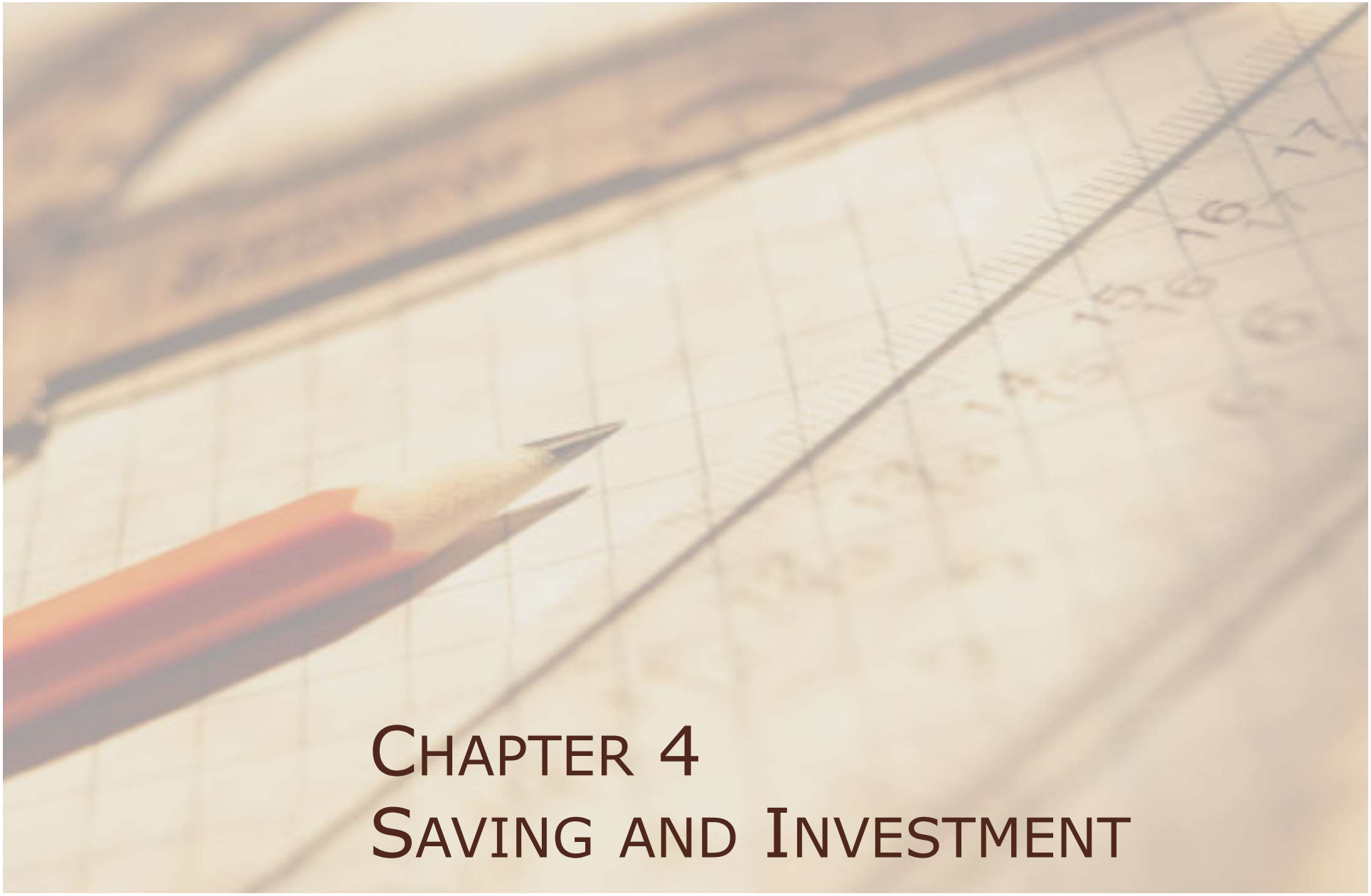

Chapter 4
Saving and Investment

Intermediate Macroeconomics, Fall 2019 (Oct. 7)

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- Min Kim
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  - office hours: 13:30-14:30 on Tuesdays at 423 in NJ hall
  - will do 16 lectures, while professor is on parental leave
- We will cover
  - chapter 4: Savings – Investment diagram
  - chapters 9-13: Aggregate Demand – Supply framework
- Let's start with warm-ups

