CHAPTER 3
AGGREGATE OUTPUT, INCOME, AND EXPENDITURE

Objectives:

- To understand the factors which determine the levels of aggregate output, income, and expenditure in the ***long run;***
- To analyse the long-run ***division of output and expenditure*** between consumption [*C*], investment [*I*], and govt. expenditure [*G*];
- To understand how the level of ***real interest rates*** [*r*] is determined in the long run.

I. Long-run Versus Short-run Determinants of Real GDP [*Y*].

- How much output an economy produces in a particular year depends on:
  - the economy's capacity to **supply** output;
  - the level of **demand** for output relative to that capacity.

- In the **long run**, as opposed to the short run, real GDP [*Y*] is determined primarily by **capacity to supply**, rather than by demand relative to capacity.

II. The Supply of Output.

1. The production function.

- The quantity of output produced in any period depends on:
  - the quantities of inputs of ***capital*** (*K*) and ***labour*** (*L*) employed in production;
  - the ***technology*** of production, or the productive efficiency of inputs *L* and *K*.

- **Def:** ***The economy's production function shows the maximum quantity of output [Y] which can be produced by various amounts of labour [L] and capital [K], given current production technology:***

$$Y = F(K, L),$$

where: ⇧ K (with L constant) ➔ ⇧ Y
and ⇧ L (with K constant) ➔ ⇧ Y

(marginal products of capital and labour always positive)

- Notes on the production function:

- Many real-world production functions have ***constant returns to scale*** - a doubling [halving] of **both** input quantities will double [halve] output:

$$zY = F(zK, zL) \text{ for any positive number, } z.$$

- ***Technological progress*** changes the production function by increasing Y for *given* values of L and K.

2. The supplies of the factors of production.

- Assume that there are **fixed supplies** of labour [$\bar{L}$]and capital [$\bar{K}$] available for employment, and a **given technology**.

- Assume that factor prices adjust to ensure there is **full employment** of labour and capital:

$$L = \bar{L} \quad \text{and} \quad K = \bar{K}$$

- Then the quantity of output produced [Y] will be determined by the **productive capacity** of the economy:

$$Y = F(\overline{K}, \overline{L})$$
$$= \overline{Y}$$

where: $\overline{Y}$ = ***full-employment real GDP***

III. The Demand for Output.

1. Definition, and composition of, aggregate expenditure.

- **Def:** ***Aggregate expenditure (E) measures total planned spending on the final goods and services the economy produces*.**

- Assume a **closed** economy [i.e. no exports or imports, $NX = 0$]

- **Aggregate expenditure** [E] is sum of planned consumption spending, planned investment spending, and planned govt. spending on output:

$$E = C + I + G$$

2. The consumption function.

- Assume the level of consumption spending [***C***] **varies directly** with the level of aggregate **disposable income** of consumers defined to equal GDP [*Y*] minus net taxes [*T*], or [***Y- T***]:

$$C = C(Y - T)$$

↓

"is a function of"

where: ⇧ $(Y\text{-}T)$ ➔ ⇧C

⇩ $(Y\text{-}T)$ ➔ ⇩C

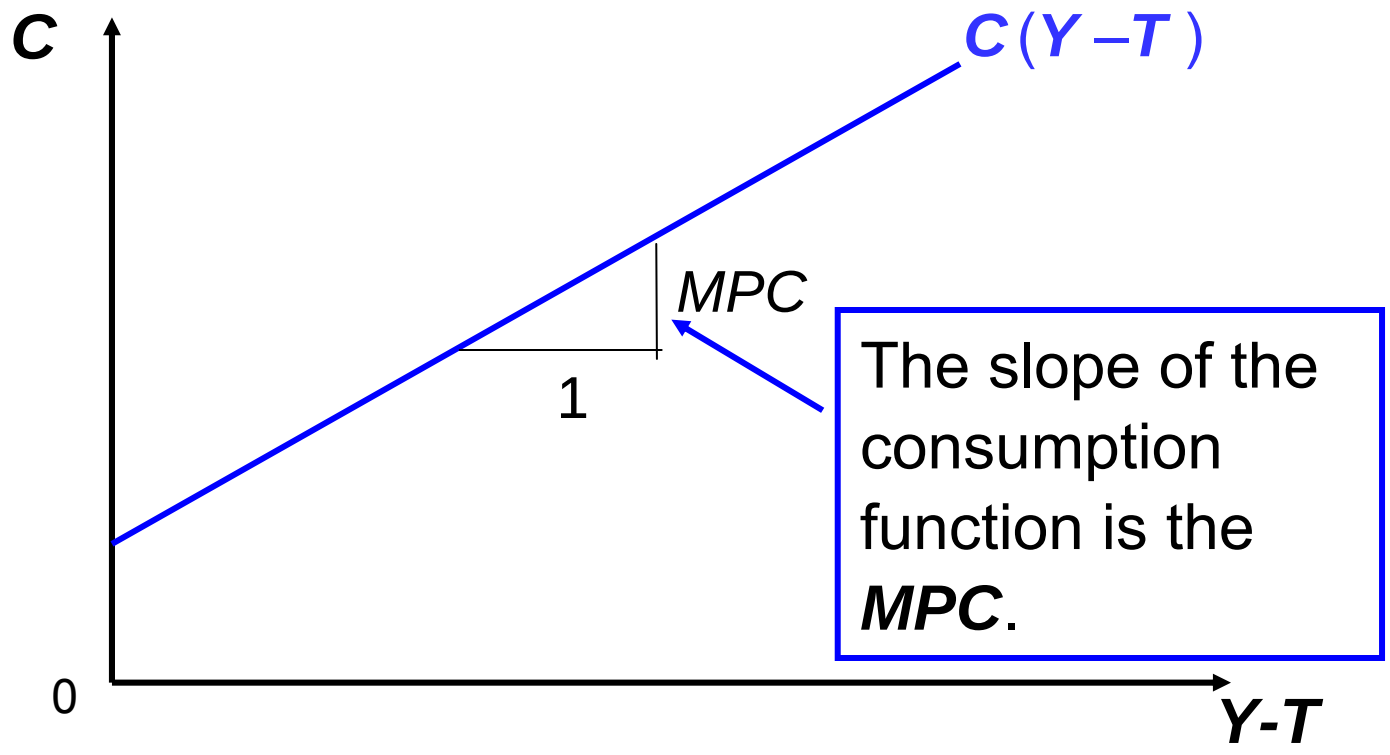
- The ***marginal propensity to consume*** **[*MPC*]** is the amount by which *C* changes for a one-$ increase in $(Y\text{-}T)$:

$$MPC = \frac{\Delta C}{\Delta (Y\text{-}T)}$$

- The *MPC* is between zero and one: $0 < MPC < 1$.

- The MPC equals the **slope** of the consumption function.

Fig. 3-6



3. The investment function.

- Investment spending - purchases of new plant and equipment or new housing - is financed either by borrowing, or by liquidating financial assets.

- In either case, there is a "**financing cost**" is determined by the current level of **interest rates**.

- The "true" cost of financing investment spending is given by the **real** interest rate [*r*] or the nominal interest rate corrected for the effects of inflation [as an approximation, the real interest rate = the nominal interest rate *minus* the rate of inflation].

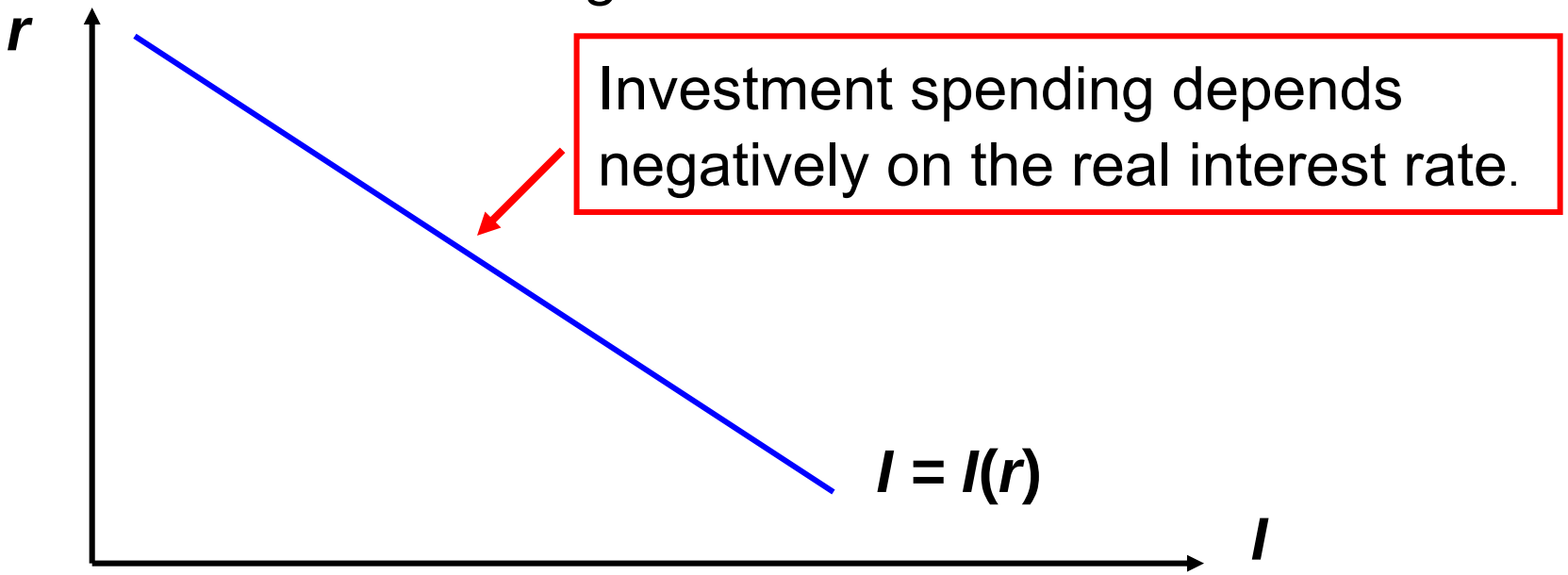
- Planned investment spending [***I***] **will vary inversely** with the level of real interest rates [***r***]:

$I = I(r)$ where: ⇧r ➔ ⇩I

↓ ⇩r ➔ ⇧I

"is a function of"

Fig. 3-7



4. Government spending and taxes.

- We assume that both govt. spending on output [G] and the level of taxes (net of transfers) [T] are **exogenous** variables whose values are determined by the **fiscal policy** decisions of govt.:

$$G = \overline{G}$$

$$T = \overline{T}$$

IV. The Complete Model of the Output Market.

- The aggregate **supply** of output:

$$Y = F(\bar{K}, \bar{L})$$
$$= \bar{Y}$$

Explanation: The amount of output supplied is the maximum which can be produced [given technology] with full employment of the [given] supplies of labour and capital.

- The aggregate **demand** for output:

$$E = C(\overline{Y} - \overline{T}) + I(r) + \overline{G}$$

- Explanation: Planned expenditure [E], or demand for output, is determined by:

  - the level of real GDP[Y]: ⇧Y ➔ ⇧E
  - the real interest rate [r]: ⇧r ➔ ⇩E
  - fiscal policy [G, T]: ⇧G ➔ ⇧E
    and ⇧T ➔ ⇩E

- **Equilibrium** in the market for output occurs when supply of output equals the demand for output:

$$\bar{Y} = E$$

$$\boxed{\bar{Y} = C(\bar{Y} - \bar{T}) + I(r) + \bar{G}}$$

- The variable which *adjusts to ensure equilibrium* in the market for output is the **interest rate** [*r*]:
  - If $\bar{Y} > E$, then $r \Downarrow \rightarrow I(r) \Uparrow \rightarrow \Uparrow E$ until $\bar{Y} = E$
  - If $\bar{Y} < E$, then $r \Uparrow \rightarrow I(r) \Downarrow \rightarrow \Downarrow E$ until $\bar{Y} = E$
- To understand this adjustment process we need to analyse how the interest rate is determined.

