resented by the variable A). For example, compared to rich nations, poor nations may have less access to advanced technologies, lower levels of education (or *human capital*), or less efficient economic policies. Such differences could mean less output for given inputs of capital and labor; in the Cobb–Douglas production function, this is translated into a lower value of the parameter A. If so, then capital need not be more valuable in poor nations, even though capital is scarce.

A second reason capital might not flow to poor nations is that property rights are often not enforced. Corruption is much more prevalent; revolutions, coups, and expropriation of wealth are more common; and governments often default on their debts. So even if capital is more valuable in poor nations, foreigners may avoid investing their wealth there simply because they are afraid of losing it. Moreover, local investors face similar incentives. Imagine that you live in a poor nation and are lucky enough to have some wealth to invest; you might well decide that putting it in a safe country like the United States is your best option, even if capital is less valuable there than in your home country.

Whichever of these two reasons is correct, the challenge for poor nations is to find ways to reverse the situation. If these nations offered the same production efficiency and legal protections as the U.S. economy, the direction of international capital flows would likely reverse. The U.S. trade deficit would become a trade surplus, and capital would flow to these emerging nations. Such a change would help the poor of the world escape poverty.[2] ■

5-3 Exchange Rates

Having examined the international flows of capital and of goods and services, we now extend the analysis by considering the prices that apply to these transactions. The *exchange rate* between two countries is the price at which residents of those countries trade with each other. In this section we first examine precisely what the exchange rate measures, and we then discuss how exchange rates are determined.

Nominal and Real Exchange Rates

Economists distinguish between two exchange rates: the nominal exchange rate and the real exchange rate. Let's discuss each in turn and see how they are related.

The Nominal Exchange Rate The **nominal exchange rate** is the relative price of the currencies of two countries. For example, if the exchange rate between the U.S. dollar and the Japanese yen is 120 yen per dollar, then you can

[2] For more on this topic, see Robert E. Lucas, "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review* 80 (May 1990): 92–96.

exchange one dollar for 120 yen in world markets for foreign currency. A Japanese who wants to obtain dollars would pay 120 yen for each dollar he bought. An American who wants to obtain yen would get 120 yen for each dollar he paid. When people refer to "the exchange rate" between two countries, they usually mean the nominal exchange rate.

Notice that an exchange rate can be reported in two ways. If one dollar buys 120 yen, then one yen buys 0.00833 dollar. We can say the exchange rate is 120 yen per dollar, or we can say the exchange rate is 0.00833 dollar per yen. Because 0.00833 equals 1/120, these two ways of expressing the exchange rate are equivalent.

This book always expresses the exchange rate in units of foreign currency per dollar. With this convention, a rise in the exchange rate—say, from 120 to 125 yen per dollar—is called an *appreciation* of the dollar; a fall in the exchange rate is called a *depreciation*. When the domestic currency appreciates, it buys more of the foreign currency; when it depreciates, it buys less. An appreciation is sometimes called a *strengthening* of the currency, and a depreciation is sometimes called a *weakening* of the currency.

The Real Exchange Rate The **real exchange rate** is the relative price of the goods of two countries. That is, the real exchange rate tells us the rate at which we can trade the goods of one country for the goods of another. The real exchange rate is sometimes called the *terms of trade*.

To see the relation between the real and nominal exchange rates, consider a single good produced in many countries: cars. Suppose an American car costs \$10,000 and a similar Japanese car costs 2,400,000 yen. To compare the prices of the two cars, we must convert them into a common currency. If a dollar is worth 120 yen, then the American car costs 1,200,000 yen. Comparing the price of the American car (1,200,000 yen) and the price of the Japanese car (2,400,000 yen), we conclude that the American car costs one-half of what the Japanese car costs. In other words, at current prices, we can exchange 2 American cars for 1 Japanese car.

