



UNIWERSYTET WARSZAWSKI
Wydział Nauk Ekonomicznych

The Mundell-Fleming model

dr hab. Bartłomiej Rokicki

Chair of Macroeconomics and International Trade Theory

Faculty of Economic Sciences, University of Warsaw



Main assumptions of the model

- Small open economy
- Short term analysis – constant prices and wages
- An extended version of the IS-LM model with balance of payments
- We analyse the impact of macroeconomic policy (fiscal and monetary) on the small open economy under two different exchange rate regimes:
 - Flexible exchange rates
 - Fixed exchange rates



The key equations of the open economy ISLM model

The key equations take the form of:

$$IS: Y = C(Y_d) + I(i) + G + NX(Y, Y^*, q)$$

$$LM: M/P = L(i, Y)$$

where $NX = x_1 Y^* + x_2 q - m_1 Y + m_2 q$

Once we plug the above into the IS equation we get:

$$Y = a + cY_d + \bar{I} - bi + G + x_1 Y^* + x_2 q - m_1 Y + m_2 q$$

$$Y = \frac{1}{1 - c(1 - t) + m_1} [a + \bar{I} - bi + G + x_1 Y^* + qv]$$

where $v = x_2 + m_2$ is the real exchange rate elasticity of net export.



Balance of payments – the BP curve

- We have already shown (e.g. the classical model of the open economy) that the balance of payments equals:

$$BP = (I - S) + NX = KA + CA = 0$$

with $CA = NX = xY^* - mY + qv$ and $KA = K(i - i^*)$

where K stays for the degree of international mobility of capital

- Plugging the above into equation of the balance of payments and solving for i we receive the BP curve equation:

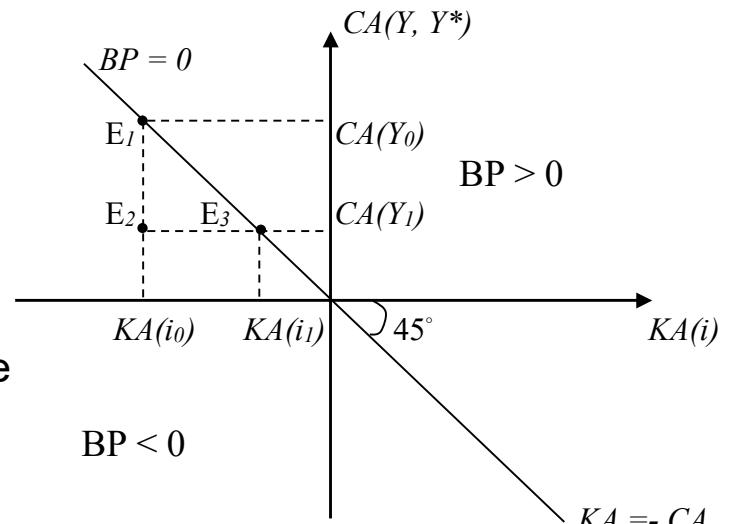
$$BP: \quad i = i^* - (xY^* - mY + qv)/K$$

Balance of payments and the relation between CA and KA

- All points on the right hand side of the BP curve show the balance of payments surplus (since $CA + KA > 0$).
- All points on the left hand side of the BP curve show the balance of payments deficit (since $CA + KA < 0$).
- The logic of the relation between the CA and the KA is the following:

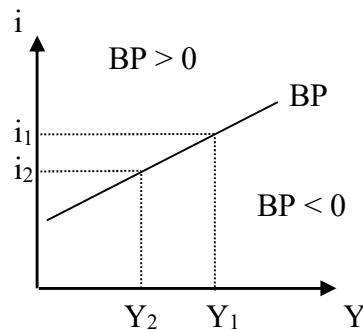
Starting at point E_1 (where the income and the interest rate equal Y_0 and i_0 respectively) we may see that an increase in domestic income to Y_1 will lead to a fall of current account balance (import increases).

Hence, we move to the point E_2 . Here, there is a balance of payments deficit that must be compensated by an increased capital inflow. So the interest rate increases from i_0 to i_1 , which leads to a decrease in the KA deficit. As a result we move from E_2 to E_3 .



