The M-F Result under Fixed Exchange Rates

In showing how the M-F results come about, the logic that we used started with r^* determining r, both under flexible and fixed exchange rates. With perfect capital substitutability and static expectations regarding exchange rate depreciation, r is effectively fixed for this small country. This is in fact the key to the M-F results. Once r is no longer fixed but endogenous, the M-F results break down. There are several assumptions that make r endogenous. Chapter 10 of Dornbusch ("Open Economy Macroeconomics", Basic Books, 1980) shows two of them; the two-country assumption and the imperfect capital substitutability assumption.

This part of the lecture essentially follows Chapter 10 of Dornbusch (1980), and is not reproduced in detail here. Only an outline of the Dornbusch analysis, along with some additional explanations and comments are given.

In the first part of Chapter 10, Professor Dornbusch explains the M-F result under the original assumptions of small country, perfect capital substitutability and static expectations regarding exchange rate depreciation. When the small country attempts a monetary expansion through an open market purchasing operation (buying domestic bonds in exchange for money), there is downward pressure on the domestic rate of interest. This leads to a massive and immediate outflow of capital, and the IRPC is maintained. As a result, r does not diverge from r^*. In the process of this capital outflow, the domestic currency is sold and the foreign currency is bought, which puts pressure on the exchange rate to depreciate. The exchange rate must be kept constant, so the monetary authority intervenes in the foreign exchange market. It buys the domestic currency and sells the foreign currency. The supply of domestic currency in the market declines. At the same time, foreign exchange reserves are lost, and this brings down domestic money supply (recall the balance sheet of the central bank). Money supply is brought down to the original level and the attempt at money supply expansion fails. In short, the money supply is not controllable as an exogenous policy variable in this economy. (As already mentioned, this is a restatement of the Inconsistent Triangle.)

As for fiscal policy, its effectiveness is enhanced by the fact that the rate of interest remains constant. Fiscal expansion puts upward pressure on the rate of interest, capital inflow ensues, and the exchange rate comes under pressure to appreciate. The monetary authorities counter this pressure with intervention, selling the domestic currency and buying the foreign currency. Money supply increases and r stays at the level equal to r^*. This enables fiscal expansion to occur without "crowding-out" private sector investment.

Alternative assumptions: Two-Country assumption

Professor Dornbusch changes the small country assumption into a two-country assumption in the second part of the chapter. The IRPC holds, expectations on exchange rate changes are static, so the domestic rate of interest is still equal to the foreign rate of interest. But the foreign rate of interest is now endogenous in this two-country setting, so the domestic and foreign interest rates are jointly endogenous (or the world interest rate is endogenous). This means that when the domestic monetary authority attempts to increase money supply, the increase does indeed take place, because the world interest rate falls in response.

This response of the interest rate is crucial, because it increases money demand. Under the small country assumption, money supply could not increase because money demand remained constant, because the rate of interest remained constant. It was like pouring water into a container of fixed size. If we add water to a container that is already full to the brim, the excess water will simply spill out and be lost. The amount of water in the container remains the same. In the same way, if we try to add money supply when money demand is equal to money supply and money demand remains constant, the additional money supplied will spill and be lost in the form of losses in foreign exchange reserves. The amount of domestic money supply and demand remains the same.

In contrast, in the two-country setting, the world interest rate declines in response to monetary expansion, making monetary policy effective in boosting income. The interest rate declines because it increases money demand which makes it possible for money supply to expand. And the decline in interest rate (or the expansion in money supply) increases spending, which stimulates income. In fact, the monetary expansion could take place in either country and it would increase income in both countries.

This is because this two-country model is not much different from a closed-economy small country model. The only difference is that the variables are superficially divided into two. The adjective "superficially" is used here, because the two countries' goods, money and bonds are perfect substitutes. There is effectively only one IS, one LM and one bond market equilibrium condition. In economics, the only characteristic that distinguishes a "good" (in the broad sense of the word) is the price. Differences in colour, size, shape or any other characteristic do not count. If the price (or cost) is the same, it is the same "good" and belongs to the same equilibrium condition.

The IRPC states that the price of holding domestic bonds is equal to the price of holding foreign bonds. They are perfect substitutes, or effectively the same bonds, and there is only one equation that shows the equilibrium condition for these bonds. On the supply side, there is the sum of the supply of domestic and foreign bonds, and on the demand side, there is the sum of the demand for domestic and foreign bonds.

In addition, because of fixed exchange rates, the domestic currency can be changed into the foreign currency at a fixed exchange rate at all times. Hence the two currencies are also perfect substitutes. There is only one LM equation in the world, with the sum of domestic and foreign money supply on one side and the sum of domestic and foreign money demand on the other.

Furthermore, prices of goods are assumed to be fixed in this model and *P=eP** is also assumed, so with the exchange rate fixed, the domestic product can also be changed into the foreign product at a fixed price at all times. Hence the two goods are also perfect substitutes. There is only one IS equation in this model, with the sum of domestic and foreign aggregate production on one side and the sum of domestic and foreign aggregate demand on the other.