We can summarize our calculation as follows:

$$\text{Real Exchange Rate} = \frac{(120 \text{ yen/dollar}) \times (10{,}000 \text{ dollars/American Car})}{(2{,}400{,}000 \text{ yen/Japanese Car})}$$

$$= 0.5 \frac{\text{Japanese Car}}{\text{American Car}}.$$

At these prices and this exchange rate, we obtain one-half of a Japanese car per American car. More generally, we can write this calculation as

$$\text{Real Exchange Rate} = \frac{\text{Nominal Exchange Rate} \times \text{Price of Domestic Good}}{\text{Price of Foreign Good}}.$$

The rate at which we exchange foreign and domestic goods depends on the prices of the goods in the local currencies and on the rate at which the currencies are exchanged.

This calculation of the real exchange rate for a single good suggests how we should define the real exchange rate for a broader basket of goods. Let e be the nominal exchange rate (the number of yen per dollar), P be the price level in the United States (measured in dollars), and P^* be the price level in Japan (measured in yen). Then the real exchange rate ϵ is

$$\begin{array}{ccccc} \text{Real} & & \text{Nominal} & & \text{Ratio of} \\ \text{Exchange} & = & \text{Exchange} & \times & \text{Price} \\ \text{Rate} & & \text{Rate} & & \text{Levels} \end{array}$$

$$\epsilon = e \times (P/P^*).$$

The real exchange rate between two countries is computed from the nominal exchange rate and the price levels in the two countries. *If the real exchange rate is high, foreign goods are relatively cheap, and domestic goods are relatively expensive. If the real exchange rate is low, foreign goods are relatively expensive, and domestic goods are relatively cheap.*

The Real Exchange Rate and the Trade Balance

What macroeconomic influence does the real exchange rate exert? To answer this question, remember that the real exchange rate is nothing more than a relative price. Just as the relative price of hamburgers and pizza determines which you choose for lunch, the relative price of domestic and foreign goods affects the demand for these goods.

Suppose first that the real exchange rate is low. In this case, because domestic goods are relatively cheap, domestic residents will want to purchase fewer imported goods: they will buy Fords rather than Toyotas, drink Coors rather than Heineken, and vacation in Florida rather than Italy. For the same reason, foreigners will want to buy many of our goods. As a result of both of these actions, the quantity of our net exports demanded will be high.

The opposite occurs if the real exchange rate is high. Because domestic goods are expensive relative to foreign goods, domestic residents will want to buy many imported goods, and foreigners will want to buy few of our goods. Therefore, the quantity of our net exports demanded will be low.

Drawing by Matteson; © 1988 The New Yorker Magazine, Inc.

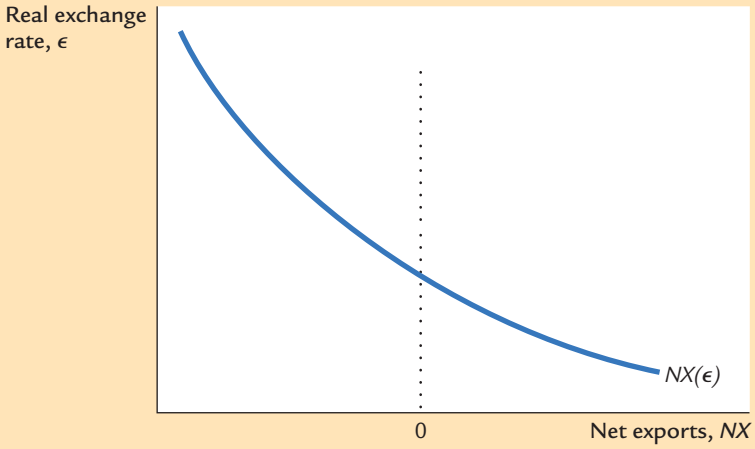
"How about Nebraska? The dollar's still strong in Nebraska."

We write this relationship between the real exchange rate and net exports as

$$NX = NX(\epsilon).$$

This equation states that net exports are a function of the real exchange rate. Figure 5-7 illustrates the negative relationship between the trade balance and the real exchange rate.

