~~EC201 Intermediate Macroeconomics~~

~~Lecture 25-26~~: Fiscal and Monetary Policy in Open Economies: the Mundell-Fleming Model

Lecture Outline:

- Fiscal and Monetary policy in a small open economy;
- Flexible and Fixed Exchange Rates;

Essential reading:

Mankiw: Ch. 12

Introduction

The Mundell-Fleming model is an IS-LM model developed for the case of an open economy. In this particular lecture note we will consider only the case of a small-open economy. However, the analysis can be easily generalised to the case where a particular country is not a small-open economy (like a large open economy).

We make two main assumptions to derive our model:

1) Perfect Capital Mobility: there are no restrictions on international trade in assets. Furthermore, domestic and international bonds are perfect substitutes. This means that they have the same features in terms of risk, maturity etc. etc.

2) Small-open economy definition: a small-open economy is an economy that is too small to affect the world prices of any good. This implies that the trade volume is too small compared to the international level. Furthermore, since a small-open economy cannot affect the world prices, it cannot affect also the world interest rate.

Assumption 1) implies that in the domestic country it must be true that: $r = r^*$, where r is the interest rate in the domestic economy while r^* is the world interest rate (the interest rate prevailing in the international market of assets). Assumption 2) implies that a small-open economy takes the world interest rate as given (= exogenous).

In our model we consider only the real interest rate, meaning that we do not consider changes in prices. Therefore, in the Mundell-Fleming model **we take the prices as fixed** as in the classical IS-LM model. Therefore, our model should be considered a short-run model. Since the prices are fixed (in the domestic economy and also in the international markets), the nominal exchange rate moves in the same direction as the real exchange rate.

$$\varepsilon = \frac{eP}{P^*}$$

$\frac{P}{P^*}$ is a constant in our model, therefore a change in e will change ε proportionally.

This implies that we can write the Net Exports as a function of the nominal exchange rate instead of the real exchange rate: $NX(e)$, with $\frac{dNX(e)}{de} < 0$, an increase (*decrease*) in the nominal exchange rate will decrease (*increase*) the Trade Balance.

The Mundell-Fleming Model

We use an IS-LM model where now we have an extra term in the IS curve that is given by $NX(e)$. Differently from the standard IS-LM model that was derived in the *(r-Y)-space*, the Mundell-Fleming model is derived in the *(e-Y) space*. The reason is given by assumptions 1) and 2) made before. Under those assumptions the domestic interest rate (r) is always equal to the world interest rate (r^*), therefore it cannot be determined in the domestic country. This means that we consider the domestic interest rate as given in our analysis. The first building block is given by the IS curve in an open economy. We denote the IS curve in an open economy as IS^* to make it different from the IS curve derived in a closed economy. The main ingredients of this open economy IS curve are:

Real Interest Rate: $r = r^*$

Consumption function: $C = C(Y - T)$

Investment function: $I = I(r^*)$

Government expenditure exogenous: G

Net Exports function: $NX(e)$

The National Identity in an open economy gives us:

$$Y = C + I + G + NX$$

Using the function defined above into that we obtain:

$$Y = C(Y - T) + I(r^*) + G + NX(e) \qquad 1)$$

Equation 1) implicitly defines a relationship between the nominal exchange rate and the level of Real Income in the goods market (implicitly because we are working with general functional form, for example we do not know explicitly the consumption function or the net exports function). Equation 1) gives us implicitly the IS^* for a small open economy when there is perfect capital mobility. What is the relationship between *e* and *Y* implied by 1)? Negative or positive? We know it is going to be

negative since an increase in *e* (an appreciation of the domestic currency compared to the currency of the rest of the world) will decrease NX and therefore Y will decrease. Mathematically, we can see that by implicitly differentiate equation 1). Rewrite that equation as:

$$Y - C(Y - T) - I(r^*) - G - NX(e) \equiv F(Y, e) = 0$$

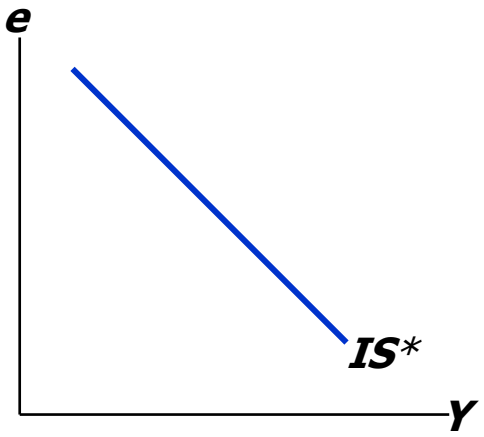
$$\frac{\partial e}{\partial Y} \equiv -\frac{F_Y}{F_e} = -\frac{1 - \frac{\partial C}{\partial Y}}{-\frac{dNX(e)}{de}} \qquad 2)$$

Notice that $\frac{\partial C}{\partial Y}$ is the marginal propensity to consume that by assumption is positive and less than 1. Therefore the denominator of 2) is positive.

We know that $\frac{\partial NX(e)}{\partial e} < 0$, therefore $-\frac{\partial NX(e)}{\partial e} > 0$. The denominator of 2) is positive. Given those facts the derivative in 2) is negative and therefore equation 1) implies a negative relationship between *e* and *Y*.

The IS* tells us all the combinations of *Y* and *e* that make the goods market in the domestic country in equilibrium given the world interest rate.

Graphically:



Notice that we have e in the vertical axis.

The IS* shifts for the same reason as in the classical IS curve. An increase in G (or a decrease in T) will shift the IS* to the right. However, the economic intuition behind those shifts will be different now.

Example: suppose a decrease in T.

Start at any point on the initial IS* curve. At this point, initially, Y = C + I + G + NX. Now cut taxes. At the **initial value** of Y, disposable income (Y-T) is higher, causing

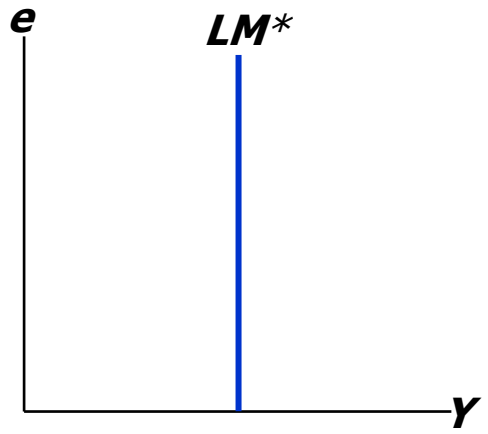
consumption to be higher. Other things equal, the goods market is out of the equilibrium: C + I + G + NX > Y. An increase in Y (of just the right amount) would restore equilibrium. Hence, each value of *e* is associated with a larger value of Y. OR, a decrease in NX of just the right amount would restore equilibrium at the initial value of Y. But the decrease in NX requires an increase in e. Hence, each value of Y is associated with a higher value of *e*. This means that the IS* shifts up.

The LM* curve in a small open economy

The LM* curve is very similar to the usual one. The main difference is that we replace the domestic interest rate with the world interest rate since by assumption they are equal:

LM* curve: $\frac{M}{P} = L(r^*, Y)$

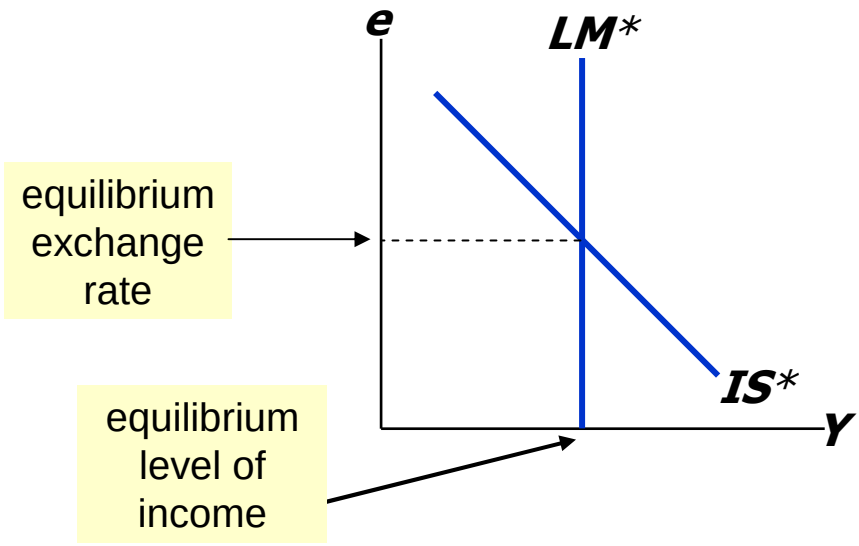
Since the LM* is independent on the nominal exchange rate, in the *e*-*Y* space it will be a vertical line at some level of Y. The reason is because given ***r****, there is only one value of ***Y*** that equates money demand with supply, regardless of ***e***.



