

# CHAPTER 11

## AGGREGATE DEMAND II: APPLYING THE IS-LM MODEL

### Objectives:

- ❑ To apply IS-LM analysis to understand the causes of short-run fluctuations in real GDP and the short-run impact of monetary and fiscal policies on the economy;
- ❑ To use the IS-LM model to analyse and compare the short-run and long-run effects of demand shocks and monetary and fiscal policies on the economy.

# I. Explaining Short-run Fluctuations with the IS-LM Model.

## 1. Changes in fiscal policy.

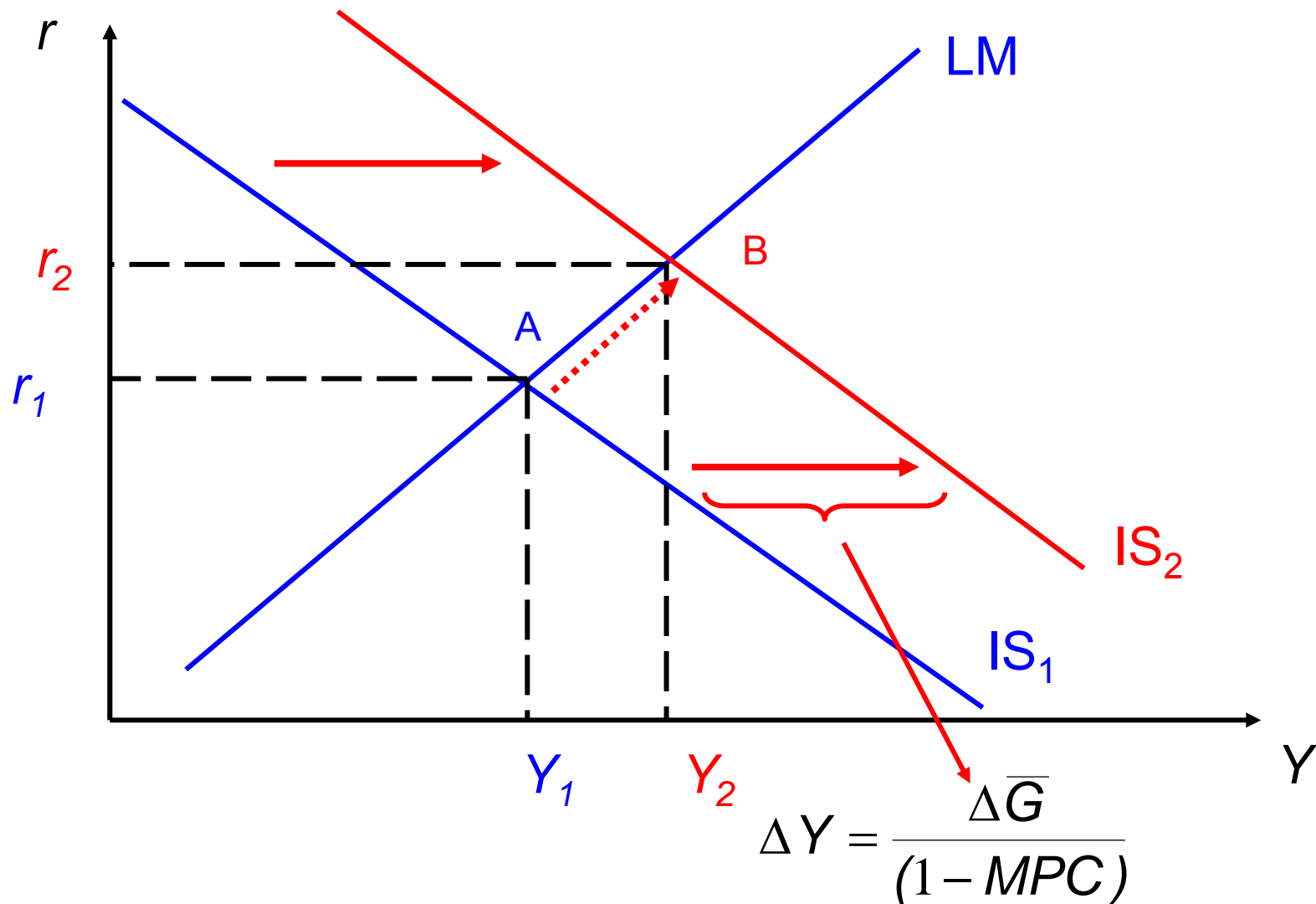
### (a) The short-run effects of an increase in govt. spending ( $\uparrow G$ )

- Assume economy initially in equilibrium at point A, where  $Y = Y_1$  and  $r = r_1$ .
- Then  $G$  increases (with no change in any other exogenous variable).
- IS shifts right** by a horizontal distance equal to

$$\Delta Y = \frac{\Delta \bar{G}}{(1 - MPC)}$$

- New short-run equilibrium is at point B where  $Y = Y_2 > Y_1$  and  $r = r_2 > r_1$ .

Fig. 11-1



□ Explanation:

$\uparrow G \rightarrow \uparrow E$

$\rightarrow E > Y_1$

$\rightarrow Y \uparrow$  until  $Y = E$

$\rightarrow (M/P)^d \uparrow$

$\rightarrow (M/P)^d > (M/P)^s$

$\rightarrow r \uparrow$

$\rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^s$

□ Note the “vanishing” govt. purchases multiplier. IS shifts right by  $\Delta G / (1 - \text{MPC})$  **but** the equilibrium level of income increases **by less** than this:

- **much** less - if IS is **flat** or LM is **steep**
- **not** much less - if IS is **steep** or LM is **flat**

- Why is the govt purchases multiplier smaller in the IS-LM model than in the Keynesian-cross model? The answer is the **“crowding out effect.”**
- In the IS-LM model an increase in  $G$  increases income which causes an increase in interest rates which, in turn, lowers investment spending. Hence, an increase in  $G$  reduces (or “crowds out”) some amount of  $I$ :

$$\uparrow G \rightarrow \uparrow Y \rightarrow \uparrow r \rightarrow \downarrow I$$

- The crowding-out effect will be **larger** the more interest rates rise as  $Y$  increases (i.e. the **steeper the LM** curve) and the more investment spending falls as  $r$  increases (i.e. the **flatter the IS** curve).

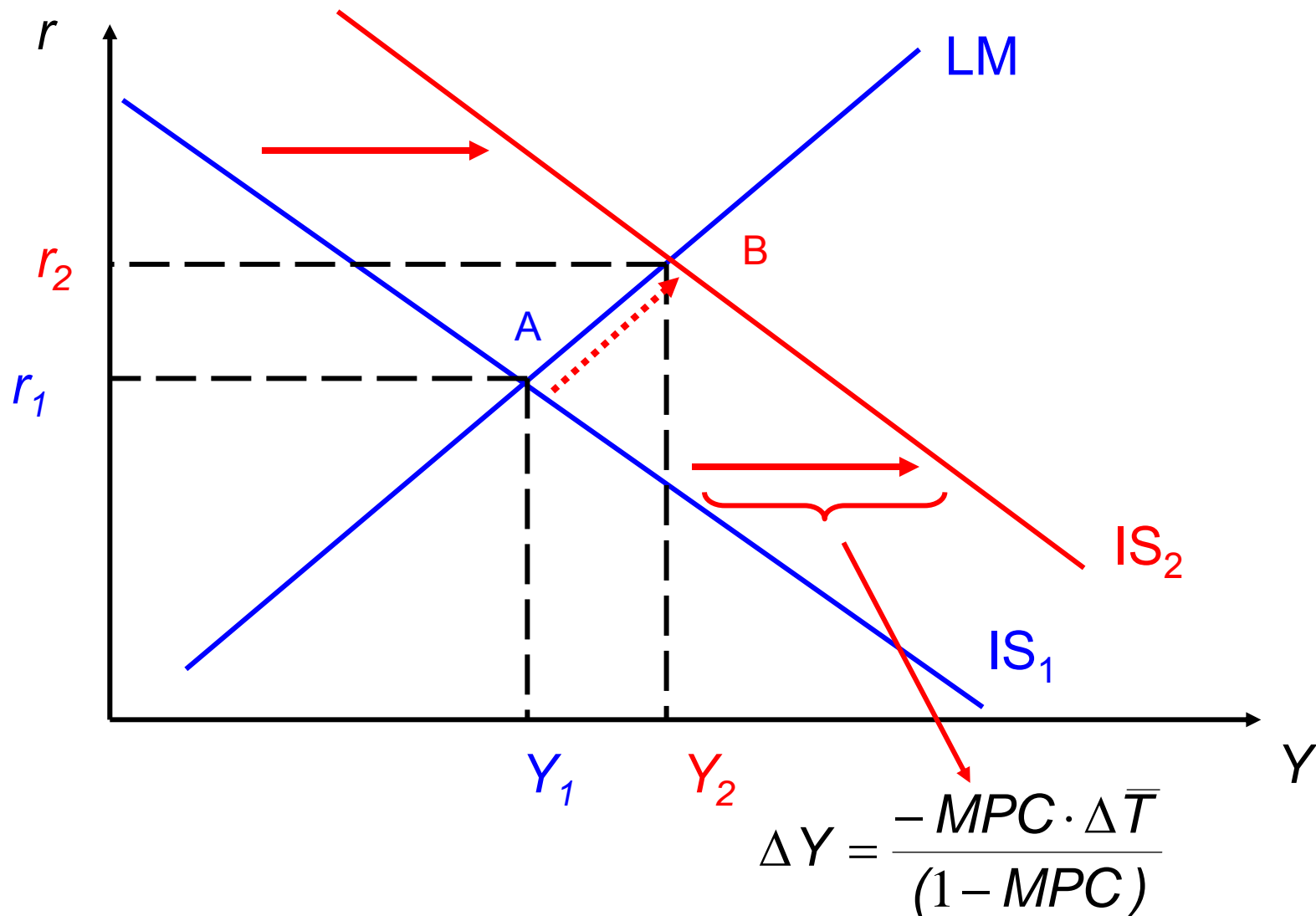
**(b) The short-run effects of a decrease in taxes ( $\downarrow T$ )**

