Uniwersytet Warszawski
Wydział Nauk Ekonomicznych

Macroeconomics 1
The IS-LM model

Dr Łukasz Matuszczak

The model assumptions

- A model combining equilibrium in the goods and services market with equilibrium in the money market;
- IS (the name is derived from I = S, for a simple model without government and foreign) represents equilibrium in the market for goods and services - derivation from the Keynes model;
- LM (L for liquidity preference, M for a given money supply) represents equilibrium in the money market;
- Solving the model means determining a combination of income (Y) and interest rate (r) that balances both markets simultaneously.

The model assumptions

- The extended Keynes model
  - Money market
  - Investments dependent on the level of interest rate
    $I = I \ - bi$
- The state influences the amount of income, the amount of demand and the interest rate through:
  - Fiscal policy (Keynes model)
  - Monetary policy (money supply changes)

The IS curve

- Closed Economy

$$AE = C + I + G \text{, a } C = a + c\left(Y + \overline{TR} - tY\right) = \mathrm{a} + \mathrm{c}\overline{\mathrm{TR}} + c(1-t)Y \text{ ,}$$

$$I = \overline{I} - br \text{ ,} \quad \mathrm{G} = \overline{\mathrm{G}}$$

$$AE = \underbrace{\left(a + \overline{I} + \overline{G}\right)}_{\overline{A}} + c\overline{TR} - br + c(1-t)Y$$

$$AE = \overline{A} + c\overline{TR} - br + c(1-t)Y$$

- The Equilibrium condition Y=AE:

$$AE = Y^* = \overline{A} + c\overline{TR} - br + c(1-t)Y^* \rightarrow Y^* = \frac{1}{1-c(1-t)}\left[\overline{A} + c\overline{TR} - br\right]$$

$$\alpha' = \frac{1}{1-c(1-t)}, \quad Y^* = \alpha'\left[\overline{A} + c\overline{TR} - br\right]$$

$$IS: r = \frac{\alpha'\overline{A} + \alpha' c\overline{TR}' - Y^*}{\alpha' b} = \frac{\overline{A} + c\overline{TR}'}{b} - \frac{(1-c(1-t))}{b}Y^* = \frac{\overline{A} + c\overline{TR}'}{b} - \frac{1}{b\alpha'}Y^*$$

The IS curve

- Opened economy:

$$AE = C + I + G + NX = a + cY_D + \bar{I} - br + \overline{G} + \overline{X} - \overline{Z} - mY =$$

$$a + \bar{I} - br + \overline{G} + c(Y - \overline{T} - tY + \overline{TR}) + \overline{X} - \overline{Z} - mY =$$

$$- br + a + \bar{I} + \overline{G} + cY - c\overline{T} - ctY + c\overline{TR} + \overline{X} - \overline{Z} - mY =$$

$$- br + c(1 - t)Y - mY + \underbrace{a + \bar{I} + \overline{G} - c\overline{T} + c\overline{TR} + \overline{X} - \overline{Z}}_{\overline{A}}$$