In increase in money supply (M) will shift the LM* to the right. Since P is fixed and r* is exogenous, if the central bank increases M, then Y must increase to equate money demand (L) with money supply (M/P).

Equilibrium in the Mundell-Fleming model

Putting together the two curves derived before:



Floating and Fixed Exchange Rates

In a system of **floating exchange rates**, ***e*** is allowed to fluctuate in response to changing economic conditions. In contrast, under **fixed exchange rates**, the central bank trades domestic for foreign currency at a predetermined price. In this case suppose the central bank wants to maintain a fixed exchange rate between the UK pound and the US dollar, for example a 1 to 1 exchange rate = 1 Dollar = 1 Pound. Let's focus only on the trade balance (NX):

Exports from UK to US increases: in this case UK citizens receive dollars that they need to convert into pounds. Therefore in UK this will represents a **supply of dollars** and a **demand for pounds**.

Imports to UK from US: in this case UK importers convert their pounds into dollars to pay for the US goods imported. Therefore we have that imports in this case represents a **demand for dollars** and a **supply of pounds**.

Sterilisation to keep Fixed the Exchange Rate

If a country wants to keep a fixed exchange rate regime the central bank must intervene in the foreign exchange market every time there is a tendency for the exchange rate to move away from the fixed rate. Suppose that the UK central bank wants to keep a fixed exchange rate between the pound and the dollars at the level e_0.

Now, suppose that at the exchange rate e_0 we have that in UK, NX<0.

This means that at e_0 we have imports (M) greater than exports (X). In terms of demand and supply of pounds: now there is an excess of supply for pounds (and an excess of demand for dollars).

Without any intervention the exchange rate will now move down (the value of the pound will decrease) to restore the equilibrium NX=0 that means equality between demand and supply for pounds and dollars. If the UK central bank wants to keep the exchange rate fixed at e_0 where NX<0 it must buy this excess supply of pounds by selling dollars in the foreign market. Therefore when NX<0 at the fixed exchange rate, there will be an excess of supply of domestic currency (and an excess of demand for foreign currency) and the central must adjust this excess of supply by selling foreign currency and buying domestic currency in order to keep the exchange rate at the fixed level. This operation made by the central bank is called **Sterilization**.

In order to perform this operation the central bank must have some amount of dollars available. The amount of foreign currencies hold by the central bank is called **Reserves**. In order to keep an exchange rate fixed, the central bank of a given country must have enough Reserves so that it can sell or buy the domestic currency for foreign currency at the fixed price given by the fixed nominal exchange rate.

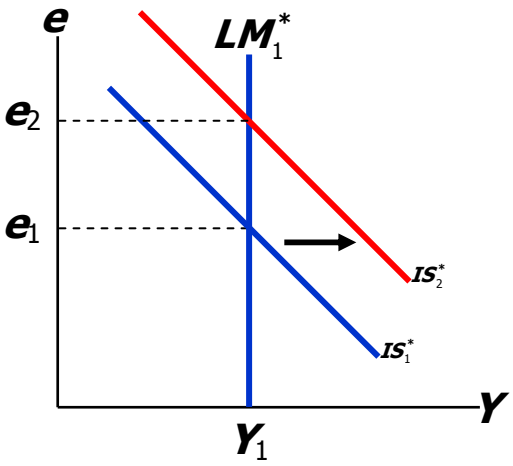
Notice that in this setting a situation where NX<0 at the fixed exchange rate cannot be sustained forever since the amount of Reserves cannot be infinite. After a while, a **devaluation** of the domestic currency may be required. In some cases devaluation is the result of what we call a **currency crisis** (for example the UK Pound and the Italian Lira crisis in September 1992 when the two currencies were forced to leave the European Exchange Rate Mechanism). In the case where there where at the fixed exchange rate we have NX > 0, there will be an excess of demands for pounds (and an excess of supply of dollars) and therefore the central bank will sell pounds and buys dollars. In this case the reserves of the domestic central bank will increase.