V. Financial Markets and the Interest Rate

- The interest rate is determined in financial markets at the level required to produce **financial sector equilibrium** by *equating the demand for new loans to finance investment spending to the supply of new lending available to finance such spending.*

- Assume:

  - All **investment** spending [*I*] is financed by new borrowing.

  - Any **govt. budget deficit** [*G* - *T*] is financed by new govt. borrowing which reduces the pool of funds available to firms to finance current investment spending.

- Any **govt. budget surplus**, or public savings [T - G] is used to retire existing govt. debt thus "freeing up" funds which can be used to finance new borrowing by firms.

- All **private, or household, savings,** which is the excess of disposable income over consumption spending [(Y - T) - C], is used to make new loans [to firms or govt.].

- The **demand** for new loans to finance investment is identical to the level of investment spending [I] and varies inversely with the real interest rate [r]:

Demand for new loans = $I(r)$

- The **supply** of new loans to firms to finance investment is equal to the amount of **private savings**, *plus (or minus)* the amount of **public savings (or dissavings):**

Supply of new loans **=** $(Y - T - C)$ + $(T - G)$

↓ ↓

"private saving" + "public [dis]savings"

= $(Y - C - G)$

= **S** or "**national savings**"

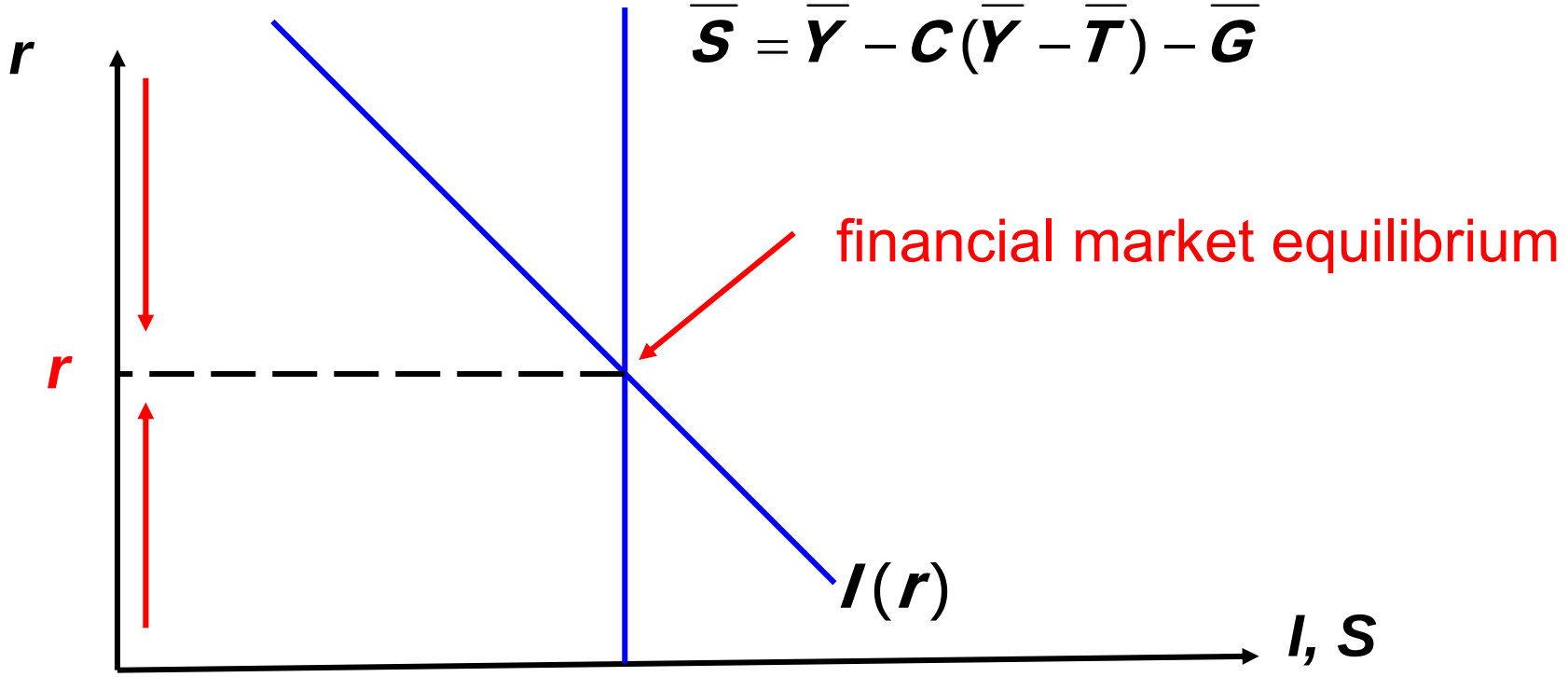
- The supply of new loans, or national savings [S], is independent of the interest [r] rate but depends on:
  - income [Y]
  - fiscal policy [G, T]

- $S = Y - C - G$
  $= \overline{Y} - C(\overline{Y} - \overline{T}) - \overline{G}$
  $= \overline{S}$

- The real interest rate [*r*] adjusts to ensure that the demand for loans just equals the supply of loans and financial markets are in equilibrium:

$r \Uparrow$ or $\Downarrow$ until $I(r) = \overline{S}$

Fig. 3-8



- **Financial** market equilibrium implies **output** market equilibrium:

$$I(r) = \bar{S} \rightarrow \textbf{Financial market equilibrium}$$

$$\therefore I(r) = \bar{Y} - C(\bar{Y} - \bar{T}) - \bar{G}$$

$$\therefore C(\bar{Y} - \bar{T}) + I(r) + \bar{G} = \bar{Y}$$

$$\therefore E = \bar{Y} \rightarrow \textbf{Output market equilibrium}$$

VI. The Long-run Effects on the Economy of an Increase in Govt. Spending [⇧*G*].

- Assume that national savings is initially S_1 and that the financial market is in initial equilibrium at interest rate r_1.

