MODULE 12

Small Open Economy Equilibrium V:

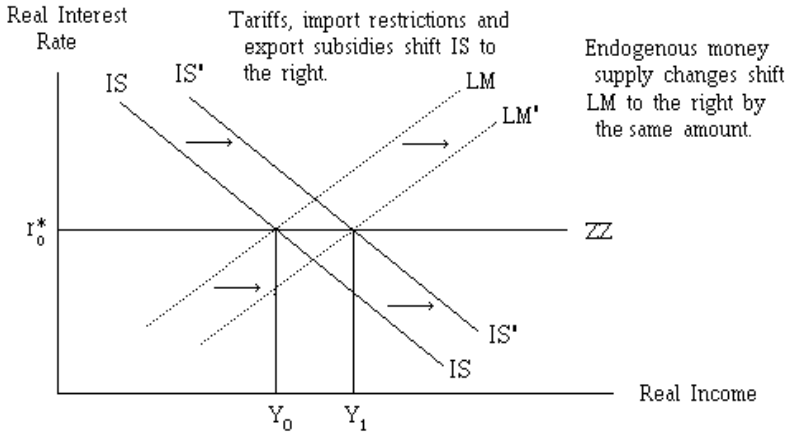
Additional Policy Issues

This module completes the subsequence dealing with small-open-economy equilibrium. It begins by extending the analysis to encompass commercial policy (tariffs and export subsidies) and the effects of devaluations and revaluations of pegged exchange rates. Then it examines the forces that determine the time path of the full-employment equilibrium real exchange rate. This leads to a discussion of the phenomenon of exchange rate overshooting in the short-run when domestic output and output prices cannot adjust to the effects of exchange rate changes induced by shocks to the demand and supply of money. The effects of monetary policy on real and nominal interest rates are considered next along with the effects of direct foreign exchange market intervention on the nominal exchange rate. The theory of purchasing power parity is then explained and evaluated, followed by an analysis of the implications of rational expectations for the conduct of monetary policy.

1. Commercial Policy

Commercial policy is viewed here as the attempt to change employment and output by changing tariffs and quotas on imports or subsidies on domestic exports. A tariff, import restriction or export subsidy increases the current account balance at each level of the real exchange rate, shifting world aggregate demand onto domestic goods. The *IS* curve shifts to the right as shown in Figure 1.2.

Figure 1.2:



The money supply increases automatically, driving *LM* to the right until it crosses through the new *IS*-*ZZ* intersection.[1] If there is full employment the price level will increase to eliminate the expansion of exports relative to imports and prevent output from rising above Y_F. The rise in P will require a proportional rise in M to keep *LM* from shifting to the left away from the *IS*-*ZZ*-Y_F intersection. The effect is shown in Figure 1.3.

[1]The equations of flow and stock equilibrium are reproduced in the module along with a review of the equilibrating process under fixed and flexible exchange rates. That review is tied to Figure 1.1 which is not shown here.

Figure 1.3:

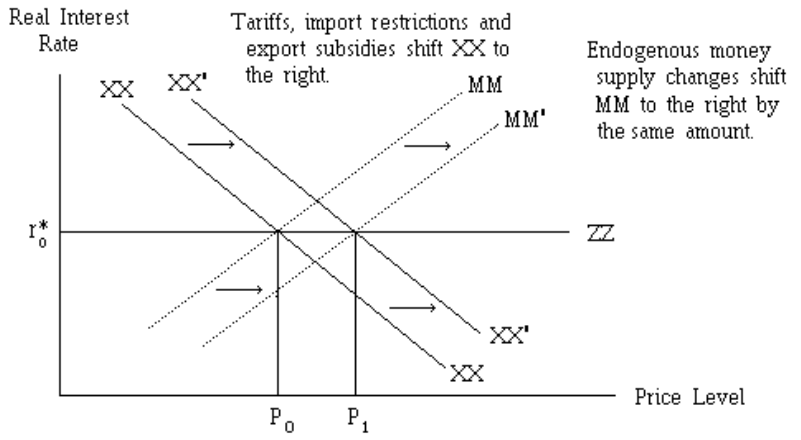
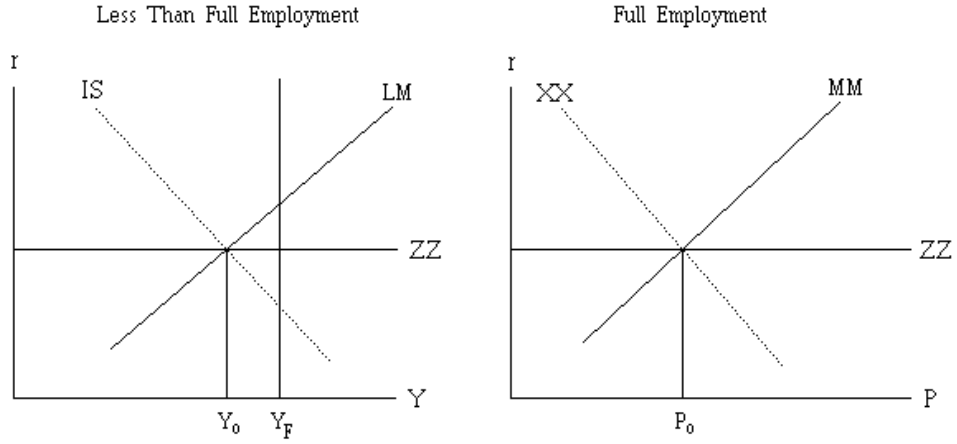


Figure 1.4:



Under a flexible exchange rate regime equilibrium is determined by the intersection of either *LM* or *MM* and *ZZ* as shown in Figure 1.4. Any tendency of *IS* or *XX* to shift to the right as a result of commercial policy initiatives will raise income or prices and increase the quantity of money demanded. Domestic residents will try to sell assets to foreign residents

to increase their money holdings. This will cause an appreciation of the nominal (and real) exchange rate, driving *IS* and *XX* (and output and the price level) back to their original positions. These policies are thus ineffective devices for raising domestic output and employment under flexible exchange rates.

Because commercial policies of the sort discussed above increase domestic output and employment (under fixed exchange rates) by shifting world demand off foreign and onto domestic goods, they have the effect of reducing employment in the rest of the world. While this effect is of trivial magnitude when the domestic economy is very small, a simultaneous attempt on the part of all countries to increase employment by putting tariffs on imports will be ineffectual. Each country expands at others' expense, so the overall employment effects will cancel out (and efficiency gains from international trade will be sacrificed). For this reason these policies are called *beggar-thy-neighbor policies.*

Monetary policy is also a beggar-thy-neighbor policy under flexible exchange rates in the sense that a domestic monetary expansion leads to a devaluation of the domestic currency that shifts world demand from foreign to domestic goods. But when all small countries expand their money supplies the world money supply will increase and the world interest rate will fall, increasing employment in every country. This issue is discussed in the next module entitled *Big Open Economy Equilibrium.*

Finally, we note that fiscal policy under fixed exchange rates is not a beggar-thy-neighbor policy since it deteriorates the domestic current account balance and hence increases aggregate demand in the rest of the world.

2. The Effects of a Devaluation

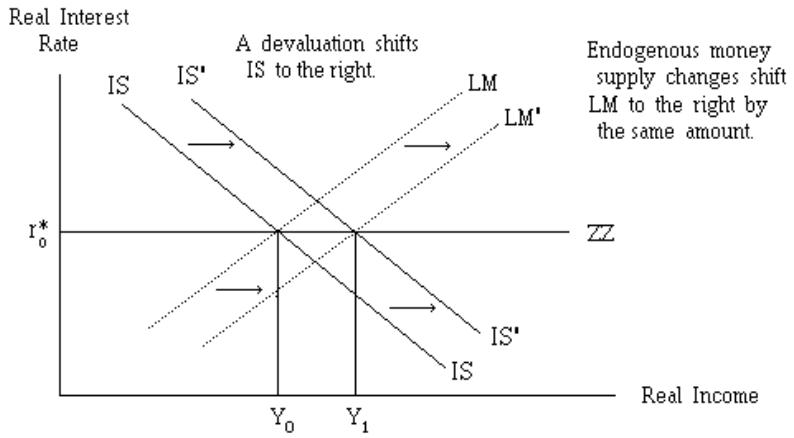
Changes in official or parity exchange rates have typically been frequent. A devaluation of the official exchange rate operates like a tariff—it shifts world demand for goods and services off of foreign and onto domestic output. An increase in the official parity value of the currency—an appreciation or revaluation—has the opposite effect.

A devaluation of the official exchange rate under conditions of less than full employment lowers q in the by now familiar flow equilibrium equation,

$$\begin{aligned} Y &= \frac{1}{s+m}\left(Z_{BT}+\alpha+\delta\right)+\frac{m^*}{s+m}Y^*-\frac{\mu}{s+m}r^* \\ &\quad -\frac{\sigma}{s+m}q+\frac{1}{s+m}DSB \end{aligned} \tag{1}$$

making domestic goods cheaper in world markets. The current account balance increases, increasing aggregate demand and shifting *IS* to the right. Given the new fixed level of the exchange rate, output will increase under less-than-full-employment conditions as shown in Figure 2.1. As output rises at the given world real interest rate, the quantity of money demanded increases leading to a sale of assets abroad by domestic residents and an increase in official reserve holdings as the authorities purchase the foreign exchange necessary to keep the exchange rate from appreciating back to its old level. Thus, *LM* shifts rightward to pass through the new *IS*-*ZZ* intersection.

Figure 2.1:



These money supply and foreign exchange reserve adjustments can be seen more easily if we write the asset equilibrium equation in the form

$$M = P\left[\theta - \Omega\, r^* - \Omega\, \tau^e + \epsilon\, Y\right] \tag{3}$$

and take advantage of the fact that

$$M = mmH = mm(R + D). \tag{4}$$

This enables us to rewrite the asset equation as[2]

$$R = \left[\frac{P}{mm}(\theta + \epsilon\, Y - \Omega\,(r^* + \tau^e))\right] - D. \tag{5}$$

[2]Equation (2) in the module is a repetition of the asset equation that is not shown here.