Quick review

- In economics, we like to use a function to describe the relationships between the variables of interest

$$Y = f(X)$$

  - variable Y moves with variable X through $f(\cdot)$

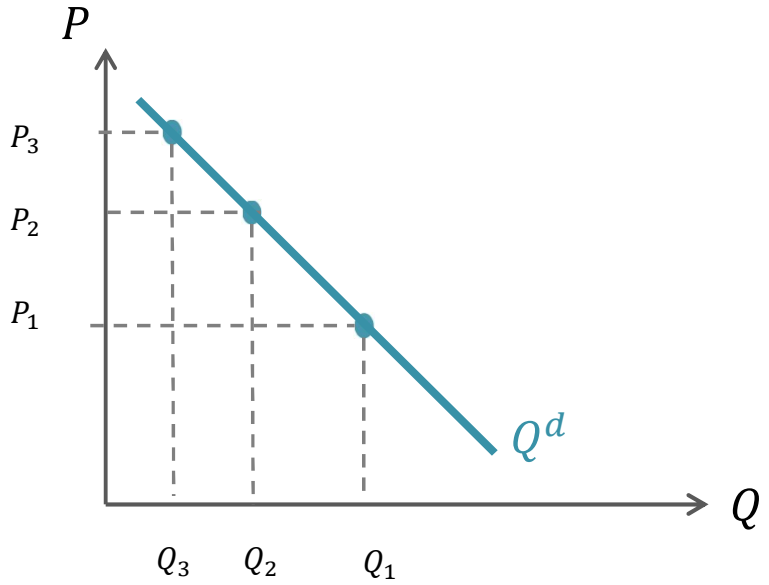
- For example, a demand curve Q^d :

$$Q = a - bP \text{ for some } a, b > 0$$

  - b : responsiveness to the price change
  - a : income, expectations, preferences, prices of other goods, etc.

Quick review

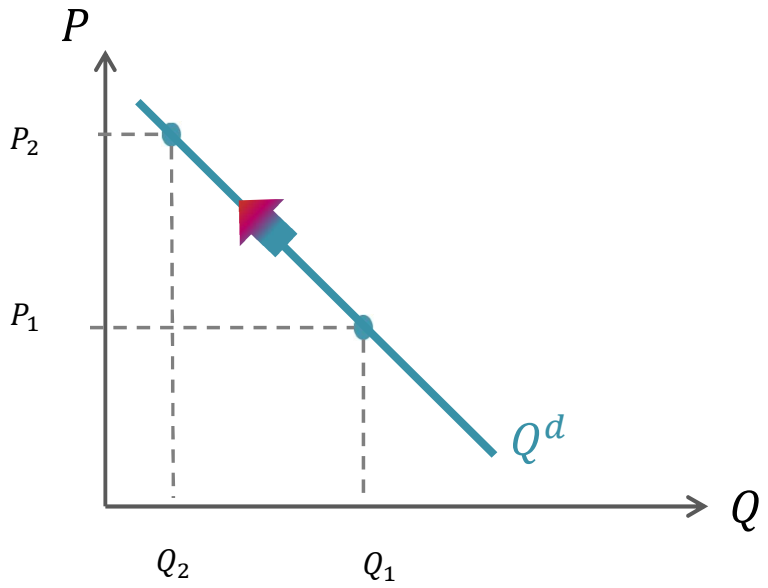
- The graph for the inverse demand curve $P = \frac{a}{b} - \frac{1}{b}Q$ is



- Two concepts:
  - movements along the curve
  - shifts of the curve

Movements along the curve

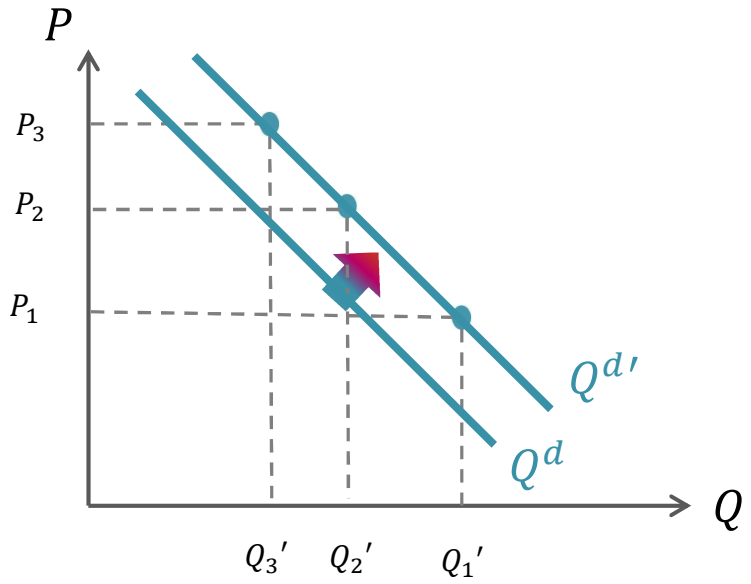
- How does Q change as P changes?