- ❑ Assume economy initially in equilibrium at point A, where  $Y = Y_1$  and  $r = r_1$ .
- ❑ Then  $T$  decreases (with no change in any other exogenous variable).
- ❑ **IS shifts right** by a horizontal distance equal to

$$\Delta Y = \frac{-MPC \cdot \Delta \bar{T}}{(1 - MPC)}$$

- New short-run equilibrium is at point B where  $Y = Y_2 > Y_1$  and  $r = r_2 > r_1$ .

Fig. 11-2





### Explanation:

$$\downarrow T \rightarrow \uparrow (Y-T)$$

$$\rightarrow \uparrow C$$

$$\rightarrow \uparrow E$$

$$\rightarrow E > Y_1$$

$$\rightarrow Y \uparrow \text{ until } Y = E$$

$$\rightarrow (M/P)^d \uparrow$$

$$\rightarrow (M/P)^d > (M/P)^s$$

$$\rightarrow r \uparrow \rightarrow (M/P)^d \downarrow \text{ until } (M/P)^d = (M/P)^s$$



Again the impact on equilibrium  $Y$  of a cut in taxes is reduced by the crowding-out effect; the tax multiplier is **lower in the IS-LM model** than in the Keynesian-cross model.

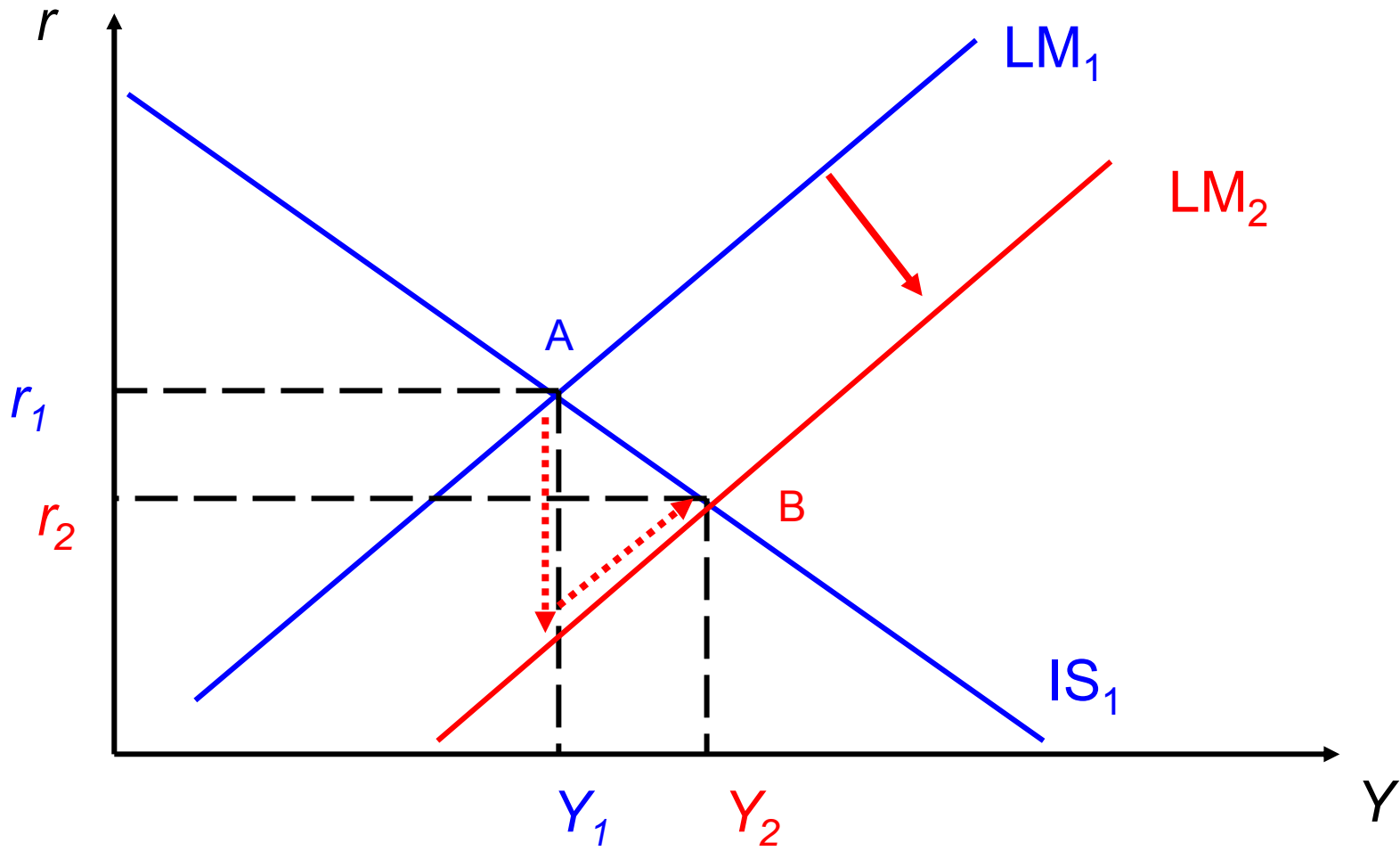


**Conclusion: expansionary fiscal policy raises output and interest rates.**

## 2. Changes in monetary policy: short-run effects of an increase in money supply ( $\uparrow M$ )

- ❑ Assume economy initially in equilibrium at point A, where  $Y = Y_1$  and  $r = r_1$ .
- ❑ Then  $M$  increases (with no change in any other exogenous variable).
- ❑  $(M/P) \uparrow$  (as the price level is fixed) and **LM shifts down and to the right.**
- ❑ New short-run equilibrium is at point B where  $Y = Y_2 > Y_1$  and  $r = r_2 < r_1$ .

Fig. 11-3



□ Explanation:

$\uparrow M^s \rightarrow \uparrow (M/P)^s$   
 $\rightarrow (M/P)^s > (M/P)^d$   
 $\rightarrow r \downarrow \rightarrow (M/P)^d \uparrow$  until  $(M/P)^d = (M/P)^s$   
 $\rightarrow I \uparrow$   
 $\rightarrow E \uparrow$   
 $\rightarrow E > Y_1$   
 $\rightarrow Y \uparrow$  until  $Y = E$   
 $\rightarrow (M/P)^d \uparrow$   
 $\rightarrow (M/P)^d > (M/P)^s$   
 $\rightarrow r \uparrow \rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^s$

