Economics 442
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The Open Economy in the Short Run

This set of notes outlines the IS-LM model of the open economy. First, it covers an accounting identity. Then the open economy IS curve, which incorporates an exchange rate/interest rate relationship, is derived, and combined with the LM curve. The model is used to examine policy in an open economy, under floating exchange rates. Finally, policy under fixed exchange rates is examined.

1. The National Saving Identity

This is accounting. Consider the open economy definition of GDP, from the spending side:

$$Y \equiv C + I + G + \underbrace{[-IM/\varepsilon \ + X + NI + NT]}_{=\widehat{CA}}$$

(Where all the variables are "ex post" values, not "planned" or "ex ante values"). IM (imports in foreign real units) is divided by ε, the real exchange rate, to convert imports expressed foreign real units into domestic real units. NI is net income, NT is net transfers. Income can only be disposed of by being taxed, saved or consumed:

$$Y \equiv C + S + T$$

Combining these two definitions leads to:

$$C + S + T \equiv Y \equiv C + I + G + [-IM/\varepsilon + X + NI + NT]$$

Cancelling out consumption, and rearranging yields:

$$(S - I) + (T - G) \equiv -IM/\varepsilon + X + NI + NT \equiv CA$$

Where *NX* is net exports, which is defined as exports minus imports; and $\varepsilon = (EP / P^*)$, the real exchange rate.

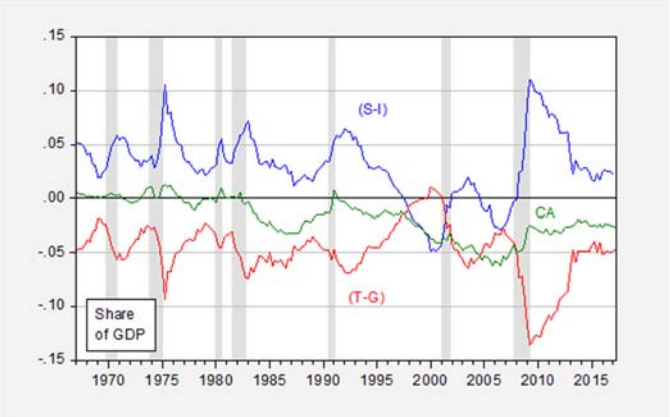


Chart 1: National saving identity, 1967-2016

The NSI is an accounting identity that states that the current account must equal the sum of excess of private saving over investment, and the government budget balance (the latter is public sector saving). From this identity, one can't say that the left hand side causes the right hand side, or vice versa.

2. A Model of Income Determination in the Open Economy

We now move to a model, which allows us to examine cause and effect. For simplicity, net income and net transfers are set to zero. C, I, G, X, IM are now "planned" or "ex ante" values. Only in equilibrium will planned values equal ex post (actual) values.

Equilibrium is given by the condition output equals aggregate demand

$$Y = Z$$

Aggregate demand in the open economy is given by:

$$Z \equiv C + I + G + \underbrace{\left(X - \frac{IM}{\varepsilon}\right)}_{=NX}$$

Combining

$$Y = C(Y - T) + I(Y, i) + G - IM(Y, \varepsilon)/\varepsilon \ + X(Y^*, \varepsilon)$$

Where all the variables now denote "planned" or "ex ante" values. Assume imports and exports behave as in (19.2) and (19.3):

$$IM = IM(Y, \varepsilon) \qquad \frac{\partial IM}{\partial Y} > 0, \frac{\partial IM}{\partial \varepsilon} > 0$$

$$X = X(Y^*, \varepsilon) \qquad \frac{\partial X}{\partial Y^*} > 0, \frac{\partial X}{\partial \varepsilon} < 0$$

Let net exports be re-written:

$$NX(Y, Y^*, \varepsilon) = X(Y^*, \varepsilon) - IM(Y, \varepsilon)/\varepsilon$$

Substituting into equation (19.1), using the functional forms for the domestic components of aggregate demand from Chapter 14 yields the IS curve for the open economy:

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, \varepsilon) \qquad (19.1)$$