  - When the price increases from P_1 to P_2, the quantity demanded decreases, from Q_1 to Q_2

Shifts of the curve

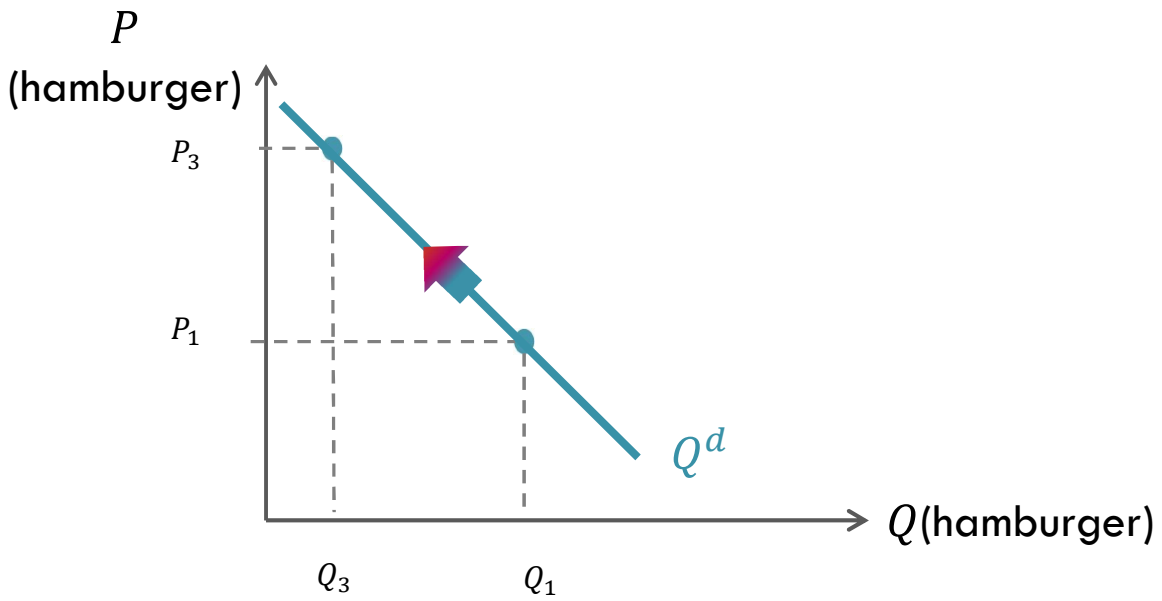
- What happens if a changes?
  - Suppose that there is an increase in income so that a increases



  - the curve shifts outwards parallelly, assuming it is a normal good

Example: hamburger, ketchup, and chicken

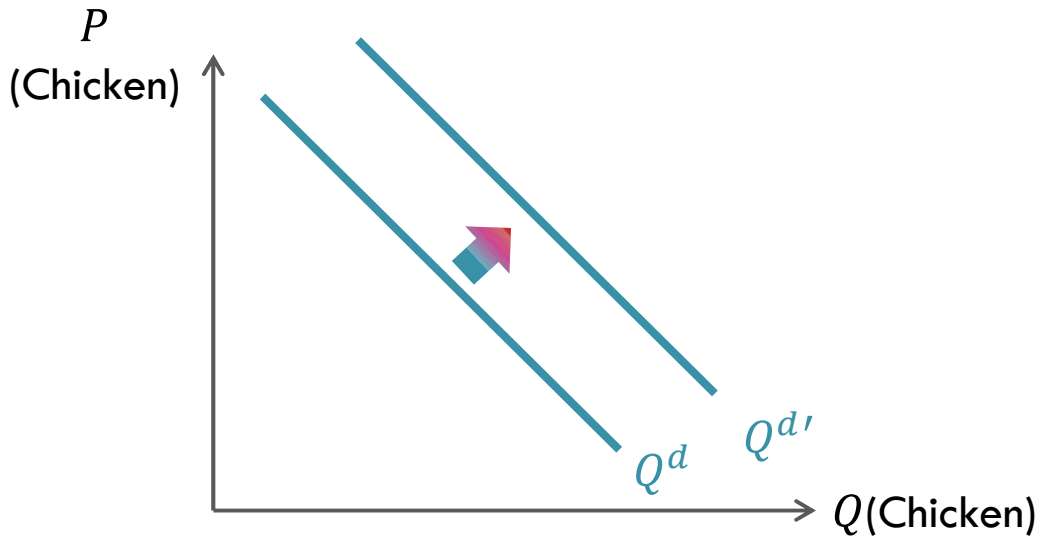
- Suppose that the price for hamburger rises
  - What happens to the demand for chicken (substitute good) and the demand for ketchup (complementary good)?



  - the quantity demanded for hamburger decreases (along the curve)