The devaluation-induced rise in income leads to an increase in the demand for base money, given by the expression in the square brackets. At a given level of D, this results in a one-shot increase in the stock of official foreign exchange reserves. The increase in reserves could be avoided if the central bank were to increase D appropriately by purchasing bonds in the open market.

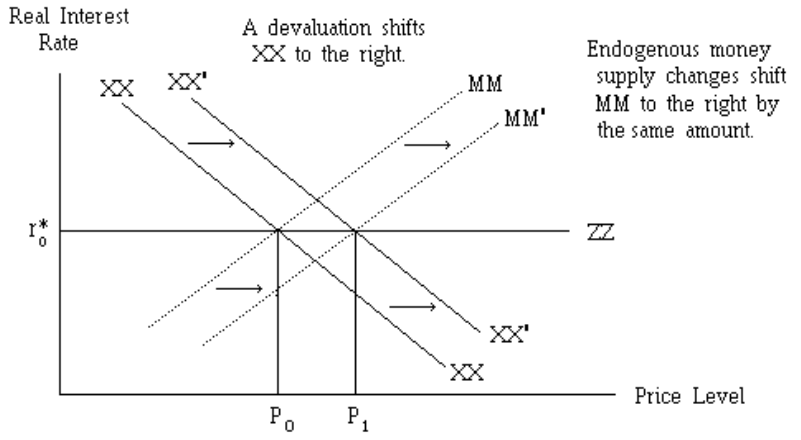
A balance of payments deficit is a continual outflow of foreign exchange reserves as indicated by a negative rate of change of R through time. For such a deficit to occur D must be growing at a faster rate through time than the demand-for-base-money terms in the square brackets in equation (5). If the devaluation does not affect the rate of growth of the domestic source component of base money or the rates of growth of the demand for money and the money multiplier mm (the latter two growth rates determine the rate of growth of the demand for high-powered money), it will not affect the rate of growth of the stock of reserves. It will produce a one-shot increase the level of the stock of reserves while not necessarily increasing the the rate of growth (or reducing the rate of decline) in that stock through time. Thus it will not necessarily cure a balance of payments deficit. A balance of payments deficit can be easily cured without changing the exchange rate by simply reducing the rate at which D is growing through time. Also, a one-shot increase in the stock of reserves can be brought about by a one-shot reduction in D without changing the official rate of exchange of domestic for foreign currency.

Since a devaluation is not necessary to correct a balance of payments deficit, what would be its purpose? One possible purpose would be to expand output and employment in a recession. The problem is, however, that this is a beggar-thy-neighbor policy—any gain in domestic output (which occurs through an increase in the current account balance) comes at the expense of employment and output in the rest of the world. Moreover, both countries' governments must agree on the official rate of exchange between two currencies. Why should a foreign country accept a reduction in its output and employment so that the devaluing country can get its economy out of a recession?

It turns out that a devaluation (or appreciation) of the exchange rate parity is the only way a country can change its price level in a fixed-exchange-rate regime under full-employment conditions. This is shown on Figure 2.2. The devaluation shifts XX to the right. The money supply must then be increased either by an open market purchase of domestic bonds or an accumulation of official foreign exchange reserves by the central bank to shift MM to the right by an equivalent amount. Similarly, an appreciation

of the currency will lower the domestic price level.

Figure 2.2:



The price level change consequent on a devaluation can be equally well achieved by increasing the money supply and letting the exchange rate float—the same money supply change will be associated with a given movement in the exchange rate whether the money supply adjustment is exogenous (and the exchange rate adjusts endogenously) or the exchange rate adjustment is exogenous (and the money supply adjusts endogenously).

When countries change their official exchange rates, they usually move them by several percentage points. Since a devaluation or appreciation of the domestic currency will move the equilibrium domestic price level by the same percentage, it would seem that official exchange rate movements are a rather blunt instrument for manipulating the domestic price level. A better approach would probably be to let the exchange rate float and gradually change the rate of domestic monetary expansion.

Under conditions where assets can be freely bought and sold internationally there is little reason to change the exchange rate once a country has committed itself to a fixed exchange rate regime. Traditionally, exchange rate adjustments within the framework of fixed exchange rate regimes have occurred in an environment where the government is imposing controls on the international movement of capital assets so that people are not able to purchase and sell assets across international boundaries in the process of changing their desired money holdings.

3. The Forces Determining the Real Exchange Rate Under Full-Employment Conditions

Recall that the real exchange rate is equal to

$$q = \frac{P}{\Pi P^*} \tag{1}$$

where Π, the nominal exchange rate, is the domestic currency price of foreign currency. The real goods market equation,

$$\begin{aligned} Y \quad = \quad & \frac{1}{s+m}\left(Z_{BT} - Z_{S-I}\right) + \frac{m^*}{s+m}\,Y^* - \frac{\mu}{s+m}\,r^* \\ & - \frac{\sigma}{s+m}\,q + \frac{1}{s+m}\,DSB \end{aligned} \tag{2}$$

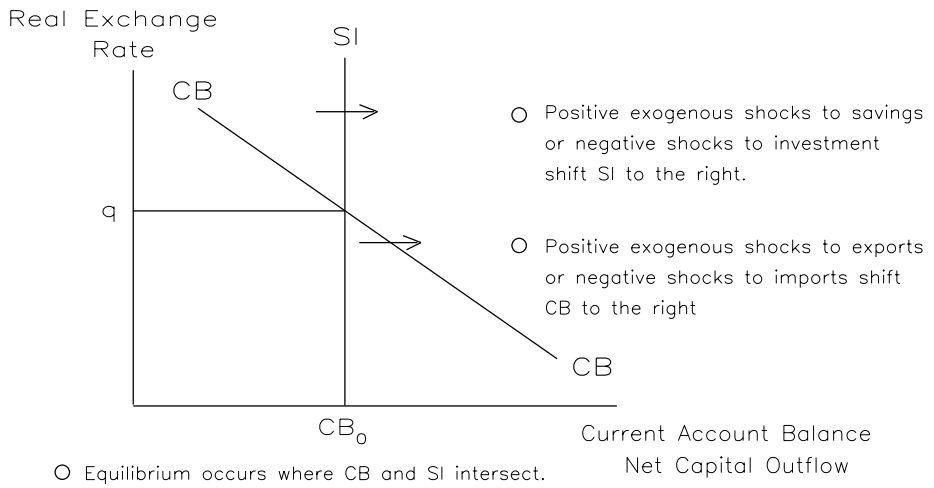
can be manipulated to yield an expression determining the real exchange rate by bringing q to the left side:

$$q = \frac{1}{\sigma}\left(Z_{BT} - Z_{S-I}\right) + \frac{m^*}{\sigma}\,Y^* - \frac{\mu}{\sigma}\,r^* - \frac{s+m}{\sigma}\,q + \frac{1}{\sigma}\,DSB \tag{3}$$

The process by which equilibrium is achieved under full-employment conditions can be seen with reference to Figure 3.1. The vertical line *SI* gives the desired net capital inflow—it shifts to the right with an exogenous increase in savings or decrease in investment. It is vertical because the net capital flow is not affected by changes in the real exchange rate when domestic and foreign incomes and the real interest rate remain the same. The line *CB* gives the relationship between the real exchange rate and the current account balance—a fall in the real exchange rate causes the current account balance surplus to increase. An exogenous increase in exports or reduction in imports shifts this curve to the right. Equilibrium occurs where the desired net capital outflow equals the current account balance.

Shocks to the net capital flow (i.e., to Z_{S-I}) shift the *SI* line and cause the real exchange rate to adjust to create an equivalent change in the current account balance. Exogenous shocks to exports and imports (to Z_{BT}) shift the *CB* curve. Since the vertical *SI* line remains in position, the real exchange rate has to adjust to keep the current account balance equal to the unchanged net capital flow. The current account balance is thus unaffected.

Figure 3.1:



The path of the real exchange rate through time as saving, investment and technological change occur and the full-employment levels of domestic and foreign output and the real interest rate evolve will thus depend on how Z_{S-I} and Z_{BT} change through time. A less formal way of thinking of this process is to build on the fact that the real exchange rate is the relative price of domestic output in terms of foreign output. It will be determined, like all relative prices, by supply and demand. An increase in the world demand for domestic relative to foreign output output will cause the price of domestic output in terms of foreign output to rise. An increase in the supply of domestic relative to foreign output will cause it to fall.

Technological change and the growth of the capital stocks in the domestic and foreign economies will determine how the relative supplies of the two outputs evolve through time. These same factors, because they determine domestic and foreign incomes, will also determine the evolution of the demands for domestic and foreign output through time. Government policy will affect this process to the extent that it causes domestic and rest-of-world demand to shift between foreign and domestic goods. Because a crucial element here is technological change, which is impossible to quantify, the exact confluence of forces that determine the movements of the full-employment real exchange rate in practical real-world cases remains a mystery, given the present state of economic science. Economists can speculate, sometimes correctly, that a shock to oil prices or a change in government policy that affected domestic savings or investment or shifted world demand onto do-

mestic goods caused a particular observed movement in a country's real exchange rate. But coherent explanations of real exchange rate movements over extended time periods are difficult to come by.

Forecasting movements in the real exchange rate is even more difficult, for two reasons: First, as just noted it is difficult to establish the quantitative relationship between technological and policy developments and the real exchange rate. Second, even if we knew these relationships precisely, we would have to correctly forecast the future path of technological change and the various political forces affecting government policy. It is thus not surprising that economists have found that the naive forecast that the real exchange rate will remain the same between this period and next, while nearly always wrong, is virtually impossible to improve upon. More elaborate forecasts typically lead to larger prediction errors.

Economists have found that actual real exchange rate movements typically can be described by equations of the form

$$q_t = q_{t-1} + e_t \tag{4}$$

where e_t is a random or stochastic variable that is equally likely to be be positive or negative but will average out to zero. Equation (4) can be rearranged as

$$q_t - q_{t-1} = e_t \tag{5}$$

which says that the real exchange rate will change from period to period by an amount which is equally likely to be positive as negative. In this case the exchange rate is said to follow a *random walk process.*

This random walk process must be distinguished from *mean centered processes* that can be described

$$q_t = \bar{q} + e_t \tag{6}$$

where q deviates from some average level $\bar{q}$ by an amount e_t. Every period q reverts back to its mean or average value before been perturbed again by the shock e_t. In (6) the exchange rate deviates randomly from its average level while in case (4) and (5) it wanders randomly with no fixed anchor.

