

EE320 (2/2012)

INTRODUCTORY MATHEMATICAL ECONOMICS

STATIC (or EQUILIBRIUM) ANALYSIS

(Part 2)

Topics

- Equilibrium in national-income analysis
 - Keynesian model
 - IS-LM model
 - Comparative statics

Simplest Keynesian National-Income Model

- Consider a *closed* economy (i.e. no trade).

- The equilibrium is: $Y = C + I_0 + G_0$

where $C = a + bY$ ($a > 0, 0 < b < 1$)

- At equilibrium, $Y = a + bY + I_0 + G_0$



- Corresponding consumption: $C^* = a + bY^*$



Closed Economy with Proportional Income Tax

- Equilibrium condition: $Y = C + I_0 + G_0$

where $C = a + bY_d \quad (a > 0, 0 < b < 1)$

$$Y_d = Y - T$$

$$T = tY \quad (0 < t < 1)$$

- At equilibrium, $Y = a + bY_d + I_0 + G_0$

$$Y = a + b(1-t)Y + I_0 + G_0$$



Open Economy with Proportional Income Tax

- Equilibrium condition: $Y = C + I_0 + G_0 + X_0 - M$

where $C = a + bY_d \quad (a > 0, 0 < b < 1)$

$$T = tY \quad (0 < t < 1)$$

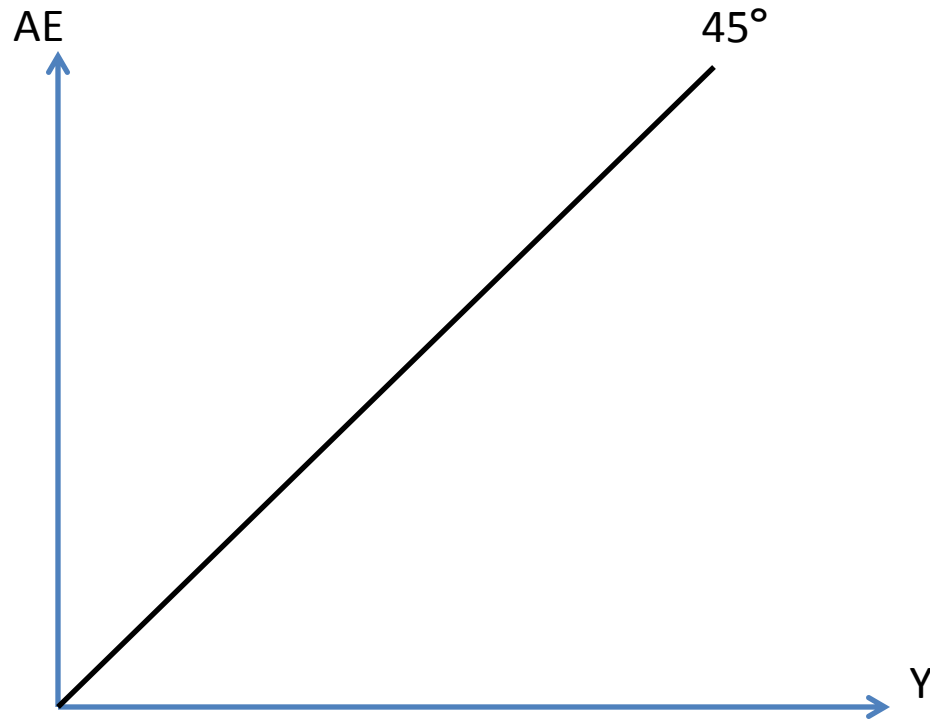
$$M = mY$$

- At equilibrium, $Y = a + b(1-t)Y + I_0 + G_0 + X_0 - mY$



- If $M = mY_d$, $Y^* = ?$

Graph: Keynesian National-Income Model



Suppose G increases. What is the new value of Y^* ?

Comparative Statics Analysis

- Suppose government increases its expenditure, what's the impact on the equilibrium national income (i.e. $\Delta Y^*/\Delta G=?$)

- Recall: $Y^* = \frac{a + I_0 + G_0 + X_0}{1 - b(1 - t) + m}$, and suppose $\Delta G = G_1 - G_0$.

