
Classical Dichotomy

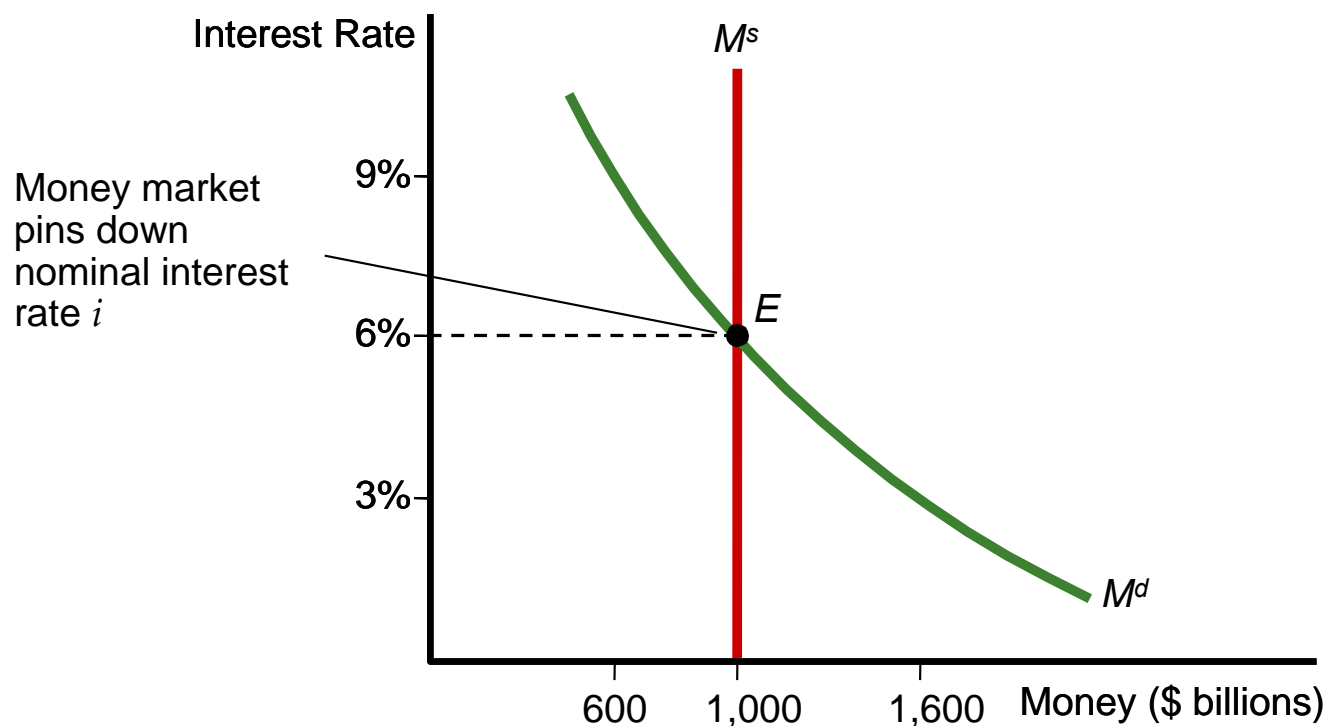
(no new reading assignment for this part)

Dichotomy of Money and Real Economy

- Economy exhibits **dichotomy of money and real economy** if real variables such as output, unemployment, and real interest rates can be analyzed without considering what is happening to nominal variables like money or price level
 - Classical model exhibits such dichotomy, a result referred to as **classical dichotomy**

Adding Money To Classical Model

- Money market pins down nominal interest rate i



Adding Money To Classical Model

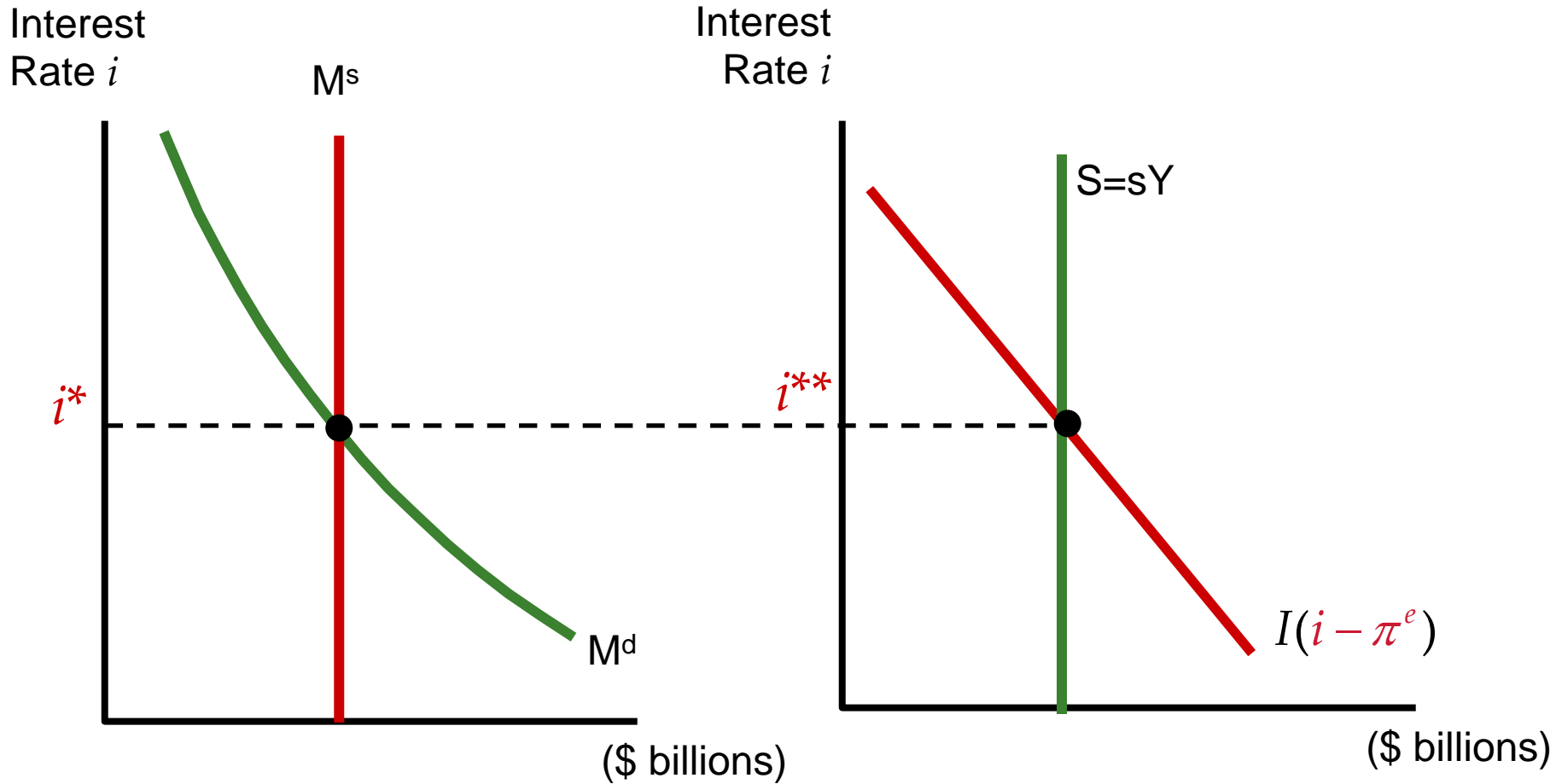
- Money market pins down nominal interest rate i
- Given expected rate of inflation, nominal interest rate i is linked to real interest rate r through

$$r \approx i - \pi^e$$

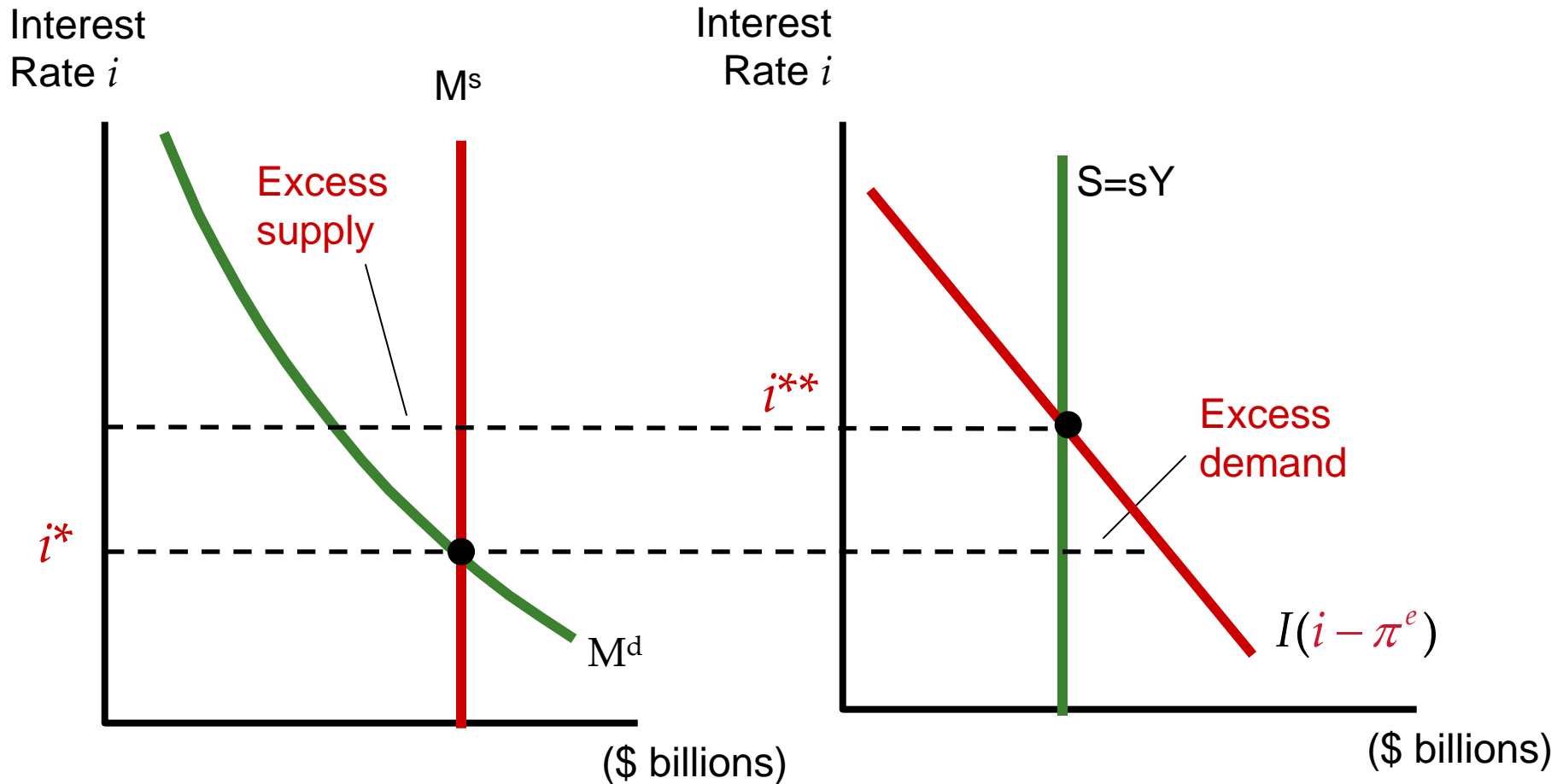
Adding Money To Classical Model

- For the money market to fit into Classical model, need money market equilibrium (MME) and loanable funds market equilibrium (LFME) to be **consistent**
 - MME and LFME are **consistent**, if they imply the same equilibrium interest rate

