International Monetary Economics

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Introduction

Chapter 18
Fixed Exchange Rates and Foreign Exchange Intervention

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 ISZZ/LMZZ model

$$(1)\quad Y = c_0 + c_1(Y-T) + b_0 - b_2 R + G + NX_0 - NX_1 Y + NX_2 Y^* + NX_3 \frac{E \cdot P^*}{P}$$

Goods market equilibrium condition

$$(2)\qquad \frac{H+F}{P} = d_0 + d_1 Y - d_2 R$$

Money market equilibrium condition

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

UIP-Condition, complete capital mobility, small country assumption

Parameters

- c_1: Marginal propensity to consume
- b_2: Interest rate responsiveness of investments
- NX_1: Income responsiveness of net exports
- NX_2: Foreign income responsiveness of net exports
- NX_3: Real exchange rate responsiveness of net exports
- d_1: Income responsiveness of real money demand
- d_2: Interest rate responsiveness of real money demand

Variables

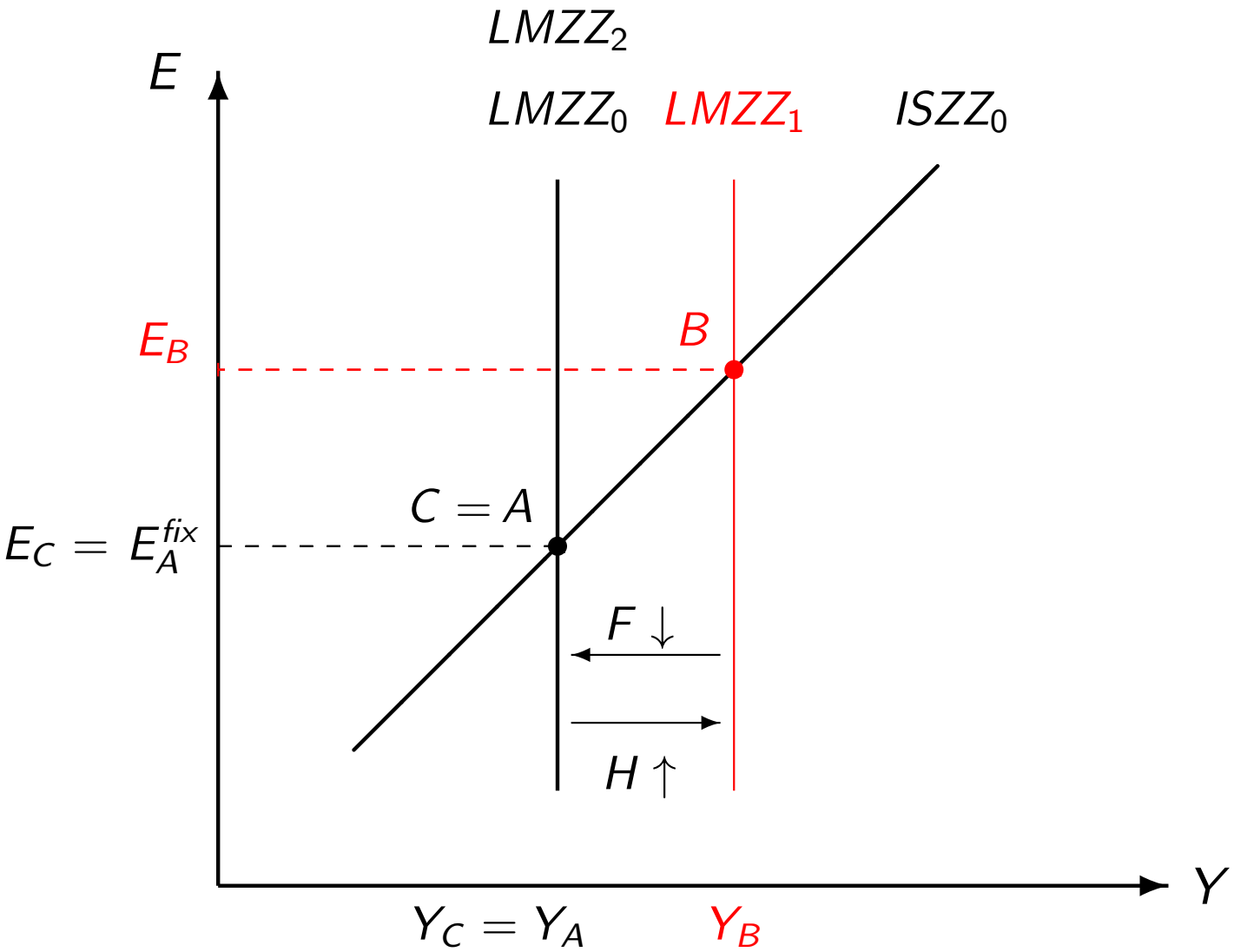
Endogenous variables:

- Y: Domestic GDP-level, Income, Output
- R: Domestic interest rate
- F: Foreign component of money supply (in a fixed exchange rate system)

Exogenous variables:

- E: Nominal exchange rate (in a fixed exchange rate system)
- c_0: Autonomous component of consumption
- b_0: Autonomous component of investments
- NX_0: Autonomous component of net exports
- d_0: Autonomous component of money demand
- T: Taxes
- G: Government expenditures
- H: Domestic component of money supply
- P: Domestic price level
- R^*: Foreign interest rate
- Y^*: Foreign GDP
- P^*: Foreign price level

Expansionary monetary policy ISZZ/LMZZ model



Matrix notation

$$Y = c_0 + c_1(Y - T) + b_0 - b_2 R^* + G + NX_0 - NX_1 Y + NX_2 Y^* + NX_3 \frac{E \cdot P^*}{P}$$

$$\frac{H + F}{P} = d_0 + d_1 Y - d_2 R^*$$

- We want to write the equations in matrix notation and sort the variables in a way that the endogenous variables are collected on the LHS and the exogenous variables are collected on the RHS.
- Furthermore, assume that the domestic and foreign goods price levels are equal to 1 and constant ($\bar{P}^* = \bar{P} = 1$).

$$\begin{aligned} Y - c_1 Y + NX_1 Y &= c_0 - c_1 T + b_0 - b_2 R^* + G + NX_0 + NX_2 Y^* + NX_3 E \\ d_1 Y - F &= H - d_0 + d_2 R^* \end{aligned}$$

Matrix notation

$$\begin{aligned} Y - c_1 Y + NX_1 Y &= c_0 - c_1 T + b_0 - b_2 R^* + G + NX_0 + NX_2 Y^* + NX_3 E \\ d_1 Y - F &= H - d_0 + d_2 R^* \end{aligned}$$

In matrix notation:

$$\begin{bmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{bmatrix} \begin{bmatrix} Y \\ F \end{bmatrix} = \begin{bmatrix} c_0 - c_1 T + b_0 - b_2 R^* + G + NX_0 + NX_2 Y^* + NX_3 E \\ H - d_0 + d_2 R^* \end{bmatrix}$$

Taking the total differential yields:

$$\begin{bmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{bmatrix} \begin{bmatrix} dY \\ dF \end{bmatrix} = \begin{bmatrix} dc_0 - c_1 dT + db_0 - b_2 dR^* + dG + dNX_0 + NX_2 dY^* - NX_3 dE \\ dH - dd_0 + d_2 dR^* \end{bmatrix}$$

The income multiplier of an expansionary monetary policy in a fixed exchange rate system: $dY/dH = 0$?

$$\begin{bmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{bmatrix} \begin{bmatrix} dY \\ dF \end{bmatrix} = \begin{bmatrix} 0 \\ dH \end{bmatrix}$$

$$dY = \frac{\begin{vmatrix} 0 & 0 \\ dH & -1 \end{vmatrix}}{\begin{vmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{vmatrix}} = \frac{0 \cdot (-1) - dH \cdot 0}{(1 - c_1 + NX_1) \cdot (-1) - d_1 \cdot 0}$$

$$\frac{dY}{dH} = 0$$

The reserve multiplier of an expansionary monetary policy in a fixed exchange rate system: $dF/dH = -1$?

$$\begin{bmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{bmatrix} \begin{bmatrix} dY \\ dF \end{bmatrix} = \begin{bmatrix} 0 \\ dH \end{bmatrix}$$

$$dF = \frac{\begin{vmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & dH \end{vmatrix}}{\begin{vmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{vmatrix}} = \frac{(1 - c_1 + NX_1) \cdot dH - d_1 \cdot 0}{(1 - c_1 + NX_1) \cdot (-1) - d_1 \cdot 0}$$