Figure 3.2 gives an example of a mean centered process of the sort described by (6) while Figure 3.3 gives three examples of random walk processes described by (4) and (5).[3]

[3]All of the examples in Figures 3.2 and 3.3 are derived from the same statistical process generating e_t. A sequence of 160 values of e_t was generated. The first 40 appear in Figure 3.2 and the remaining three sets of 40 were used to generate the series in Figure 3.3

Figure 3.2:

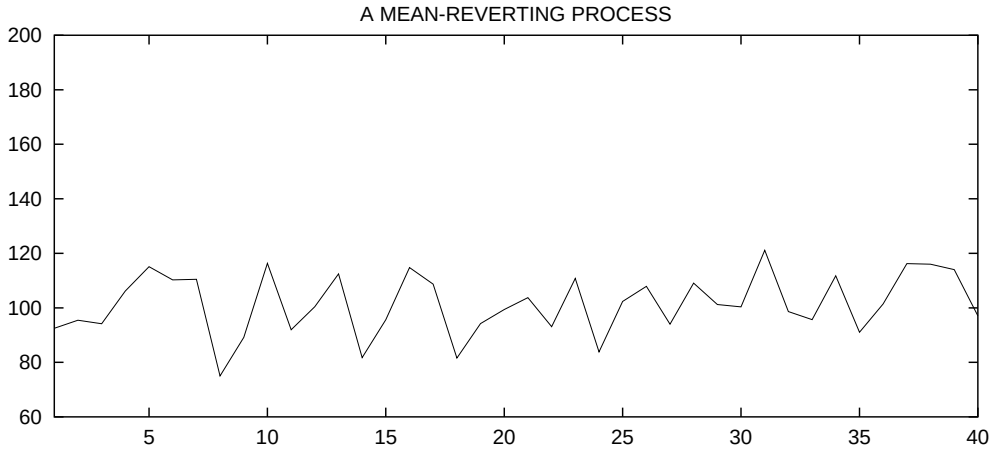
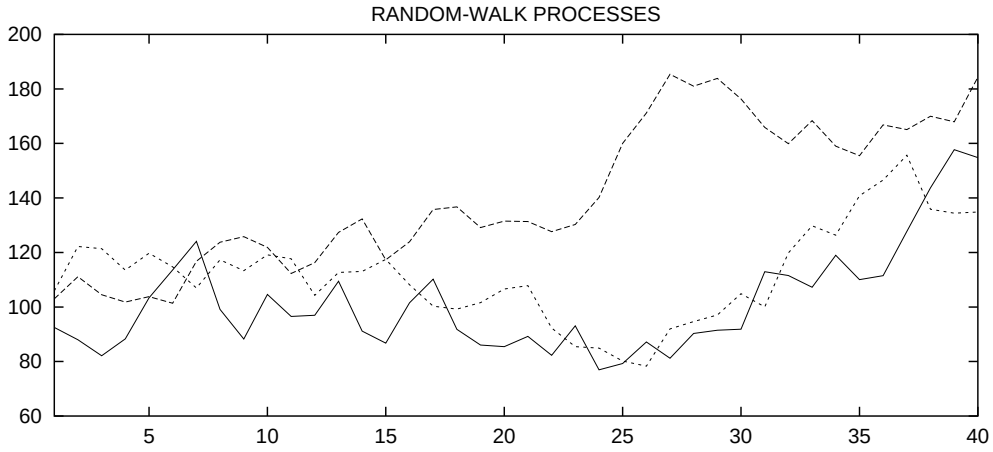


Figure 3.3:



These artificially generated series can be contrasted with the actual real exchange rate movements that occurred for Italy, Germany and Britain relative to the United States, shown in Figure 3.4. While it turns out that actual real-world real exchange rate series are usually not true random walks—there is typically some tendency for positive shocks to get smaller when the real exchange rate is above the mean and negative shocks to get smaller when it is below the mean—the difference is not apparent to the naked eye.

Figure 3.4:

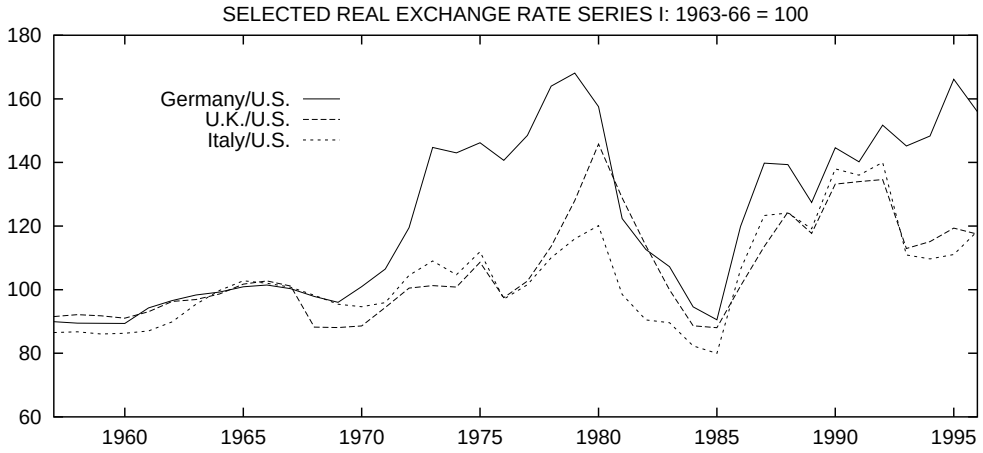
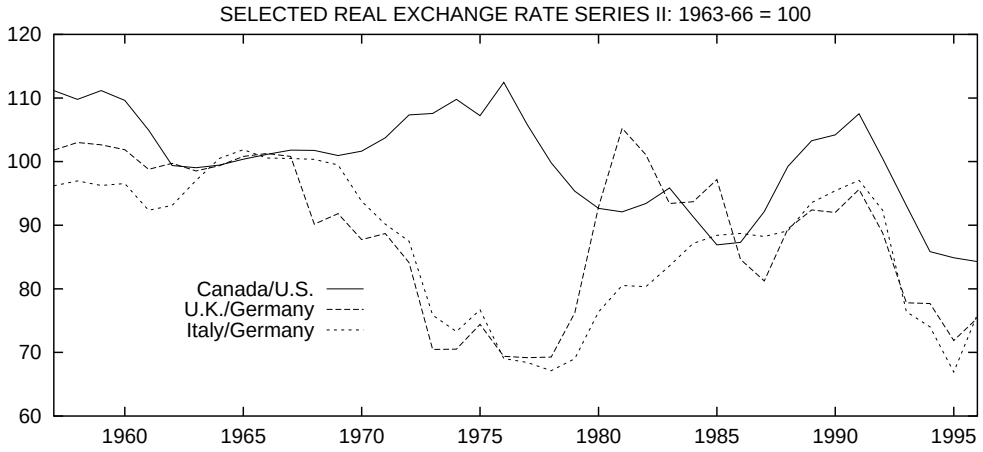


Figure 3.5:



This near-random-walk character of real exchange rate movements is consistent with the finding that usually the best predictor of tomorrow's exchange rate is today's. Real exchange rates exhibit this behavior because the factors determining them are equally likely to have positive as negative effects in any given period. This does not mean, of course, that real exchange rates are randomly determined—it means simply that they appear to us as randomly determined, the variable e_t being a measure of our ignorance.

Finally, when we look carefully at the real exchange rate movements in Figure 3.4, we note persistent movements in the order of 30 to 50 percent over time periods of longer than 4 or 5 years. Similar though somewhat smaller persistent movements are evident in the series in Figure 3.5.

4. Exchange Rate Overshooting

We now look at forces affecting the real exchange rate when prices are rigid and employment can change. From the definition of the real exchange rate

$$q = \frac{P}{\Pi P^*} \tag{1}$$

we can see that the nominal and real exchange rates as we define them will move in opposite directions while the real and nominal values of the domestic currency move in the same direction. Rearranging (1) to move the nominal exchange rate to the left side,

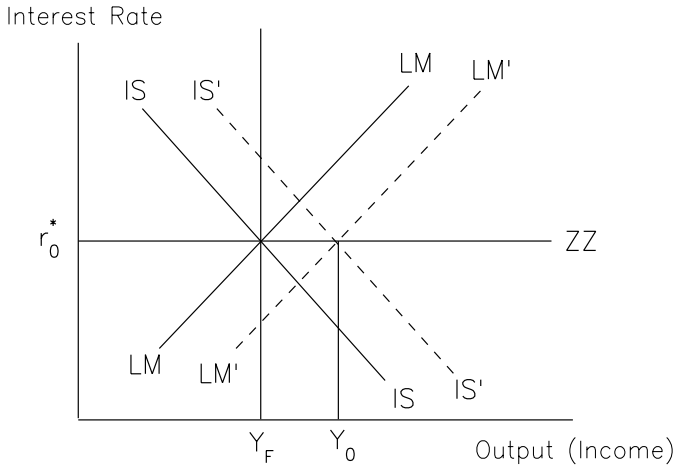
$$\Pi = \frac{1}{q}\frac{P}{P^*}, \tag{2}$$

we note that the nominal exchange rate is the product of two terms—the reciprocal of the real exchange rate $1/q$ and the ratio of the domestic to the foreign price level P/P^*.