The BP curve in the ISLM framework

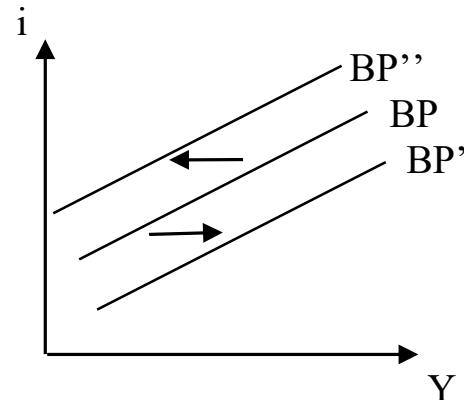
- Below we show the BP curve in the ISLM framework.
- The BP curve depicts different combinations of income and interest rate that assure the balance of payment equilibrium.
- The points below the BP curve refer to the balance of payments deficit (e.g. an increase of income given constant interest rate will cause a fall in NX-CA).
- By analogy, the points above the BP curve refer to the balance of payments surplus.



The shift of the BP curve

- The BP curve equation implies that it will shift in the ISLM framework once there is a change of Y^* , i^* or q .
- A fall of Y^* and q together with an increase of i^* will shift the BP to the left to BP'' (for a given i the points at BP show now a deficit).
- An increase of Y^* and q together with a fall of i^* will shift the BP to the right to BP' (for a given i the points at BP show now a surplus) .

$$BP: \quad i = i^* - (xY^* - mY + qv)/K$$

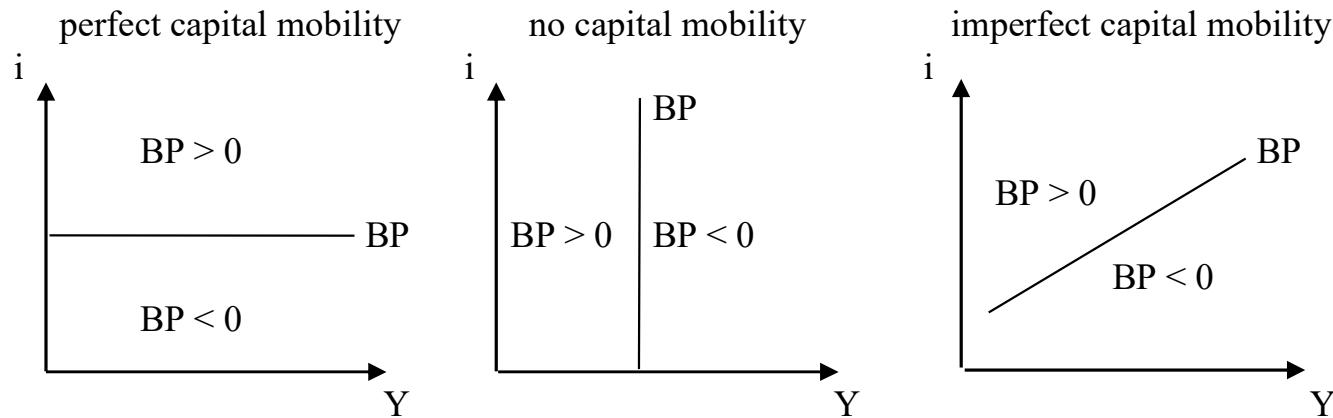


The slope of the BP curve

- The slope of BP curve depends on the international mobility level of capital (parameter K). With perfect capital mobility BP curve is horizontal because:

$$K \Rightarrow \infty \quad \text{and} \quad i = i^*$$

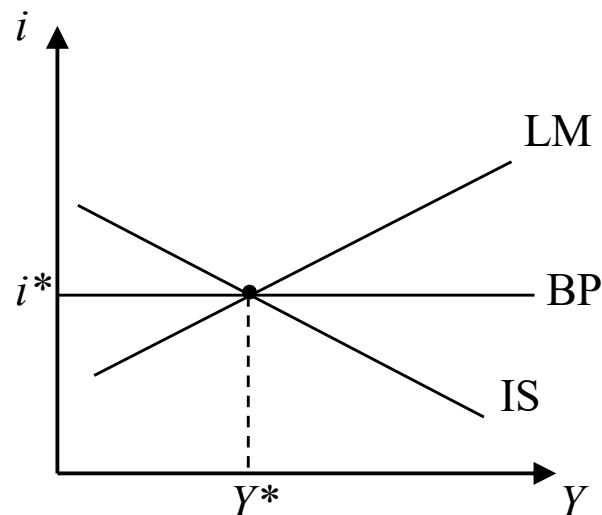
- With no capital mobility $K = 0$, and BP curve is vertical (interest rate do not influence capital flows). Finally, with imperfect capital mobility BP curve is positively sloped.





The equilibrium in the Mundell-Fleming model

- The equilibrium in the model is given by the intersection of all three curves (IS-LM-BP)



Equilibrium in the model with perfect capital mobility

The points below the BP curve mean balance of payments deficit, the points above balance of payments surplus



Internal and external equilibrium

- The Mundell-Fleming model shows that there may be a conflict between internal and external equilibrium.
- External equilibrium means that the balance of payments is balanced.
- Internal equilibrium happens when current production level equals potential one.
- This is clear that all governments will focus on providing internal equilibrium.
- Yet, some measures applied may result ineffective.



Exchange rate regime

- The Mundell-Fleming model shows that the effectiveness of national macroeconomic policy depends on the exchange rate system. This is because in open economy the real exchange rate influence net export and thus income.
- Fully flexible exchange rate regimes – very rarely in practice
- Mostly often, countries choose exchange rate regimes in which exchange rate is somehow controlled by monetary authorities (*managed float, dirty float, fixed exchange rate, pegged exchange rate*)
- Macroeconomic policy problem: links between monetary and exchange rate policy
- Regional integration initiatives, sometimes include monetary integration (fixed exchange rates or even common currency)



Fixed exchange rates versus flexible exchange rates

Fixed exchange rates

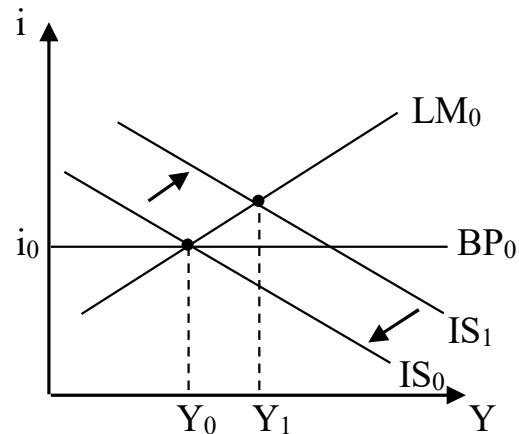
- Within this system central bank keeps the price of national currency stable by buying or selling foreign currencies. As consequence, the balance of payments curve is fixed. The only exception is once the central bank decides to roughly devalue or revalue national currency.
- It is important to remember that maintenance of fixed exchange rate is possible only in case of having sufficient official reserves. Hence, if a country faces balance of payments deficit in a long term then the central bank will have to eventually devalue national currency.

Flexible exchange rates

- Here, exchange rate may adjust to the changes in national and foreign economic situation. As a result, the BP curve may move upwards or downwards depending on whether there is a appreciation or depreciation of national currency.

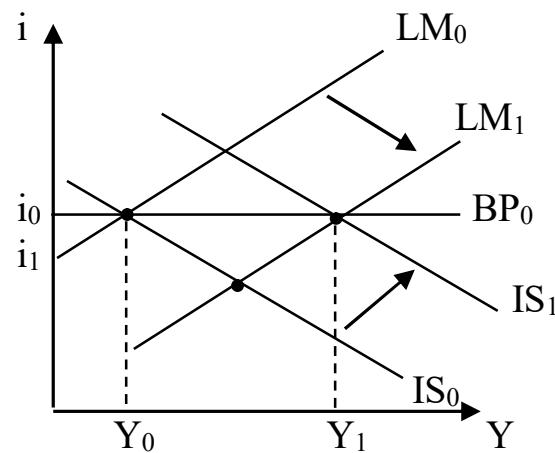
Fiscal policy under flexible exchange rates and perfect capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- As a result, domestic interest rate is higher than international one. So there will be an inflow of capital, BP surplus and appreciation of domestic currency.
- Appreciation leads to an increase in imports and a fall of exports – IS_1 shifts back to IS_0 .
- Final result: constant Y , constant i .
- Conclusion – fiscal policy is ineffective.



