

6.3 IS-LM in terms of equation

- Equilibrium in product market ---- **IS**
- Equilibrium in money market ---- **LM**

6.3.1 Equilibrium in product market

$$Y = DAE$$

$$DAE = C + I + G, \quad C = C_a + bY^d = C_a + b(Y - T) \\ = C_a + bY - bT$$

$$I = I_a - hr$$

$$G = G_a$$

$$T = T_a$$

Equilibrium in product market

$$DAE = C + I + G$$

$$DAE = C_a + bY - bT_a + I_a - hr + G_a$$

At equilibrium : **$Y = DAE$**

$$Y = C_a + bY - bT_a + I_a - hr + G_a$$

$$Y - bY = C_a - bT_a + I_a - hr + G_a$$

$$(1 - b) Y = (C_a - bT_a + I_a + G_a) - hr$$

Equilibrium in product market

At equilibrium :

$$Y = DAE$$

$$(1 - b) Y = (C_a - bT_a + I_a + G_a) - hr$$

$$Y = \frac{1}{(1 - b)} [C_a - bT_a + I_a + G_a] - \left(\frac{h}{1 - b} \right) r$$

$$\Delta Y = \frac{1}{(1 - b)} \Delta [C_a - bT_a + I_a + G_a] - \left(\frac{h}{1 - b} \right) \Delta r$$

$$\left(\frac{h}{(1 - b)} \right) r = \frac{1}{1 - b} [C_a - bT_a + I_a + G_a] - Y$$

$$r = \frac{1}{h} [C_a - bT_a + I_a + G_a] - \frac{(1 - b)}{h} Y$$

$$\Delta r = \frac{1}{h} \Delta [C_a - bT_a + I_a + G_a] - \frac{(1 - b)}{h} \Delta Y$$

Slope of IS curve

=

$$\frac{\Delta r}{\Delta Y}$$

=

$$-\frac{(1 - b)}{h}$$

<

0

Factors cause IS to shift

Factors cause IS to shift :

$$\Delta Y = \frac{1}{1-b} \Delta G_a \Rightarrow \left. \frac{\Delta Y}{\Delta G_a} \right|_{IS} = \frac{1}{1-b}$$

$$\Delta Y = \frac{-b}{1-b} \Delta T_a \Rightarrow \left. \frac{\Delta Y}{\Delta T} \right|_{IS} = \frac{-b}{1-b}$$

Factors cause
IS to shift

:

Every variable (**except “r”**)
causes DAE to shift

6.3.2 Equilibrium in money market

Equilibrium in money market : $M^s = M^d$

$$M^d = C_0 + C_1Y - C_2r$$

At equilibrium : $M^s = M^d$

$$M^s = C_0 + C_1Y - C_2r$$

Equilibrium in money market

LM equation : $M^s = C_0 + C_1 Y - C_2 r$

$$C_2 r = C_0 + C_1 Y - M^s$$

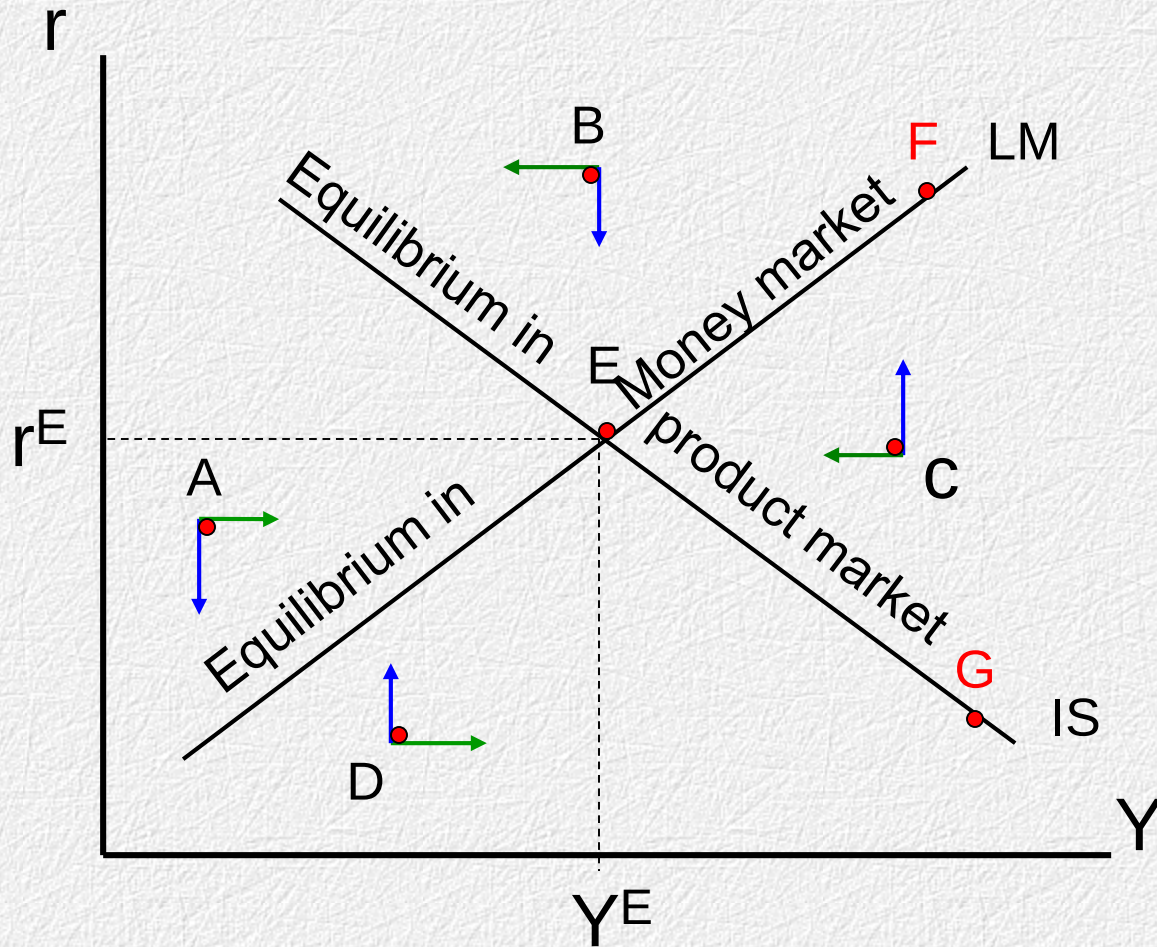
$$r = \frac{C_0}{C_2} + \frac{C_1}{C_2} Y - \frac{M^s}{C_2}$$

Slope of LM curve = $\frac{\Delta r}{\Delta Y} = \frac{C_1}{C_2} > 0$

**Factors
cause LM
to shift**

: $\Delta r = \frac{-1}{C_2} \Delta M^s \Rightarrow \left. \frac{\Delta r}{\Delta M^s} \right|_{LM} = \frac{-1}{C_2} < 0$

6.4 The IS-LM combined



- **Points above LM curve ($r > r_0$) eg.**

At point **A** and **B** $\Rightarrow M^s > M^d \Rightarrow$ Excess supply of money $\Rightarrow$

People use excess
Supply of money to
buy bond $\Rightarrow$ Bond price $\uparrow$ $\Rightarrow$ r $\downarrow$ $\Rightarrow$

$M^d \uparrow$ until $M^d = M^s$ $\Rightarrow$ Adjust to LM curve

- **Points below LM curve ($r < r_0$) eg.**

At point **C** and **D** $\Rightarrow M^d < M^s \Rightarrow$ Excess demand for money $\Rightarrow$

People sell bond to
hold money $\Rightarrow$ Bond price $\downarrow$ $\Rightarrow$ r $\uparrow$ $\Rightarrow$

$M^d \downarrow$ until $M^d = M^s$ $\Rightarrow$ Adjust to LM curve

- **Points above IS curve ($Y > Y_0$) eg.**

At point **B** and **C**



$Y > DAE$



Inventory **↑**



Producers produce less good



Use less factors of production



$Y \downarrow$ until $Y = DAE$



Adjust to IS curve

- **Points below IS curve ($Y < Y_0$) eg.**

At point **A** and **D**



$Y < DAE$



Inventory **↓**



Producers produce more good



Use more factors of production



$Y \uparrow$ until $Y = DAE$



Adjust to IS curve

- **Points on LM curve, but not on IS curve, eg. Point F**

Point **F** is not an equilibrium of economic system



Although it is an equilibrium in money market, it is not an equilibrium in product market