If one assumes that prices are constant at home and abroad, and $P / P^* = 1$, then $\varepsilon = E$. Further, with constant price level, inflation is zero, and the real interest rate equals the nominal. Hence, equation (19.1) becomes:

$$Y = C(Y - T) + I(Y, i) + G + NX(Y, Y^*, E) \qquad (19.2)$$

(I hold inflation constant, so the i and hThe problem with this formulation of the IS curve is that any change in the exchange rate shifts the curve; if one could make *E* a function of the interest rate, that

would solve that problem. There is a relationship that one can exploit, called the interest rate parity condition:

$$(1+i_t) = (1+i_t^*)\frac{E_t}{E_{t+1}^e}$$

This is a "no arbitrage profits condition", which states that one can't expect to get a higher return in one location versus another, expressed in a common currency. ***Note:*** *this is equivalent to saying capital is freely mobile between countries.* Rearranging:

$$E_t = \frac{(1+i_t)}{(1+i_t^*)}E_{t+1}^e \qquad (19.4)$$

If the foreign interest rate stays constant, the exchange rate appreciates whenever the home interest rate rises. It also rises if the future expected exchange rate rises, which complicates matters. As a first approximation, assume the future expected exchange rate stays constant. Then:

$$E_t = \frac{(1+i)}{(1+i^*)}\overline{E}^e \qquad (19.5)$$

Equation (19.5) can be substituted into the IS curve to yield:

$$Y = C(Y-T) + I(Y,i) + G + NX(Y,Y^*,\left(\tfrac{1+i}{1+i^*}\right)\bar{E}^e)$$

Assume the central bank targets the interest rate; then the LM is:

$$i = \bar{\imath}$$

Solving this system of equations would lead to the following equilibrium:

$$Y_0 = Y\left(G,T,\bar{\imath},Y^*,\left(\frac{1+\bar{\imath}}{1+i^*}\right)\bar{E}^e\right)$$

The solution to this is shown in the below graph. Notice that the higher the domestic interest rate, the stronger the nominal exchange rate (value of the home economy currency).

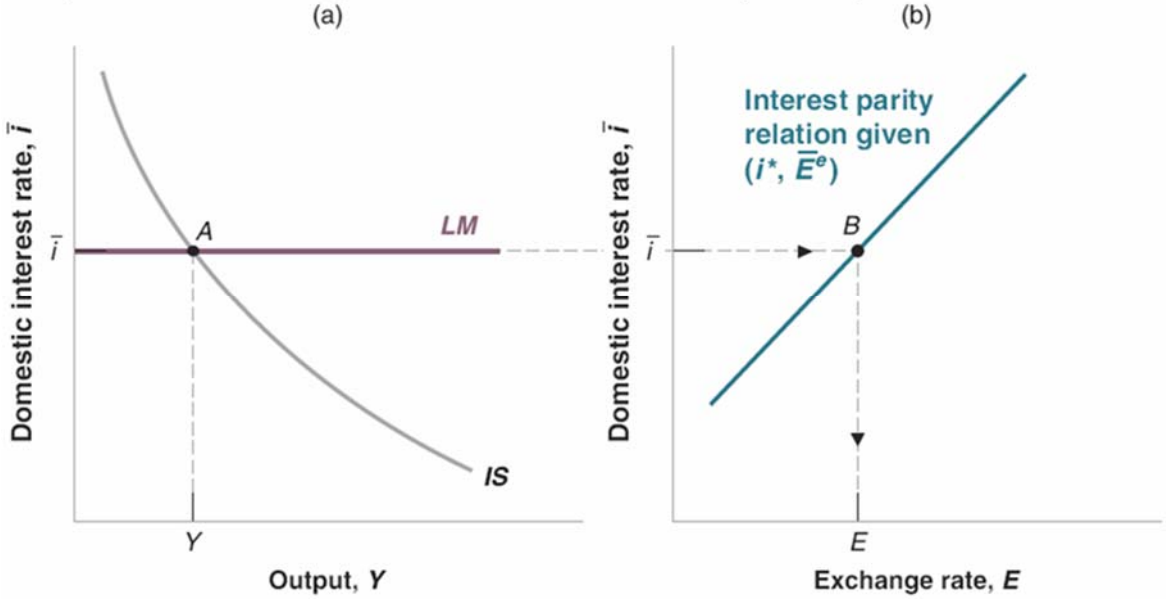


Figure 1: IS-LM and Exchange rate-interest rate relationship

3. Policy in an Open Economy, with Flexible Exchange Rates

We examine fiscal and monetary policy, respectively, in an open economy. First, contractionary monetary policy.