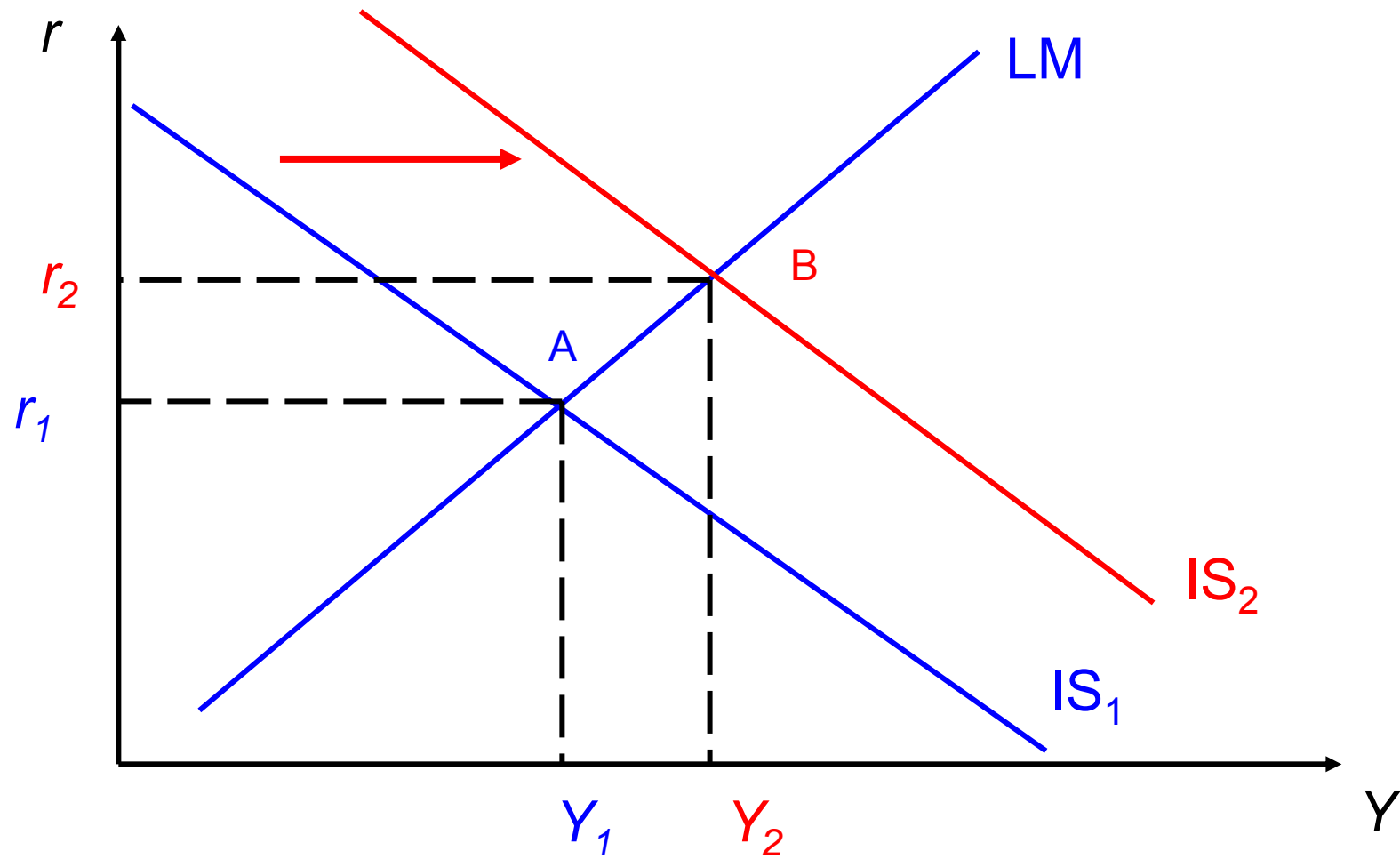
□ **Conclusion: expansionary monetary policy lowers interest rates and increases income.**

### 3. Monetary and Fiscal Policy Interactions.

- The effects of expansionary fiscal policy ( $\uparrow G$  or  $\downarrow T$ ) on  $Y, r$  depend on what Bank of Canada does:
  - (a) If it does nothing  $\rightarrow Y\uparrow, r\uparrow$
  - (b) may keep  $r$  constant by  $M\uparrow$
  - (c) may keep  $Y$  constant by  $M\downarrow$

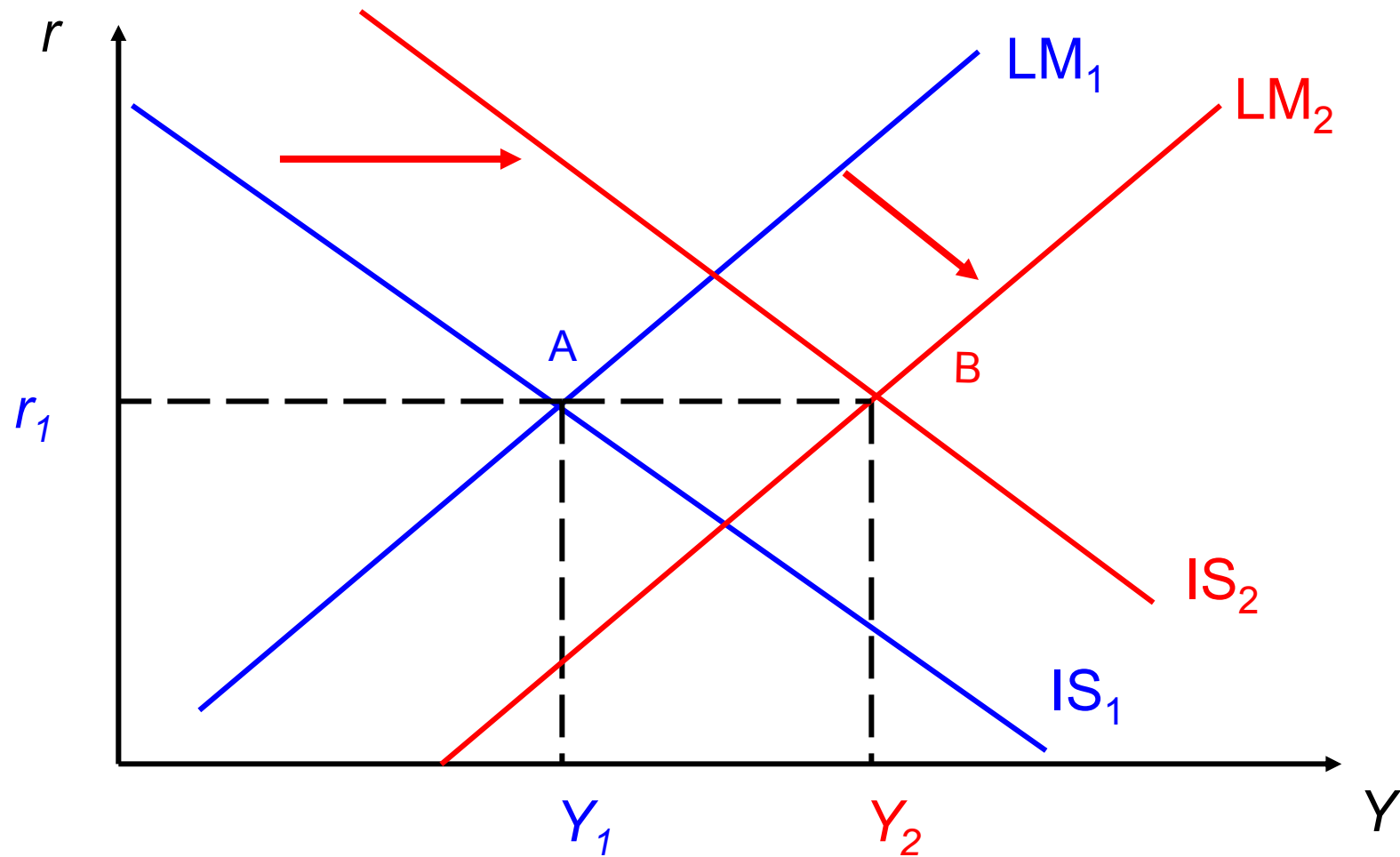
- Case (a): Bank of Canada holds **money supply** constant

Fig. 11-4 (a)



