MODULE 13

Big Open Economy Equilibrium

This module analyzes big-country as well as small-country equilibrium in a world of either one big country and one small one, or two big countries, one of which may be an aggregate of small countries. It begins with one big country and one small one, analyzing effects of shocks in the big country and the impact of these shocks on, and response by, the small country. It then goes on to analyze two-big-economy equilibrium under commodity monetary standards where, alternatively, both countries are on a gold standard or one country is on a gold standard and the other is on a silver standard. Next, the focus shifts to a two-big country situation where one country is the key-currency country and the other is an aggregate of peripheral countries, all of which peg their currencies to the key-currency. The effects of real and monetary shocks in the key-currency country on the rest of the world are analyzed. Finally, the focus shifts to a two-big-country situation where one big country is an aggregation of small countries and all countries adopt flexible exchange rates. The effects of big-country shocks on the home economy and on the rest of the world under alternative rest-of-world responses are analyzed.

1. Commercial Policy

1. Two-Country Equilibrium: One Big Country and One Small Country

This module focuses on two-country situations, beginning with one big country and the other too small to have an influence on the world real interest rate.

Figure 1.1:

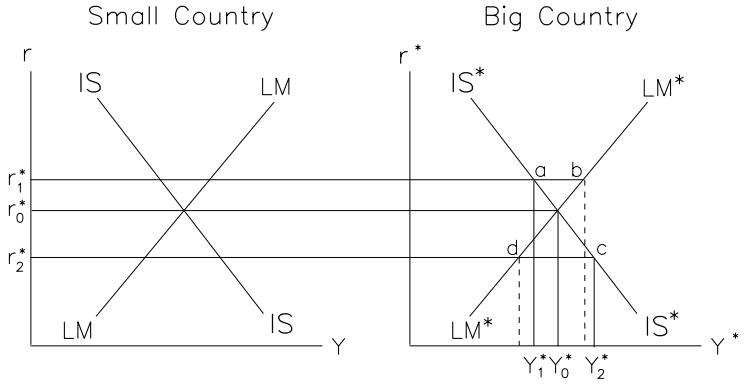


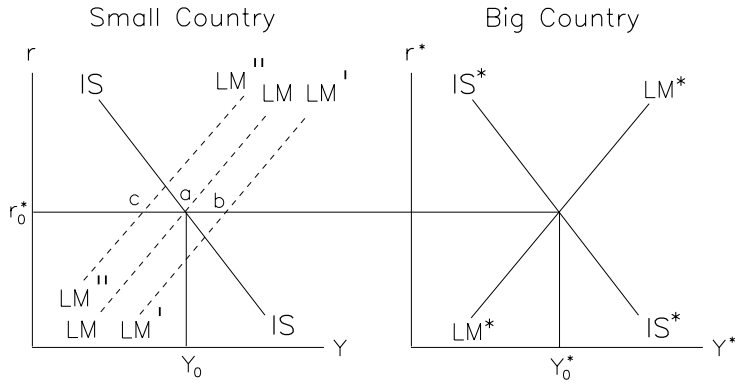
Figure 1.1 shows the process by which equilibrium is achieved in the big country.[1] Fixed price levels and less than full employment are assumed in both economies. At real interest rate r_1^* the big country's income will equal Y_1^* and there will be an excess supply of money equal to ab measured in income units. People will try to unload their excess money holdings by purchasing assets, causing world asset prices to rise and the world real interest rate to fall until equilibrium is achieved at r_0^* and Y_0^*. Similarly, if the world real interest rate is at r_2^* the equilibrium level of income in the big country will be Y_2^* and there will be an excess demand for money on the part of big-country residents equal to cd. A fall in world asset prices and a rise in the world real interest rate to its equilibrium level r_0^* will result.

Given the equilibrium world real interest rate established in the large country, the small country's situation is shown in the left panel of Figure 1.2. The equilibrating process will depend upon whether the small

[1]The two horizontal axes in all two-country figures in this module are scaled so that an equal percentage change in the two countries' incomes will represent the same distance along both axes.

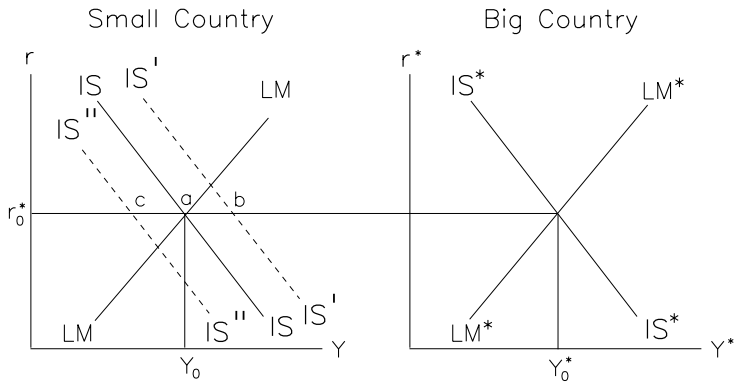
country adopts a fixed or flexible exchange rate. Its choice of exchange rate regime will have no bearing on big-country equilibrium.

Figure 1.2:



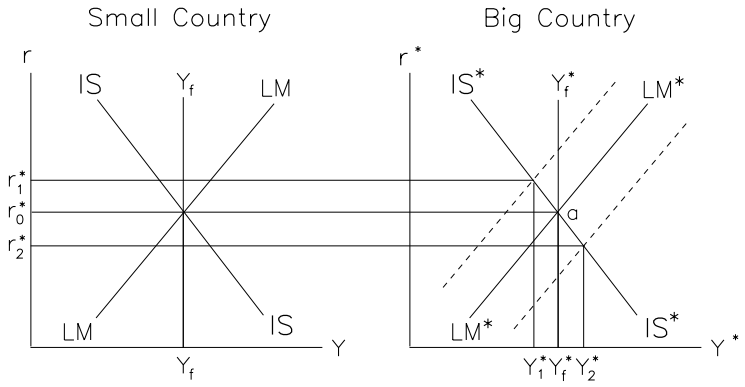
We know from previous modules that under a fixed exchange rate small-open-economy equilibrium is determined by the *IS* curve in conjunction with the world real interest rate. The small country's central bank is forced to adjust the money supply until the *LM* curve crosses the *IS* curve at the world interest rate at point *a*. When the exchange rate is flexible, small-country equilibrium is determined by the *LM* curve in combination with the world interest rate as shown in Figure 1.3. The *IS* curve will then adjust endogenously through changes in the nominal and real exchange rates until it passes through the intersection of the *LM* curve with the world interest rate line, as shown at point *a*.

Figure 1.3:



Under full-employment conditions the two countries' output levels are given by the vertical lines $Y_f^* Y_f^*$ and $Y_f Y_f$ in Figure 1.4. The big country's real money stock must adjust, through changes in wages and prices, to drive LM^* through the intersection of IS^* and $Y_f^* Y_f^*$.

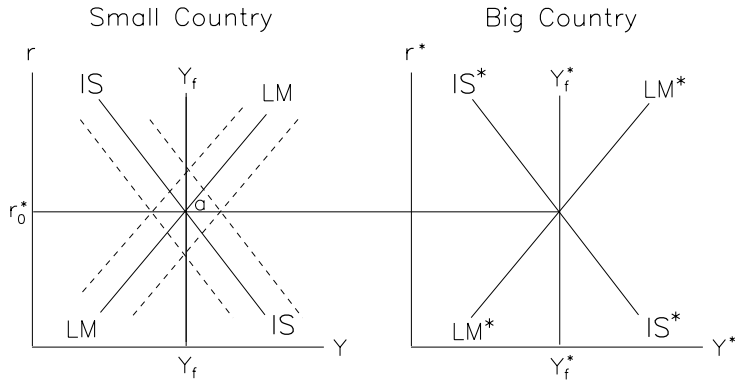
Figure 1.4:



In the small country, as shown in Figure 1.5, both the *IS* and *LM* curves must pass through point *a*. The real exchange rate must adjust to drive the *IS* curve through that point. If the nominal exchange rate is fixed this real exchange rate adjustment will occur through changes in the price level resulting from the pressures of world demand for domestic goods, with the nominal money supply adjusting endogenously through changes in official foreign exchange reserves to ensure that *LM* also passes through point *a*. If

the exchange rate is flexible, wages and prices will adjust until the *LM* curve passes through point a, with the nominal and real exchange rates adjusting endogenously to ensure that *IS* also passes through that point.