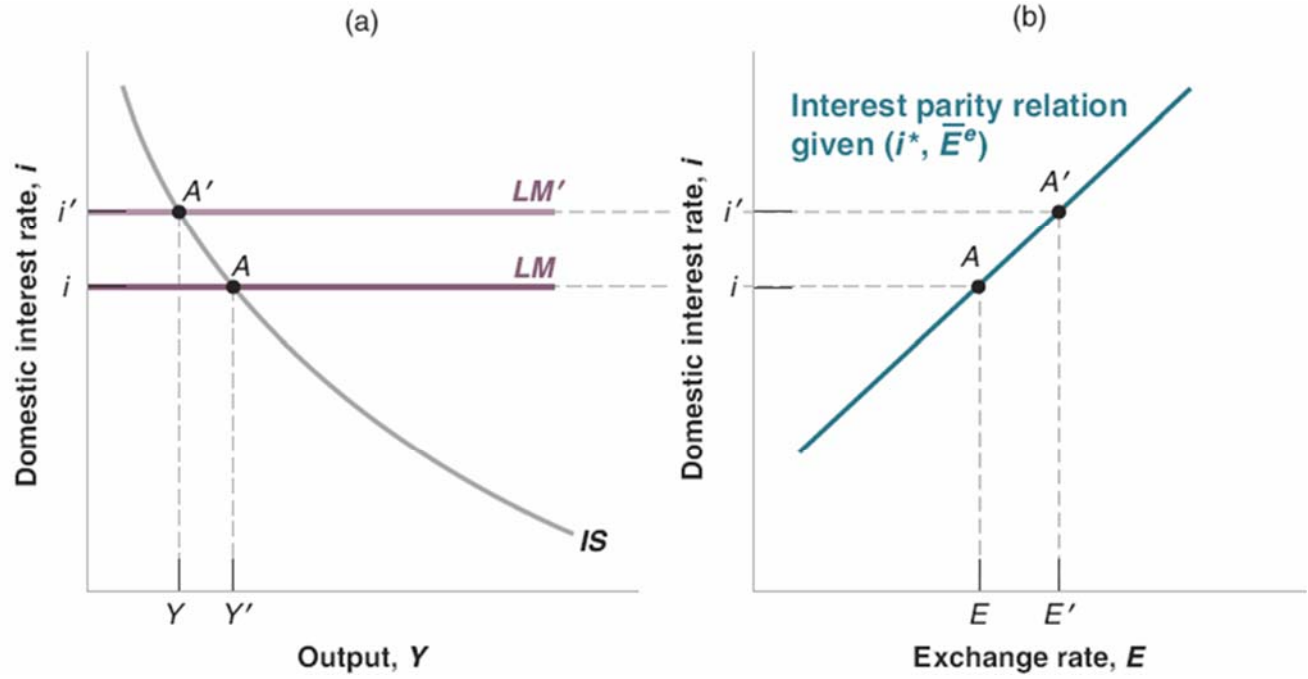


Figure 3: Monetary policy (contraction)

The higher interest which results from a monetary contraction induces a strengthening of the currency. Imports tend to rise, and exports fall, from the currency appreciation. However, because income falls, imports fall somewhat. The net impact on net exports is ambiguous.

For expansionary fiscal policy, the result depends upon the conduct of monetary policy. With fully accommodative monetary policy:

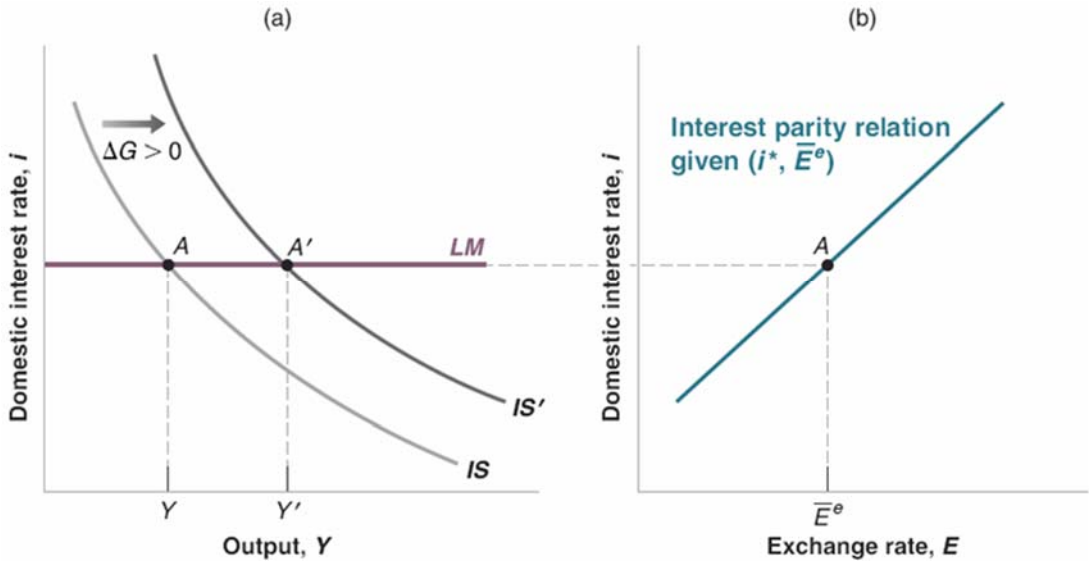


Figure 2: Fiscal policy (expansion) when central bank is accommodative

To the extent the central bank follows something like a Taylor rule, the target interest rate would be moved up in response to an expansionary fiscal policy.

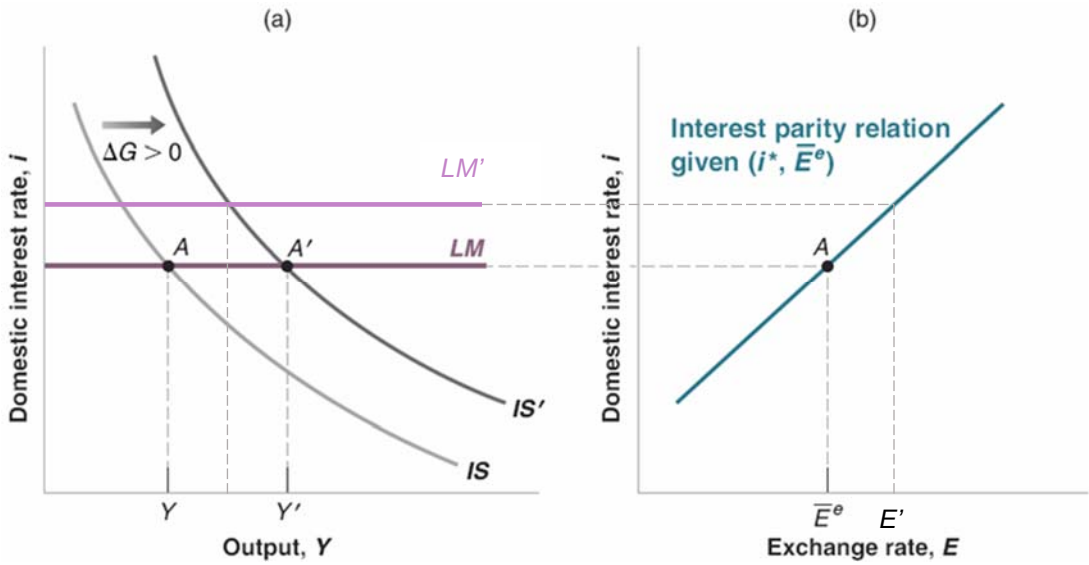


Figure 3: Fiscal policy (expansion) when central bank leans against expansionary fiscal policy

The fiscal expansion can also induce an increase in the interest rate if the central bank targets the money stock (which means the LM curve is upward sloping) which appreciates the currency. With the higher interest rate, both investment and net exports are "crowded out".