Thus, in this two-country model there is only one IS, one LM and one bond market equilibrium condition. It is analytically similar to a closed economy model; the difference is that each of the endogenous and exogenous variables comprises two parts. There is not much wonder if monetary policy worked even under fixed exchange rates, perfect capital substitutability and static expectations. The expansion of world money supply leads to increases in the sum of the two incomes. There are two routes from monetary expansion to income expansion in this two-country setting, one through the decline in interest rate and the other through the increase in income. Professor Dornbusch shows foreign income Y^* as a function of domestic income Y and the world rate of interest r :

$$Y^* = \Phi^*(Y, r) \quad \text{where} \quad \Phi_Y^* > 0, \Phi_r^* < 0.$$

An increase in Y and a decrease in r both lead to an increase in Y^*. Both take place as a result of monetary expansion. The international transmission is positive for monetary policy in this model.

The allocation of the income increase between home and abroad is not discussed in Chapter 10, but would depend on the partial derivatives Φ_Y^* and Φ_r^* which are functions of partial derivatives $E_r^*, E_{Y^*}^*, T_Y, T_{Y^*}$, as well as E_r and E_Y (where E is aggregate expenditure and T is trade).

With regard to the question of allocation between the two countries, Professor Dornbusch discusses the allocation of the loss of foreign exchange reserves. When either monetary authority conducts an open market operation to increase money supply, supply exceeds demand in the world money market. The world rate of interest declines and both domestic and foreign demand for money increase. Professor Dornbusch shows

mathematically how the allocation of this increase in money demand depends on the relative size of the two countries (Y and Y^*) as well as the response of money demand to interest rate changes (partial derivatives L_r and L_{r^*}). Money demand will increase

more domestically, the larger is Y relative to Y^* and the larger L_r is relative to L_{r^*}.

And the larger the increase in money demand at home, the smaller the loss of foreign exchange reserves at home, because the size of the container expands that much more to hold the additional supply of money.

Fiscal policy could have a negative transmission in this two-country model. If domestic income increases that would have a positive effect on foreign income, but an increase in the world interest rate has a negative effect on foreign income. When the domestic fiscal authority increases government spending, the sum of the two incomes and the world rate of interest both increase. The increase in the rate of interest is due to the increased demand for funds.

Since domestic and foreign products are perfect substitutes in this model, a domestic fiscal expansion could just as easily increase foreign income as domestic income. An increase in foreign income would have a positive effect on domestic income, but there is the increase in the world interest rate to contend with. Although not explicitly stated in Chapter 10, this suggests a possibility that domestic fiscal policy would be ineffective in increasing domestic income. In fact, it could even lead to a decline in domestic income, in the extreme case where the increase in domestic government spending is spent entirely on buying foreign products and only the effect of higher interest rate remains domestically. We need to remember, however, that this result depends on the assumption that domestic and foreign product prices are constant. Without this assumption, domestic and foreign products can not remain perfect substitutes under fixed exchange rates.

Alternative assumptions: Imperfect Capital Substitution

In the third part of Chapter 10, Professor Dornbusch revives the small country assumption and introduces the new assumption of imperfect capital mobility. Domestic and foreign bonds are not the same in the eyes of investors and there are two separate equilibrium conditions for each.

Professor Dornbusch expresses the degree of capital substitutability in an extremely intuitive way, as a function of the partial derivatives that show the response of demand for bonds to changes in domestic and foreign interest rates (σ_r and σ_{r^*}, where σ is the

demand function for domestic bonds).   Perfect capital substitutability is a state in which the sum of these partial derivatives goes to infinity, i.e. when investors respond to interest rate changes with immediate and massive capital flows.   In contrast, if capital substitutability is imperfect, the sum of these partial derivatives stays within the range of larger than zero but smaller than infinity.

The loss of foreign exchange reserves resulting from monetary expansion is derived as a function of the sum of these partial derivatives:

$$\frac{dR}{dD} = -1 - \frac{Lr}{\sigma_r + \sigma^*_{r^*}}$$

where R is the stock of foreign exchange reserves and D is the stock of domestic bonds held by the central bank.   An increase in D means the central bank has conducted an open market purchase operation, expanding money supply.

Under perfect capital substitutability, the denominator of the second term on the right-hand side goes to infinity, rendering the left-hand side equal to -1.   The expansion in money supply (by expansion in central bank holding of domestic bonds) is completely offset by the loss in foreign exchange reserves; they are exactly the same in amount and opposite in sign.   But if capital is only imperfectly substitutable, this expression is larger than -1 and smaller than zero, indicating that there is room for monetary expansion. Money supply is controllable, at least to an extent.   In response to monetary expansion, the rate of interest declines and income increases.   Professor Dornbusch also shows that fiscal policy is effective, and its effectiveness increases with the substitutability of domestic and foreign capital.   When capital substitutability is perfect, there is no crowding-out.