International Monetary Economics

Georg Stadtmann
stadtmann@europa-uni.de

Introduction

Chapter 15
Money, Interest Rates, and Exchange Rates

How to set up a model

1. Define the equilibrium conditions
2. Derive the slope of the curves
3. Determine equilibrium
4. Identify the shock: It is always an *exogenous* variable, which changes in the beginning!
5. Which curve shifts in which direction? Use the equations!
6. Shift the curves and determine new equilibrium.
7. Confirm graphical results by computing the multipliers.
8. Compare and conclude.

Equations of the monetary model

(1) $$\bar{y} = \delta(e + p^* - p) + \gamma\bar{y} + g$$

Goods market equilibrium condition

(2) $$m - p = \phi\bar{y} - \lambda R$$

Money market equilibrium condition

(3) $$R = R^*$$

UIP-Condition

Greek letters: positive parameters
All variables except interest rates are in logs.

Why in logs?

(4)
$$\frac{M}{P}$$

Suppose, we want to derive the total differential:

(5)
$$\frac{M}{P} = M \cdot P^{-1}$$

(6)
$$P^{-1} dM + (-1) \cdot MP^{-1-1} \cdot dP = \frac{dM}{P} - \frac{M}{P^2} \cdot dP$$

Writing equation (4) in natural logs: $m - p$. Total differential:

(7)
$$dm - dp$$

Goods market equilibrium condition

$$\bar{y} = \delta(e + p^* - p) + \gamma\bar{y} + g$$

- $(e + p^* - p)$ natural log of the real exchange rate.
- No investment $\Rightarrow$ goods demand does not depend in a negative way on the domestic interest rate.

Greek letters

- δ: delta
- γ: gamma
- ϕ: phi
- λ: lambda

Denotation of the symbols

Endogenous variables:

- p = domestic price level
- e = nominal exchange rate (in a floating exchange rate system)
- R = domestic interest rate

Exogenous variables:

- p^* = foreign price level
- m = nominal money supply
- $\bar{y}$ = domestic output level
- R^* = foreign interest rate
- g = government spending

Important: Domestic output is exogenous $\Rightarrow$ output is capacity constrained!

Goods market equilibrium: Derivation of the IS-curve

(8) $$\bar{y} = \delta(e + p^* - p) + \gamma\bar{y} + g$$

We want to solve equation for the goods price level (p):

(9) $$\delta(e + p^* - p) = \bar{y} - \gamma\bar{y} - g$$

Dividing by δ leads to:

(10) $$e + p^* - p = \frac{(1-\gamma)\bar{y}}{\delta} - \frac{g}{\delta}$$

Isolating p leads to:

(11) $$p = e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$$

Goods market equilibrium: Derivation of the IS-curve

(12) $$p = e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$$

Taking the total differential leads to:

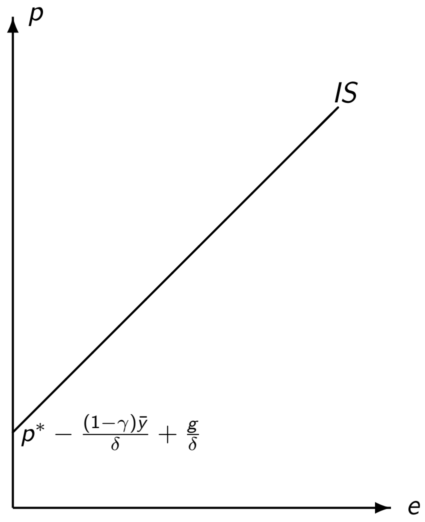
(13) $$dp = de + dp^* - \frac{(1-\gamma)d\bar{y}}{\delta} + \frac{dg}{\delta}$$

We are interested in the ratio dp/de. All other variables are held constant so that their changes are equal to zero:

(14) $$dp = de \qquad \Rightarrow \qquad \frac{dp}{de} = 1 > 0$$

The IS-curve has a positive slope of one!

The IS-curve



Shifts of the IS-curve

$$(12)\quad p = e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$$

- If the foreign price level increases ($p^* \uparrow$), or
- if government spending increases ($g \uparrow$), or
- if the output level decreases ($\bar{y} \downarrow$),

the IS-curve will shift upwards.

- The IS-curve does not shift, if the domestic price level (p) or the nominal foreign exchange rate (e) change, because these variables are displayed on the vertical/horizontal axis!