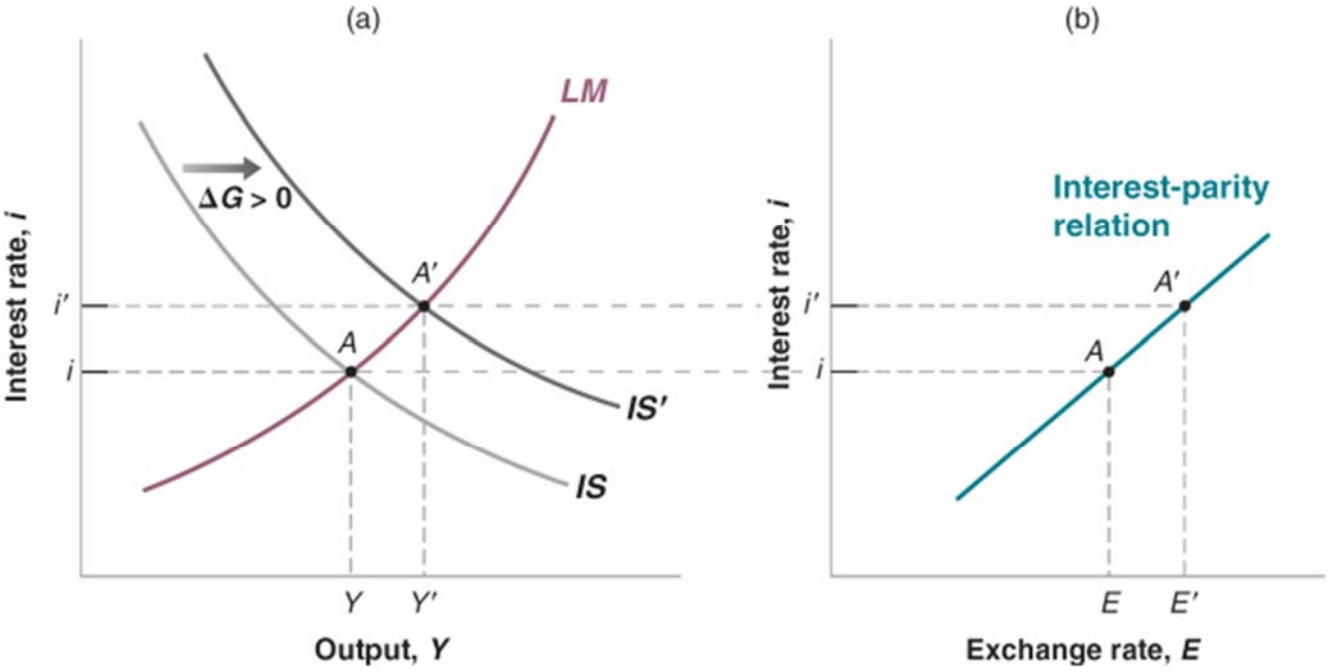


Figure 4 Fiscal policy (expansion) when central bank targets the money supply

On this second point, because income is higher than initially, so too is the interest rate. The real exchange rate is stronger, so net exports are unambiguously lower than before.

4. An Example: The US, 1980-90

Soon after being appointed Fed Chairman in August 1979, Paul Volcker announced target money supply growth rates that resulted in an increased Fed funds rate to record highs, in order to reduce inflation.

With the inauguration of President Ronald Reagan in January 1981, a program of tax cuts, and defense expenditures were implemented, resulting in a structural budget deficit (solid line, Figure 4). Real interest rates rose as a consequence (dashed).

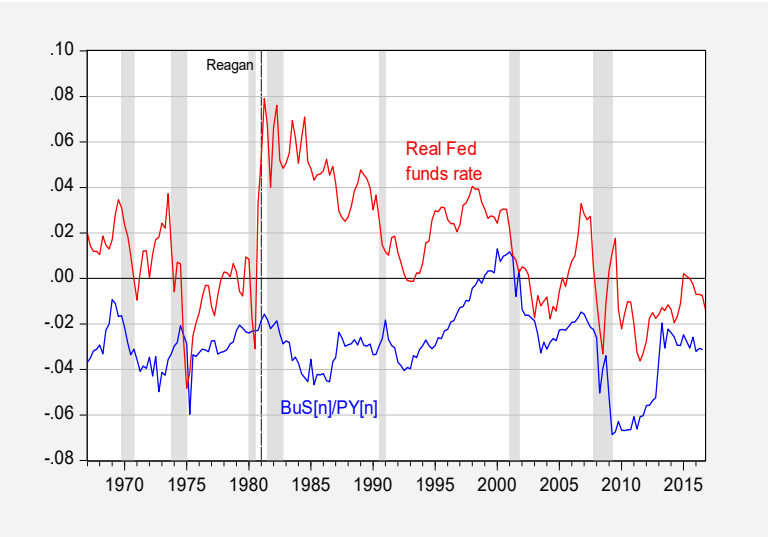


Figure 5: Federal structural budget balance to potential GDP (blue), and Fed funds interest rate minus lagged one year CPI inflation (red).

