Topic 2 : Debt Market and The Structure of Interest Rate (2)

EE431/438

Federic Mishkin, The Economics of Money, Banking and Financial Markets Chapter 4 - 6
(available at the reserve section of the library, HG173 .M57 2007)

August 2012

Outline

1. Measuring Interest Rates (handout - part 1)
2. Nominal Interest Rates (i) and Real Interest Rates (r) (handout - part 2)
3. The Behavior of Interest Rate (handout - part 2)
4. Risk and Term Structure of Interest Rate (handout - part 2)

2. Nominal Interest Rates (i) and Real Interest Rates (r)

- Real Value VS. Nominal Value
- Which one the effect of a change in the price level is eliminated?
- For example, real GDP VS. nominal GDP
- Changes in the price level $\Rightarrow$ a different between "real" and "nominal value"
- Price $\uparrow$, Purchasing power .....
- Nominal value may $\uparrow$ but real value $\downarrow \Rightarrow$ "Money Illusion"
- Bond : pay the price to day , receive cash flow payment in the future
- Price $\uparrow$, the purchasing power of the cash flow received $\downarrow$

- Nominal interest rate : the effect of a change in the price level is not eliminated
- Real interest rate : the effect of a change in the price level is eliminated
- YTM = ... interest rates
- Example: Lend your friend 1000 Baht, 1 year,10% interest rate. $PI_0 = 100$, $PI_1 = 125$. What is the nominal interest rate you charge your friend? What is the real interest rate you get ?

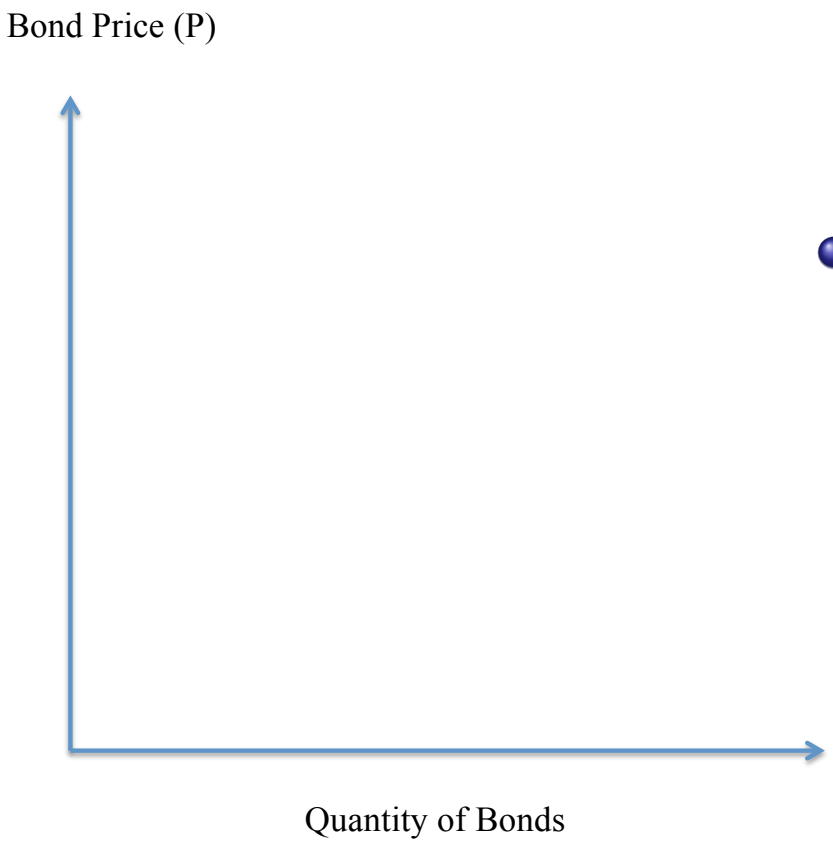
- Example: Lend your friend 1000 Baht, 1 year, and you want 10% real interest rate. What is the nominal interest rate you will charge your friend?
  - Price level at the begining of the year $=PI_0 = 100$. At the end of the year $=PI_1 = 100$
  - Price level at the begining of the year $=PI_0 = 100$. At the end of the year $=PI_1 = 125$

- $(1 + r)(1 + \pi^e) = (1 + i)$
- $i = r + \pi^e$
- Fisher Equation : Nominal Interest Rate (i) = Real Interest Rate(r) + Expected Inflation Rate(π^e)

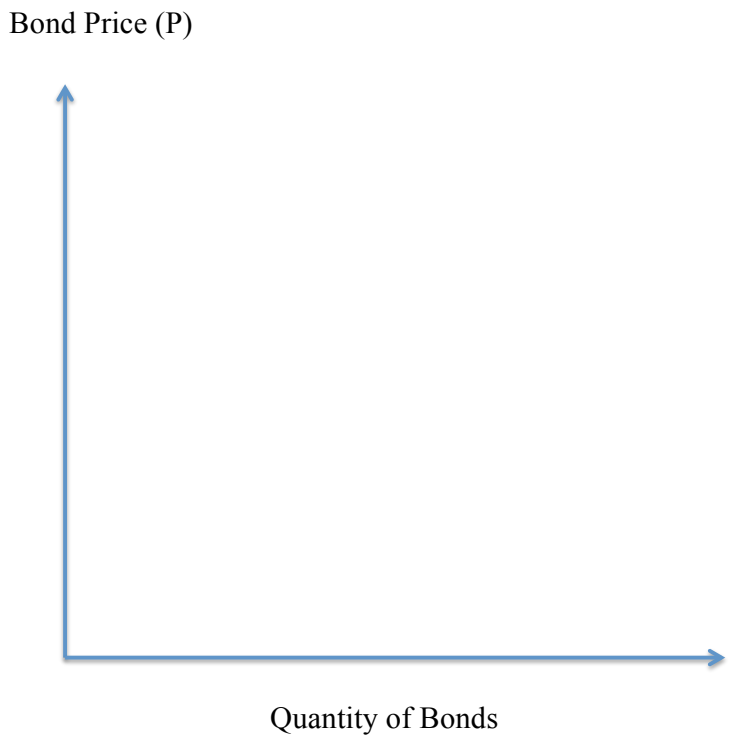
3.1 Loanable Fund Theory : Interest Rate $\Leftarrow$ Bond Demand (loanable fund supply) and Bond Supply (loanable fund demand)

