

# Fiscal & Financial System in Japan A

2010 Spring

## Session 6 Determination of Interest Rates:

### The Keynesian Framework

May 31, 2010

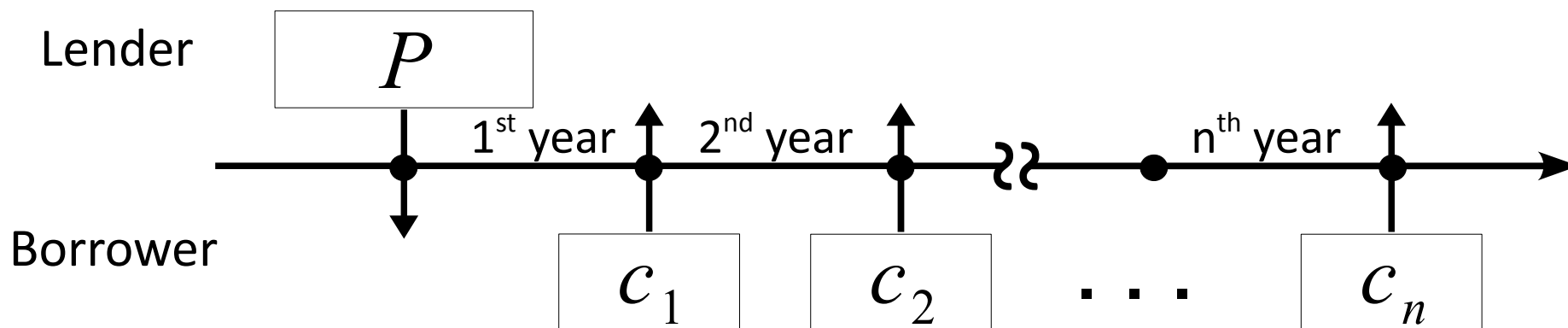
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# Yield to Maturity (Interest Rates)



$$P = \frac{c_1}{1+i} + \frac{c_2}{(1+i)^2} + \dots + \frac{c_n}{(1+i)^n}$$

$P$  ,  $n$  , and  $c_1, c_2, \dots, c_n$  given,  
this equation gives the yield to maturity (interest rate)  
of the financial instrument.

# Examples

5-year discount bond with a face value of 100,000 yen sold at 90,000 yen

$$90,000 = \frac{0}{1+i} + \frac{0}{(1+i)^2} + \frac{0}{(1+i)^3} + \frac{0}{(1+i)^4} + \frac{100,000}{(1+i)^5}$$

$$i = 0.021$$

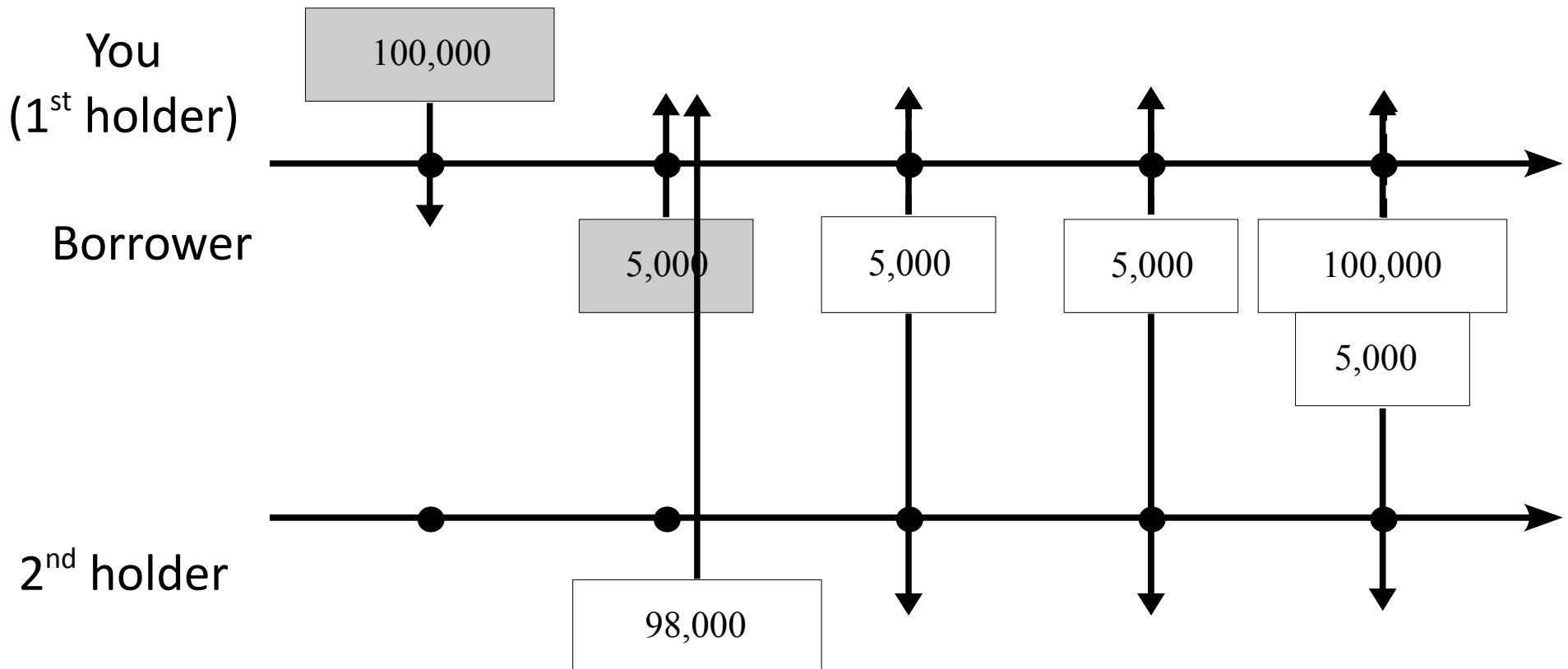
20-year commercial mortgage of 10,000,000 yen with annual payments of 1,273,100 yen