Suppose for the sake of argument that the full-employment real exchange rate is constant through time. The effect on output of a monetary expansion when the exchange rate is flexible can be seen from Figure 4.1. The increase in the money supply shifts *LM* to the right causing domestic residents to rebalance their portfolios by purchasing assets abroad. The domestic currency devalues, reducing the real exchange rate, shifting world demand onto domestic goods and increasing the level of output the short run when the price level is inflexible. *IS* shifts rightward to IS'. The domestic unemployment rate falls below its normal (full-employment) level. This pressure on the labour market eventually causes nominal wages and prices to rise. As the price level rises the real money stock declines, shifting *LM* back to its original position. This rise in the price level reduces the real exchange rate back to its original level, shifting *IS* back to its original position. When full employment is again achieved the price level and nominal exchange rate will have risen in proportion to the increase in the money supply and the levels of real output and the real exchange rate will have returned to their original levels. The monetary expansion thus has a temporary downward effect on

the real exchange rate and upward effect on real income and a permanent upward effect on the nominal exchange rate and domestic price level.

Figure 4.1:



The above analysis assumes that the short-run adjustment of output and employment is immediate while the adjustment in the price level takes time. In fact, however, the adjustment of output will also take time—it will take time for the devaluation of the real and nominal exchange rates to shift world demand onto domestic goods and a further period for the increased demand to increase domestic output. This has important implications for the process of exchange rate adjustment.

Consider the stock equilibrium equation, rewritten to put the nominal money stock on the left side[4]

$$M = P\left[\theta + \epsilon Y - \Omega\left(r^* + \tau^e\right)\right] \tag{5}$$

An increase in M increases the left side of this equation immediately, but it will take time for something to happen to increase the right side. During this time interval domestic residents will have excess money holdings and will be trying to exchange them for assets on the international market. Although the adjustment of output will take time, the exchange of money for

[4]Equations (3) and (4) are repeats of the stock and flow equilibrium equations and are not shown here.

assets and the associated pressure on the exchange rate will occur immediately. The upward movement of the nominal exchange rate (and downward movement of the real exchange rate) will explode unless something happens to bring the two sides of the asset equilibrium equation into equality. This prompts us to delve more deeply into the question of how we measure the price level.

We have written the asset equilibrium equation using the price level of domestic output as our price variable. In fact, however, we should measure the real money stock using the price index of goods absorbed or bought by domestic residents. These goods are of two types: domestic goods whose price is denoted by P, and foreign goods whose price is denoted by (ΠP^*). The price level that should be used in equation (5) is thus

$$\hat{P} = wP + (1 - w)(\Pi P^*) \tag{6}$$

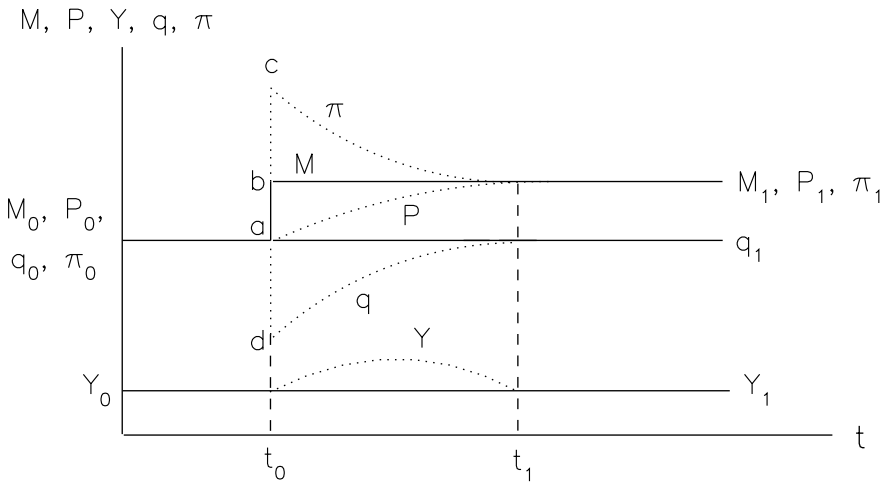
where w is the share of domestic goods in total domestic absorption. And the asset or stock equilibrium equation must now be written

$$M = \hat{P}\,[\theta + \epsilon\, Y - \Omega\,(r^* + \tau^e)]. \tag{7}$$

An increase in the nominal exchange rate will directly raise the properly defined domestic price level in (7) in the proportion $(1 - w)$. The rise in $\hat{P}$ will be less than the rise in Π because $(1 - w) < 1$. Since $\hat{P}$ must rise in proportion to the rise in M to reestablish asset equilibrium when nothing else has yet had time to adjust, a rise in Π in excess of the rise in M (and in excess of the long-run equilibrium rise in Π) must occur. *Exchange Rate Overshooting* takes place—the exchange rate overshoots its new long-run equilibrium in the process of getting to it.

This is illustrated in Figure 4.2. When everything including the price level adjusts immediately, M, P, and Π will all shift up by the distance ab at time t_0 and remain at their new levels indefinitely. And q and Y will remain constant. When income and prices cannot adjust immediately, Π will jump all the way up to point c and then gradually fall back to its long-run equilibrium level. q will jump down to point d and then gradually rise back up to its original level. P will rise gradually to its long-run equilibrium level. And Y will rise temporarily relative to its long-run level while P is adjusting. When time t_1 is reached everything will be back in long-run equilibrium.

Figure 4.2:



Economists can say with certainty that the adjustment will be of the sort described above and portrayed in Figure 4.2. But they cannot predict with any precision in real-world cases the length of time that will elapse between t_0 and t_1. If people know that the government is increasing M they will adjust wages and prices immediately unless they are locked into long-term contracts since nobody would willingly take less than the optimal wage or price. Then t_0 and t_1 will occur almost simultaneously. When it takes a long time for people to learn that M has changed or when wages and prices are temporarily fixed by contract, t_0 and t_1 will be far apart.

There is a mechanism that will moderate overshooting exchange rate movements in certain circumstances. You will recall from your study of the module entitled *The Foreign Exchange Market* that the domestic real interest rate is related to the foreign real interest rate according to the equation

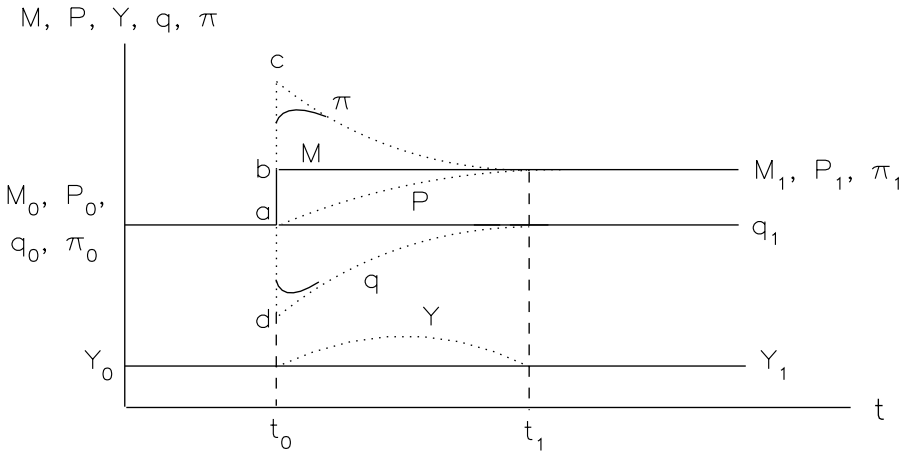
$$r = r^* + \theta - E_q. \tag{8}$$

The domestic interest rate will differ from the foreign interest rate by a risk premium θ minus the expected rate of increase in the real exchange rate E_q. An expected increase in the real exchange rate will increase the expected future value of (yield a capital gain on) domestic capital goods, making asset holders willing to hold domestic capital at a lower rate of interest.

An overshooting movement of the nominal and real exchange rates will by definition be corrected by a movement in the opposite direction. When

there is an overshooting devaluation, the expectation will be that q will rise in the future. E_q will then become positive and the domestic interest rate will fall, making people willing to hold some of the excess money holdings that led to the devaluation. This will moderate the degree of overshooting of the nominal and real exchange rates, rounding off the peaks at points c and d in Figure 4.3.

Figure 4.3:



Interest rate adjustments that moderate the degree of overshooting will occur only if people are able to discern that overshooting is in fact taking place. If real the exchange rate is perceived to be a random walk, which scientific evidence suggests best describes it, E_q will be unaffected by the change in q and no moderation of the overshooting will occur. But one cannot rule out the possibility that certain shocks to the exchange rate could be viewed by a significant segment of the market to be overshooting shocks, even though in general the real exchange rate exhibits random walk behavior.

Essentially the same exchange rate overshooting process will occur when there are shocks to the demand for money. In this case the right side of equation (7) will shift with the left side remaining unchanged. The immediate adjustment of the exchange rate required to bring the two sides into equality will overshoot its ultimate long-run equilibrium level.

The government could prevent overshooting adjustments of the exchange

rate resulting from demand for money shocks by varying the supply of money to offset them, keeping the two sides of (7) equal. To do this, of course, it would have to know when the demand for money is shifting and by how much.

5. Monetary Policy, Interest Rates and the Exchange Rate

It should now be clear that the government can control the nominal exchange rate and, for short periods, the real exchange rate as well. Many people, including central bankers, think that governments also control domestic interest rates and frequently use this control in implementing monetary policy. It is also widely believed that the government can manipulate the nominal exchange rate by buying and selling foreign currency for domestic currency on the international market.

First, consider the ability of the authorities to manipulate domestic interest rates. In the module entitled *The Foreign Exchange Market* the following equations were presented:

$$\begin{aligned} i &= i^* + \theta + E_\Pi && (1)\\ i &= r + E_p && (2)\\ i^* &= r^* + E_p^* && (3)\\ r &= r^* + \theta - E_q && (4) \end{aligned}$$

where i and r are the nominal and real interest rates respectively, and E_Π, E_q and E_p are, respectively, the expected rates of change of the nominal and real exchange rates and price level. As always, * denotes rest-of-world variables. The first equation says that the domestic nominal interest rate must exceed the foreign nominal interest rate by an allowance for risk (θ) plus an amount equal to the capital loss expected on domestic nominal assets relative to foreign assets from the future rise in in the price of foreign currency in terms of domestic currency. Otherwise people would shift asset holdings between domestic- and foreign-currency denominated bonds. The second and third equations are the Fisher equations—each country's nominal interest rate must equal its real interest rate plus the expected rate of inflation. The fourth equation says that the domestic real interest rate must exceed the foreign real interest rate by the risk premium minus the expected rate of increase in the real exchange rate—an increase in the real exchange rate creates a capital gain from holding domestic rather than foreign real capital goods, making it profitable to hold them at a lower real interest rate.