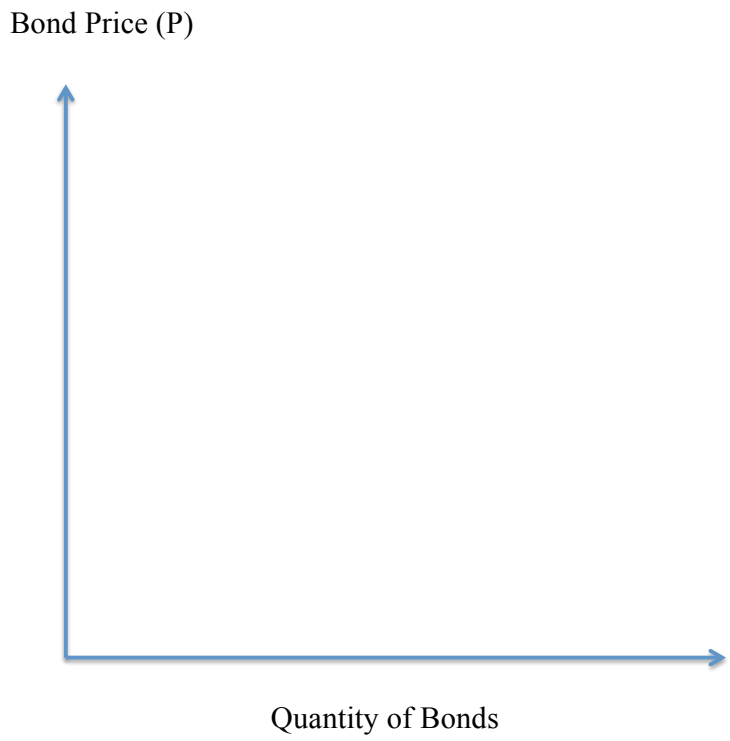
Determinants of Bond Demand (B^d)
1. Wealth $\uparrow$, B^d.....
2. Expected return on bonds relative to other assets $\uparrow$, B^d.....
$r \uparrow$, B^d.....
*** π^e **constant,** $i \uparrow$ **Bond Price ....,** r **.....** B^d**.....,** ***
i constant , $\pi^e \uparrow$**,** r ....., B^d.....
3. Liquidity relative to other asset s$\uparrow$, B^d.....
4. Riskiness relative to other assets $\uparrow$, B^d.....

- Shift in Bond Demand : example



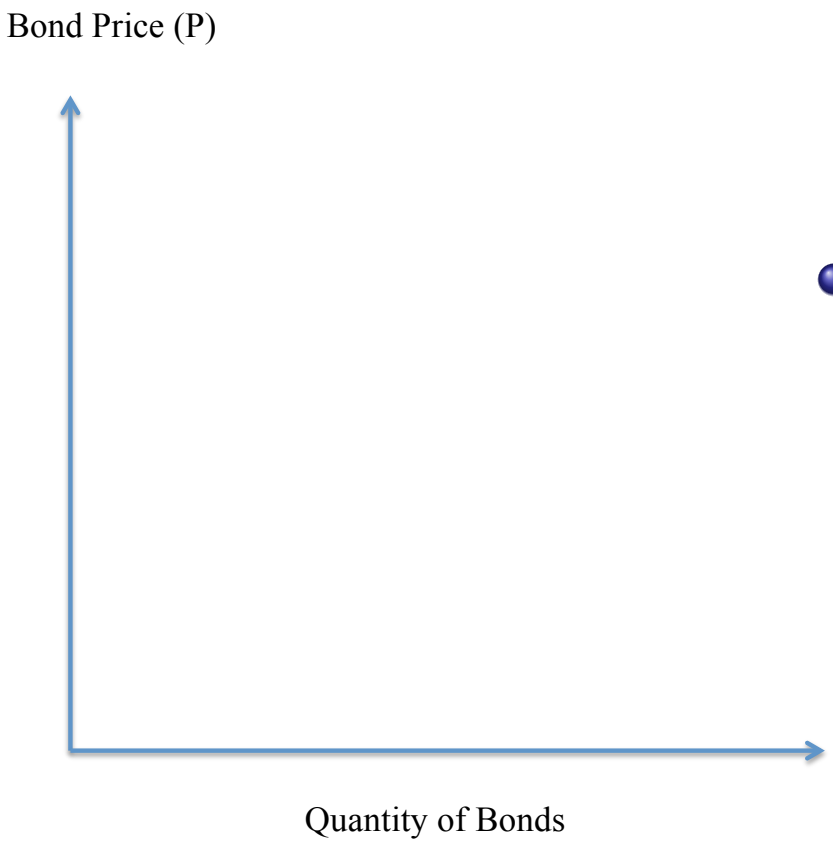
- Suppose Bond demand shift to the right,
  - total wealth.....
  - liquidity of bonds relative to the other assets .....
  - risk relative to other assets .....