$$10,000,000 = \frac{1,273,100}{1+i} + \frac{1,273,100}{(1+i)^2} + \dots + \frac{1,273,100}{(1+i)^{20}}$$

$$i = 0.11$$

# Bond Prices and Interest Rates

If you sell the bond in a secondary market ...



What is the interest rate for the new holder?

The interest rate for the 2<sup>nd</sup> holder is given by ...

$$98,000 = \frac{5,000}{1+i} + \frac{5,000}{(1+i)^2} + \frac{5,000+100,000}{(1+i)^3}$$

$$\rightarrow i = 0.0574$$

What if he could buy at lower  $P$  ?

$$P = \frac{5,000}{1+i} + \frac{5,000}{(1+i)^2} + \frac{5,000+100,000}{(1+i)^3}$$

Fall in bond price  $P \downarrow$   $\longleftrightarrow$  Rise in interest rate  $i \uparrow$   
Rise in bond price  $P \uparrow$   $\longleftrightarrow$  Fall in interest rate  $i \downarrow$

Bond prices and interest rates are **NEGATIVELY** related.

# Numerical Example

$$P = \frac{5,000}{1+i} + \frac{5,000}{(1+i)^2} + \frac{5,000+100,000}{(1+i)^3}$$

How does the interest rate change with the bond price?

Bond prices	Interest rates
100,000 (face value)	0.05
98,000	0.0574
96,000	0.0651
94,000	0.0730
92,000	0.0811
90,000	0.0895

