

CHAPTER 12 TWELVE

Aggregate Demand in the Open Economy

When conducting monetary and fiscal policy, policymakers often look beyond their own country's borders. Even if domestic prosperity is their sole objective, it is necessary for them to consider the rest of the world. The international flow of goods and services and the international flow of capital can affect an economy in profound ways. Policymakers ignore these effects at their peril.

In this chapter we extend our analysis of aggregate demand to include international trade and finance. The model developed in this chapter, called the **Mundell–Fleming model**, is an open-economy version of the *IS–LM* model. Both models stress the interaction between the goods market and the money market. Both models assume that the price level is fixed and then show what causes short-run fluctuations in aggregate income (or, equivalently, shifts in the aggregate demand curve). The key difference is that the *IS–LM* model assumes a closed economy, whereas the Mundell–Fleming model assumes an open economy. The Mundell–Fleming model extends the short-run model of national income from Chapters 10 and 11 by including the effects of international trade and finance from Chapter 5.

The Mundell–Fleming model makes one important and extreme assumption: it assumes that the economy being studied is a small open economy with perfect capital mobility. That is, the economy can borrow or lend as much as it wants in world financial markets and, as a result, the economy's interest rate is determined by the world interest rate. One virtue of this assumption is that it simplifies the analysis: once the interest rate is determined, we can concentrate our attention on the role of the exchange rate. In addition, for some economies, such as Belgium or the Netherlands, the assumption of a small open economy with perfect capital mobility is a good one. Yet this assumption—and thus the Mundell–Fleming model—does not apply exactly to a large open economy such as the United States. In the conclusion to this chapter (and more fully in the appendix), we consider what happens in the more complex case in which international capital mobility is less than perfect or a nation is so large it can influence world financial markets.

One lesson from the Mundell–Fleming model is that the behavior of an economy depends on the exchange-rate system it has adopted. We begin by assuming that the economy operates with a floating exchange rate. That is, we assume that the central bank allows the exchange rate to adjust to changing economic conditions. We then examine how the economy operates under a fixed exchange rate,

and we discuss whether a floating or fixed exchange rate is better. This question has been important in recent years, as many nations around the world have debated what exchange-rate system to adopt.

12-1 The Mundell–Fleming Model

In this section we build the Mundell–Fleming model, and in the following sections we use the model to examine the impact of various policies. As you will see, the Mundell–Fleming model is built from components we have used in previous chapters. But these pieces are put together in a new way to address a new set of questions.¹

The Key Assumption: Small Open Economy With Perfect Capital Mobility

Let's begin with the assumption of a small open economy with perfect capital mobility. As we saw in Chapter 5, this assumption means that the interest rate in this economy r is determined by the world interest rate r^* . Mathematically, we can write this assumption as

$$r = r^*.$$

This world interest rate is assumed to be exogenously fixed because the economy is sufficiently small relative to the world economy that it can borrow or lend as much as it wants in world financial markets without affecting the world interest rate.

Although the idea of perfect capital mobility is expressed with a simple equation, it is important not to lose sight of the sophisticated process that this equation represents. Imagine that some event were to occur that would normally raise the interest rate (such as a decline in domestic saving). In a small open economy, the domestic interest rate might rise by a little bit for a short time, but as soon as it did, foreigners would see the higher interest rate and start lending to this country (by, for instance, buying this country's bonds). The capital inflow would drive the domestic interest rate back toward r^* . Similarly, if any event were ever to start driving the domestic interest rate downward, capital would flow out of the country to earn a higher return abroad, and this capital outflow would drive the domestic interest rate back upward toward r^* . Hence, the $r = r^*$ equation represents the assumption that the international flow of capital is rapid enough to keep the domestic interest rate equal to the world interest rate.

¹ The Mundell–Fleming model was developed in the early 1960s. Mundell's contributions are collected in Robert A. Mundell, *International Economics* (New York: Macmillan, 1968). For Fleming's contribution, see J. Marcus Fleming, "Domestic Financial Policies Under Fixed and Under Floating Exchange Rates," *IMF Staff Papers* 9 (November 1962): 369–379. In 1999, Robert Mundell was awarded the Nobel Prize for his work in open-economy macroeconomics.

The Goods Market and the IS^* Curve

The Mundell–Fleming model describes the market for goods and services much as the $IS-LM$ model does, but it adds a new term for net exports. In particular, the goods market is represented with the following equation:

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

This equation states that aggregate income Y is the sum of consumption C , investment I , government purchases G , and net exports NX . Consumption depends positively on disposable income $Y - T$. Investment depends negatively on the interest rate, which equals the world interest rate r^* . Net exports depend negatively on the exchange rate e . As before, we define the exchange rate e as the amount of foreign currency per unit of domestic currency—for example, e might be 100 yen per dollar.

You may recall that in Chapter 5 we related net exports to the real exchange rate (the relative price of goods at home and abroad) rather than the nominal exchange rate (the relative price of domestic and foreign currencies). If e is the nominal exchange rate, then the real exchange rate ϵ equals eP/P^* , where P is the domestic price level and P^* is the foreign price level. The Mundell–Fleming model, however, assumes that the price levels at home and abroad are fixed, so the real exchange rate is proportional to the nominal exchange rate. That is, when the nominal exchange rate appreciates (say, from 100 to 120 yen per dollar), foreign goods become cheaper compared to domestic goods, and this causes exports to fall and imports to rise.

We can illustrate this equation for goods market equilibrium on a graph in which income is on the horizontal axis and the exchange rate is on the vertical axis. This curve is shown in panel (c) of Figure 12-1 and is called the IS^* curve. The new label reminds us that the curve is drawn holding the interest rate constant at the world interest rate r^* .

The IS^* curve slopes downward because a higher exchange rate reduces net exports, which in turn lowers aggregate income. To show how this works, the other panels of Figure 12-1 combine the net-exports schedule and the Keynesian cross to derive the IS^* curve. In panel (a), an increase in the exchange rate from e_1 to e_2 lowers net exports from $NX(e_1)$ to $NX(e_2)$. In panel (b), the reduction in net exports shifts the planned-expenditure schedule downward and thus lowers income from Y_1 to Y_2 . The IS^* curve summarizes this relationship between the exchange rate e and income Y .

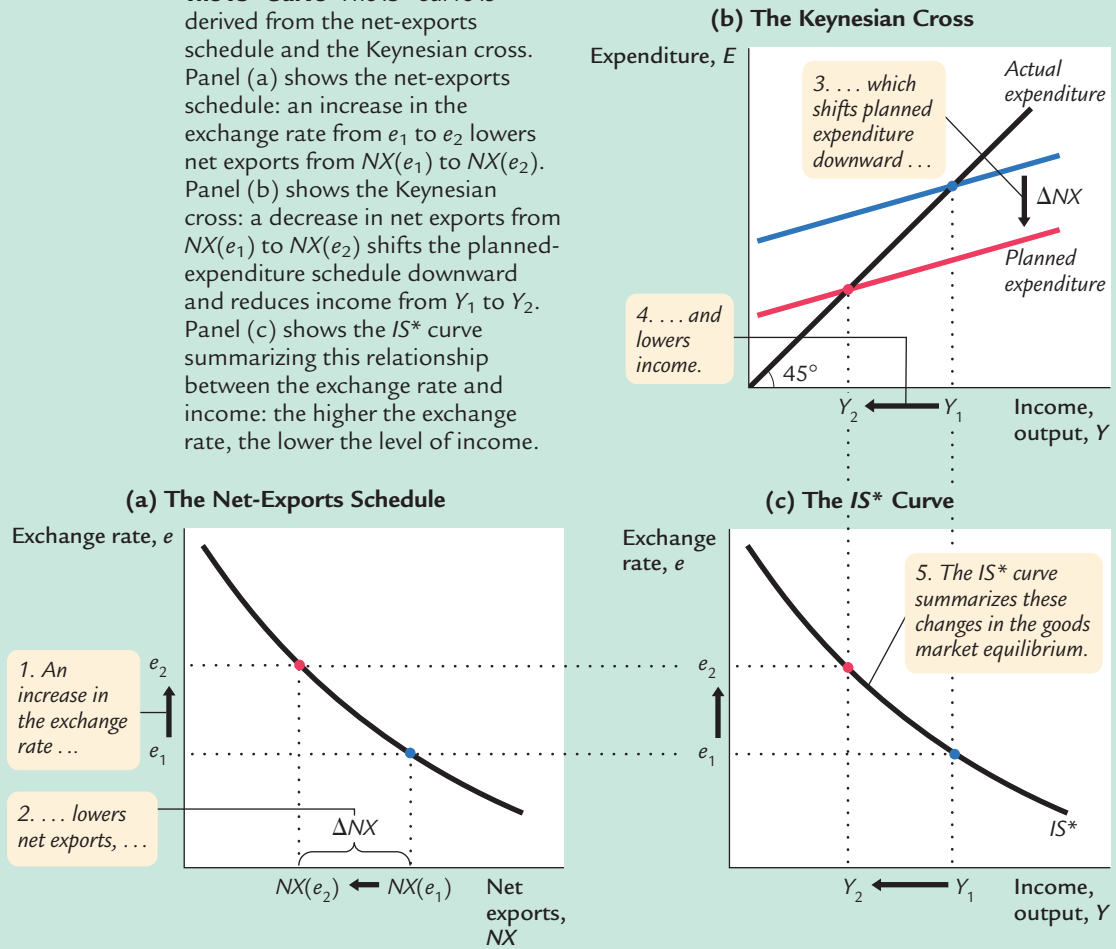
The Money Market and the LM^* Curve

The Mundell–Fleming model represents the money market with an equation that should be familiar from the $IS-LM$ model, with the additional assumption that the domestic interest rate equals the world interest rate:

$$M/P = L(r^*, Y).$$

figure 12-1

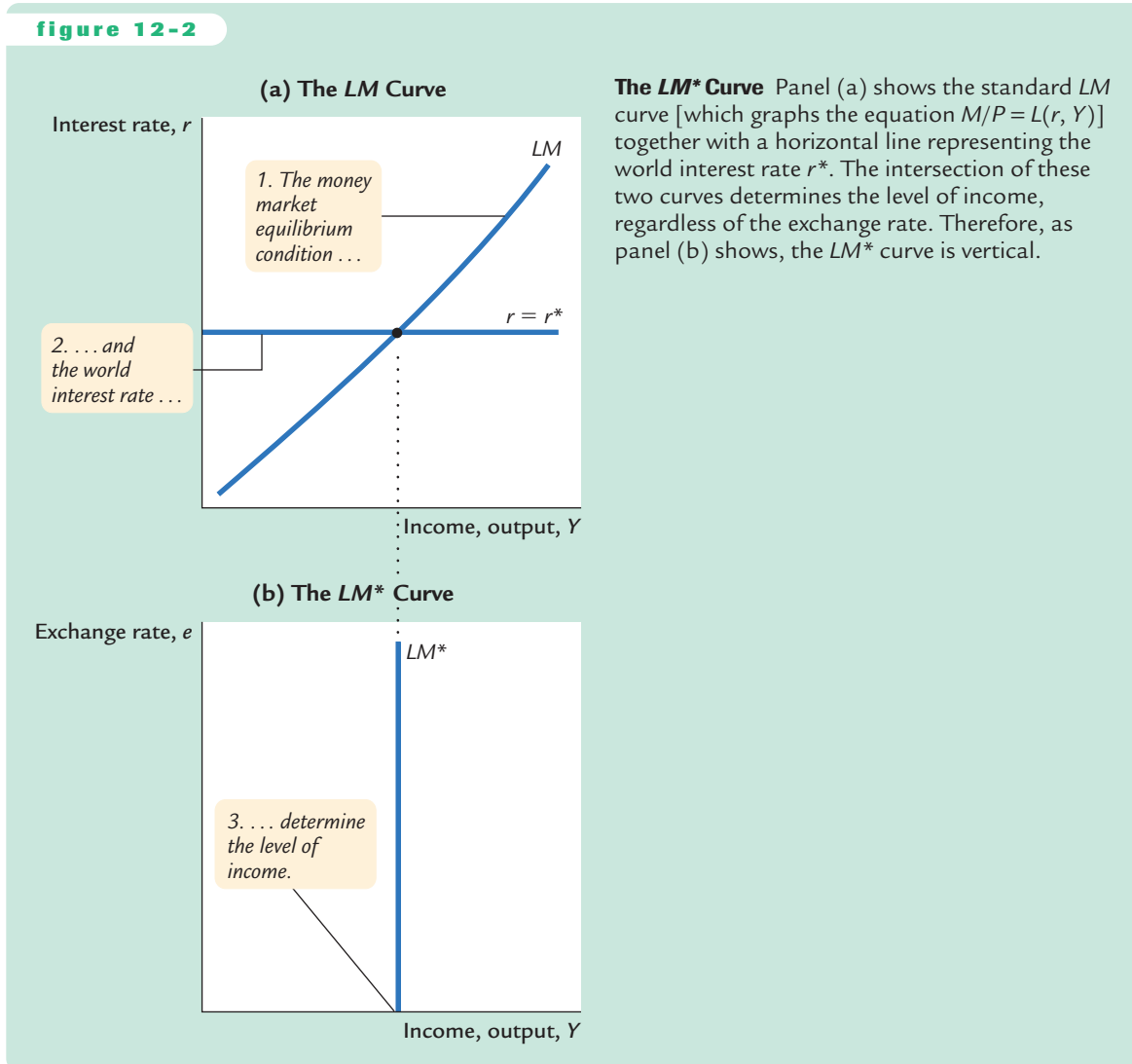
The IS^* Curve The IS^* curve is derived from the net-exports schedule and the Keynesian cross. Panel (a) shows the net-exports schedule: an increase in the exchange rate from e_1 to e_2 lowers net exports from $NX(e_1)$ to $NX(e_2)$. Panel (b) shows the Keynesian cross: a decrease in net exports from $NX(e_1)$ to $NX(e_2)$ shifts the planned-expenditure schedule downward and reduces income from Y_1 to Y_2 . Panel (c) shows the IS^* curve summarizing this relationship between the exchange rate and income: the higher the exchange rate, the lower the level of income.