Example: hamburger, ketchup, and chicken

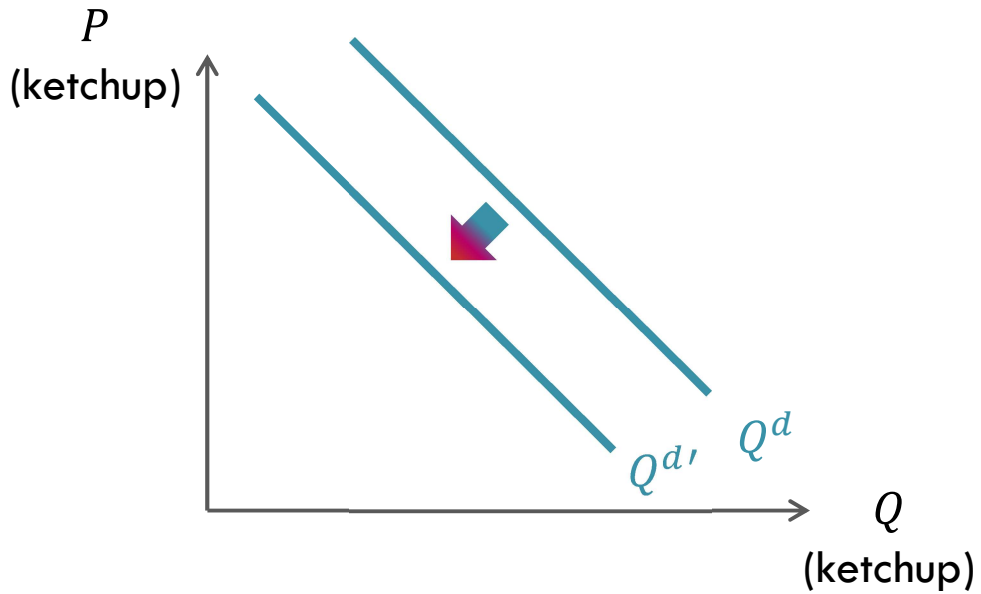
- Demand for chicken (substitute good) increases



  - the demand curve shifts outwards
    - this can be interpreted as a increases

Example: hamburger, ketchup, and chicken

- Demand for ketchup (complementary good) decreases



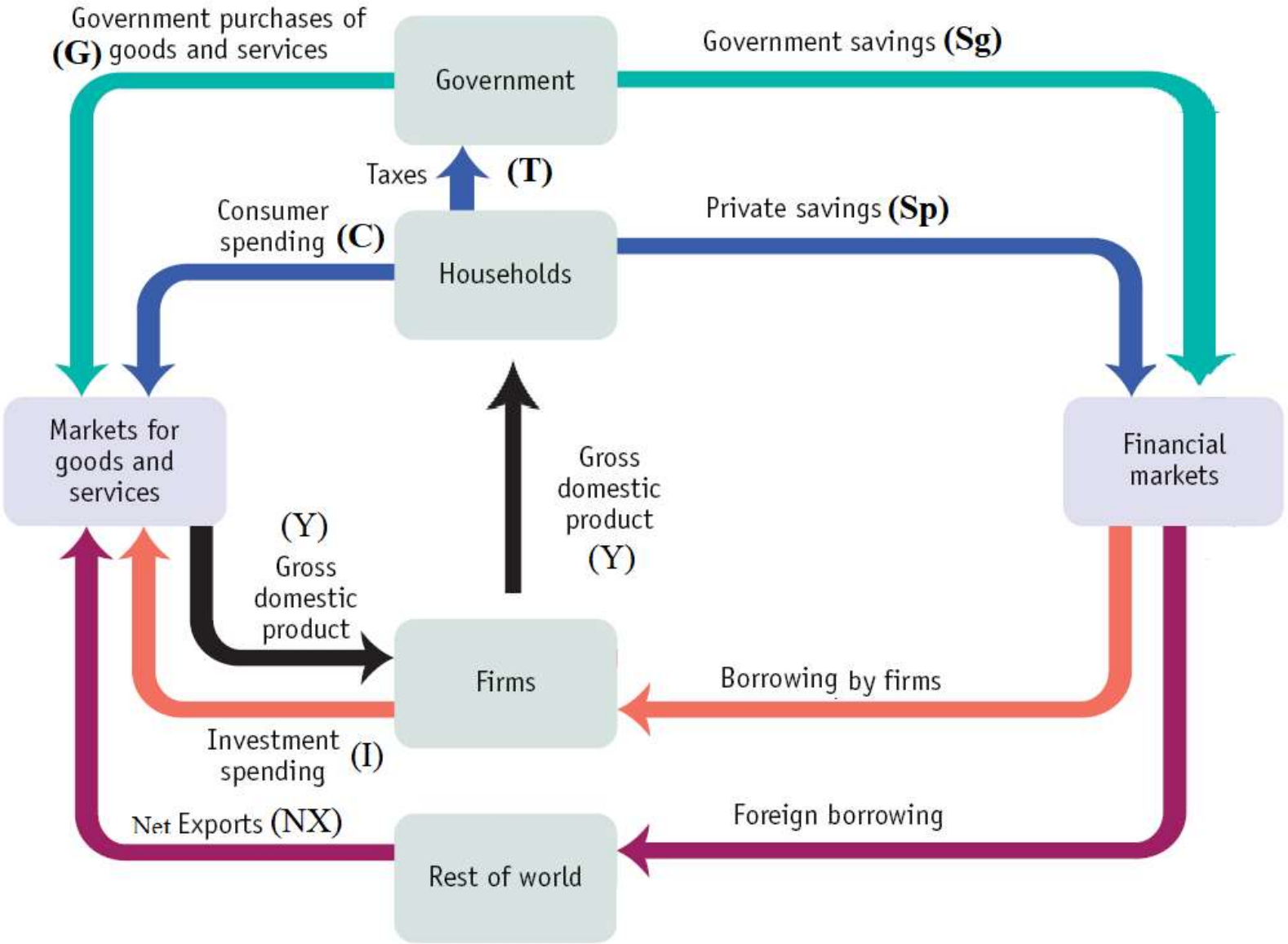
  - the demand curve shifts downwards
    - this can be interpreted as a decreases