## **4. Determination of Interest Rates: The Keynesian Framework (Mishkin Ch.5)**

# Behavior of Interest Rates

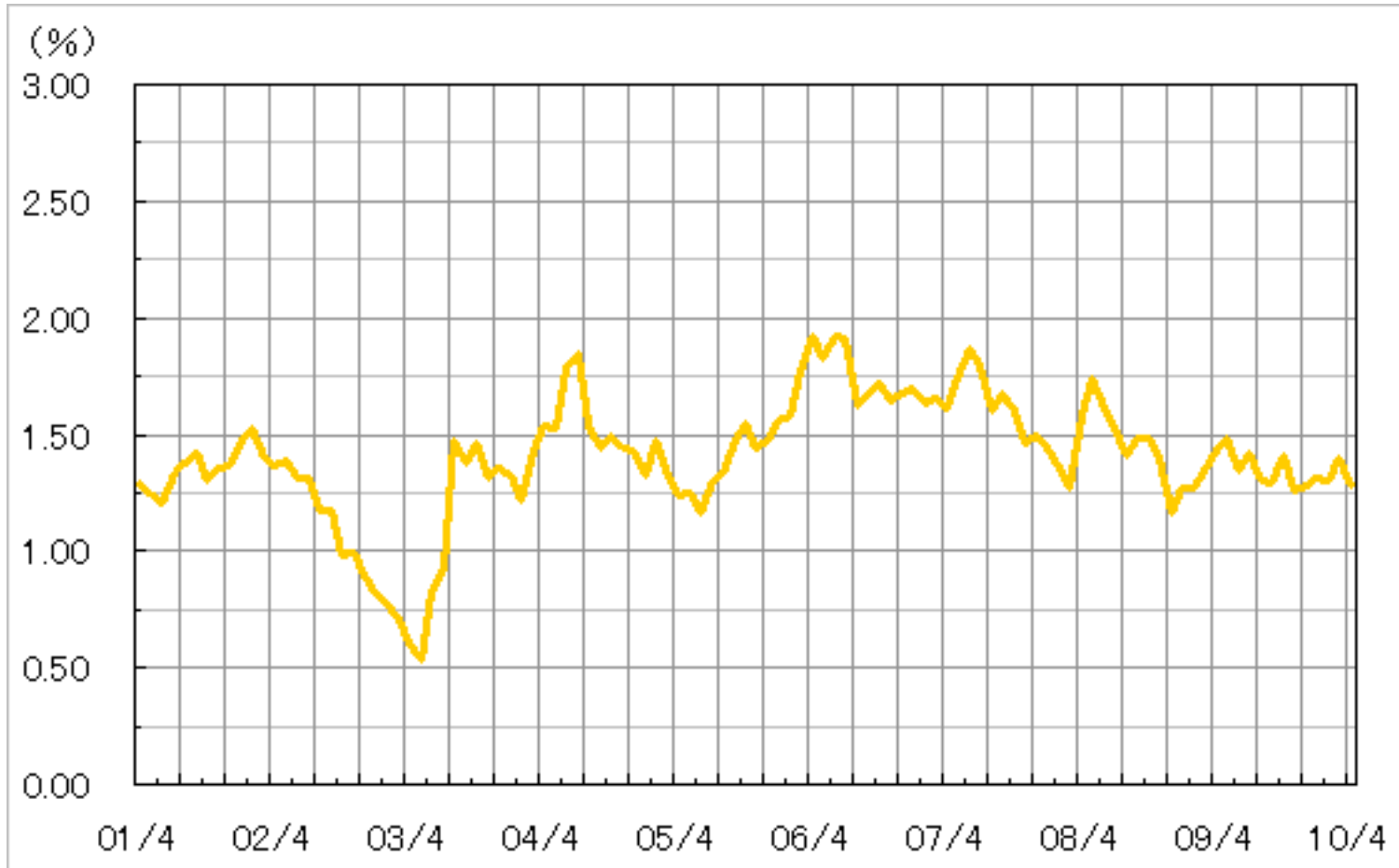


Figure: Long-term JGB yield ( 10-year newly issued bond )

Source: Japan Bond Trading Co., Ltd.

[http://www.bb.jbts.co.jp/data/index\\_kinri.html](http://www.bb.jbts.co.jp/data/index_kinri.html)



# Behavior of Interest Rates

What drives interest rates to change from day to day?



How are interest rates determined at particular levels?



Negative relationship between interest rates and bond prices



Interest rates determination  $\longleftrightarrow$  Bond prices determination



How are prices of bonds determined?



Demand for and supply of bonds jointly determine the prices.



What affects the demand for and supply of bonds?

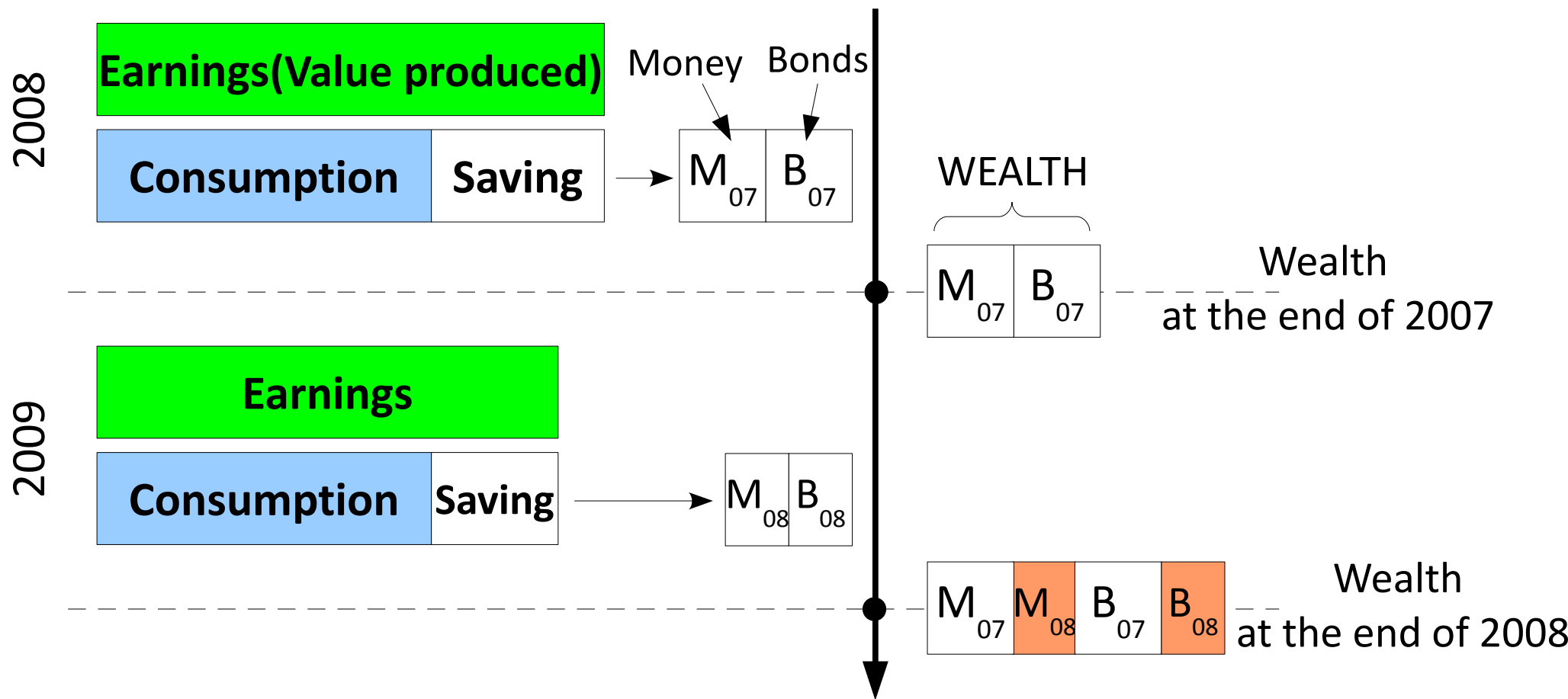
# Preliminaries

Cash currency  
Deposit money  
Quasi-money } **MONEY**  
can be easily used to pay for something,  
while yielding small interest relative to “BOND.”