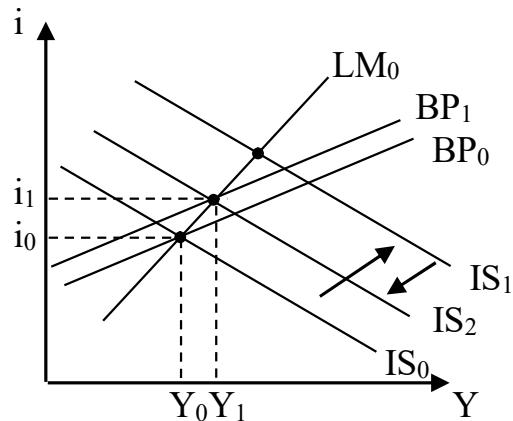
Monetary policy under flexible exchange rates and perfect capital mobility

- Expansionary monetary policy will shift LM to the right – there is an increase in Y and a fall in i .
- As a result there is an outflow of capital (domestic interest rate is lower than international one), balance of payments deficit and a depreciation of domestic currency. Depreciation leads to an increase in exports that shifts IS to IS_1 .
- Final result: higher Y , constant i .
- Conclusion – monetary policy is effective.



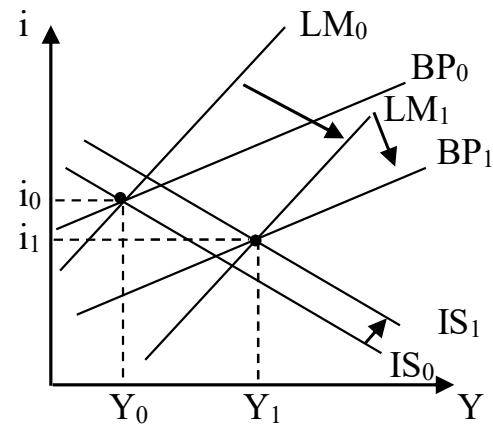
Fiscal policy under flexible exchange rates and imperfect capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- As a result there is a capital inflow, balance of payments surplus and appreciation of domestic currency (q falls).
- Appreciation shifts BP upwards to BP_1 .
- At the same time it harms net exports and shifts IS_1 to IS_2 .
- Final result: higher Y , higher i .
- Conclusion – fiscal policy is not very effective.



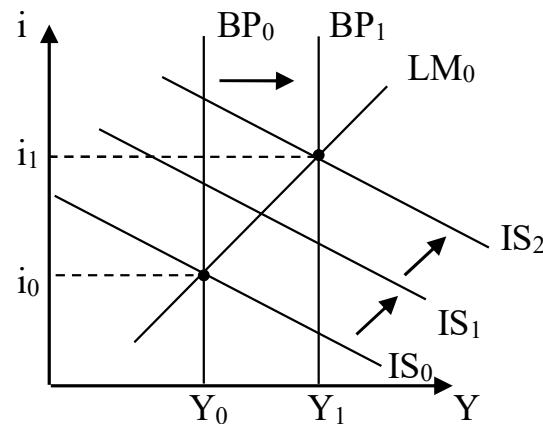
Monetary policy under flexible exchange rates and imperfect capital mobility

- Expansionary monetary policy will shift LM to the right – there is an increase in Y and a fall in i .
- There is a capital outflow, balance of payments deficit and depreciation of domestic currency.
- Depreciation shifts BP_0 down to BP_1 and leads to an increase in net exports.
- As a result IS_0 shifts to IS_1 .
- Final result: higher Y , lower i (although could be either higher or constant).
- Conclusion – monetary policy is effective.