Figure 1.5:



2. Effects of Stabilization Policy on the Home Economy

The effects of stabilization policy and real and monetary shocks in the small country on its own economy were covered in the *Small Open Economy Equilibrium* sequence of modules.

The flexible exchange rate case is reviewed in Figure 2.1. Equilibrium is determined by the intersection of the *LM* curve and the world interest rate line *ZZ* with the nominal exchange rate adjusting endogenously to drive the *IS* curve through that same point. In the long run wages and prices adjust to ensure that *LM* crosses *ZZ* at the full-employment output level. Monetary shocks will affect output, employment and prices, while fiscal expansions, tariffs and other real shocks will simply result in offsetting exchange rate changes to maintain *IS* at a level determined by *LM* and *ZZ*.

Figure 2.1:

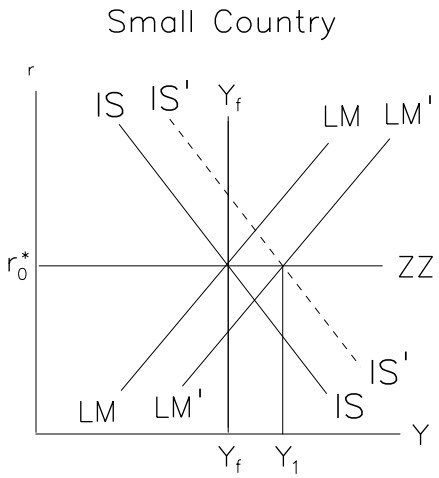
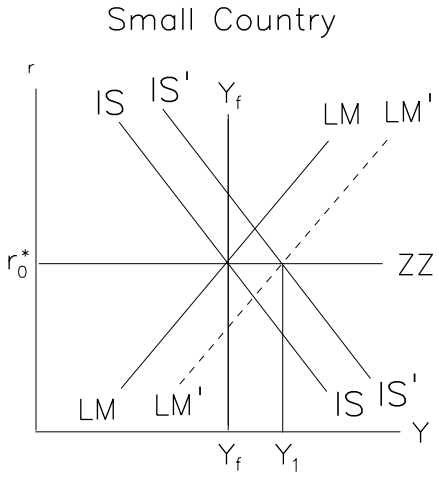


Figure 2.2:

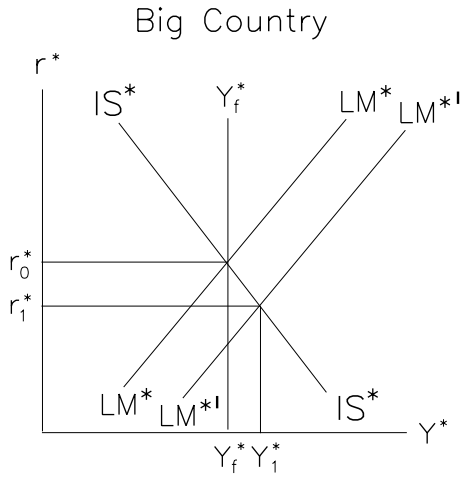


When the exchange rate is fixed, equilibrium is determined by the intersection of the *IS* curve with the *ZZ* line as shown in Figure 2.2 with *LM* adjusting endogenously as the central bank is forced, through adjustments of official foreign exchange reserves, to supply whatever quantity of money the public wishes to hold. A monetary expansion will thus be impossible

but a fiscal expansion or other positive real shock will shift *IS* to the right, increasing income and employment in the short run, with the money supply increasing endogenously. In the long run, wages and prices will rise, increasing the real exchange rate and shifting the *IS* curve back through the intersection of *ZZ* and the vertical full-employment output line, with the *LM* curve endogenously tagging along.

A devaluation of the nominal exchange rate to a new fixed level will lower the real exchange rate and shift *IS* to the right with the necessary increase in the money supply and equivalent adjustment of the *LM* curve occurring endogenously. Again the price level will rise in the long-run, returning the real exchange rate to its original level and shifting *IS* back to intersect with *ZZ* at the full-employment output level. Foreign exchange reserve adjustments will ensure an equivalent leftward shift of *LM*.

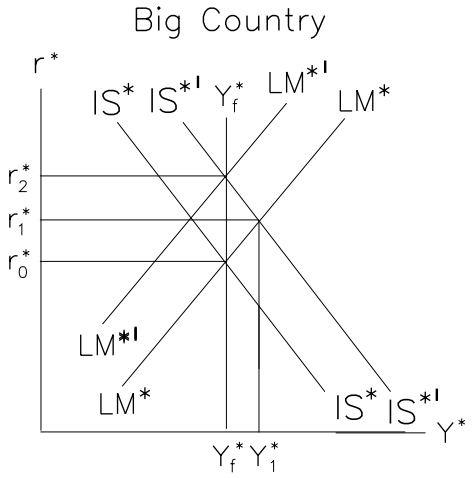
Figure 2.3:



The big country's trade balance is a tiny fraction of its income, so movements in the real and nominal exchange rates are of no consequence to its equilibrium. An increase in its money supply will shift its *LM* curve to the right, say to $LM^{*\prime}$ in Figure 2.3. Big-country residents will attempt to purchase non-monetary assets with their excess money holdings, driving the world real interest rate down. Short-run equilibrium will be reestablished at the real interest rate r_1^* and the income level Y_1^*. In the long run, wages and prices will rise, reducing the real money stock and shifting the *LM* curve back to its original position. At that point income will have returned to

Y_f^* and the world interest rate to r_0^*. The price level will ultimately rise in proportion to the increase in the nominal money supply so that the real money supply returns to its initial level.

Figure 2.4:



The effects of a fiscal expansion and other positive real sector shocks in the big country are shown in Figure 2.4. The *IS* curve shifts to the right to $IS^{*'}$ causing the interest rate to rise to r_1^* and income to y_1^*. In the long run, wages and prices rise, reducing the real stock of money and shifting *LM* to the left. Long-run equilibrium will be reestablished at interest rate r_2^* where $LM^{*'}$ crosses $IS^{*'}$. Fiscal policy is thus effective in manipulating the world real interest rate and the domestic price level in the long run. This contrasts with big-country monetary policy, which will affect nominal prices in the long run but leave the real interest rate and all other real magnitudes unchanged.

3. Small Country Response to Big Country Monetary Shocks

How can the small country respond to big-country shocks and what are the implications for its employment, income and prices of alternative responses? Ultimately, the response must take the form of a decision to adopt a either a fixed or flexible exchange rate and, if the latter is chosen, a decision as to

what kind of monetary policy to follow. This section deals with the response to monetary shocks in the big country.

A positive monetary shock in the big country shifts LM^* to the right, lowering the world real interest rate and increasing big-country output in the short run.