This equation states that the supply of real money balances, M/P , equals the demand, $L(r, Y)$. The demand for real balances depends negatively on the interest rate, which is now set equal to the world interest rate r^* , and positively on income Y . The money supply M is an exogenous variable controlled by the central bank, and because the Mundell–Fleming model is designed to analyze short-run fluctuations, the price level P is also assumed to be exogenously fixed.

We can represent this equation graphically with a vertical LM^* curve, as in panel (b) of Figure 12-2. The LM^* curve is vertical because the exchange rate does not enter into the LM^* equation. Given the world interest rate, the LM^* equation determines aggregate income, regardless of the exchange rate. Figure 12-2 shows how the LM^* curve arises from the world interest rate and the LM curve, which relates the interest rate and income.

figure 12-2



Putting the Pieces Together

According to the Mundell–Fleming model, a small open economy with perfect capital mobility can be described by two equations:

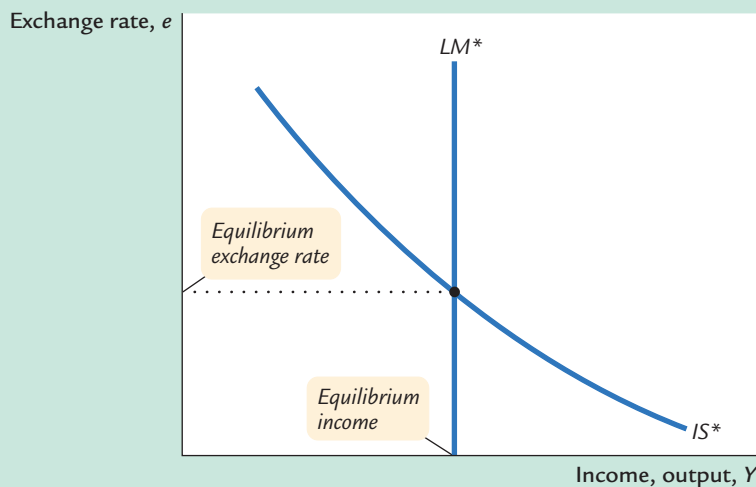
$$Y = C(Y - T) + I(r^*) + G + NX(e) \quad IS^*,$$

$$M/P = L(r^*, Y) \quad LM^*.$$

The first equation describes equilibrium in the goods market, and the second equation describes equilibrium in the money market. The exogenous variables are fiscal policy G and T , monetary policy M , the price level P , and the world interest rate r^* . The endogenous variables are income Y and the exchange rate e .

Figure 12-3 illustrates these two relationships. The equilibrium for the economy is found where the IS^* curve and the LM^* curve intersect. This intersection

figure 12-3

**The Mundell–Fleming Model**

This graph of the Mundell–Fleming model plots the goods market equilibrium condition IS^* and the money market equilibrium condition LM^* . Both curves are drawn holding the interest rate constant at the world interest rate. The intersection of these two curves shows the level of income and the exchange rate that satisfy equilibrium both in the goods market and in the money market.

shows the exchange rate and the level of income at which both the goods market and the money market are in equilibrium. With this diagram, we can use the Mundell–Fleming model to show how aggregate income Y and the exchange rate e respond to changes in policy.

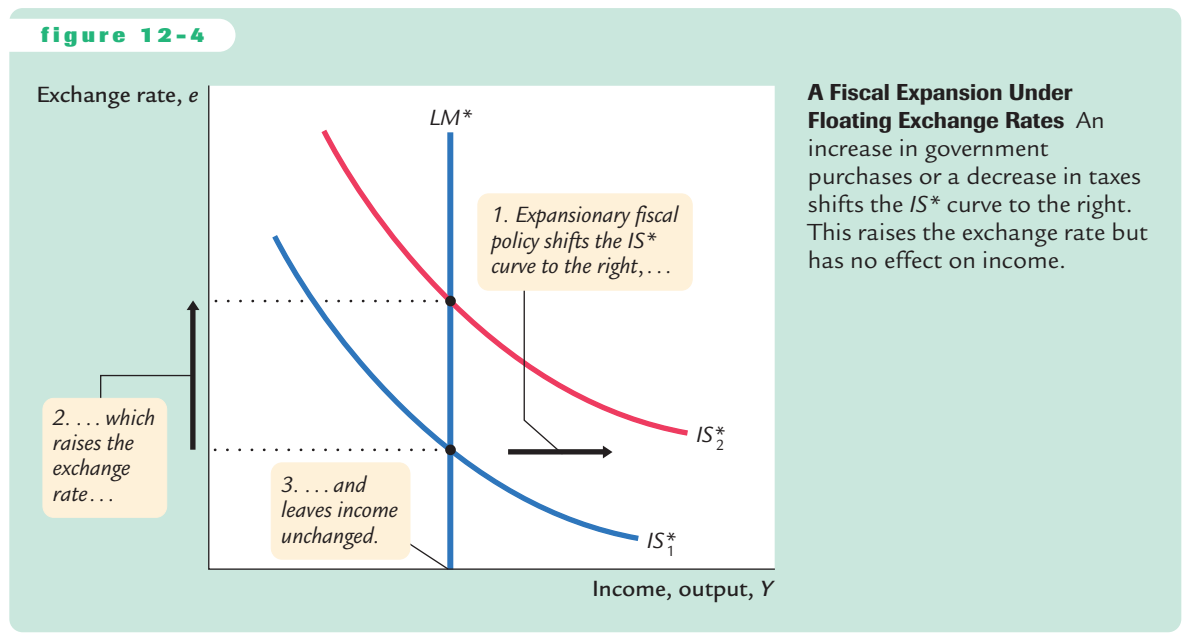
12-2 The Small Open Economy Under Floating Exchange Rates

Before analyzing the impact of policies in an open economy, we must specify the international monetary system in which the country has chosen to operate. We start with the system relevant for most major economies today: **floating exchange rates**. Under floating exchange rates, the exchange rate is allowed to fluctuate in response to changing economic conditions.

Fiscal Policy

Suppose that the government stimulates domestic spending by increasing government purchases or by cutting taxes. Because such expansionary fiscal policy increases planned expenditure, it shifts the IS^* curve to the right, as in Figure 12-4. As a result, the exchange rate appreciates, whereas the level of income remains the same.

Notice that fiscal policy has very different effects in a small open economy than it does in a closed economy. In the closed-economy $IS-LM$ model, a fiscal expansion raises income, whereas in a small open economy with a floating exchange rate, a fiscal expansion leaves income at the same level. Why the



difference? When income rises in a closed economy, the interest rate rises, because higher income increases the demand for money. That is not possible in a small open economy: as soon as the interest rate tries to rise above the world interest rate r^* , capital flows in from abroad. This capital inflow increases the demand for the domestic currency in the market for foreign-currency exchange and, thus, bids up the value of the domestic currency. The appreciation of the exchange rate makes domestic goods expensive relative to foreign goods, and this reduces net exports. The fall in net exports offsets the effects of the expansionary fiscal policy on income.

Why is the fall in net exports so great that it renders fiscal policy powerless to influence income? To answer this question, consider the equation that describes the money market:

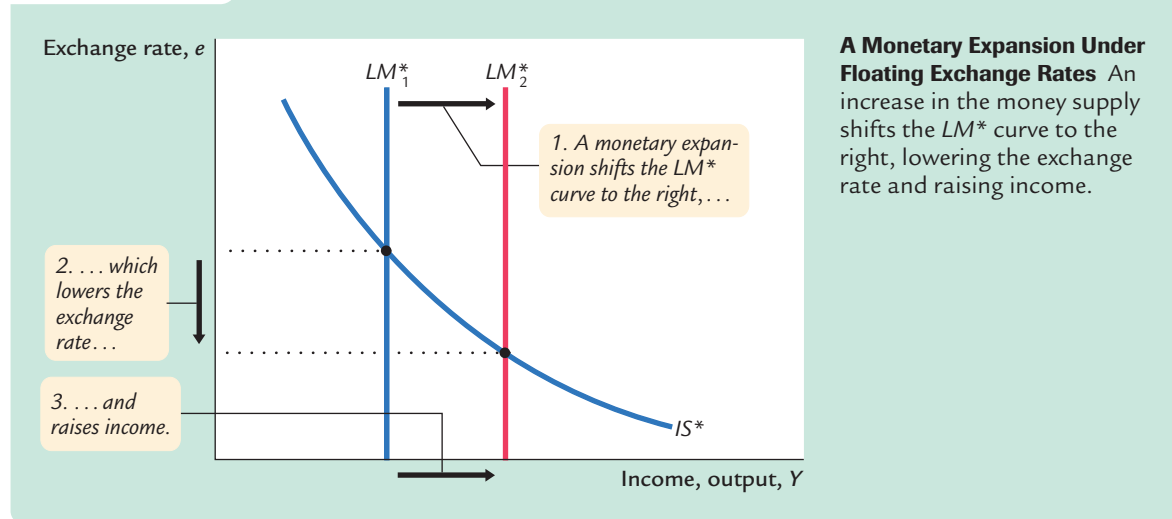
$$M/P = L(r, Y).$$

In both closed and open economies, the quantity of real money balances supplied M/P is fixed, and the quantity demanded (determined by r and Y) must equal this fixed supply. In a closed economy, a fiscal expansion causes the equilibrium interest rate to rise. This increase in the interest rate (which reduces the quantity of money demanded) allows equilibrium income to rise (which increases the quantity of money demanded). By contrast, in a small open economy, r is fixed at r^* , so there is only one level of income that can satisfy this equation, and this level of income does not change when fiscal policy changes. Thus, when the government increases spending or cuts taxes, the appreciation of the exchange rate and the fall in net exports must be large enough to offset fully the normal expansionary effect of the policy on income.