Equation (4) implies that the domestic authorities can raise the domestic real interest rate by making domestically held capital more risky or by inducing an expected future decline in the domestic real exchange rate. The latter could be brought about by reducing the money supply under circumstances where domestic residents know that the resulting appreciation of the real exchange rate is a temporary overshooting adjustment that will subsequently dissipate. If the exchange rate is perceived to be a random walk, however, the expected future real real exchange rate will always equal the current rate and E_q will be zero. These conditions do not give the small country's central bank much room to manipulate the domestic real interest rate.

The central bank can easily manipulate the nominal interest rate by changing the rate of expansion of the domestic money supply and, ultimately, the actual and expected rates of inflation. Although changes in the real interest rate, if perceived to be permanent, are likely to affect domestic investment, nominal interest rate changes alone are not.

These conclusions seem to conflict with the assertions of most central banks that they conduct their monetary policy by manipulating domestic interest rates. It is apparent, however, that the interest rates central banks claim to control are the interest rates on overnight loans of reserves between commercial banks and not the real interest rates that enter into the determination of investment expenditure.

As banks clear cheques drawn on each other, reserves are constantly shifting from bank to bank. Since these reserve holdings do not bear interest, banks will choose to keep them as small as is consistent with their obligations to their depositors and any government regulations that apply. When a bank's reserves are drawn down unexpectedly it will borrow reserves on an overnight basis from other banks who have a surplus over their needs. When all banks find themselves short of reserves the interest rate on these overnight borrowings will increase and when they have surplus reserves the overnight rate will decline.

These interest rates on overnight borrowing will never diverge persistently from the interest rates on the broad range of other assets in the economy because, given a few days or a week, banks can always liquidate their assets to replenish reserve or shift excess reserves into a broad range of assets. And the domestic interest rates at which banks can lend and borrow in the economy as a whole are anchored to foreign interest rates on securities of equivalent risk and maturity.

A central bank, by increasing and decreasing the reserves of the banking system, can substantially move the overnight rate on inter-bank loans, but

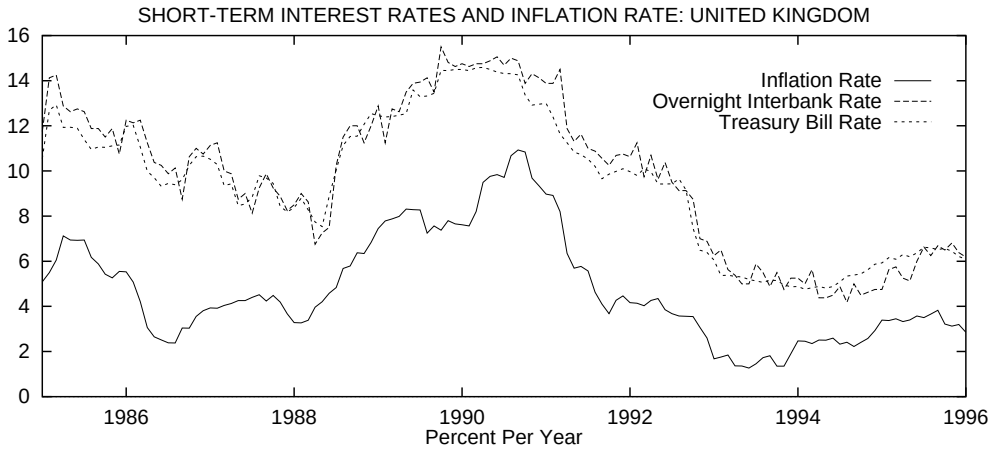
the effect is necessary temporary since the banks can access the broader capital market within a day or two. Every time the central bank expands reserves, of course, it increases the money supply and every time it contracts reserves the domestic money supply declines. Central banks usually also set an interest rate at which they will lend as a "last resort" to commercial banks that are short of reserves. This interest rate, called *bank rate*, is usually announced in advance along with a target level or range at which the central bank would like to keep the overnight interbank borrowing rate.

While the central bank may exercise the intention of moving the overnight borrowing rate up or down it can never be sure if it has accomplished its goal, since this rate is also affected by market conditions which central bank economists can only forecast imperfectly. The bank thus will often not be able to determine whether it was responsible for moving the overnight rate in a particular direction or whether the rate would have moved in that direction anyway.

Nevertheless, the home truth is that every time the central bank tries to manipulate the overnight rate it changes the money supply in a direction that can be predicted from its declared intentions. By changing the "official" level or range for the overnight rate, therefore, a central bank can inform the private sector of its policy intentions, whether or not its subsequent actions actually significantly affect the rate. Such announcements will affect market expectations. Changes in bank rate perform the same function, whether or not the central bank actually loans a significant quantity of reserves to the banking system at that rate.

Figure 5.1 plots short-term interest rates and the inflation rate for Great Britain. Notice how the movements in the two interest rates parallel the movements in the inflation rate—this suggests that the primary factor affecting observed movements in nominal interest rates is the inflation rate. Actual inflation rates are reflected in expected inflation rates to a considerable degree. The differences between the overnight interbank lending and treasury bill rates are small. And they do not necessarily reflect the monetary actions of the central bank since the the risk and liquidity characteristics of the two assets are different (and may be changing) in comparison to the characteristics of other assets that could alternatively be held.

Figure 5.1:



The inflation rate and some interest rates in Germany are plotted in Figure 5.2. The pattern is similar to that for Britain. Note that the German treasury bill rate was constant for a short period. This suggests that the authorities pegged it during this interval. They could do this because they are the only supplier of treasury bills—as long as the rate is not set too high, investors will choose to hold a continually changing quantity of these assets (perhaps zero on occasion) within the range of quantities that the government is willing to make available.

Figure 5.2:

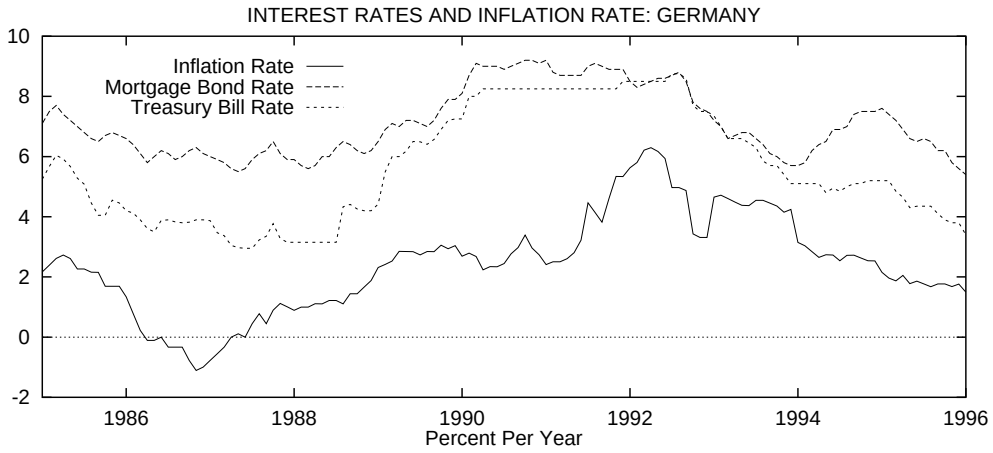


Figure 5.3 and Figure 5.4 plot, respectively, the inflation rates and treasury bill rates for Britain and Germany. Notice that the observed differences in the two countries' treasury bill rates are roughly consistent with the differences in their inflation rates.

Figure 5.3:

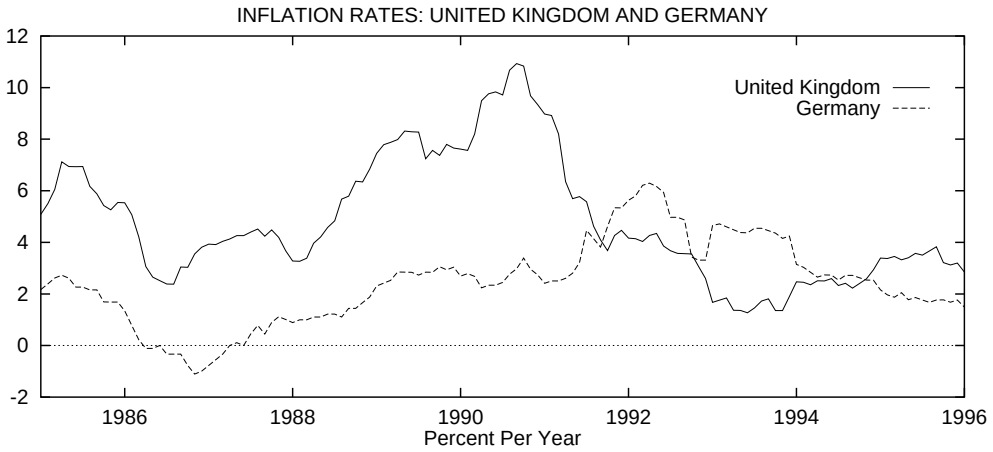
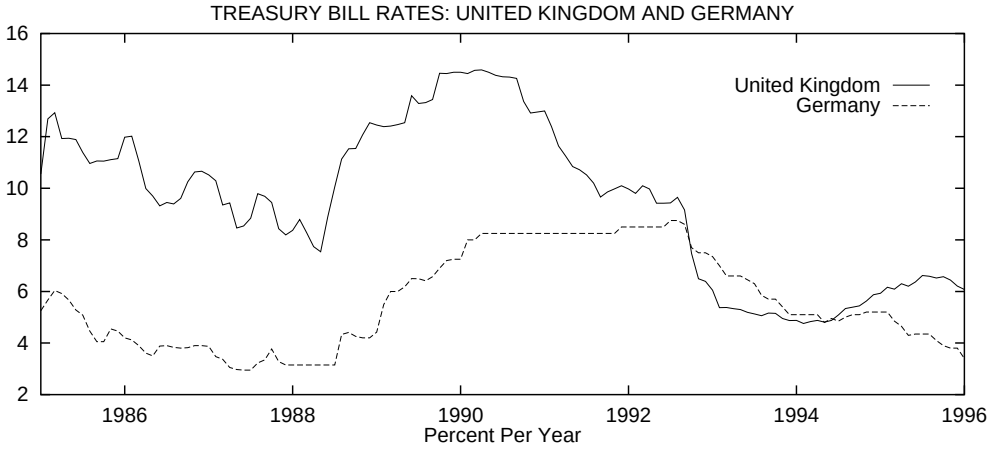