Government bonds  
Corporate bonds } **BOND**  
pays large interests,  
while it cannot be easily used for payments.

LIQUIDITY is the ease and certainty with which a particular financial asset is converted into a means of payment.

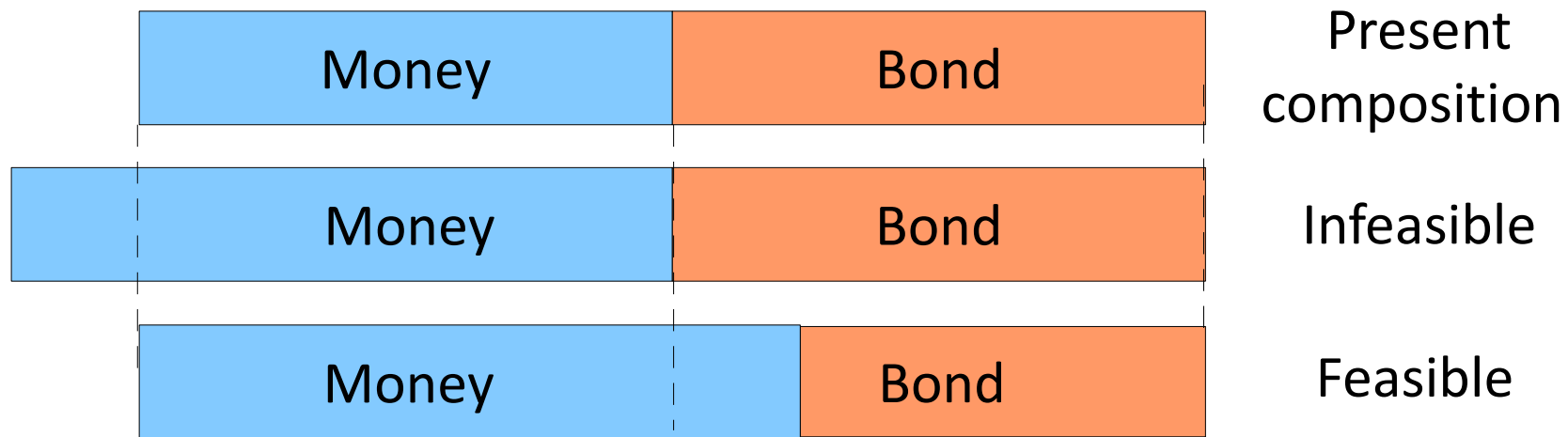
	Liquidity	Profitability
Money	High	Low
Bond	Low	High



- Your purchasing power can be kept until the future in the form of “money” and “bonds.”
- Only when you spend less than you earn, you can add to your “wealth.”  
 → You must take “time” to increase your wealth.
- Your wealth is composed of “money” and “bonds.”

Suppose that you have been engaged and you expect that you will need to pay for the wedding in a few months.

You want to increase money which is easily used to pay.  
But you can't immediately add to your wealth.



All you can do is to sell your bonds in secondary markets and receive money in exchange.

You can only change the composition of your wealth.

Tradings of bonds mainly happen in secondary markets, therefore interest rates are strongly affected by the prices of previously issued bonds.

# Demand for Bonds

For a short term, we can increase a particular type of asset only by reducing the other type.

Holding more money means holding fewer bonds.  
(Holding more bonds means holding less money.)

When you want to have more money, you want to sell your bonds.

Increase }  
Decrease } in demand for money  $\leftrightarrow$  Decrease }  
Increase } in demand for bonds

Focuses on demand/supply of money help us to see the determination of bond prices, and thus interest rates.

What affects demand for money?

# Cost of Holding Money

Increasing money means decreasing bonds.  
(Increasing bonds means decreasing money.)

Holding money means selling bonds of equal value,  
thus giving up interest payments from those bonds.