$$\frac{dF}{dH} = \frac{1 - c_1 + NX_1}{-(1 - c_1 + NX_1)} = -1$$

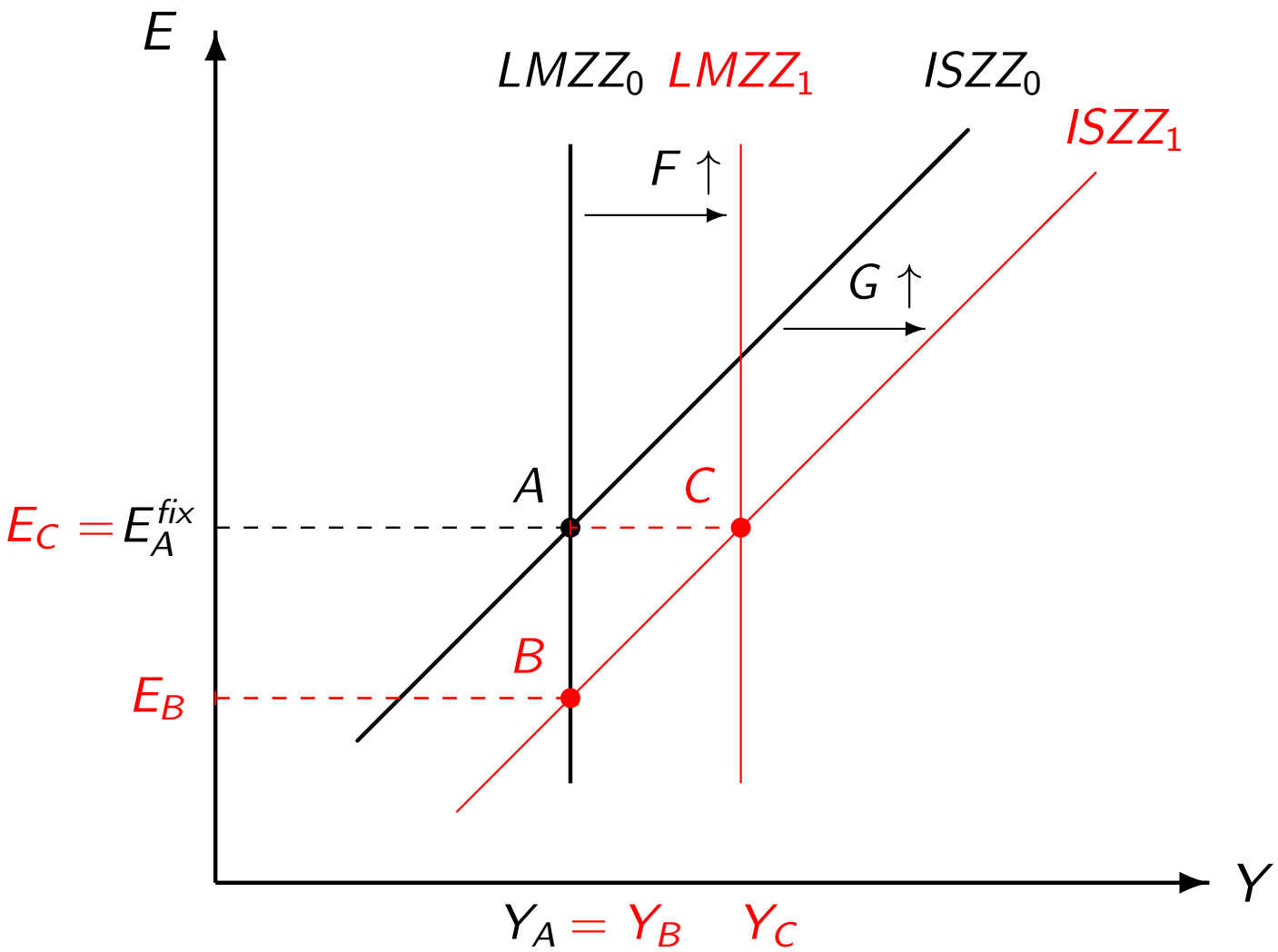
Central bank looses reserves on a 1:1 basis.

Conclusion: Expansionary monetary policy ISZZ/LMZZ model

In a *fixed* exchange rate system

- an increase of the domestic component of money supply leads to a decrease of the reserve component on a 1:1 basis.
- The central bank is not able to influence the *level* of money supply.
- Monetary policy is ineffective in influencing the GDP level and thereby the unemployment rate.