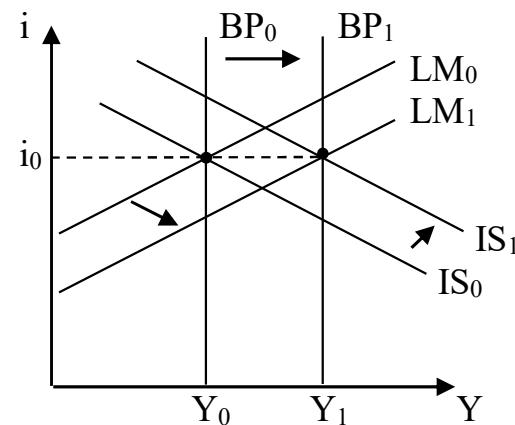
Fiscal policy under flexible exchange rates and no capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- As a result there is a balance of payments deficit (import increases, no capital flows) and depreciation of domestic currency.
- Depreciation shifts BP_0 to BP_1 and leads to an increase in net exports (IS_1 shifts to IS_2).
- Final result: higher Y , higher i .
- Conclusion – fiscal policy is effective.



Monetary policy under flexible exchange rates and no capital mobility

- Expansionary monetary policy will shift LM to the right – there is an increase in Y and a fall in i .
- There is an increase in imports, balance of payments deficit and depreciation of domestic currency.
- Depreciation shifts BP_0 to BP_1 , leads to an increase in net exports and shifts IS_0 to IS_1 .
- Final result: higher Y , constant i .
- Conclusion – monetary policy is effective.





Question 1. Show graphically using the Mundell-Fleming model what impact will have an introduction of import restrictions (that improve net exports exogenously, irrespective of the exchange rate). Assume that we have a flexible exchange rate and a perfect capital mobility. Will the introduction of import restrictions improve net exports in equilibrium, as argued by many politicians? Provide the chart and explain.

Question 2. Suppose that the government of the small open economy with perfect capital mobility and flexible exchange rate increases lump taxes. Please, compare the impact of such a policy on income, private savings, investment, real interest rate, trade balance and real exchange rate in a short and a long run. The answer should be based on the Mundell-Fleming model (short run) and the classical model of the open economy (long run).

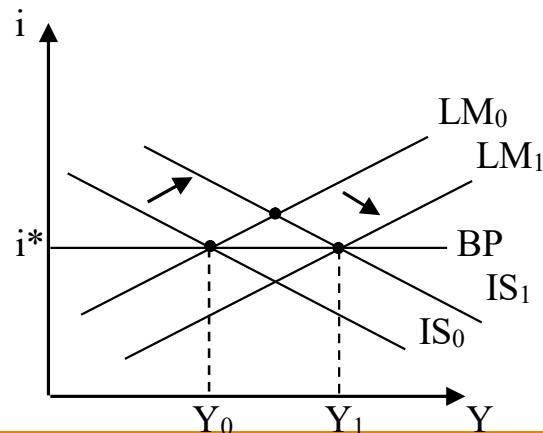


Question 3. Imagine that we have a country with imperfect capital mobility and flexible exchange rate. What will happen with domestic income and interest rate if there is a decrease in foreign interest rate? What will happen with CA and KA? Explain your answer.

Question 4. Assume that the government of a big open economy decides to increase its public spending. How would it influence income and interest rate of the small open economy given that we face perfect capital mobility under the flexible exchange rate regime? What would happen with exchange rate and domestic exports? Explain.

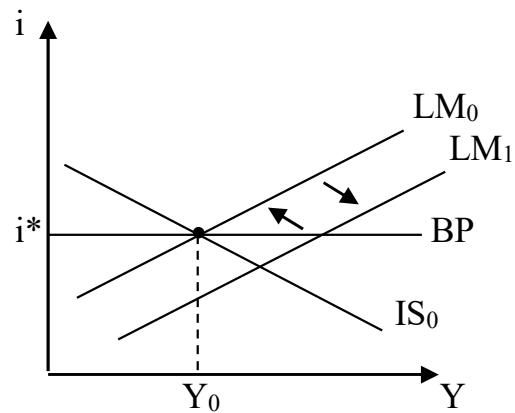
Fiscal policy under fixed exchange rates and perfect capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- As a result of an increase in i there will be a rise in capital inflow and a balance of payments surplus.
- In order to keep the exchange rate fixed (there is a pressure towards appreciation) central bank increases money supply – this shifts LM_0 to the right to LM_1 (there is a further increase in Y and a fall in i).
- Final result: higher Y , constant i .
- Conclusion – fiscal policy is effective.



