

Lecture 10: The Open Economy IS-LM Model

I. OVERVIEW

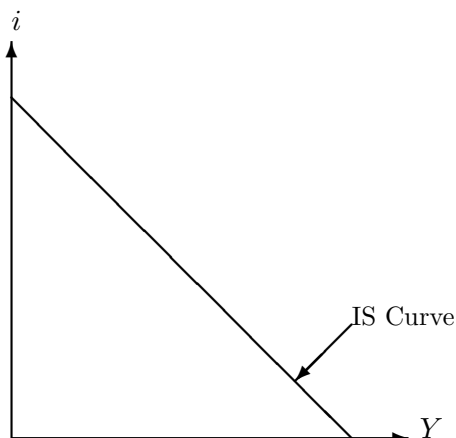
- In the last two lectures, we developed the IS-LM model for a closed economy. In the next 3 lectures, we develop the IS-LM model for an open economy and use it to analyze the impact of fiscal and monetary policy under different exchange rate systems.
- In today's lecture, we discuss how incorporating open economy features change the description of the IS curve and the LM curve presented in the last two days.
- We will then analyze the equilibrium of the model and discuss how to model the impact of changes in fiscal and monetary policy, and also discuss how the impact of policies depends on the choice of exchange rate system.

II. THE IS CURVE IN AN OPEN ECONOMY

- The IS curve still is a relationship between interest rates and output in the short run. The basic equation for the IS curve in an open economy is closely related to the national income accounting identity $Y = C + I + G + NX$, where Y is GDP.
- The relationships for C, I and G are identical to the closed economy case, but we need to specify an additional relationship for the open economy case.
- Net Exports (NX) are assumed to depend on 3 things: income in the domestic economy (Y), income in the rest of the world (Y^*) and the real exchange rate (R). The relationship can be summarized by the following equation $NX = NX(Y, Y^*, R)$.
- In general, we specify that net exports decrease when domestic income increases, increase when foreign income increases and increase when the real exchange rate depreciates and vice versa.
- Why does the NX relationship make sense? Richer countries are likely to consume more goods, and also a greater variety of goods, thus are likely to have more imports. Net exports are assumed to be negatively related to domestic income.
- Applying a similar argument to foreign countries implies that the domestic economy is likely to export more when income in the rest of the world is high. So NX is positively related to income in the rest of the world.
- Finally net exports are positively related to the real exchange rate. Recall that we defined the real exchange rate as the relative price of foreign goods.

$$R = \frac{\$/\text{foreign currency} * \text{foreign currency price of foreign goods}}{\$ \text{ price of domestic goods}} = \frac{\$ \text{ price of foreign goods}}{\$ \text{ price of domestic goods}}$$

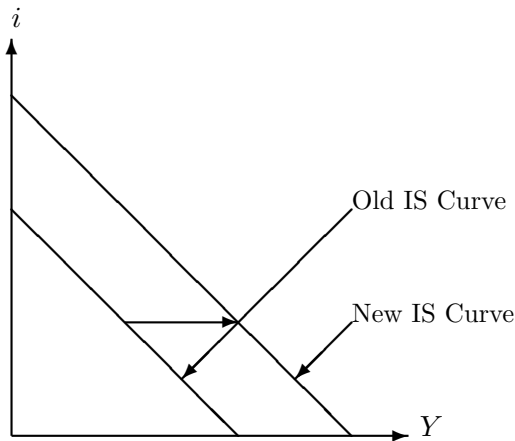
- An increase in R , a real exchange rate depreciation, increases the relative price of foreign goods, reducing imports and increasing exports. Therefore NX is positively related to the real exchange rate.
- The IS curve should continue to have a negative slope: when interest rates are high, investment falls and therefore Y must fall as well.



- In addition to changes described earlier, changes in foreign output or the real exchange rate that affect NX cause the IS curve to shift. In particular.
 1. Increases in output in the rest of the world (Y^*) raise exports and therefore increase expenditure on and production of domestic goods and services. This shifts the IS curve out. Reductions in output in the rest of the world reduce exports and expenditure on domestic goods and services, therefore shifting the IS curve in.
 2. Depreciation of the real exchange rate (an increase in R) makes foreign goods relatively more expensive and therefore increases expenditure on domestic goods and services. This helps increase net exports and therefore shifts the IS curve out. Appreciation of the real exchange rate, by making domestic goods more expensive will shift the IS curve in.
- Real exchange rate depreciation can be brought about by either nominal exchange rate depreciation, higher foreign inflation or lower domestic inflation.
- Conversely, real exchange rate appreciation can be brought about by either nominal exchange rate appreciation, lower foreign inflation or higher domestic inflation.
- A couple of graphical examples are provided below.