➤
$$Y^{*1} - Y^{*0} = \frac{a + I_0 + G_1 + X_0}{1 - b(1 - t) + m} - \frac{a + I_0 + G_0 + X_0}{1 - b(1 - t) + m}$$



IS-LM Model

- The previous Keynesian model only deals with the equilibrium in the goods (or commodity) market. It seeks to determine the equilibrium level of national income.
- The **IS-LM model** deals with not only the **commodity market** but also the **money market**. It determines **the equilibrium levels of national income and interest rate** in the economy.
- The **IS curve** represents the equilibrium in the commodity market.
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- The **LM curve** represents the equilibrium in the money market.
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IS-LM Model: Closed Economy & No Tax

- Commodity Market:

$$Y = C + I + G_0$$

$$C = a + bY \quad (a > 0, 0 < b < 1)$$

$$I = I_0 - ir \quad (I_0, i > 0, \text{ and } r \text{ is interest rate})$$

- $Y = a + bY + I_0 - ir + G_0$

- Money Market:

$$M^S = M_0$$

$$M^D = kY - hr \quad (k, h > 0)$$

- At equilibrium, $M_0 = kY - hr$

- From the two equilibrium conditions, we can solve for Y^* and r^* :

IS-LM Model: Closed Economy with Tax

- Commodity Market:

$$Y = C + I + G_0$$

$$C = a + bY_d \quad (a > 0, 0 < b < 1)$$

$$I = I_0 - ir \quad (I_0, i > 0)$$

$$Y_d = Y - T \quad \text{where } T = tY \quad (0 < t < 1)$$

$$\rightarrow Y = a + b(1-t)Y + I_0 - ir + G_0$$

- Money Market:

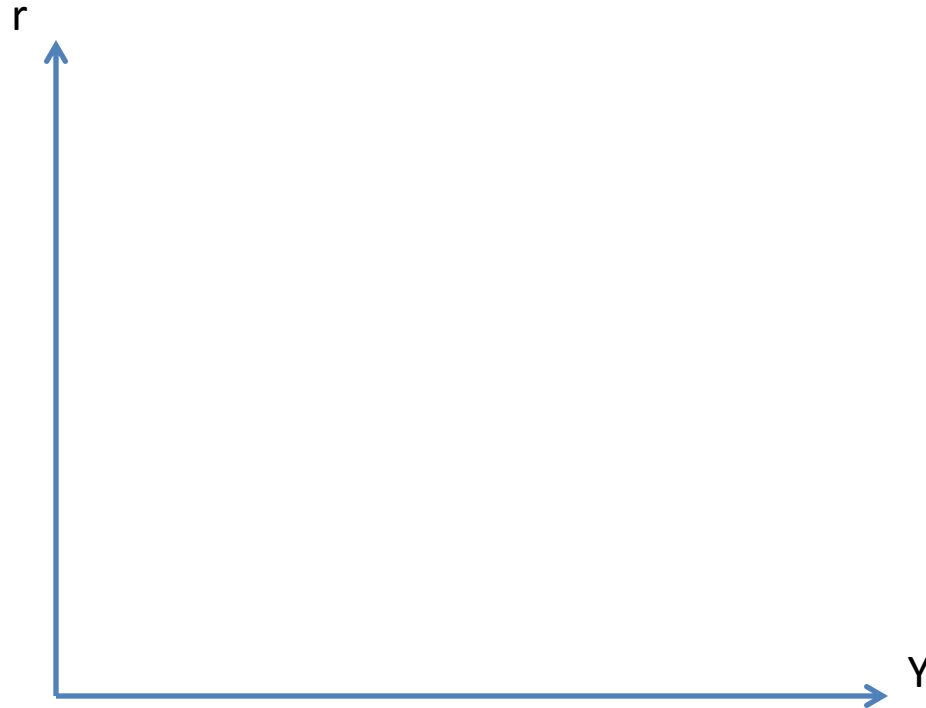
$$M^S = M_0$$

$$M^D = kY - hr \quad (k, h > 0)$$

$$\rightarrow M_0 = kY - hr$$

- Equilibrium values for Y^* and r^* :

Graph: Equilibrium in IS-LM Model



- When the government increases its expenditure, what's the impact on the equilibrium Y and r ?

Comparative Statics Analysis: IS-LM Model

- In a closed economy with tax, suppose G increases ($\Delta G = G_1 - G_0$), $\Delta Y^*/\Delta G = ?$ and $\Delta r^*/\Delta G = ?$
- Recall: $Y^* = \frac{(a + I_0 + G_0)h - iM_0}{ik + h[1 - b(1 - t)]}$ and $r^* = \frac{(a + I_0 + G_0)k - [1 - b(1 - t)M_0]}{ik + h[1 - b(1 - t)]}$