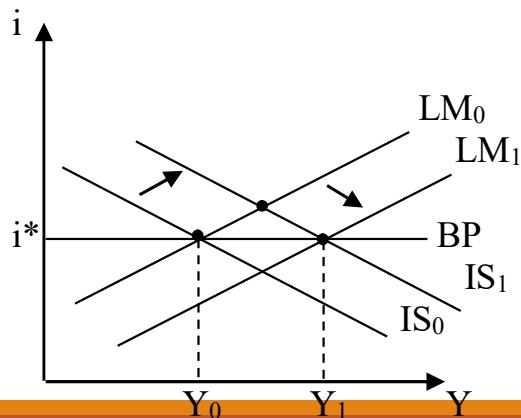
Monetary policy under fixed exchange rates and perfect capital mobility

- Expansionary monetary policy will shift the LM_0 to the right to LM_1 that leads to an increase of Y and a fall of i .
- As a result of a fall in i there will be a decrease in capital inflow and a balance of payments deficit.
- In order to keep the exchange rate fixed (there is a pressure towards depreciation) central bank sells foreign currencies and cuts money supply – this shifts LM_1 back to LM_0 (so Y falls and i increases to the previous level).
- Final result: constant Y , constant i .
- Conclusion – monetary policy is ineffective.



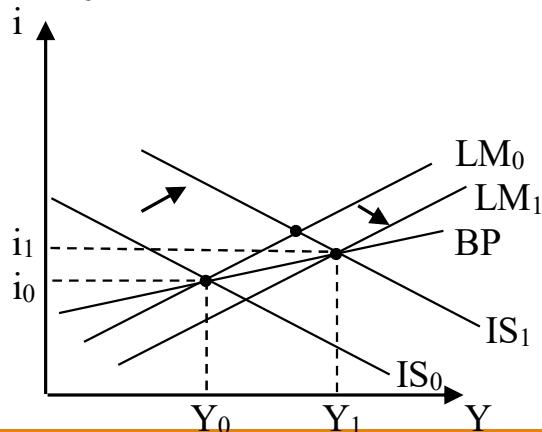
Exchange rate policy under fixed exchange rates and perfect capital mobility

- Devaluation of national currency will shift the IS_0 to the right to IS_1 (since NX increases) that leads to an increase of Y and i .
- As a result of an increase in i there will be a rise in capital inflow and a balance of payments surplus.
- In order to keep the exchange rate fixed after devaluation (there is a pressure towards appreciation) central bank increases money supply – this shifts LM_0 to the right to LM_1 (there is a further increase in Y and a fall in i).
- Final result: higher Y , constant i .
- Conclusion – exchange rate policy (devaluation) is effective.



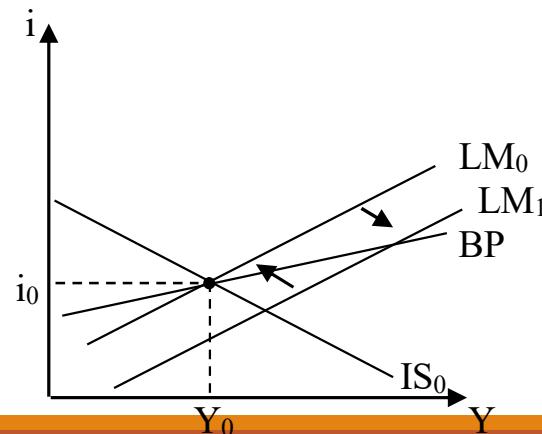
Fiscal policy under fixed exchange rates and imperfect capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- As a result of an increase in i there will be a rise in capital inflow and a balance of payments surplus.
- In order to keep the exchange rate fixed (there is a pressure towards appreciation) central bank increases money supply – this shifts LM_0 to the right to LM_1 (there is a further increase in Y and a fall in i).
- Final result: higher Y , higher i .
- Conclusion – fiscal policy is effective.