Here, there exists excess supply of output ($Y > DAE$)

- **Points on IS curve, but not on LM curve, eg. Point G**

Point **G** is not an equilibrium of economic system



Although it is an equilibrium in product market, it is not an equilibrium in money market

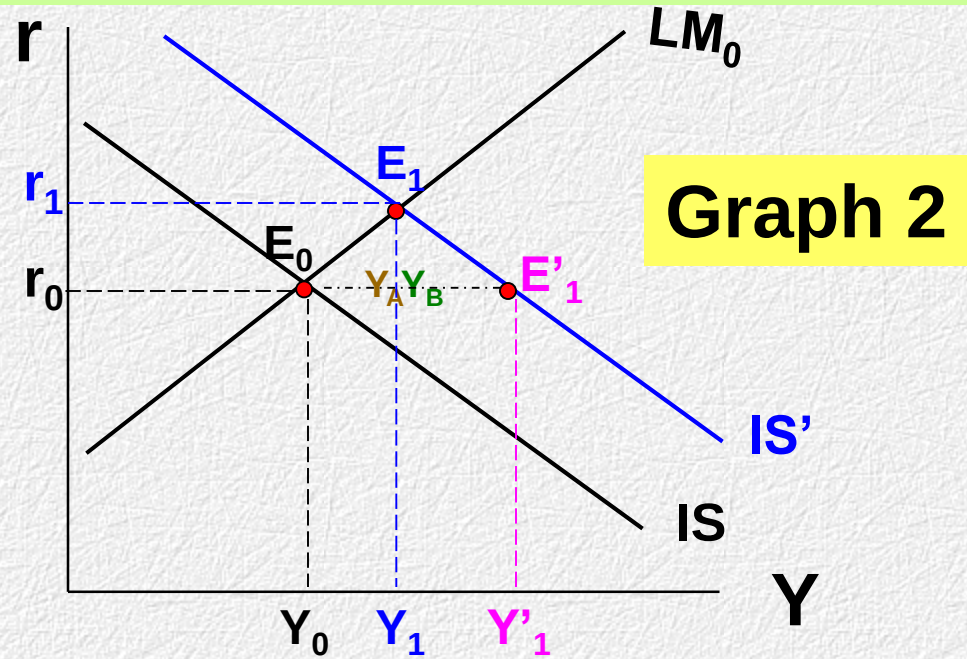
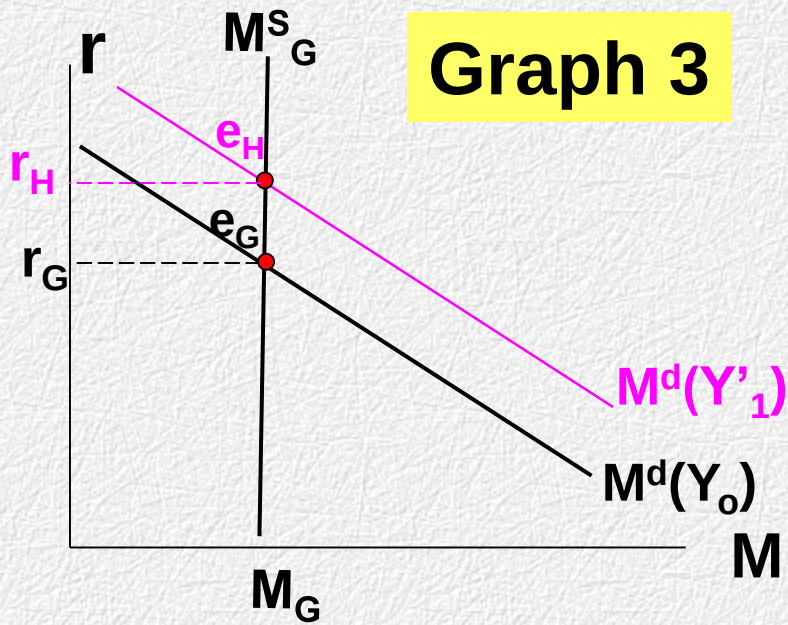