FIGURE 5-7



Net Exports and the Real Exchange Rate The figure shows the relationship between the real exchange rate and net exports: the lower the real exchange rate, the less expensive are domestic goods relative to foreign goods, and thus the greater are our net exports. Note that a portion of the horizontal axis measures negative values of *NX:* because imports can exceed exports, net exports can be less than zero.

The Determinants of the Real Exchange Rate

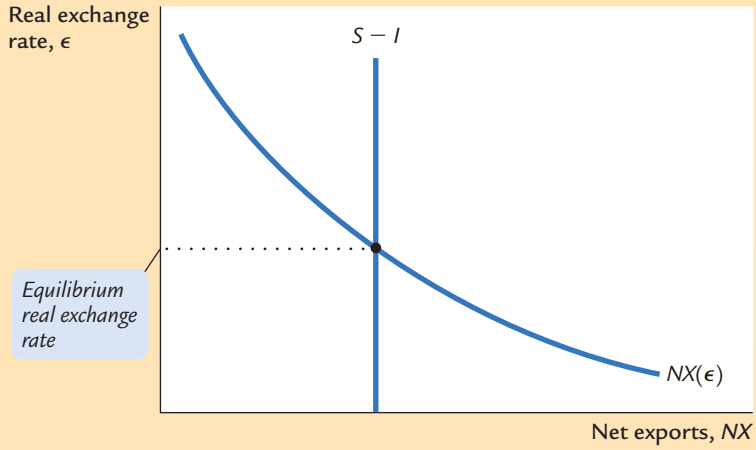
We now have all the pieces needed to construct a model that explains what factors determine the real exchange rate. In particular, we combine the relationship between net exports and the real exchange rate we just discussed with the model of the trade balance we developed earlier in the chapter. We can summarize the analysis as follows:

- The real exchange rate is related to net exports. When the real exchange rate is lower, domestic goods are less expensive relative to foreign goods, and net exports are greater.
- The trade balance (net exports) must equal the net capital outflow, which in turn equals saving minus investment. Saving is fixed by the consumption function and fiscal policy; investment is fixed by the investment function and the world interest rate.

Figure 5-8 illustrates these two conditions. The line showing the relationship between net exports and the real exchange rate slopes downward because a low real exchange rate makes domestic goods relatively inexpensive. The line representing the excess of saving over investment, $S - I$, is vertical because neither saving nor investment depends on the real exchange rate. The crossing of these two lines determines the equilibrium real exchange rate.

Figure 5-8 looks like an ordinary supply-and-demand diagram. In fact, you can think of this diagram as representing the supply and demand for foreign-currency exchange. The vertical line, $S - I$, represents the net capital outflow and thus the supply of dollars to be exchanged into foreign currency and invested abroad. The downward-sloping line, $NX(\epsilon)$, represents the net demand for dollars coming from

FIGURE 5-8



How the Real Exchange Rate Is Determined The real exchange rate is determined by the intersection of the vertical line representing saving minus investment and the downward-sloping net-exports schedule. At this intersection, the quantity of dollars supplied for the flow of capital abroad equals the quantity of dollars demanded for the net export of goods and services.

foreigners who want dollars to buy our goods. *At the equilibrium real exchange rate, the supply of dollars available from the net capital outflow balances the demand for dollars by foreigners buying our net exports.*

How Policies Influence the Real Exchange Rate

We can use this model to show how the changes in economic policy we discussed earlier affect the real exchange rate.

Fiscal Policy at Home What happens to the real exchange rate if the government reduces national saving by increasing government purchases or cutting taxes? As we discussed earlier, this reduction in saving lowers $S - I$ and thus NX. That is, the reduction in saving causes a trade deficit.

Figure 5-9 shows how the equilibrium real exchange rate adjusts to ensure that NX falls. The change in policy shifts the vertical $S - I$ line to the left, lowering the supply of dollars to be invested abroad. The lower supply causes the equilibrium real exchange rate to rise from ϵ_1 to ϵ_2—that is, the dollar becomes more valuable. Because of the rise in the value of the dollar, domestic goods become more expensive relative to foreign goods, which causes exports to fall and imports to rise. The change in exports and the change in imports both act to reduce net exports.