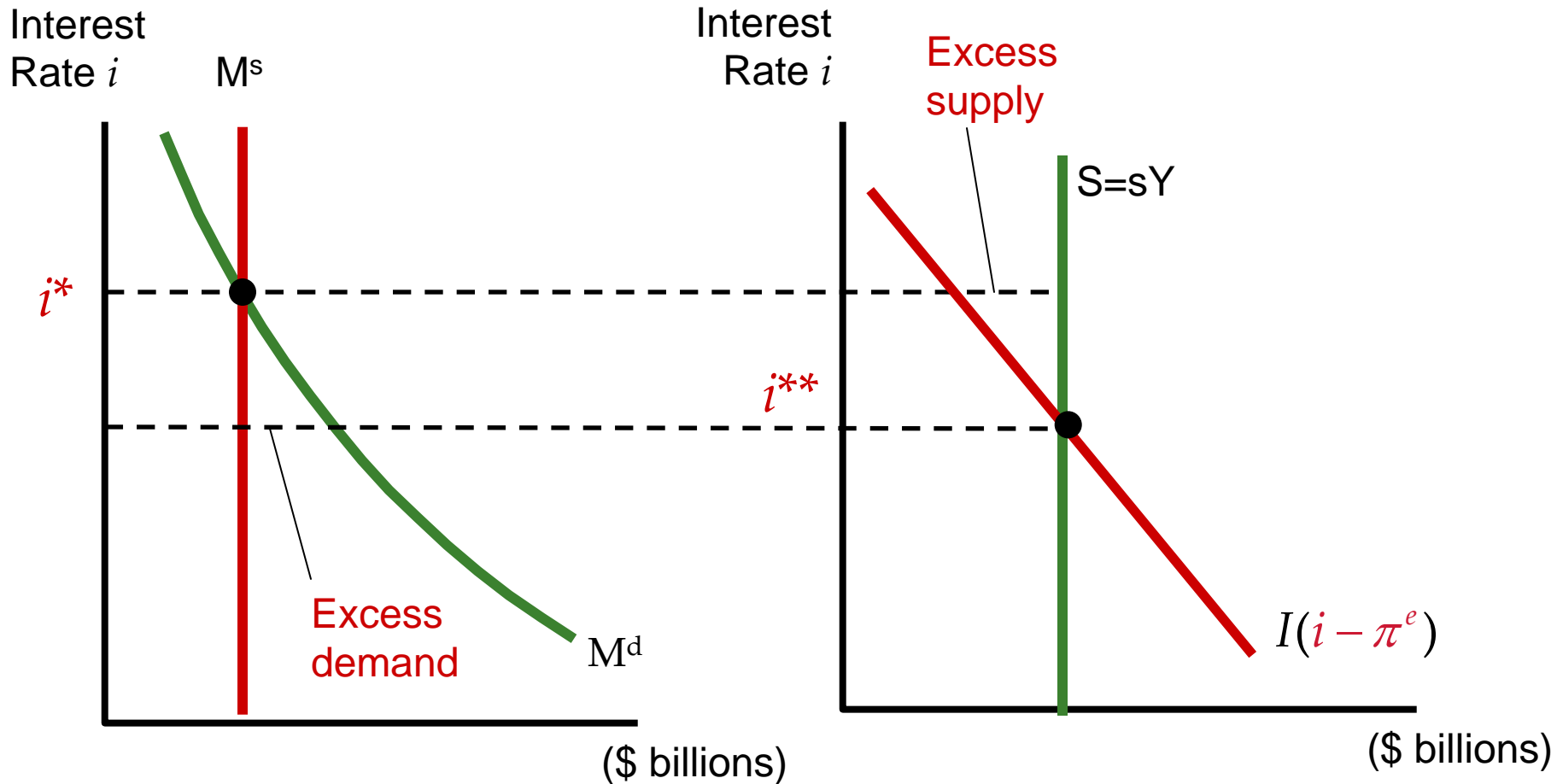
MME and LFME are Consistent



MME and LFME are Inconsistent



MME and LFME are Inconsistent



Fundamental Question

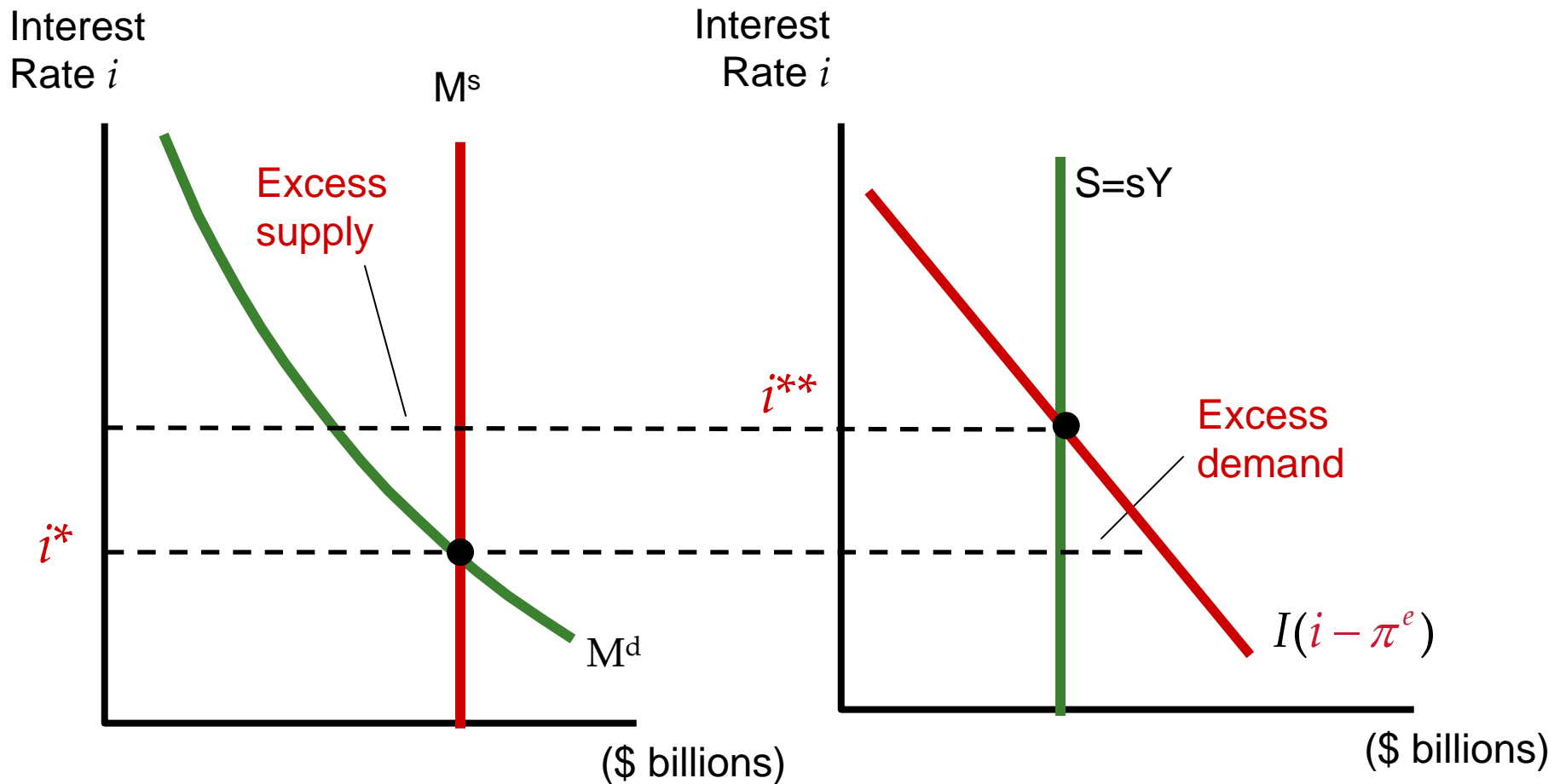
- What restores consistency between money market and loanable funds market in the classical model?

Fundamental Question

- What restores consistency between money market and loanable funds market in the classical model?
- **Answer: the price level P does**
 - The only thing left on the table!

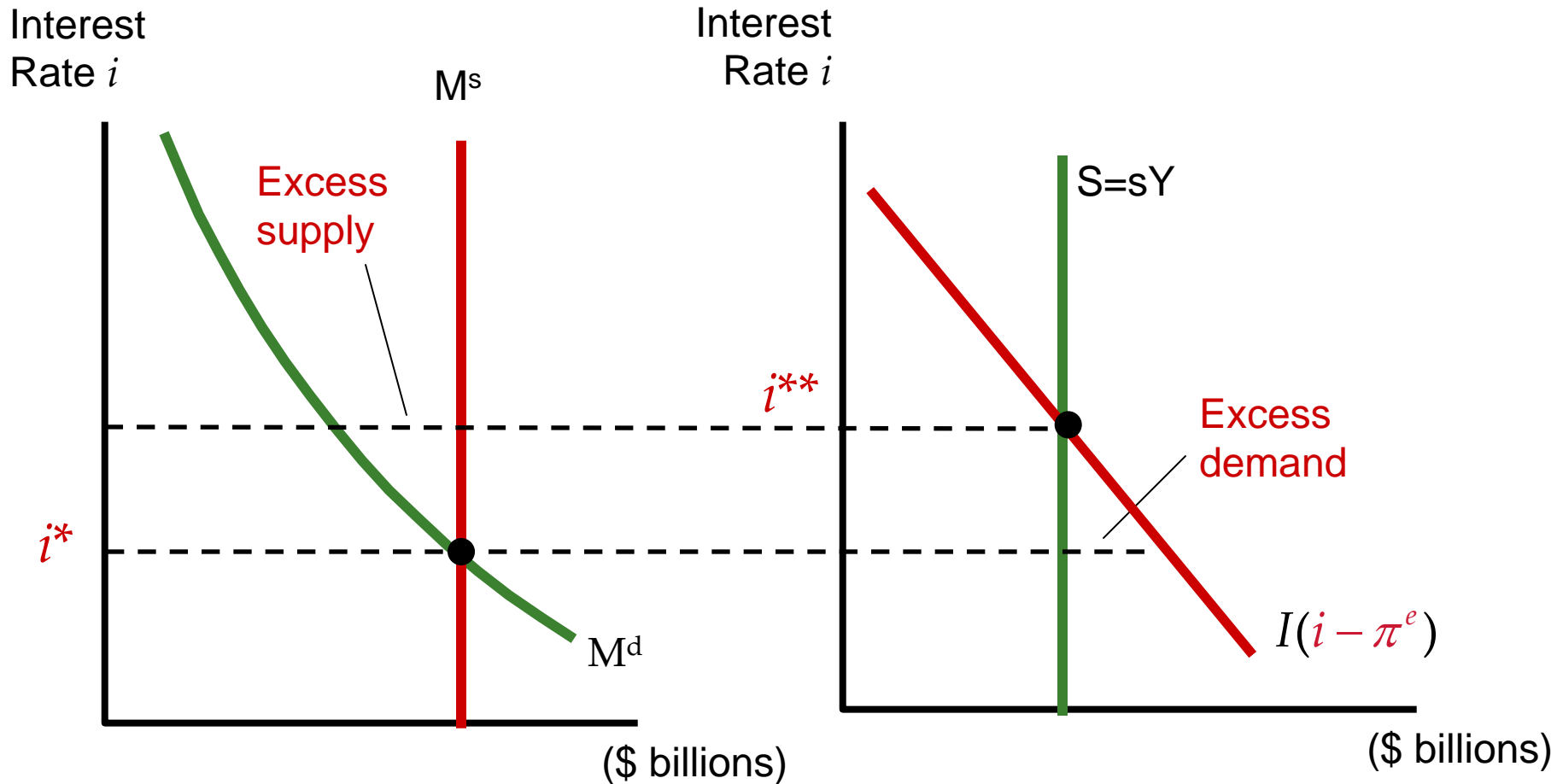
How?

