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

$$Y = DAE$$

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

$= C_a + bY - bT$

$I = I_a - hr$

$G = G_a$

$T = T_a$

Equilibrium in product market

$$DAE = C + I + G$$

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

At equilibrium : $Y = DAE$

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

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

$$(1- b)\, Y = (C_a - bT_a + I_a + Ga) - hr$$

Equilibrium in product market

At equi^{m} : $Y = DAE$

$$(1- b)\, Y = (C_a - bT_a + I_a + Ga) - hr$$

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

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

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

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

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

Slope of **IS** curve $= \dfrac{\Delta r}{\Delta Y} =$ $\quad < 0$

Factors cause IS to shift

Factors cause IS to shift :

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

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

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 equi m : $M^s = M^d$

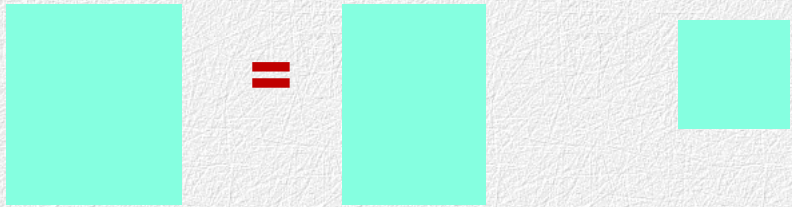
$$M^s = C_0 + C_1Y - C_2r$$

Equilibrium in money market

LM equation : $M^s = C_0 + C_1Y - C_2r$

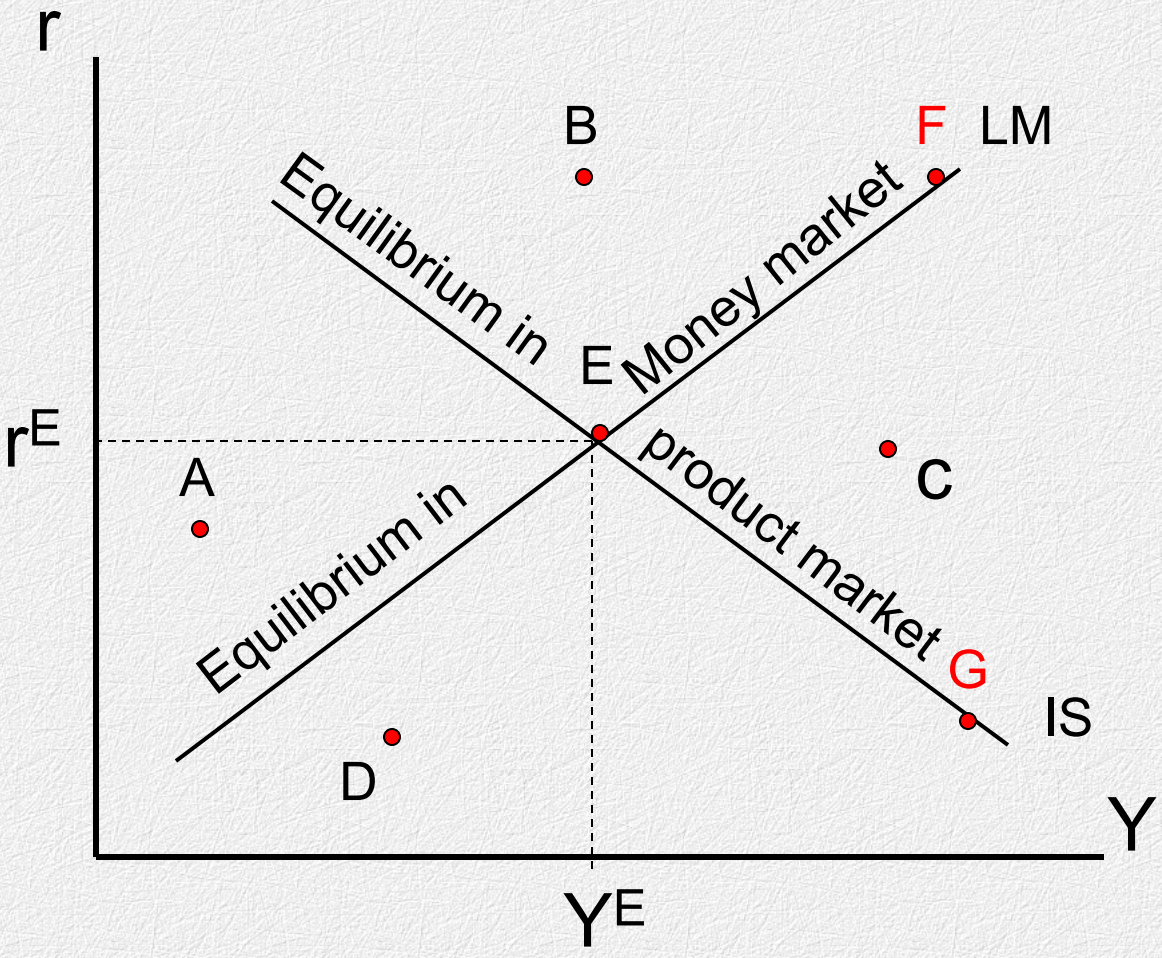
$$C_2r = C_0 + C_1Y - M^s$$

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

Slope of LM curve = = 

Factors cause LM to shift : $\Delta r = \frac{-1}{C_2}\Delta M^s$ ➡ $\left.\frac{\Delta r}{\Delta M^s}\right|_{LM} = \frac{-1}{C_2} < 0$

6.4 The IS-LM combined



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

At point A and B

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

At point C and D

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

At point B and C

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

- **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 →

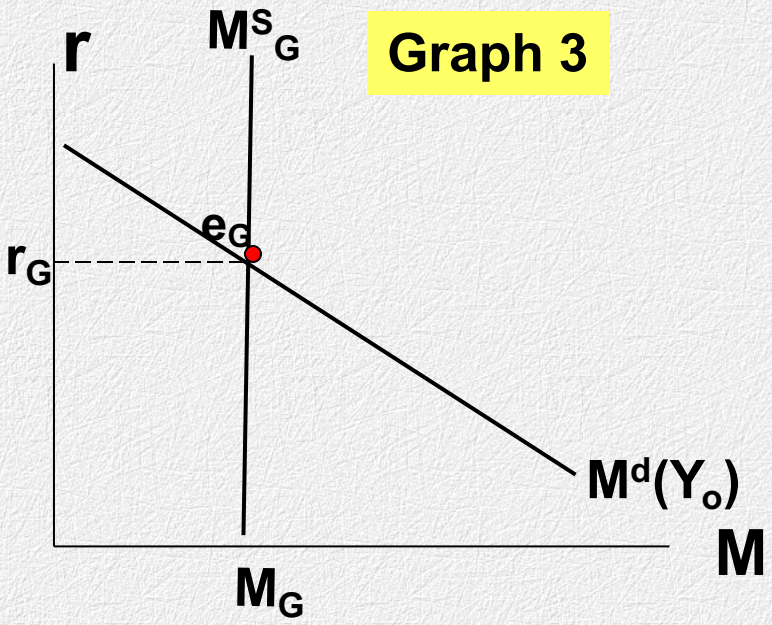
- **Points on IS curve, but not on LM curve, eg. Point G**