Bond Price (P)
Quantity of Bonds


Bond Price (P)
Quantity of Bonds

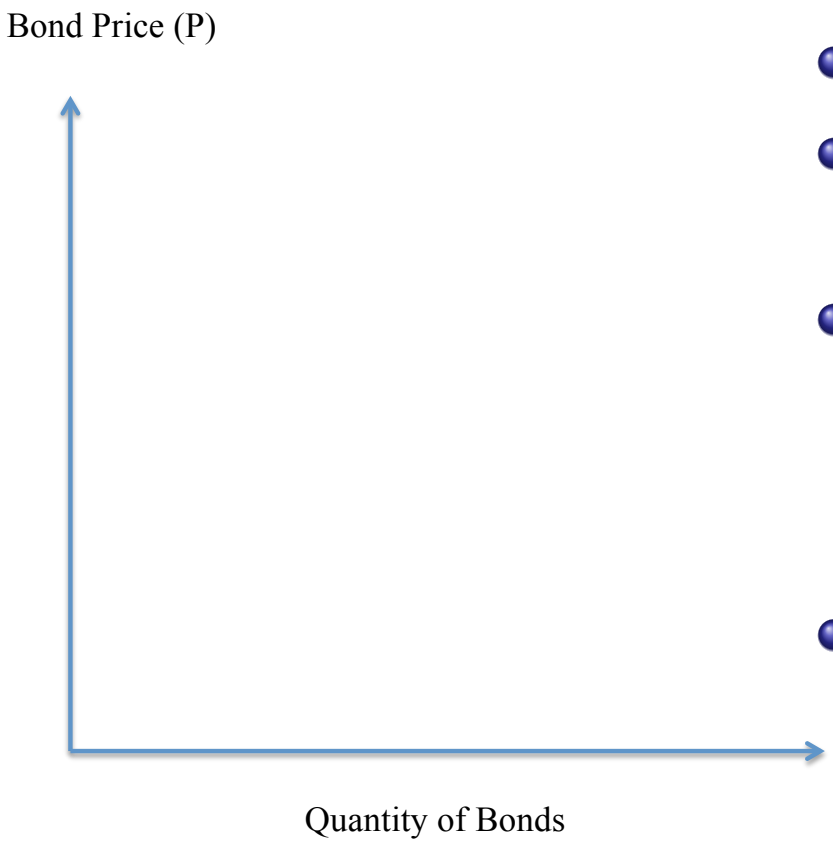
Determinants of Bond Supply (B^s)
1. Expected Profitability $\uparrow$, B^s.....
Corporate Taxation $\uparrow$, B^s.....
Subsidy $\uparrow$, B^s.....
2. Expected Inflation
$\pi^e \uparrow$**,** r ....., all i, B^s.....
*** π^e **constant,** $i \uparrow$ **Bond Price ... ,** r **....,**$i \uparrow$, r ...., B^s...., ***
3. Government Borrowing
Government Borrowing $\uparrow$, B^s.....

- Shift in Bond Supply



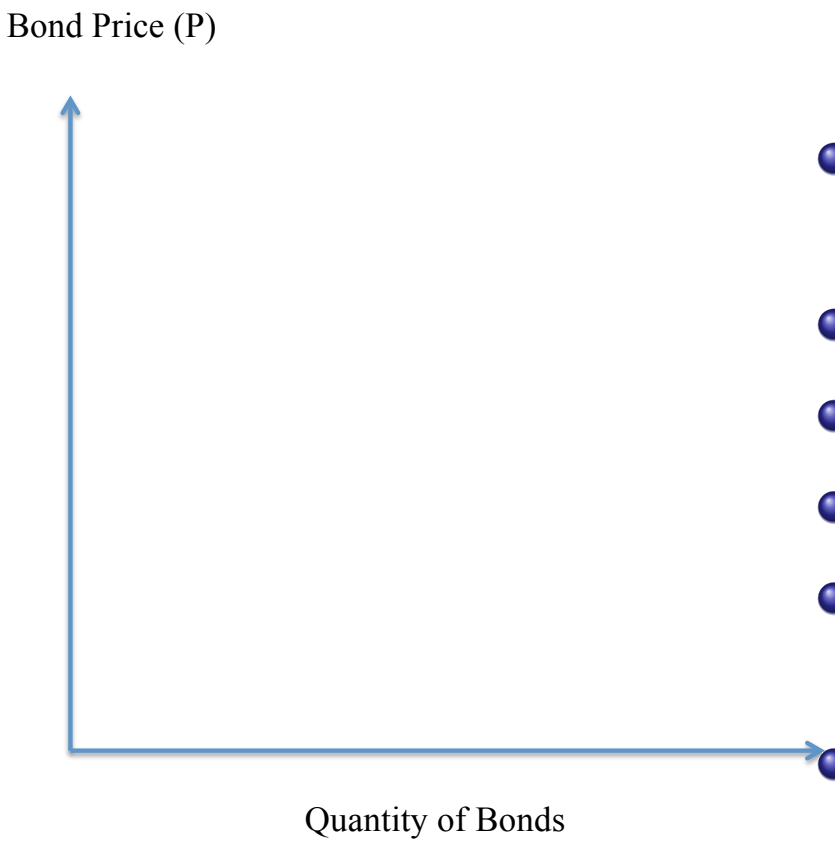
- Suppose Bond Supply shift to the right,
  - profitability of investments .....
  - expected inflation ......
  - government deficit .....