What we have done so far

- What should we look at to know about the economy?
  - what are the important macro variables?
- Among others, main interest is real GDP, Y
  - that summarizes how well the economy is doing
- *Chapter 2*: How can we measure Y?
  - total production = total expenditure = total income
- *Chapter 3*: What determines Y?
  - assuming the aggregate production function: $Y = AK^b L^{1-b}$

- *Chapters 6 and 7*: How does Y grow over time?
  - in the long-run, the economy converges to the steady state k^*, which depends on A, b, n, δ and s
  - *assuming* $S = sY$ for some fixed saving rate s and $I = S$
- What is missing?
  - economy does not work mechanically
    - $S = sY$ is a strong assumption and how $I = S$?
  - agents make decisions and interact in the markets
    - households/firms/government/rest-of-world
- We assume that the output is fixed $Y = F(\bar{K}, \bar{L}) = \bar{Y}$
  - and we will focus on goods and financial markets

Flow diagram



- What is the (general) equilibrium of the economy?
  - *supply=demand* in all markets (goods and financial markets)
- Walras' law says
  - *"if all other markets in an economy are in equilibrium, then that specific market must also be in equilibrium"*
- We will look for the equilibrium in goods market

$$Y = C + I + G + NX$$

  - so that financial market is <u>also</u> in equilibrium

Outline of Chapter 4

- Consumption, saving, and investment
  - the *uses of saving identity*
- Equilibrium in three cases:
  - a closed economy
  - a small open economy
  - a large open economy
- Some exercises
  - the "global savings glut"

Consumption

- **Consumption** expenditure depends on many factors
- We separate these factors into three categories:

$$C = \overline{C} + C(Y - T, r)$$
$$+ \quad -$$

  - where:

$Y - T$ = disposable income

r = real interest rate

$\overline{C}$ = autonomous consumption
(*i.e.*, everything else)

Recall from Chapter 2

- A **nominal interest rate** is the cost of borrowing, or the price paid for the rental of funds
  - if you borrow $100 at 2% interest for one year
  - As a borrower, you will have to pay back $102
- The **real interest rate** is an interest rate adjusted for changes in prices, measures purchasing power
  - suppose now that the expected inflation is 2%
    - dollars will be worth 2% less, so the *real* cost of borrowing (or the real interest rate) is 0%.
    - the amount of goods you can buy with $100 today is the same as the amount you can buy with $102 next year
    - no change in terms of *purchasing power*

Why does C depend negatively on r?

- r is a relative price
  - current consumption vs. future consumption
- Example: buying a new TV today vs. in one year
  - suppose price is $500 in both years (no inflation)
  - current cost of TV today is $500
  - what is the *current* cost of TV in one year?
    - how much you need to save today?

- Let x be the amount you need to save

$$x(1+r) = \$500 \qquad \text{or} \qquad x = \frac{\$500}{1+r}$$

- when $r = 1\%$ $\Rightarrow$ $x = \dfrac{\$500}{1.01} \approx \$495$

- When r increases to 10% $\Rightarrow$ $x = \dfrac{\$500}{1.10} \approx \$455$

➡ current consumption is relatively more expensive

From consumption to saving

- Private saving is disposable income minus consumption

$$S_P = Y - T - C$$

- Govt. saving is tax revenue minus govt. expenditure

$$S_G = T - G$$

- **National saving** is S_P plus S_G

$$S = Y - C - G$$

- Output: $Y = F(\overline{K}, \overline{L}) = \overline{Y}$
- Fiscal policy is exogenous: $G = \overline{G}$ and $T = \overline{T}$
  - it does not depend on r
- Consumption: $C = \overline{C} + C(Y - T, r)$
- Then:

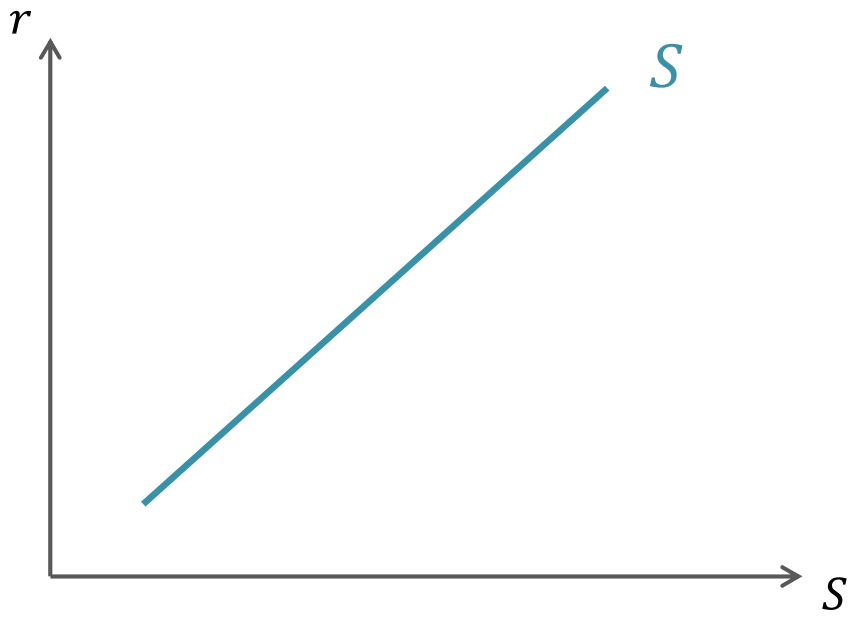
$$S = \overline{Y} - \overline{C} - C\left(\overline{Y} - \overline{T}, r\right) - \overline{G}$$

  - an increasing function of the real interest rate r

Graphically,

- **National saving** is:

$$S = \overline{Y} - \overline{C} - C\left(\overline{Y} - \overline{T}, r\right) - \overline{G}$$



Investment

- Recall: **investment** is expenditure on currently produced capital goods …
  - … that are used to produce other goods over an extended period of time
- Assume: $I = \bar{I} + I(r)$

  where $\bar{I}$ = autonomous investment
- Why is investment decreasing in r?

- Example: firm is considering buying a new machine
  - costs $\$100{,}000$
  - will produce benefit of $\$\mathbf{5{,}000}$ per year (forever)

  Q: should the firm buy the machine?

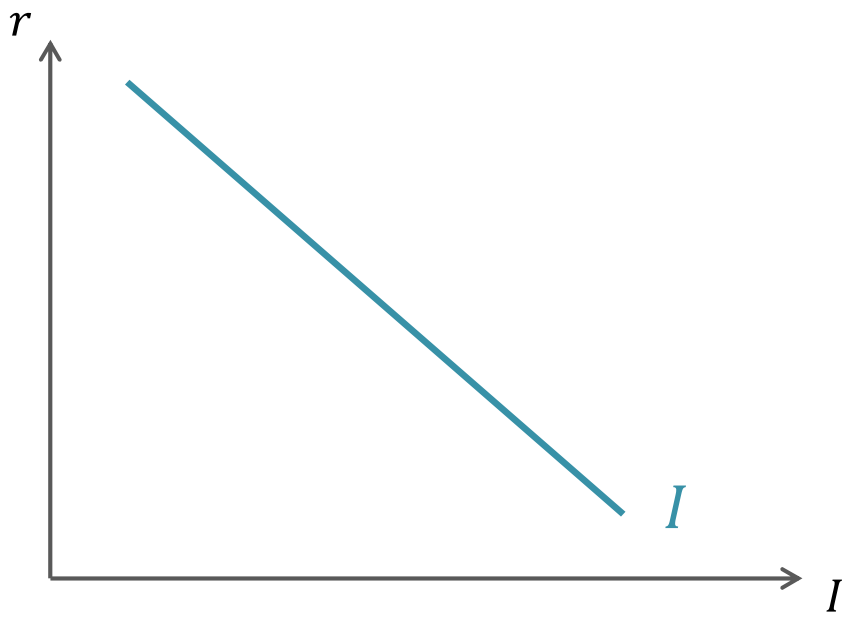
- Suppose firm can borrow $\$100{,}000$ at interest rate *r*
  - annual interest cost = $(r) \times \$100{,}000$
  - If $r = 10\%$ ⟶ annual cost = $\$10{,}000$ ⟶ do not buy
  - if $r = 3\%$ ⟶ annual cost = $\$3{,}000$ ⟶ buy

  - an decreasing function of the real interest rate r

Graphically,

- **Investment** is:

$$I = \bar{I} + I(r)$$



Relating saving to investment

- National saving:

$$S = Y - C - G$$

- Imposing the equilibrium condition in goods market

$$Y = C + I + G + NX$$

- Then

$$S = (C + I + G + NX) - C - G$$

or

$$\boxed{S = I + NX}$$

the "uses of saving" identity

Implications

- Use of national savings (S)
  - Invest in capital goods (I)
  - Sell goods to foreigners for foreign currency assets (NX)
    - $S - I$ is called *net capital outflow*
- Goods market is in **equilibrium** if $S = I + NX$
  - by Walras' law, financial market is <u>also</u> in equilibrium
- If $S \neq I + NX$, there will be some "adjustments"
  - so that the economy is in equilibrium

