3543 Fiscal and Financial System in Japan A / KC3002 International Finance

Fall 2013

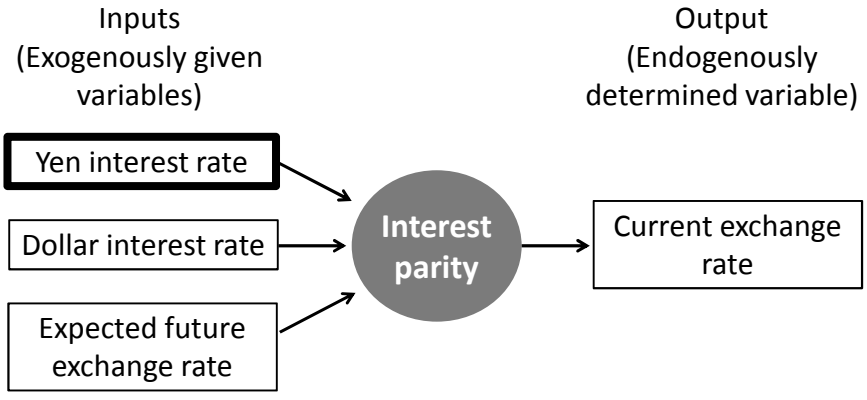
Lecture 4(Oct 11)
Interest Rates

Hideyuki IWAMURA
Faculty of International Studies

MEIJI GAKUIN UNIVERSITY

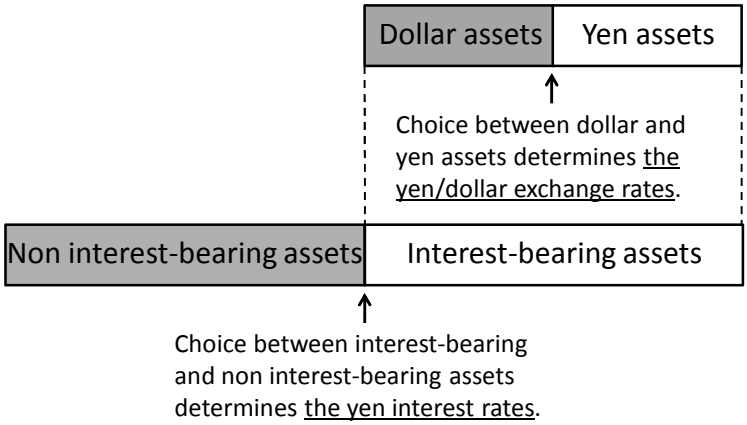
1

Interest Parity Model(Oct.4)



2

Today's Outline



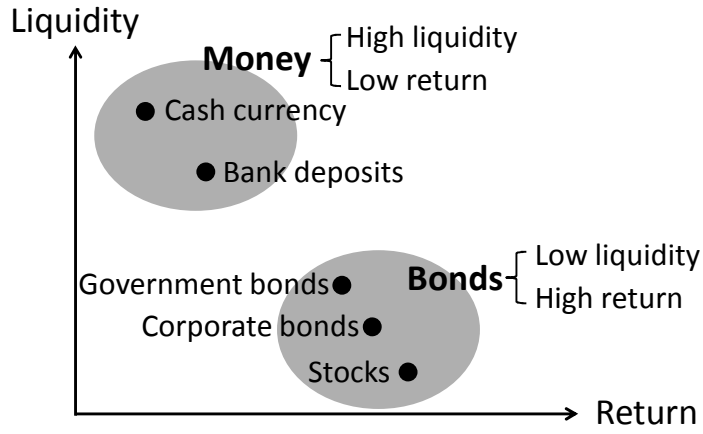
3

Various Types of Financial Assets

Cash currency（現金）	IOUs issued by the central bank
Bank deposits（銀行預金）	IOUs issued by commercial banks
Government bonds（政府債）	IOUs issued by the central or local governments
Corporate bonds（社債）	IOUs issued by firms

4

Money and Bonds



Liquidity：the ease and speed with which an asset can be used to purchase goods/services

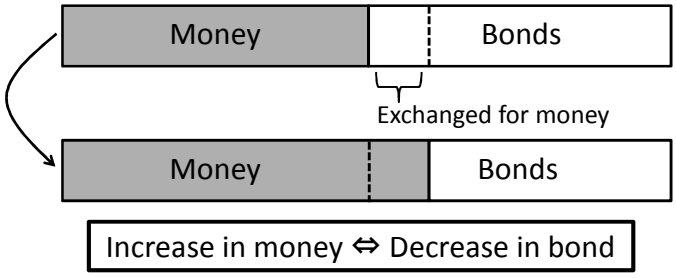
5

Money and Bonds

Total Wealth

We should hold some money as a precaution against some unexpected expenses.