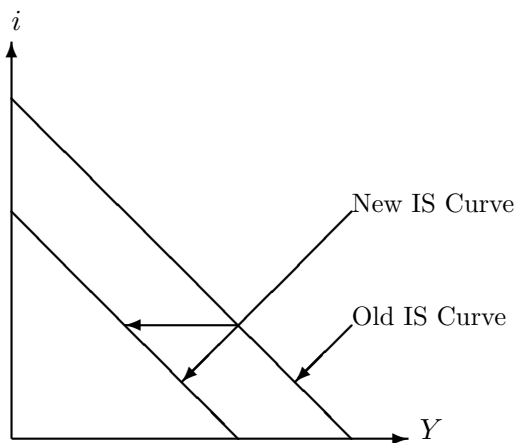
EXAMPLE 1

- A depreciation of the real exchange rate will raise exports, and therefore production, of domestic goods and services. This will cause the IS curve to shift outwards.



EXAMPLE 2

- Lower GDP in foreign countries will lower exports, and therefore production, of domestic goods and services. This will cause the IS curve to shift inwards.



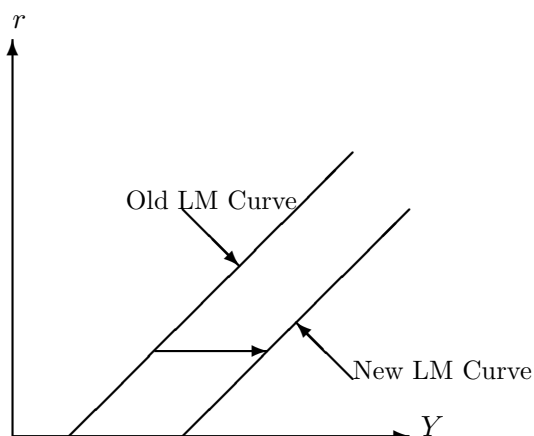
III. THE LM CURVE IN AN OPEN ECONOMY

- The analysis of the LM curve in an open economy is not very different from the closed economy case. As before, we can express the demand for money, as a function of the interest rate i , income Y , price P and exogenous factors μ and that the supply of money is set exogenously by the Federal Reserve.
- As in the closed economy case, the Fed can and does change the money supply by buying and selling bonds. In the open economy, we also have to consider one other reason for change in the money supply. The central bank will also change the money supply whenever it exchanges domestic and foreign currency.

- When the central bank hands out domestic currency in exchange for foreign currency it increases the domestic money supply: the LM curve shifts out.
- When the central bank hands out foreign currency in exchange for domestic currency, it decreases the amount of domestic currency in circulation: the LM curve shifts in.
- Note that under flexible exchange rates there is no change in the money supply when domestic and foreign currencies are exchanged. That is because the transactions in the f/x market only result in domestic and foreign money changing hands, there is no overall increase or decrease in the money supply, just a change in who has domestic currency and who has foreign currency.

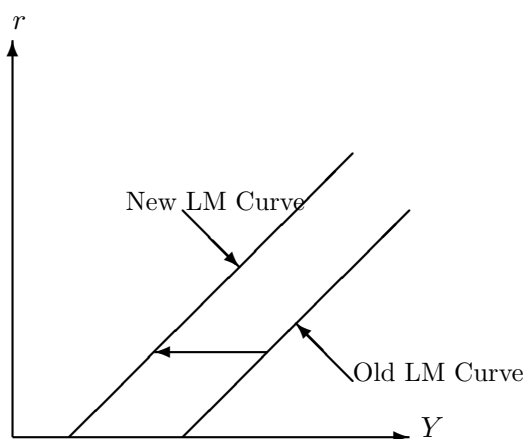
Example 1: CB exchanges domestic money for foreign money

- When the central bank takes in foreign currency and hands out domestic currency in exchange for it the money supply increases - LM shifts out



Example 2: CB exchanges foreign money for domestic money

- When the central bank takes in domestic currency and hands out foreign currency in exchange for it the money supply decreases - LM shifts in