- A change in π^e



- Suppose $\pi^e \uparrow$
- Bond Demand shift to ..... and Bond Supply shift to .....
- Equilibrium Bond Price ..... , Equilibrium nominal interest rate ..... Equilibrium quantity .....
- Recall : Fisher equation $\Rightarrow i = r +$ ..... , implying $\pi^e \uparrow$, i .....
- "Fisher effect"

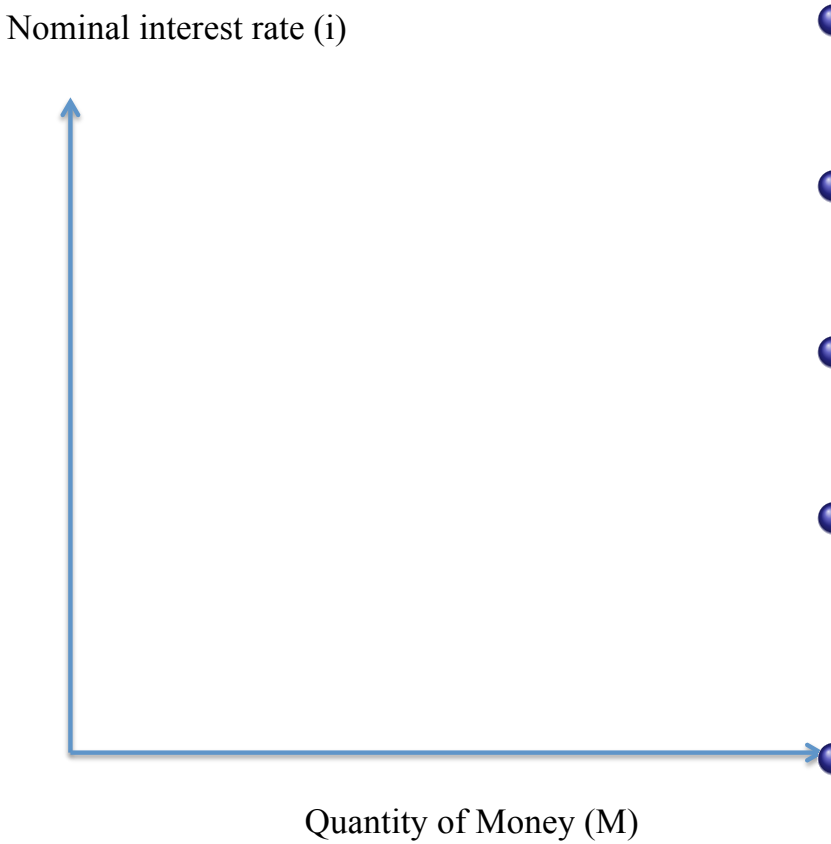
- Reponse to a business cycle expansion



- In a business cycle expansion, income and wealth are rising.
- Bond Demand shift to .....
- and Bond Supply shift to .....
- Equilibrium Bond Price ..... ,
- Equilibrium nominal interest rate .....
- Equilibrium quantity .....

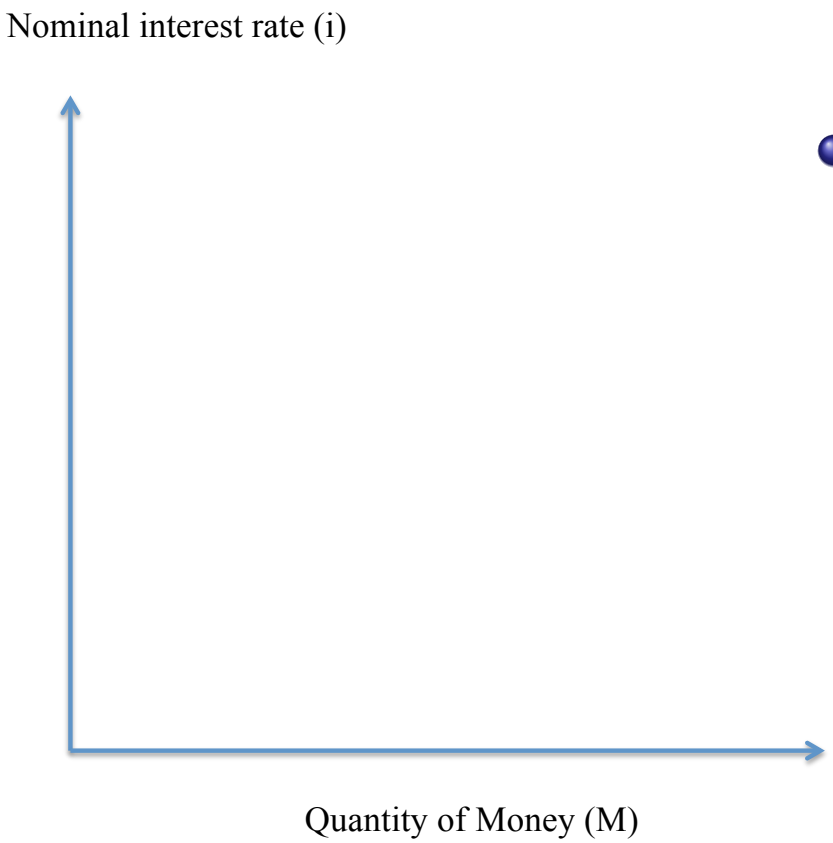
3.2 Liquidity Preference Framework (Keynesian)