Monetary Policy

Suppose now that the central bank increases the money supply. Because the price level is assumed to be fixed, the increase in the money supply means an increase in real balances. The increase in real balances shifts the LM^* curve to the right, as in Figure 12-5. Hence, an increase in the money supply raises income and lowers the exchange rate.

figure 12-5



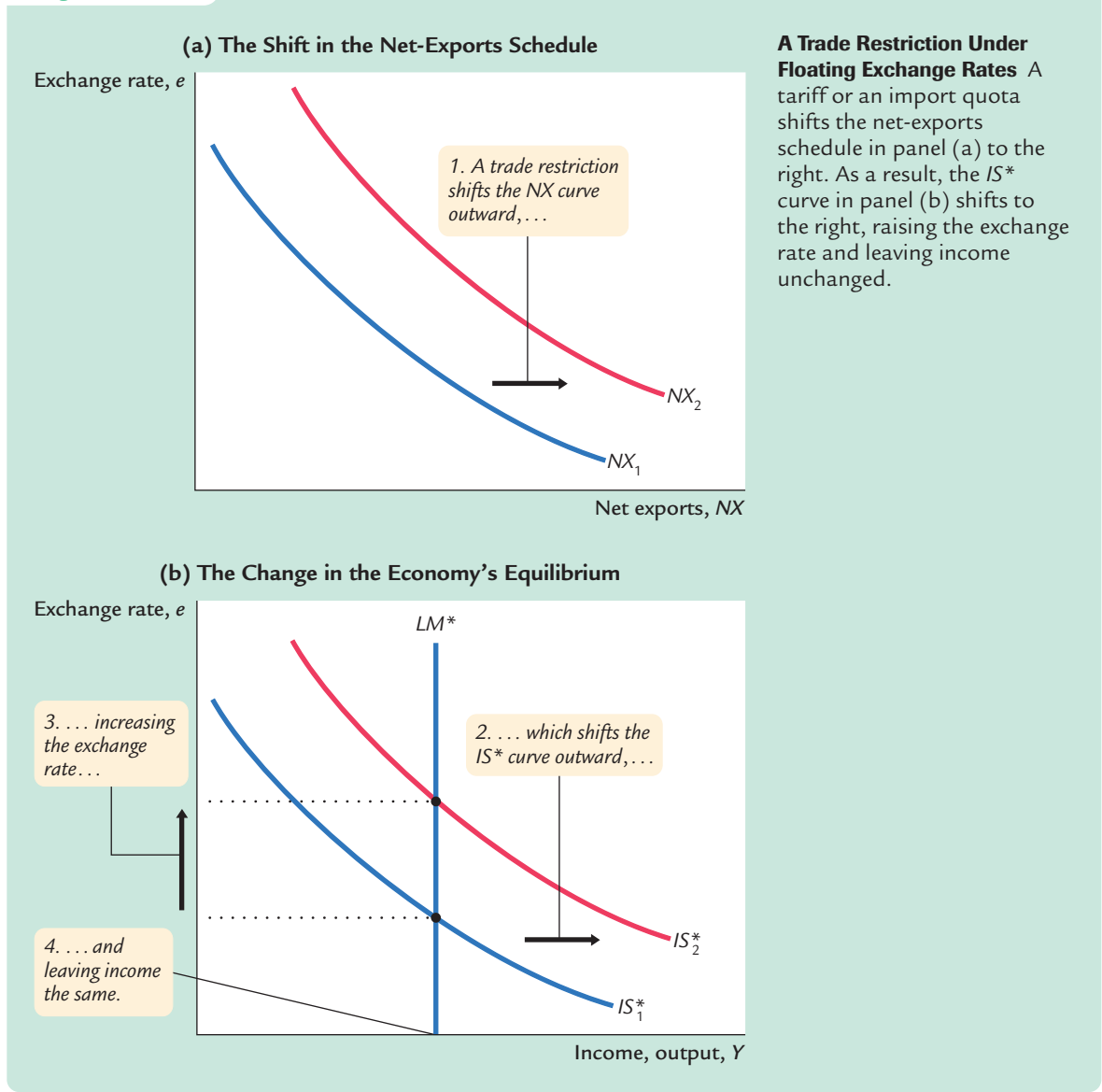
Although monetary policy influences income in an open economy, as it does in a closed economy, the monetary transmission mechanism is different. Recall that in a closed economy an increase in the money supply increases spending because it lowers the interest rate and stimulates investment. In a small open economy, the interest rate is fixed by the world interest rate. As soon as an increase in the money supply puts downward pressure on the domestic interest rate, capital flows out of the economy as investors seek a higher return elsewhere. This capital outflow prevents the domestic interest rate from falling. In addition, because the capital outflow increases the supply of the domestic currency in the market for foreign-currency exchange, the exchange rate depreciates. The fall in the exchange rate makes domestic goods inexpensive relative to foreign goods and, thereby, stimulates net exports. Hence, in a small open economy, monetary policy influences income by altering the exchange rate rather than the interest rate.

Trade Policy

Suppose that the government reduces the demand for imported goods by imposing an import quota or a tariff. What happens to aggregate income and the exchange rate?

Because net exports equal exports minus imports, a reduction in imports means an increase in net exports. That is, the net-exports schedule shifts to the

figure 12-6



A Trade Restriction Under Floating Exchange Rates A tariff or an import quota shifts the net-exports schedule in panel (a) to the right. As a result, the IS^* curve in panel (b) shifts to the right, raising the exchange rate and leaving income unchanged.

right, as in Figure 12-6. This shift in the net-exports schedule increases planned expenditure and thus moves the IS^* curve to the right. Because the LM^* curve is vertical, the trade restriction raises the exchange rate but does not affect income.

Often a stated goal of policies to restrict trade is to alter the trade balance NX . Yet, as we first saw in Chapter 5, such policies do not necessarily have that effect. The same conclusion holds in the Mundell–Fleming model under floating exchange rates. Recall that

$$NX(e) = Y - C(Y - T) - I(r^*) - G.$$

Because a trade restriction does not affect income, consumption, investment, or government purchases, it does not affect the trade balance. Although the shift in the net-exports schedule tends to raise NX , the increase in the exchange rate reduces NX by the same amount.

12-3 The Small Open Economy Under Fixed Exchange Rates

We now turn to the second type of exchange-rate system: **fixed exchange rates**. In the 1950s and 1960s, most of the world's major economies, including the United States, operated within the Bretton Woods system—an international monetary system under which most governments agreed to fix exchange rates. The world abandoned this system in the early 1970s, and exchange rates were allowed to float. Some European countries later reinstated a system of fixed exchange rates among themselves, and some economists have advocated a return to a worldwide system of fixed exchange rates. In this section we discuss how such a system works, and we examine the impact of economic policies on an economy with a fixed exchange rate.

How a Fixed-Exchange-Rate System Works

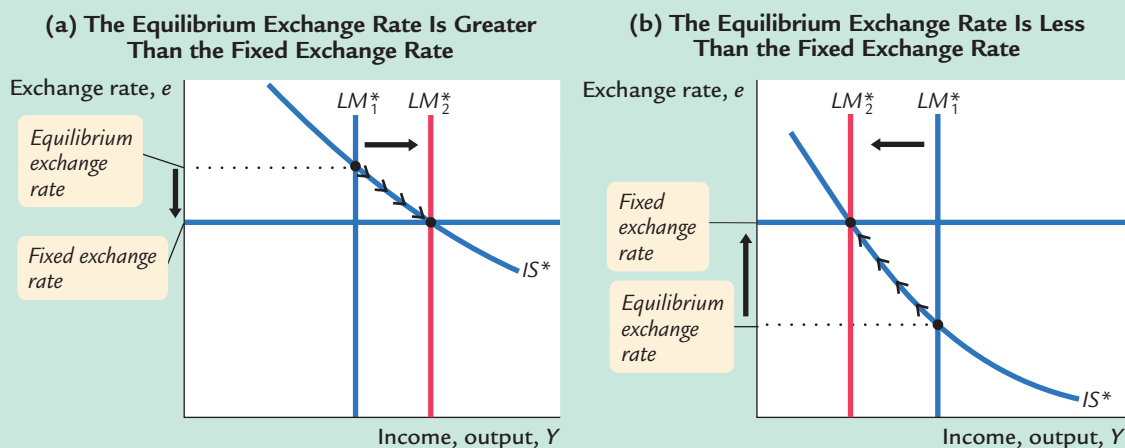
Under a system of fixed exchange rates, a central bank stands ready to buy or sell the domestic currency for foreign currencies at a predetermined price. For example, suppose that the Fed announced that it was going to fix the exchange rate at 100 yen per dollar. It would then stand ready to give \$1 in exchange for 100 yen or to give 100 yen in exchange for \$1. To carry out this policy, the Fed would need a reserve of dollars (which it can print) and a reserve of yen (which it must have purchased previously).

A fixed exchange rate dedicates a country's monetary policy to the single goal of keeping the exchange rate at the announced level. In other words, the essence of a fixed-exchange-rate system is the commitment of the central bank to allow the money supply to adjust to whatever level will ensure that the equilibrium exchange rate equals the announced exchange rate. Moreover, as long as the central bank stands ready to buy or sell foreign currency at the fixed exchange rate, the money supply adjusts automatically to the necessary level.

To see how fixing the exchange rate determines the money supply, consider the following example. Suppose that the Fed announces that it will fix the exchange rate at 100 yen per dollar, but, in the current equilibrium with the current money supply, the exchange rate is 150 yen per dollar. This situation is illustrated in panel (a) of Figure 12-7. Notice that there is a profit opportunity: an arbitrageur could buy 300 yen in the marketplace for \$2, and then sell the yen to the Fed for \$3, making a \$1 profit. When the Fed buys these yen from the arbitrageur, the dollars it pays for them automatically increase the money supply. The



figure 12-7



How a Fixed Exchange Rate Governs the Money Supply In panel (a), the equilibrium exchange rate initially exceeds the fixed level. Arbitrageurs will buy foreign currency in foreign-exchange markets and sell it to the Fed for a profit. This process automatically increases the money supply, shifting the LM^* curve to the right and lowering the exchange rate. In panel (b), the equilibrium exchange rate is initially below the fixed level. Arbitrageurs will buy dollars in foreign-exchange markets and use them to buy foreign currency from the Fed. This process automatically reduces the money supply, shifting the LM^* curve to the left and raising the exchange rate.

rise in the money supply shifts the LM^* curve to the right, lowering the equilibrium exchange rate. In this way, the money supply continues to rise until the equilibrium exchange rate falls to the announced level.

Conversely, suppose that when the Fed announces that it will fix the exchange rate at 100 yen per dollar, the equilibrium is 50 yen per dollar. Panel (b) of Figure 12-7 shows this situation. In this case, an arbitrageur could make a profit by buying 100 yen from the Fed for \$1 and then selling the yen in the marketplace for \$2. When the Fed sells these yen, the \$1 it receives automatically reduces the money supply. The fall in the money supply shifts the LM^* curve to the left, raising the equilibrium exchange rate. The money supply continues to fall until the equilibrium exchange rate rises to the announced level.

It is important to understand that this exchange-rate system fixes the nominal exchange rate. Whether it also fixes the real exchange rate depends on the time horizon under consideration. If prices are flexible, as they are in the long run, then the real exchange rate can change even while the nominal exchange rate is fixed. Therefore, in the long run described in Chapter 5, a policy to fix the nominal exchange rate would not influence any real variable, including the real exchange rate. A fixed nominal exchange rate would influence only the money supply and the price level. Yet in the short run described by the Mundell–Fleming model, prices are fixed, so a fixed nominal exchange rate implies a fixed real exchange rate as well.

CASE STUDY

The International Gold Standard

During the late nineteenth and early twentieth centuries, most of the world's major economies operated under a gold standard. Each country maintained a reserve of gold and agreed to exchange one unit of its currency for a specified amount of gold. Through the gold standard, the world's economies maintained a system of fixed exchange rates.

To see how an international gold standard fixes exchange rates, suppose that the U.S. Treasury stands ready to buy or sell 1 ounce of gold for \$100, and the Bank of England stands ready to buy or sell 1 ounce of gold for 100 pounds. Together, these policies fix the rate of exchange between dollars and pounds: \$1 must trade for 1 pound. Otherwise, the law of one price would be violated, and it would be profitable to buy gold in one country and sell it in the other.

For example, suppose that the exchange rate were 2 pounds per dollar. In this case, an arbitrageur could buy 200 pounds for \$100, use the pounds to buy 2 ounces of gold from the Bank of England, bring the gold to the United States, and sell it to the Treasury for \$200—making a \$100 profit. Moreover, by bringing the gold to the United States from England, the arbitrageur would increase the money supply in the United States and decrease the money supply in England.

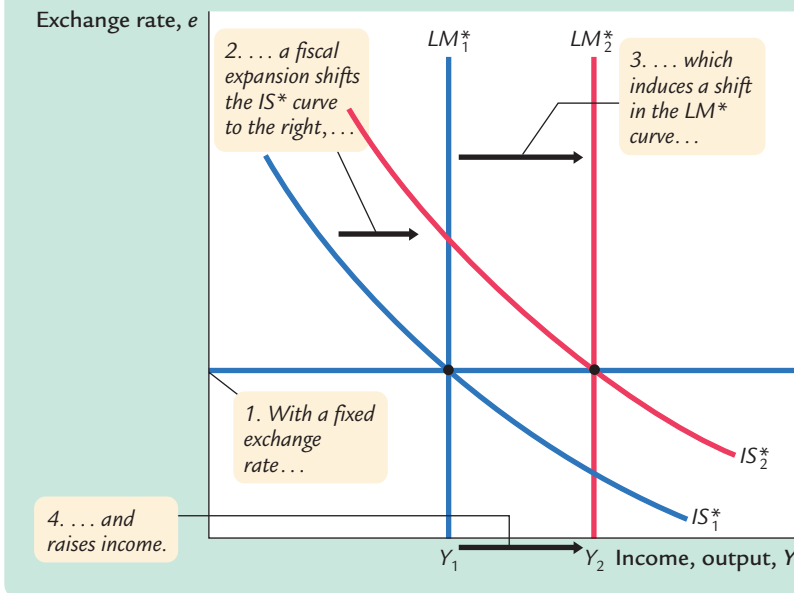
Thus, during the era of the gold standard, the international transport of gold by arbitrageurs was an automatic mechanism adjusting the money supply and stabilizing exchange rates. This system did not completely fix exchange rates, because shipping gold across the Atlantic was costly. Yet the international gold standard did keep the exchange rate within a range dictated by transportation costs. It thereby prevented large and persistent movements in exchange rates.²

Fiscal Policy

Let's now examine how economic policies affect a small open economy with a fixed exchange rate. Suppose that the government stimulates domestic spending by increasing government purchases or by cutting taxes. This policy shifts the IS^* curve to the right, as in Figure 12-8, putting upward pressure on the exchange rate. But because the central bank stands ready to trade foreign and domestic currency at the fixed exchange rate, arbitrageurs quickly respond to the rising exchange rate by selling foreign currency to the central bank, leading to an automatic monetary expansion. The rise in the money supply shifts the LM^* curve to the right. Thus, under a fixed exchange rate, a fiscal expansion raises aggregate income.