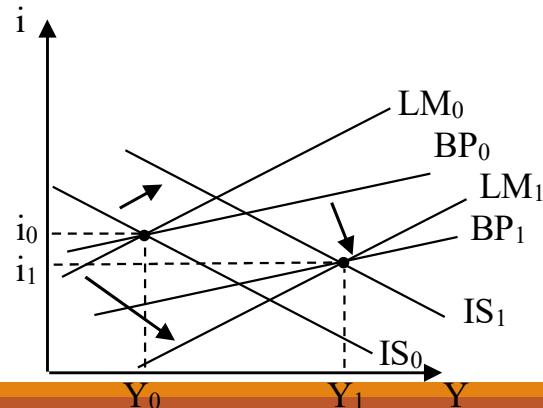
Monetary policy under fixed exchange rates and imperfect capital mobility

- Expansionary monetary policy will shift the LM_0 to the right to LM_1 that leads to an increase of Y and a fall of i .
- As a result of a fall in r there will be a decrease in capital inflow and a balance of payments deficit.
- In order to keep the exchange rate fixed (there is a pressure towards depreciation) central bank sells foreign currencies and cuts money supply – this shifts LM_1 back to LM_0 (so Y falls and i increases to the previous level).
- Final result: constant Y , constant i .
- Conclusion – monetary policy is ineffective.



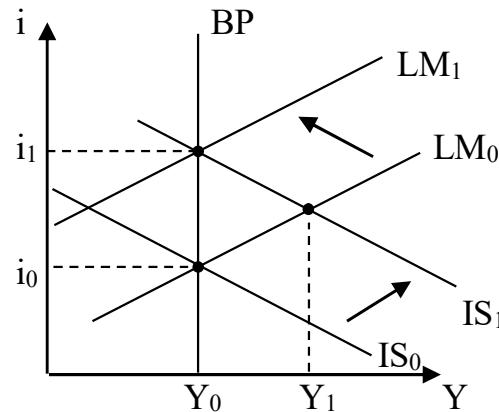
Exchange rate policy under fixed exchange rates and imperfect capital mobility

- Devaluation of national currency will shift the IS_0 to the right to IS_1 (since NX increases) that leads to an increase of Y and i .
- Moreover, BP_0 shifts to BP_1 because of an increase in the real exchange rate.
- As a result of an increase in i there will be a rise in capital inflow and a balance of payments surplus.
- In order to keep the exchange rate fixed after devaluation (there is a pressure towards appreciation) central bank increases money supply – this shifts LM_0 to the right to LM_1 (there is a further increase in Y and a fall in i).
- Final result: higher Y , unknown i (may rise, fall or stay constant).
- Conclusion – exchange rate policy (devaluation) is effective.



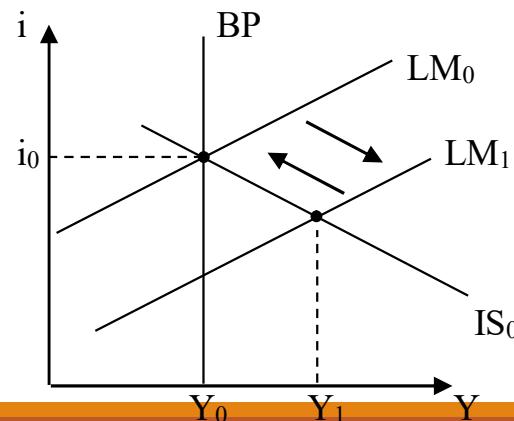
Fiscal policy under fixed exchange rates and no capital mobility

- Expansionary fiscal policy will shift the IS_0 to the right to IS_1 that leads to an increase of Y and i .
- Since there is no capital mobility, an increase in i has no impact on balance of payments. Still, an increase in Y leads to a balance of payments deficit.
- In order to keep the exchange rate fixed (there is a pressure towards depreciation) central bank decreases money supply – this shifts LM_0 to the left to LM_1 (there is a further increase in i and a fall in Y).
- Final result: constant Y , higher i .
- Conclusion – fiscal policy is ineffective.