Figure 3.1:

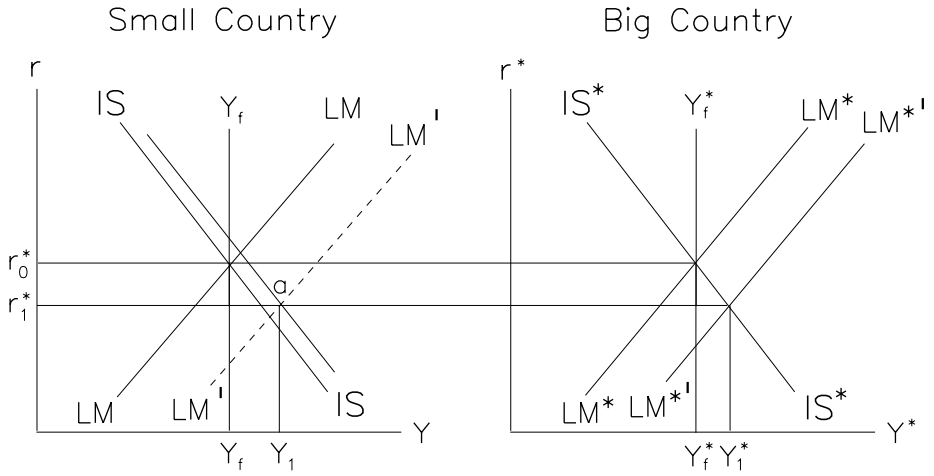


Figure 3.1 shows what happens when the small country adopts a fixed exchange rate. The increase in the big country's income leads to an increase in imports from the small country and a rightward shift *IS* curve. Income in the small country, determined by the intersection of *IS* and the world real interest rate line, increases to the level indicated by point a, with the money supply expanding automatically, shifting LM to LM'. In the long run the price level in the big country will rise, reducing the real quantity of money, shifting LM^* back to its original position and returning the world real interest rate and foreign output to r_0^* and Y_f^*. Given the fixed exchange rate, the rise in the world real interest rate will reduce the small country's output and income back to Y_f, returning the demand for real money balances to its original level as full employment is reestablished. The new equilibrium involves the same income and interest rate levels and the same *IS* curve as the original pre-shock equilibrium so the real exchange rate must ultimately return to its pre-shock level.[2] Since the nominal exchange rate is fixed, the

[2]Note that the increase in small-country exports to the big country will be eliminated by the return of the big country's output to its original position.

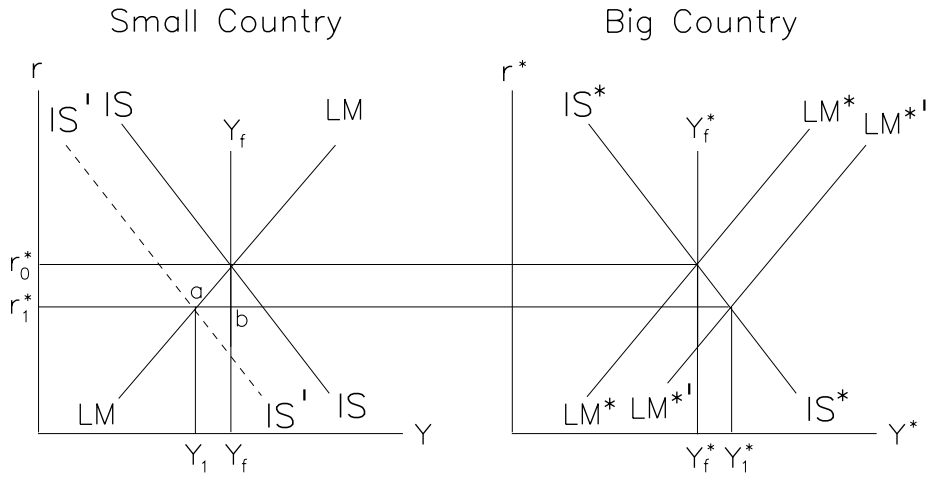
small country's price level must rise in proportion to the big country's price level. This follows from the definition of the real exchange rate,

$$q = \frac{P}{\Pi P^*},$$

where q is the real exchange rate, P and P^* are the price levels and Π is the nominal exchange rate (price of the big country's currency in terms of the small country's currency). To maintain the fixed exchange rate, the authorities will have to buy or sell foreign exchange reserves in return for domestic currency to ensure that the domestic nominal money stock rises in proportion to the domestic price level.

The important thing to note here is that when the exchange rate is fixed big-country monetary shocks have the same effects in both countries in both the short and long runs.

Figure 3.2:



When the small country lets the exchange rate float and holds the domestic money supply constant the short-run effects are the opposite to those under a fixed exchange rate. This is shown in Figure 3.2. Equilibrium is now determined by the intersection of the *LM* curve and the world real interest rate line. Since *LM* is positively sloped, output must decline. The currency appreciates endogenously, shifting *IS* to *IS′*, with the new short-run equilibrium occurring at point *a*.

Note that income in the small country moves in the opposite direction to income in the big country. The small country's central bank could prevent

the decline in domestic income by increasing the money supply sufficiently to shift *LM* rightward to intersect the real interest rate line at point *b*. This would reduce the required appreciation of the nominal and real exchange rates, making the leftward shift of *IS* smaller so that it too would pass through point *b*.

In the long run when the exchange rate is flexible, the return of the world interest rate to r_0^* will mean that *IS* must return to its original level in Figure 3.2, equilibrium being determined by the intersection of *LM* and the world interest rate line. The real exchange rate returns to its pre-shock level along with the *IS* curve and P remains constant while P^* rises, so Π must end up lower than its pre-shock level in the same proportion as P^* is higher. The flexible exchange rate insulates the small country's economy from the big country's monetary shock in the long run, though not in the short run.

If the small country's central bank increases the money supply in the short run to maintain income equal to Y_f at point *b*, this monetary expansion will have to be reversed as the world interest rate returns to r_0^*.

When the small country's authorities vary the money supply to maintain domestic income constant in the face of shocks from abroad they are adopting a regime of *Managed Floating* instead of a pure flexible exchange rate regime. Such precise control of domestic output is difficult because the small country's authorities have to be able to determine what kinds of shocks are occurring and to correctly gauge their magnitude. Then they also have to know the time path of the response of the domestic economy to their policy actions.

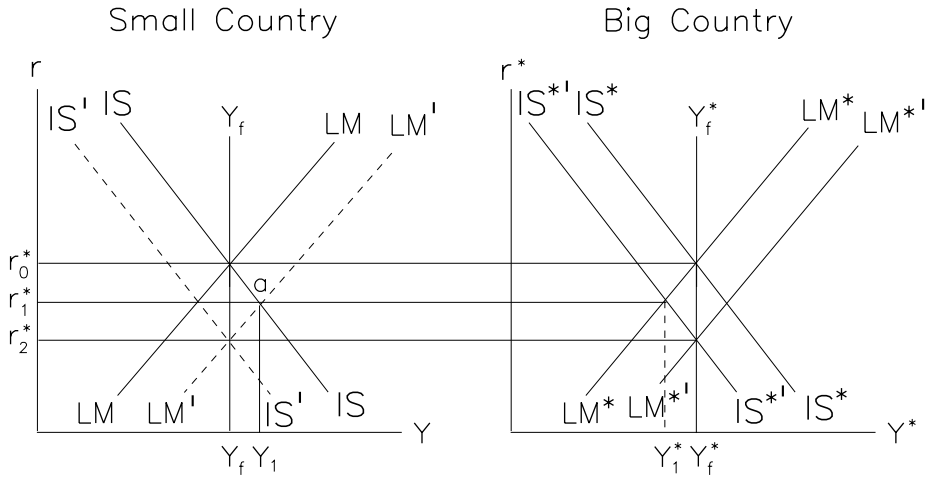
4. Small Country Response to Big Country Real Shocks

Now consider alternative small-country responses to real shocks occurring in the big country. Real shocks resulting from exogenous declines in consumption or investment or tight fiscal policy involve a leftward shift in IS^*, with the world interest rate falling, say to r_1^* in Figure 4.1. To keep things simple, assume that the small country experiences no real shock so that *IS* is initially unaffected.