Cost of holding money

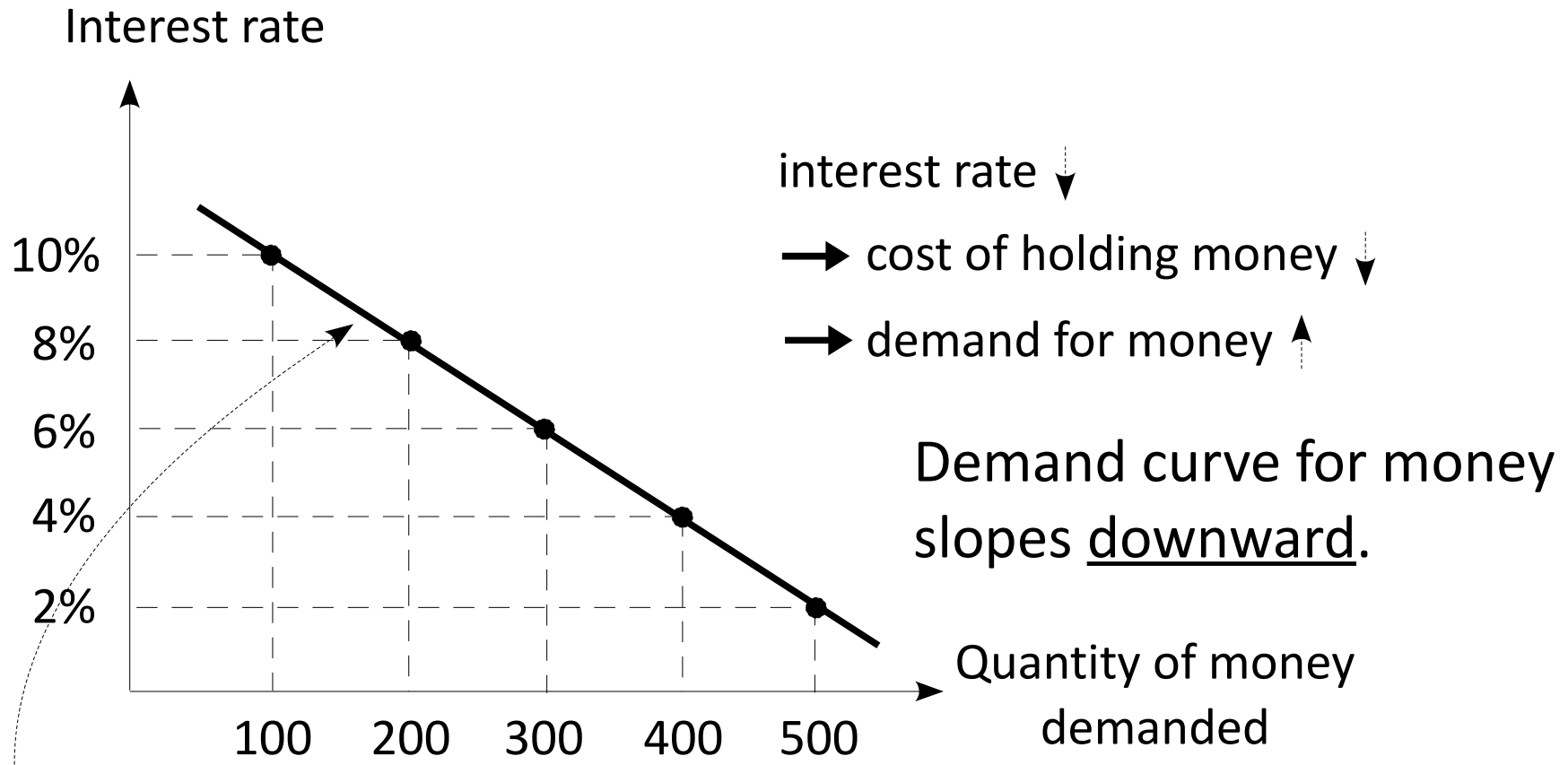
Interest rates are high (low)

→ Costs of holding money are large (small)

→ Demands for money are small (large)

Demands for money negatively depend on the interest rates of bonds.

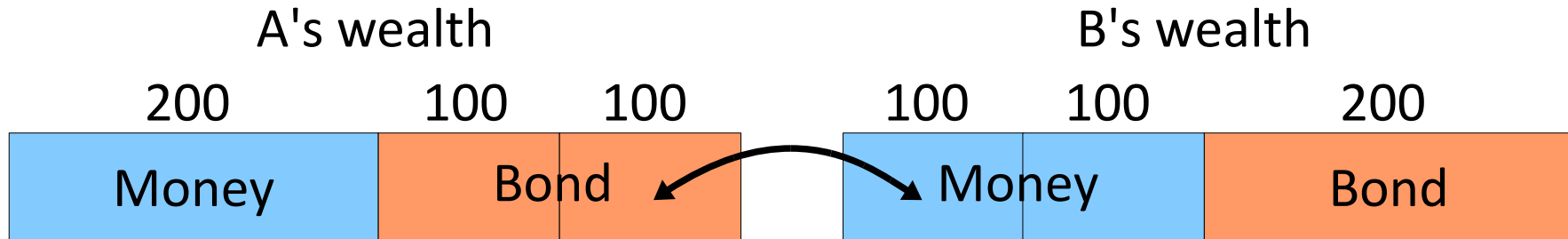
# Demand for Money



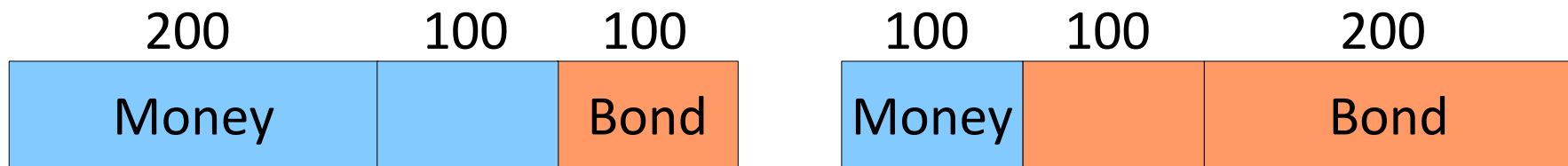
## DEMAND CURVE:

The quantity of money people desire to hold at each level of interest rate

# Supply of Money



A wants to have more money, and B wants to have more bonds.  
B buys bonds from A, and A receives money from B.