- two main assets people use to store their wealth : Money and Bonds
- $M^d + B^d = M^s + B^s =$ total wealth
- $M^d = M^s \rightarrow B^d = B^s$. Whenever money market is in equilibrium, bond market must be in equilibrium.
- Analysing money market is equivalent to analysing bond market
- Liquidity preference framework $\rightarrow$ analyse the money market
- Money Demand
  - Transation demand
  - Precautionary demand
  - Speculative demand
- Money Supply
  - controlled by the central bank



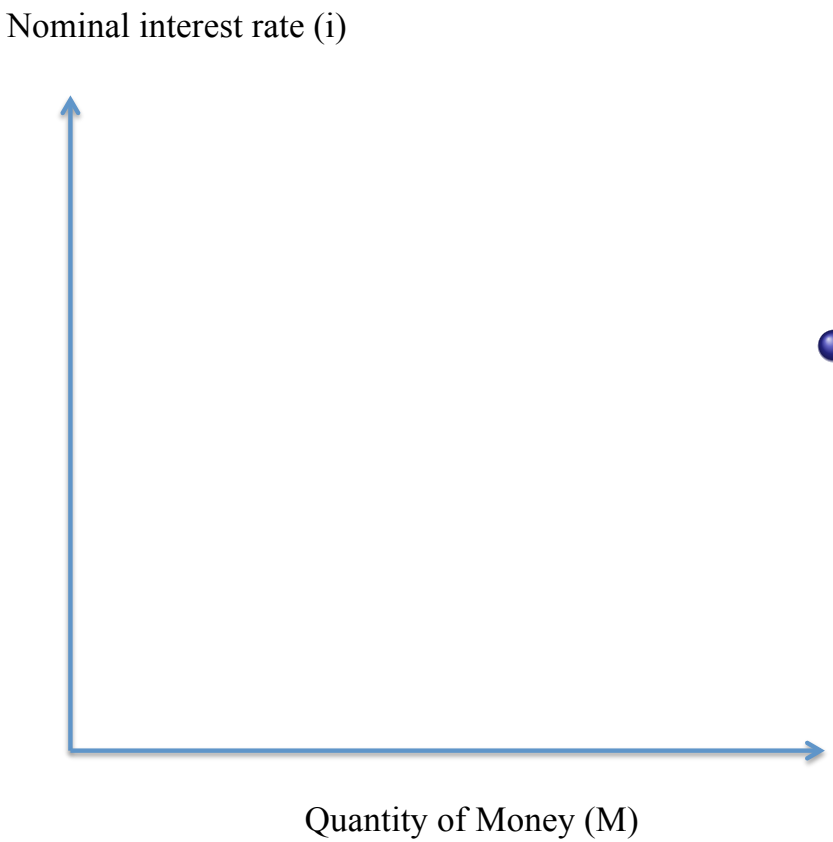
- If interest rate is lower than the equilibrium interest rate,
- there will be excess money .....
- agents will ..... (buy/sell) more bonds,
- then bond ..... (demand/supply) ..... (increases/decreases),
- therefore the interest rate ..... (increases/decreases)

- Shift in money supply



- Suppose money supply shift to the right, caused by
  - the central bank ..... money supply
  - How does the central bank raise the money supply?
    - open market operation, ... securities
    - ..... policy interest rates

- Shift in money demand



- Suppose money demand shift to the right, caused by
  - income .....
  - price level .....

4. Structure of Interest Rates

- In practice, there are many rates of interest; deposit rates (saving, time deposits), lending rates, government bonds, corporate bonds
- Interest rates varies because different levels of risk of the borrowers and/or different borrowing periods
- Why bonds with the same term to maturity have different interest rates $\Leftarrow$ the risk structure of interest rate
- Bond's term to maturity $\Rightarrow$ interest rates $\Rightarrow$ the term structure of interest rates

4.1 Risk Structure of Interest Rate

Why bonds with the same term to maturity have different interest rates? 4 important factors

1. Default Risk:

- the risk which occurs when the issuer of the bond is unable or unwilling to make interest rate payment when promised or the face value when the bond matures
  - Corporate suffering big losses might be more likely to suspend interest payments on its bonds. This means its bonds have high default risk.
  - Default-free bonds = government bonds : because government can always increases taxes (however, in the international debt market, government bonds are not considered risk-free. We focuses on the case where government bonds are risk-free.)
  - The spread between interest rates and risk-free rate is called .....

- a bond with default risk (any corporate bonds) always have risk premium .... 0 and an increase in its default risk will ..... the risk premium
- default risk $\rightarrow$ interest rate : the information is important for both buyers and sellers to price the bond correctly
- information $\rightarrow$ market efficiency
- Information about default risk is provided by “credit rating agencies” ; Standard and Poor’s , Moody’s, TRIS

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+	Non Investment 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	

2. Liquidity :

- liquidity = how easy an asset can be quickly converted in to the medium of exchange, with a little loss of value
- The more liquid an asset is, ... desirable it is.
- Which one is more liquid, government bonds or corporate bonds?
- The difference between government bond yields and corporate bond yields reflects both bond's default risk and liquidity.