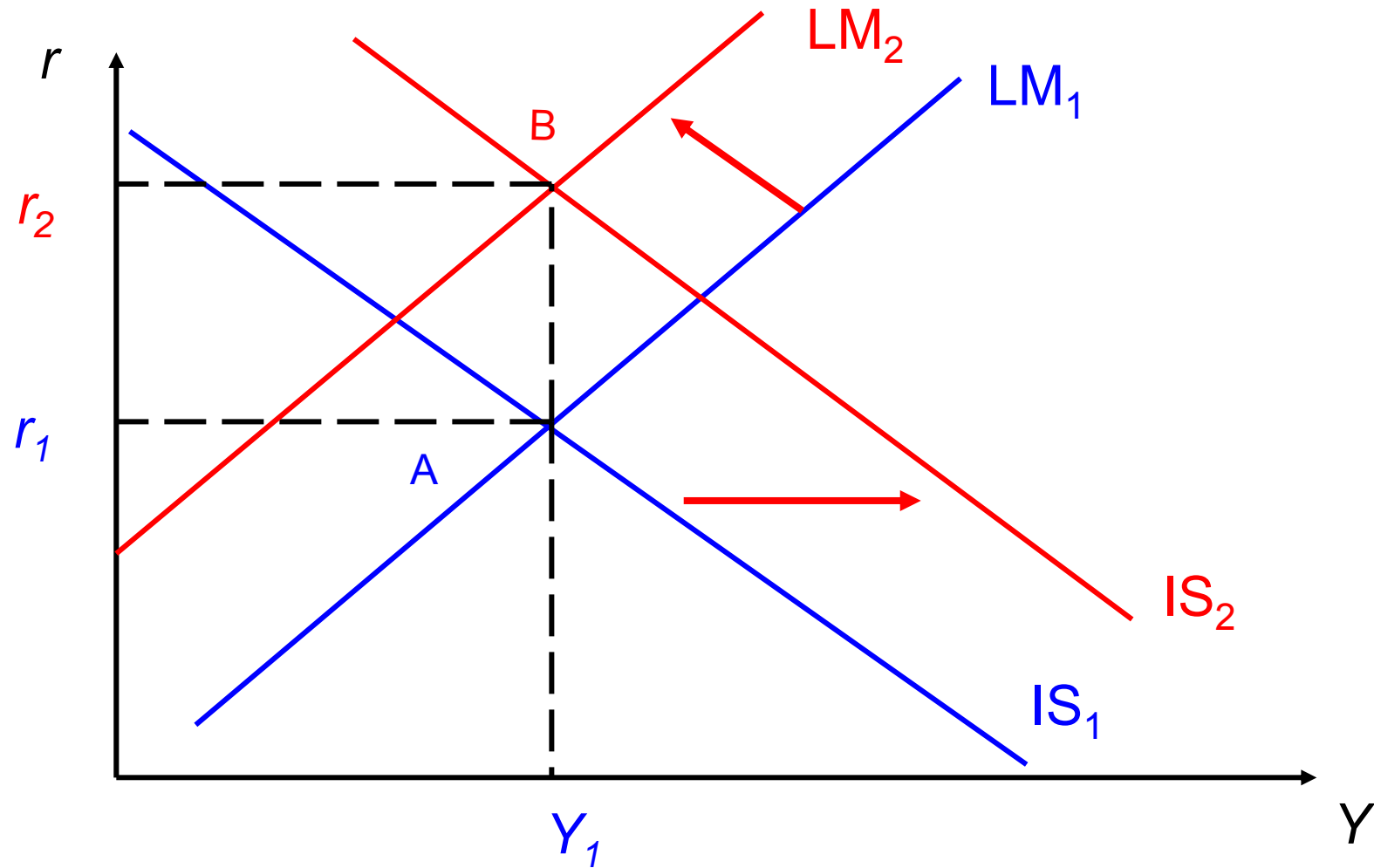
- Case (b): Bank of Canada holds **interest rate** constant

Fig. 11-4 (b)



- Case (c): Bank of Canada holds **income** constant

Fig. 11-4 (c)



## 4. Shocks in the IS-LM Model.

- **Shocks to the IS curve** - exogenous shocks to demand for goods and services
  - wave of pessimism -  $I \downarrow$  as business confidence falls → **IS shifts left**
  - stock market crash -  $C \downarrow$  as consumer wealth and confidence falls → **IS shifts left**
  
- **Shocks to the LM curve** - exogenous changes in the demand for money
  - worries about security of holding wealth in less liquid forms leads to exogenous increase in money demand → **LM shifts up/left**

- **Monetary and fiscal policies can be used to offset the impact of demand shocks:**
  - In the face of the 1987 stock market crash which reduced consumer spending the US Federal Reserve Board adopted expansionary monetary policy: **leftward shift of IS curve offset by rightward shift of LM curve.**

- In 2001 a sharp decline in investment demand (as the “irrational exuberance” and overoptimism of the late 1990s gave way to realism) sent the US economy into recession. In response, the Federal Reserve expanded the money supply and aggressively lowered interest rates. In addition, President Bush, who took office in early 2001, cut taxes and increased spending (particularly after 9/11). The US govt. budget went from surplus in 2000 to deficit in 2001 and 2002. The result was that the initial leftward shift of the IS curve ( $\downarrow I$ ) was offset by a rightward shift of the LM curve ( $\uparrow M$ ) and rightward shift of the IS curve ( $\downarrow T$  and  $\uparrow G$ .)

- In 2008-09, collapse of US housing “bubble” and associated financial crisis, accompanied by a stock market crash, decreased consumer wealth and consumer and business confidence which brought on the most severe (world-wide) recession since the Great Depression. In response, the Federal Reserve (and other central banks around the world) adopted expansionary monetary policy while governments embarked upon expansionary fiscal programs which increased public spending and cut taxes.

□ **Sometimes policy changes reinforce the effects of demand shocks:**

- The Canadian recession of the early 1990s was partly caused by a decline in the velocity of circulation of money whose effects were reinforced by the anti-inflationary monetary policy pursued by the Bank of Canada. **The leftward shift of the LM curve as velocity declined was reinforced by a further leftward shift as money supply fell.**

## II. The IS-LM Model in the Short Run and in the Long Run.

### 1. Prices and output in the short-run and the long run

- In the short-run **prices are stuck** at some pre-determined level [  $\bar{P}$  ] and firms adjust output to match demand at constant prices.
  
- In the long-run, **prices are flexible** and rise or fall depending on whether actual output (  $Y$  ) exceeds, or is less than, full-employment, or natural, output, (  $\bar{Y}$  ).

□ Specifically:

➤  $Y > \bar{Y} \rightarrow P \uparrow$

(when output is **above** its natural level prices **rise**)

➤  $Y < \bar{Y} \rightarrow P \downarrow$

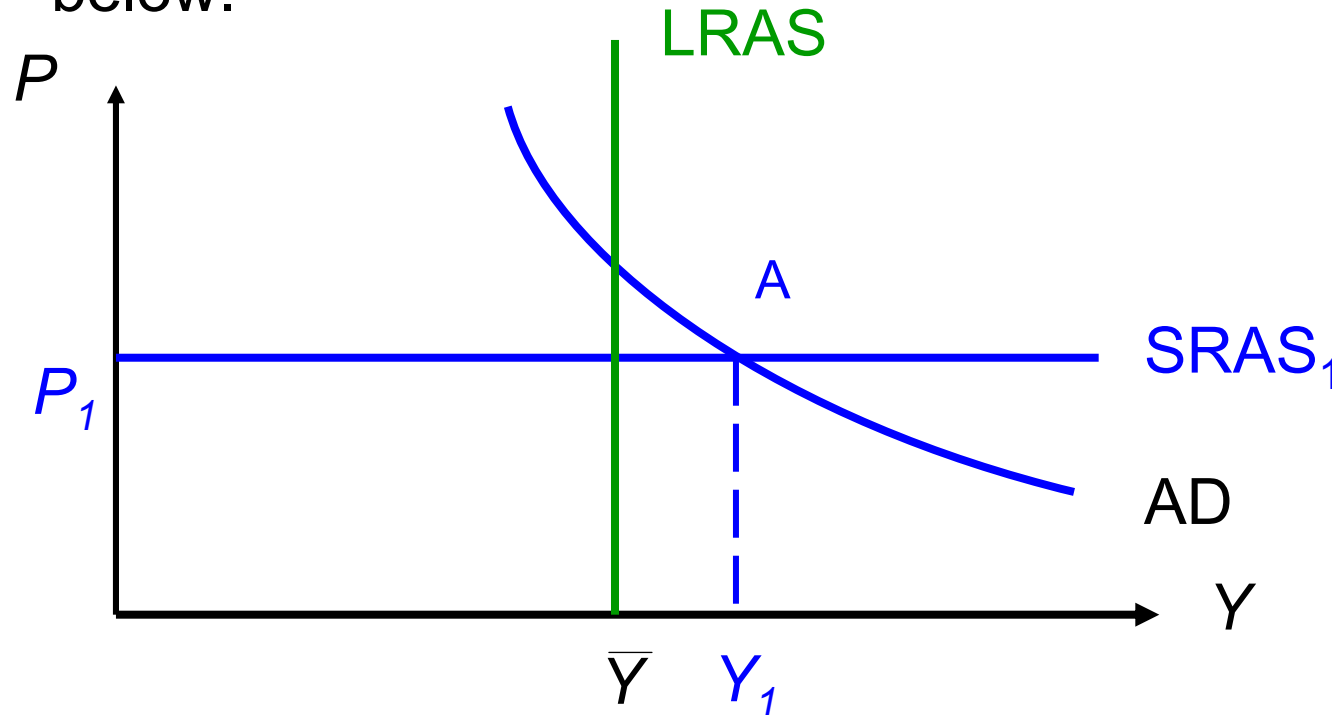
(when output is **below** its natural level prices **fall**)