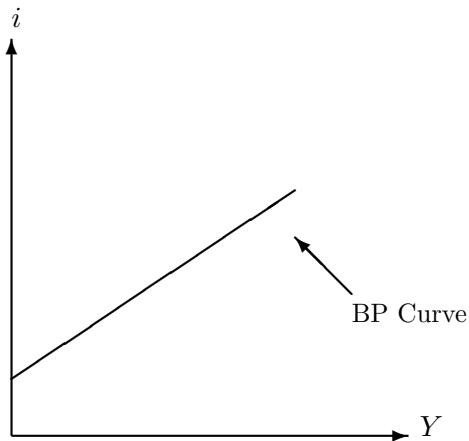


IV. THE BP CURVE

- In a closed economy case we did not have to concern ourselves with what was happening in the rest of the world in performing our analysis.
- For instance, an increase in government purchases would shift the IS curve out and raise domestic interest rates and output, while an increase in the money supply would shift the LM curve out, lowering interest rates and raising output. These changes in Y and i would be independent of, and have no effect on, events in the rest of the world.
- In an open economy, things get a little more complicated because we have to be concerned about the balance of payments. Even though the initial impact of changes in fiscal and monetary policy on the IS and LM curves are the same, these changes also have an additional impact on the Balance of Payments through changes in the interest rate and GDP.
- We need to account for these changes as well since in the open economy equilibrium not only will goods market balance and money market balance have to hold but the Balance of Payments Accounts must balance as well!
- The BP curve denotes all the combinations of i and Y for which $CA+KA=0$. In other words where BOP, defined as the sum of the current and capital account, equals zero.
- We can specify the following relationship for the BP curve.

$$0 = CA(Y, Y^*, R) + KA \left(i, i^*, \frac{e^E - e}{e} \right)$$

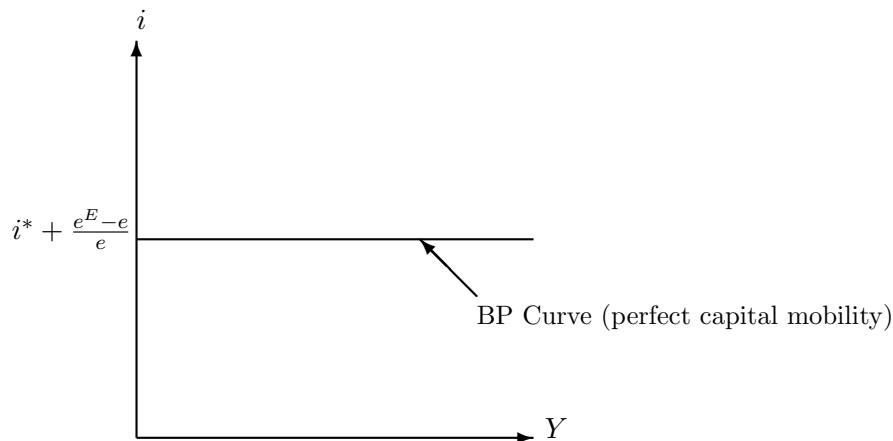
- Note that the current account is positively related to foreign GDP (Y^*) (because higher GDP in foreign countries will result in them buying more goods from us), negatively related to domestic GDP (Y) (because higher domestic GDP results in an increase in imports) and positively related to the real exchange rate (R) (because a real depreciation raises the relative price of foreign goods bringing about an improvement in the trade balance).
- The capital account is positively related to domestic interest rates (i) (because higher domestic interest rates will result in a capital inflow), negatively related to foreign interest rates (i^*) (because higher foreign interest rates results in a capital outflow) and negatively related to the expected depreciation of the domestic currency ($\frac{e^E - e}{e}$) (because an increase in the expected depreciation of the domestic currency will increase the return from investing abroad causing a capital outflow).
- We would expect the BP curve to have a positive slope - higher Y will lead to a CA deficit, which in turn requires a higher i to generate a counterbalancing KA surplus.
- Graphically, we can draw the BP curve as



- We can make the BP curve even easier to understand by assuming perfect capital mobility. Perfect capital mobility implies that money is free to move to and from the country without any restrictions. This is increasingly becoming the norm in the world today, so it is good to use it as the standard assumption. Later on in the semester, I will relax this assumption and consider the case of imperfect capital mobility.
- Under the assumption of perfect capital mobility, the capital account will dominate the BOP - since large sums of money can be moved very quickly and very easily, far more easily than goods can, in the short run, the BOP adjustment will be driven much more by the capital account than by the current account.
- In other words, changes in Y (which affect the current account) are not as important as changes in i (which affect the capital account) - the BP line will be horizontal at the value of i that brings about $CA + KA = 0$. What is that value of i ? We know that the value of i has to satisfy UIRP. In other words, the BP line simply is a horizontal line at the domestic interest rate which happens to satisfy the UIRP condition