Expansionary fiscal policy ISZZ/LMZZ model



The income multiplier of an expansionary fiscal policy in a fixed exchange rate system: $dY/dG > 0$?

$$\begin{bmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{bmatrix} \begin{bmatrix} dY \\ dF \end{bmatrix} = \begin{bmatrix} dG \\ 0 \end{bmatrix}$$

$$dY = \frac{\begin{vmatrix} dG & 0 \\ 0 & -1 \end{vmatrix}}{\begin{vmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{vmatrix}} = \frac{dG \cdot (-1) - 0 \cdot 0}{(1 - c_1 + NX_1) \cdot (-1) - d_1 \cdot 0}$$

$$\frac{dY}{dG} = \frac{1}{1 - c_1 + NX_1} > 0$$

The reserve multiplier of an expansionary fiscal policy in a fixed exchange rate system: $dF/dG > 0$?

$$dF = \frac{\begin{vmatrix} 1 - c_1 + NX_1 & dG \\ d_1 & 0 \end{vmatrix}}{\begin{vmatrix} 1 - c_1 + NX_1 & 0 \\ d_1 & -1 \end{vmatrix}} = \frac{(1 - c_1 + NX_1) \cdot 0 - d_1 \cdot dG}{(1 - c_1 + NX_1) \cdot (-1) - d_1 \cdot 0}$$

$$\frac{dF}{dG} = \frac{d_1}{1 - c_1 + NX_1} > 0$$

- Central bank has to buy foreign currency & accumulates foreign reserves ($F \uparrow$).
- Domestic currency in circulation increases ($M \uparrow$)!

Conclusion: Expansionary fiscal policy ISZZ/LMZZ model

In a *fixed* exchange rate system an expansionary fiscal policy

- is *very* effective in influencing the GDP level.
- does not lead to an increase of the domestic interest rate so that there is NO interest rate induced crowding out effect on investment.

Equations of the monetary model

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

Goods market equilibrium condition

(5) $$ln(H + F) - p = \phi\bar{y} - \lambda R$$

Money market equilibrium condition

(6) $$R = R^*$$

UIP-Condition

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

Denotation of the symbols

Endogenous variables:

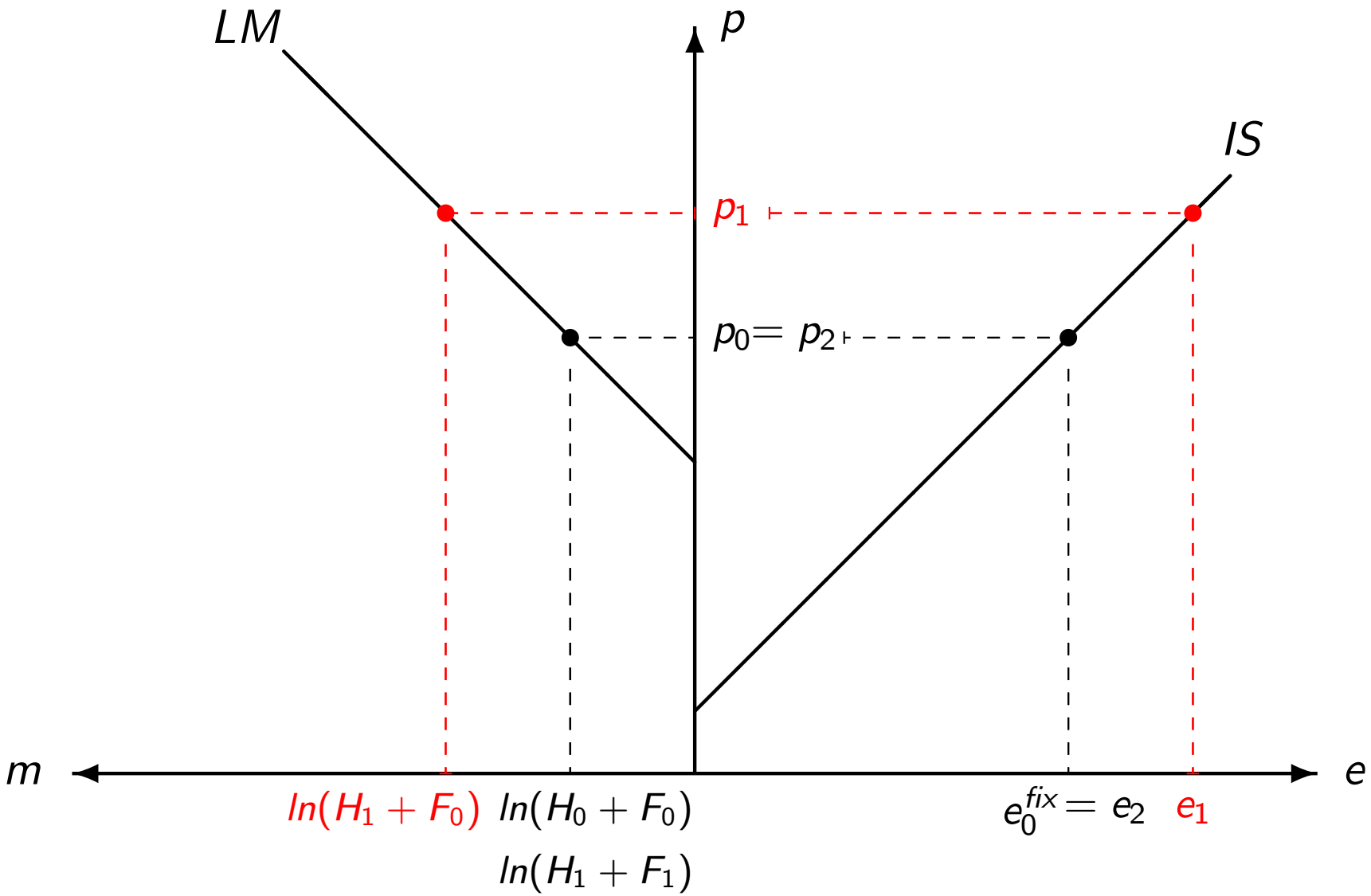
- p = domestic price level
- F = foreign component of money supply (in a fixed exchange rate system)
- R = domestic interest rate