Money market equilibrium: Derivation of the LM-curve

$$(2)\ \ m - p = \phi\bar{y} - \lambda R \qquad (3)\ \ R = R^*$$

Plugging (3) in (2) yields:

$$(15) \qquad m - p = \phi\bar{y} - \lambda R^*$$

Solving for p leads to:

$$(16) \qquad p = m - \phi\bar{y} + \lambda R^*$$

Money market equilibrium: Derivation of the LM-curve

$$(16) \quad p = m - \phi \bar{y} + \lambda R^*$$

Taking the total differential leads to:

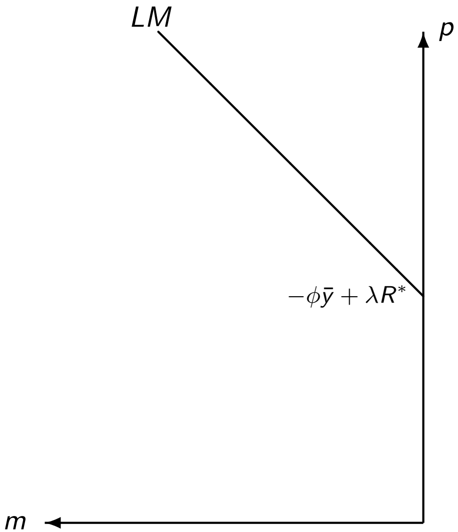
$$(17) \qquad dp = dm - \phi d\bar{y} + \lambda dR^*$$

We are interested in the ratio dp/dm. All other variables are held constant so that their changes are equal to zero:

$$(18) \qquad dp = dm \qquad \Rightarrow \qquad \frac{dp}{dm} = 1 > 0$$

The LM-curve has a positive slope of one!

LM-curve



Shifts of the LM-curve

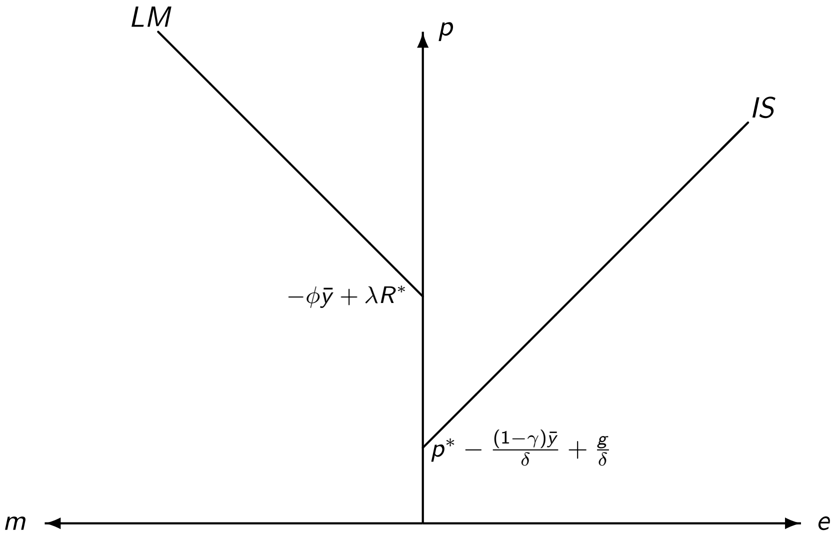
$$(16)\quad p = m - \phi\bar{y} + \lambda R^*$$

- If the foreign interest rate increases ($R^* \uparrow$) or
- if the output level decreases ($\bar{y} \downarrow$),