Adding up

- Rewrite our identity as

$$S = I + NX \qquad \Rightarrow \qquad S - I = Export - Import$$

- This identity holds for every country in equilibrium:

$$S_{US} - I_{US} = Export_{US} - Import_{US}$$
$$S_{Canada} - I_{Canada} = Export_{Canada} - Import_{Canada}$$
$$S_{Mexico} - I_{Mexico} = Export_{Mexico} - Import_{Mexico}$$
$$\dots$$

- Adding across all countries in the world:

$$\sum_i S_i - \sum_i I_i = \sum_i Export_i - \sum_i Import_i$$

- Repeating:

$$\sum_i S_i - \sum_i I_i = \sum_i Export_i - \sum_i Import_i$$

total saving in the world

total investment in the world

total exports

total imports

Q: How are these related?

A: total exports = total imports

(every good exported from one country is imported to another)

- Result:

$$\sum_i S_i - \sum_i I_i = 0 \quad \text{or}$$

total saving in the world = total investment in the world

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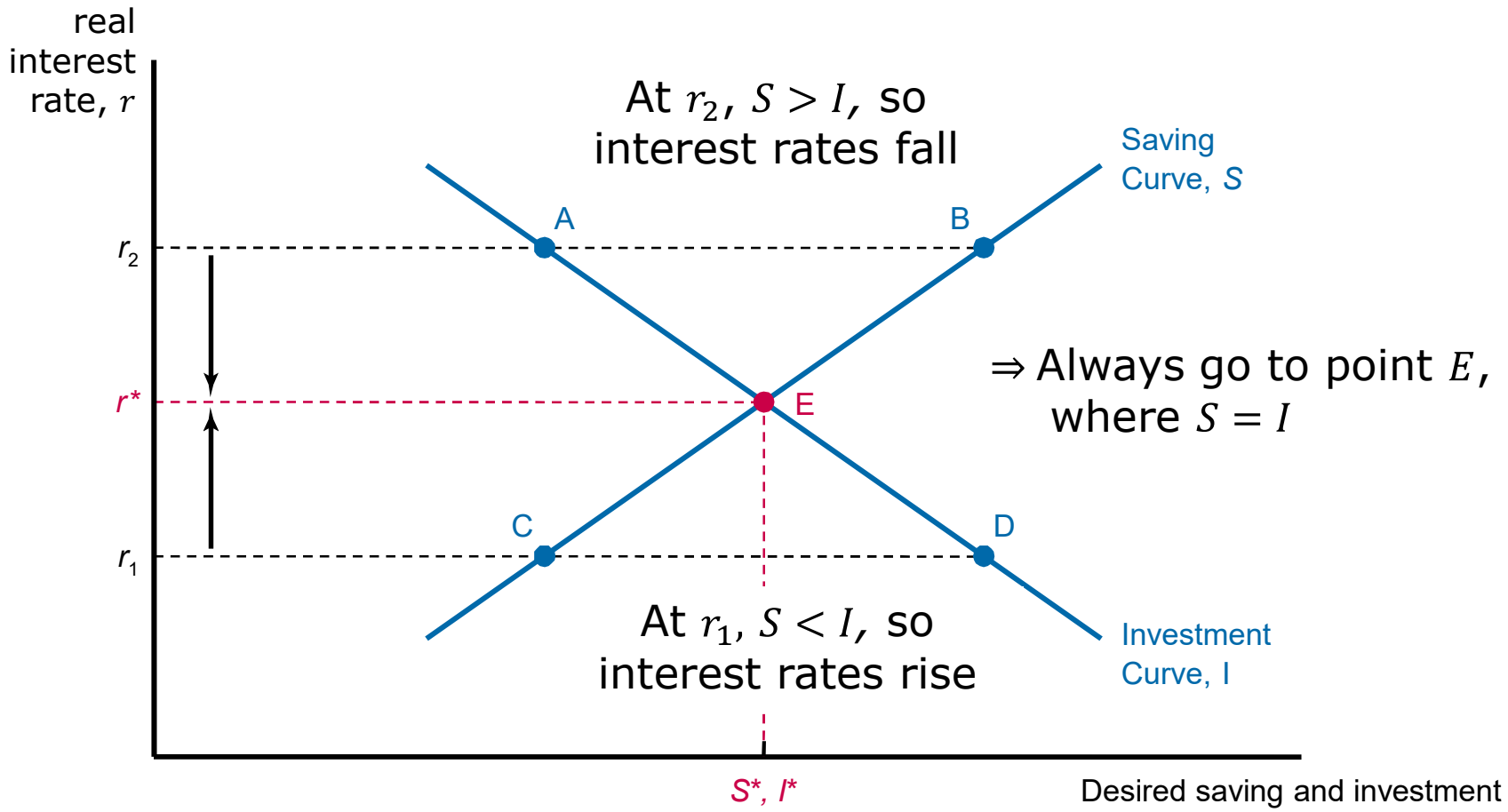
1) A closed economy