Figure 5.4:

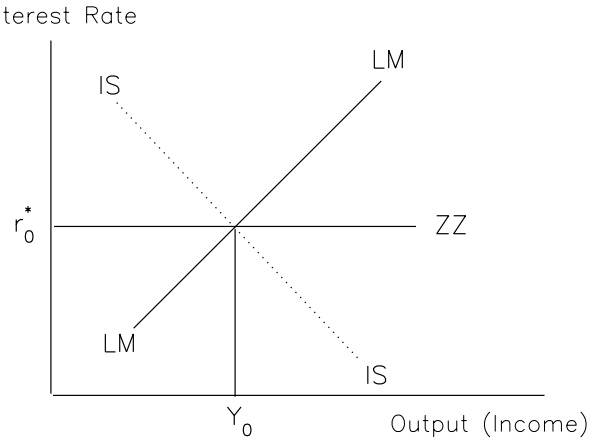


Finally, we investigate the claim that the government can control the exchange rate by simply buying and selling domestic currency for foreign

currency on the international market. The money supply can be written as a multiple of the sum of the source components of base money:

$$M = mmH = mm[R + D] \tag{5}$$

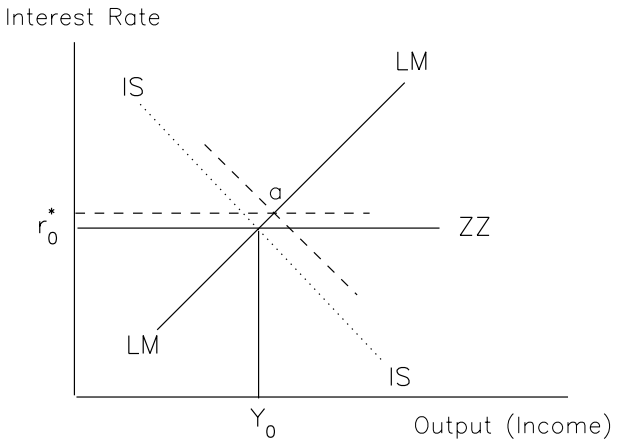
Figure 5.5:



An increase in the stock of reserves will raise the money supply only if the authorities do not sterilize its effects by equivalently reducing the domestic source component. This can be seen from Figure 5.5. Equilibrium is determined by the intersection of the *LM* curve and the *ZZ* line. If the money supply does not change, neither does the *LM* curve and neither does the equilibrium. The nominal exchange rate that will drive *IS* through the *LM*-*ZZ* intersection remains unchanged. The only possible effect on the exchange rate would be a timing effect. The purchase of foreign currency occurs immediately, while the sale of foreign currency in return for domestic currency by domestic residents (as they rebalance their portfolios after purchasing bonds from the government) may take some time. There might thus be some temporary appreciation of the exchange rate. Also, the official purchase of foreign exchange reserves might affect the domestic interest rate. The government is buying foreign assets exclusively when it increases its foreign exchange reserve holdings while the private sector will sell domestic as well as foreign assets when it replenishes the money holdings lost to the government by purchasing bonds. Since this creates an excess supply of domestic non-monetary assets on the international market, the domestic interest rate will rise relative to the foreign interest rate if domestic and foreign assets are not perfect substitutes. *ZZ* will shift upward in Figure 5.6

since a higher domestic interest rate will now be associated with the existing world interest rate. A devaluation of the domestic currency will then occur to shift *IS* through point *a*.

Figure 5.6:



For a significant interest rate effect to remain in the long-run, however, the risk premium on the domestic assets must permanently and significantly increase as a result of this portfolio shuffle. Since the substitution of domestic for foreign assets in domestic residents' portfolios will be an extremely small fraction of their overall aggregate portfolio, it is hard to imagine that this effect will be large.

Of course, if the effect of an increase in official foreign exchange holdings on the money supply is not sterilized by an open-market operation in domestic bonds, the domestic money supply will increase. Employment and/or prices will increase in the same manner as would have occurred from any increase in the money supply, no matter how it was generated.

6. Purchasing Power Parity

The concept of purchasing power parity holds that that one can determine what the nominal exchange rate between two countries' currencies should be by looking at the ratio of their price levels. A deviation of the actual exchange rate from its purchasing-power-parity level would thus indicate that the currency is over- or under-valued in the market. The equation defining the real exchange rate (equation (1) in the module) can be rearranged to yield

$$\Pi = \frac{1}{q}\frac{P}{P^*} \tag{2}$$

It is immediately evident that a domestic inflation that increased the domestic price level by 25 percent would predictably raise the nominal exchange rate (depreciate the currency) by 25 percent. And failure of the exchange rate to adjust would leave the domestic currency overvalued. It is a further short step to argue loosely that the eventual movement of the exchange rate to its purchasing-power-level is a return to equilibrium.

The crucial assumption in this argument is that the real exchange rate is constant. It is based on the notion that every commodity should have the same price, measured in a single currency, in every country—otherwise people would conduct arbitrage by buying the good in the country where it is cheap and selling it in the country where it is dear. This *law of one price* must obviously be true, barring government intervention, for *traded goods* after tariffs, transport costs and quality differences are taken into account. It is clearly not true for *non-traded goods*. Since the advance of technology and associated growth of real income in different parts of the world will cause the prices of non-traded relative to traded goods to change, there is no reason to expect that the average price of any particular country's output in terms of other countries' output—its equilibrium real exchange rate—will be constant through time. Moreover, since countries do not all produce the same traded goods, changes in world relative prices of the different traded goods will also change their real exchange rates. A high nominal value of a country's currency may thus reflect a high equilibrium value of its real exchange rate and not a movement in the equilibrium price level that has not yet been adjusted to. At the same time, the fact that the equilibrium real exchange rate may change through time should not be allowed to cloud the principle that countries having more inflation will experience devaluations of their nominal exchange rates with respect to countries having less inflation.

Figure 6.1 plots the real exchange rates of Britain, Germany, Italy and

Japan with respect to the U.S. Persistent movements of 40 percent and more extending over 5 to 15 year intervals are prevalent. Figure 6.2 plots the real exchange rate of Canada with respect to the U.S. and the real exchange rates of Britain and Italy with respect to Germany.

Figure 6.1:

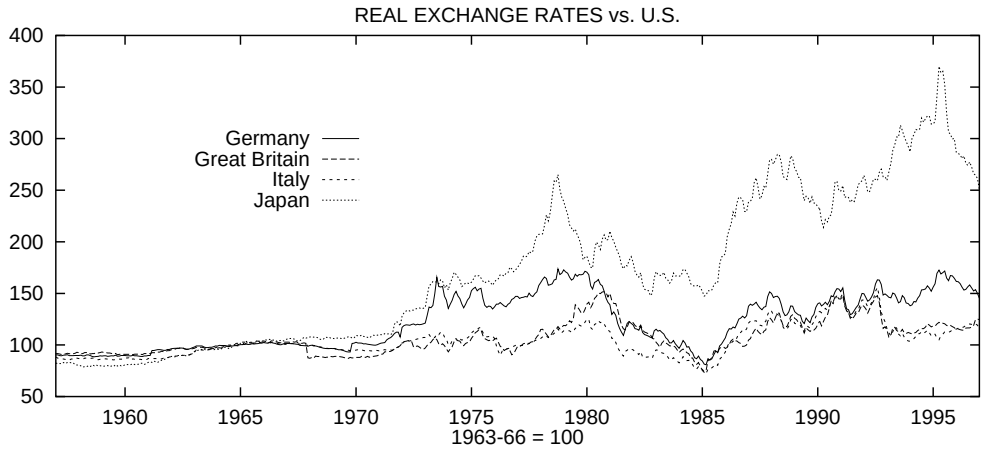
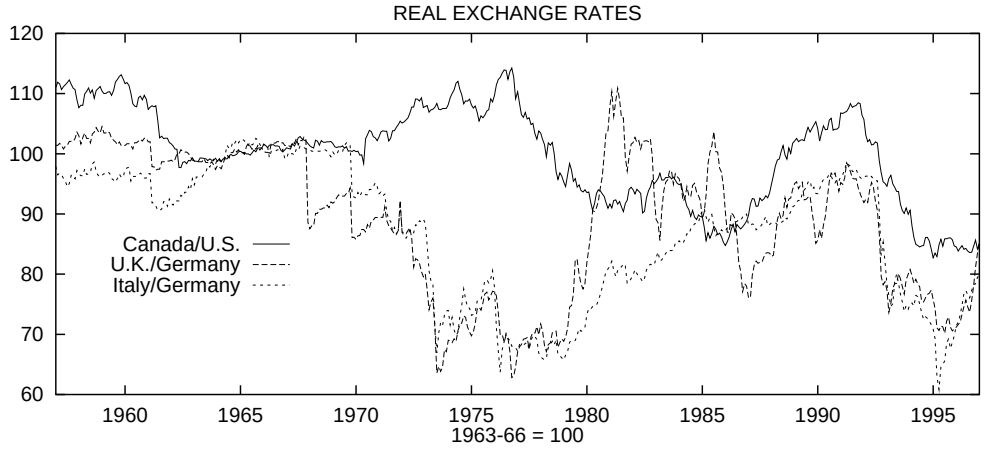


Figure 6.2:



The question arises as to whether these observed real exchange rate moments were effected by nominal exchange rate adjustments or by movements in the countries' relative price levels. Figure 6.3 presents the picture

for Britain vs. the U.S. and Figure 6.4 shows what happened in Germany relative to the United States. Real and nominal exchange rates tend to move in step although their trends differ due to different long-term inflation rates viz. the U.S. There is no apparent relationship between the relative price level movements and the real exchange rate changes. Figure 6.5 presents similar evidence for Italy, Figure 6.6 for Japan and Figure 6.7 for Canada.