Again, the small country's authorities have to decide whether to fix the exchange rate or let it float and, if a float is adopted, they then have to decide upon an appropriate monetary policy. Suppose they fix the exchange rate. Then equilibrium will be determined by the intersection of *IS* and the

real interest rate line. Output will rise to Y_1 in the small country while at the same time falling to Y_1^* in the big country. The small country's money supply will increase endogenously in the process, shifting *LM* to the right to pass through point *a*. Output moves in opposite directions in the two countries in the short run. This is in contrast with big-country monetary shocks, which cause the two countries' outputs to move in the same direction in the short run under fixed exchange rates.

Figure 4.1:



In the long run, the price level in the big country will fall, driving LM^* down to $LM^{*\prime}$, as output and income in the big-country return to the full-employment level. This will drive the world interest rate down further to r_2^*. The fall in the big-country's price level will increase the small country's real exchange rate at the fixed level of the nominal exchange rate and at any given domestic price level. Ultimately, the real exchange rate must appreciate sufficiently to drive *IS* to *IS'* so it will cross through the intersection of the Y_f line and the real interest rate line.

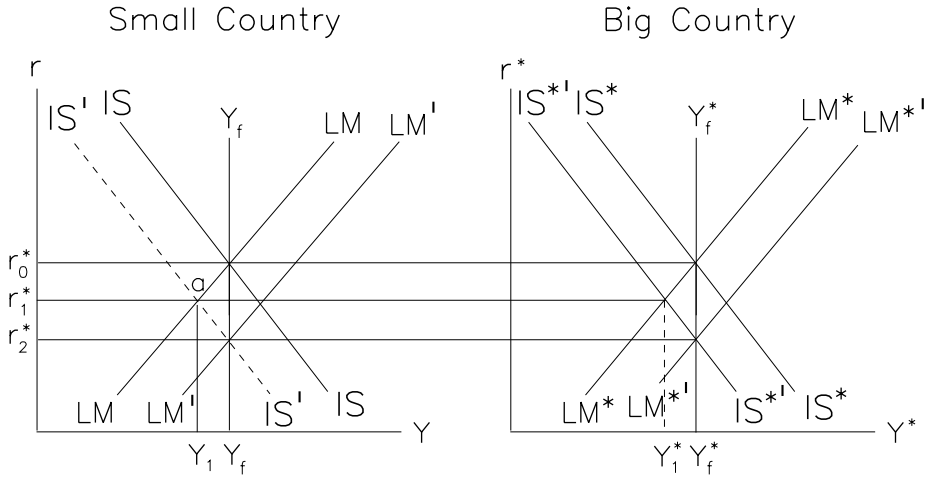
The return of income to Y_f will reduce the quantity of money demanded by the small country's residents. At the same time, the decline in the real interest rate will increase the quantity of money demanded. The figure is drawn so that these two effects offset each other exactly with no net effect on portfolio equilibrium. In this event no further change in the stock of official foreign exchange reserves or the stock of nominal money holdings will occur as long-run equilibrium is established provided that the domestic price level

does not change.

The domestic price level could ultimately move in either direction or not at all because the real exchange rate appreciates while the nominal exchange rate is constant and the foreign price level falls. Clearly, however, the small country's price level will move by less than the movement of the price level in the big country. This suggests that by maintaining the fixed exchange rate the small country neutralizes at least some of the effects of big-country real shocks on its price level in the long run, although the short-run output effects on the small country are opposite to those in the big-country.

Now suppose that the small country lets the exchange rate float and holds its money supply constant. The effects of the big country real shock on the small country in this case are shown in Figure 4.2. The fall in the world interest rate in the short-run causes output to fall to Y_1, since equilibrium is now determined by the intersection of LM and the real interest rate line at point a. Under a flexible exchange rate with a constant money supply, the income and output effects in the big-country are transmitted directly to income and output in the small country. The small country's currency will appreciate to shift IS to the left to IS'.

Figure 4.2:



In the long run when the price level in the big country falls and the world real interest rate moves down to r_2^*, there will be equivalent downward pressure on the small country's price level. The domestic price level will have to fall until LM has shifted to the right to LM'. If the big and small

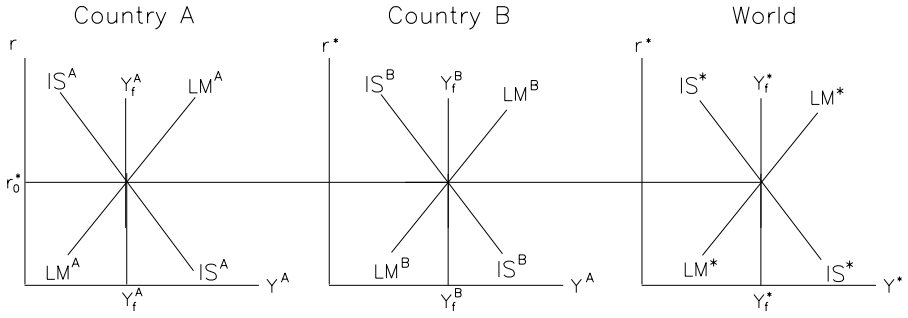
country are structurally the same except for size, we would expect the their price levels to fall in the same proportion. The entire adjustment of the real exchange rate required to shift *IS* to *IS′* will then fall on the nominal exchange rate. Under a flexible exchange rate with a constant money supply the effect of the shock on the big country's price level is transmitted directly to the price level of the small country.

The small country's central bank can manage the float to keep the domestic price level from falling. It simply increases the money stock sufficiently to shift *LM* to *LM′* at the given pre-shock domestic price level. This will mean that real exchange rate adjustment required to move *IS* to *IS′* will not necessarily involve an appreciation of the nominal exchange rate. It will depend upon whether the fall in P^* is sufficient, at the unchanged level of P, to bring about the required appreciation of the real exchange rate.

5. Equilibrium With Two Countries of Equal Size Using Commodity Money Standards

We now suppose that the world consists of two countries of equal size with both countries using either gold or silver as their money in circulation. We ignore the banking system and assume that the quantities of precious metals used as money are in fixed supply.

Figure 5.1:



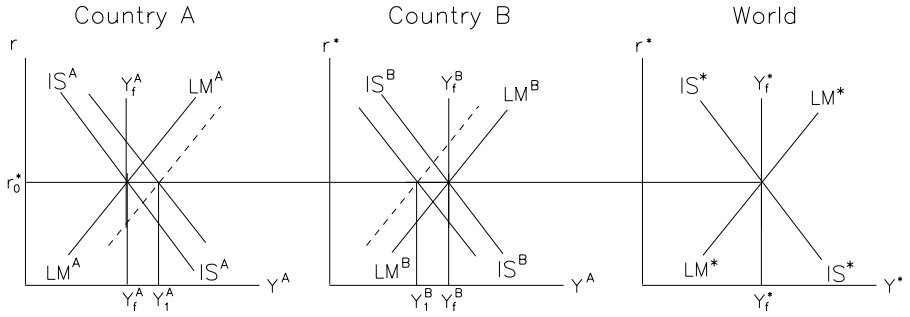
Equilibrium in the two countries and the world as a whole is portrayed in Figure 5.1. The *IS* curves in the two countries are drawn so that any feedback effects between the countries as both expand in response to a decline in the world real interest rate are incorporated into their respective curves.

The world *IS* curve is simply the horizontal sum of the *IS* curves of the two countries. And the world *LM* curve is the horizontal sum to the two countries' *LM* curves.

Consider two alternative commodity currency regimes—one where country A adopts gold as its commodity currency and country B adopts silver, and one where both countries tie their currencies to gold. When both countries adopt gold we have an international gold standard which implies that the exchange rate is fixed. When one country adopts gold and the other silver the exchange rate between the two currencies is flexible, being equal to the relative price of gold in terms of silver.