➤  $Y = \bar{Y} \rightarrow P \Rightarrow$

(when output **equals** its natural level prices are **stable**)

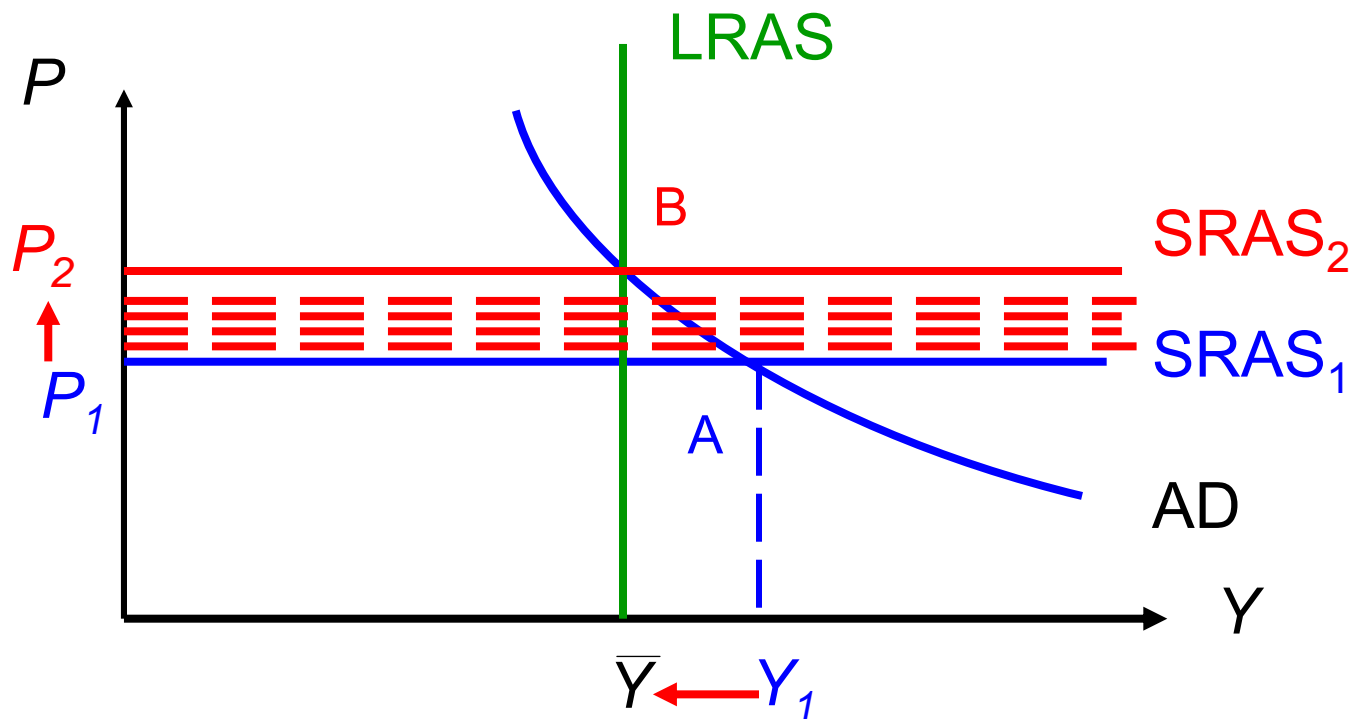
- These differences between the short-run and long-run behaviour of prices lead to a distinction between the conditions required for **short-run** equilibrium and those required for **long-run** equilibrium:
  - **Short-run equilibrium**: output is stable when it equals aggregate demand:  $Y = E$
  - **Long-run equilibrium**: both output **and** the price level are stable when output equals demand at its natural level:  $Y = E = \bar{Y}$

- This distinction can be illustrated in the diagram below.



- The economy is in **short-run equilibrium** at point **A**, where the aggregate demand (AD) curve intersects the horizontal short-run aggregate supply (SRAS<sub>1</sub>) curve:

$$Y = Y_1 > \bar{Y} ; P = P_1.$$



- Because  $Y = Y_1 > \bar{Y}$  in the **long run** prices will rise shifting the SRAS curve upwards and resulting in falling demand and output along the AD curve.

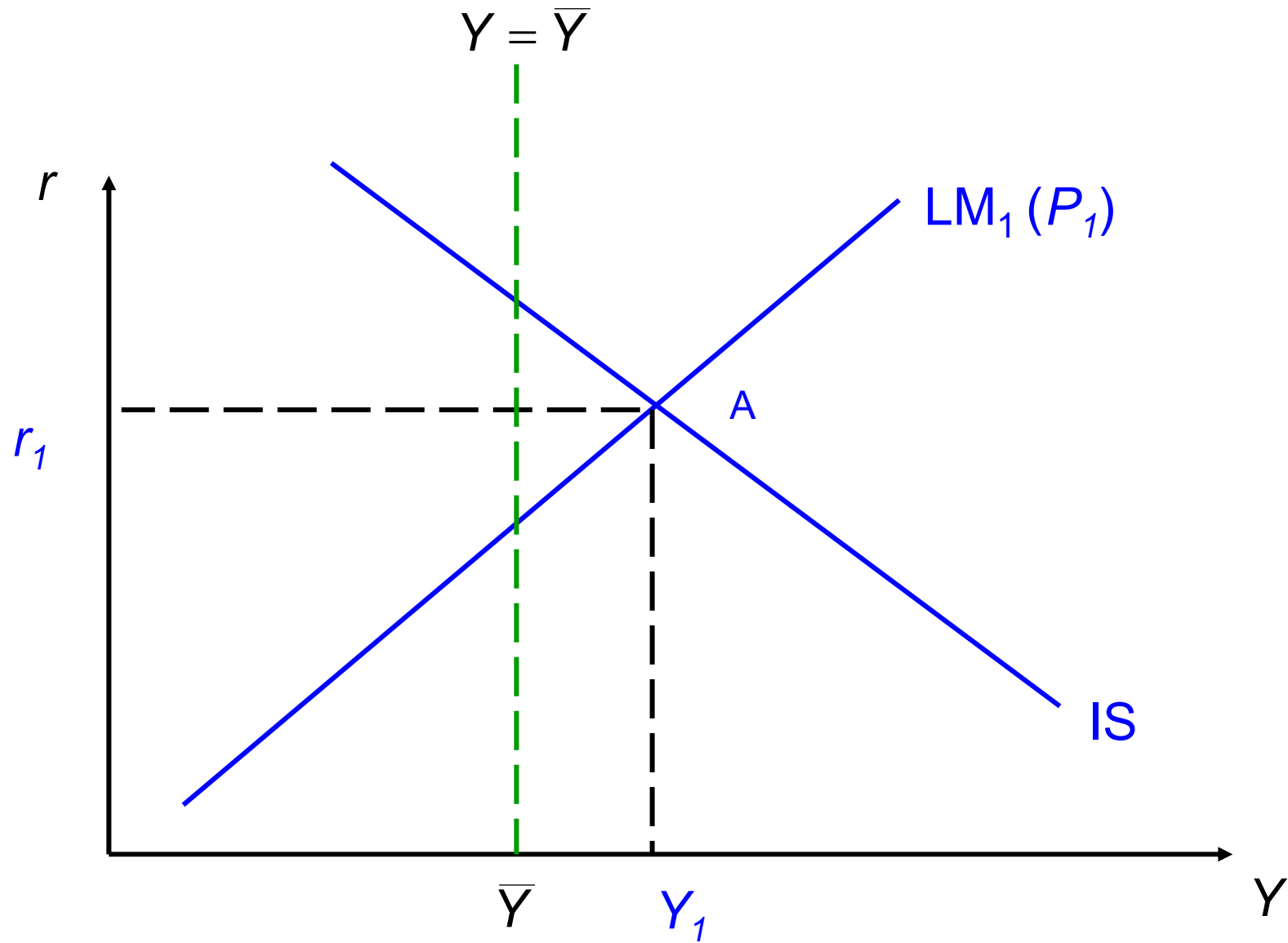
- **Long equilibrium** is reached at point **B** where AD intersects the long-run aggregate supply (LRAS) curve (drawn as a vertical line at  $Y = \bar{Y}$ ) and the eventual short-run aggregate supply curve (SRAS<sub>2</sub>):

$$Y = Y_2 = \bar{Y} \quad ; \quad P = P_2 > P_1$$

## 2. The adjustment from a short-run IS-LM equilibrium to a long-run IS-LM equilibrium.

- Assume that the economy is initially in a short-run equilibrium at point A, where the IS and LM curves intersect to the **right** of the vertical line representing the natural level of output, which we will call “***the full-employment line.***”
- The short-run equilibrium values of output, interest rate, and price level are