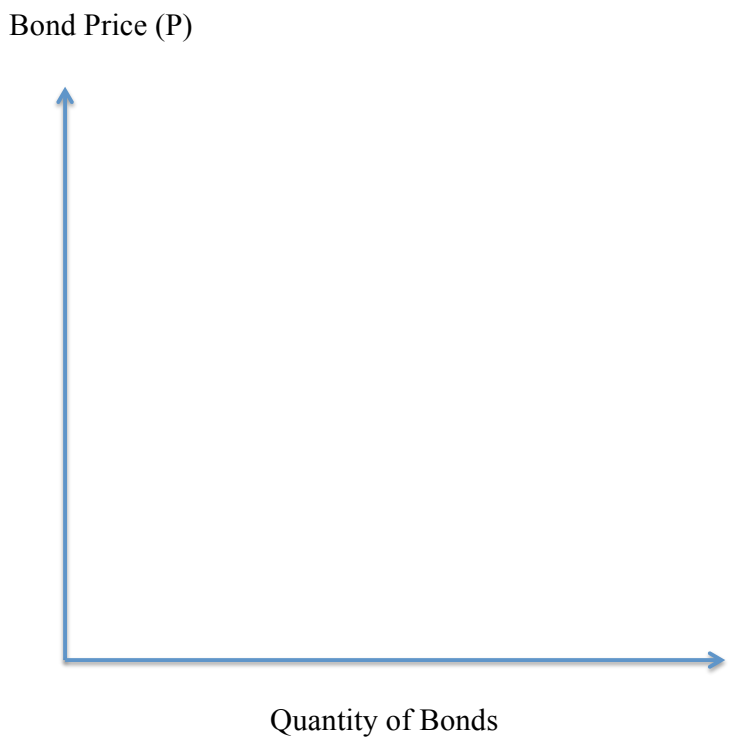
3. Income tax considerations

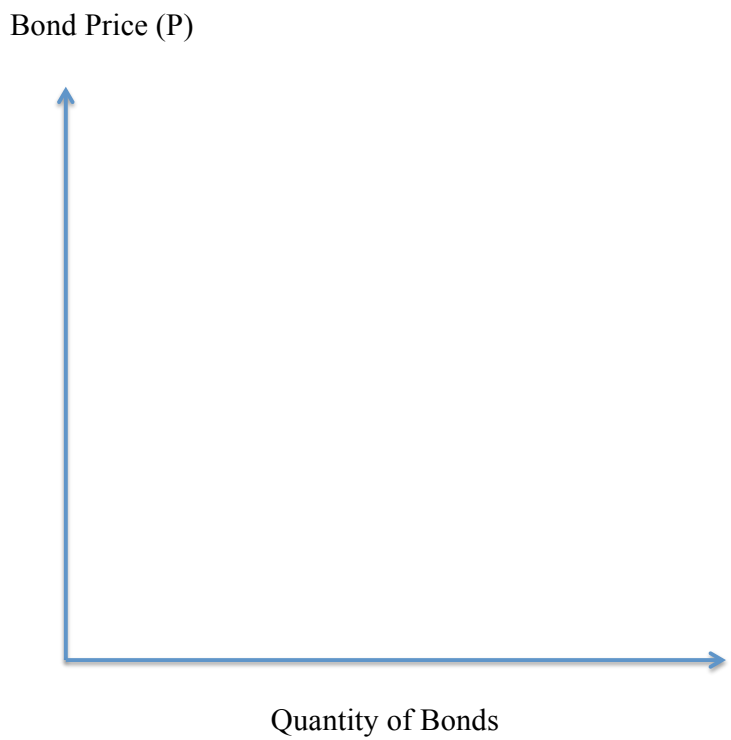
- some bonds are exempt from income taxes
- buyers consider their returns after taxes
- therefore, those bonds which are tax-free will pay a lower interest rate than it should do if they are not tax-free

Interest rate risk premium of a bond = Interest rate on the bond - interest rate on default free bonds with the same maturity

What will happen to the risk premium if

- default risk of a corporate bond increase?
- liquidity of a corporate bond decrease relative to the government bonds?
- income tax on the bond interest increases?





4.2 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
- Generally, when talking about the yield curve, it refers to the yield on government bonds
- In most cases (normal situations),
  1. Yield curve slopes .....
  2. Interest rates on bonds of different maturities move together over time
- three theories explain why bonds with differing terms to maturity have different yields to maturity: which one can explain the two findings the best
- note that what information the yield curve does contain remains a topic of debate in economics

4.2.1 Segmented Market Theory

- Assumption : bonds of different maturities are not substitutes at all
- Result
  - market for bonds with different maturies are totally separated from one another
  - interest rates (YTM) and bond prices for each bonds with different maturities are determined by the demand and sypply of the bonds in each market only
- Does segmented market theory can explain the first fact, the yield curve usually slopes upward?
  - yields on bonds with longer maturity is .....
  - yield on bonds with shorter maturity is .....
  - This means the demand for bonds with ..... maturity is higher
- Does segmented market theory can explain the second fact, the yields on bond with different maturity usually move together?
  - Yes/No.. why?

4.2.2 Expectation Theory

- Assumption: bonds of different maturities are perfect substitutes (with the same level of risk, liquidity, taxation)
- Result : For a given investment period, at equilibrium, is it possible to have the returns from investment in bonds with different maturities?
- Let $i_{n,t}$ is the interest rate on bonds with n years time to maturity, at time t
- Consider a two-years investment period

$$\begin{aligned} \text{Buy and hold} &= \text{Roll Over} \\ (1+i_{2,t})^2 &= \end{aligned}$$

- Consider a n years investment period

$$i_{n,t} = \frac{i_{1,t} + i^e_{1,t+1} + i^e_{1,t+2} + ... + + i^e_{1,t+n-1}}{n}$$

Example: Given the following information, in 2012

- Government bond, ttm = 3 years, YTM = 6%
- Government bond, ttm = 2 years, YTM = 4%
- Government bond, ttm = 1 years, YTM = 2%

What is the expected YTM on a government bond with 1 year time to maturity in 2013 and 2014?