Here we have considered just the trade balance; however, the trade balance is just a part of the international accounting. In general, it is the deficit of the Balance of Payments (and not only of the trade balance) that determines if the reserves will be reduced and it is the surplus of the Balance of Payments that determines if the reserves of a country will increase. Therefore, it may be sustainable for a long time a situation where at the fixed exchange rate NX<0, as long as the trade deficit is compensated by a surplus in the capital account such that the balance of payment is still in equilibrium (BP = 0). Notice that under a fixed exchange rate regime the monetary policy is restricted to maintain the predetermined exchange rate and therefore cannot be used for others goals (like increasing real output, etc. etc.)

The Mundell-Fleming model under Floating Exchange Rate: Fiscal and Monetary Policy

a) Fiscal Policy:

Suppose an increase in G or a decrease in T in the domestic country:



The IS* curve shifts upward. Given the LM* curve, there will be an appreciation of the exchange rate while equilibrium output will not change. Intuition for the results:

A fiscal expansion puts upward pressure on the country's interest rate. In a small open economy with perfect capital mobility, as soon as the domestic interest rate rises even the tiniest bit about the world rate, tons of foreign (financial) capital will flow in to take advantage of the rate difference. But in order for foreigners to buy these U.K. bonds, they must first acquire U.K. pounds. Hence, the capital inflows cause an increase in foreign demand for dollars in the foreign exchange market, causing the pound to appreciate. This appreciation makes exports more expensive to foreigners and imports cheaper to people at home, and thus causes NX to fall. The fall in NX offsets the effect of the fiscal expansion. How do we know that $\Delta Y = 0$? In order to maintain the equilibrium in the money market we need Y to be unchanged: the fiscal expansion does not affect either the real money supply (M/P) or the world interest rate (because this economy is "small"). Hence, any change in income would throw the money market out of equilibrium. So, the exchange rate has to rise until NX has fallen enough to perfectly offset the expansionary impact of the fiscal policy on output. ***Result****: In a small open economy with perfect capital mobility and floating exchange rate, fiscal policy cannot affect real GDP*

This is because there is a crowding out effect.

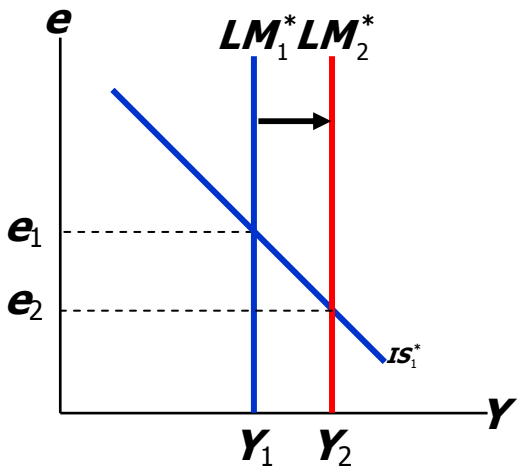
Crowding out Effect:

closed economy: Fiscal policy crowds out investment by causing the interest rate to rise.

small open economy: Fiscal policy crowds out net exports by causing the exchange rate to appreciate.

b) Monetary Policy:

Suppose an increase in M. This will shift the LM^* curve to the right without affecting the IS^* curve:



Intuition: initially, the increase in the money supply puts downward pressure on the interest rate. (In a closed economy, the interest rate would fall.) Because the economy is small and open, when the interest rate tries to fall below r*, savers invest abroad. This capital outflow causes the exchange rate to fall, which causes NX and hence Y to increase. ***Result****: In a small open economy with perfect capital mobility and floating exchange rate, monetary policy is very effective in affecting real GDP.*