Suppose money market interest rate is too low...



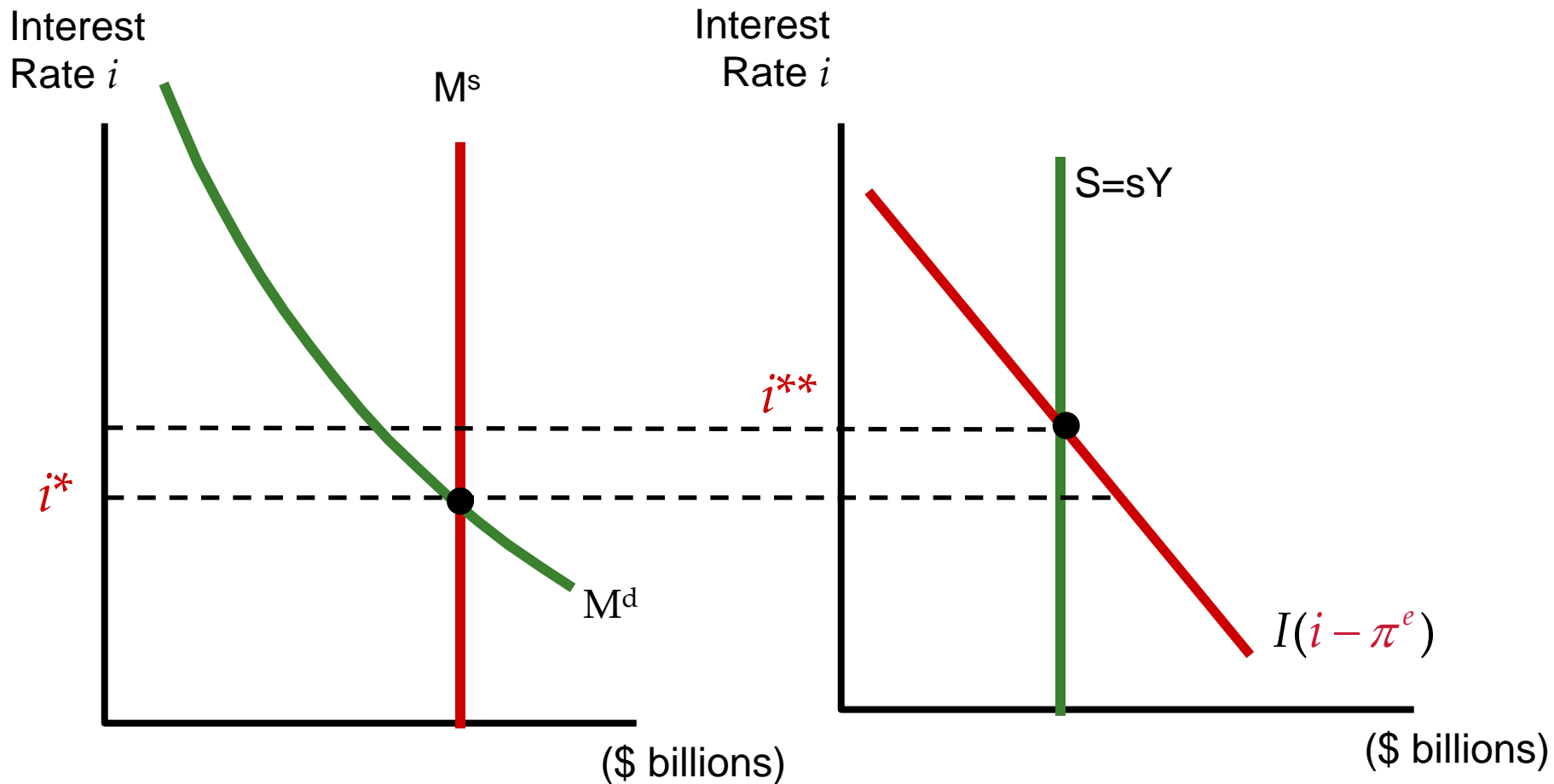
How?

Price level P increases \rightarrow money demand goes up ...



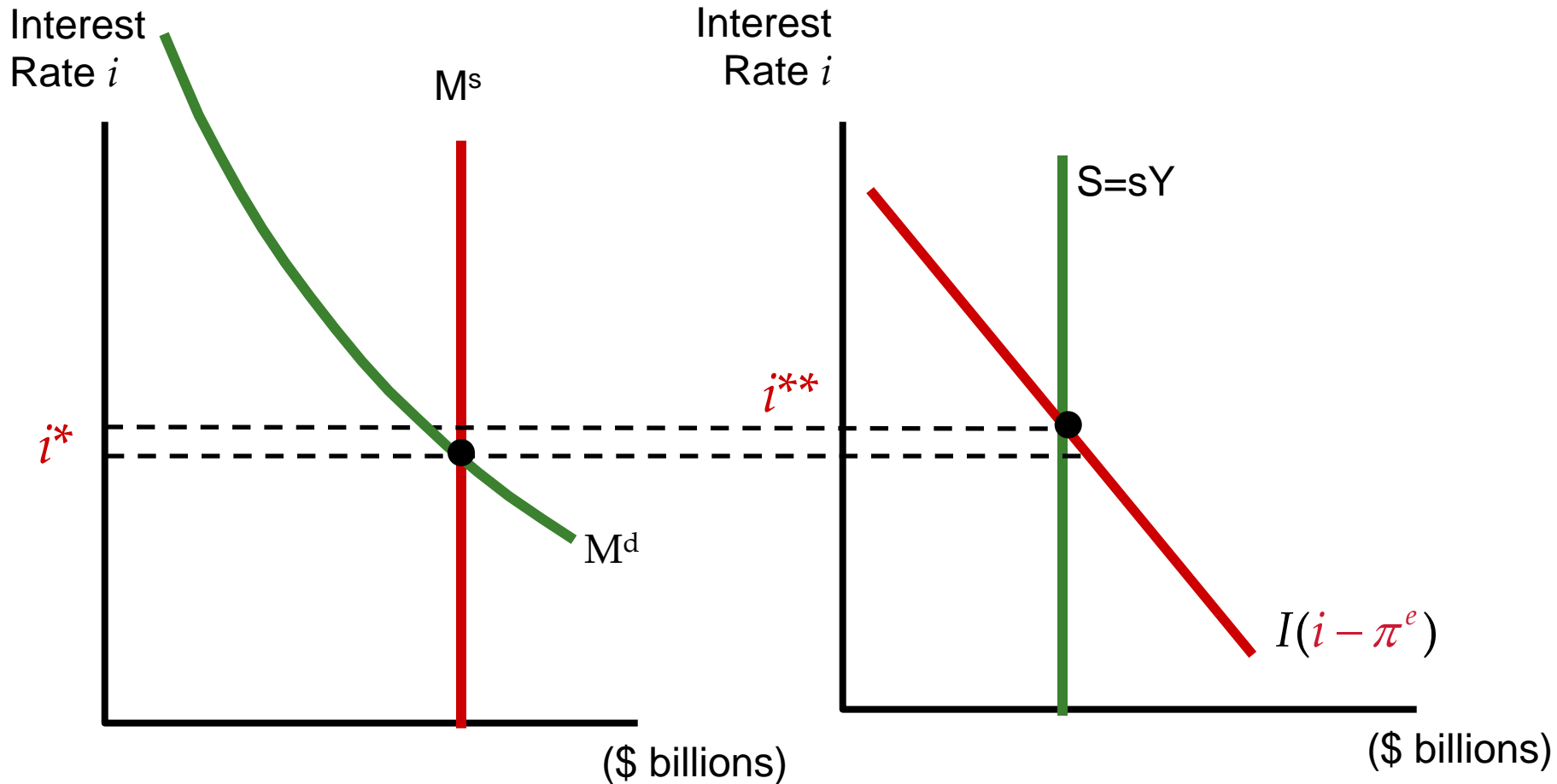
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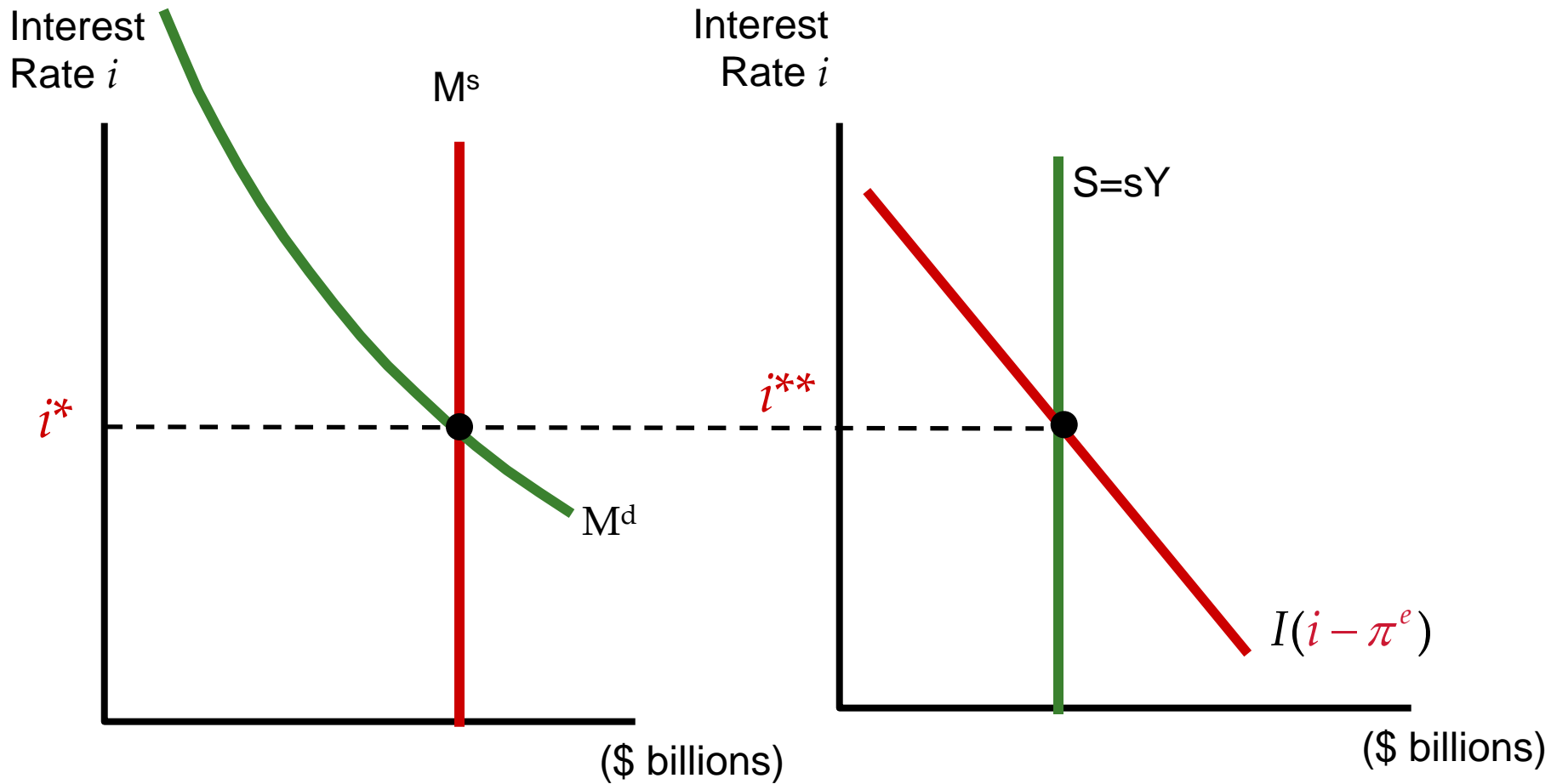
How?