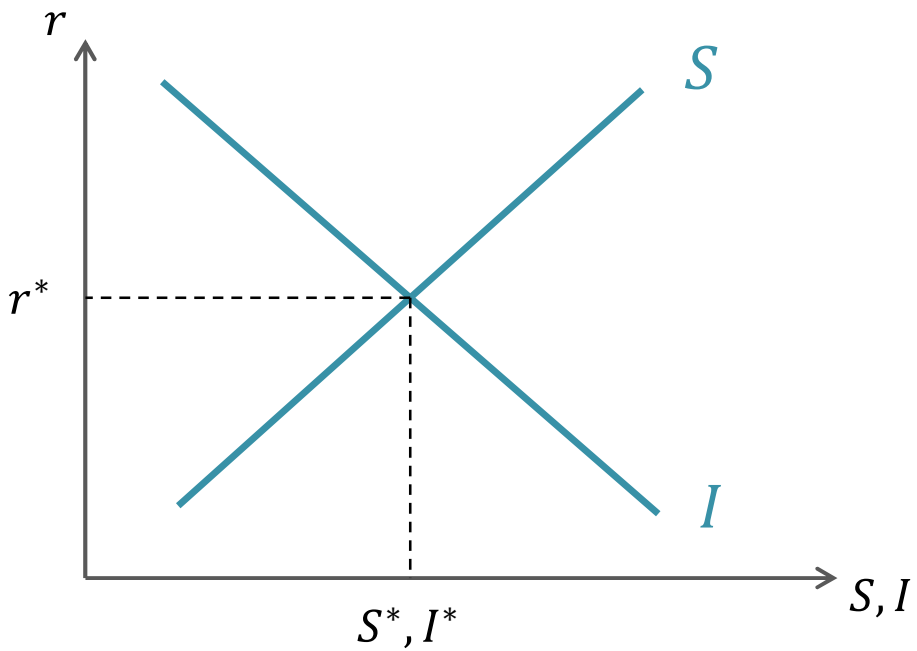
- Suppose there is *no* international trade
  - then NX must equal zero
  - and $S = I$ must hold in equilibrium
- Two interpretations:
  - we are looking at an economically closed country
  - we are looking at the world as a whole
- Real interest rate r is determined by local forces
  - supply (of saving) and demand (for investment)

Equilibrium in a closed economy



Increase in government spending ($\overline{G}\uparrow$)

- will decrease national saving $S = \overline{Y} - \overline{C} - C\left(\overline{Y} - \overline{T}, r\right) - \overline{G}$



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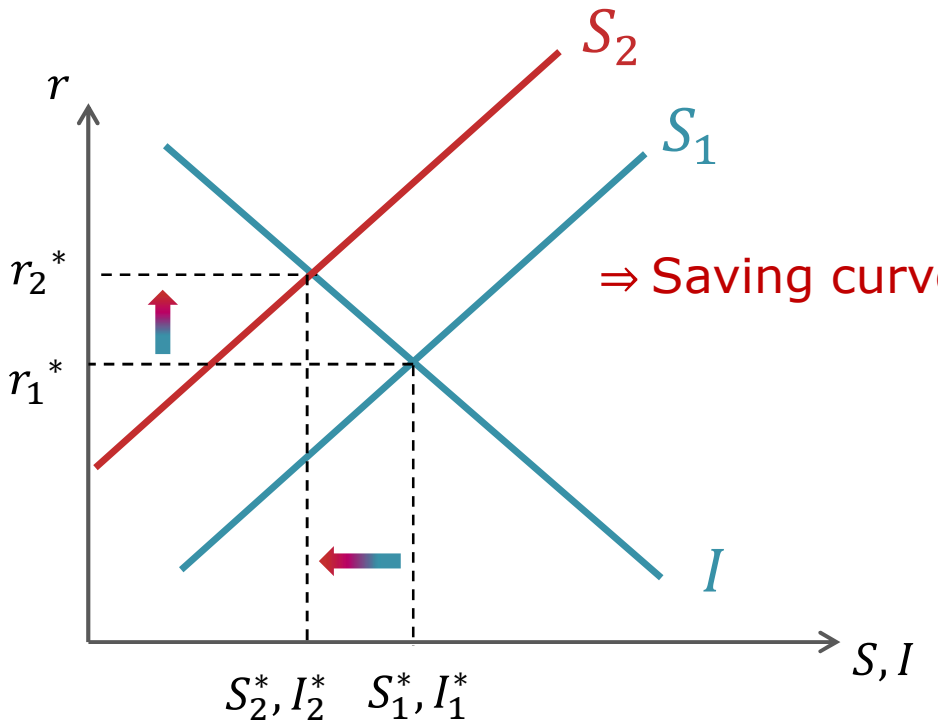

⇒ Saving curve shifts to the left

- Equilibrium level of saving and investment fall
  - this is called **crowding out effect**
  - criticism to fiscal stimulus package by the government