Suppose that Country A imposes a tariff on its imports. This will shift world demand from B-goods to A-goods, shifting IS^A to the right and IS^B to the left in Figure 5.2. In the short run under a world gold standard output in A will rise to Y_1^A and output in B will fall to Y_1^B. These output changes will increase the demand for money in A and reduce it in B and A-residents will thus sell assets to B-residents in return for gold. Gold will flow from Country B to Country A, shifting LM^A to the right and LM^B to the left until these curves intersect with the new *IS* curves.

Figure 5.2:

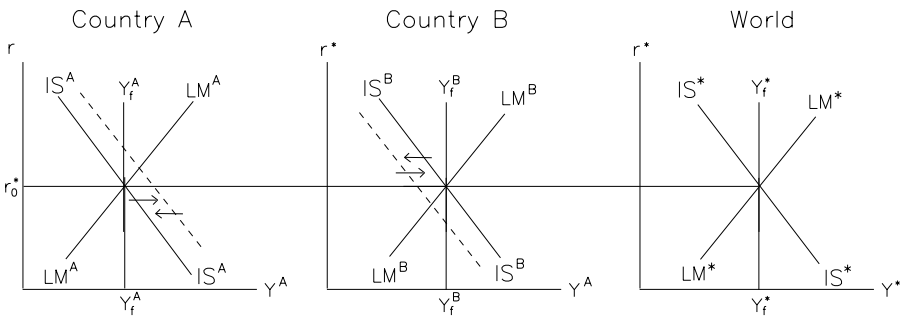


In the long-run, the price level in Country A will rise and the price level in Country B will fall. This will reduce the real stock of money in A and increase the real stock of money in B, shifting the two *LM* curves back to their original positions. In addition, the increase in the price level in Country A relative to Country B at the fixed exchange rate will shift expenditure from A to B and returning the two *IS* curves to their original positions and the countries' outputs back to full-employment. The real exchange rate adjusts through price level changes to restore world commodity market

equilibrium—A-goods become relatively more expensive to compensate for the advantage given them by the tariff.

Suppose alternatively that Country A is on a gold standard and Country B is on a silver standard. When the tariff shifts IS^A to the right and IS^B to the left, increasing income and the demand for money in A and reducing income and the demand for money in B, the attempts of A-residents to sell assets to B-residents for gold and of B-residents to buy assets from A-residents for silver creates an excess demand for gold and an excess supply of silver. The price of gold rises and the price of silver falls. This raises the price of A-goods relative to B-goods and shifts the two countries' *IS* curves back to their original positions, as shown in Figure 5.3. Country A's currency has appreciated in the world market to re-establish equilibrium. No change in outputs, employments, or price levels occur.

Figure 5.3:

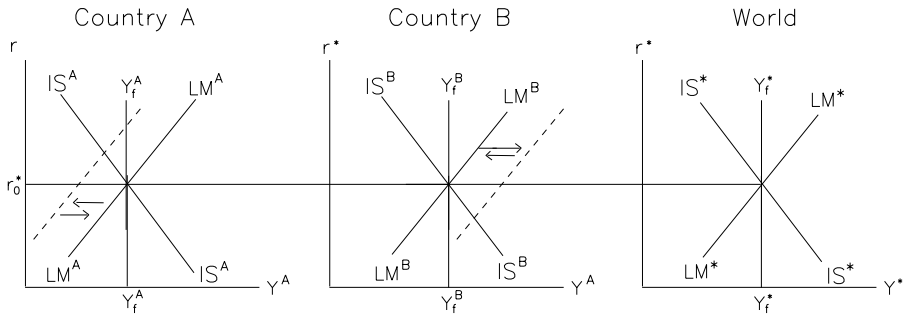


Now let us return to the case where both countries are on a gold standard and assume that, starting from a position of equilibrium, the government of Country A is required to give a reparation to the government of Country B equal to one-quarter of the national gold stock. The A-government taxes gold from A-residents and transfers it to the B-government, which distributes the gold to B-residents. This will shift LM^A to the left and LM^B to the right in Figure 5.4. A-residents will now hold too small a stock of money at their current income level and B-residents will have excess money balances. To maintain portfolio equilibrium, the residents of Country A will sell assets to the residents of Country B for gold. Gold will move back from B to A, shifting the *LM* curves back towards their original positions.

This leaves the residents of Country B with ownership of some of the capital that Country A's residents previously owned. A-residents will now

have smaller interest earnings and residents of B larger interest earnings so there will have been a shift of income from country A to country B. Moreover, A-residents, since they have less income, will end up buying less B-goods and B-residents, having more income, will buy more A-goods. The relative price levels of the two countries, and hence the real exchange rate, may have to change as equilibrium is reestablished. The direction of this effect will depend on whether the shift of interest earnings resulting from the movement of capital (the decline in A's debt service balance) exceeds or falls short of the shift in the balance of trade in goods (the increase in A's trade account balance).

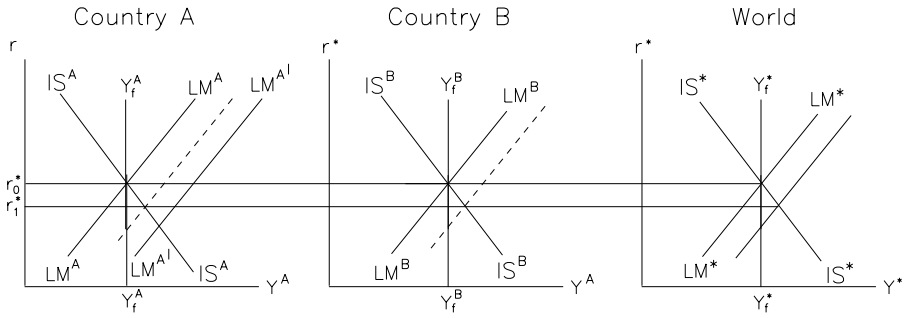
Figure 5.4:



Now suppose that the two countries are on a gold standard and there is a substantial gold discovery in Country A. This will shift LM^A to the right to $LM^{A'}$ in Figure 5.5. Since the world gold stock has increased, LM^* will also shift to the right, but only by half as much as the rightward shift of LM^A. The rightward shift of LM^* drives the world interest rate down to r_1^* and output rises in both countries.

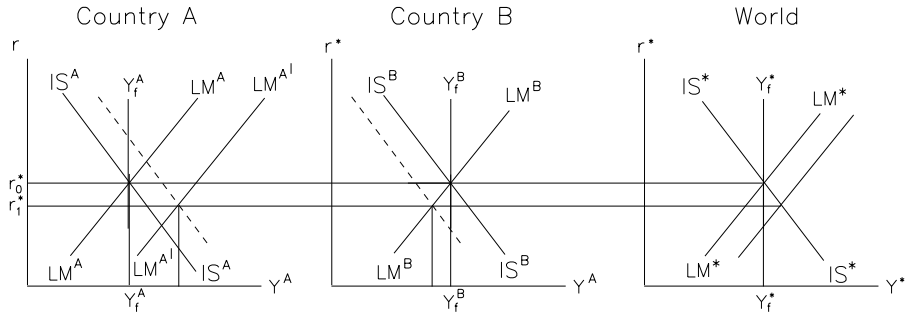
A-residents will have excess, and B-residents deficient, money holdings at the new levels of output and the world interest rate, so gold will flow from A to B in return for non-monetary assets, shifting the LM^A to the left and LM^B to the right until they pass through the intersections of the respective IS curves and the new world interest rate line. In the long run, prices in both countries will rise, shifting their LM curves and the world LM curve back to their levels before the gold discovery occurred. The world interest returns to its original level and full employment is re-established in both countries.