Example: Given the following information, in 2012

- Government bond, ttm = 3 years, YTM = 5%
- Government bond, ttm = 2 years, YTM = 6%
- Government bond, ttm = 1 years, YTM = 8%

What is the expected YTM on a government bond with 1 year time to maturity in 2013 and 2014?

- According to Expectation Theory,
  - upward sloping yield curve $\rightarrow$ the market expects the interest rate to .....
  - downward sloping yield curve $\rightarrow$ the market expects the interest rate to .....
  - flat yield curve $\rightarrow$ the market expects the interest rate to .....
- How well the theory can explain the two findings?
  - 1. yield curve usually slopes upwards $\rightarrow$ .....
  - 2. the yields on bond with different maturity usually move together?

4.2.3.1 Preferred Habitat Theory

- Assumption : Bonds of different maturities are partial (not perfect) substitutes
- Result: 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

$$i_{n.t} = \frac{i_{1,t} + i^e_{1,t+1} + i^e_{1,t+2} + ... + +i^e_{1,t+n-1}}{n} + \eta_{n,t}$$

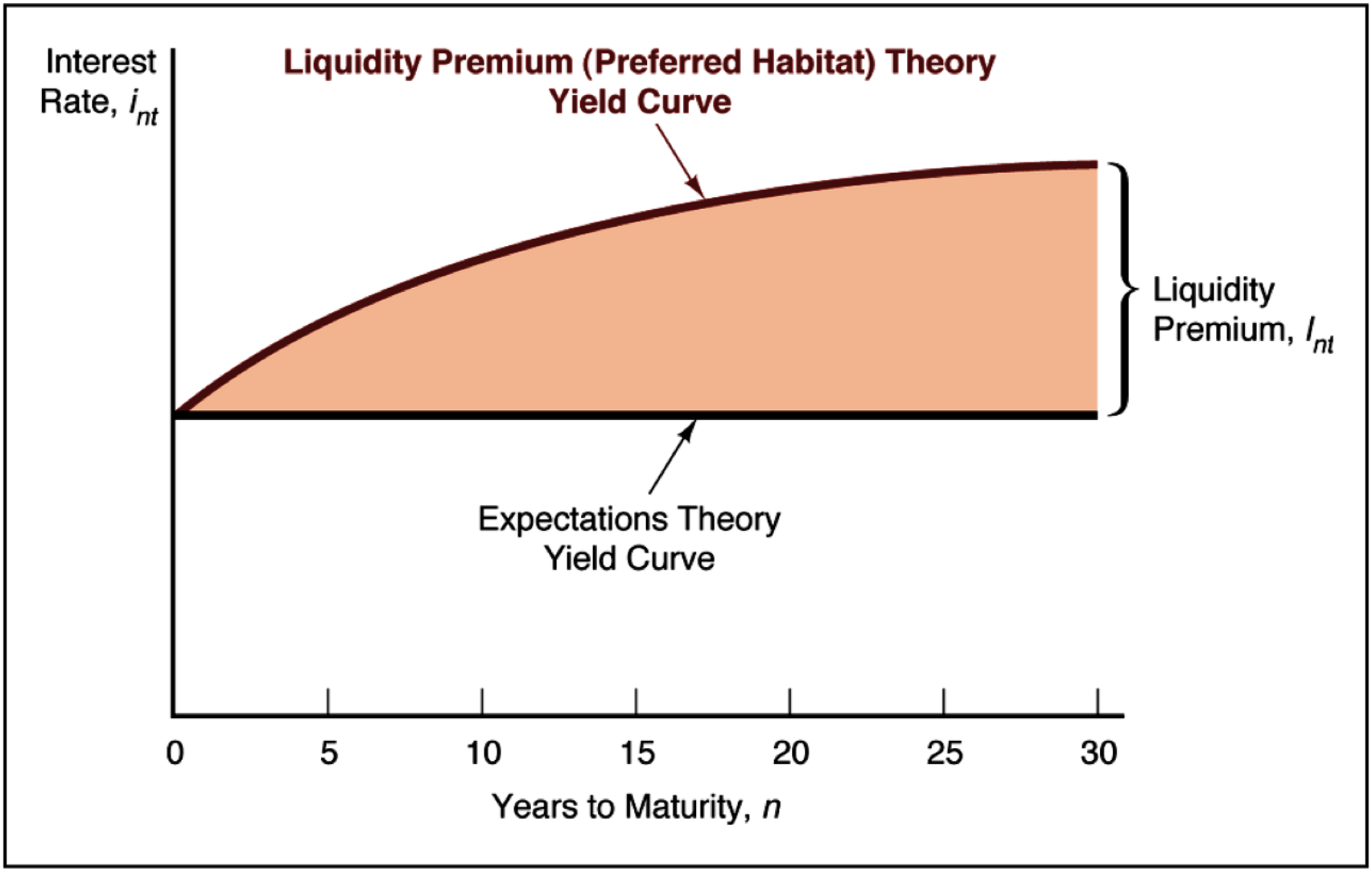
$\eta_{n,t}$ is term premium for bonds with n time to maturity at time t
η is ..... for bonds with the time to maturity that the investor likes the most, it is ..... bonds with a different time to maturity