² For more on how the gold standard worked, see the essays in Barry Eichengreen, ed., *The Gold Standard in Theory and History* (New York: Methuen, 1985).

figure 12-8

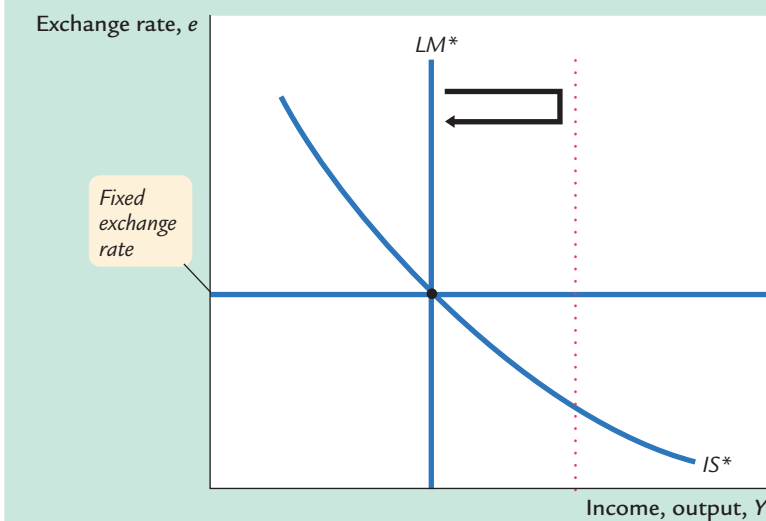


A Fiscal Expansion Under Fixed Exchange Rates A fiscal expansion shifts the IS^* curve to the right. To maintain the fixed exchange rate, the Fed must increase the money supply, thereby shifting the LM^* curve to the right. Hence, in contrast to the case of floating exchange rates, under fixed exchange rates a fiscal expansion raises income.

Monetary Policy

Imagine that a central bank operating with a fixed exchange rate were to try to increase the money supply—for example, by buying bonds from the public. What would happen? The initial impact of this policy is to shift the LM^* curve to the right, lowering the exchange rate, as in Figure 12-9. But, because the central bank is committed to trading foreign and domestic currency at a fixed exchange

figure 12-9



A Monetary Expansion Under Fixed Exchange Rates If the Fed tries to increase the money supply—for example, by buying bonds from the public—it will put downward pressure on the exchange rate. To maintain the fixed exchange rate, the money supply and the LM^* curve must return to their initial positions. Hence, under fixed exchange rates, normal monetary policy is ineffectual.

rate, arbitrageurs quickly respond to the falling exchange rate by selling the domestic currency to the central bank, causing the money supply and the LM^* curve to return to their initial positions. Hence, monetary policy as usually conducted is ineffectual under a fixed exchange rate. By agreeing to fix the exchange rate, the central bank gives up its control over the money supply.

A country with a fixed exchange rate can, however, conduct a type of monetary policy: it can decide to change the level at which the exchange rate is fixed. A reduction in the value of the currency is called a **devaluation**, and an increase in its value is called a **revaluation**. In the Mundell–Fleming model, a devaluation shifts the LM^* curve to the right; it acts like an increase in the money supply under a floating exchange rate. A devaluation thus expands net exports and raises aggregate income. Conversely, a revaluation shifts the LM^* curve to the left, reduces net exports, and lowers aggregate income.

CASE STUDY

Devaluation and the Recovery From the Great Depression

The Great Depression of the 1930s was a global problem. Although events in the United States may have precipitated the downturn, all of the world's major economies experienced huge declines in production and employment. Yet not all governments responded to this calamity in the same way.

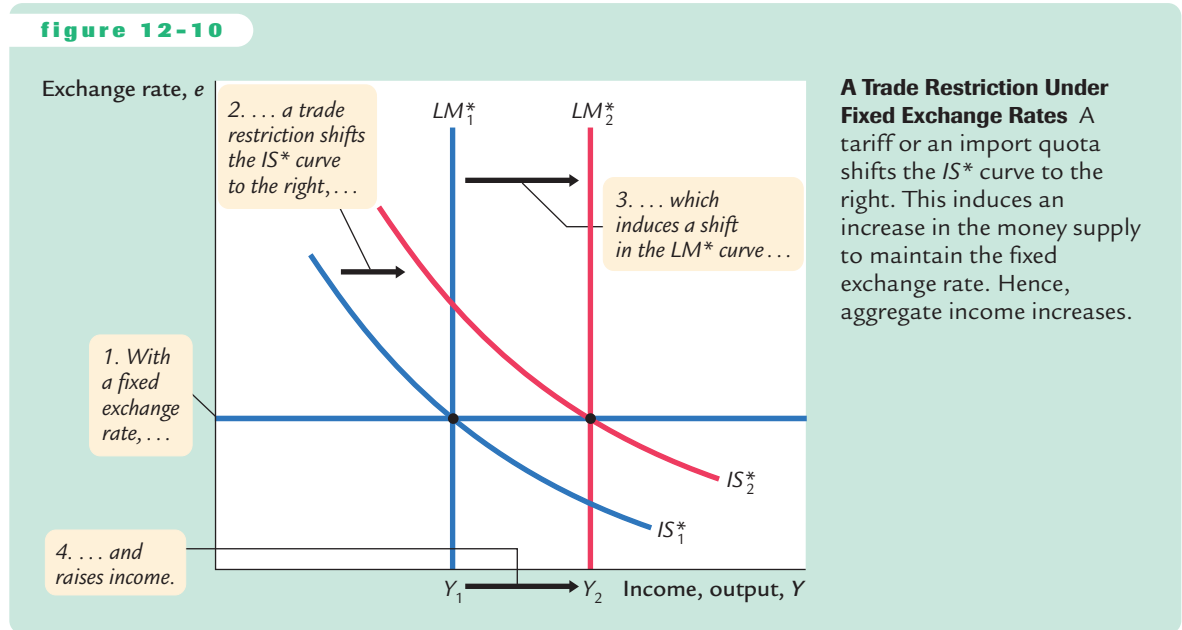
One key difference among governments was how committed they were to the fixed exchange rate set by the international gold standard. Some countries, such as France, Germany, Italy, and the Netherlands, maintained the old rate of exchange between gold and currency. Other countries, such as Denmark, Finland, Norway, Sweden, and the United Kingdom, reduced the amount of gold they would pay for each unit of currency by about 50 percent. By reducing the gold content of their currencies, these governments devalued their currencies relative to those of other countries.

The subsequent experience of these two groups of countries conforms to the prediction of the Mundell–Fleming model. Those countries that pursued a policy of devaluation recovered quickly from the Depression. The lower value of the currency raised the money supply, stimulated exports, and expanded production. By contrast, those countries that maintained the old exchange rate suffered longer with a depressed level of economic activity.³

Trade Policy

Suppose that the government reduces imports by imposing an import quota or a tariff. This policy shifts the net-exports schedule to the right and thus shifts the IS^* curve to the right, as in Figure 12-10. The shift in the IS^* curve tends to

³ Barry Eichengreen and Jeffrey Sachs, "Exchange Rates and Economic Recovery in the 1930s," *Journal of Economic History* 45 (December 1985): 925–946.



raise the exchange rate. To keep the exchange rate at the fixed level, the money supply must rise, shifting the LM^* curve to the right.

The result of a trade restriction under a fixed exchange rate is very different from that under a floating exchange rate. In both cases, a trade restriction shifts the net-exports schedule to the right, but only under a fixed exchange rate does a trade restriction increase net exports NX . The reason is that a trade restriction under a fixed exchange rate induces monetary expansion rather than an appreciation of the exchange rate. The monetary expansion, in turn, raises aggregate income. Recall the accounting identity

$$NX = S - I.$$

When income rises, saving also rises, and this implies an increase in net exports.

Policy in the Mundell–Fleming Model: A Summary

The Mundell–Fleming model shows that the effect of almost any economic policy on a small open economy depends on whether the exchange rate is floating or fixed. Table 12-1 summarizes our analysis of the short-run effects of fiscal, monetary, and trade policies on income, the exchange rate, and the trade balance. What is most striking is that all of the results are different under floating and fixed exchange rates.

To be more specific, the Mundell–Fleming model shows that the power of monetary and fiscal policy to influence aggregate income depends on the exchange-rate regime. Under floating exchange rates, only monetary policy can affect income. The usual expansionary impact of fiscal policy is offset by a rise in

table 12-1

The Mundell–Fleming Model: Summary of Policy Effects

Policy	EXCHANGE-RATE REGIME					
	FLOATING			FIXED		
	IMPACT ON:					
	Y	e	NX	Y	e	NX
Fiscal expansion	0	↑	↓	↑	0	0
Monetary expansion	↑	↓	↑	0	0	0
Import restriction	0	↑	0	↑	0	↑

Note: This table shows the direction of impact of various economic policies on income Y , the exchange rate e , and the trade balance NX . A “↑” indicates that the variable increases; a “↓” indicates that it decreases; a “0” indicates no effect. Remember that the exchange rate is defined as the amount of foreign currency per unit of domestic currency (for example, 100 yen per dollar).

the value of the currency. Under fixed exchange rates, only fiscal policy can affect income. The normal potency of monetary policy is lost because the money supply is dedicated to maintaining the exchange rate at the announced level.

12-4 Interest-Rate Differentials

So far, our analysis has assumed that the interest rate in a small open economy is equal to the world interest rate: $r = r^*$. To some extent, however, interest rates differ around the world. We now extend our analysis by considering the causes and effects of international interest-rate differentials.

Country Risk and Exchange-Rate Expectations

When we assumed earlier that the interest rate in our small open economy is determined by the world interest rate, we were applying the law of one price. We reasoned that if the domestic interest rate were above the world interest rate, people from abroad would lend to that country, driving the domestic interest rate down. And if the domestic interest rate were below the world interest rate, domestic residents would lend abroad to earn a higher return, driving the domestic interest rate up. In the end, the domestic interest rate would equal the world interest rate.

Why doesn't this logic always apply? There are two reasons.

One reason is country risk. When investors buy U.S. government bonds or make loans to U.S. corporations, they are fairly confident that they will be repaid with interest. By contrast, in some less developed countries, it is plausible to fear that a revolution or other political upheaval might lead to a default on loan repayments. Borrowers in such countries often have to pay higher interest rates to compensate lenders for this risk.

Another reason interest rates differ across countries is expected changes in the exchange rate. For example, suppose that people expect the French franc to fall in value relative to the U.S. dollar. Then loans made in francs will be repaid in a less valuable currency than loans made in dollars. To compensate for this expected fall in the French currency, the interest rate in France will be higher than the interest rate in the United States.

Thus, because of both country risk and expectations of future exchange-rate changes, the interest rate of a small open economy can differ from interest rates in other economies around the world. Let's now see how this fact affects our analysis.

Differentials in the Mundell–Fleming Model

To incorporate interest-rate differentials into the Mundell–Fleming model, we assume that the interest rate in our small open economy is determined by the world interest rate plus a risk premium θ :

$$r = r^* + \theta.$$

The risk premium is determined by the perceived political risk of making loans in a country and the expected change in the real exchange rate. For our purposes here, we can take the risk premium as exogenous in order to examine how changes in the risk premium affect the economy.