Figure 5.5:



Suppose alternatively that the same gold discovery occurs in Country A, but that Country B is now on a silver standard. Again, LM^A and LM^* both shift to the right with LM^* shifting by half as much as LM^A. And the world interest rate again falls to r_1^*. Excess supply of money again occurs in A and excess demand for money in B. Now, however, the attempt of A-Residents to sell gold for assets and of B-residents to sell assets for silver causes the price of gold to fall relative to the price of silver. This constitutes a devaluation of A-currency, which shifts IS^A to the right and IS^B to the left until they pass through the intersections of the respective LM curves and the world interest rate line. This is shown in Figure 5.6.

Figure 5.6:



Income and employment rise in Country A as a result of both the fall in the world real interest rate and the shift of demand from B-goods to A-goods

consequent on the devaluation of A-currency. Output in B falls because the effect of the rise in the price of gold relative to silver on the country's trade balance more than offsets the effect of the fall in the world real interest rate on domestic investment.

In the long-run, wages and prices in A rise until LM^A returns to its original position and full-employment is regained. As this happens, LM^* returns to its original position and the world interest rate goes back to r_0^*. Since nothing has affected the full-employment levels of output or the full-employment levels of savings and investment in the two countries, the real exchange rate must return to its original position. This means that the real quantity of money demanded in A will return to its original level, with the result that the price of gold will have to rise in Country A until the real value of gold (i.e., the real stock of money) is the same as it was before the discovery.

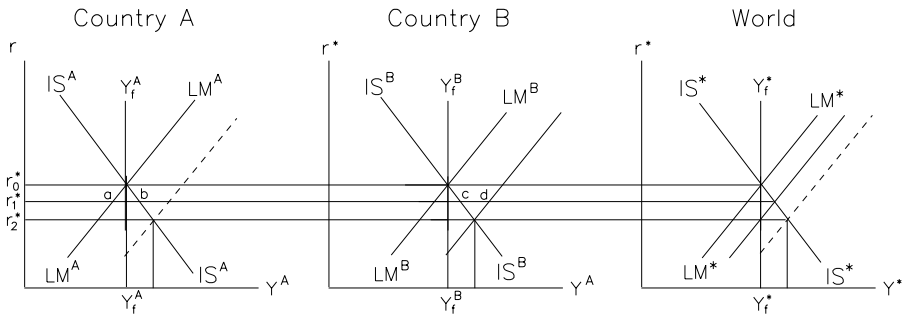
Since nothing has happened to change desired savings or investment or full-employment output in Country B the demand for real money holdings in that country will remain unchanged. This means that the price level in B (and the price of silver) will be unchanged in the long-run by the gold discovery. The nominal quantity of money and the price level in A have increased in the same proportion with A's currency (i.e., gold) devaluing in that proportion. This leaves the real exchange rate unchanged.

6. Equilibrium With Two Countries of Equal Size: Key-Currency System

We now examine a fixed-exchange-rate system like the Bretton Woods system in which all countries save one (called the peripheral countries) peg their currencies to the currency of the remaining country (the key currency country). This system requires that the key-currency country not attempt to fix any exchange rates—an attempt to do so will provide unlimited profits for arbitragers.

Assume that country A pegs its currency to the currency of country B and that both countries are of equal size, with country A consisting of an aggregate of many small peripheral countries. Short-run equilibrium occurs when the respective countries' *IS* and *LM* curves, and the world *IS* and *LM* curves, cross each other at the same world real interest rate. Long-run equilibrium occurs when those intersections also occur on the respective vertical full-employment lines. This is shown in Figure 6.1 at the world real interest rate r_0^*.

Figure 6.1:



Suppose that there is a monetary expansion (or other positive monetary shock) in Country B, the key-currency country. LM^B shifts to the right and the world *LM* curve shifts to the right by half the rightward shift of LM^B. The world real interest rate falls to r_1^*. At that world real interest rate there is excess demand for money in Country A equal to the distance *ab* and excess supply of money in Country B equal to the distance *cd*. A-residents sell non-monetary assets to B-residents and the authorities in country A increase A's money supply as they add to their official reserves of B-currency-denominated short-term assets to keep their currency from appreciating.

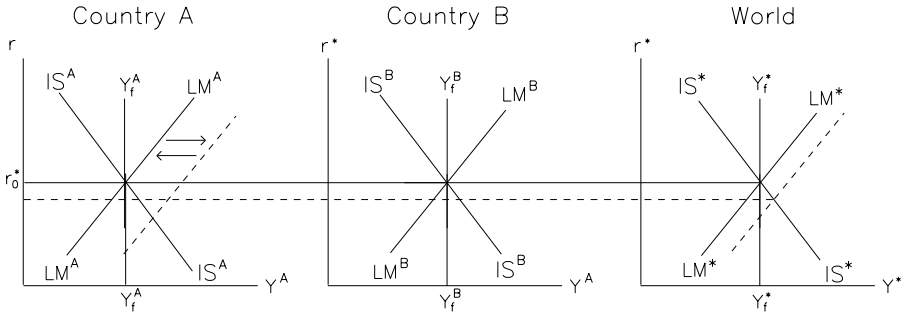
The Country A aggregate is sufficiently large that an increase in its money supply will significantly increase the world money supply, further driving down the world real interest rate and reducing the excess demand for money in Country B. Since B's *IS* and *LM* curves are unaffected as portfolio equilibrium is re-established in A, this process will continue until the world real interest rate has fallen sufficiently to pass through the intersection of Country B's new *LM* curve with its *IS* curve. The world real interest rate will fall to r_2^* and output will increase in both countries.

The equilibrium world real interest rate is thus determined by the intersection of the *IS* and *LM* curves in the key-currency country. The peripheral country's authorities are induced to produce exactly the same monetary shocks as occur in the key-currency country, which can therefore conduct its monetary policy as though it were the only country in the world.

In the long run, wages and prices will rise in both the key-currency and the peripheral country, shifting their *LM* curves back to their original positions and the world real interest rate back to its original position. Since nothing happens to affect the real exchange rate, and the nominal exchange

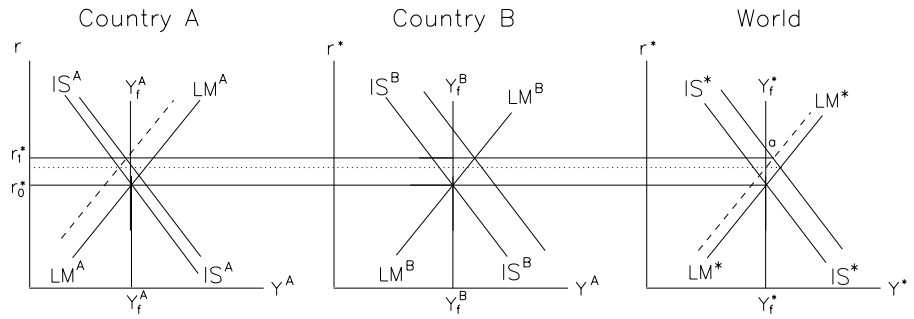
rate is fixed, both countries' price levels must rise in the same proportion. By fixing its exchange rate, the peripheral country adopts the key-currency country's monetary policy, with whatever consequences that might entail for domestic inflation. If the peripheral country were to try to conduct an independent monetary policy, shifting LM^A to the right, it would create excess money holdings which domestic residents would exchange for foreign assets. To maintain the fixed exchange rate, its authorities will have to buy back those excess money holdings in return for foreign exchange reserves, maintaining LM^A in its initial position. Monetary policy is impotent in peripheral countries. This is shown in Figure 6.2.