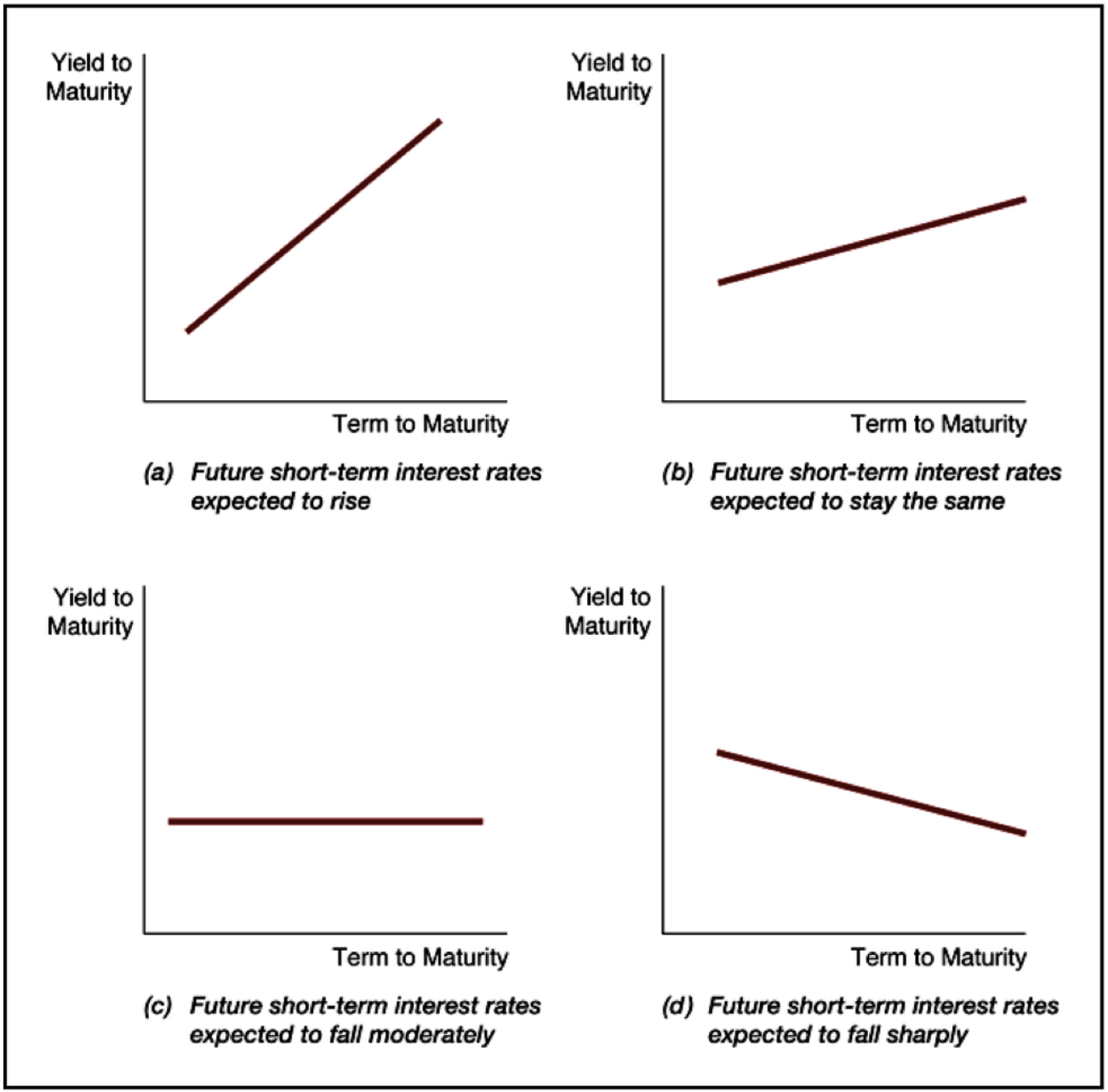
4.2.3.2 Liquidity Premium

- Assumption : Bonds of different maturities are partial (not perfect) substitutes. Investors prefer short-term bonds over long-term ones because short-term bonds are more liquid
- Result: Investors will be willing to buy bonds of longer term maturities only if they earn a somewhat higher expected return.

$$i_{n.t} = \frac{i_{1,t} + i^e_{1,t+1} + i^e_{1,t+2} + \ldots + + i^e_{1,t+n-1}}{n} + \eta_{n,t}$$

- Therefore, η is ..... for long-term bonds, it is ..... for short-term bonds.


Interest Rate, i_{nt}
Liquidity Premium (Preferred Habitat) Theory Yield Curve
Liquidity Premium, l_{nt}
Expectations Theory Yield Curve
0
5
10
15
20
25
30
Years to Maturity, n


Yield to Maturity
Term to Maturity
(a) Future short-term interest rates expected to rise
Yield to Maturity
Term to Maturity
(b) Future short-term interest rates expected to stay the same
Yield to Maturity
Term to Maturity
(c) Future short-term interest rates expected to fall moderately
Yield to Maturity
Term to Maturity
(d) Future short-term interest rates expected to fall sharply

- How well the theory can explain the two findings?
  - 1. yield curve usually slopes upwards $\rightarrow$ .....
  - 2. the yields on bond with different maturity usually move together?

$$i_{n.t} = \frac{i_{1,t} + i^e_{1,t+1} + i^e_{1,t+2} + ... + + i^e_{1,t+n-1}}{n} + \eta_{n,t}$$