Here, there exists excess demand for money ($M^d > M^s$)

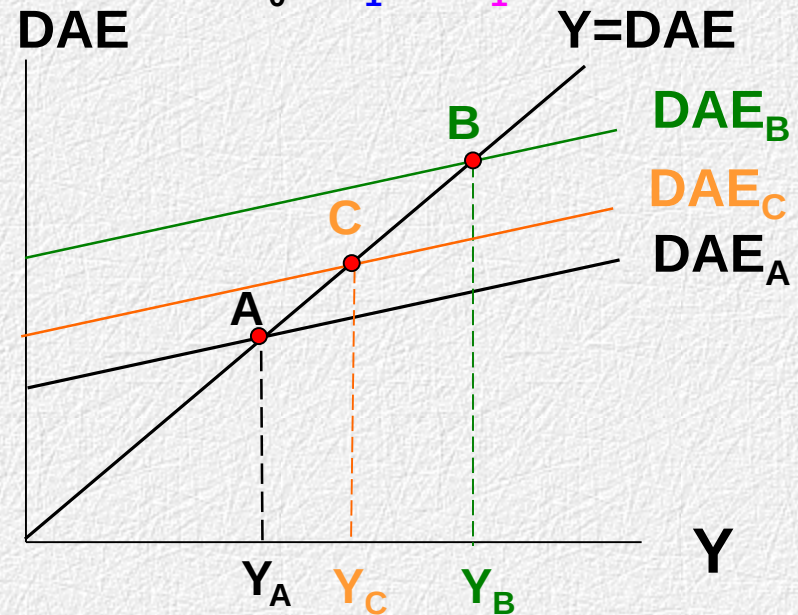
6.5 Changes in equilibrium of product and money market

- **From shift of IS curve**
- **From shift of LM curve**

Effect of Expansion fiscal policy $G \uparrow$ or $T \downarrow$ or both



Graph 1



Before applying fiscal policy

- Equilibrium in product market is at point **A** (Graph 1)
- Equilibrium in money market is at point **e_G** (Graph 3)
- Equilibrium in economy is at point **E₀** in IS – LM model (Graph 2)
equilibrium **r = r₀**, equilibrium **Y = Y₀**

When using expansionary fiscal policy (such as G ↑)

Graph 1

G ↑



DAE ↑

DAE shifts to the left
from **DAE_A** to **DAE_B**



$$\mathbf{Y \uparrow = Y_A Y_B = Y_0 Y'_1 = multiplier * \Delta G}$$

Graph 2

IS shifts to the right (level of shift on horizontal axis = $Y_A Y_B = Y_0 Y'_1$)

⇒ Equilibrium in economy changes from **E₀** to **E₁**

⇒ Equilibrium **r ↑** from **r₀** to **r₁**

⇒ Equilibrium **Y ↑** from **Y₀** to **Y₁**

Explaining adjustment from E_0 to E_1

Graph 2

At E_0 E_0 is on LM curve, but not on new IS curve

It is an equilibrium in money market, but not equilibrium in product market

At E_0 $Y < DAE \Rightarrow$ Excess demand for output $\Rightarrow$ inventory $\downarrow$

$\Rightarrow$ Producers produce more $\Rightarrow$ Use more factor of production $\Rightarrow$ In product market $Y \uparrow$ from Y_0 to Y'_1

Graph 3

In money market when $Y \uparrow \Rightarrow M^d \uparrow$ M^d shifts to the right

$\Rightarrow r \uparrow = r_G r_H = r_0 r_1$

Explaining adjustment from E_0 to E_1 (Continued)

Graph 1

In production market when $r \uparrow \Rightarrow I \downarrow \Rightarrow DAE \downarrow$