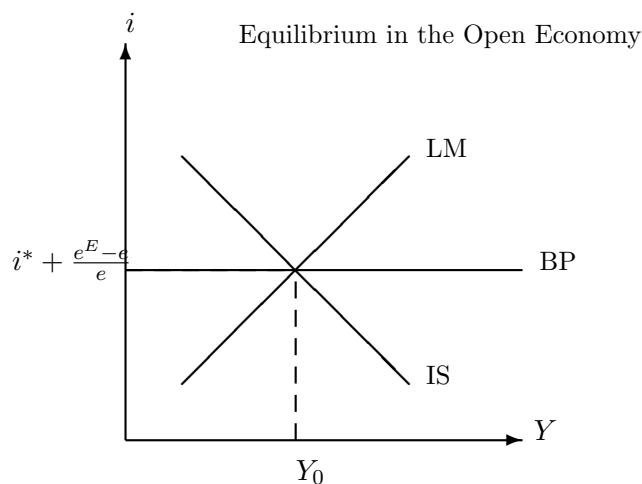
$$i = i^* + \frac{e^E - e}{e}$$

- Graphically, we can draw the BP curve under perfect capital mobility as



V. THE COMPLETE OPEN ECONOMY IS-LM MODEL

- Putting it all together, we see that in the open economy the short run equilibrium will have to be at the point where IS, LM and BP all intersect one another.

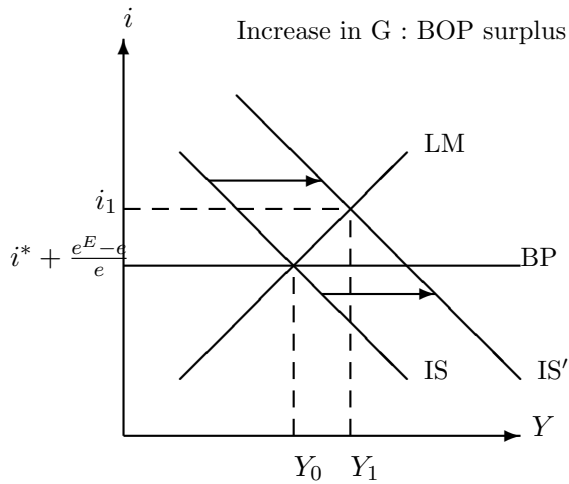


- In an open economy we have to not only account for the closed economy changes but we also must take into account that

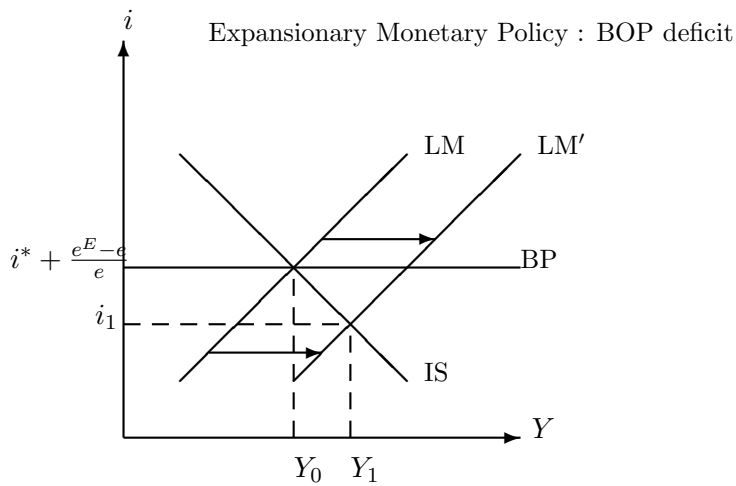
$$i = i^* + \frac{e^E - e}{e}$$

at equilibrium. In other words, the open economy equilibrium is much more complicated than the closed economy equilibrium.

- For example, consider an increase in government purchases which will shift out the IS curve and result in an increase in the domestic interest rate. In a closed economy setting, this would be the only impact of the fiscal policy. In an open economy setting, this increase in interest rates will result in a BOP surplus since $i > i^* + \frac{e^E - e}{e}$, which will bring about an inflow of money into the country (a KA surplus). Thus the economy will not be in equilibrium at i_1, Y_1 and further changes will have to occur.



- Similarly, consider an increase in the money supply which will shift out the LM curve and result in a decrease of the domestic interest rate. In a closed economy setting, this would be the only impact of the monetary policy. In an open economy setting, this decrease in interest rates will result in a BOP deficit since $i < i^* + \frac{e^E - e}{e}$, and bring about an outflow of money from the country. Thus the economy will not be in equilibrium at i_1, Y_1 and further changes will have to occur.



- The impact (and type) of these further changes depend on the exchange rate system that the country has as well as on the size of the country. We will examine these changes in the next couple of classes, first for flexible exchange rates and then for fixed exchange rates.