The monetary transmission mechanism is now:

small open economy: $\uparrow M \Rightarrow \downarrow e \Rightarrow \uparrow NX \Rightarrow \uparrow Y$

Notice the difference with the closed economy case:

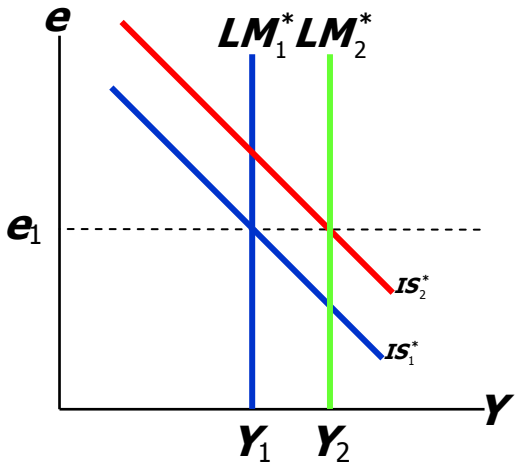
closed economy: $\uparrow M \Rightarrow \downarrow r \Rightarrow \uparrow I \Rightarrow \uparrow Y$

The Mundell-Fleming model under Fixed Exchange Rate: Fiscal and Monetary Policy

a) Fiscal Policy

Suppose an increase in G or a decrease in T. Suppose that the nominal exchange rate must be kept fixed at the level e_1. An upward shift of the IS^* will put a pressure on the nominal exchange rate to increase. In order to keep the nominal exchange rate

fixed, the central bank must increase the money supply and shift the LM^* to the right.



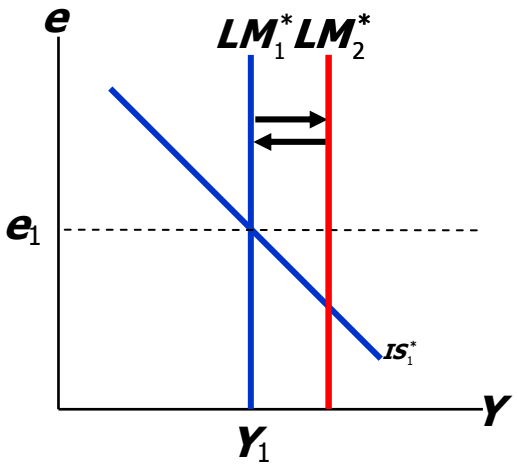
In this case the final result from an increase in G is an increase in Y, from Y_1 to Y_2 while the nominal exchange rate does not change.

***Result**: In a small open economy with perfect capital mobility and fixed exchange rate, fiscal policy is very effective in affecting real GDP.*

The basic idea is that given that the nominal exchange rate is fixed, then NX is fixed and therefore there is not the crowding out effect we had with a floating exchange rate regime.

b) Monetary Policy:

Suppose an increase in M. Since the IS^* does not change this increase in M will shift the LM^* to the right. This movement will put pressure to the nominal exchange rate to decrease. However, if the central bank wants to keep the nominal exchange rate fixed it must decrease M by the same amount to restore the initial equilibrium. The final result is therefore no change in Y and no change in *e*.



***Result**: In a small open economy with perfect capital mobility and fixed exchange rate, monetary policy cannot affect real GDP.*

Floating vs. Fixed exchange rates

Argument for floating rates:

A floating exchange rate regime allows monetary policy to be used to pursue other goals like stable growth and low inflation. With floating exchange rate a country can react better to shocks to its terms of trade. Speculative attacks on the currency of a country are not possible if the exchange rate is floating.

Disadvantages of floating rates:

Expectations play an important role in determining the exchange rate (think about the uncovered interest parity). This implies that flexible exchange rate may be subject to large fluctuations which in turn require large movements in the interest rate. Large movements in the interest rate may make the economy unstable.

Arguments for fixed rates:

A fixed exchange rate regime helps in avoiding uncertainty and volatility in exchange rate, making international transactions easier. Disciplines monetary policy to prevent excessive money growth and hyperinflation (with fixed exchange rate the money supply is mainly used to maintain the exchange rate stability).