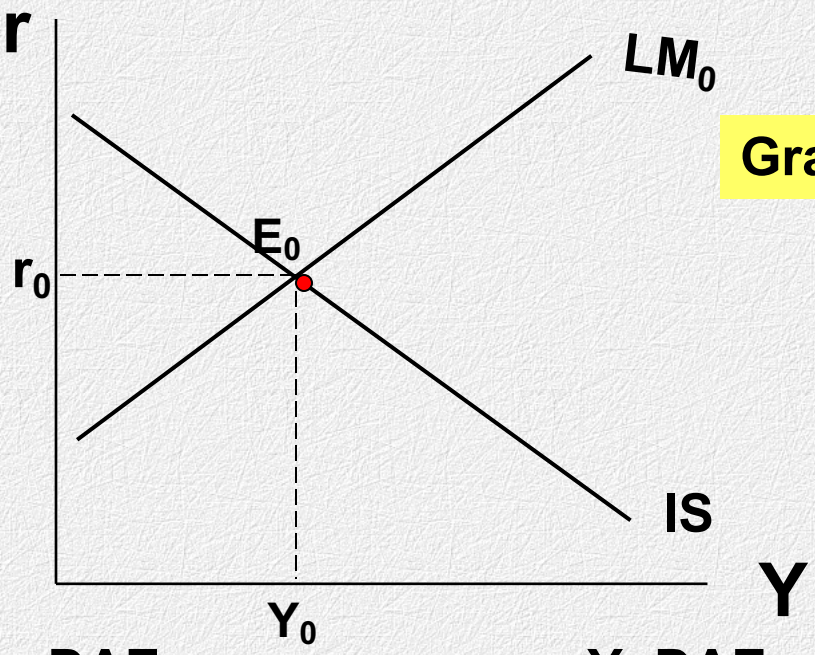
Point G is not an equilibrium of economic system → Although it is an equilibrium in product market, it is not an equilibrium in money market →

6.5 Changes in equilibrium of product and money market

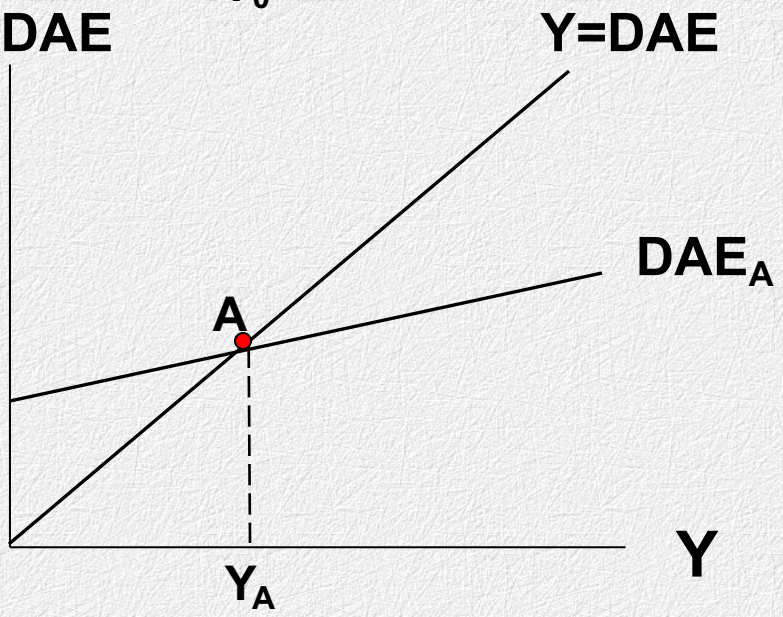
- From shift of IS curve
- From shift of LM curve

Effect of Expansion fiscal policy G ↑ or T ↓ 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 E_0 in IS – LM model (Graph 2)

  equilibrium $r = r_0$, equilibrium $Y = Y_0$

When using expansionary fiscal policy (such as G ↑)

Graph 1 G ↑ ⇨

⇨

Graph 2

⇨ Equilibrium in economy changes from E_0 to E_1

⇨ Equilibrium r ↑ from r_0 to r_1

⇨ Equilibrium Y ↑ from Y_0 to Y_1

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

At E_0 ⇨ ⇨

⇨ ⇨ ⇨ In product market

Y ↑ from Y_0 to Y'_1

Graph 3

In money market when Y ↑ ⇨

⇨ r ↑ = $r_G r_H = r_0 r_1$

Explaining adjustment from E_0 to E_1 (Continued)