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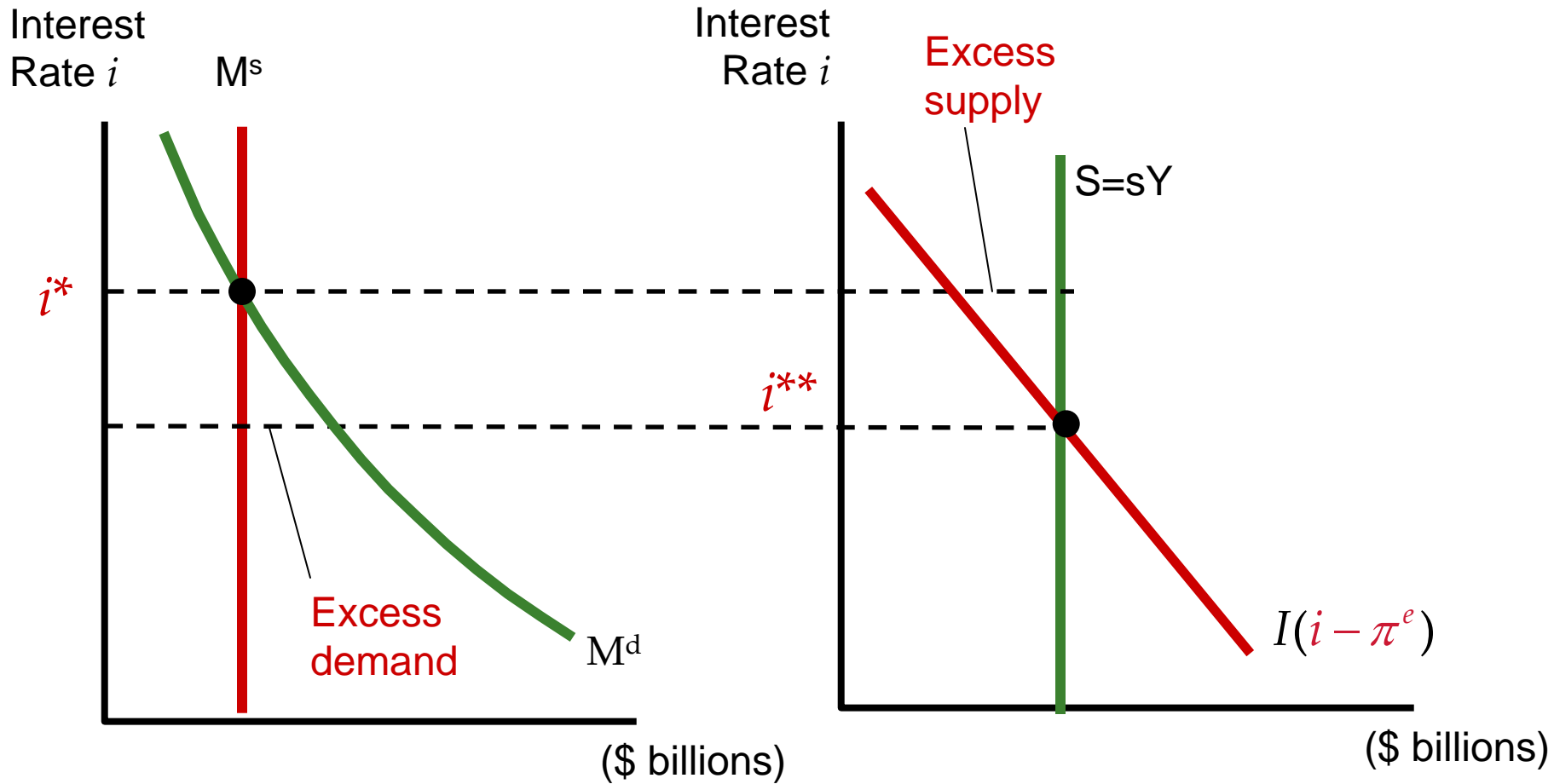
How?

The gap closes in



How?

Suppose money market interest rate is too high...

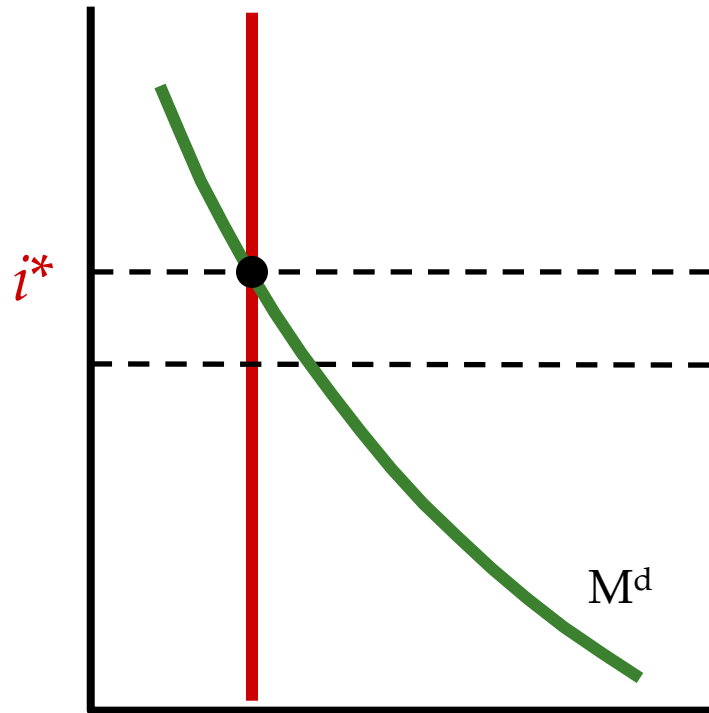


How?

Price level P falls \rightarrow money demand goes down ...

Interest
Rate i

M^s

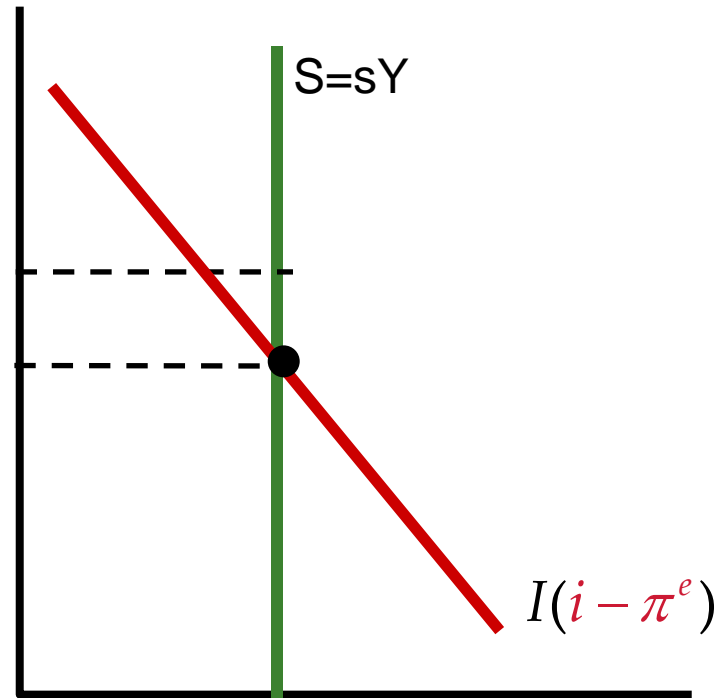


(\$ billions)

Interest
Rate i

$S=sY$

i^{**}



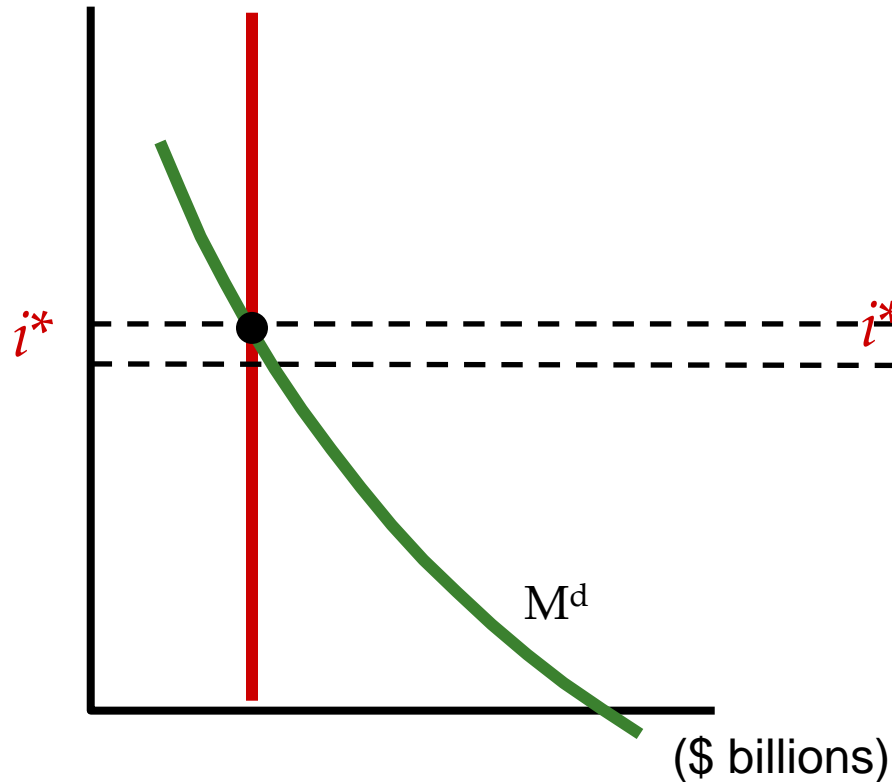
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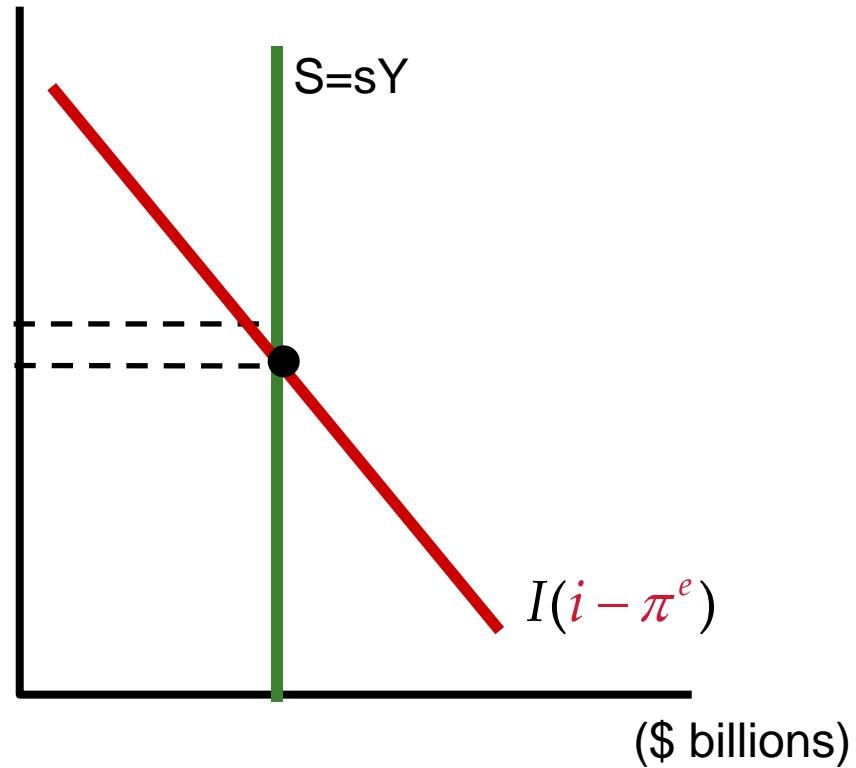
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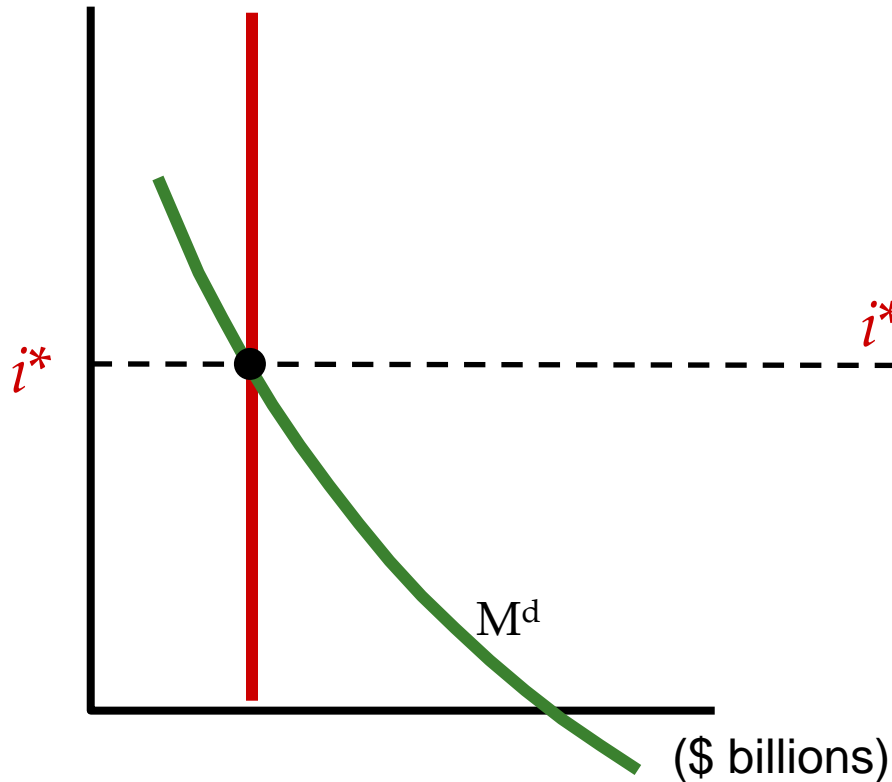