Figure 6.3:

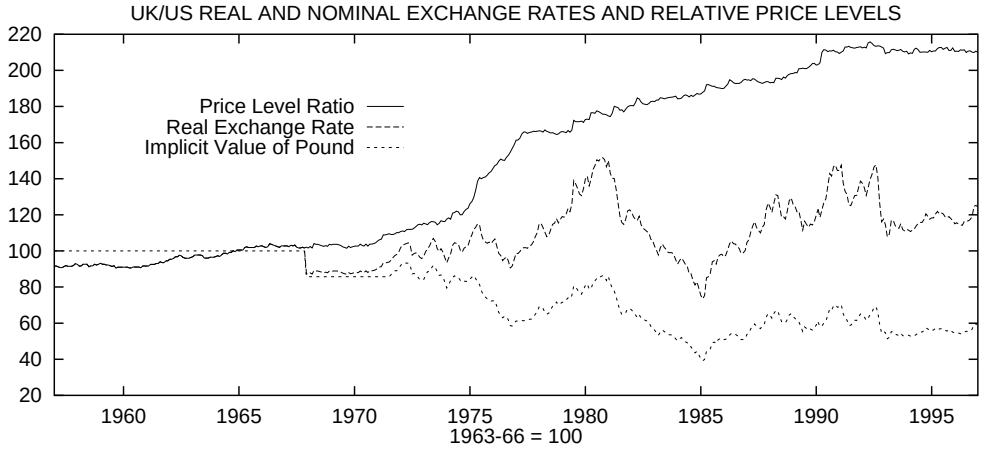


Figure 6.4:

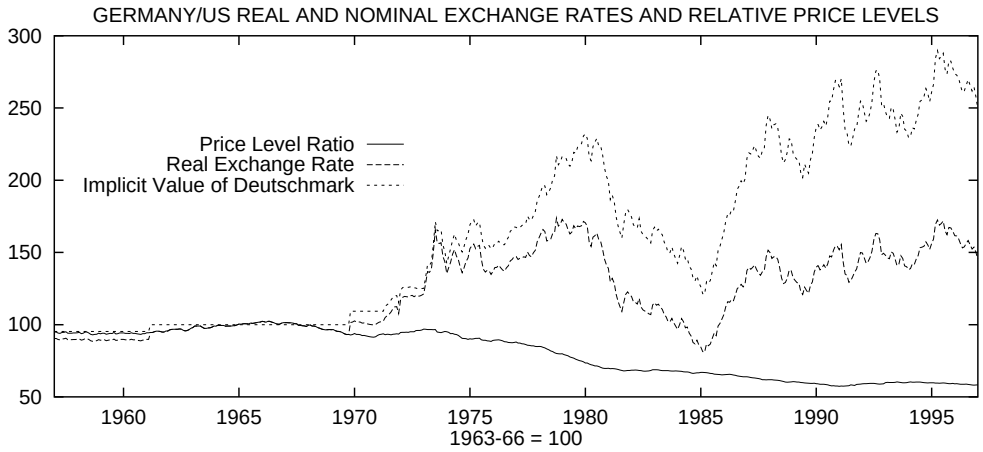


Figure 6.5:

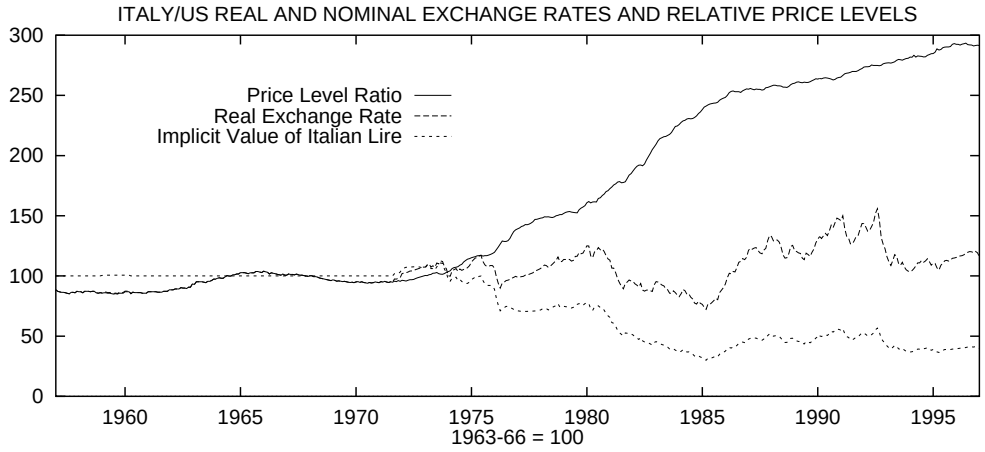


Figure 6.6:

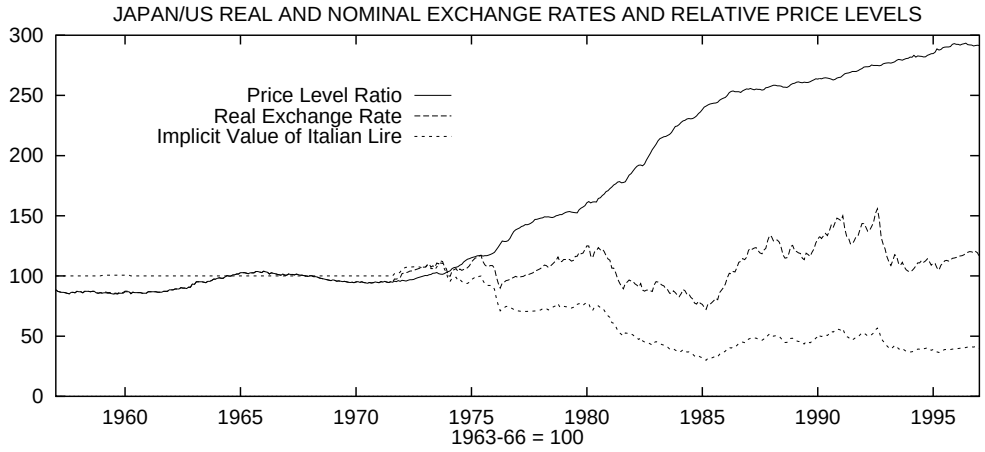
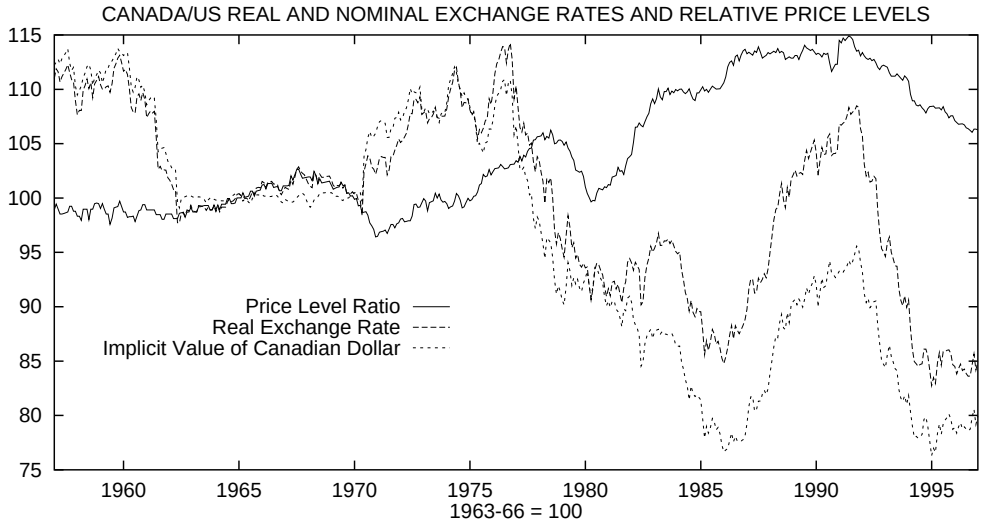


Figure 6.7:



Finally, consider the evidence for the U.K. and Italy vs. Germany in Figure 6.8 and Figure 6.9. Because of the enormously different inflation experiences of these countries plots going all the way back to 1957 are not revealing of the relationship between real and nominal exchange rate movements. Accordingly, shorter data series, from 1987 to 1997, were plotted monthly.

Figure 6.8:

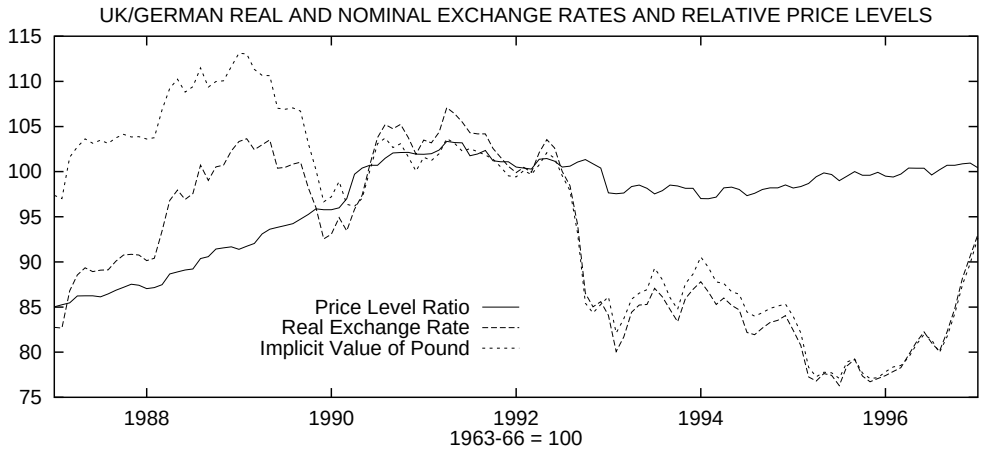
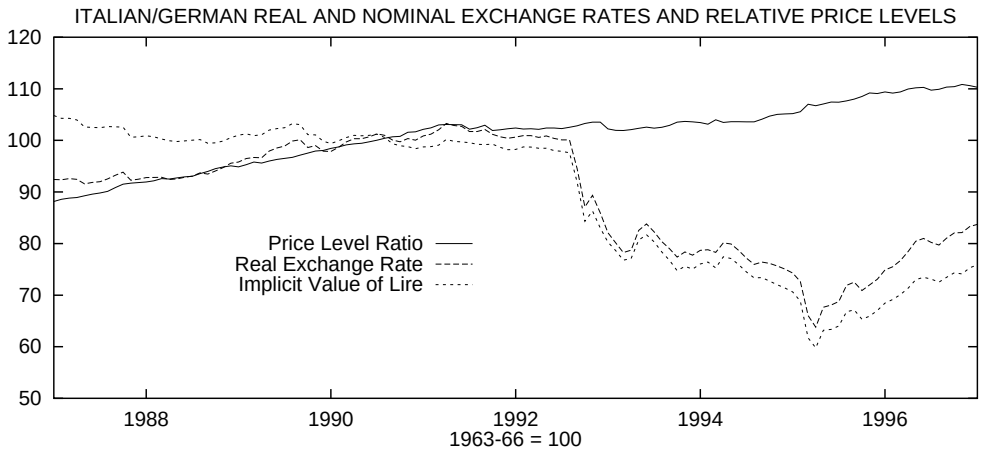