Graph 1

In production market when r ↑ ⇨ ⇨

⇨ $Y \downarrow = Y_B Y_C = Y'_1 Y_1$

Crowding-out effect

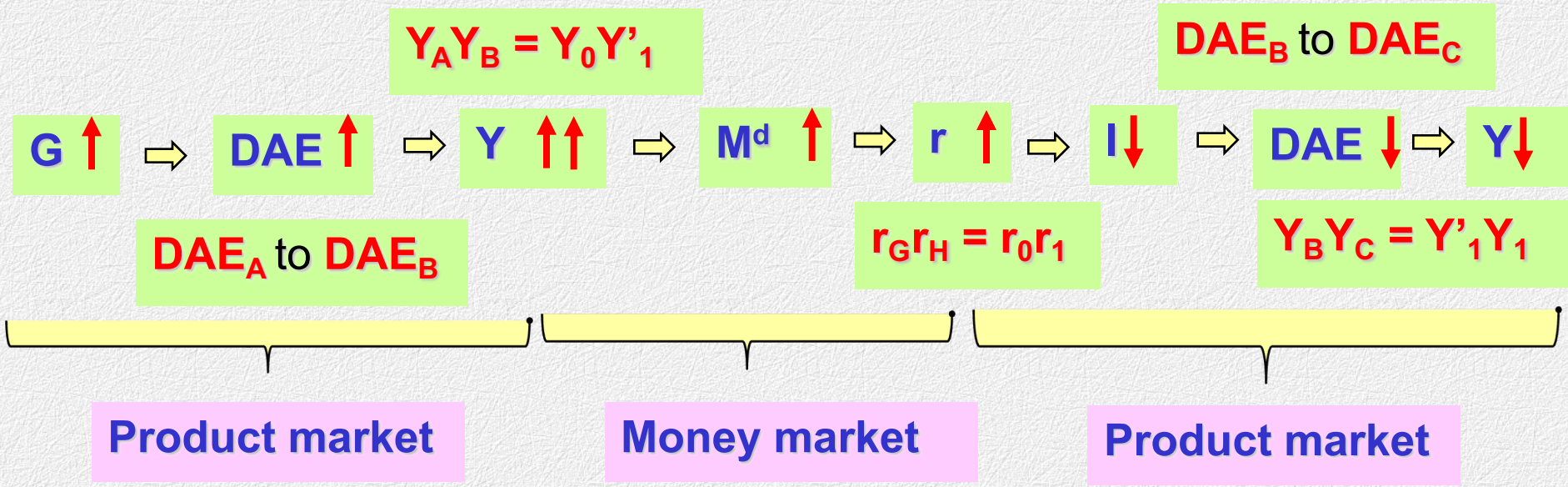
Graph 2

At the end, new equilibrium r = r_1 , new equilibrium Y = Y_1

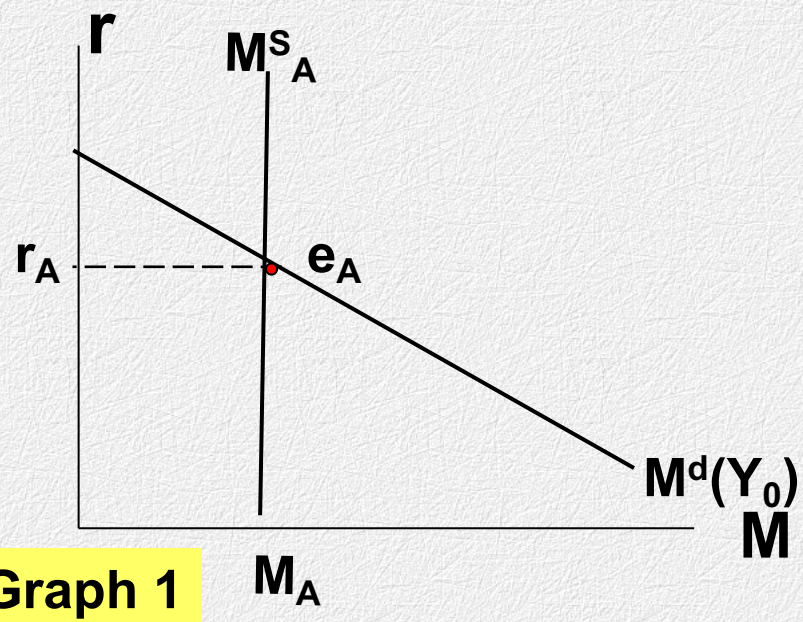