How?

The gap closes in

Interest
Rate i

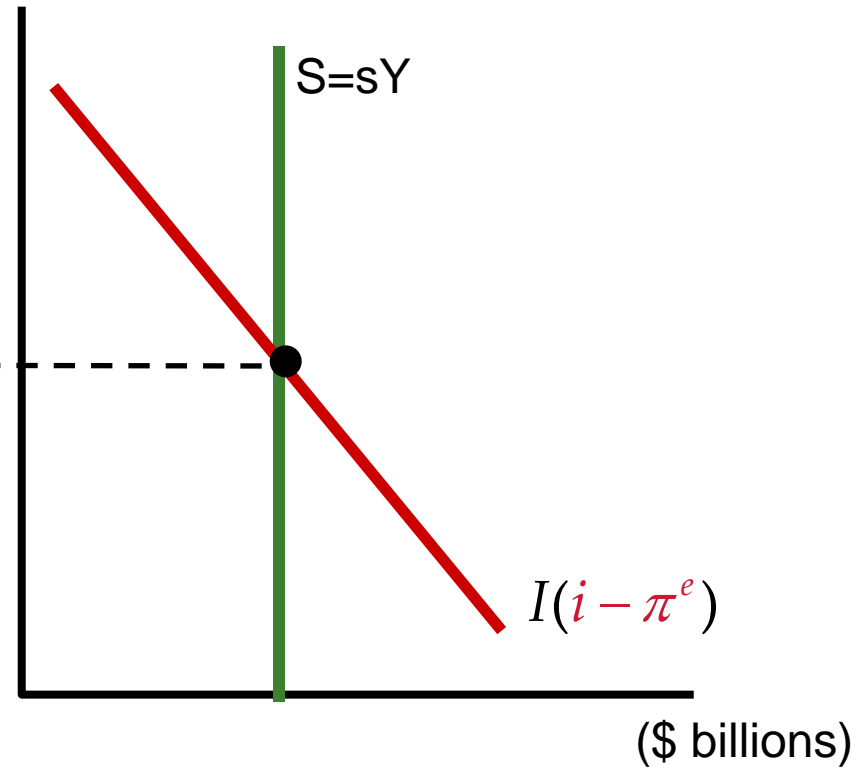
M^s



Interest
Rate i

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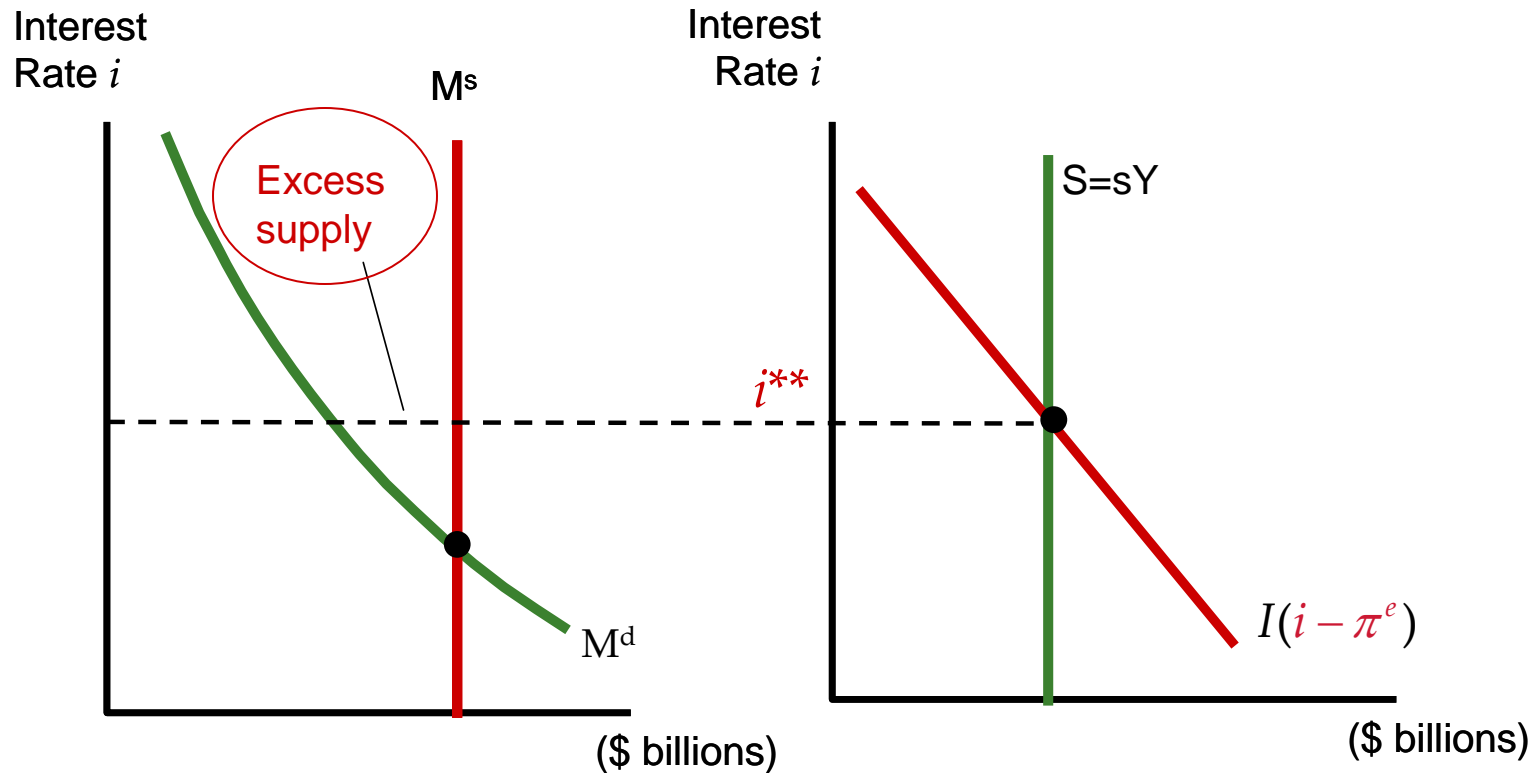


Mechanism?

- What is the mechanism that restores consistency?
 - Why price level P ?
 - What makes the price level P go up?

Example

- Money demand is “too low” → excess supply of money

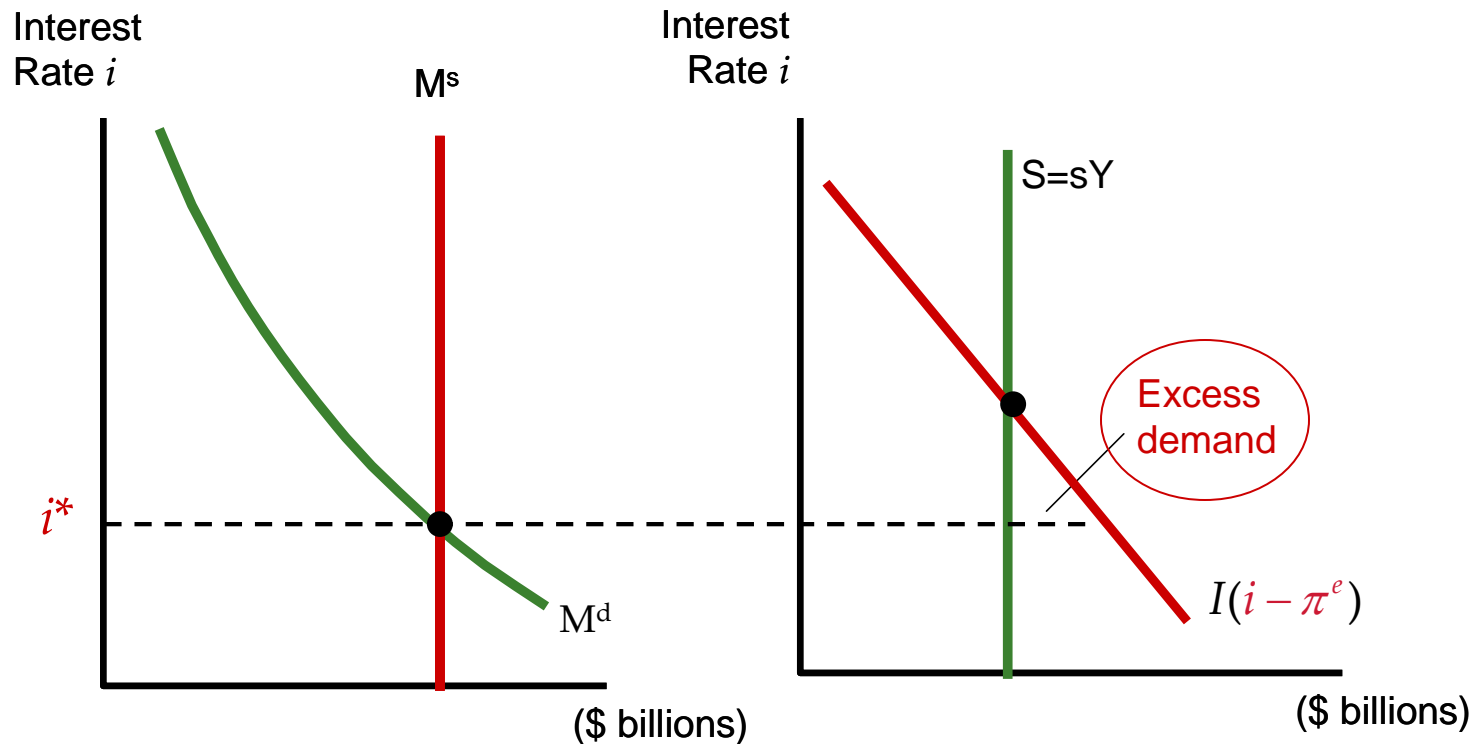


Example

- Money demand is “too low” → excess supply of money
 - Public wants to increase their bond holdings and reduce their money holdings
 - Price of bonds increases on the bonds market; interest rates fall
 - As interest rates fall, additional bonds are issued by firms to fund their excess demand for investment...