Fiscal Policy Abroad What happens to the real exchange rate if foreign governments increase government purchases or cut taxes? This change in fiscal policy reduces world saving and raises the world interest rate. The increase in the world interest rate reduces domestic investment I, which

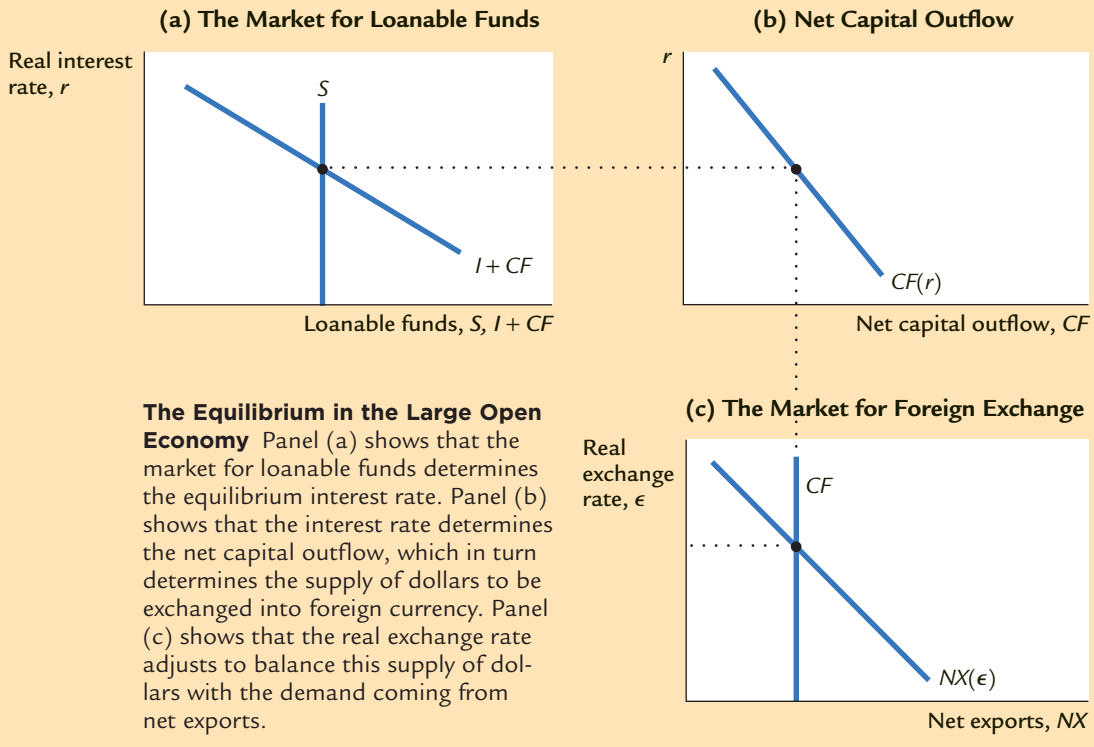
The real exchange rate is determined as in Figure 5-18, and the price levels are determined by monetary policies here and abroad, as we discussed in Chapter 4. Forces that move the real exchange rate or the price levels also move the nominal exchange rate.

Policies in the Large Open Economy

We can now consider how economic policies influence the large open economy. Figure 5-19 shows the three diagrams we need for the analysis. Panel (a) shows the equilibrium in the market for loanable funds; panel (b) shows the relationship between the equilibrium interest rate and the net capital outflow; and panel (c) shows the equilibrium in the market for foreign exchange.