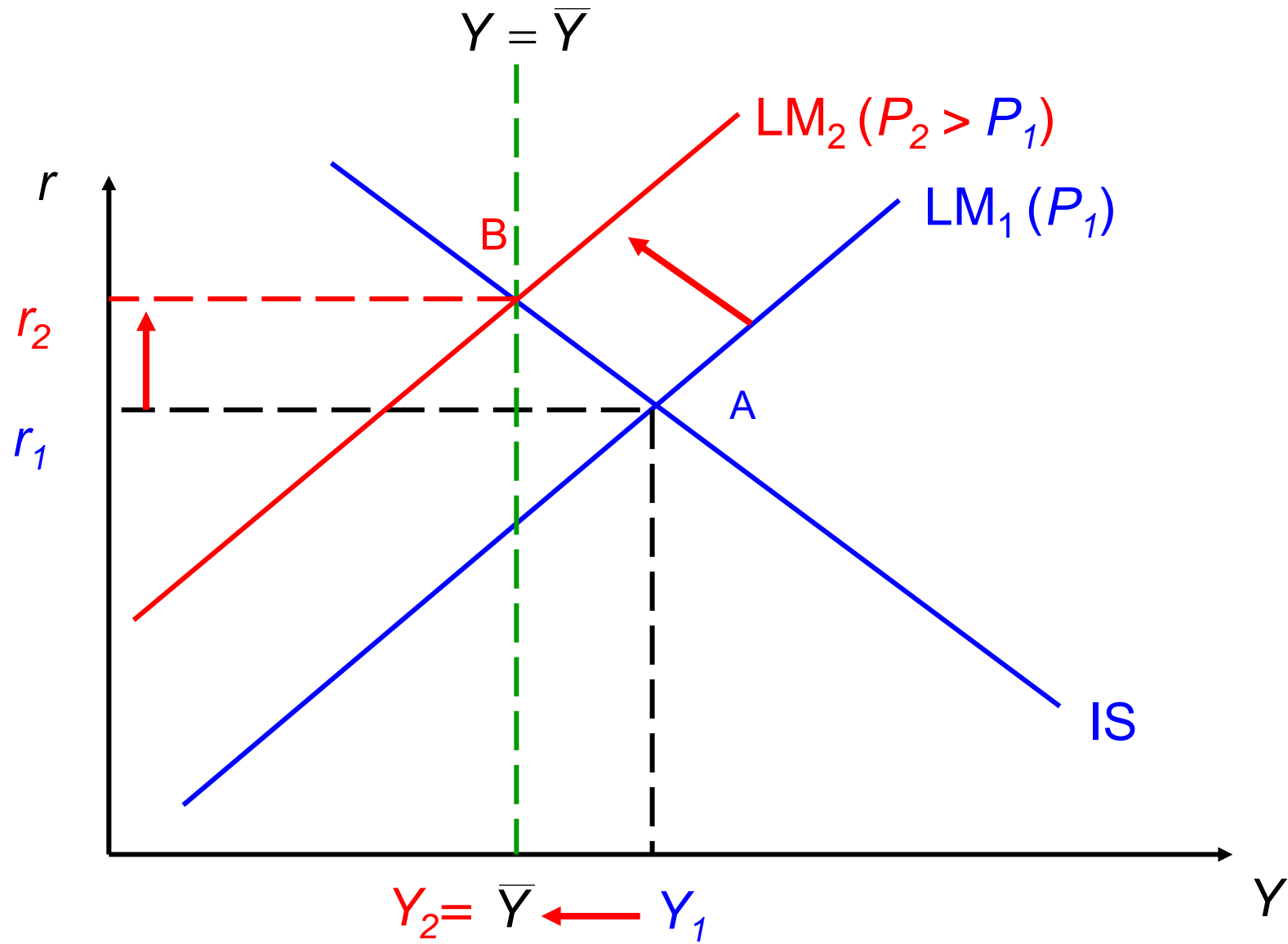
$$Y = Y_1 > \bar{Y} ; r = r_1 ; P = P_1.$$



- Because  $Y = Y_1 > \bar{Y}$  in the **long-run** when prices are flexible,  $P$  will rise, reducing the real supply of money ( $\downarrow [M/P]$ ) and causing the **LM curve to shift left**.
- The **long-run IS-LM equilibrium** occurs at point B where IS-LM intersect on the vertical full-employment line, where

$$Y = Y_2 = \bar{Y} ; r = r_2 > r_1; \text{ and } P = P_2 > P_1$$

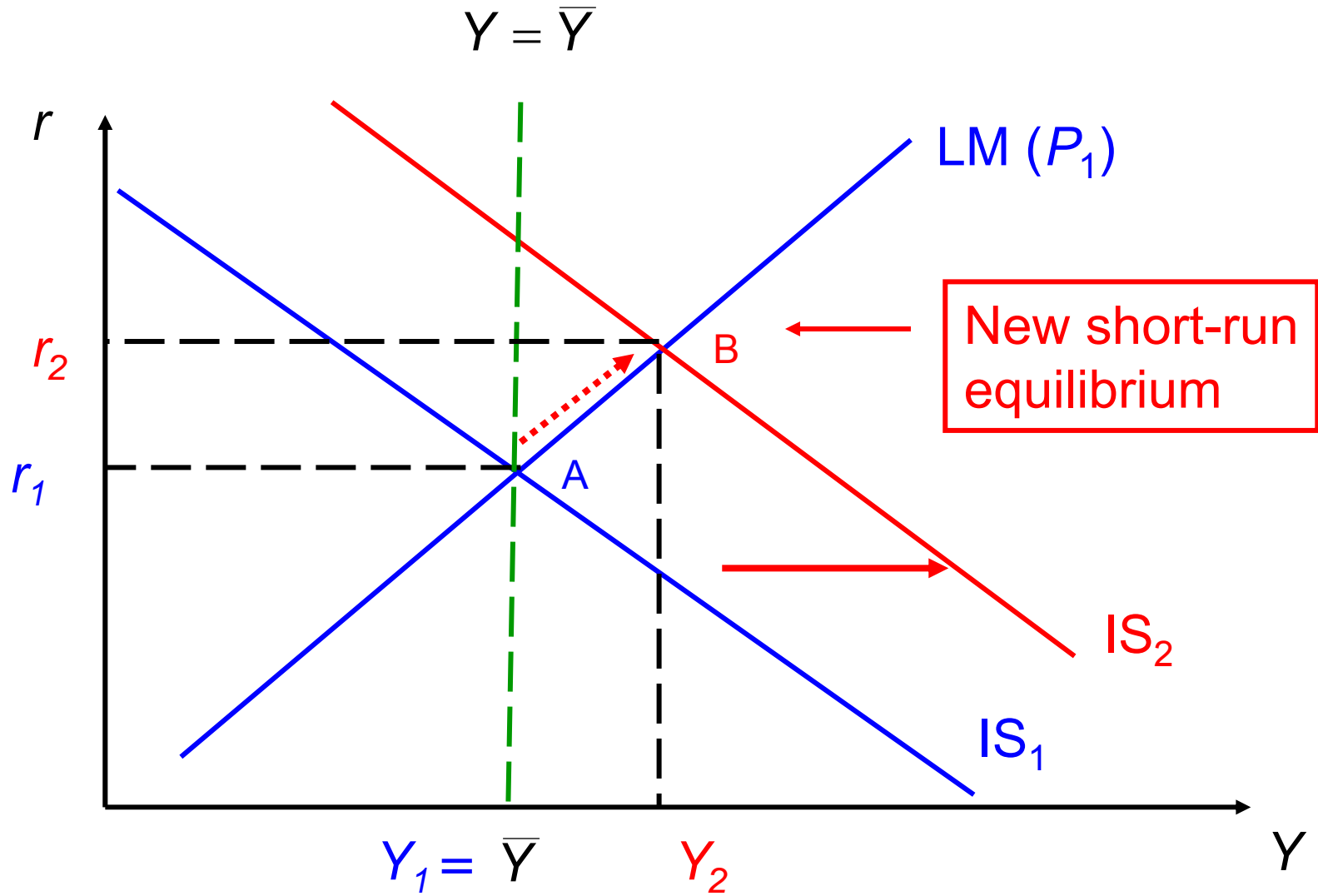
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### 3. The short-run and long-run effects of fiscal policy in the IS-LM model.