Figure 6.2:



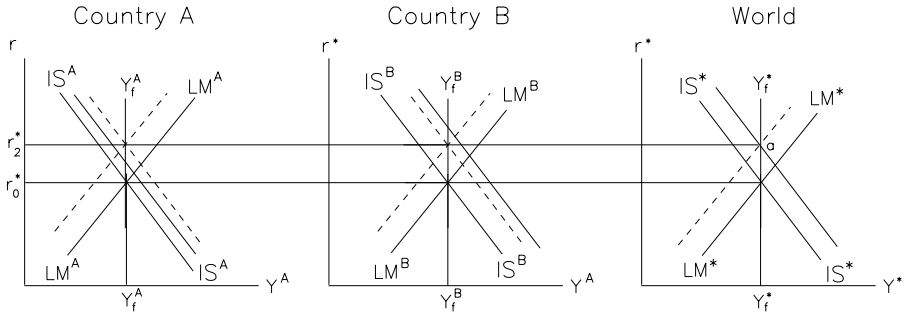
Now suppose that there is a fiscal expansion or other real shock in Country B, shifting IS^B to the right in Figure 6.3. To the extent that the additional demand for goods in B bleeds through into A, IS^A will also shift to the right, but by a smaller amount than the rightward shift of IS^B. The world IS curve will shift to the right by less than the shift in IS^B but more than IS^A. This will increase the world interest rate as indicated by the dotted line. An excess demand for money will occur in Country B and an excess supply of money in Country A. A-residents will buy non-monetary assets from B-residents and A's central bank will be forced to reduce the money supply in A, shifting LM^A to the left. This will reduce the world money supply, shifting LM^* to the left and further raising the world real interest rate to r_1^*. Output and employment increase in country B and in the world as a whole but (in the particular example shown) decline in country A.

Figure 6.3:



In the long run, wages and prices will rise in Country B, leading to a decline in A's real exchange rate that will shift A's *IS* curve to the right and B's *IS* curve to the left. The world *IS* curve will be unchanged because the change in the real exchange rate simply reallocates the existing level of world aggregate demand among the two countries. The final equilibrium world real interest rate must be at point a in Figure 6.3.

Figure 6.4:



The long run equilibrium is shown in Figure 6.4. To avoid clutter, the curves depicting short-run equilibrium are omitted. The solid unlabeled *IS* curves indicate their levels after the fiscal shock but before any short- or long-run adjustments occur. The dashed *IS* and *LM* curves indicate their final equilibrium levels. The final equilibrium is determined by the magnitude of the shock to the world *IS* curve. Since the shock to B's *IS* curve exceeds the

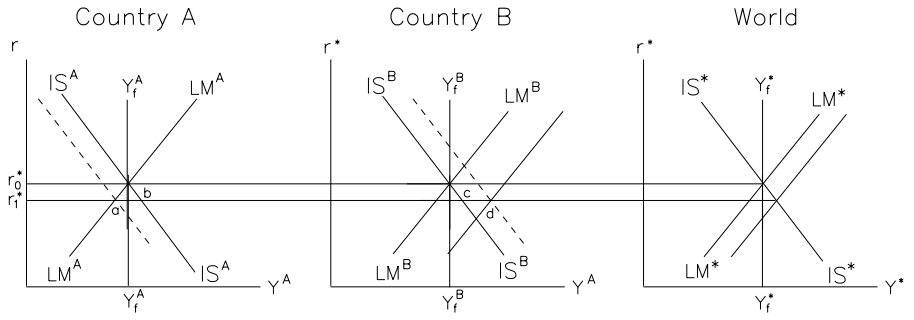
shocks to both A's and the world's *IS* curves, A's real exchange rate must decline in the long run to shift its *IS* curve to the right and B's *IS* curve to the left to pass through their respective full-employment output lines at the horizontal world interest rate line. The final equilibrium world interest rate is r_2^*. Given the fixed nominal exchange rate, B's price level must rise relative to A's to produce the required decline in the real exchange rate. A's price level may rise or fall.

An analysis of the effects of fiscal policy and other real shocks in the peripheral countries would be of little practical interest because peripheral countries are usually small and their fiscal policies uncoordinated. As a result, a fiscal shock in a peripheral country will have no significant effect on the key-currency country (which is usually large) or on the rest of the world. The same situation holds for commercial policies and exchange rate devaluations in individual peripheral countries.

7. Equilibrium With Two Countries of Equal Size: Flexible Exchange Rates

Finally, we consider how monetary and fiscal policy work in a big open economy when exchange rates are allowed to float. The effects of these policies in the big country depend on how other countries manage their money supplies in response to the consequences of those policies for their income, employment and prices.

Figure 7.1:



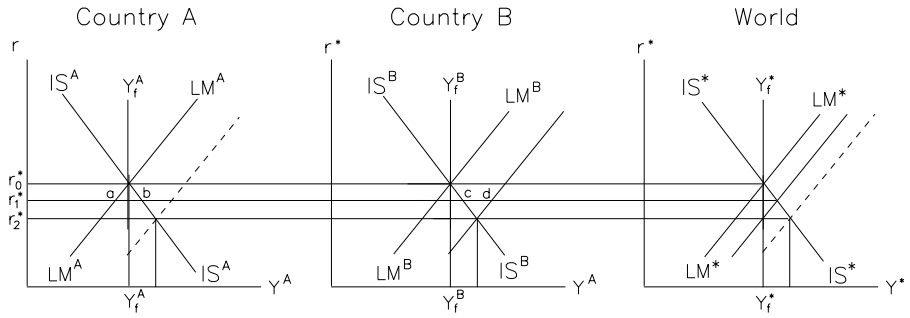
Suppose that Country B increases its money supply, shifting LM^B to the right in Figure 7.1. The world *LM* curve shift to the right by half the

amount that LM^B shifts—these new curves are the solid unlabeled curves. The world interest rate falls to r_1^* leaving an excess supply of money in Country B equal to the distance *cd* and an excess demand for money in A equal to the distance *ab*. B-residents will try to buy assets from A-residents, causing B-currency to depreciate and shifting IS^A to the left and IS^B to the right.

Assuming that Country A holds its money supply constant and Country B maintains its money supply at its new higher level, B-currency will depreciate until IS^A passes through point *a* and IS^B passes through point *d*. Income and employment will fall in A and rise further in B. By holding its money supply constant in the face of monetary expansion in B, Country A loses income and employment and magnifies the short-run income and employment gains in B.

In the long run B's price level will rise, shifting its *LM* curve back to its original position and returning the world real interest rate to r_0^*. As Country B's price level rises relative to the price level in Country A, the real exchange rate returns to its initial level, shifting A's *IS* curve back to the right and B's *IS* curve back to the left. In the end, the price level in B will have risen and the nominal value of its currency will have fallen in proportion to the increase in B's money supply, with all real variables, including the real exchange rate, returning to their original levels. Since A's *LM* curve remains at its original level, its price level is ultimately unaffected by the monetary shock in B.

Figure 7.2:

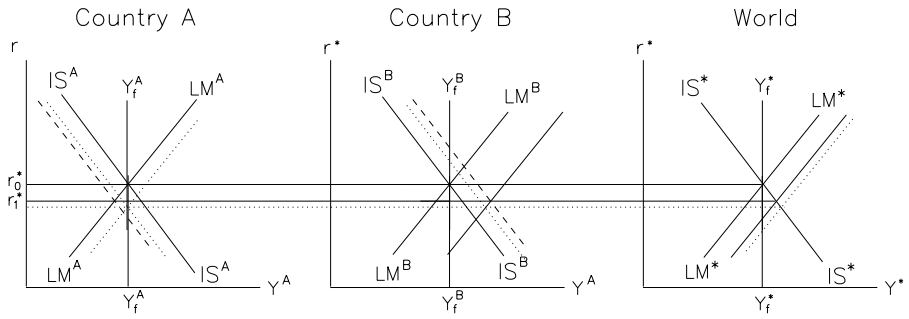


Policy-makers in the countries comprising the aggregate A, if they know what is going on, are likely to try to adjust their money supplies to prevent B-currency from depreciating. The result, shown in Figure 7.2, is the same

as occurs when B is given the key-currency role. The world real interest rate falls to r_2^* and A's income and employment (and price level in the long-run) move identically with B's. The A-countries now end up mimicking the monetary shocks in B.