As the US real interest rate rose (solid line), and the nominal rate rose relative to the foreign interest rate, the dollar strengthened (dashed line), as indicated in the interest parity condition, assuming the future exchange rate is constant (equation 19.5).

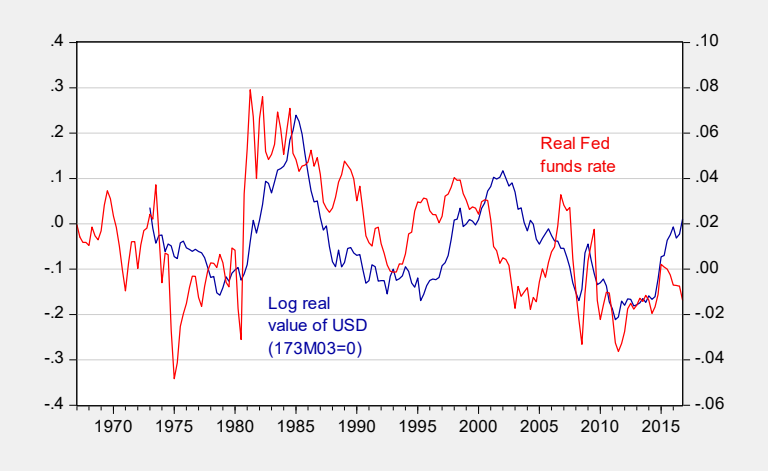


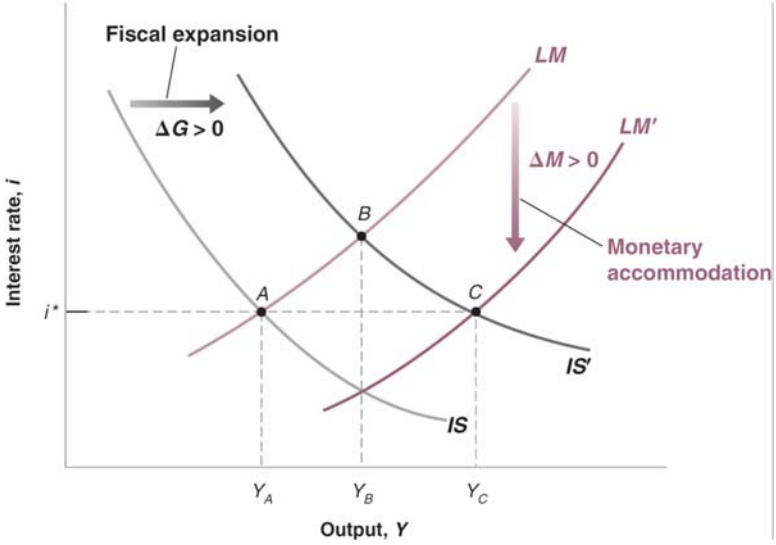
Figure 6: Fed funds rate minus lagged one year inflation (solid line), and log real value of the US dollar against a broad basket of currencies (dashed line).

5. Fiscal Policy in an Open Economy, with Fixed Exchange Rates

Under (credibly) fixed exchange rates (and perfect capital mobility), the expected future exchange rate must equal the current exchange rate, so equation 19.4 becomes:

$$E_t = \frac{(1+i_t)}{(1+i_t^*)} E_{t+1}^e \rightarrow 1 = \frac{(1+i_t)}{(1+i_t^*)} \rightarrow (1+i_t) = (1+i_t^*)$$

Fixed exchange rates have strong implications for macroeconomic policy.



When exchange rates are fixed (and there are no controls on capital flows), the monetary authorities are committed to keeping the exchange rate constant. This means the interest rate has to be kept constant, and equal to the foreign interest rate. Hence, if government spending is increased, the monetary authority must increase the money supply.

Note that if the monetary authority tried to undertake an independent monetary contraction or expansion, that policy would be undone by capital inflows/outflows.

Figure 7: Policy under fixed exchange rates, perfect capital mobility

The above discussion applies when capital mobility is perfect, i.e., interest rate parity holds. That condition applies to interactions between developed countries, for instance between the US and the UK. If barriers to capital mobility exist due for instance to legal restrictions on moving funds across borders (e.g., China), then the exchange rate can be influenced by other factors than interest rates – in particular by buying or selling foreign currency.