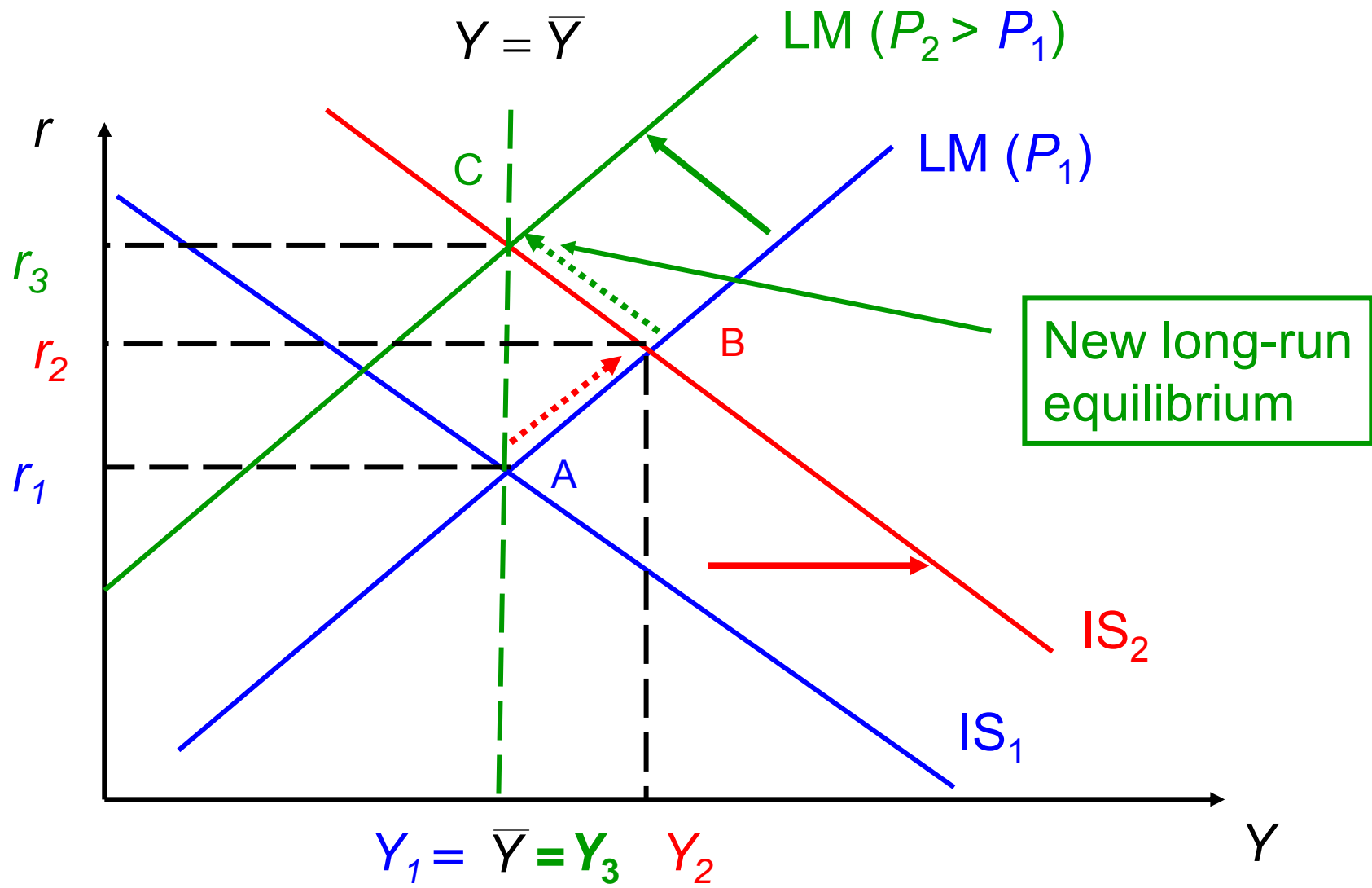
- Assume economy initially in long-run IS-LM equilibrium at point A, where  $Y_1 = \bar{Y}$ ,  $r = r_1$ , and  $P = P_1$ .
- Then  $G$  increases (with no change in any other exogenous variable).
- IS shifts right and a new **short-run equilibrium** is reached at point **B** where:

$$Y = Y_2 > \bar{Y}, \quad r = r_2 > r_1, \quad \text{and} \quad P = P_1.$$



- In the **long-run**, prices rise reducing the real money supply and shifting the LM curve to the left.
- The new **long-run equilibrium** is at point **C** where

$$Y = Y_1 = \bar{Y}, \quad r = r_3 > r_2 > r_1 \text{ and } P = P_2 > P_1$$



□ Explanation:

In the **short run**:

$\uparrow G \rightarrow \uparrow E$

$\rightarrow E > Y_1$

$\rightarrow Y \uparrow$  until  $Y = E$

$\rightarrow (M/P)^d \uparrow$

$\rightarrow (M/P)^d > (M/P)^s$

$\rightarrow r \uparrow$

$\rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^s$

In the **long run**:

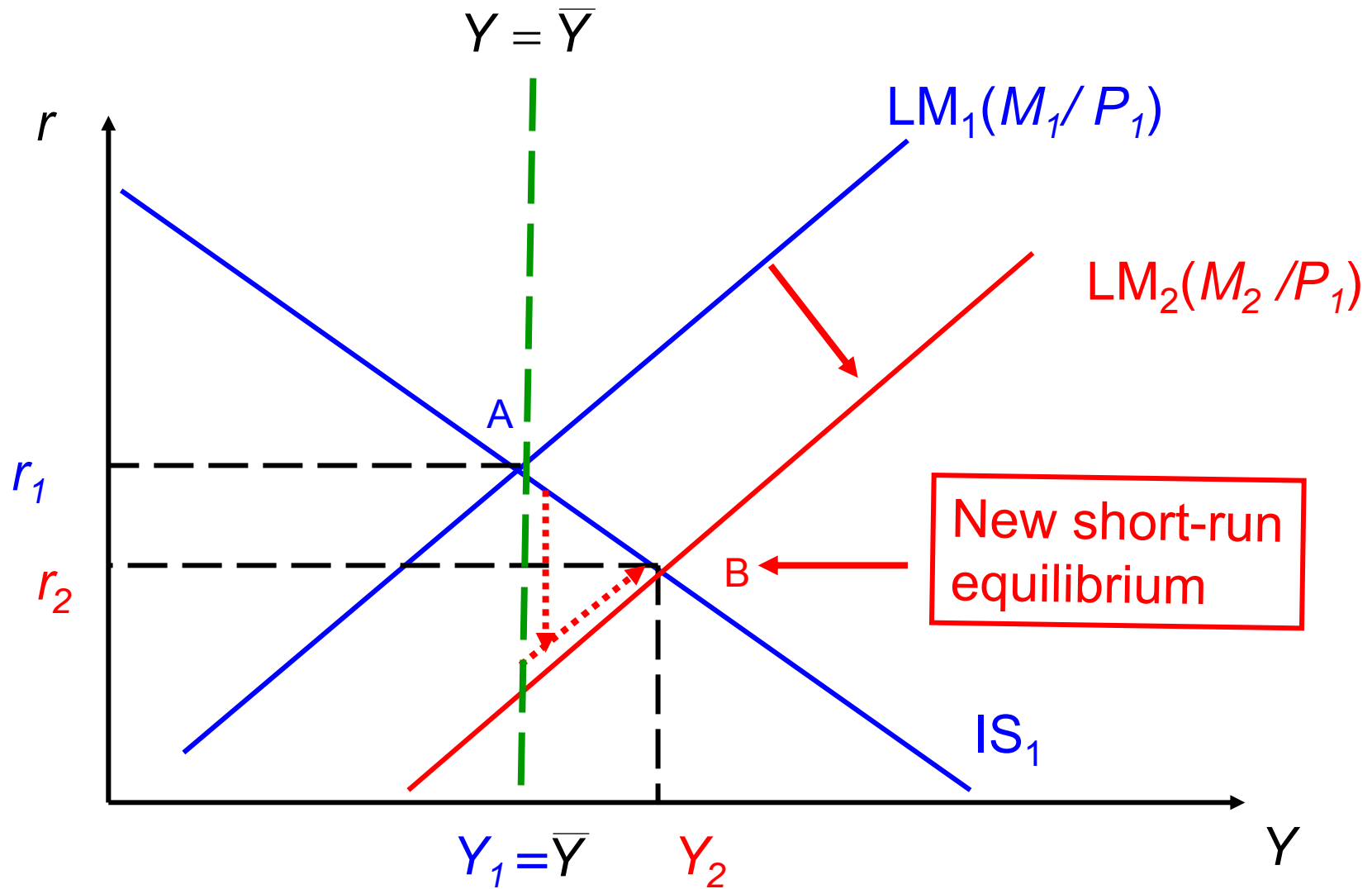
- $Y > \bar{Y} \rightarrow P \uparrow$
- $\rightarrow (M/P)^S \downarrow$
- $\rightarrow (M/P)^S < (M/P)^d$
- $\rightarrow r \uparrow \rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^S$
- $\rightarrow I \downarrow$
- $\rightarrow E \downarrow$
- $\rightarrow E < Y_2$
- $\rightarrow Y \downarrow$  until  $Y = E = \bar{Y}$

- **Conclusion:** While expansionary fiscal policy raises the equilibrium level of output in the **short run** in the **long run it has no permanent impact on output** but results only in an increase in interest rates and prices.
  