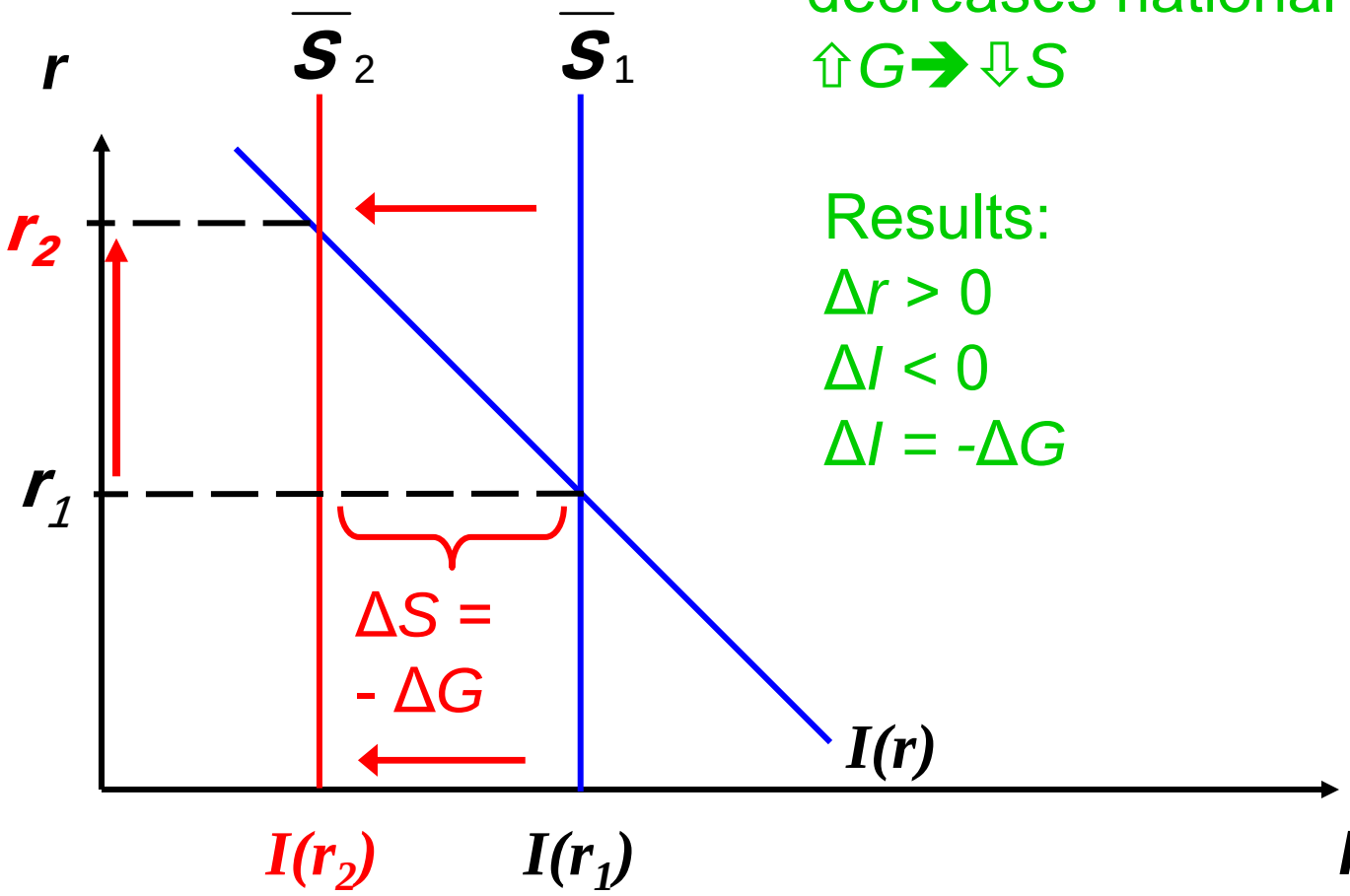
- Then govt. spending **increases** by $\Delta\overline{G}$ [with no change in the level of taxes, $\overline{T}$].

- The national saving curve **shifts to the left** as national saving decreases by the amount of the increase in *G*:

$$\overline{S} = \overline{Y} - C(\overline{Y} - \overline{T}) - \overline{G}$$

$$\Delta\overline{S} = -\Delta\overline{G}$$

Fig. 3-9



An increase in *G* decreases national saving:
⇧*G*➔⇩*S*

Results:
Δ*r* > 0
Δ*I* < 0
Δ*I* = -Δ*G*

- Explanation:

$\overline{S}$ ⇩ from S_1 to S_2 , where $\Delta\overline{S} = -\Delta\overline{G}$