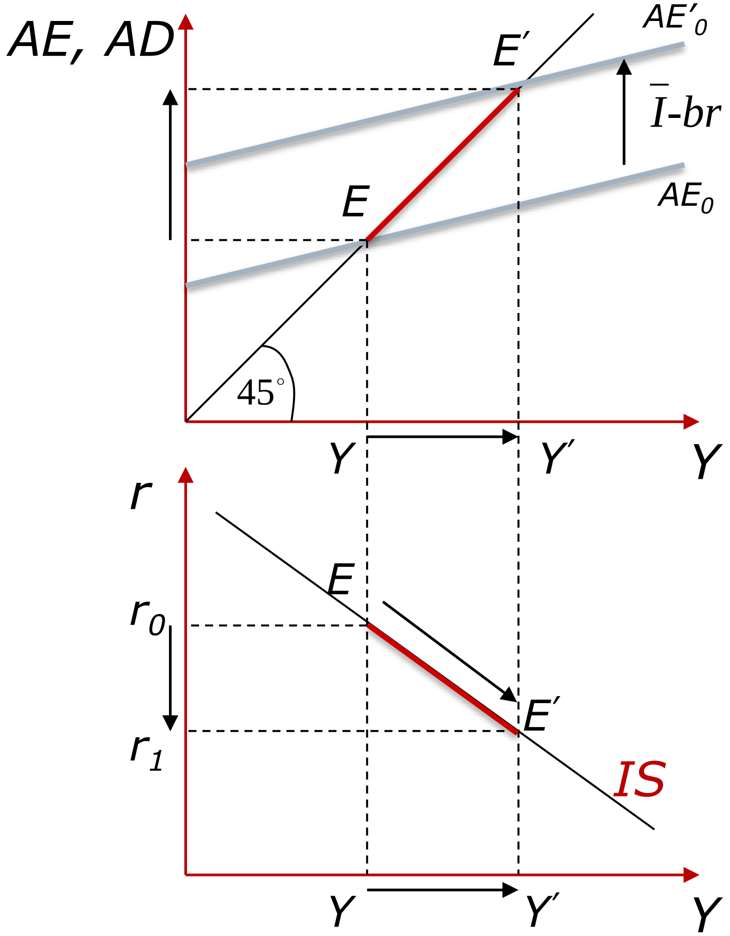
$$AE = -br + \left[c(1 - t) - m\right]Y + \overline{A}$$

- The Equilibrium condition Y=AD:

$$AE = Y^* = - br + [\, c(1 - t) - m]Y^* + \overline{A} \rightarrow br = [\, c(1 - t) - m - 1]Y^* + \overline{A}, [\, c(1 - t) - m - 1] = -1/\alpha$$

$$IS: r = \frac{[\, c(1 - t) - m - 1]}{b} Y^* + \frac{\overline{A}}{b}, \text{ lub } IS: r = - \frac{Y^*}{b\alpha} + \frac{\overline{A}}{b}$$

Graphical derivation of the IS curve



$$r\downarrow \Rightarrow I = \left(\bar{I}\text{-}br\right)\uparrow \Rightarrow AE\uparrow \Rightarrow Y\uparrow$$

The LM curve – money market

- A quick reminder about the demand for money:
  - Demand for money
  - Transactional motive
  - Precautionary motive
  - Wallet theme
- Money demand:

$$L = k \times Y - h \times i$$

Sensitivity of demand for money related to the level of income

The sensitivity of demand for money related to the level of interest rates

The LM curve – money market

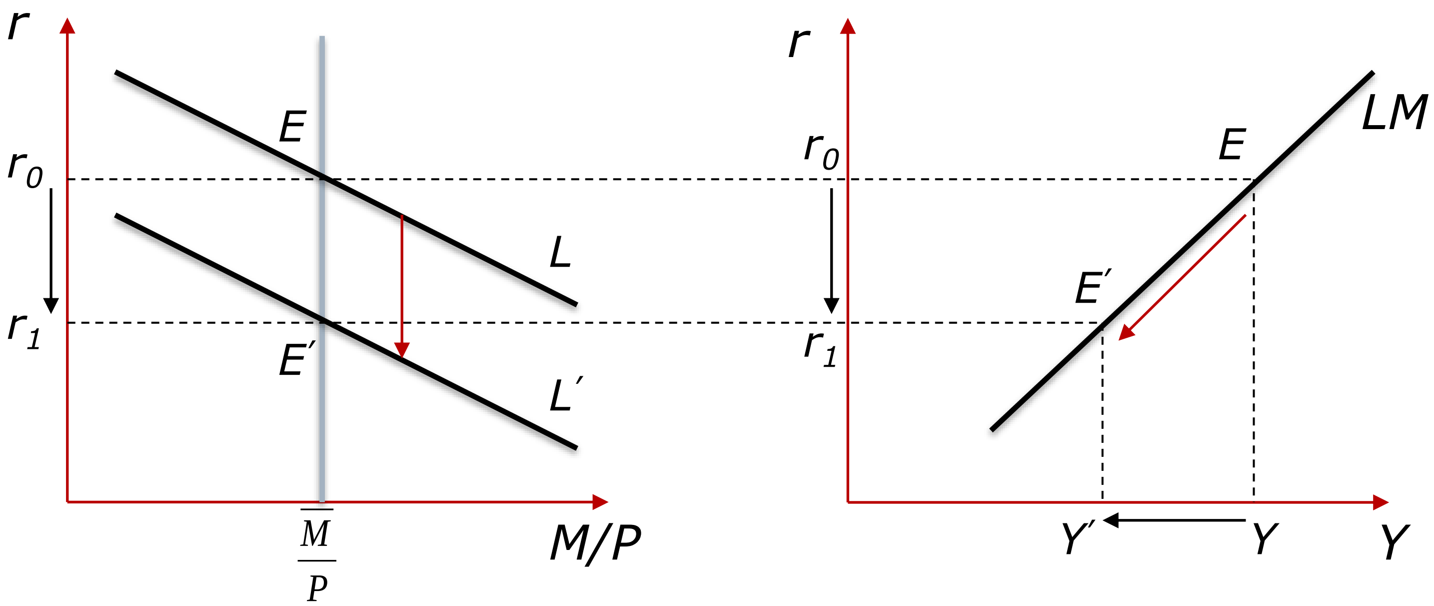
- In equilibrium
  - demand=supply:

$$\frac{\overline{M}}{P} = L$$

- The LM curve:

$$\frac{\overline{\mathrm{M}}}{\mathrm{P}} = kY - hr \rightarrow r = \frac{k}{h}Y - \frac{1}{h}\frac{\overline{\mathrm{M}}}{\mathrm{P}}$$

Graphical derivation of the LM curve



$$Y \downarrow \Rightarrow L \downarrow \Rightarrow r \downarrow$$

The model equilibrium

- At the intersection of the IS and LM curves, both markets are in equilibrium, hence:

$$\mathrm{IS}: r = -\frac{\mathrm{Y}}{\mathrm{b}\alpha} + \frac{\overline{\mathrm{A}}}{\mathrm{b}}$$

$$\mathrm{LM}: r = \frac{k}{h}Y - \frac{1}{h}\frac{\overline{\mathrm{M}}}{\mathrm{P}}$$

$$\frac{k}{h}Y - \frac{1}{h}\frac{\overline{\mathrm{M}}}{\mathrm{P}} = -\frac{\mathrm{Y}}{\mathrm{b}\alpha} + \frac{\overline{\mathrm{A}}}{\mathrm{b}}$$

$$\left(\frac{k}{h} + \frac{1}{\mathrm{b}\alpha}\right)Y = \frac{\overline{\mathrm{A}}}{\mathrm{b}} + \frac{1}{h}\frac{\overline{\mathrm{M}}}{\mathrm{P}} \rightarrow \left(\frac{\alpha\mathrm{b}k + h}{\alpha\mathrm{b}h}\right)Y = \frac{\overline{\mathrm{A}}}{\mathrm{b}} + \frac{1}{h}\frac{\overline{\mathrm{M}}}{\mathrm{P}} \Big/ \cdot\, \alpha\mathrm{b}h$$

$$(\alpha\mathrm{b}k + h)Y = \alpha h\overline{\mathrm{A}} + \alpha\mathrm{b}\frac{\overline{\mathrm{M}}}{\mathrm{P}} \rightarrow Y^{*} = \frac{\alpha h}{\alpha\mathrm{b}k + h}\overline{\mathrm{A}} + \frac{\alpha\mathrm{b}}{\alpha\mathrm{b}k + h}\frac{\overline{\mathrm{M}}}{\mathrm{P}}$$