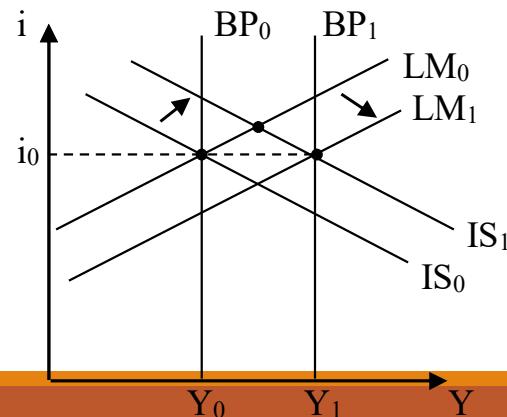
Monetary policy under fixed exchange rates and no capital mobility

- Expansionary monetary policy will shift the LM_0 to the right to LM_1 , that leads to an increase of Y and a fall of i .
- Since there is no capital mobility, an increase in i has no impact on balance of payments. Still, an increase in Y leads to a balance of payments deficit.
- In order to keep the exchange rate fixed (there is a pressure towards depreciation) central bank sells foreign currencies and cuts money supply – this shifts LM_1 back to LM_0 (so Y falls and i increases to the previous level).
- Final result: constant Y , constant i .
- Conclusion – monetary policy is ineffective.



Exchange rate policy under fixed exchange rates and no capital mobility

- Devaluation of national currency will shift the IS_0 to the right to IS_1 (since NX increases) that leads to an increase of Y and i .
- Moreover, BP_0 shifts to BP_1 because of an increase in the real exchange rate.
- In spite of increase in Y , after the shift of BP there is still a balance of payments surplus.
- In order to keep the exchange rate fixed after devaluation (there is a pressure towards appreciation) central bank increases money supply – this shifts LM_0 to the right to LM_1 (there is a further increase in Y and a fall in i).
- Final result: higher Y , constant i .
- Conclusion – exchange rate policy (devaluation) is effective.





Question 5. The small economy of Rokitkowo, due to outstanding economic policy run by president Rokitek stays at full employment. After another sleepless night, president Rokitek has decided to change the structure of demand in order to increase investment. What should be the mix of fiscal and monetary policy if there is no international mobility of capital and the economy has fixed exchange rates. Show your results drawing the necessary diagram.

Question 6. What will be the impact of revaluation of domestic currency on output if we have an economy with imperfect capital mobility and fixed exchange rates? Would be the impact larger if we had a perfect capital mobility in this case?



Question 7. Imagine that these days Germany, the biggest trade partner of Poland, is suffering from a deep economic slowdown. How would it influence Polish economy if we entered the ERM2 mechanism and we had to maintain the fixed exchange rates (there is an imperfect capital mobility)? What about CA and KA?

Show the necessary diagram and provide the written justification.

Question 8. The ungrateful citizens of Rokitkowo have decided to elect Mr. Lazyman as a new president. Very quickly, due to new government policies the public debt increased dramatically and there was a necessity to cut public spending sharply. How would it influence the economy of Rokitkowo if, for some reasons, Rokitkowo was forced to keep fixed exchange rates? Assume that we start from an equilibrium and there is an imperfect capital mobility. What about CA and KA?



Question 9. Applying the Mundell-Fleming model analyse the impact on domestic income, interest rate, CA and KA of the following events:

- (a) a fall of foreign interest rate;
- (b) a fall of foreign income.

Provide an analysis for two different countries:

- country A with fixed exchange rate and imperfect capital mobility
- country B with flexible exchange rate and perfect capital mobility

Question 10. Applying the Mundell-Fleming model analyse the impact on domestic income, interest rate, CA and KA of the following events:

- (a) an increase of foreign interest rate;
- (b) a fall of foreign demand on domestic goods.

Provide an analysis for two different countries:

- country A with fixed exchange rate and perfect capital mobility
- country B with flexible exchange rate and imperfect capital mobility