DAE shifts from DAE_B to $DAE_C \Rightarrow Y \downarrow = Y_B Y_C = Y'_1 Y_1$



Crowding-out effect

Graph 2

At the end, new equilibrium $r = r_1$, new equilibrium $Y = Y_1$
at point equilibrium point E_1

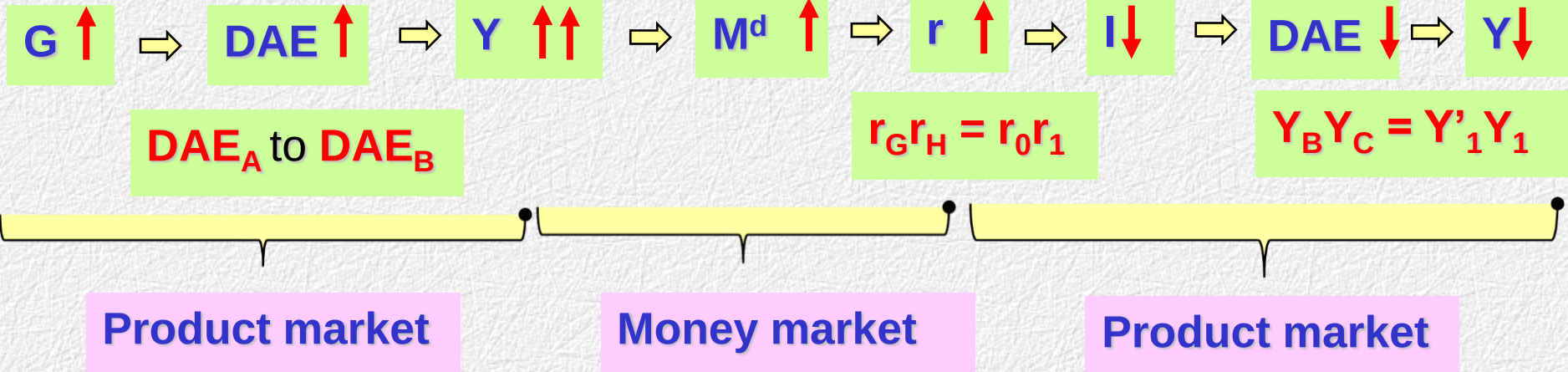
The net change of **equilibrium r** and **equilibrium Y** of
fiscal policy expansion is $r \uparrow = r_0 r_1$, $Y \uparrow = Y_0 Y_1$

Explaining adjustment from E_0 to E_1 (Continued)