➔ $S_2 < I(r_1)$

➔ Supply of loans < Demand for loans at r_1

➔ r⇧ from r_1 to r_2

➔ $I(r)$ ⇩

➔ Demand for loans ⇩

➔ Financial mkt. equilibrium restored: $S_2 = I(r_2)$

- The increase in G has **no effect on the amount of output produced by the economy** which is fixed by the given supplies of the factors of production:

$$Y = \overline{Y} = F(\overline{K}, \overline{L})$$

- The increase in *G* has **no effect on total expenditure on output [*E*],** because *r* adjusts to keep

$$E = \overline{Y} \text{ (fixed)}$$

- The **composition of *E* changes** with investment spending decreasing by exactly the amount by which *G* increased [the **"crowding out" effect**] while consumption spending [*C*] is unchanged:

$$\Delta I(r) = \Delta \overline{S} = -\Delta \overline{G}$$

$$\Delta C = 0$$

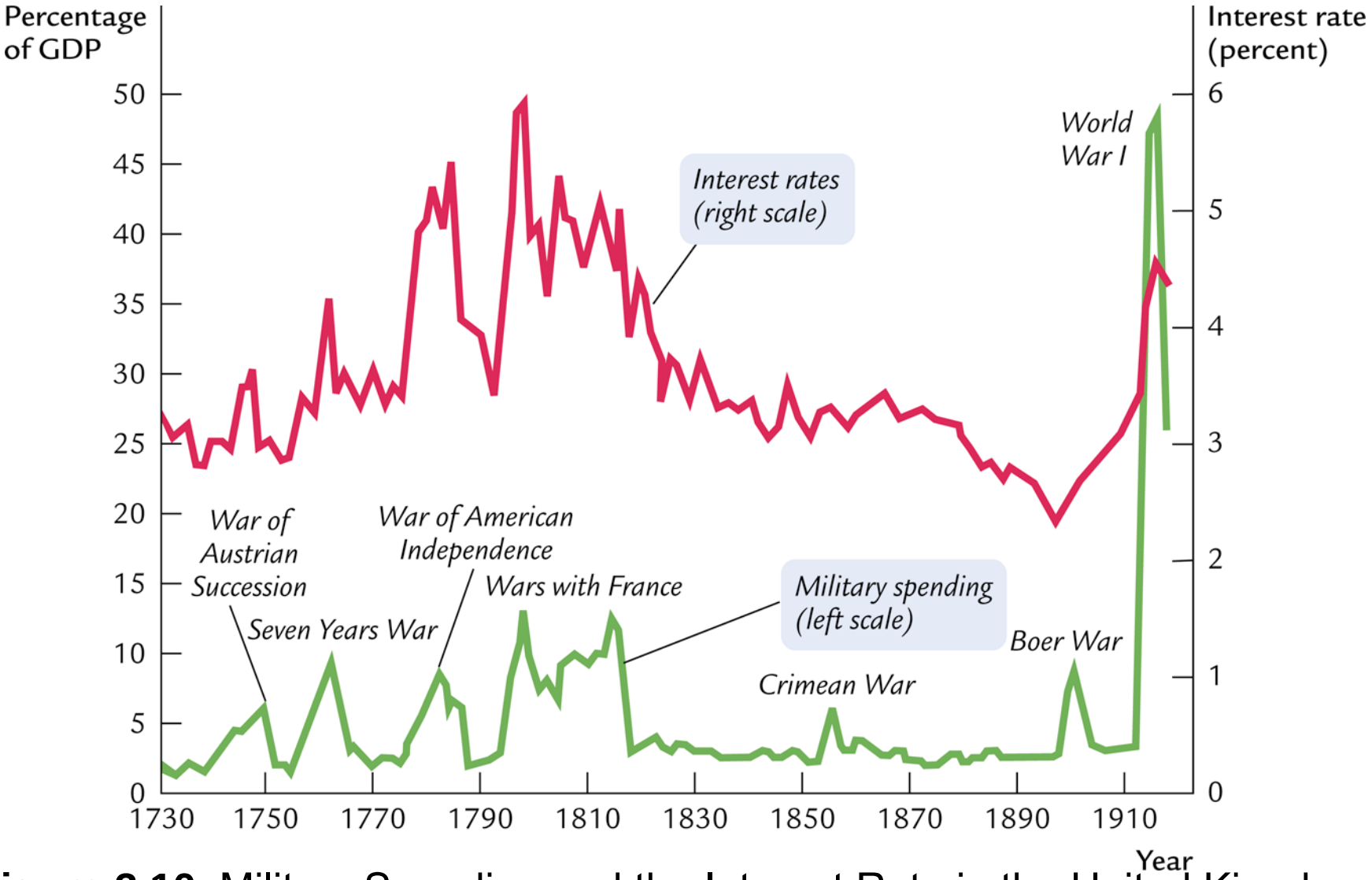


Figure 3.10 Military Spending and the Interest Rate in the United Kingdom

Mankiw and Scarth: Macroeconomics, Canadian Third Edition

VII. The Long-run Effects on the Economy of an Increase in Taxes [⇧T].

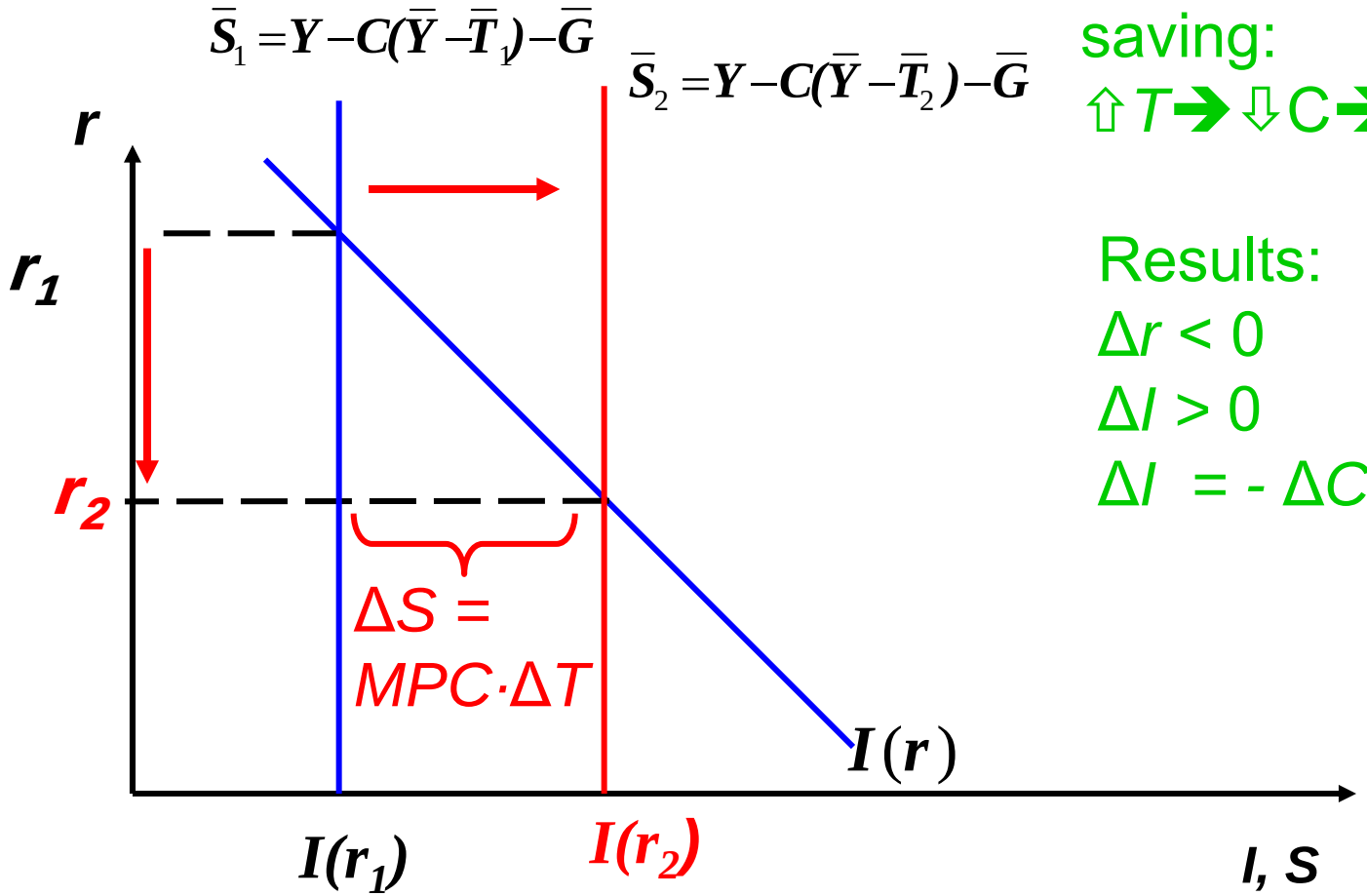
- Assume that national savings is initially S_1 and that the financial market is in initial equilibrium at interest rate r_1.

- Then taxes **increase** by $\Delta\overline{T}$ [with no change in the level of govt. spending, $\overline{G}$].