The model is largely the same as before. The two equations are

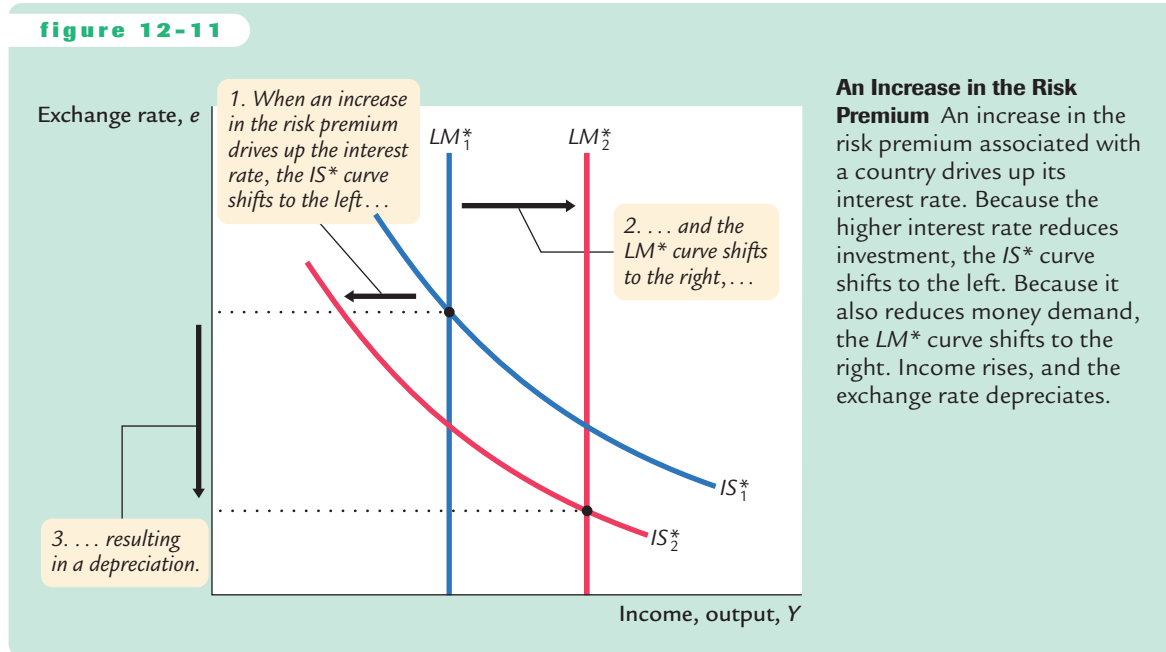
$$\begin{aligned} Y &= C(Y - T) + I(r^* + \theta) + G + NX(e) && IS^*, \\ M/P &= L(r^* + \theta, Y) && LM^*. \end{aligned}$$

For any given fiscal policy, monetary policy, price level, and risk premium, these two equations determine the level of income and exchange rate that equilibrate the goods market and the money market. Holding constant the risk premium, the tools of monetary, fiscal, and trade policy work as we have already seen.

Now suppose that political turmoil causes the country's risk premium θ to rise. The most direct effect is that the domestic interest rate r rises. The higher interest rate, in turn, has two effects. First, the IS^* curve shifts to the left, because the higher interest rate reduces investment. Second, the LM^* curve shifts to the right, because the higher interest rate reduces the demand for money, and this allows a higher level of income for any given money supply. [Recall that Y must satisfy the equation $M/P = L(r^* + \theta, Y)$.] As Figure 12-11 shows, these two shifts cause income to rise and the currency to depreciate.

This analysis has an important implication: expectations of the exchange rate are partially self-fulfilling. For example, suppose that people come to believe that the French franc will not be valuable in the future. Investors will place a larger risk premium on French assets: θ will rise in France. This expectation will drive

figure 12-11



up French interest rates and, as we have just seen, will drive down the value of the French currency. Thus, the expectation that a currency will lose value in the future causes it to lose value today.

One surprising—and perhaps inaccurate—prediction of this analysis is that an increase in country risk as measured by θ will cause the economy’s income to increase. This occurs in Figure 12-11 because of the rightward shift in the LM^* curve. Although higher interest rates depress investment, the depreciation of the currency stimulates net exports by an even greater amount. As a result, aggregate income rises.

There are three reasons why, in practice, such a boom in income does not occur. First, the central bank might want to avoid the large depreciation of the domestic currency and, therefore, may respond by decreasing the money supply M . Second, the depreciation of the domestic currency may suddenly increase the price of imported goods, causing an increase in the price level P . Third, when some event increases the country risk premium θ , residents of the country might respond to the same event by increasing their demand for money (for any given income and interest rate), because money is often the safest asset available. All three of these changes would tend to shift the LM^* curve toward the left, which mitigates the fall in the exchange rate but also tends to depress income.

Thus, increases in country risk are not desirable. In the short run, they typically lead to a depreciating currency and, through the three channels just described, falling aggregate income. In addition, because a higher interest rate reduces investment, the long-run implication is reduced capital accumulation and lower economic growth.

CASE STUDY

International Financial Crisis: Mexico 1994–1995

In August 1994, a Mexican peso was worth 30 cents. A year later, it was worth only 16 cents. What explains this massive fall in the value of the Mexican currency? Country risk is a large part of the story.

At the beginning of 1994, Mexico was a country on the rise. The recent passage of the North American Free Trade Agreement (NAFTA), which reduced trade barriers among the United States, Canada, and Mexico, made many confident about the future of the Mexican economy. Investors around the world were eager to make loans to the Mexican government and to Mexican corporations.

Political developments soon changed that perception. A violent uprising in the Chiapas region of Mexico made the political situation in Mexico seem precarious. Then Luis Donaldo Colosio, the leading presidential candidate, was assassinated. The political future looked less certain, and many investors started placing a larger risk premium on Mexican assets.

At first, the rising risk premium did not affect the value of the peso, because Mexico was operating with a fixed exchange rate. As we have seen, under a fixed exchange rate, the central bank agrees to trade the domestic currency (pesos) for a foreign currency (dollars) at a predetermined rate. Thus, when an increase in the country risk premium put downward pressure on the value of the peso, the Mexican central bank had to accept pesos and pay out dollars. This automatic exchange-market intervention contracted the Mexican money supply (shifting the LM^* curve to the left) when the currency might otherwise have depreciated.

Yet Mexico's reserves of foreign currency were too small to maintain its fixed exchange rate. When Mexico ran out of dollars at the end of 1994, the Mexican government announced a devaluation of the peso. This decision had repercussions, however, because the government had repeatedly promised that it would not devalue. Investors became even more distrustful of Mexican policymakers and feared further Mexican devaluations.

Investors around the world (including those in Mexico) avoided buying Mexican assets. The country risk premium rose once again, adding to the upward pressure on interest rates and the downward pressure on the peso. The Mexican stock market plummeted. When the Mexican government needed to roll over some of its debt that was coming due, investors were unwilling to buy the new debt. Default appeared to be the government's only option. In just a few months, Mexico had gone from being a promising emerging economy to being a risky economy with a government on the verge of bankruptcy.

Then the United States stepped in. The U.S. government had three motives: to help its neighbor to the south, to prevent the massive illegal immigration that might follow government default and economic collapse, and to prevent the investor pessimism regarding Mexico from spreading to other developing countries. The U.S. government, together with the International Monetary Fund (IMF), led an international effort to bail out the Mexican government. In particular, the United States provided loan guarantees for Mexican government debt, which allowed the Mexican government to refinance the debt that was coming

due. These loan guarantees helped restore confidence in the Mexican economy, thereby reducing to some extent the country risk premium.

Although the U.S. loan guarantees may well have stopped a bad situation from getting worse, they did not prevent the Mexican meltdown of 1994–1995 from being a painful experience for the Mexican people. Not only did the Mexican currency lose much of its value, but Mexico also went through a deep recession. Fortunately, by the late 1990s, aggregate income was growing again, and the worst appeared to be over. But the lesson from this experience is clear and could well apply again in the future: changes in perceived country risk, often attributable to political instability, are an important determinant of interest rates and exchange rates in small open economies.

CASE STUDY

International Financial Crisis: Asia 1997–1998

In 1997, as the Mexican economy was recovering from its financial crisis, a similar story started to unfold in several Asian economies, including Thailand, South Korea, and especially Indonesia. The symptoms were familiar: high interest rates, falling asset values, and a depreciating currency. In Indonesia, for instance, short-term nominal interest rates rose above 50 percent, the stock market lost about 90 percent of its value (measured in U.S. dollars), and the rupiah fell against the dollar by more than 80 percent. The crisis led to rising inflation in these countries (because the depreciating currency made imports more expensive) and to falling GDP (because high interest rates and reduced confidence depressed spending). Real GDP in Indonesia fell about 13 percent in 1998, making the downturn larger than any U.S. recession since the Great Depression of the 1930s.

What sparked this firestorm? The problem began in the Asian banking systems. For many years, the governments in the Asian nations had been more involved in managing the allocation of resources—in particular, financial resources—than is true in the United States and other developed countries. Some commentators had applauded this “partnership” between government and private enterprise and had even suggested that the United States should follow the example. Over time, however, it became clear that many Asian banks had been extending loans to those with the most political clout rather than to those with the most profitable investment projects. Once rising default rates started to expose this “crony capitalism,” as it was then called, international investors started to lose confidence in the future of these economies. The risk premiums for Asian assets rose, causing interest rates to skyrocket and currencies to collapse.

International crises of confidence often involve a vicious circle that can amplify the problem. Here is one story about what happened in Asia:

1. Problems in the banking system eroded international confidence in these economies.
2. Loss of confidence raised risk premiums and interest rates.

3. Rising interest rates, together with the loss of confidence, depressed the prices of stock and other assets.
4. Falling asset prices reduced the value of collateral being used for bank loans.
5. Reduced collateral increased default rates on bank loans.
6. Greater defaults exacerbated problems in the banking system. Now return to step 1 to complete and continue the circle.

Some economists have used this vicious-circle argument to suggest that the Asian crisis was a self-fulfilling prophecy: bad things happened merely because people expected bad things to happen. Most economists, however, thought the political corruption of the banking system was a real problem, which was then compounded by this vicious circle of reduced confidence.

As the Asian crisis developed, the IMF and the United States tried to restore confidence, much as they had with Mexico a few years earlier. In particular, the IMF made loans to the Asian countries to help them over the crisis; in exchange for these loans, it exacted promises that the governments would reform their banking systems and eliminate crony capitalism. The IMF's hope was that the short-term loans and longer-term reforms would restore confidence, lower the risk premium, and turn the vicious circle into a virtuous circle. This policy seems to have worked: the Asian economies recovered quickly from their crisis.

12-5 Should Exchange Rates Be Floating or Fixed?

Having analyzed how an economy works under floating and fixed exchange rates, let's consider which exchange-rate regime is better.

Pros and Cons of Different Exchange-Rate Systems

The primary argument for a floating exchange rate is that it allows monetary policy to be used for other purposes. Under fixed rates, monetary policy is committed to the single goal of maintaining the exchange rate at its announced level. Yet the exchange rate is only one of many macroeconomic variables that monetary policy can influence. A system of floating exchange rates leaves monetary policy-makers free to pursue other goals, such as stabilizing employment or prices.

Advocates of fixed exchange rates argue that exchange-rate uncertainty makes international trade more difficult. After the world abandoned the Bretton Woods system of fixed exchange rates in the early 1970s, both real and nominal exchange rates became (and remained) much more volatile than anyone had expected. Some economists attribute this volatility to irrational and destabilizing speculation by international investors. Business executives often claim that this volatility is harmful because it increases the uncertainty that accompanies international business transactions. Yet, despite this exchange-rate volatility, the amount of world trade has continued to rise under floating exchange rates.

Advocates of fixed exchange rates sometimes argue that a commitment to a fixed exchange rate is one way to discipline a nation's monetary authority and prevent excessive growth in the money supply. Yet there are many other policy rules to which the central bank could be committed. In Chapter 14, for instance, we discuss policy rules such as targets for nominal GDP or the inflation rate. Fixing the exchange rate has the advantage of being simpler to implement than these other policy rules, because the money supply adjusts automatically, but this policy may lead to greater volatility in income and employment.

In the end, the choice between floating and fixed rates is not as stark as it may seem at first. During periods of fixed exchange rates, countries can change the value of their currency if maintaining the exchange rate conflicts too severely with other goals. During periods of floating exchange rates, countries often use formal or informal targets for the exchange rate when deciding whether to expand or contract the money supply. We rarely observe exchange rates that are completely fixed or completely floating. Instead, under both systems, stability of the exchange rate is usually one among many of the central bank's objectives.



“Then it’s agreed. Until the dollar firms up, we let the clamshell float.”

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CASE STUDY

Monetary Union in the United States and Europe

If you have ever driven the 3,000 miles from New York City to San Francisco, you may recall that you never needed to change your money from one form of currency to another. In all fifty U.S. states, local residents are happy to accept the U.S. dollar for the items you buy. Such a *monetary union* is the most extreme form of a fixed exchange rate. The exchange rate between New York dollars and San Francisco dollars is so irrevocably fixed that you may not even know that there is a difference between the two. (What’s the difference? Each dollar bill is issued by one of the dozen local Federal Reserve Banks. Although the bank of origin can be identified from the bill’s markings, you don’t care which type of dollar you hold because everyone else, including the Federal Reserve system, is ready to trade them one for one.)

