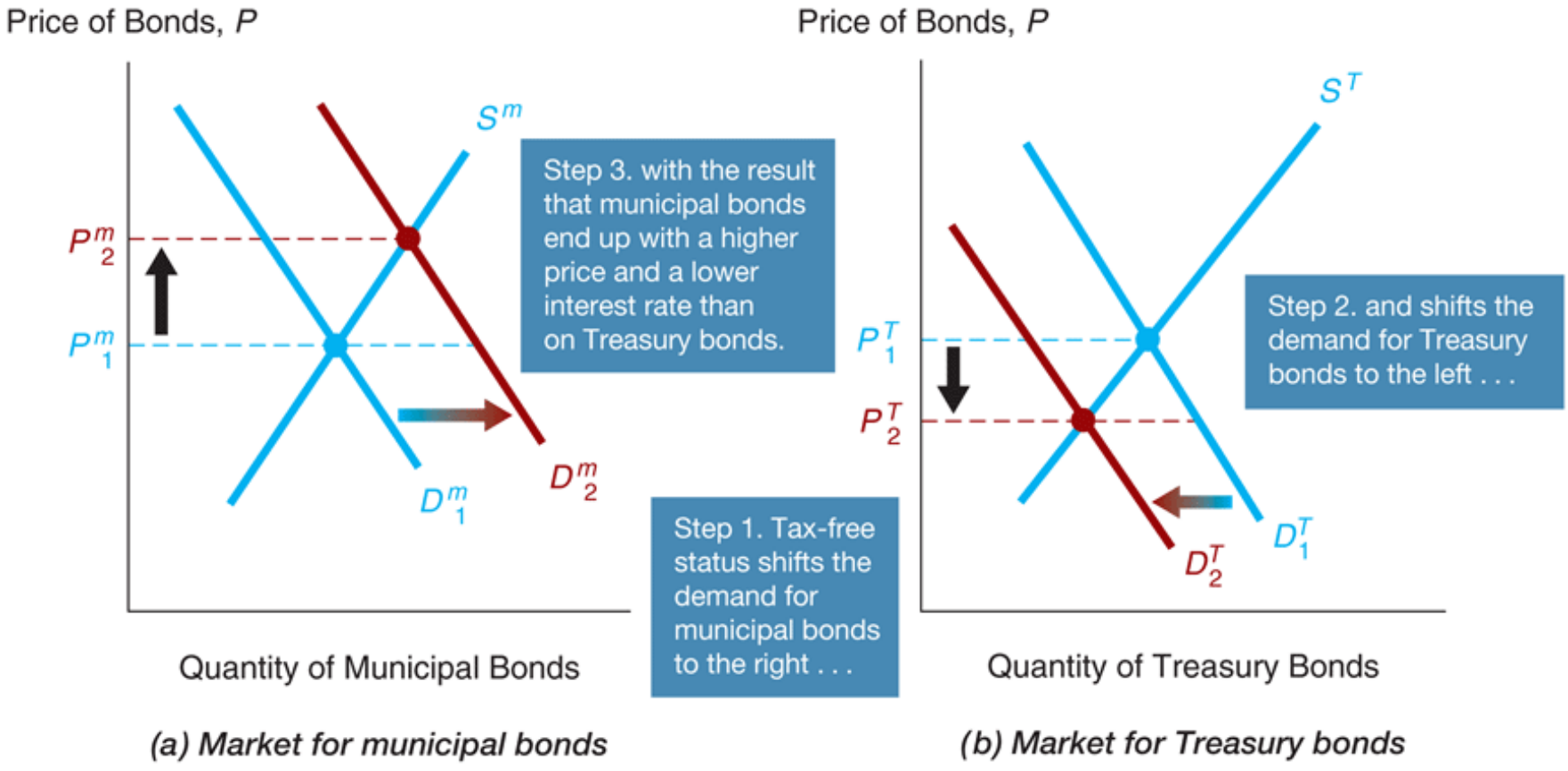
- **Income tax considerations**

  - **municipal bonds**: bonds issued by local governments

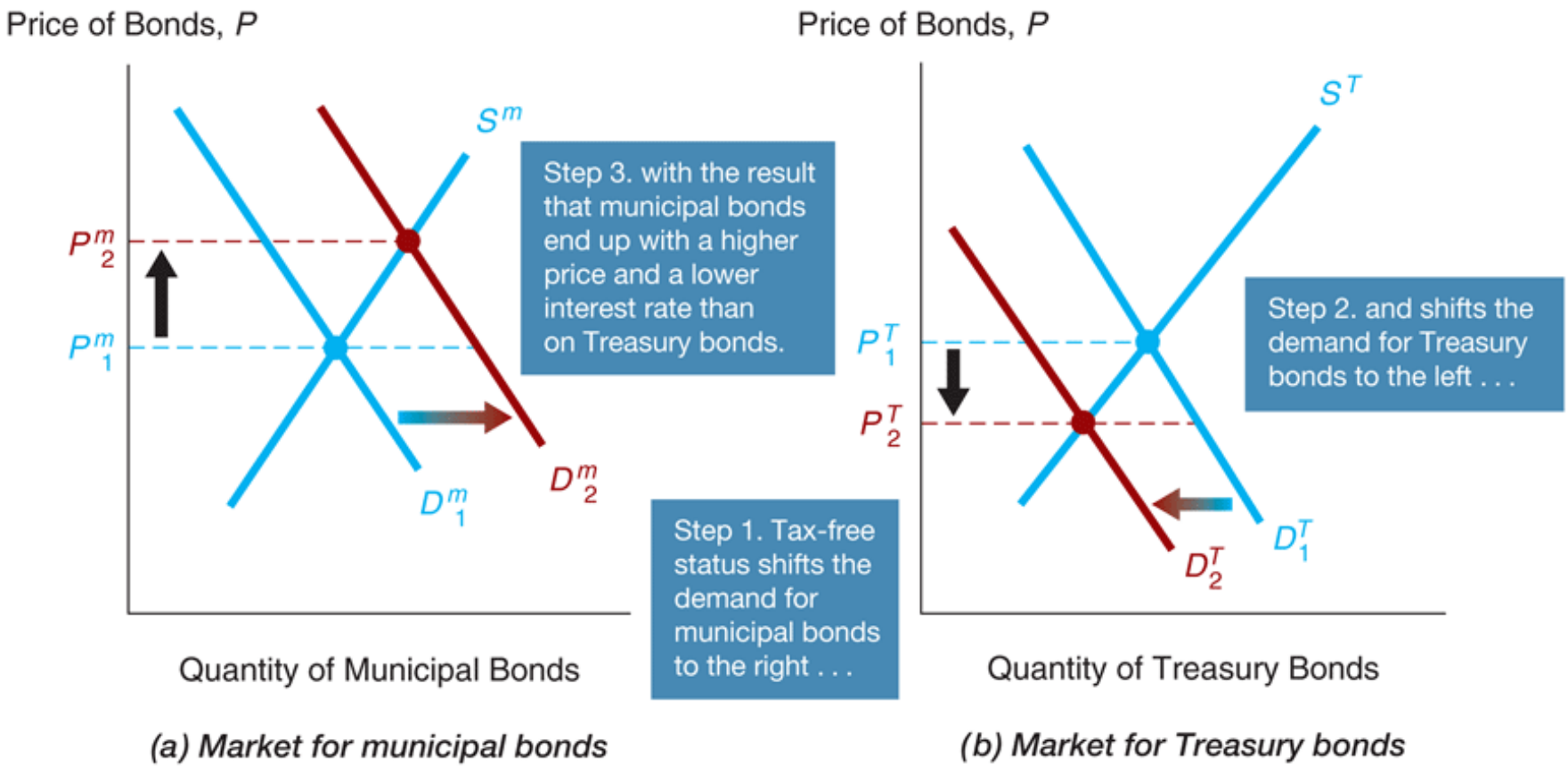
  - Why municipal bonds have lower interest rates than US treasury bonds even though it has higher risk and less liquidity?

  -Interest payments on municipal bonds are exempt from federal income taxes.