Exogenous variables:

- H = domestic (H=Home) component of money supply
- p^* = foreign price level
- $\bar{y}$ = domestic output level
- R^* = foreign interest rate
- e = nominal exchange rate (in a fixed exchange rate system)

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

Expansionary monetary policy monetary model in a fixed exchange rate system



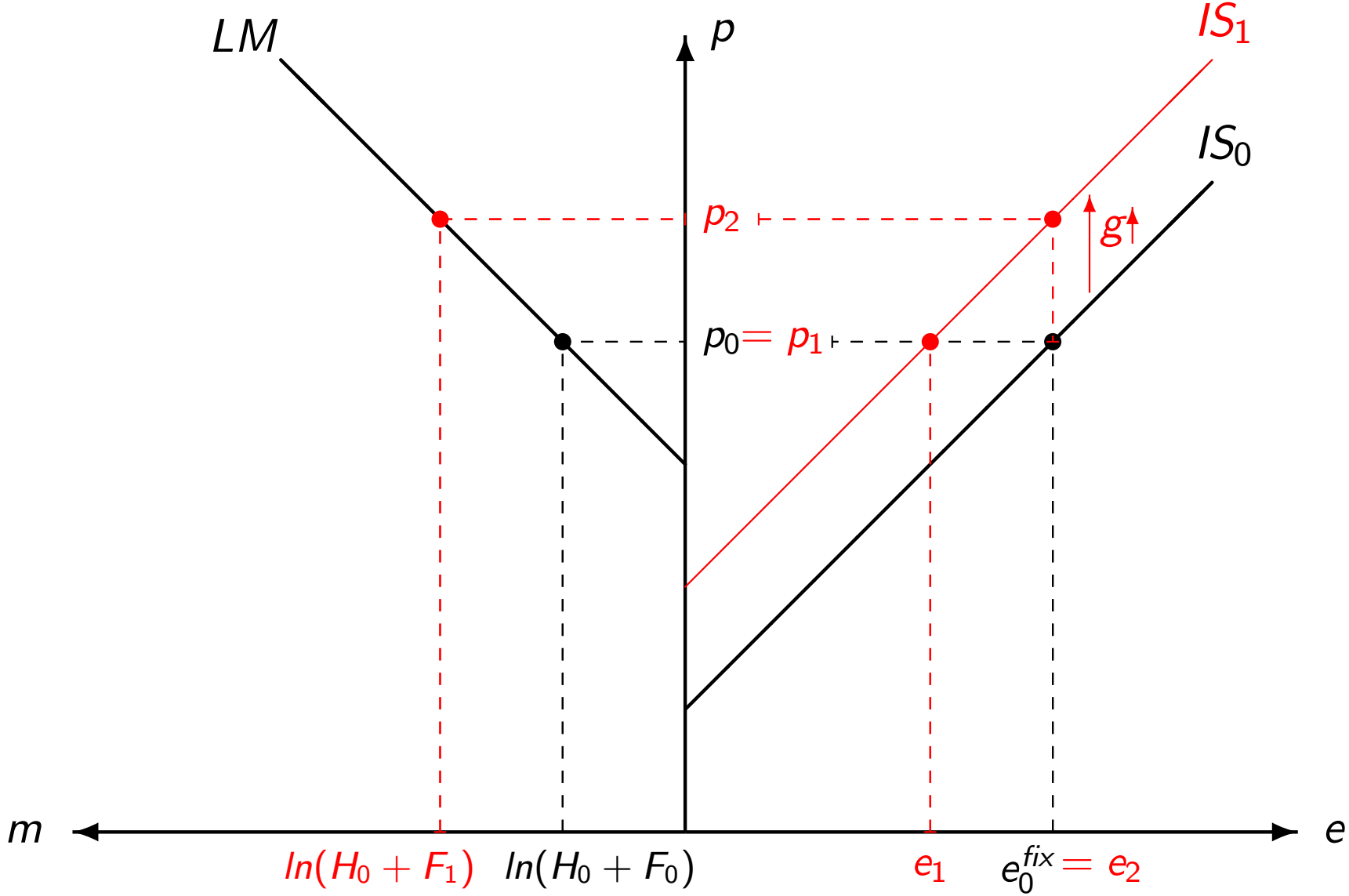
Comparison

The monetary models confirms the results from the ISZZ/LMZZ model:

- Expansionary monetary policy ($H \uparrow$) is neutral, because central bank just looses reserves ($F \downarrow$).

- Can there be a role for monetary policy in a fixed exchange rate system?
- Shocks of the foreign interest rate.
- Shocks in money demand.

Expansionary fiscal policy monetary model in a fixed exchange rate system



Equations of the monetary model

Goods market equilibrium condition

$$\bar{y} = \delta(e + p^* - p) + \gamma\bar{y} + g \tag{7}$$

Money market equilibrium condition

$$ln(H + F) - p = \phi\bar{y} - \lambda R \tag{8}$$

Let's define $ln(H + F) = ln(M) = m$:

$$m - p = \phi\bar{y} - \lambda R \tag{9}$$

UIP-Condition

$$R = R^* \tag{10}$$

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

Denotation of the symbols

Endogenous variables:

- p = domestic price level
- m = nominal money supply (in a fixed exchange rate system)
- R = domestic interest rate

Exogenous variables:

- p^* = foreign price level
- $\bar{y}$ = domestic output level
- R^* = foreign interest rate
- e = nominal exchange rate (in a fixed exchange rate system)

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

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:
$1 \cdot p + 0 \cdot m = e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta}$
$1 \cdot p - 1 \cdot m = -\phi\bar{y} + \lambda R^*$

$$\begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} p \\ m \end{bmatrix} = \begin{bmatrix} e + p^* - \frac{(1-\gamma)\bar{y}}{\delta} + \frac{g}{\delta} \\ -\phi\bar{y} + \lambda R^* \end{bmatrix} \tag{11}$$

Taking the total differential yields:

$$\begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix} \begin{bmatrix} dp \\ dm \end{bmatrix} = \begin{bmatrix} de + dp^* - \frac{(1-\gamma)d\bar{y}}{\delta} + \frac{dg}{\delta} \\ -\phi d\bar{y} + \lambda dR^* \end{bmatrix} \tag{12}$$

Price multiplier of an expansionary fiscal policy

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

Applying Cramer's rule yields:

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

(13)
$$\frac{dp}{dg} = \frac{1}{\delta} > 0$$

Money multiplier of an expansionary fiscal policy

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

Applying once more Cramer's rule:

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

(14)
$$\frac{dm}{dg} = \frac{1}{\delta} > 0$$

Conclusion: Expansionary fiscal policy in the monetary model with fixed exchange rates

In the monetary model with *fixed* exchange rates an expansionary fiscal policy

- is – of course – not able to stimulate output ($dy/dg = 0$)
- leads to an increase of the domestic goods price level and hence, a real appreciation of the domestic currency.
- The government crowds out net export, but not via nominal appreciation, but by an increase of the price level.
- The central bank has to intervene in the foreign exchange market and buys foreign currency. The reserve component increases.