Example

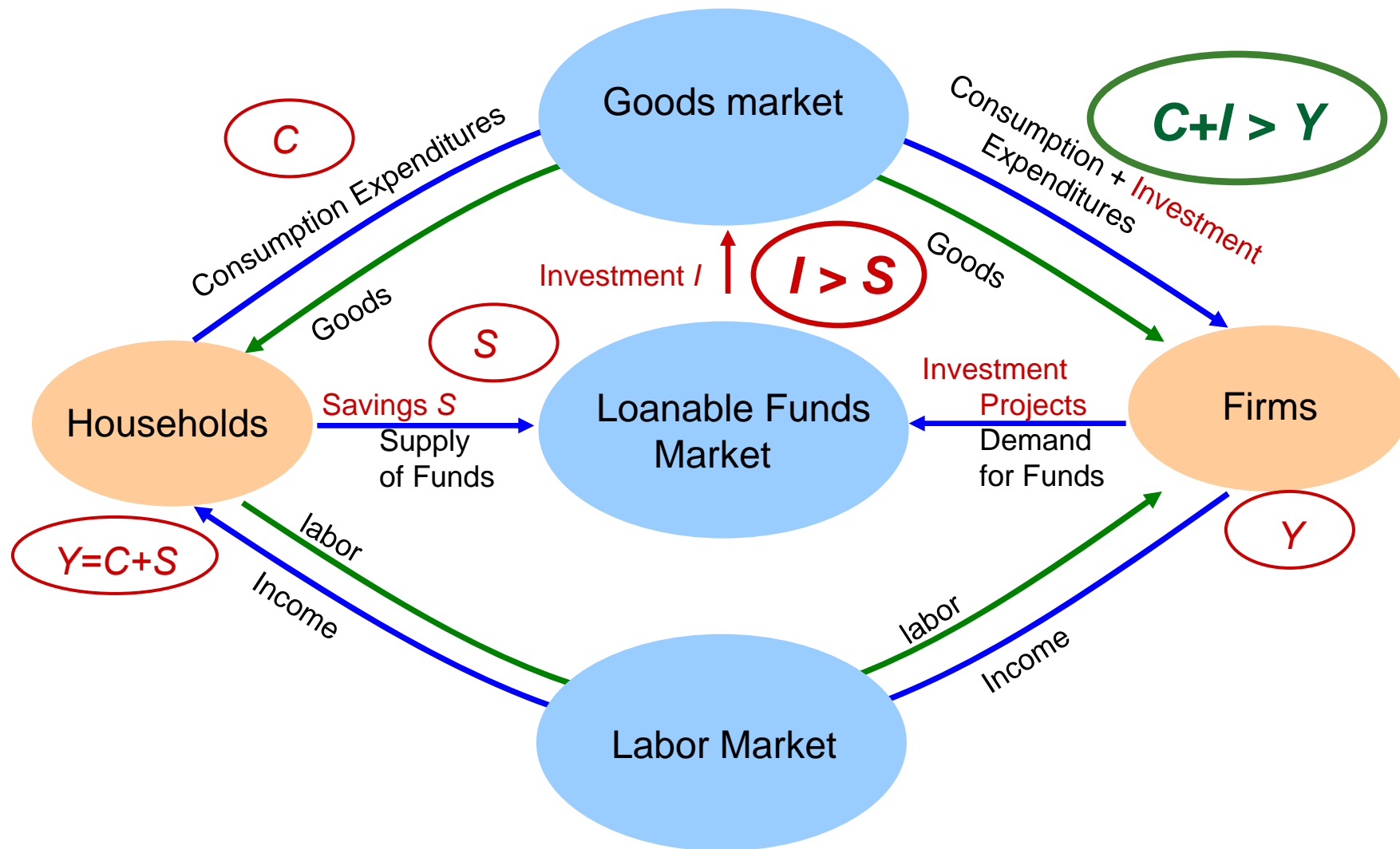
- Interest rates fall \rightarrow investment starts to exceed savings S (i.e. $I > sY$)



Example

- Total *planned* expenditures $>$ total output produced by firms
 - In the circular flow diagram, inflows (investment) exceed outflows (savings)
 - Say's law no longer holds!

Outflows < Inflows



Same Thing Analytically

- Define AE as total *planned* expenditures (called also aggregate demand)
- Then,

$$AE = C + I$$

$$AE = (1 - s)Y + I$$

$$AE = Y + [I - sY]$$

Since $I > sY = S$, so we have $AE > Y$

What Happens Next?

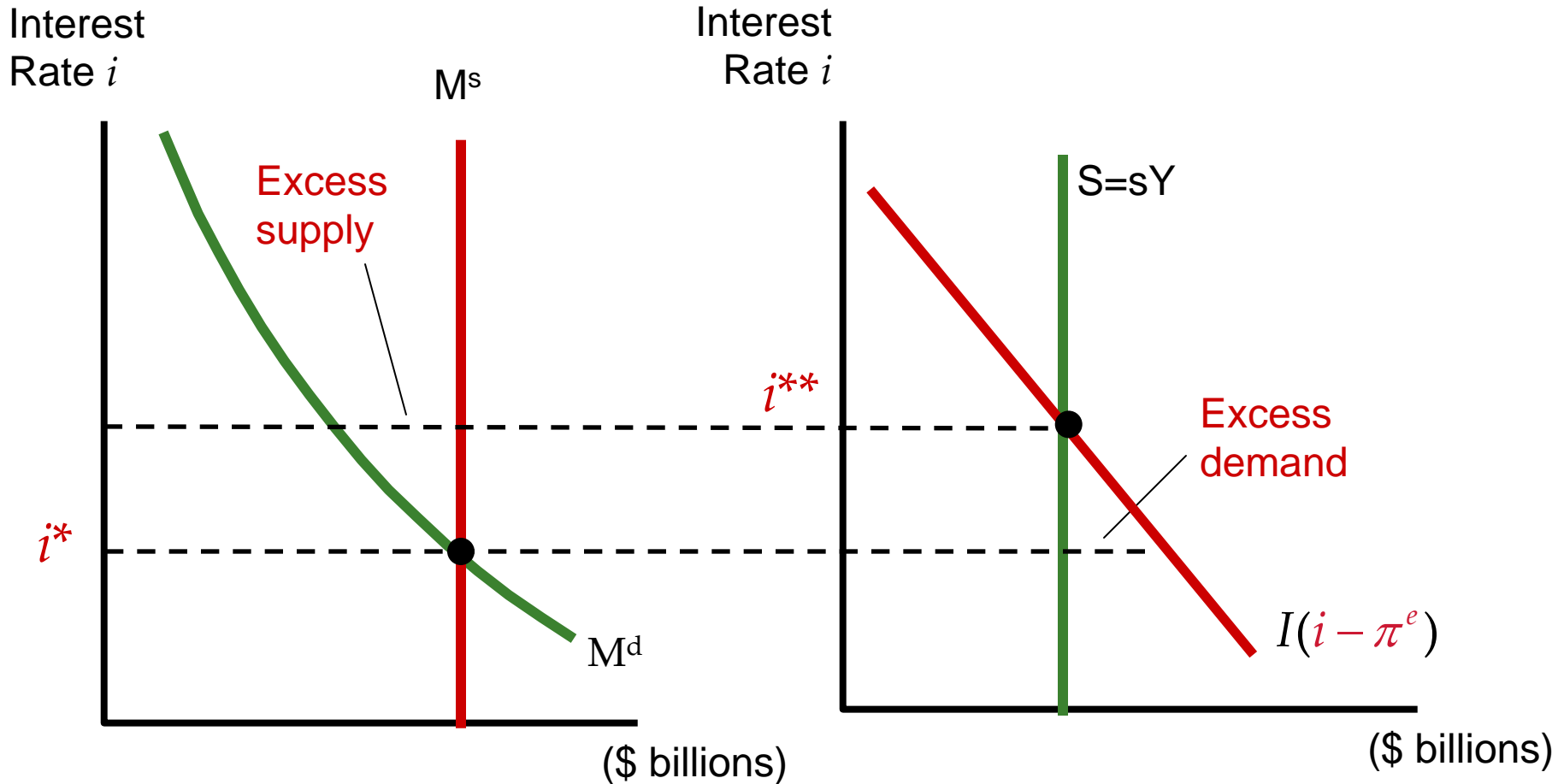
- Extra profit opportunity for firms
 - Firms can increase prices slightly, produce more and still sell everything!
- However:
 - Since all factors are already employed due to market clearing in all markets, **any attempt to increase production and employment immediately results in higher wages, higher costs, and thus higher and higher prices...**

What Happens Next?