Interest Rates on Municipal and Treasury Bonds



Term Structure of Interest Rates



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

- **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

http://finance.yahoo.com/bonds/composite_bond_rates

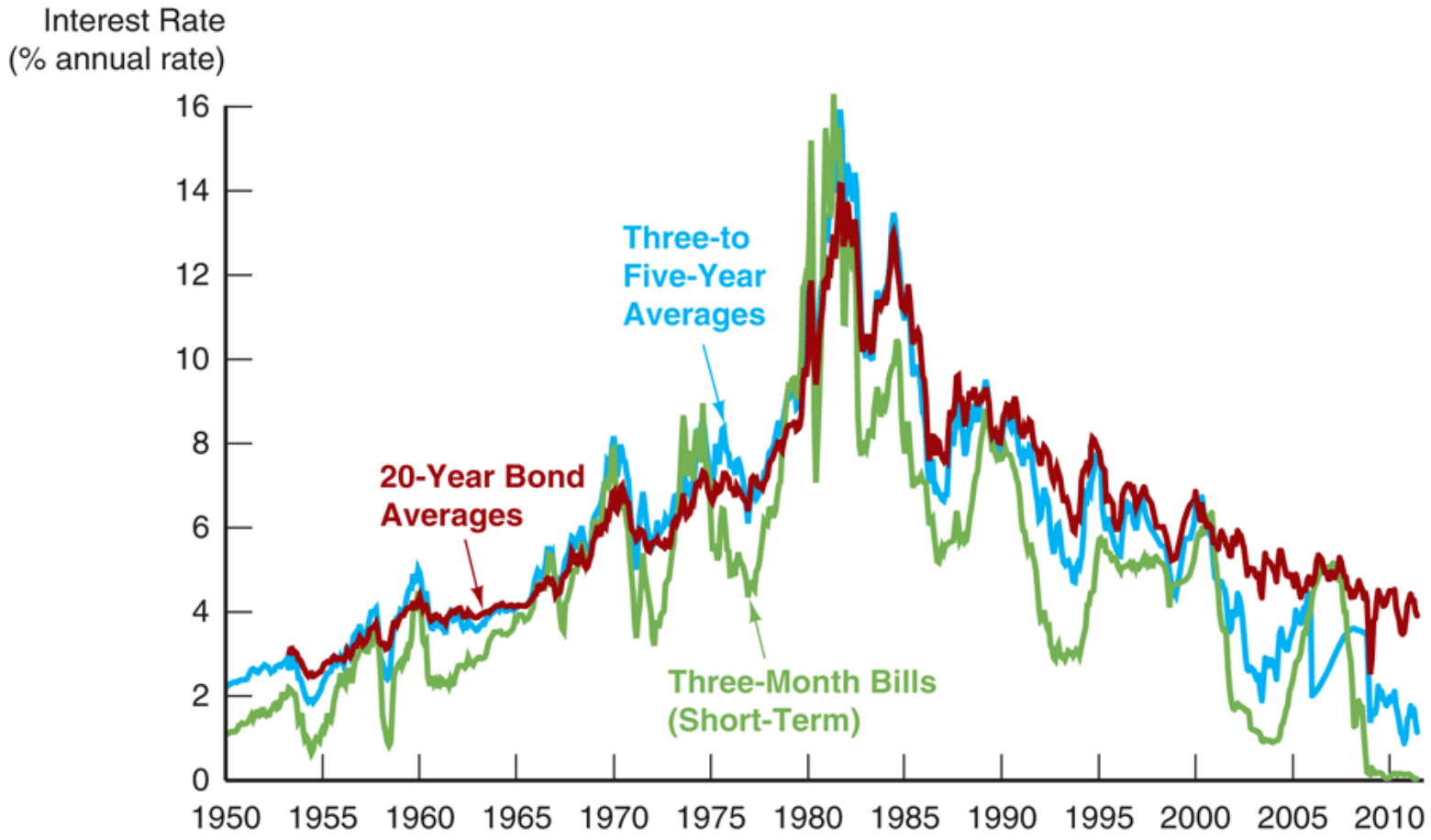
Three Facts on the Interest Rates of Bond

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

Three Theories have been proposed to explain these three facts:

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

Movements of the Interest Rates on US Government Bonds



Expectation 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**

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.