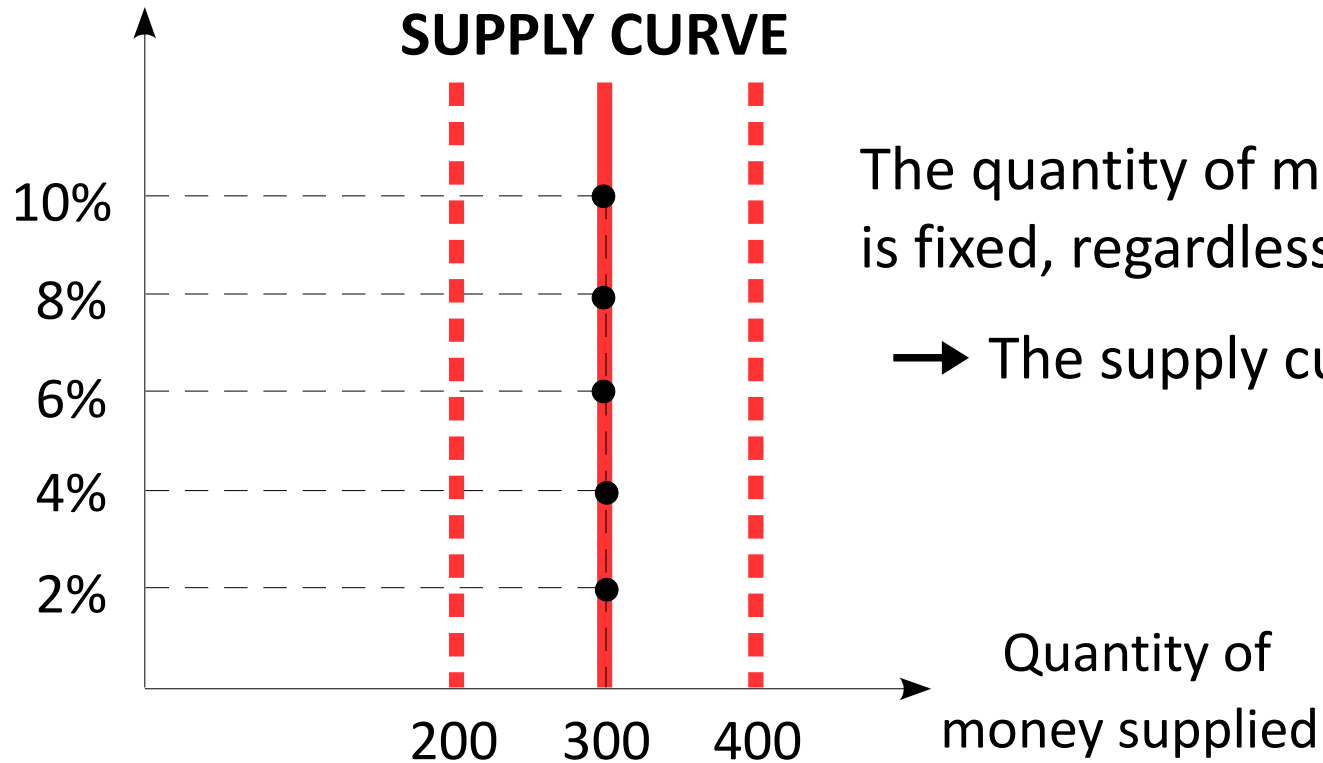
The allocation of money/bonds between A and B could vary,  
but the total amount of money/bonds stays unchanged.

Supply of money and bonds is fixed.