- The national saving curve **shifts to the right** as national saving increases by the amount of the fall in consumption spending caused by the tax increase:

$$\overline{S} = \overline{Y} - C(\overline{Y} - \overline{T}) - \overline{G}$$

$$\Delta\overline{S} = -\Delta C = MPC \cdot \Delta\overline{T}$$



An increase in *T* decreases consumption and increases national saving:
⇧*T* ➔ ⇩C ➔ ⇧S

Results:
$\Delta r < 0$
$\Delta I > 0$
$\Delta I = -\Delta C$

- Explanation:

$\overline{S}$ ⇧ from S_1 to S_2 [Where: $\Delta\overline{S} = MPCx\Delta\overline{T} < \Delta\overline{T}$]

➔ $S_2 > I(r_1)$

➔ Supply of loans > Demand for loans at r_1

➔ r⇩ from r_1 to r_2

➔ $I(r)$ ⇧

➔ Demand for loans ⇧

➔ Financial mkt. equilibrium restored: $S_2 = I(r_2)$

- The increase in *T* has **no effect on the amount of output produced by the economy** which is fixed by the given supplies of the factors of production:

$$Y = \overline{Y} = F(\overline{K}, \overline{L})$$

- The increase in *T* has **no effect on total expenditure on output [*E*],** because *r* adjusts to keep

$$E = \overline{Y} \text{ [fixed]}$$

- The **composition of *E* changes** with consumption spending [*C*] **decreasing** by the amount by which *T* increased **multiplied by the *MPC***, investment spending (*I*) **rising** by exactly the amount by which consumption spending fell, while govt. spending [G] is unchanged:

$$\Delta C = -MPC x \Delta \overline{T}$$

$$\Delta I(r) = \Delta \overline{S} = MPC x \Delta \overline{T}$$

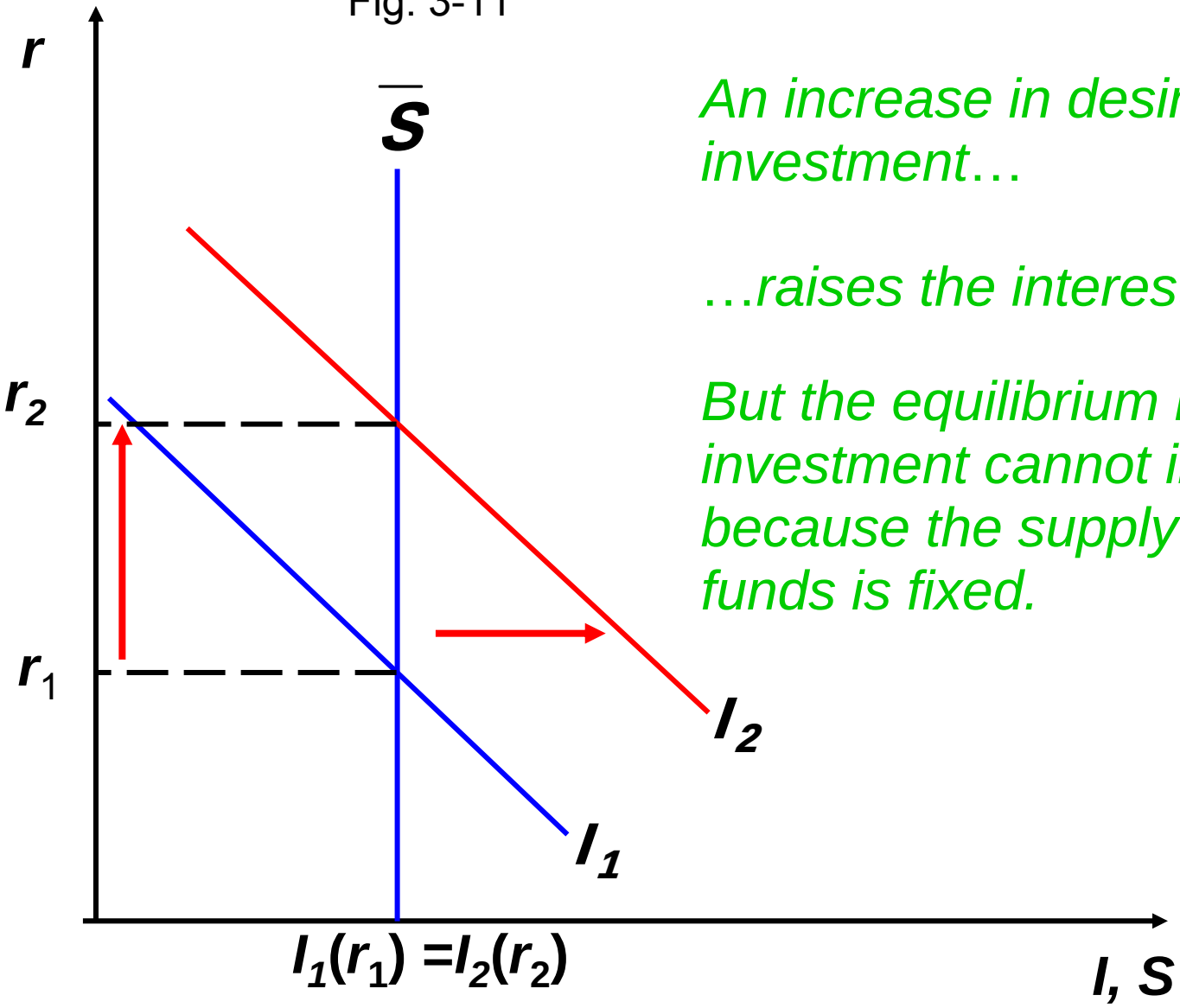
$$\Delta \overline{G} = 0$$

VIII. The Long-run Effects on the Economy of an Increase in Investment Demand.

- The investment demand function is initially $I_1(r)$ and the financial market is in initial equilibrium at interest rate r_1.

- Then there is an increase in the expected rate of return from investment spending which increases I at a given r, **shifting the investment schedule to the right to $I_2(r)$.**

Fig. 3-11



An increase in desired investment…

…raises the interest rate.

But the equilibrium level of investment cannot increase because the supply of loanable funds is fixed.

❑ Explanation:

I⇧ at r_1, shift of I-schedule to the right to $I_2(r)$

➔ $I_2(r_1) > \overline{S}$

➔ Demand for loans > Supply of loans at r_1

➔ r⇧ from r_1 to r_2

➔ $I_2(r)$ ⇩

➔ Demand for loans ⇩

➔ Financial mkt. equilibrium restored: $\overline{S} = I_2(r_2)$

- The increase in investment demand has **no effect** on the levels of aggregate output or aggregate expenditure; the interest rate (r) adjusts to keep total demand for output (E) equal to the fixed supply of output [$\overline{Y}$]

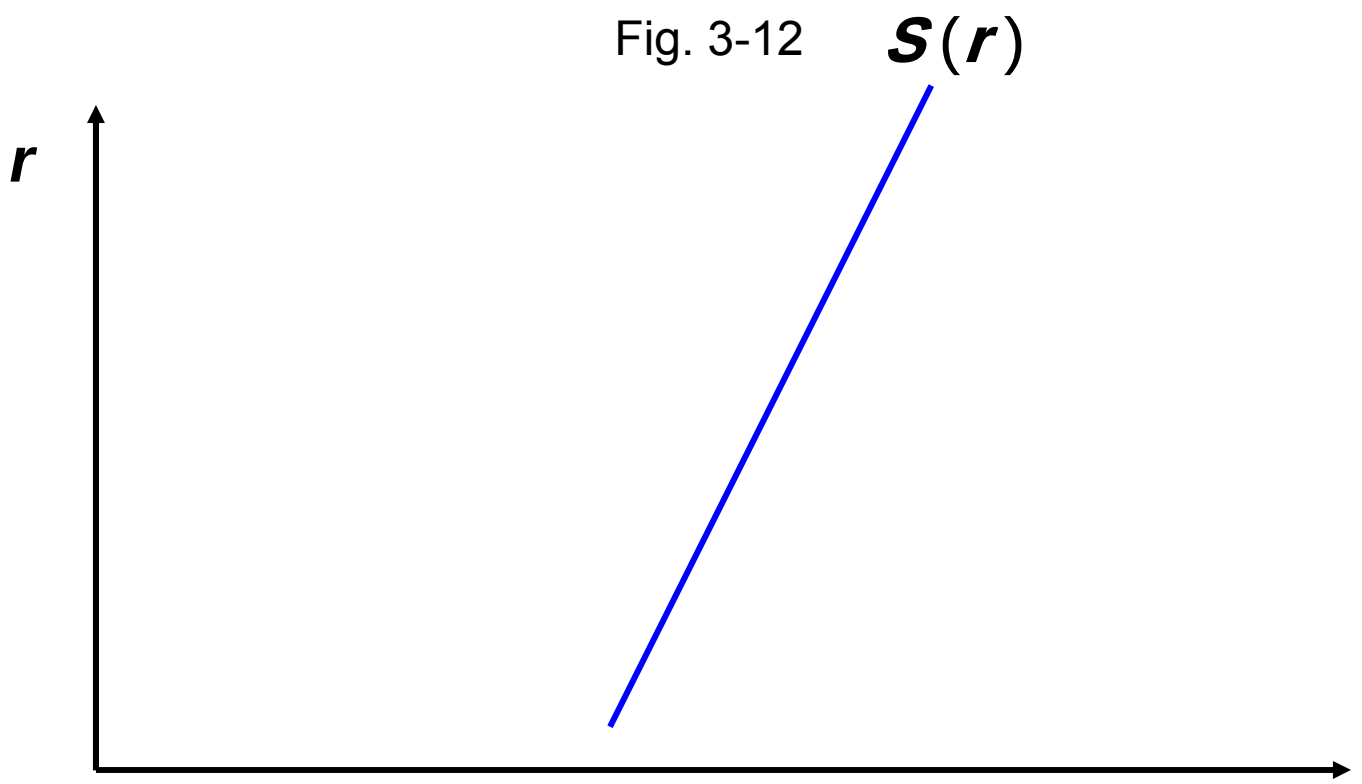
- There is **no change** in the any of the components of E (i.e. C, I or G) and hence no change in the composition of E.