- *In the long-run the crowding-out effect of expansionary fiscal policy completely offsets the direct expansionary impact of the increase in  $G$  or cut in  $T$ .*

#### 4. The short-run and long-run effects of monetary policy in the IS-LM model.

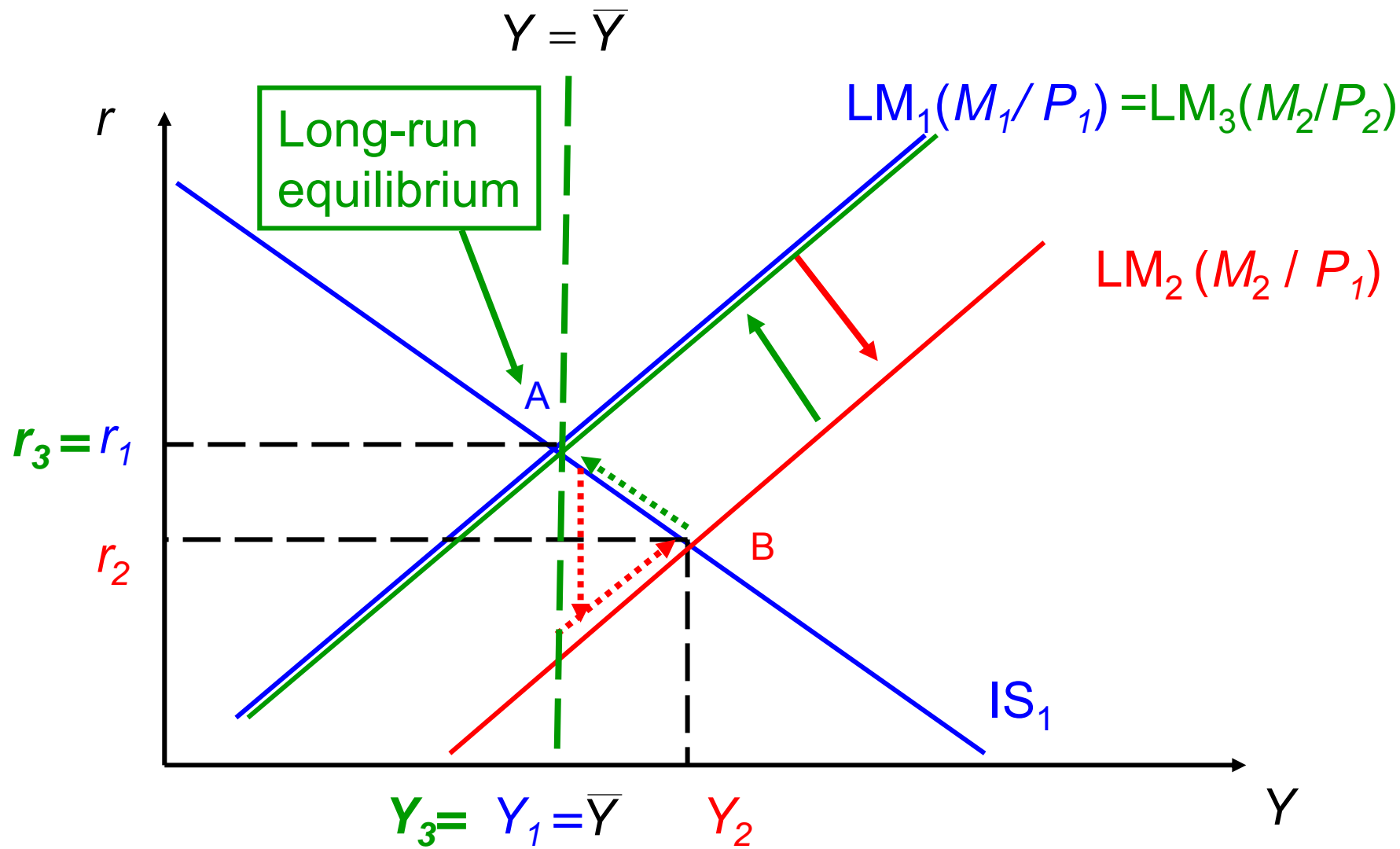
- Assume economy initially in long-run IS-LM equilibrium at point A, where  $Y_1 = \bar{Y}$ ,  $r = r_1$ , and  $P = P_1$ .
- Then  $M$  increases (with no change in any other exogenous variable).
- LM shifts right and a new **short-run equilibrium** is reached at point **B** where:

$$Y = Y_2 > \bar{Y}, \quad r = r_2 < r_1, \quad \text{and} \quad P = P_1.$$



- In the **long-run**, prices rise reducing the real money supply and shifting the LM curve to the left.
- The new **long-run equilibrium** is at point A where

$$Y = Y_1 = \bar{Y}, \quad r = r_1 \text{ and } P = P_2 > P_1$$



□ Explanation:

In the **short run:**

- ↑  $M^s \rightarrow \uparrow (M/P)^s$
- $(M/P)^s > (M/P)^d$
- $r \downarrow \rightarrow (M/P)^d \uparrow$  until  $(M/P)^d = (M/P)^s$
- $I \uparrow$
- $E \uparrow$
- $E > Y_1$
- $Y \uparrow$  until  $Y = E$
- $(M/P)^d \uparrow$
- $(M/P)^d > (M/P)^s$
- $r \uparrow \rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^s$

In the **long run**:

- $Y > \bar{Y} \rightarrow P \uparrow$
- $\rightarrow (M/P)^S \downarrow$
- $\rightarrow (M/P)^S < (M/P)^d$
- $\rightarrow r \uparrow \rightarrow (M/P)^d \downarrow$  until  $(M/P)^d = (M/P)^S$
- $\rightarrow I \downarrow$
- $\rightarrow E \downarrow$
- $\rightarrow E < Y_2$
- $\rightarrow Y \downarrow$  until  $Y = E = \bar{Y}$

- *Conclusion: While expansionary monetary policy raises the equilibrium level of output in the short run, in the long run it has no permanent impact on output but results only in an increase in the price level proportionate to the increase in money supply.*
  
- The IS-LM model can be used to confirm the truth of the (classical) proposition that in the long-run money is **neutral** and changes in the money supply have **no impact on real variables**, such as output and the (real) interest rate.

### III. Differences Between the Keynesian and Classical Models: An IS-LM Interpretation

- Begin with the two equations of the IS-LM model:

$$Y = C(Y - \bar{T}) + I(r) + \bar{G} \quad (1)$$

$$\bar{M} / P = L(r, Y) \quad (2)$$

- To complete the model we need a **third** equation.

1. **Keynesians** believe the price level is stuck. So they add:

$$P = \bar{P} \quad (3a)$$

- If  $\bar{P}$  is above the long-run equilibrium (i.e. when  $P = \bar{P}$ ,  $Y < \bar{Y}$ ) then output is too low and unemployment is too high and a stimulative policy is needed ( $G \uparrow$ ,  $T \downarrow$  or  $M \uparrow$ ).

2. **Classical** economists believe that prices are flexible. So they add this third equation:

$$Y = \bar{Y} \quad (3b)$$

- If output is below  $\bar{Y}$ , prices will fall and the economy will (quickly) adjust to full employment.

### 3. Reconciliation.

- ❑ In the **short-run** prices are sticky → world looks Keynesian.
- ❑ In the **long-run** prices are flexible → world looks classical.