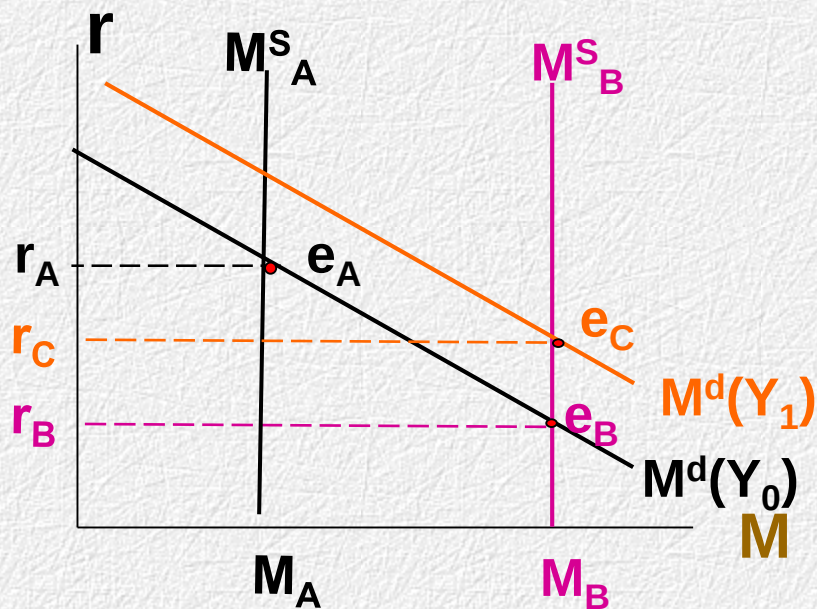
Summarize

$$Y_A Y_B = Y_0 Y'_1$$

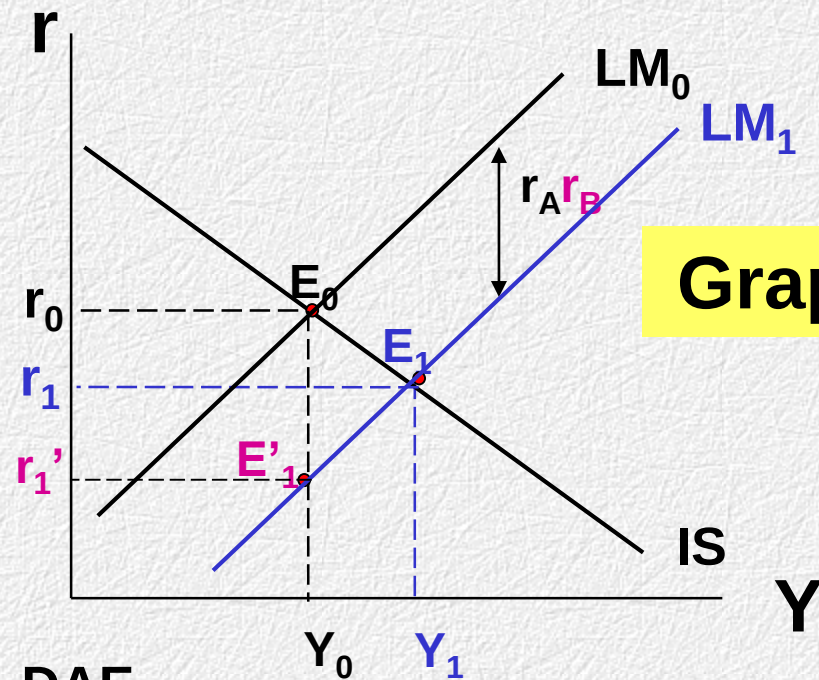
$$DAE_B \text{ to } DAE_C$$



Effect of Expansion monetary policy ($\uparrow M^s$)

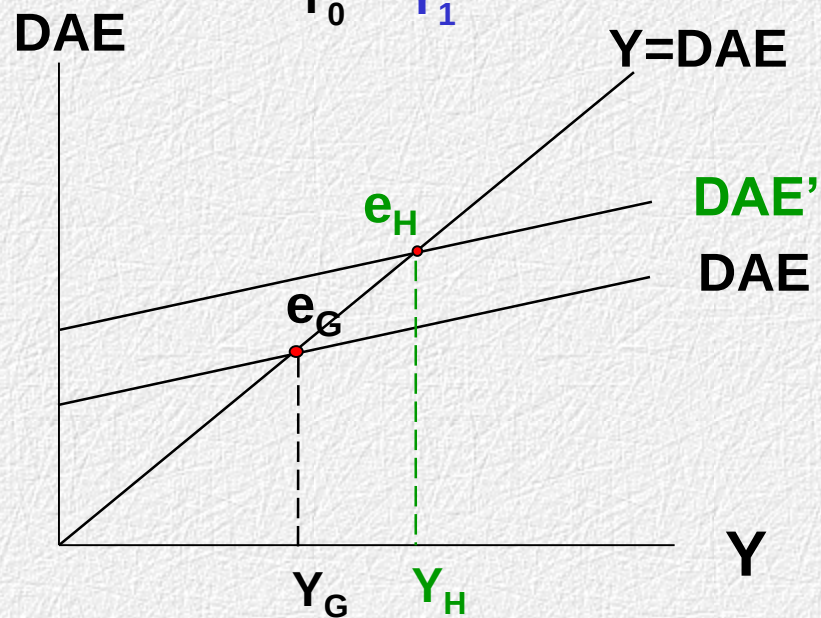


Graph 1



Graph 2

graph3



Before applying monetary policy

- Equilibrium in product market is at point e_A (Graph 1)
- Equilibrium in money market is at point e_G (Graph 3)
- Equilibrium in economy is at point E_0 in IS – LM model (Graph 2)
equilibrium $r = r_0$, equilibrium $Y = Y_0$