If you have ever made a similar 3,000-mile trip across Europe, however, your experience was probably very different. You didn’t have to travel far before needing to exchange your French francs for German marks, Dutch guilders, Spanish pesetas, or Italian lira. The large number of currencies in Europe made traveling less convenient and more expensive. Every time you crossed a border, you had to wait in line at a bank to get the local money, and you had to pay the bank a fee for the service.

Recently, however, this has started to change. Many countries in Europe have decided to form their own monetary union and use a common currency called

the *euro*, which was introduced in January 1999. The adoption of the euro is an extension of the *European Monetary System (EMS)*, which during the previous two decades had attempted to limit exchange-rate fluctuations among participating countries. When the euro is fully adopted, this goal will be achieved: the exchange rate between France and Germany will be as fixed as the exchange rate between New York City and San Francisco.

The introduction of a common currency has its costs. The most important is that the nations of Europe will no longer be able to conduct their own monetary policies. Instead, a European central bank, with participation of all member countries, will set a single monetary policy for all of Europe. The central banks of the individual countries will play a role similar to that of regional Federal Reserve Banks: they will monitor local conditions but they will have no control over the money supply or interest rates. Critics of the move toward a common currency argue that the cost of losing national monetary policy is large. If a recession hits one country but not others in Europe, that country may wish it had the tool of monetary policy to combat the downturn.

Why, according to these economists, is monetary union a bad idea for Europe if it works so well in the United States? These economists argue that the United States is different from Europe in two important ways. First, labor is more mobile among U.S. states than among European countries. This is in part because the United States has a common language and in part because most Americans are descended from immigrants, who have shown a willingness to move. Therefore, when a regional recession occurs, U.S. workers are more likely to move from high-unemployment states to low-unemployment states. Second, the United States has a strong central government that can use fiscal policy—such as the federal income tax—to redistribute resources among regions. Because Europe does not have these two advantages, it will suffer more when it restricts itself to a single monetary policy.

Advocates of a common currency believe that the loss of national monetary policy is more than offset by other gains. With a single currency in all of Europe, travelers and businesses will no longer need to worry about exchange rates, and this should encourage more international trade. In addition, a common currency may have the political advantage of making Europeans feel more connected to one another. The twentieth century was marked by two world wars, both of which were sparked by European discord. If a common currency makes the nations of Europe more harmonious, it will benefit the entire world.

Speculative Attacks, Currency Boards, and Dollarization

Imagine that you are a central banker of a small country. You and your fellow policymakers decide to fix your currency—let's call it the peso—against the U.S. dollar. From now on, one peso will sell for one dollar.

As we discussed earlier, you now have to stand ready to buy and sell pesos for a dollar each. The money supply will adjust automatically to make the equilibrium exchange rate equal your target. There is, however, one potential problem with this plan: you might run out of dollars. If people come to the central bank

to sell large quantities of pesos, the central bank's dollar reserves might dwindle to zero. In this case, the central bank has no choice but to abandon the fixed exchange rate and let the peso depreciate.

This fact raises the possibility of a *speculative attack*—a change in investors' perceptions that makes the fixed exchange rate untenable. Suppose that, for no good reason, a rumor spreads that the central bank is going to abandon the exchange-rate peg. People would respond by rushing to the central bank to convert pesos into dollars before the pesos lose value. This rush would drain the central bank's reserves and could force the central bank to abandon the peg. In this case, the rumor would prove self-fulfilling.

To avoid this possibility, some economists argue that a fixed exchange rate should be supported by a *currency board*, such as that used by Argentina in the 1990s. A currency board is an arrangement by which the central bank holds enough foreign currency to back each unit of the domestic currency. In our example, the central bank would hold one U.S. dollar (or one dollar invested in a U.S. government bond) for every peso. No matter how many pesos turned up at the central bank to be exchanged, the central bank would never run out of dollars.

Once a central bank has adopted a currency board, it might consider the natural next step: it can abandon the peso altogether and let its country use the U.S. dollar. Such a plan is called *dollarization*. It happens on its own in high-inflation economies, where foreign currencies offer a more reliable store of value than the domestic currency. But it can also occur as a matter of public policy: Panama is an example. If a country really wants its currency to be irrevocably fixed to the dollar, the most reliable method is to make its currency the dollar. The only loss from dollarization is the small seigniorage revenue, which accrues to the U.S. government.⁴

12-6 The Mundell–Fleming Model With a Changing Price Level

So far we have been using the Mundell–Fleming model to study the small open economy in the short run when the price level is fixed. To see how this model relates to models we have examined previously, let's consider what happens when the price level changes.

To examine price adjustment in an open economy, we must distinguish between the nominal exchange rate e and the real exchange rate ϵ , which equals eP/P^* . We can write the Mundell–Fleming model as

$$\begin{aligned} Y &= C(Y - T) + I(r^*) + G + NX(\epsilon) & IS^*, \\ M/P &= L(r^*, Y) & LM^*. \end{aligned}$$

⁴ Dollarization may also lead to a loss in national pride from seeing American portraits on the currency. If it wanted, the U.S. government could fix this problem by leaving blank the center space that now has George Washington's portrait. Each nation using the U.S. dollar could insert the face of its own local hero.

These equations should be familiar by now. The first equation describes the IS^* curve, and the second equation describes the LM^* curve. Note that net exports depend on the real exchange rate.

Figure 12-12 shows what happens when the price level falls. Because a lower price level raises the level of real money balances, the LM^* curve shifts to the right, as in panel (a) of Figure 12-12. The real exchange rate depreciates, and the equilibrium level of income rises. The aggregate demand curve summarizes this negative relationship between the price level and the level of income, as shown in panel (b) of Figure 12-12.

Thus, just as the $IS-LM$ model explains the aggregate demand curve in a closed economy, the Mundell-Fleming model explains the aggregate demand curve for a small open economy. In both cases, the aggregate demand curve shows the set of equilibria that arise as the price level varies. And in both cases, anything that changes the equilibrium for a given price level shifts the aggregate demand curve. Policies that raise income shift the aggregate demand curve to the right; policies that lower income shift the aggregate demand curve to the left.

figure 12-12

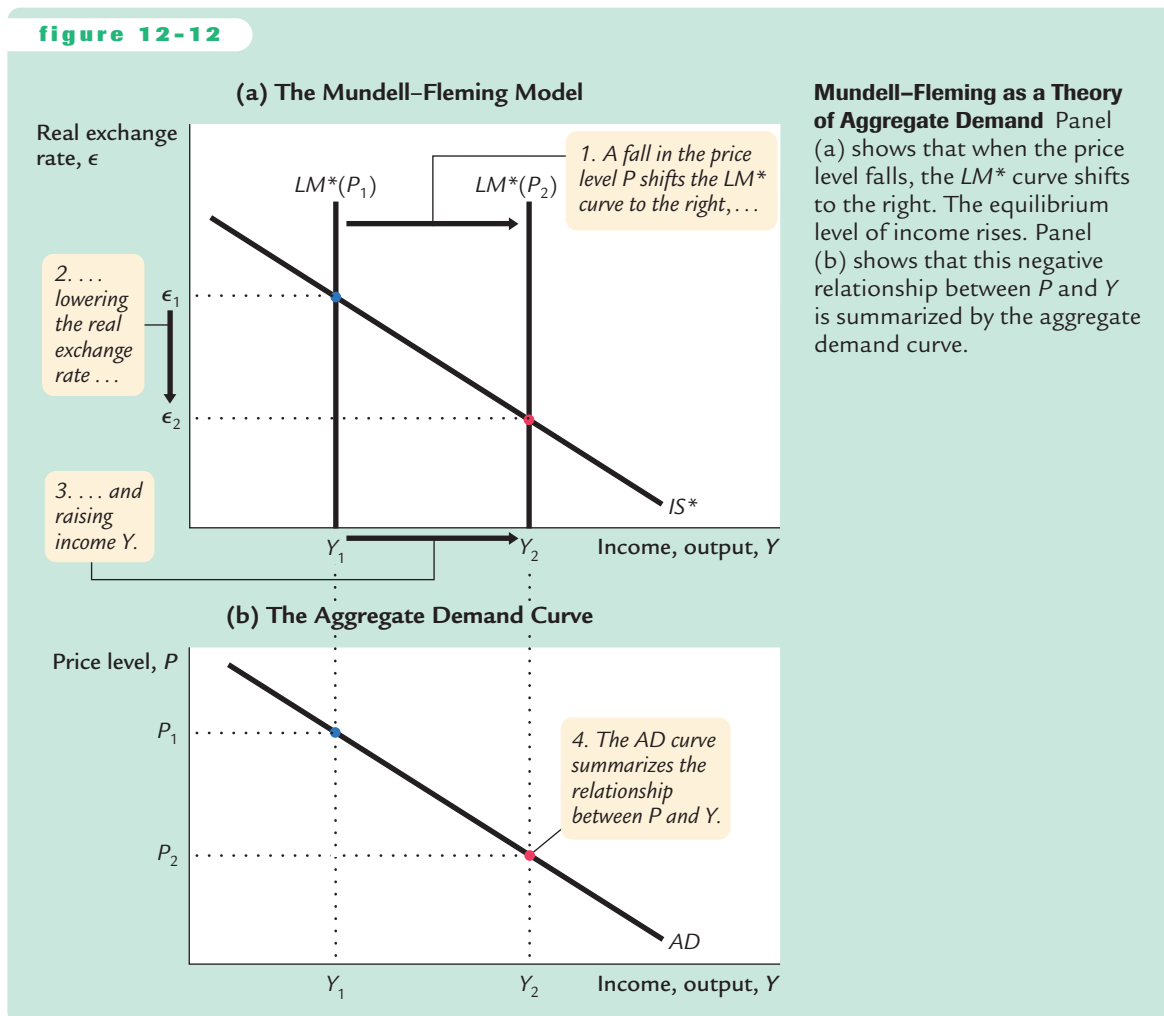
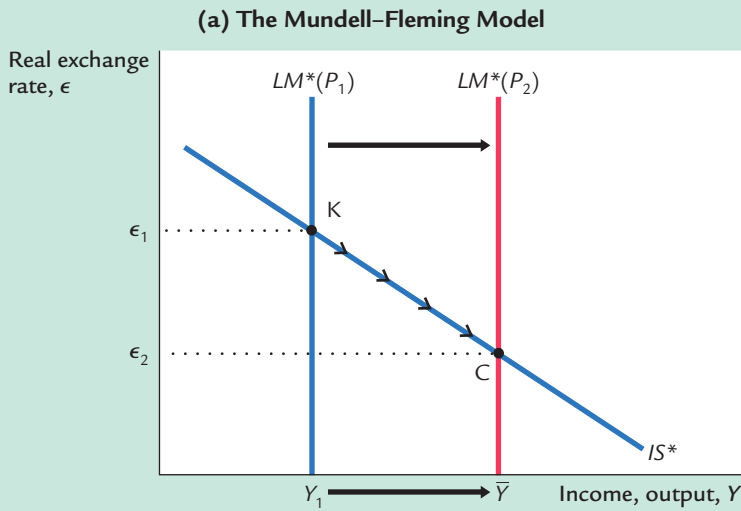
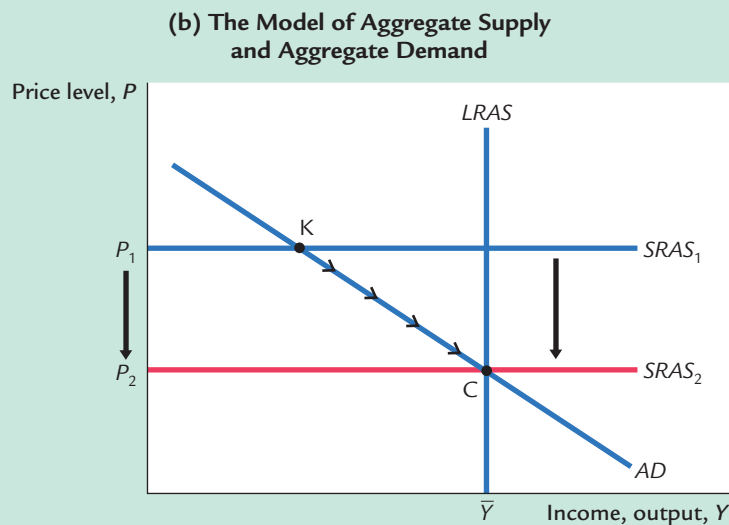


figure 12-13



The Short-Run and Long-Run Equilibria in a Small Open Economy Point K in both panels shows the equilibrium under the Keynesian assumption that the price level is fixed at P_1 . Point C in both panels shows the equilibrium under the classical assumption that the price level adjusts to maintain income at its natural rate \bar{Y} .