at point equilibrium point E_1

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

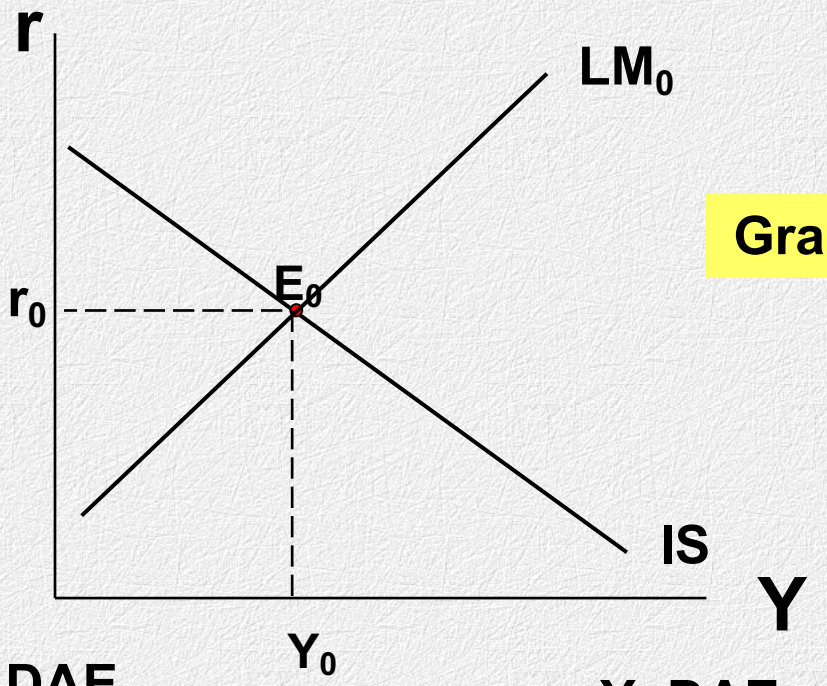
Summarize effects of fiscal policy expansion



Effect of Expansion monetary policy (↑ M^s)