The model equilibrium

- There are two multipliers in equilibrium:

$$Y^* = \underbrace{\left(\frac{\alpha}{\frac{\alpha \mathrm{b} k}{h} + 1} \right)}_{\beta} \overline{\mathrm{A}} + \underbrace{\left(\frac{\mathrm{b}}{\mathrm{h}} \frac{\alpha}{\frac{\alpha \mathrm{b} k}{h} + 1} \right)}_{\gamma} \frac{\overline{\mathrm{M}}}{\mathrm{P}}, \text{gdzie}$$

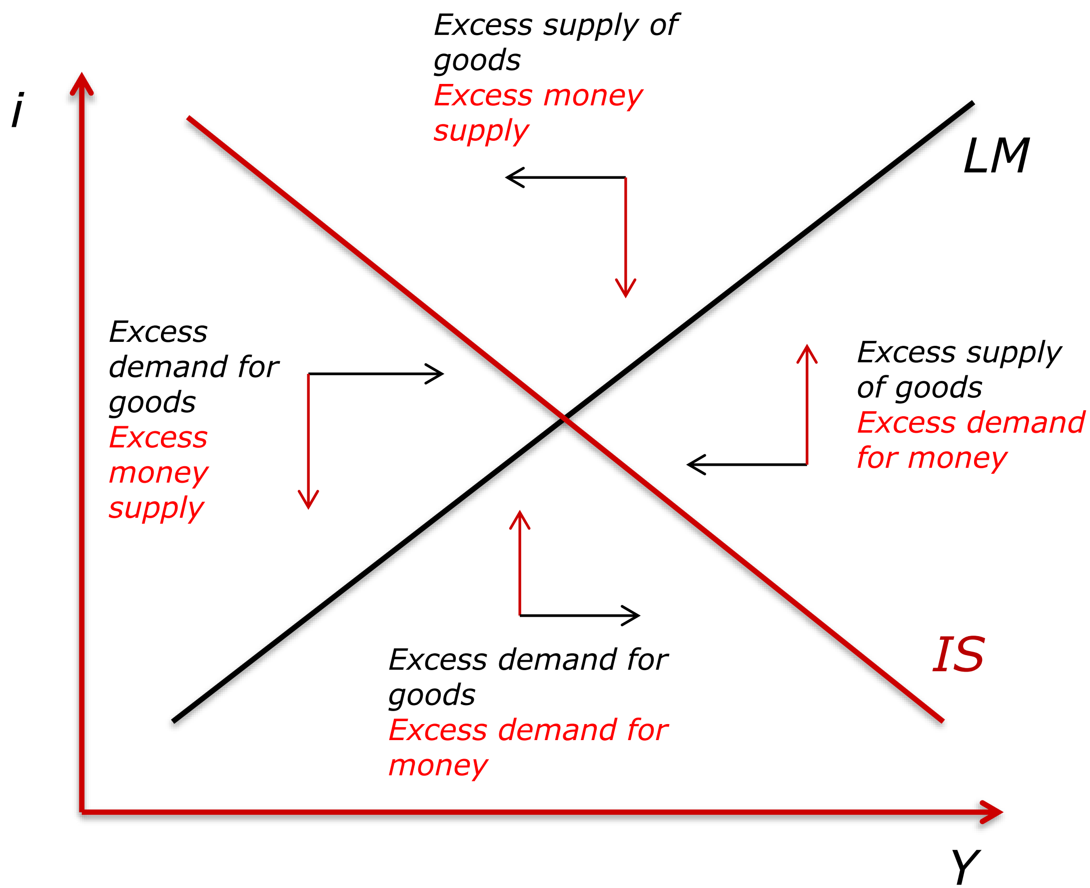