- Bingo! Firms increase prices, P goes up until the gap closes in completely
 - Output remains unchanged

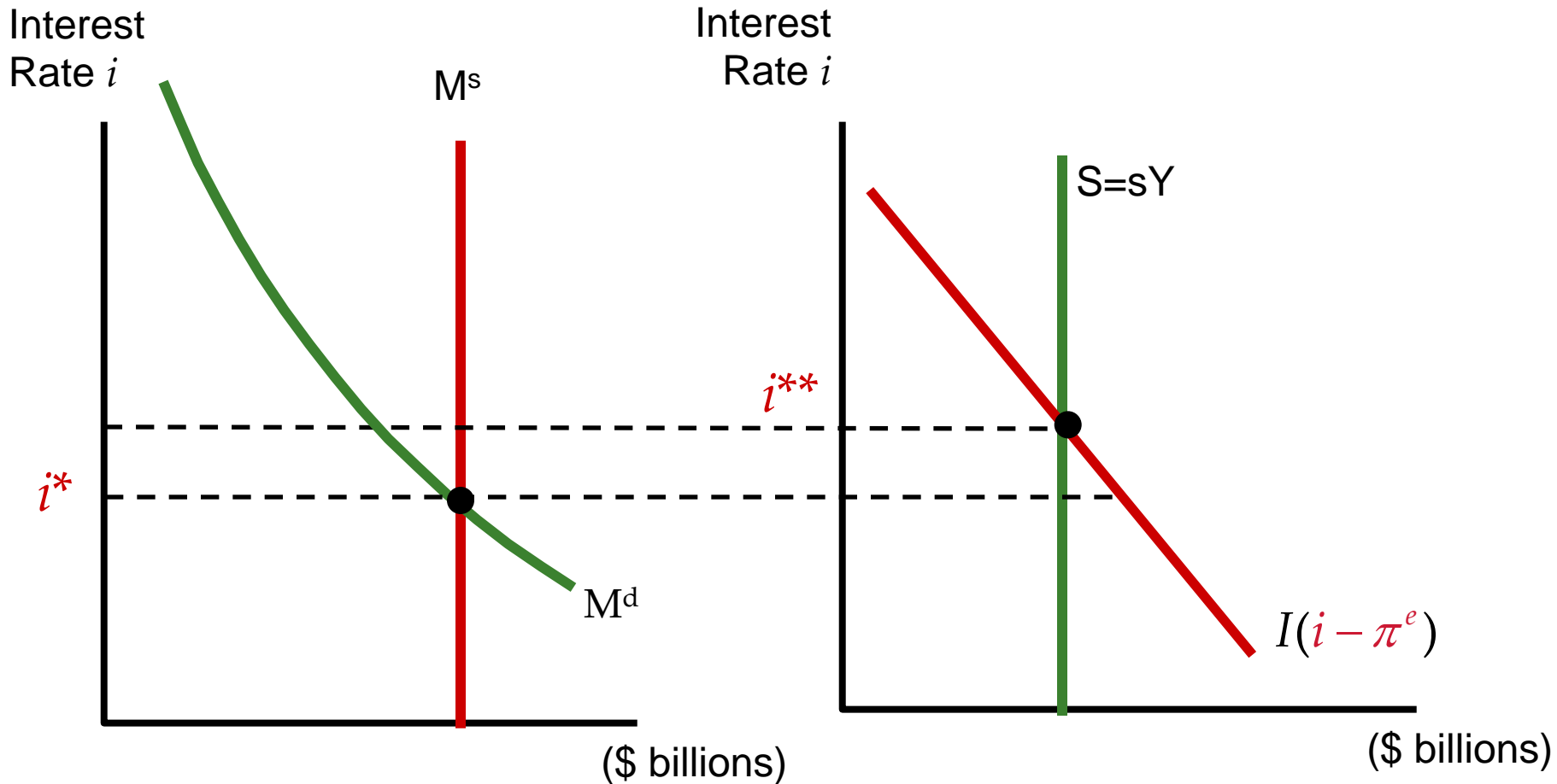
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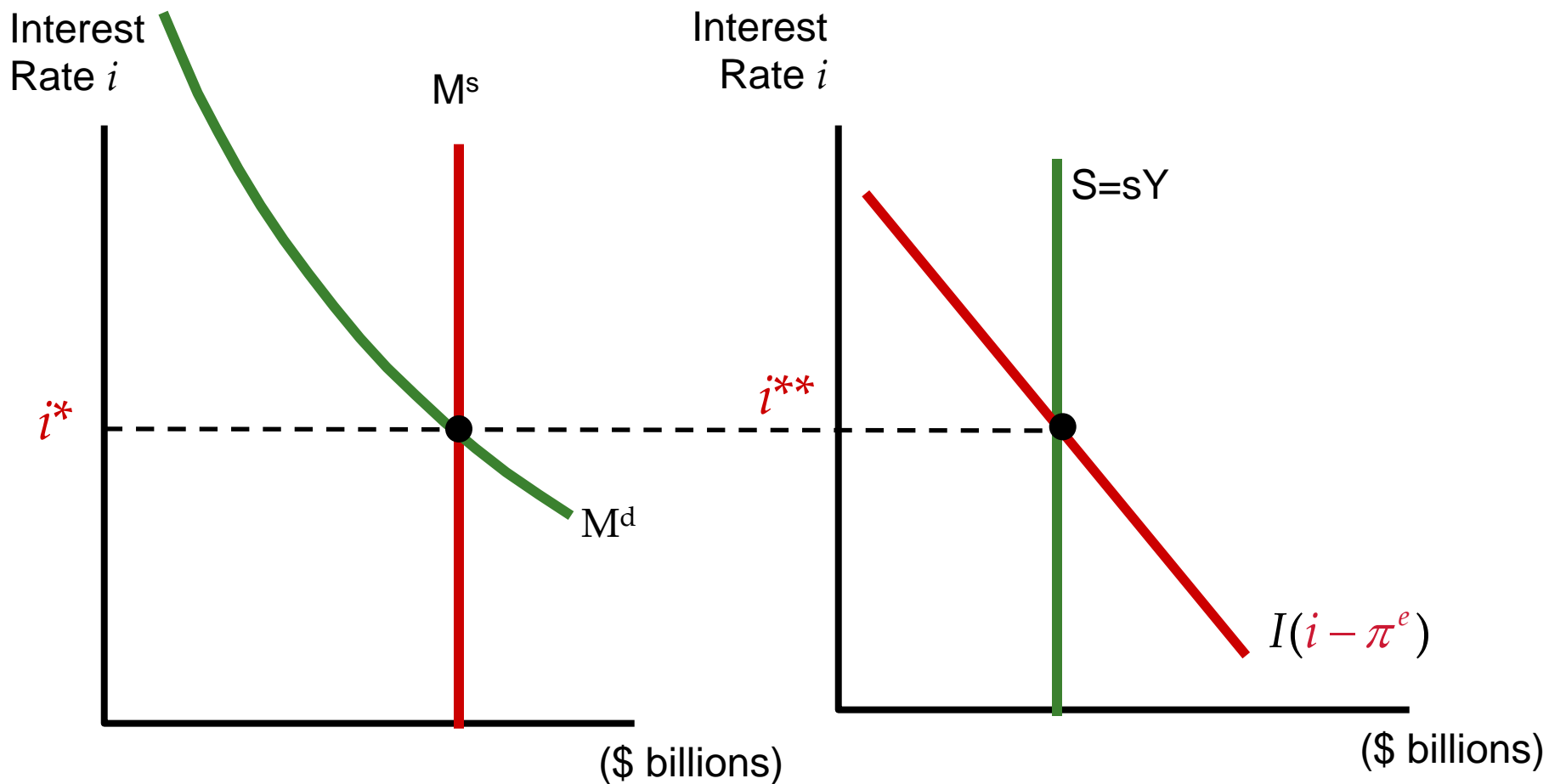
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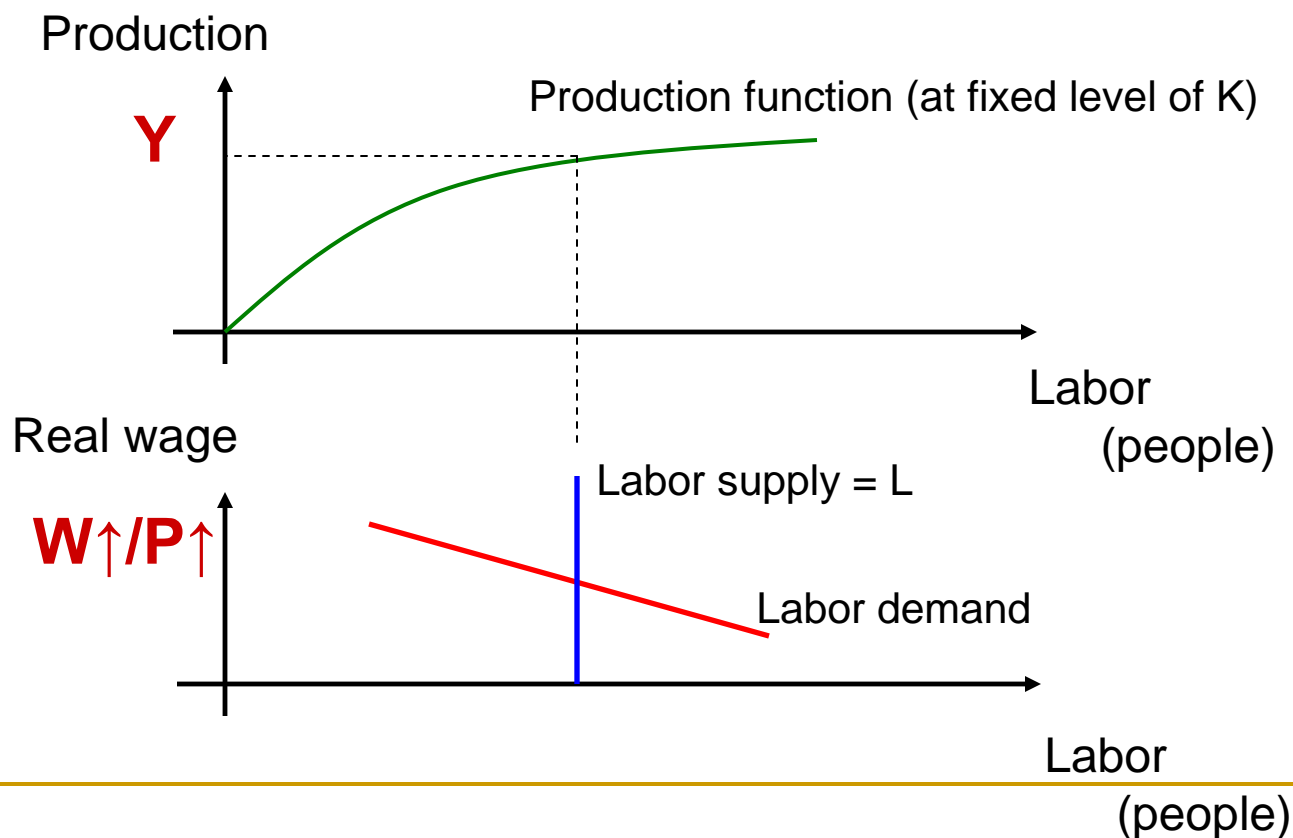
What Happens Next?