# Supply of Money

Interest rate



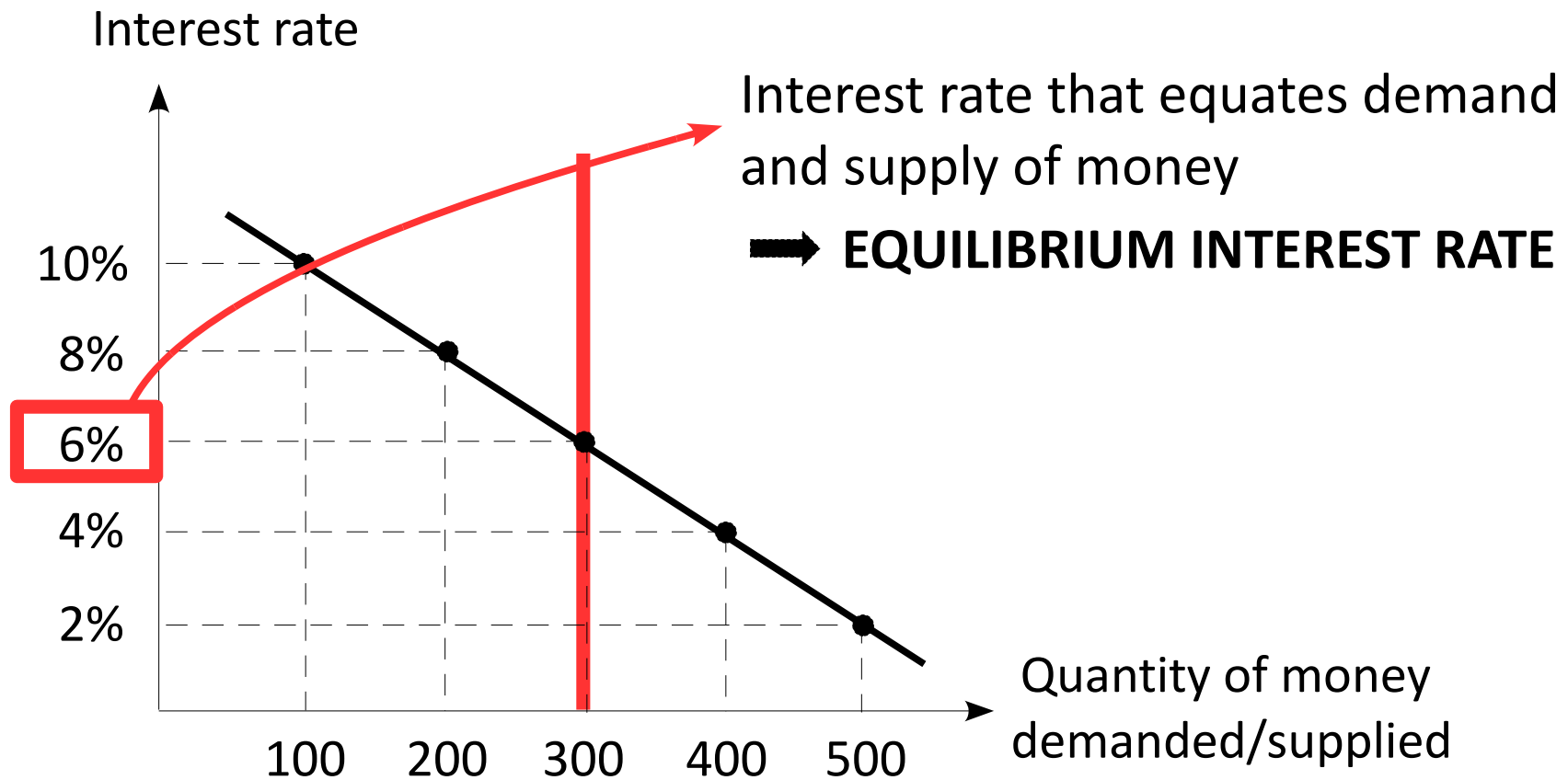
The quantity of money that we can hold is fixed, regardless of interest rates.

→ The supply curve is vertical.

Supply of money is controlled by the central bank, which bases its action on policy consideration, and hence is never affected by interest rates.