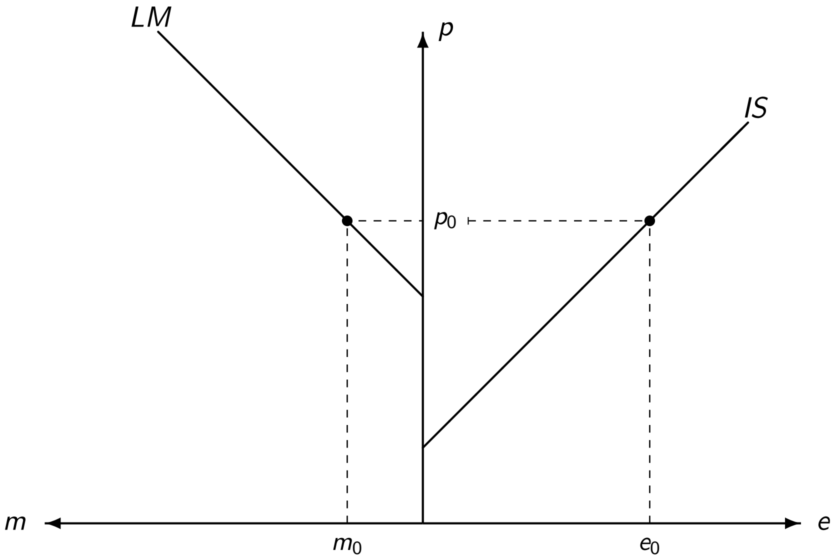
the LM-curve will shift upwards.

- The LM-curve does not shift, if nominal money supply (m) or the domestic price level (p) change, because these variables are displayed on the vertical/horizontal axis!

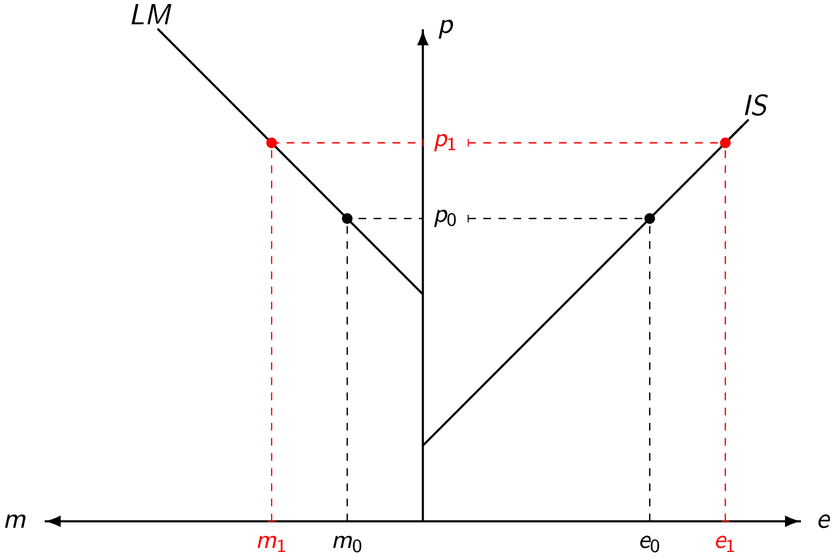
LM- and IS-curve



Equilibrium in the initial situation



Expansionary monetary policy ($m \uparrow$)



Matrix notation

$p = e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$
$p = m - \phi\bar{y} + \lambda R^*$
Writing these expressions a little bit different leads to:
$1 \cdot p - 1 \cdot e = p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$
$1 \cdot p + 0 \cdot e = m - \phi\bar{y} + \lambda R^*$

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} p \\ e \end{bmatrix} = \begin{bmatrix} p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta} \\ m - \phi\bar{y} + \lambda R^* \end{bmatrix} \tag{19}$$

Taking the total differential yields:

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} dp^* - \frac{(1-\gamma)d\bar{y}}{\delta} + \frac{dg}{\delta} \\ dm - \phi d\bar{y} + \lambda dR^* \end{bmatrix} \tag{20}$$

Matrix notation

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} dp^* - \frac{(1-\gamma)d\bar{y}}{\delta} + \frac{dg}{\delta} \\ dm - \phi d\bar{y} + \lambda dR^* \end{bmatrix}$$

- We are interested in the effects of an expansionary monetary policy ($dm > 0$).
- All other variables are kept constant so that their changes are equal to zero!

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} 0 \\ dm \end{bmatrix}$$

Price multiplier of an expansionary monetary policy

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} 0 \\ dm \end{bmatrix}$$

Applying Cramer's rule leads to:

$$dp = \frac{\begin{vmatrix} 0 & -1 \\ dm & 0 \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 0 \end{vmatrix}} = \frac{[0 \cdot 0] - [dm \cdot (-1)]}{[1 \cdot 0] - [1 \cdot (-1)]} = \frac{dm}{1}$$