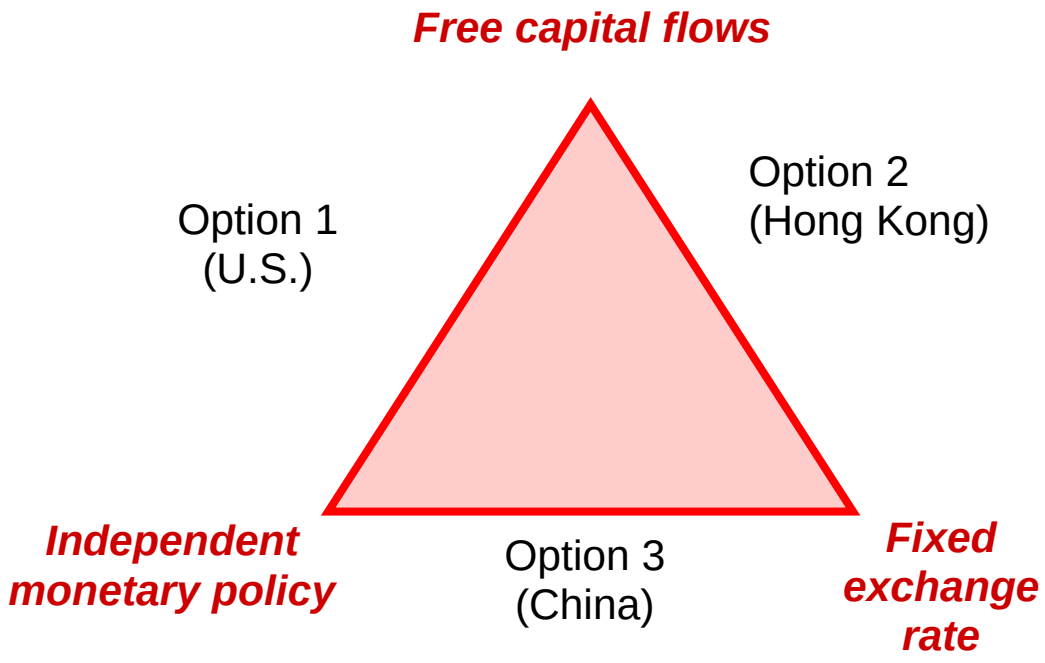
Disadvantages of fixed rates:

A country needs to give up monetary policy as a stabilisation tool. This means that it gives up the control of the internal interest rate. A fixed exchange rate regime opens the door to possible speculation, especially when the exchange rate is believed to be overvalued.

The Impossible Trinity

A nation cannot have free capital flows, independent monetary policy, and a fixed exchange rate simultaneously.

We can see this using a simple figure:



A nation must choose one side of this triangle and give up the opposite corner.

"Option 1" is allowing free capital flows and maintaining independent monetary policy, but giving up a fixed exchange rate. An example of a country that chooses this option is the United States.

"Option 2" is allowing free capital flows keeping a fixed exchange rate, but giving up independent monetary policy. A country that chooses this option is Hong Kong.

"Option 3" is keeping monetary policy independent, yet fixing the exchange rate. Doing this requires limiting capital flows. An example of a country that practices this option is China.

Mundell-Fleming Model and the *AD* curve

Here we consider another possible explanation of why there is a negative relationship between aggregate prices and aggregate real output as implied by the aggregate demand function (AD).

Consider now the Mundell-Fleming model with prices that are not fixed. In this case

we need to replace the nominal exchange rate in the NX function with the real exchange rate.

The IS* curve is now:

$$Y = C(Y - T) + I(r^*) + G + NX(\varepsilon)$$

The LM* is the same as before, but now prices can change:

$$\frac{M}{P} = L(r^*, Y)$$

Suppose an increase in P → M/P decreases → the LM* shifts to the left → the real exchange rate will increase → NX will decrease → Y will decrease.

Graphically:

$\uparrow P \Rightarrow \downarrow (M/P)$

$\Rightarrow LM$ shifts left

$\Rightarrow \uparrow \varepsilon$

$\Rightarrow \downarrow NX$

$\Rightarrow \downarrow Y$