Fiscal policy multiplier

$$\beta = \frac{\alpha}{\frac{\alpha \mathrm{b} k}{h} + 1}$$

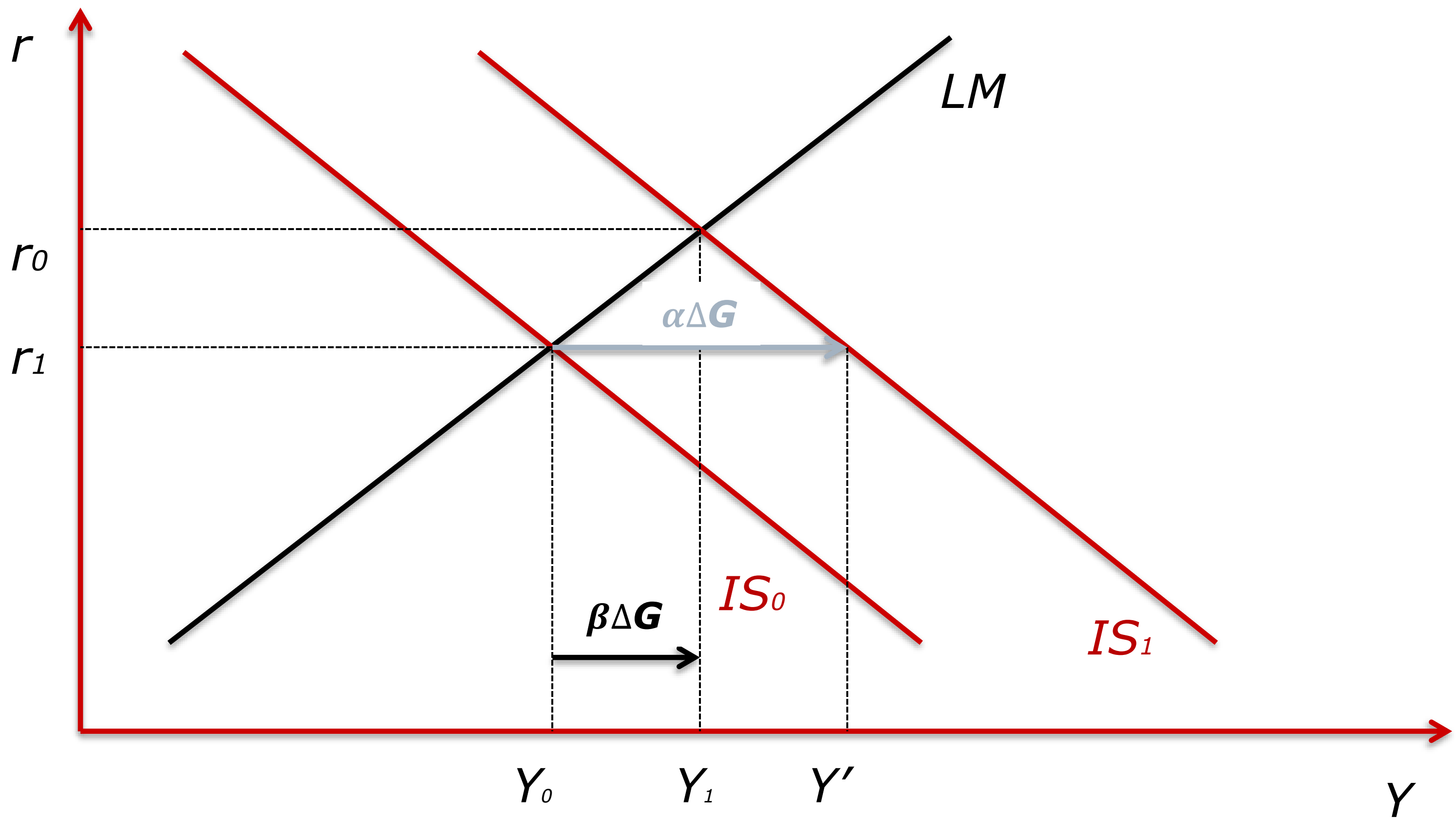
Monetary policy multiplier

$$\gamma = \frac{\mathrm{b}}{\mathrm{h}} \frac{\alpha}{\frac{\alpha \mathrm{b} k}{h} + 1} = \frac{\mathrm{b}}{\mathrm{h}} \beta$$

Demand and supply in both markets



Expansionary fiscal policy in the model



Graficzne postać modelu