When using expansionary monetary policy (eg. BOT buys gov't bond)

Graph 1

$M^s \uparrow \Rightarrow M^s$ shifts to the right $\Rightarrow r \downarrow = r_A r_B = r_0 r'_1$

Graph 2

LM shifts to the right (level of shift on vertical axis = $r_A r_B = r_0 r'_1$)

$\Rightarrow$ Equilibrium in economy changes from E_0 to E_1

$\Rightarrow$ Equilibrium $r \downarrow$ from r_0 to r_1

$\Rightarrow$ Equilibrium $Y \uparrow$ from Y_0 to Y_1

Explaining adjustment from E_0 to E_1

Graph 2

At E_0 E_0 is on IS curve, but not on new LM curve

It is an equilibrium in product market, but not equilibrium in money market

At E_0 $M^s > M^d \Rightarrow$ Excess supply for Money $\Rightarrow$

People use excess supply of money to buy bond $\Rightarrow$ Price of bond $\uparrow \Rightarrow r \downarrow$ from r_0 to r'_1

Graph 3

In production market when $r \downarrow \Rightarrow I \uparrow \Rightarrow DAE \uparrow$

DAE shifts from DAE to DAE' $\Rightarrow Y \uparrow = Y_G Y_H = Y_0 Y_1$

Explaining adjustment from E_0 to E_1 (Continued)

Graph 1

In money market when $Y \uparrow \Rightarrow M^d \uparrow \Rightarrow$

M^d shifts from $M^d(Y_0)$ to $M^d(Y_1) \Rightarrow r \uparrow = r_B r_C = r'_1 r_1$

Graph 2

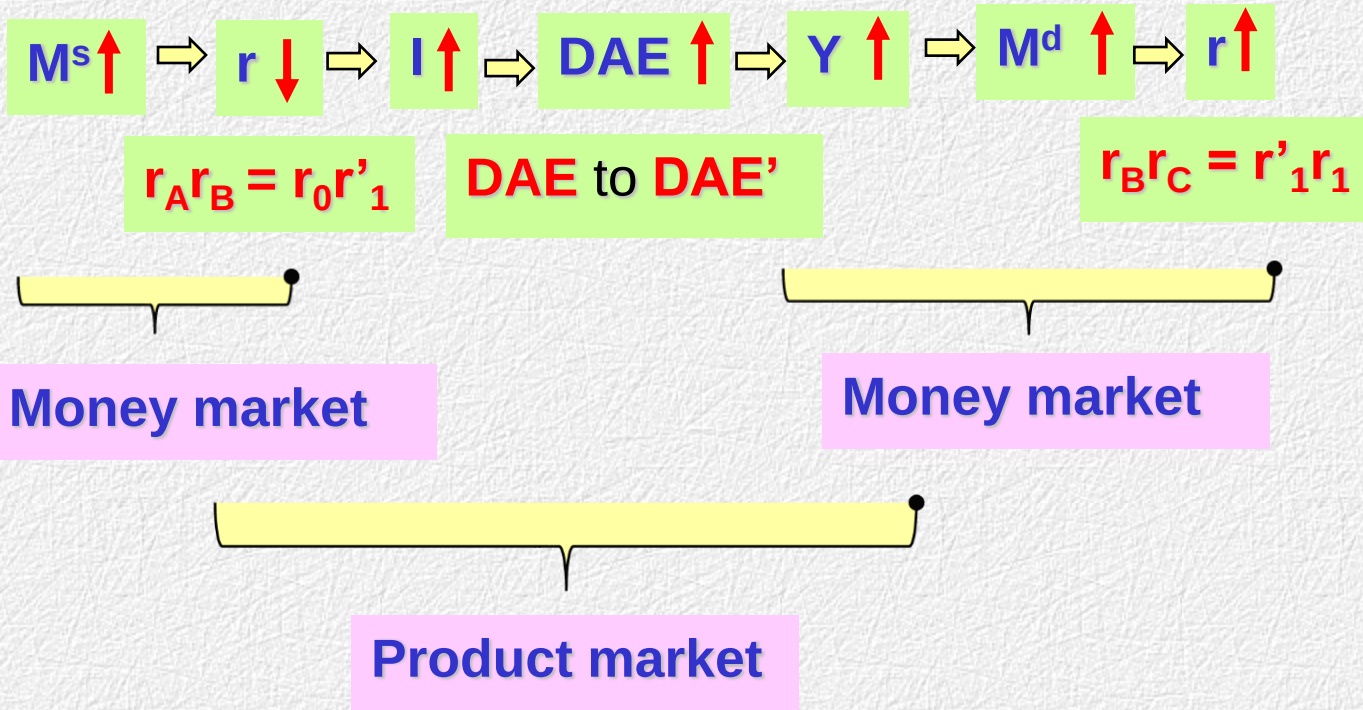
At the end, new equilibrium $r = r_1$, new equilibrium $Y = Y_1$
at point equilibrium point E_1