But the Country A aggregate can do better if its authorities have perfect information about the shocks in B and the structure of the world economy. They can expand their money supplies to limit the devaluation of B-currency to the point where their *IS* and *LM* curves cross the world real interest rate line in at full-employment. This causes a shift of A's *IS* and *LM* curves to the right, and B's *IS* curve to the left as compared to the situation where the money supply in A is held constant. The world money supply increases, shifting the world *LM* curve to the right by half the rightward shift of A's *LM* curve, and the world interest rate falls. The new short-run equilibrium is shown by the dotted lines in Figure 7.3.

Figure 7.3:



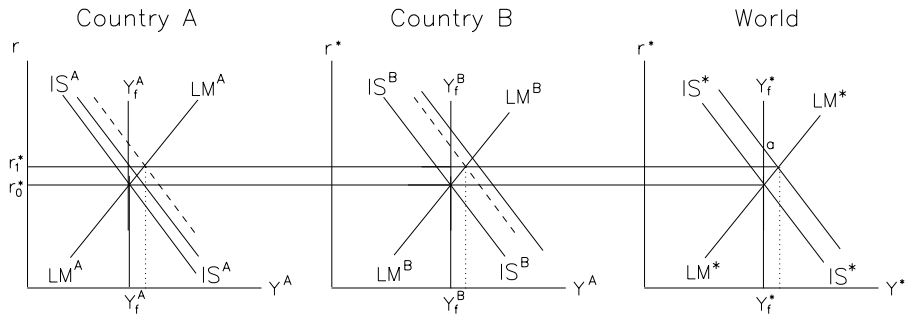
In the long run the countries composing the aggregate A will have to return their money supplies to pre-shock levels to avoid participating in the inflation that occurs in Country B. This would be accompanied by a nominal devaluation of B-currency and an increase in B's price level in the same proportion as the money shock in Country B.

In the real world, no country will deliberately shock a fully-employed economy. Observed big-country shocks must therefore be viewed as demand for money shocks that the country's authorities had insufficient knowledge to offset or supply shocks whose purpose is to correct previously uncorrected demand for money shocks. And the response of the rest of the world to shocks in the big country shocks will also be constrained by imperfect information. All we can say is that big countries will be able to conduct

independent monetary policies but the effects of those policies on the home economy will depend on how the rest of the world responds.

This principle also holds for fiscal policy and exogenous *IS*-curve shocks in big countries. A positive fiscal or other *IS* curve shock in Country B raises the world interest rate to r_1^* in Figure 7.4. At that interest rate B-residents have excess demand for money and A-residents excess supply. B-currency will appreciate in both nominal and real terms, shifting IS^B to the left and IS^A to the right until the portfolio disequilibrium has been eliminated. There will be a net increase in income and employment in both countries, assuming that the money supplies are held constant.

Figure 7.4:

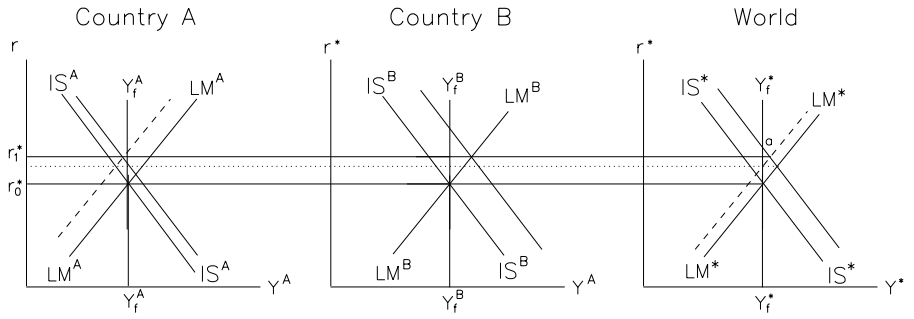


In the long run, the price level in country B will rise, reducing the world real money stock and increasing the world real interest rate. A's price level will also have to rise to force its *LM* curve through the intersection of the new higher world real interest rate line with its vertical full-employment line. The world real interest rate will ultimately pass through point *a*. The real exchange rate will adjust to ensure that the *IS* curves in both parts of the world also pass through the world real interest rate line at full employment. We know that Country B's s real exchange rate must end up higher than its pre-shock level because B's *IS* curve initially shifted to the right by more than the world *IS* curve.

The authorities in the country-A aggregate can prevent the domestic levels of income and employment from increasing in the short run by reducing their money supplies to prevent the currency of country B from appreciating. If they maintain fixed exchange rates, B-currency becomes a key-currency. Equilibrium occurs at the world real interest rate r_1^* in Figure 7.5. In that

case A's output and employment may either rise or fall in the short-run depending nature of the shock and on the structure of the world economy.

Figure 7.5:



The long-run effect will be inflationary regardless of whether the exchange rate is fixed or flexible. In either case the equilibrium world interest rate will be at point a. To prevent these long-run inflationary effects of the shock in B, A's authorities have to float the exchange rate and make nominal money supply adjustments sufficient to force LM^A to cross the world real interest rate line at full employment without a change in the price level. B's authorities could prevent an increase in the price level in B by doing the same thing.

The ultimate level of the real exchange rate and, hence, the long-term shift in it as a result of the shock, will be the same regardless of the rest-of-world's reaction to Country B's *IS*-curve shock. This is the case as long as real exchange rate adjustments do not affect the world *IS* curve or the levels of full-employment output in either part of the world. Price level increases will occur in any country that does not contract its nominal money supply to match the reduction in the demand for money consequent on the higher world real interest rate.

We can conclude from the above analysis that any big country can operate monetary and fiscal policy to achieve the traditional objectives of those policies regardless of how the other countries respond. The magnitudes of the effects of these policies will depend, however, upon whether other countries hold their money supplies constant and let the exchange rates of their currencies with the big country's currency float, or make changes in their money supplies to offset the effects on their economies of the big country's policies.

Since different countries in the rest of the world may respond differently to different policy shocks and differently to the same policy shocks on different occasions, there is substantial indeterminacy as to the effects of big-country policies on the home economy. And in a world where both real sector and demand for money shocks are frequent, both big and small countries must conduct their policies with considerable attention to how the authorities in the rest of the world are responding. When we take account of the fact that information about the magnitude and direction of these shocks and the response of domestic and foreign economies and foreign authorities to them is poor, and forecasting is an inexact science, conducting macroeconomic policy is a difficult task.

Study Question

Suppose that the Bank of Canada decides to implement a constant rate of domestic nominal money growth with the growth rate selected to produce an appropriate target rate of inflation (say, zero). Compared to the alternative of fixing the exchange rate with respect to the U.S. dollar (assume that the U.S. has a zero inflation rate), would this stabilize the Canadian economy in the sense of reducing cyclical fluctuations? Can you predict how Canadian output and employment would vary with U.S. output and employment in the two cases?

References

The tools are the same as those used previously except that we now horizontally aggregate the *IS* and *LM* curves of individual countries into world *IS* and *LM* curves. At the very elementary level this is very straight forward. The technique poses some aggregation problems that could become important if we try to push it too far, but for understanding the general nature of inter-country effects of and reactions to shocks and policies it does the job very well. For the relevant institutional background, read

J. E. Floyd, *World Monetary Equilibrium*, University of Pennsylvania Press, 1985, 1–10.

A more advanced treatment of the theory developed in this module is also contained in the above reference.