Figure 6.9:



The evidence against purchasing power parity is overwhelming. Some might still try to argue, since the real and nominal exchange rate tend to move in step with each other, that observed movements in the real exchange rate are the caused by nominal exchange rate movements arising from differences in monetary policy between countries. The problem with this view is that it implies long-term price level rigidity—if prices are flexible, monetary policy will be reflected in the price level and nominal exchange rates but not in output and the real exchange rate. Full price level adjustment usually takes place within two or three years (which is the maximum length of the typical business recession) while the observed real exchange rate movements are much longer-term. And not a shred of evidence of price level adjustment to real exchange rate movements appears in the charts we have plotted above. Our conclusion is thus that the bulk of the major observed movements in real exchange rates are changes in the equilibrium levels in response to technological change, economic growth and shifts of world investment flows between countries. This, of course, does not rule out the possibility that short-term month-to-month adjustments could result from overshooting monetary shocks.

7. Rational Expectations and Monetary Policy

It makes no sense for workers to maintain wages that are too high to give them employment. And it makes no sense for firms to agree to wage levels so high that it becomes infeasible to employ the quantity of labour that will maximize long-run profits. The problem is that in an economy where the factors that determine aggregate demand are not completely predictable, workers and firms don't know what wage rate and corresponding price level will generate full employment.

The full-employment flexible wage and price case is useful when we want to model the effects on the economy of shocks to goods or asset markets that are widely known, in which case wages and prices will adjust immediately to them, or when we want to model the long-run effects of shocks when everyone has had time to adjust. The fixed wage and price scenario is useful for the short run during which wage and price setters are unaware of shifts that have occurred in the factors driving aggregate demand. In practical cases the effects on the endogenous variables of exogenous shocks will lie somewhere between the two extreme cases of no adjustment and complete adjustment. Such in-between cases are difficult to model because theories of how and when economic decision makers learn about unfolding events are non-existent.

Nevertheless, our analysis is based on the premise that people always use all the information available to them in making economic decisions—that they have *rational expectations*. This does not imply that economic decision makers always make the correct predictions about the future—in general, they make wrong predictions. What it implies is that their predictions are not systematically biased.

The basic idea behind countercyclical monetary and fiscal policy is that the authorities, using the advice of their economists, can adjust the money supply under flexible exchange rates and fiscal policy under fixed exchange rates to continuously maintain aggregate demand at a level that will maintain full employment, given the errors that the private sector will make in setting wages and prices. Easing and and tightening of the policy stance must occur, of course, around a trend of money growth that will generate an acceptable time-path of the price level over the long run.

In implementing counter-cyclical policy, the authorities face a difficult problem. The effects on the economy of changes in the money supply will take place over a period of several months—the increase in M has to lead to a portfolio adjustment which will cause the exchange rate to change, and that exchange rate change, in turn, has to cause the trade balance to change

before aggregate demand will be affected. In order to influence output and employment, say, six months from now, the central bank has to solve two problems: First, it has to predict where these variables will be six months hence if no counter-cyclical monetary policy is applied. Then, it has to determine the exact dosage of monetary expansion that will produce the desired effect on employment six months down the road. Essentially the same problem arises with fiscal policy with the further complication that legislation often has to be passed to implement it.

Given the notoriously poor ability of economists to predict the future, the problem of what dosage of monetary expansion or contraction to apply and when to apply it would seem unsolvable. Some economists think that as a result, the government should give up on attempts at month-to-month management of the economy and concentrate instead on providing a stable monetary environment in which wage and price setters can make decisions. They think that attempts to "fine tune" the economy will make things worse, increasing the variability of employment and, ultimately, the price level. Other economists disagree, arguing that economists have some capacity to engineer greater stability of output and employment.

This brings us to a further problem. Why should economists working for the government be better able to predict the future than those working for private firms? If the government has the same information as the private sector, there is no way it can make things better by conducting countercyclical policy. The private sector will automatically take into account what it knows in setting wages and prices. If the government could predict that those settings are wrong, so could the private sector, in which case the private sector would have more appropriate wage and price settings in the first place. When the government indeed has better information than the private sector it can simply publish that information so that wage and price setters can take it into account in their decisions and prospective deviations of employment from its normal level can be avoided as much as possible.

If the government continuously informs the private sector of everything it is doing, private wage and price setters will take account of the effects of the government's actions in their wage and price setting decisions. Those decisions would have been designed to produce full employment in the absence of the government actions and, taking into account those actions, will still be designed to produce full employment. As long as the private sector has the same information about the future course of events as does the government, and knows what the government is doing, the actions of the government will have no effect on the economy. Private decision makers would otherwise have compensated for the absence of those actions when setting wages and

prices. If the government operates in secret its policies will create variations in aggregate demand that are unknown to the private sector and things will be made worse if its information is not better than that available to the private sector. When the government has information that the private sector does not have, its policies can do no more than the private sector would have done on its own had this superior information been made public. This argument that government counter-cyclical policy cannot usefully affect the economy is called the *policy irrelevance proposition*.

But this policy irrelevance argument assumes that private wage and price setters are able to change wages and prices quickly in response to new information. When they lock themselves into contracts extending over several periods, such wage and price adjustments will not be possible even if everyone knows they should be made. In this case the government can improve the situation even when its information about the economy is the same as that of the private sector. It can adjust the money supply (under flexible exchange rates) to shift aggregate demand to exactly compensate for the private sector's inability to adjust wages and prices. Contractual rigidities are likely to be important when the economy is disturbed from a stable path on which it has been for a long time and wage and price setters have been avoiding periodic costs of renegotiation by setting long-term contracts. When there is a lot of variability in aggregate demand it is in the interest of contracting parties to make more frequent shorter-term contracts so that adjustments to take new information into account can be made quickly.

In the modules entitled *Asset Markets* and *The Foreign Exchange Market*, rational expectations meant that markets were efficient—that market prices reflected all available information about future asset returns. In the above discussion we have shown that analogous arguments can be made about labour markets.

Study Questions

1. Consider the policy options of an economy operating with fixed exchange rates in the throws of a recession: a) raise tariffs; b) cut taxes; c) increase government expenditure; d) devalue the exchange rate; d) let the exchange rate float and print money. Are all these options equivalent in terms of their effects? If not, which would be the best to use?

2. Re-evaluate your answer above in the light of the policy irrelevance proposition and the difficulties of "fine tuning". Defend as coherently as you can the argument that the government should do nothing about the recession. If it chooses to do nothing, how should it manage the growth of the money supply? Should it hold the stock of base money constant, keep it growing at a constant rate, or what? Or should it maintain the fixed exchange rate at its original peg? 3. Consider the traditional argument that

fiscal policy has built-in stabilization effects. In bad times the demands on government to subsidize the unfortunate are high and, since incomes are low and taxes are geared to income, the government's tax revenues are low. And in good times government expenditures to alleviate suffering tend to be low and tax revenues high. The government budget deficit thus varies countercyclically and tends to stabilize the economy in an automatic fashion. Evaluate this argument using what you have learned from this module about the implications of rational expectations.

4. It is often argued that government budget deficits lead to current account deficits. Based on what you have learned in this and the previous module, do you think that this is the case? If your answer is yes, can the emergence of current account deficits be explained by expansionary fiscal policy? Is fiscal contraction the way to cure a current account deficit?

5. Prior to World War I the major industrial countries were on a gold standard—by fixing the prices of gold in terms of their respective currencies they adopted fixed exchange rates with respect to each other. With the onset of the war, the gold standard was abandoned. Exchange rates were thus allowed to float and by the mid-twenties, in conjunction with substantial and differential inflation in the various countries, these rates had moved significantly from their pre-war parities. It was then decided to resume the gold-standard-fixed-exchange-rate system.

- The question arises as to what the new prices of each country's currency should be in terms of the other countries' currencies—that is, what the new fixed exchange rate levels should be. How would you

decide upon the level at which each country should fix its exchange rates with respect to the other countries?

- A related issue is whether the new fixed prices of gold in terms of the various currencies should reflect current market prices or the fixed prices of gold that were in place before the War. In thinking about this, adopt the working gold-standard assumption that once the prices of gold in all countries are fixed (and governments are thus committed to buy and sell gold to maintain these prices) a country's stock of base money becomes identical to its stock of gold.

6. When a country fixes its nominal exchange rate it can costlessly eliminate any balance of payments disequilibrium that may arise and costlessly maintain any stock of foreign exchange reserves it wishes to hold. True or False? Explain your answer.

7. A devaluation of a fixed exchange rate is an appropriate cure for a balance of payments deficit in a small country. True or False? Explain your answer.

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Michael Parkin and Robin Bade, *Economics*, Addison Wesley, 1991, 847–860 and 866–874.