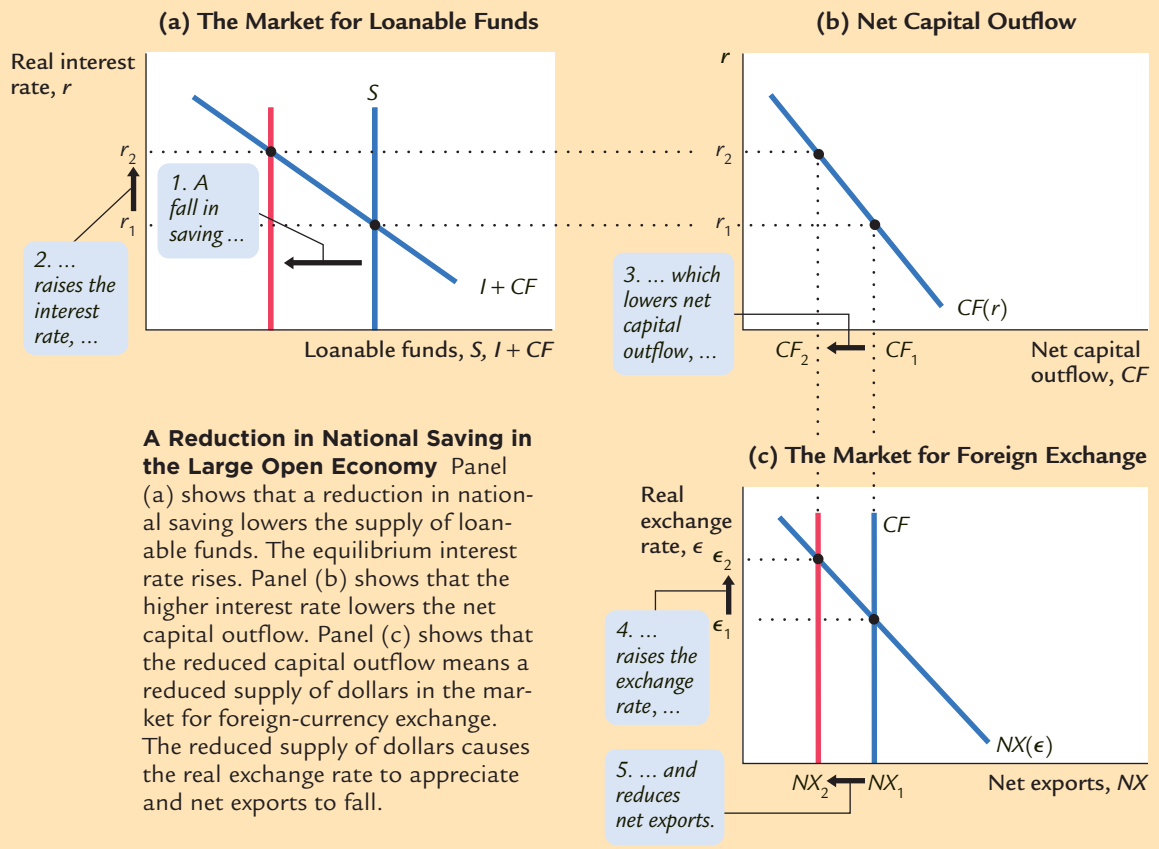
Fiscal Policy at Home Consider the effects of expansionary fiscal policy—an increase in government purchases or a decrease in taxes. Figure 5-20 shows what happens. The policy reduces national saving S, thereby reducing the supply of loanable funds and raising the equilibrium interest rate r. The higher interest rate reduces both domestic investment I and the net capital outflow CF. The fall in the net capital outflow reduces the supply of dollars to be exchanged into foreign currency. The exchange rate appreciates, and net exports fall.

FIGURE 5-19



The Equilibrium in the Large Open Economy Panel (a) shows that the market for loanable funds determines the equilibrium interest rate. Panel (b) shows that the interest rate determines the net capital outflow, which in turn determines the supply of dollars to be exchanged into foreign currency. Panel (c) shows that the real exchange rate adjusts to balance this supply of dollars with the demand coming from net exports.

FIGURE 5-20



A Reduction in National Saving in the Large Open Economy Panel (a) shows that a reduction in national saving lowers the supply of loanable funds. The equilibrium interest rate rises. Panel (b) shows that the higher interest rate lowers the net capital outflow. Panel (c) shows that the reduced capital outflow means a reduced supply of dollars in the market for foreign-currency exchange. The reduced supply of dollars causes the real exchange rate to appreciate and net exports to fall.