The gap closes in



Behind the Scene: Output and Employment

- Nominal wage W and price level P both increase
 - Real wage, employment, output, stay the same



Conclusion

- In the classical model, changes of money supply and monetary policy have no real effects (output, employment, real interest rates etc... all stay the same)
 - More money = inflation
 - Less money = deflation

Evidence for Classical Dichotomy in the Data

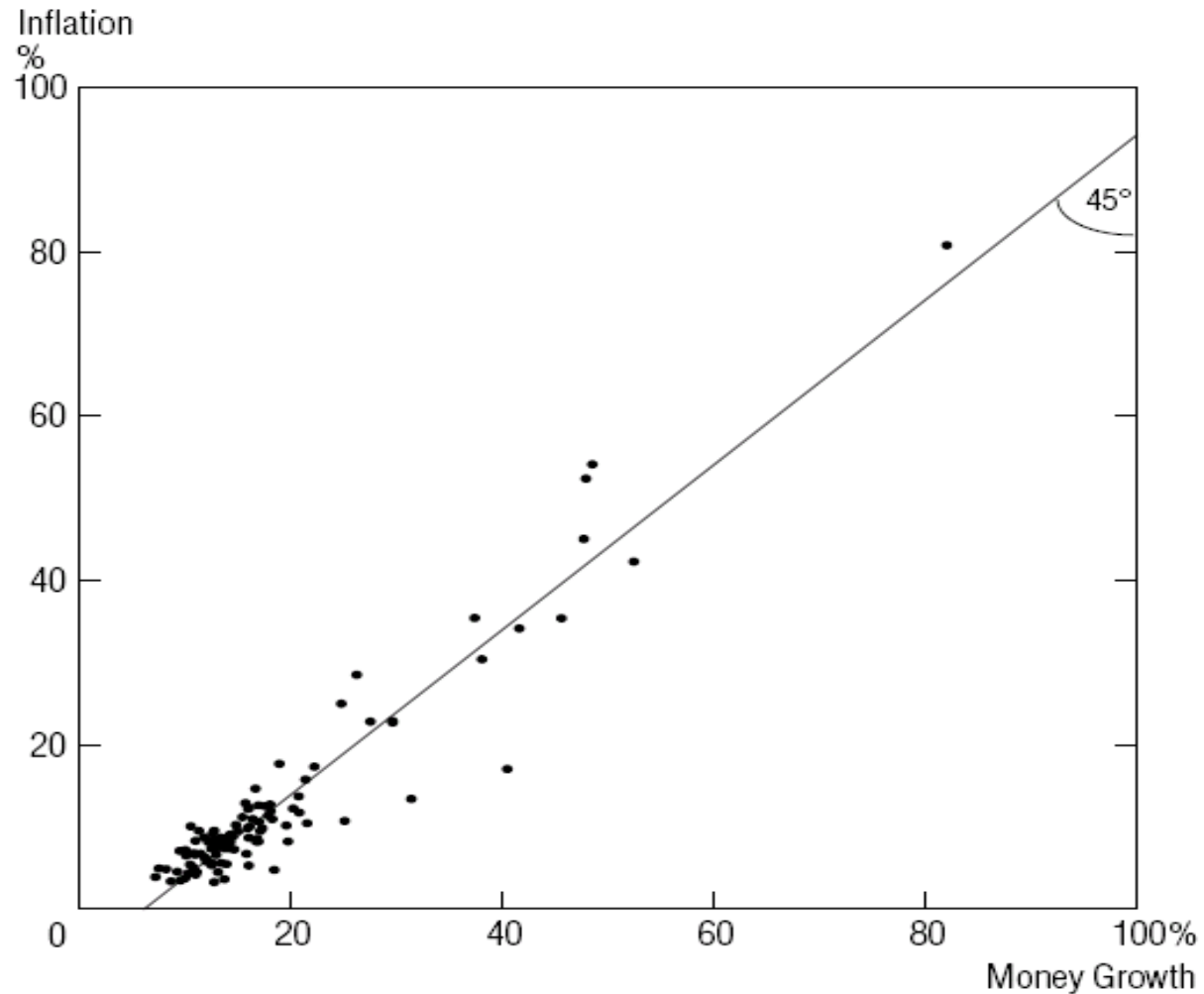
Evidence for Classical Dichotomy

- Consensus among economists is that classical dichotomy is true in the long-run
 - Higher money supply growth is systematically associated with higher inflation
 - Growth of output is unrelated to money growth rate and inflation

Money Growth and Inflation in the Data

- 30 years average growth rates of M2 money and inflation rates, 1960-1990 in 110 countries
- Source: Weber and McCandless (1995)

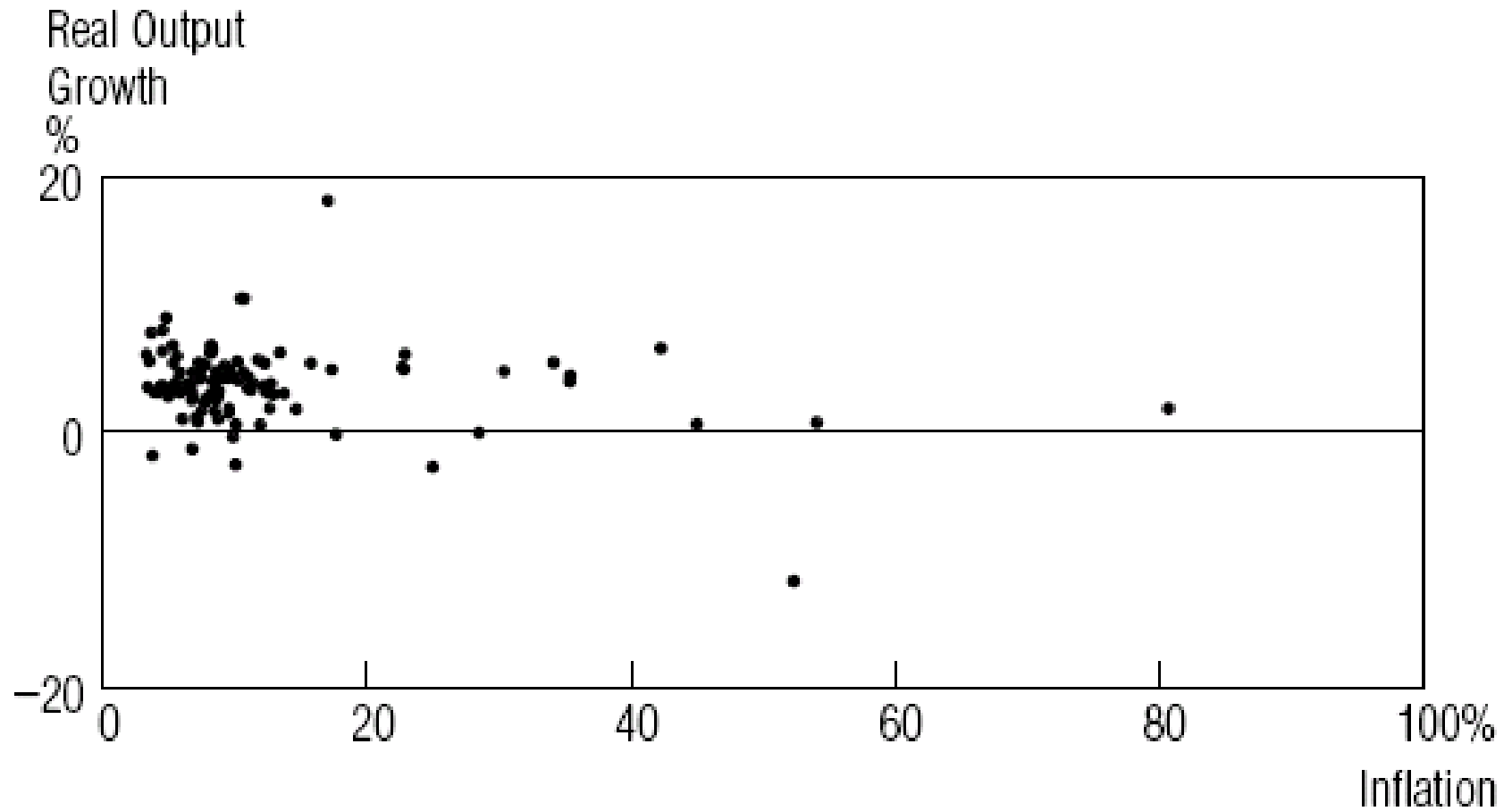
Money Growth and Inflation in the Data



Inflation and Growth in the Data

- 30 years average rates of growth in consumer prices and in real gross domestic product, 1960-1990 in 110 countries
- Source: Weber and McCandless (1995)

Inflation and Growth in the Data



Key Take Away

- In the long-run, printing money leads to inflation, and nothing more

Numerical Example

- Suppose in the equilibrium of the classical model, we have
 - Output $Y= 10$
 - Real interest rate r implied by LFME 3%
 - Money demand equation $M^d=2P+Y-100i$
 - Money supply $M^s=10$
 - Expected inflation rate $\pi^e=2\%$

Numerical Example

- Using the result of classical dichotomy, calculate the price level P

Using equilibrium condition, $M^s = M^d$, we have

$$10 = 2P + Y - 100i$$

$$10 = 2P + 10 - 5 \quad (\text{substituted out } Y=10 \text{ \& } i=r+\pi^e)$$

$$P = 5/2 = 2.5$$

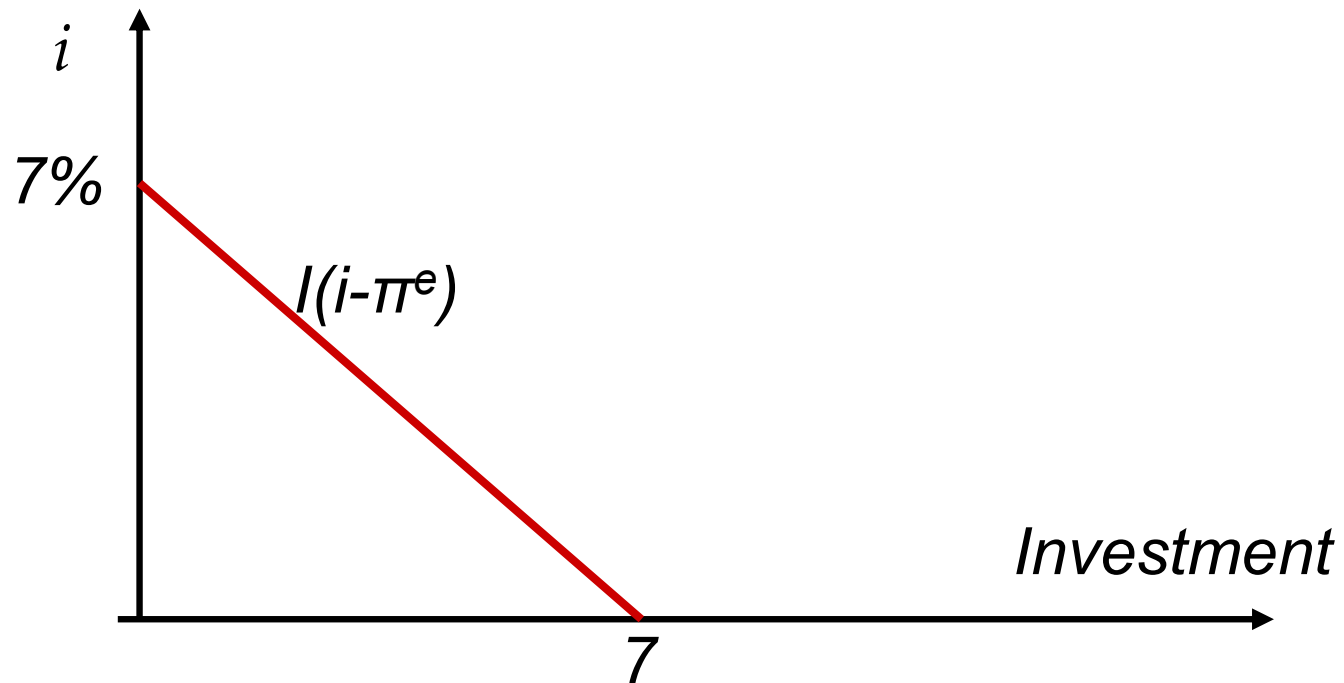
- What happens to the price level if M^s increases to 11? Following the same calculations, we obtain:

$$P = 3 \quad (\text{which implies inflation of 20\%})$$

Numerical Example

- Assuming investment function is given by $I(r)=50-500r$, plot investment function as a function of nominal interest rate instead, i.e. plot $I(i)$ given $\pi^e = 2\%$
 - Plug in $r=i-\pi^e$, to obtain:
 - $I(i)=5-100(i-\pi^e)=5-100i+2=7-100i$

Numerical Example



Numerical Example

- What happens to this function, if expected inflation goes up from 2% to 3%?
 - It shifts outwards
 - The new equation is $l(i)=5-100(i-\pi^e)=5-100i+3=8-100i$