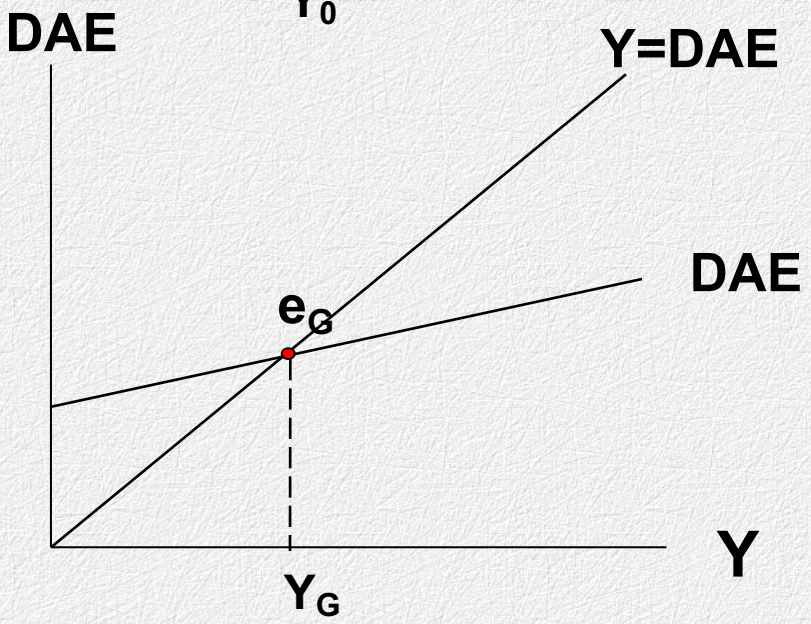


Graph 1



Graph 2

Graph 3



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 ↑ ⇨ ⇨

Graph 2

⇨ Equilibrium in economy changes from E_0 to E_1

⇨ Equilibrium r ↓ from r_0 to r_1

⇨ Equilibrium Y ↑ 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 ⇨ ⇨

⇨ ⇨

Graph 3

In production market when r ↓ ⇨ ⇨

⇨

Explaining adjustment from E_0 to E_1 (Continued)

Graph 1

In money market when Y ↑ ⇨ ⇨

⇨

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 ↓ = r_0r_1 , Y ↑ = Y_0Y_1

Explaining adjustment from E_0 to E_1 (Continued)

Summarize

$Y_G Y_H = Y_0 Y_1$

$M^s \uparrow \Rightarrow r \downarrow \Rightarrow I \uparrow \Rightarrow DAE \uparrow \Rightarrow Y \uparrow \Rightarrow M^d \uparrow \Rightarrow r \uparrow$

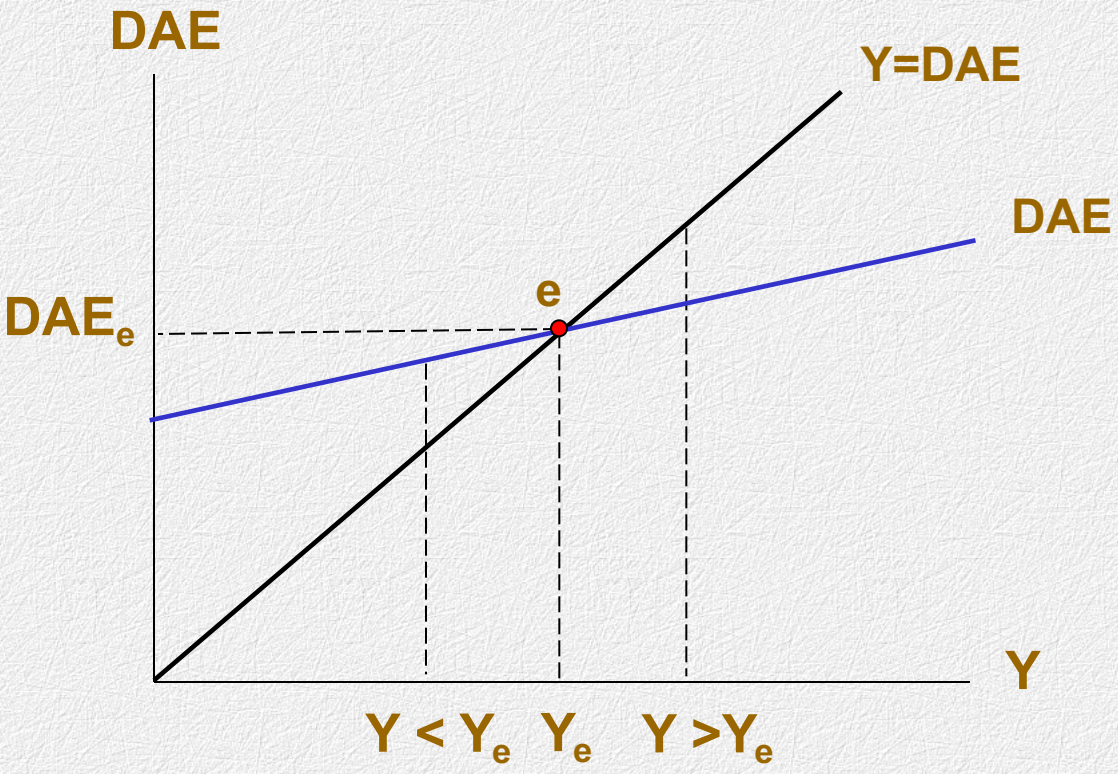
$r_A r_B = r_0 r'_1$ DAE to DAE' $r_B r_C = r'_1 r_1$