We can use this diagram to show how the short-run model in this chapter is related to the long-run model in Chapter 5. Figure 12-13 shows the short-run and long-run equilibria. In both panels of the figure, point K describes the short-run equilibrium, because it assumes a fixed price level. At this equilibrium, the demand for goods and services is too low to keep the economy producing at its natural rate. Over time, low demand causes the price level to fall. The fall in the price level raises real money balances, shifting the LM^* curve to the right. The real exchange rate depreciates, so net exports rise. Eventually, the economy reaches point C, the long-run equilibrium. The speed of transition between the short-run and long-run equilibria depends on how quickly the price level adjusts to restore the economy to the natural rate.

The levels of income at point K and point C are both of interest. Our central concern in this chapter has been how policy influences point K, the short-run equilibrium. In Chapter 5 we examined the determinants of point C, the long-run equilibrium. Whenever policymakers consider any change in policy, they need to consider both the short-run and long-run effects of their decision.

12-7 A Concluding Reminder

In this chapter we have examined how a small open economy works in the short run when prices are sticky. We have seen how monetary and fiscal policy influence income and the exchange rate, and how the behavior of the economy depends on whether the exchange rate is floating or fixed. In closing, it is worth repeating a lesson from Chapter 5. Many countries, including the United States, are neither closed economies nor small open economies: they lie somewhere in between.

A large open economy, such as the United States, combines the behavior of a closed economy and the behavior of a small open economy. When analyzing policies in a large open economy, we need to consider both the closed-economy logic of Chapter 11 and the open-economy logic developed in this chapter. The appendix to this chapter presents a model for a large open economy. The results of that model are, as one would guess, a mixture of the two polar cases we have already examined.

To see how we can draw on the logic of both the closed and small open economies and apply these insights to the United States, consider how a monetary contraction affects the economy in the short run. In a closed economy, a monetary contraction raises the interest rate, lowers investment, and thus lowers aggregate income. In a small open economy with a floating exchange rate, a monetary contraction raises the exchange rate, lowers net exports, and thus lowers aggregate income. The interest rate is unaffected, however, because it is determined by world financial markets.

The U.S. economy contains elements of both cases. Because the United States is large enough to affect the world interest rate and because capital is not perfectly mobile across countries, a monetary contraction does raise the interest rate and depress investment. At the same time, a monetary contraction also raises the value of the dollar, thereby depressing net exports. Hence, although the Mundell–Fleming model does not precisely describe an economy like that of the United States, it does predict correctly what happens to international variables such as the exchange rate, and it shows how international interactions alter the effects of monetary and fiscal policies.

Summary

1. The Mundell–Fleming model is the *IS–LM* model for a small open economy. It takes the price level as given and then shows what causes fluctuations in income and the exchange rate.
2. The Mundell–Fleming model shows that fiscal policy does not influence aggregate income under floating exchange rates. A fiscal expansion causes the

currency to appreciate, reducing net exports and offsetting the usual expansionary impact on aggregate income. Fiscal policy does influence aggregate income under fixed exchange rates.

3. The Mundell–Fleming model shows that monetary policy does not influence aggregate income under fixed exchange rates. Any attempt to expand the money supply is futile, because the money supply must adjust to ensure that the exchange rate stays at its announced level. Monetary policy does influence aggregate income under floating exchange rates.
4. If investors are wary of holding assets in a country, the interest rate in that country may exceed the world interest rate by some risk premium. According to the Mundell–Fleming model, an increase in the risk premium causes the interest rate to rise and the currency of that country to depreciate.
5. There are advantages to both floating and fixed exchange rates. Floating exchange rates leave monetary policymakers free to pursue objectives other than exchange-rate stability. Fixed exchange rates reduce some of the uncertainty in international business transactions.

KEY CONCEPTS

Mundell–Fleming model	Fixed exchange rates	Revaluation
Floating exchange rates	Devaluation	

QUESTIONS FOR REVIEW

1. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when taxes are raised. What would happen if exchange rates were fixed rather than floating?
2. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when the money supply is reduced. What would happen if exchange rates were fixed rather than floating?
3. In the Mundell–Fleming model with floating exchange rates, explain what happens to aggregate income, the exchange rate, and the trade balance when a quota on imported cars is removed. What would happen if exchange rates were fixed rather than floating?
4. What are the advantages of floating exchange rates and fixed exchange rates?

PROBLEMS AND APPLICATIONS

1. Use the Mundell–Fleming model to predict what would happen to aggregate income, the exchange rate, and the trade balance under both floating and fixed exchange rates in response to each of the following shocks:
 - a. A fall in consumer confidence about the future induces consumers to spend less and save more.
 - b. The introduction of a stylish line of Toyotas makes some consumers prefer foreign cars over domestic cars.
 - c. The introduction of automatic teller machines reduces the demand for money.
2. The Mundell–Fleming model takes the world interest rate r^* as an exogenous variable. Let's

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consider what happens when this variable changes.

- a. What might cause the world interest rate to rise?
 - b. In the Mundell–Fleming model with a floating exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?
 - c. In the Mundell–Fleming model with a fixed exchange rate, what happens to aggregate income, the exchange rate, and the trade balance when the world interest rate rises?
3. Business executives and policymakers are often concerned about the “competitiveness” of American industry (the ability of U.S. industries to sell their goods profitably in world markets).
- a. How would a change in the exchange rate affect competitiveness?
 - b. Suppose you wanted to make domestic industries more competitive but did not want to alter aggregate income. According to the Mundell–Fleming model, what combination of monetary and fiscal policies should you pursue?
4. Suppose that higher income implies higher imports and thus lower net exports. That is, the net-exports function is

$$NX = NX(e, Y).$$

Examine the effects in a small open economy of a fiscal expansion on income and the trade balance under

- a. A floating exchange rate.
- b. A fixed exchange rate.

How does your answer compare to the results in Table 12-1?

5. Suppose that money demand depends on disposable income, so that the equation for the money market becomes

$$M/P = L(r, Y - T).$$

Analyze the impact of a tax cut in a small open economy on the exchange rate and income under both floating and fixed exchange rates.

6. Suppose that the price level relevant for money demand includes the price of imported goods and that the price of imported goods depends on the exchange rate. That is, the money market is described by

$$M/P = L(r, Y),$$

where

$$P = \lambda P_d + (1 - \lambda)P_f/e.$$

The parameter λ is the share of domestic goods in the price index P . Assume that the price of domestic goods P_d and the price of foreign goods measured in foreign currency P_f are fixed.

- a. Suppose we graph the LM^* curve for given values of P_d and P_f (instead of the usual P). Explain why in this model this LM^* curve is upward sloping rather than vertical.
 - b. What is the effect of expansionary fiscal policy under floating exchange rates in this model? Explain. Contrast with the standard Mundell–Fleming model.
 - c. Suppose that political instability increases the country risk premium and, thereby, the interest rate. What is the effect on the exchange rate, the price level, and aggregate income in this model? Contrast with the standard Mundell–Fleming model.
7. Use the Mundell–Fleming model to answer the following questions about the state of California (a small open economy).
- a. If California suffers from a recession, should the state government use monetary or fiscal policy to stimulate employment? Explain. (*Note:* For this question, assume that the state government can print dollar bills.)
 - b. If California prohibited the import of wines from the state of Washington, what would happen to income, the exchange rate, and the trade balance? Consider both the short-run and the long-run impacts.

APPENDIX

A Short-Run Model of the Large Open Economy

When analyzing policies in an economy such as the United States, we need to combine the closed-economy logic of the *IS–LM* model and the small-open-economy logic of the Mundell–Fleming model. This appendix presents a model for the intermediate case of a large open economy.

As we discussed in the appendix to Chapter 5, a large open economy differs from a small open economy because its interest rate is not fixed by world financial markets. In a large open economy, we must consider the relationship between the interest rate and the flow of capital abroad. The net capital outflow is the amount that domestic investors lend abroad minus the amount that foreign investors lend here. As the domestic interest rate falls, domestic investors find foreign lending more attractive, and foreign investors find lending here less attractive. Thus, the net capital outflow is negatively related to the interest rate. Here we add this relationship to our short-run model of national income.

The three equations of the model are

$$\begin{aligned} Y &= C(Y - T) + I(r) + G + NX(e), \\ M/P &= L(r, Y), \\ NX(e) &= CF(r). \end{aligned}$$

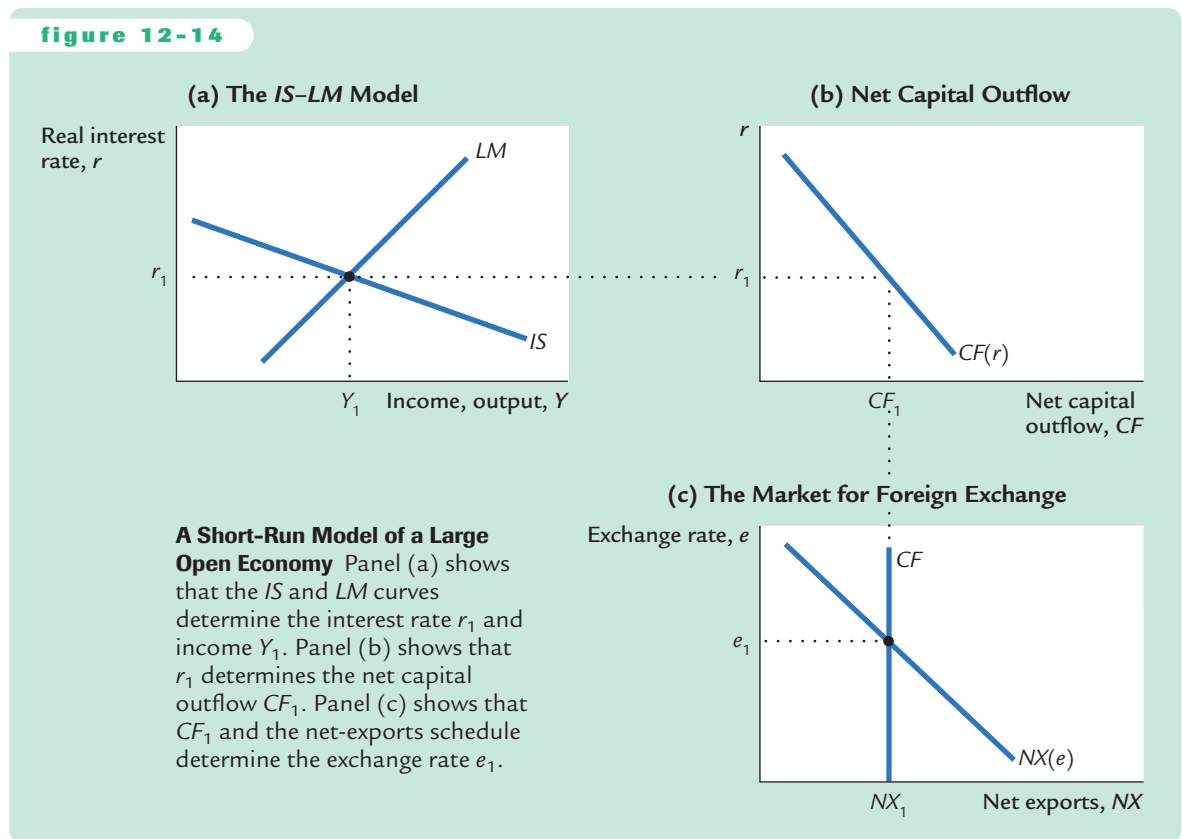
The first two equations are the same as those used in the Mundell–Fleming model of this chapter. The third equation, taken from the appendix to Chapter 5, states that the trade balance *NX* equals the net capital outflow *CF*, which in turn depends on the domestic interest rate.

To see what this model implies, substitute the third equation into the first, so the model becomes

$$\begin{aligned} Y &= C(Y - T) + I(r) + G + CF(r) && IS, \\ M/P &= L(r, Y) && LM. \end{aligned}$$

These two equations are much like the two equations of the closed-economy *IS–LM* model. The only difference is that expenditure now depends on the interest rate for two reasons. As before, a higher interest rate reduces investment. But now, a higher interest rate also reduces the net capital outflow and thus lowers net exports.

To analyze this model, we can use the three graphs in Figure 12–14 on page 342. Panel (a) shows the *IS–LM* diagram. As in the closed-economy model in Chapters 10 and 11, the interest rate *r* is on the vertical axis, and income *Y* is on the horizontal axis. The *IS* and *LM* curves together determine the equilibrium level of income and the equilibrium interest rate.