Hence, we get for the price multiplier:

$$\frac{dp}{dm} = 1 \qquad (21)$$

Exchange rate multiplier of an expansionary monetary policy

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} 0 \\ dm \end{bmatrix}$$

Applying Cramer's rule leads to:

$$de = \frac{\begin{vmatrix} 1 & 0 \\ 1 & dm \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 0 \end{vmatrix}} = \frac{[1 \cdot dm] - [1 \cdot 0]}{[1 \cdot 0] - [1 \cdot (-1)]} = \frac{dm}{1}$$

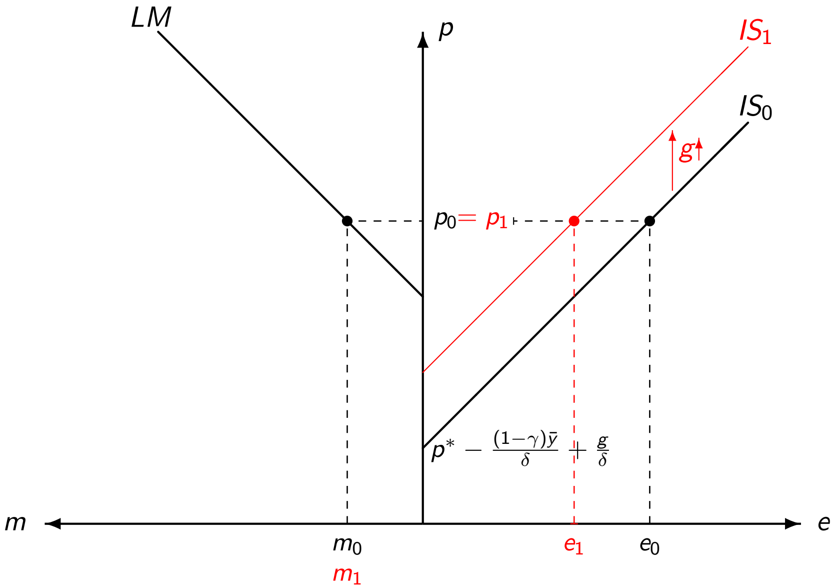
Hence, we get for the exchange rate multiplier:

$$\frac{de}{dm} = 1 \tag{22}$$

Conclusion: Monetary policy

- An increase in the nominal money supply leads to an increase in prices and the nominal exchange rate on a 1:1 basis.
- The real exchange rate is constant.
- Classical dichotomy: Money is neutral.
- Monetary variables do not influence real variables.

Expansionary fiscal policy



Price multiplier of an expansionary fiscal policy

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} \frac{dg}{\delta} \\ 0 \end{bmatrix}$$

Applying Cramer's rule yields:

$$dp = \frac{\begin{vmatrix} \frac{1}{\delta} dg & -1 \\ 0 & 0 \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 0 \end{vmatrix}} = \frac{[\frac{1}{\delta} dg \cdot 0] - [0 \cdot (-1)]}{[1 \cdot 0] - [1 \cdot (-1)]}$$

$$\frac{dp}{dg} = 0 \qquad (23)$$

Exchange rate multiplier of an expansionary fiscal policy

$$\begin{bmatrix} 1 & -1 \\ 1 & 0 \end{bmatrix} \begin{bmatrix} dp \\ de \end{bmatrix} = \begin{bmatrix} \frac{dg}{\delta} \\ 0 \end{bmatrix}$$

Applying once more Cramer's rule:

$$de = \frac{\begin{vmatrix} 1 & \frac{1}{\delta}dg \\ 1 & 0 \end{vmatrix}}{\begin{vmatrix} 1 & -1 \\ 1 & 0 \end{vmatrix}} = \frac{[1 \cdot 0] - [1 \cdot \frac{1}{\delta}dg]}{[1 \cdot 0] - [1 \cdot (-1)]} = \frac{-\frac{1}{\delta}dg}{1}$$

(24)
$$\frac{de}{dg} = -\frac{1}{\delta} < 0$$

Conclusion: Expansionary fiscal policy

- A fiscal expansion does not influence the domestic price level.
- Fiscal expansion decreases nominal exchange rate.
- Domestic currency appreciates in nominal terms ($e \downarrow$).
- Since prices are constant: Nominal appreciation leads to a real appreciation.
- Real exchange rate changes.
- Real appreciation crowds out foreign demand for domestic goods.
- Complete exchange rate induced crowding out effect!

Frequent mistakes

- When it comes to Cramer's Rule: Students use brackets instead of determinant signs ('straight lines')