Money market

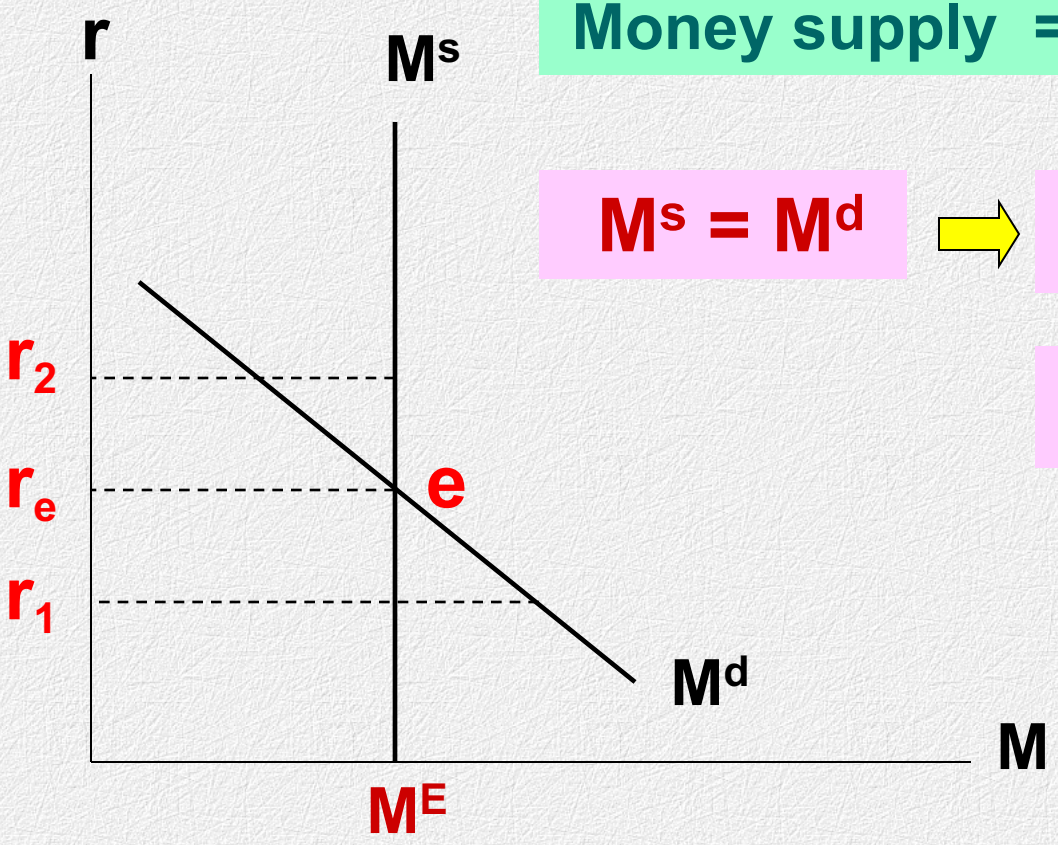
Money market

Product market

Equilibrium in good market, Y = DAE approach



Equilibrium in Money Market



Money supply = Money demand

$M^s = M^d$ ⇒ Equil^m money = M_E

Equil^m interest rate = r_E