The new net-capital-outflow term in the IS equation, $CF(r)$, makes this IS curve flatter than it would be in a closed economy. The more responsive international capital flows are to the interest rate, the flatter the IS curve is. You might recall from the Chapter 5 appendix that the small open economy represents the extreme case in which the net capital outflow is infinitely elastic at the world interest rate. In this extreme case, the IS curve is completely flat. Hence, a small open economy would be depicted in this figure with a horizontal IS curve.

Panels (b) and (c) show how the equilibrium from the $IS-LM$ model determines the net capital outflow, the trade balance, and the exchange rate. In panel (b) we see that the interest rate determines the net capital outflow. This curve slopes downward because a higher interest rate discourages domestic investors from lending abroad and encourages foreign investors to lend here. In panel (c) we see that the exchange rate adjusts to ensure that net exports of goods and services equal the net capital outflow.

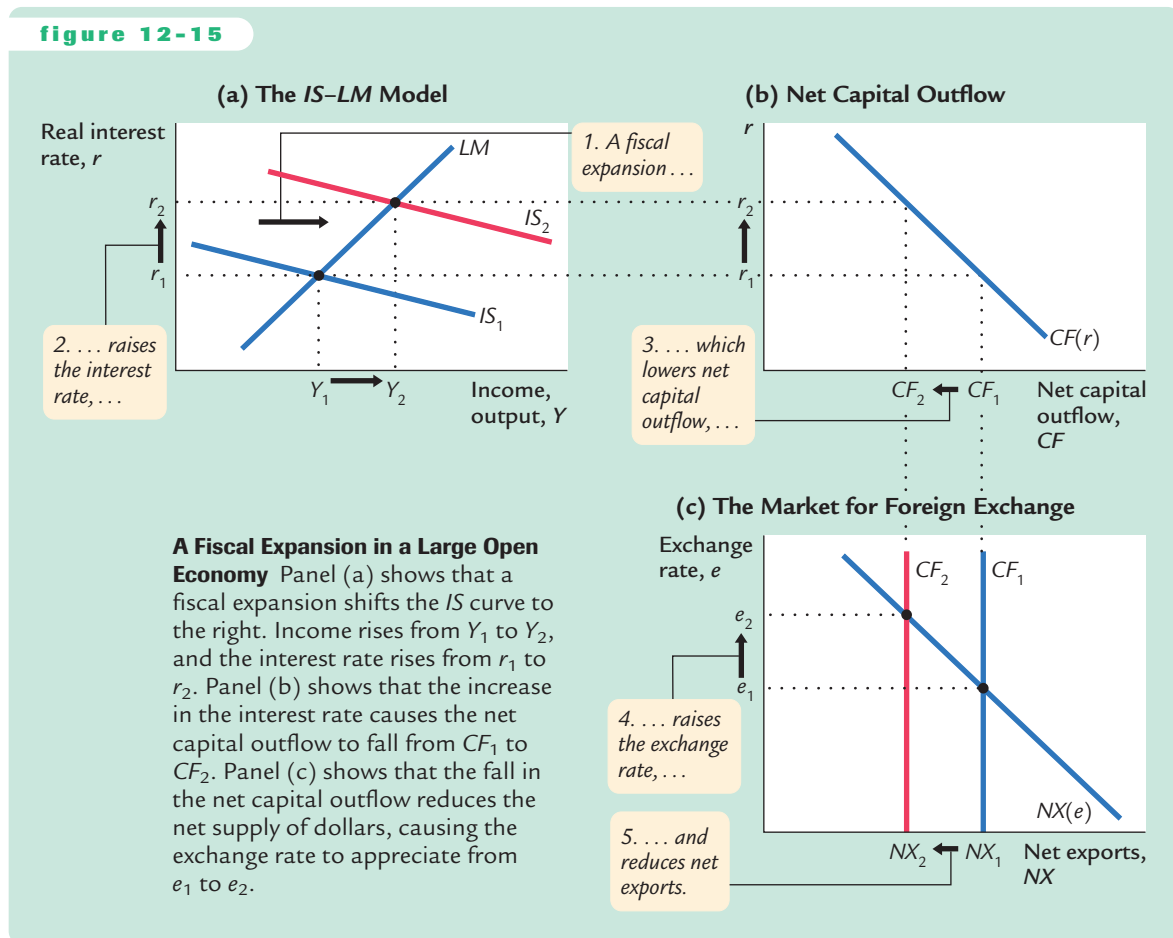
Now let's use this model to examine the impact of various policies. We assume that the economy has a floating exchange rate, because this assumption is correct for most large open economies such as the United States.

Fiscal Policy

Figure 12-15 examines the impact of a fiscal expansion. An increase in government purchases or a cut in taxes shifts the *IS* curve to the right. As panel (a) illustrates, this shift in the *IS* curve leads to an increase in the level of income and an increase in the interest rate. These two effects are similar to those in a closed economy.

Yet, in the large open economy, the higher interest rate reduces the net capital outflow, as in panel (b). The fall in the net capital outflow reduces the supply of dollars in the market for foreign exchange. The exchange rate appreciates, as in panel (c). Because domestic goods become more expensive relative to foreign goods, net exports fall.

Figure 12-15 shows that a fiscal expansion does raise income in the large open economy, unlike in a small open economy under a floating exchange rate. The impact on income, however, is smaller than in a closed economy. In a closed economy, the expansionary impact of fiscal policy is partially offset by the

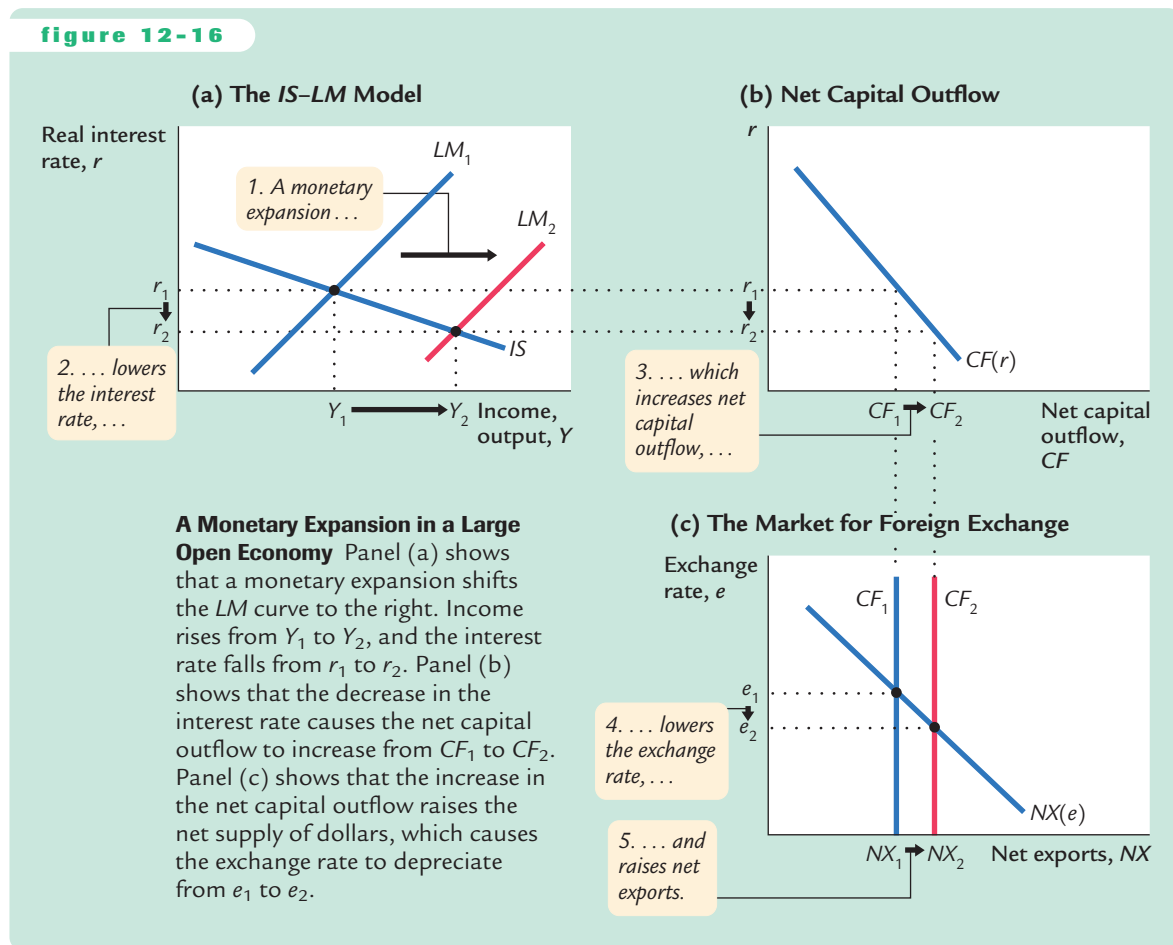


crowding out of investment: as the interest rate rises, investment falls, reducing the fiscal-policy multipliers. In a large open economy, there is yet another offsetting factor: as the interest rate rises, the net capital outflow falls, the exchange rate appreciates, and net exports fall. Together these effects are not large enough to make fiscal policy powerless, as it is in a small open economy, but they do reduce fiscal policy's impact.

Monetary Policy

Figure 12-16 examines the effect of a monetary expansion. An increase in the money supply shifts the *LM* curve to the right, as in panel (a). The level of income rises, and the interest rate falls. Once again, these effects are similar to those in a closed economy.

Yet, as panel (b) shows, the lower interest rate leads to a higher net capital outflow. The increase in *CF* raises the supply of dollars in the market for foreign exchange. The exchange rate depreciates, as in panel (c). As domestic goods become cheaper relative to foreign goods, net exports rise.



We can now see that the monetary transmission mechanism has two parts in a large open economy. As in a closed economy, a monetary expansion lowers the interest rate. As in a small open economy, a monetary expansion causes the currency to depreciate in the market for foreign exchange. The lower interest rate stimulates investment, and the lower exchange rate stimulates net exports.

A Rule of Thumb

This model of the large open economy describes well the U.S. economy today. Yet it is somewhat more complicated and cumbersome than the model of the closed economy we studied in Chapters 10 and 11 and the model of the small open economy we developed in this chapter. Fortunately, there is a useful rule of thumb to help you determine how policies influence a large open economy without remembering all the details of the model: *The large open economy is an average of the closed economy and the small open economy. To find how any policy will affect any variable, find the answer in the two extreme cases and take an average.*

For example, how does a monetary contraction affect the interest rate and investment in the short run? In a closed economy, the interest rate rises, and investment falls. In a small open economy, neither the interest rate nor investment changes. The effect in the large open economy is an average of these two cases: a monetary contraction raises the interest rate and reduces investment, but only somewhat. The fall in the net capital outflow mitigates the rise in the interest rate and the fall in investment that would occur in a closed economy. But unlike in a small open economy, the international flow of capital is not so strong as to negate fully these effects.

This rule of thumb makes the simple models all the more valuable. Although they do not describe perfectly the world in which we live, they do provide a useful guide to the effects of economic policy.

MORE PROBLEMS AND APPLICATIONS

1. Imagine that you run the central bank in a large open economy. Your goal is to stabilize income, and you adjust the money supply accordingly. Under your policy, what happens to the money supply, the interest rate, the exchange rate, and the trade balance in response to each of the following shocks?
 - a. The president raises taxes to reduce the budget deficit.
 - b. The president restricts the import of Japanese cars.
2. Over the past several decades, investors around the world have become more willing to take advantage of opportunities in other countries. Because of this increasing sophistication, economies are more open today than in the past. Consider how this development affects the ability of monetary policy to influence the economy.
 - a. If investors become more willing to substitute foreign and domestic assets, what happens to the slope of the CF function?
 - b. If the CF function changes in this way, what happens to the slope of the IS curve?
 - c. How does this change in the IS curve affect the Fed's ability to control the interest rate?
 - d. How does this change in the IS curve affect the Fed's ability to control national income?

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3. Suppose that policymakers in a large open economy want to raise the level of investment without changing aggregate income or the exchange rate.
 - a. Is there any combination of domestic monetary and fiscal policies that would achieve this goal?
 - b. Is there any combination of domestic monetary, fiscal, and trade policies that would achieve this goal?
 - c. Is there any combination of monetary and fiscal policies at home and abroad that would achieve this goal?
4. Suppose that a large open economy has a fixed exchange rate.
 - a. Describe what happens in response to a fiscal contraction, such as a tax increase. Compare your answer to the case of a small open economy.
 - b. Describe what happens if the central bank expands the money supply by buying bonds from the public. Compare your answer to the case of a small open economy.