When, for some reason, you want to hold more money, you have to exchange your bonds for money.



Increase in money ⇔ Decrease in bond

6

Cost of Holding Money

Holding more money means holding fewer bonds by the same amount.

Increasing money by ¥100,000 means reducing ¥100,000 of bonds, therefore giving up the interests those bonds would earn.

→ **Costs of holding money (opportunity cost)**

Interest rates on a *bond* affects the desired amount of *money*.

High interest rates ➔ High cost of holding money
➔ Small demand for money

Low interest rates ➔ Low cost of holding money
➔ Large demand for money

7

Cost of Holding Money: Example

Case 1: Interest rate on a bond is 1%.

If you exchange the bond for money, you will have to give up the opportunity of only ¥1,000 of interests.

You decide to hold more money.

Case 2: Interest rate on a bond is 5%.

If you exchange the bond for money, you will have to give up the opportunity of ¥5,000 of interests.

You decide to hold the bond or even to reduce money.

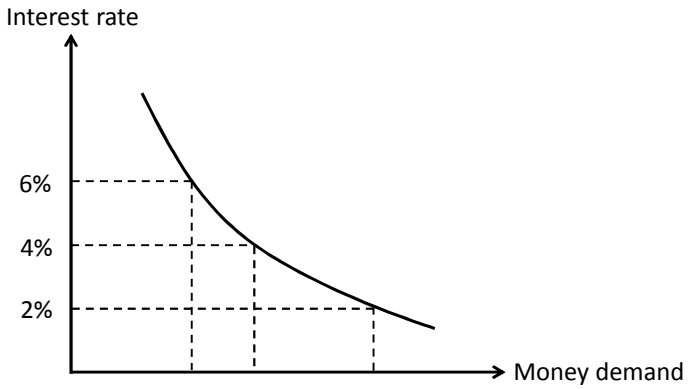
Higher interest rates lowers our demand for money.

The demand for money is negatively related with interest rates on bonds.

8

Demand for Money

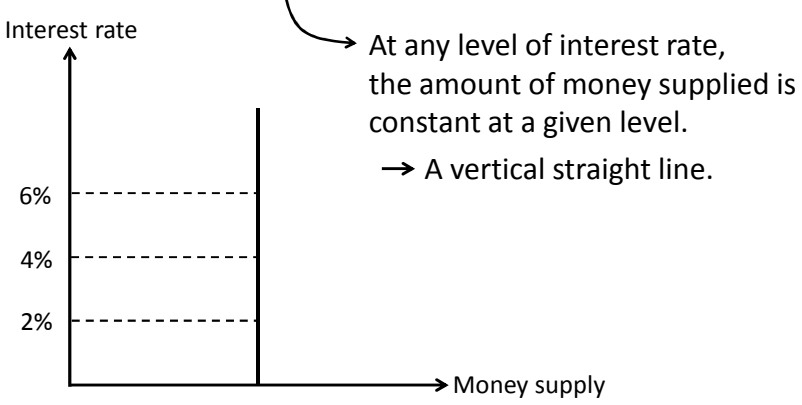
Demand for money is <u>negatively</u> related with interest rates on bonds.



9

Supply of Money

Supply of money is controlled by the central bank.
The central bank bases its decision on policy consideration, thus is <u>independent of interest rates</u>.

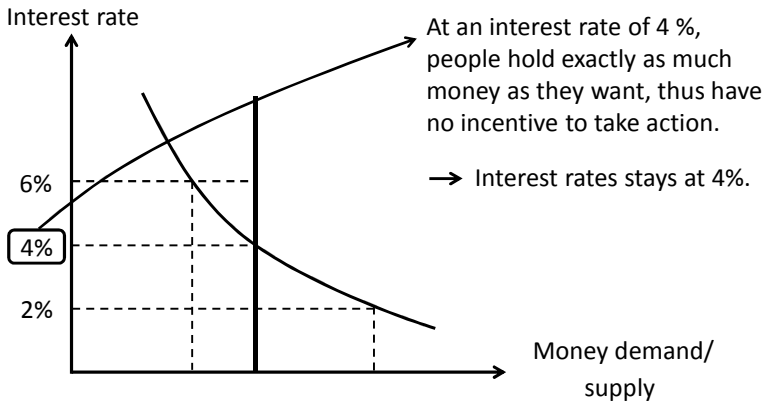


At any level of interest rate, the amount of money supplied is constant at a given level.

→ A vertical straight line.