Expectation Theory

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

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

$$2i_{2t}$$

Expectation 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

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

Expectation 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

Expectation Theory

- Explains why the term structure of interest rates changes at different times
- Explains why interest rates on bonds with different maturities move together over time (fact 1)
- Explains 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 Market 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

- 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**

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

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 Habit 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 2 The Relationship Between the Liquidity Premium (Preferred Habitat) and Expectations Theory

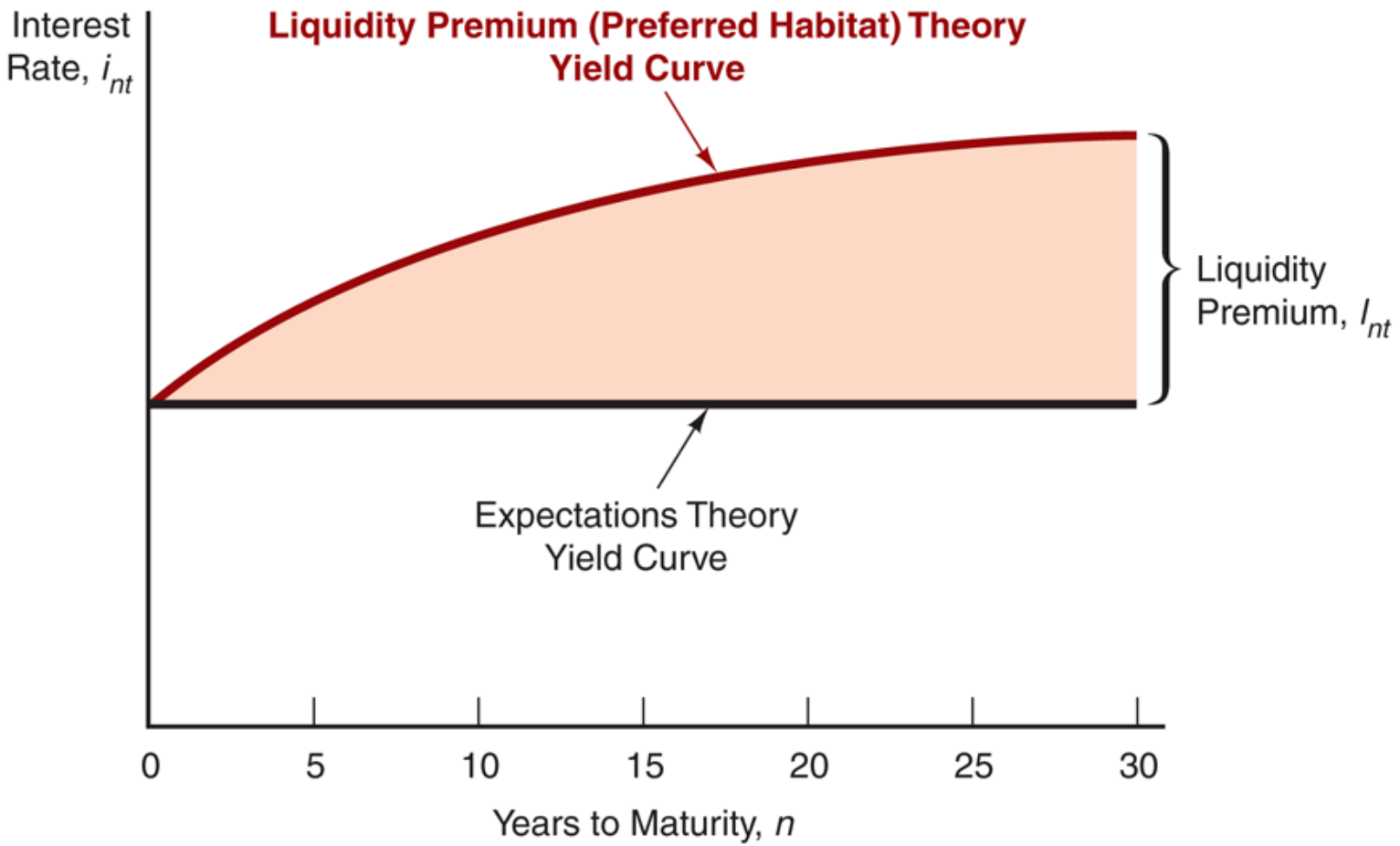


Figure 4 Yield Curves for US Government Bonds