The net change of **equilibrium r** and **equilibrium Y** of
monetary policy expansion is $r \downarrow = r_0 r_1$, $Y \uparrow = Y_0 Y_1$

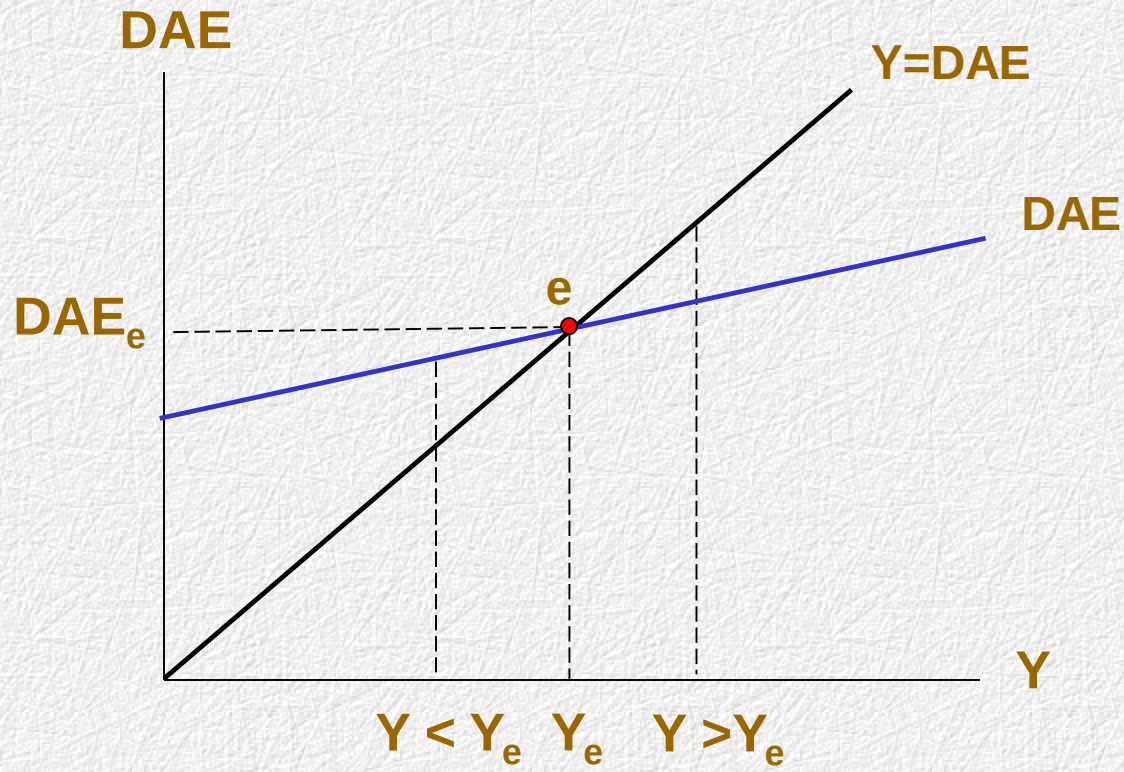
Explaining adjustment from E_0 to E_1 (Continued)

Summarize

$$Y_G Y_H = Y_0 Y_1$$



Equilibrium in good market, $Y = \text{DAE}$ approach



Equilibrium in Money Market