10

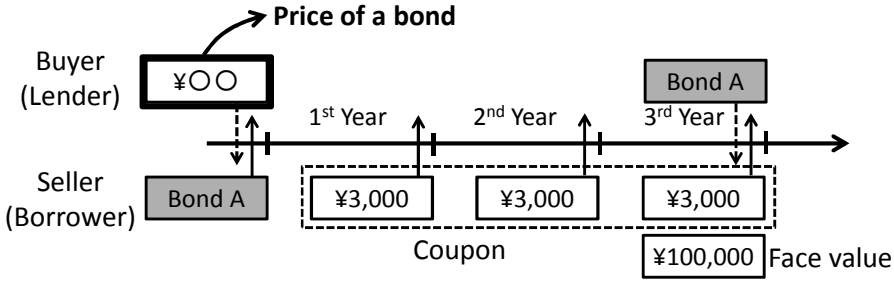
Determination of interest rates



But what if the interest rate is 6% or 2%?
Do market push it toward 4%?

11

Bond



How much do you pay for this bond *today*?

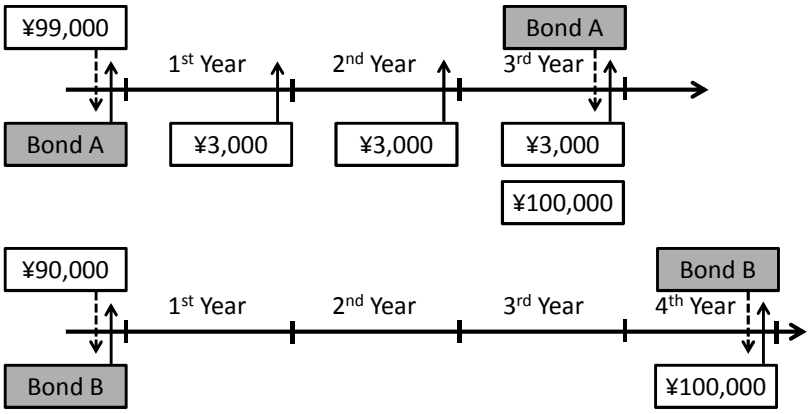
How much do you pay for this stream of *future* payments *today*?

➔ **price of a bond**

The price of a bond rises as its demand rises,
while the price falls as its demand falls.

12

Bond(2)



How can we compare two bonds with different timelines of payments?

Calculating interest rates allows us to compare these two bonds directly.

13

Interest rates (1)

Interest rate: How much <u>one unit of currency</u> invested in an asset earns for <u>one year</u>

If you lend P yens with an interest rate of i for n years, your money will be worth;

$$P \times (1+i)^n$$

If you lend ¥50,000 with an interest rate of 0.03 for 5 years, your money will be worth;

$$50{,}000 \times (1+0.03)^5$$

14

Interest rates (2)

Divide ¥99,000 into three parts.

	Today	1 year after	2 years after	3 years after
A	a_1 →	3,000		
B	a_2 →		3,000	
C	a_3 →			3,000+100,000

A: a part lent for one year and earns interests for one year

B: a part lent for two years and earns interests for two years

C: a part lent for three years and earns interests for three years

15

Interest rates (3)

Today	1 year after	2 years after	3 years after
A a_1 →	$a_1\times(1+i)$ $=3,000$		
B a_2 →		$a_2\times(1+i)^2$ $=3,000$	
C a_3 →			$a_3\times(1+i)^3$ $=3,000+100,000$

$$a_1\times(1+i)=3,000 \longrightarrow a_1=\frac{3,000}{1+i}$$

$$a_2\times(1+i)^2=3,000 \longrightarrow a_2=\frac{3,000}{(1+i)^2}$$

$$a_3\times(1+i)^3=3,000+100,000 \longrightarrow a_3=\frac{3,000+100,000}{(1+i)^3}$$

16

Interest rates (4)

	Today	1 year after	2 years after	3 years after
A	$\frac{3,000}{1+i}$ →	3,000		
B	$\frac{3,000}{(1+i)^2}$ →	$\frac{3,000}{1+i}$ →	3,000	
C	$\frac{3,000+100,000}{(1+i)^3}$ →	$\frac{3,000+100,000}{(1+i)^2}$ →	$\frac{3,000+100,000}{1+i}$ →	3,000+100,000

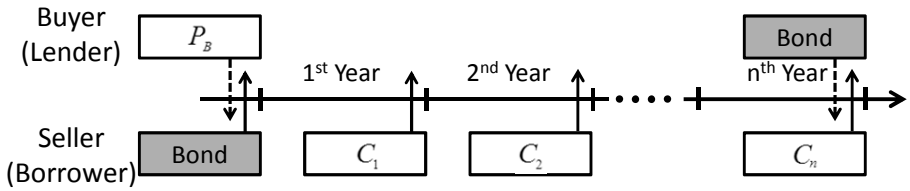
Remember we divided ¥99,000 into A, B and C.
Then, the sum of A, B and C must be equal to ¥99,000.

$$\frac{3,000}{1+i} + \frac{3,000}{(1+i)^2} + \frac{3,000+100,000}{(1+i)^3} = 99,000$$

This is an equation for the interest rate, and the solution gives the interest rate of Bond A.