# Interest Rate Determination

## “Equilibrium Interest Rate”

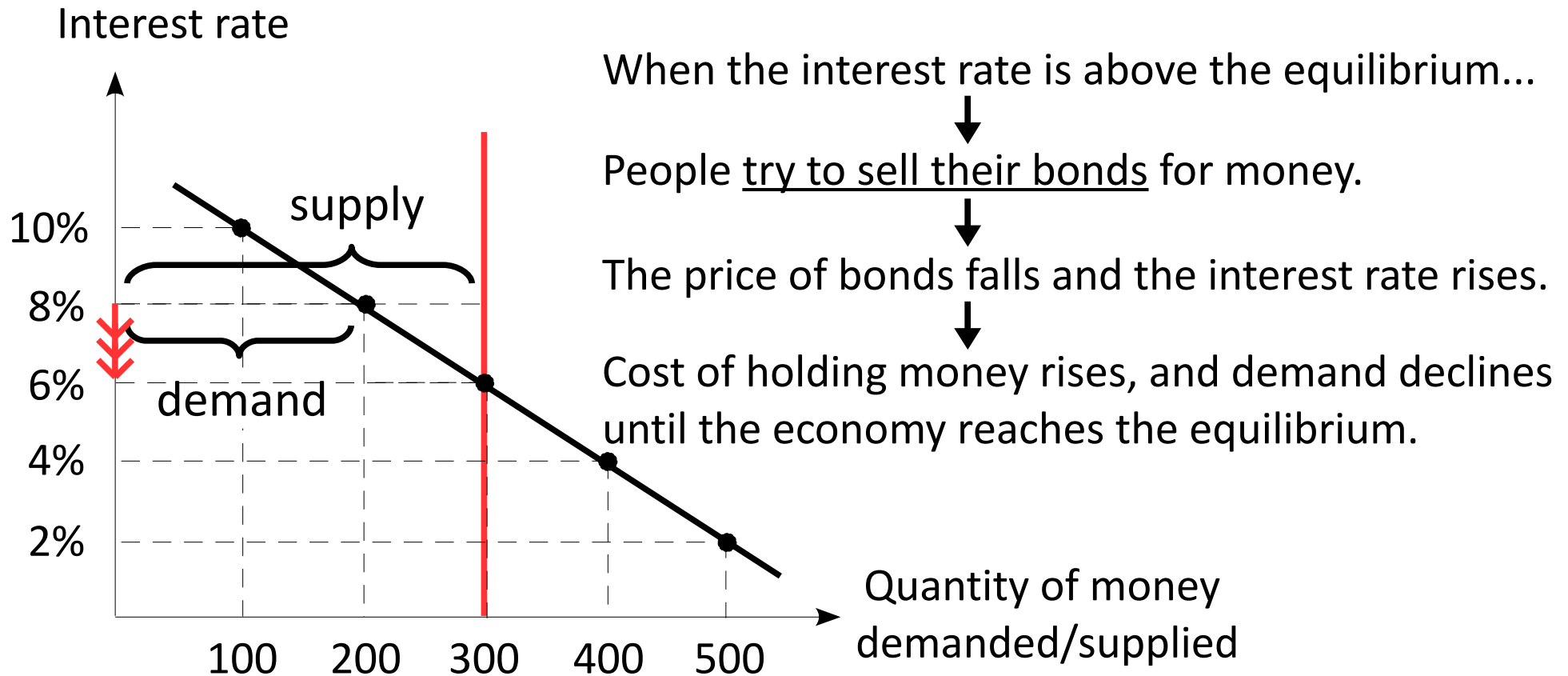


Economic theory says that interest rate is “determined” at the equilibrium level.

Why the equilibrium?

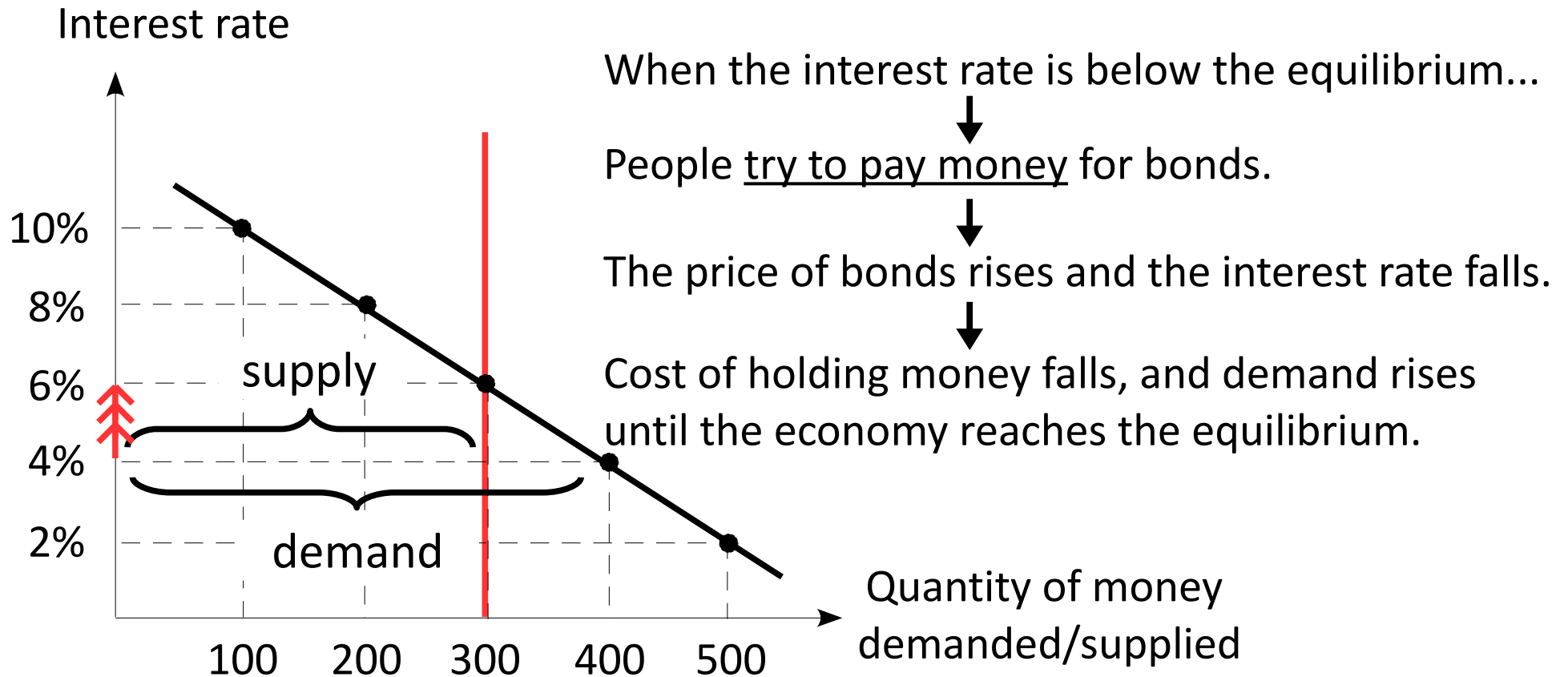
What does “determine” mean?

# What happens off the Equilibrium?



The interest rate is automatically directed to the equilibrium level.

# What Happens off the Equilibrium?



Again, the interest rate is automatically directed to the equilibrium.

# Why Focus on Equilibrium?

- (1) At any other level of interest rate, people hold more/less money than they want, and the market automatically starts to move toward the equilibrium interest rate.
- (2) Once the market reaches the equilibrium, people hold the amount of money that they want, and there is no motive to sell or buy bonds. The bond price, and thus interest rate, stays the same.

Markets justify the equilibrium interest rate alone.

We should pay attention to the equilibrium interest rate.