- Note that while investment demand **at a given *r*** has increased, the *actual amount of investment spending has **not** changed* because the equilibrium value of r has risen.

IX. The Model with Savings Depending upon r

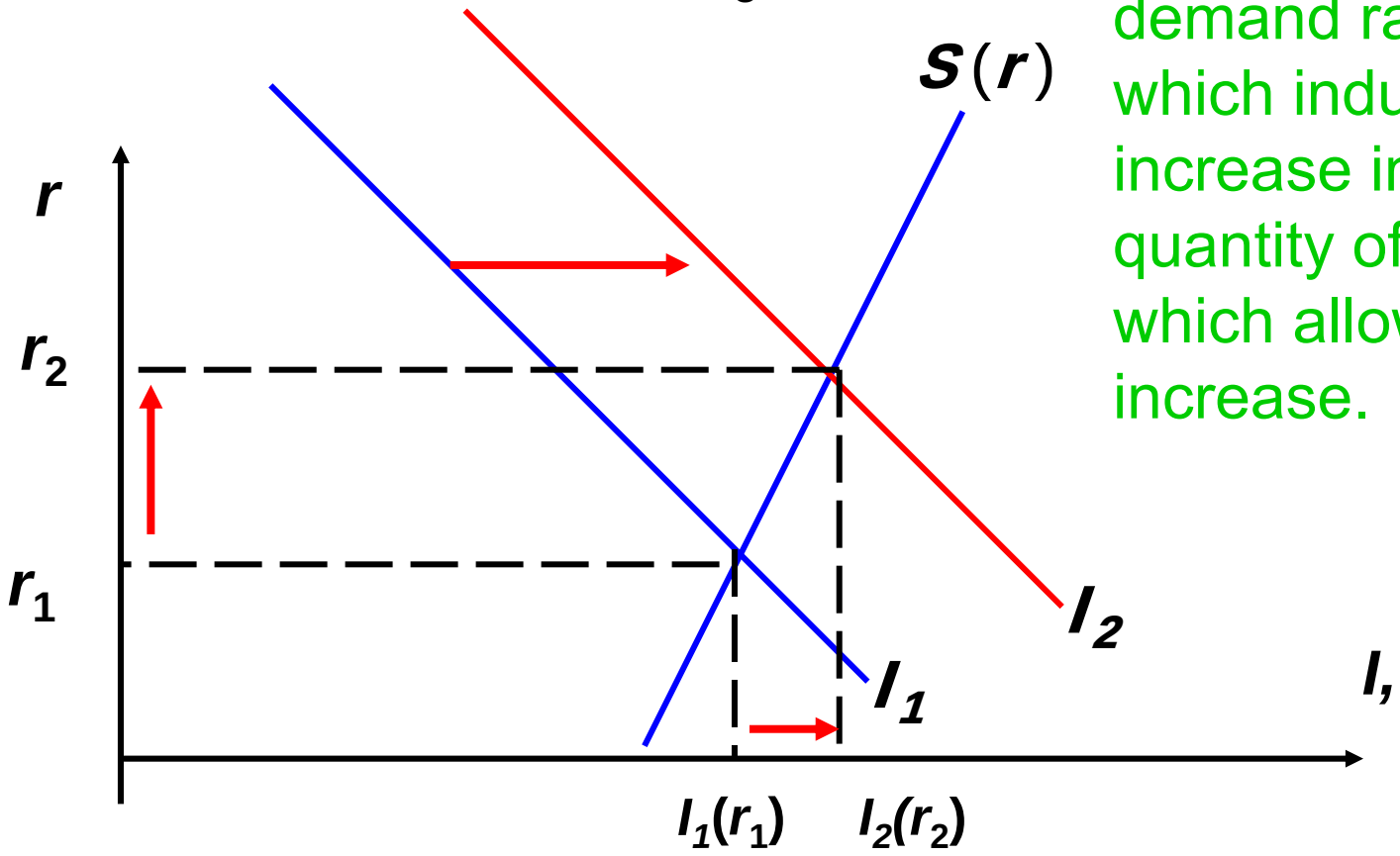
- Assume that an increase in the interest rate reduces consumption spending and increases saving with the result that the saving schedule is upward sloping.

Fig. 3-12



- Now an increase in investment demand increases both the equilibrium interest rate and **the equilibrium quantity of investment.**

Fig. 3-13



An increase in investment demand raises ***r***, which induces an increase in the quantity of saving, which allows ***I*** to increase.