17

Interest rates (5)



$$\frac{C_1}{1+i} + \frac{C_2}{(1+i)^2} + \cdots + \frac{C_n}{(1+i)^n} = P_B$$

If the stream of payments and the price of a bond are given, the equation gives the interest rate that the bond offers.

The equation also shows how the price of a bond and its interest rate are related.

18

Bond price and interest rate: example

What if you buy Bond A at a lower price?

$$\frac{3{,}000}{1+i}+\frac{3{,}000}{(1+i)^2}+\frac{3{,}000+100{,}000}{(1+i)^3}=\boxed{99{,}000} \qquad i=0.0356$$

$$\downarrow \qquad\qquad \downarrow$$

$$\frac{3{,}000}{1+i}+\frac{3{,}000}{(1+i)^2}+\frac{3{,}000+100{,}000}{(1+i)^3}=\boxed{95{,}000} \qquad i=0.0483$$

With the stream of payments constant, as the price of a bond falls, its interest rate rises.

19

How to compute interest rates

$$\frac{3{,}000}{1+i}+\frac{3{,}000}{(1+i)^2}+\frac{3{,}000+100{,}000}{(1+i)^3}=99{,}000$$

$$D=\frac{3{,}000}{1+i}+\frac{3{,}000}{(1+i)^2}+\frac{3{,}000+100{,}000}{(1+i)^3}-99{,}000$$

1. Substitute an arbitrary value into i and compute D.

2-a. If $D>0$, substitute a smaller value into i.

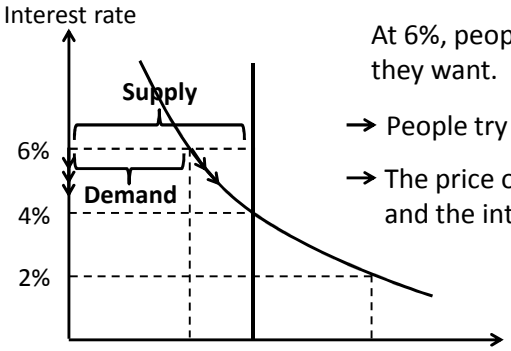
2-b. If $D<0$, substitute a smaller value into i.

Repeat the process until D is close enough to zero, when you can find an interest rate that *approximately* satisfies the equation.

You can use *Goal Seek* in MS Excel to find out an approximate solution.

20

Equilibrium interest rate (1)



At 6%, people hold more money than they want.

→ People try to exchange money for bonds.

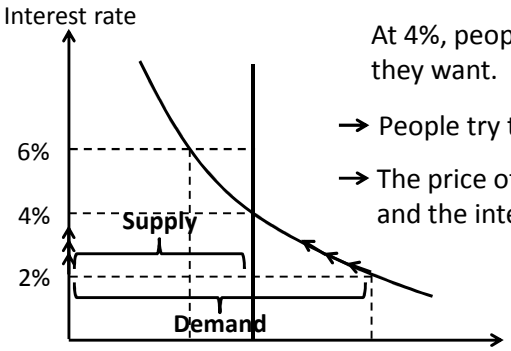
→ The price of a bond rises, and the interest rate falls.

→ The cost of holding money falls.

→ The demand for money rises.

21

Equilibrium interest rate (2)



At 4%, people hold less money than they want.

→ People try to exchange bonds for money.

→ The price of a bond falls, and the interest rate rises.

→ The cost of holding money rises.

→ The demand for money falls.

22

Conclusion

- At interest rates higher than 4%
  Because people hold more money than they want, they try to exchange money for bonds, raising the price of bonds and lowering the interest rate.
- At interest rates lower than 4%
  Because people hold less money than they want, they try to exchange bonds for money, lowering the price of bonds and raising the interest rate.
- At 4%
  Because people hold exactly as much money as they want, they do not take another action and the interest rate stays.

The interest rate of bonds is determined so that the demand for money could be just equal to the outstanding stock of money.

23