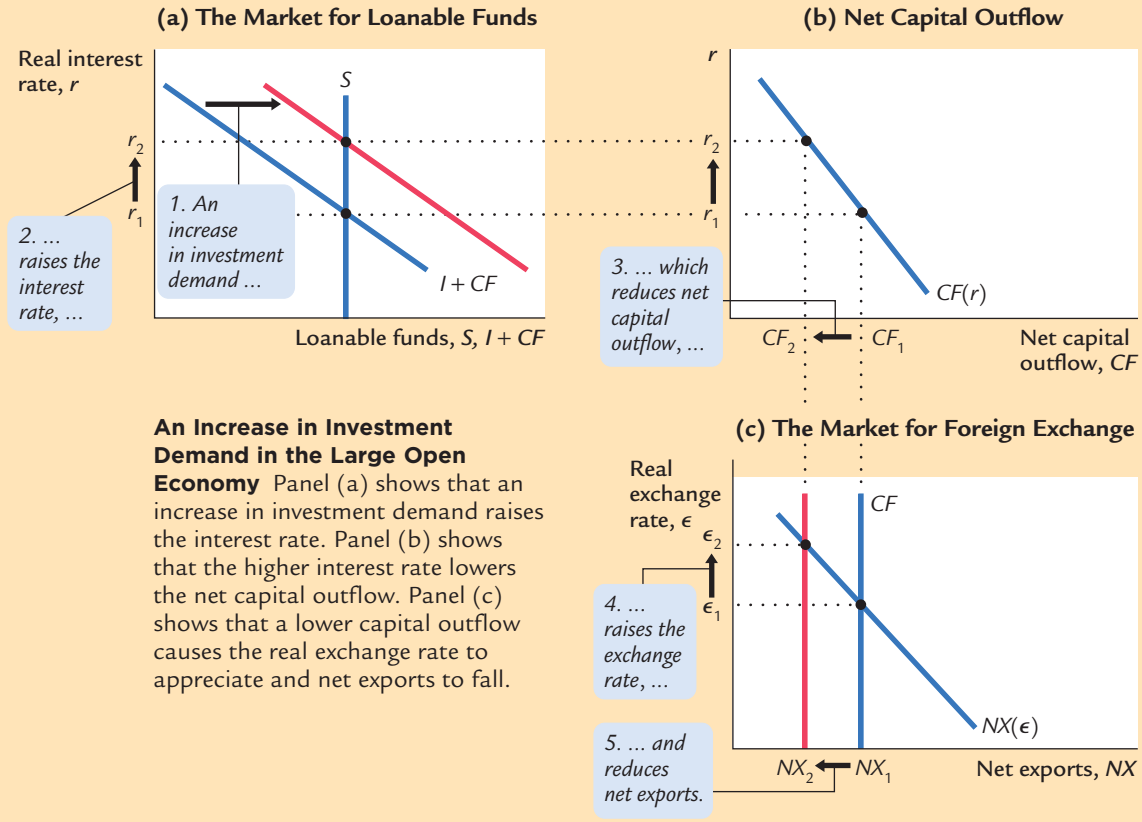
Note that the impact of fiscal policy in this model combines its impact in the closed economy and its impact in the small open economy. As in the closed economy, a fiscal expansion in a large open economy raises the interest rate and crowds out investment. As in the small open economy, a fiscal expansion causes a trade deficit and an appreciation in the exchange rate.

One way to see how the three types of economy are related is to consider the identity

$$S = I + NX.$$

In all three cases, expansionary fiscal policy reduces national saving S. In the closed economy, the fall in S coincides with an equal fall in I, and NX stays constant at zero. In the small open economy, the fall in S coincides with an equal fall in NX, and I remains constant at the level fixed by the world interest rate. The large open economy is the intermediate case: both I and NX fall, each by less than the fall in S.

FIGURE 5-21

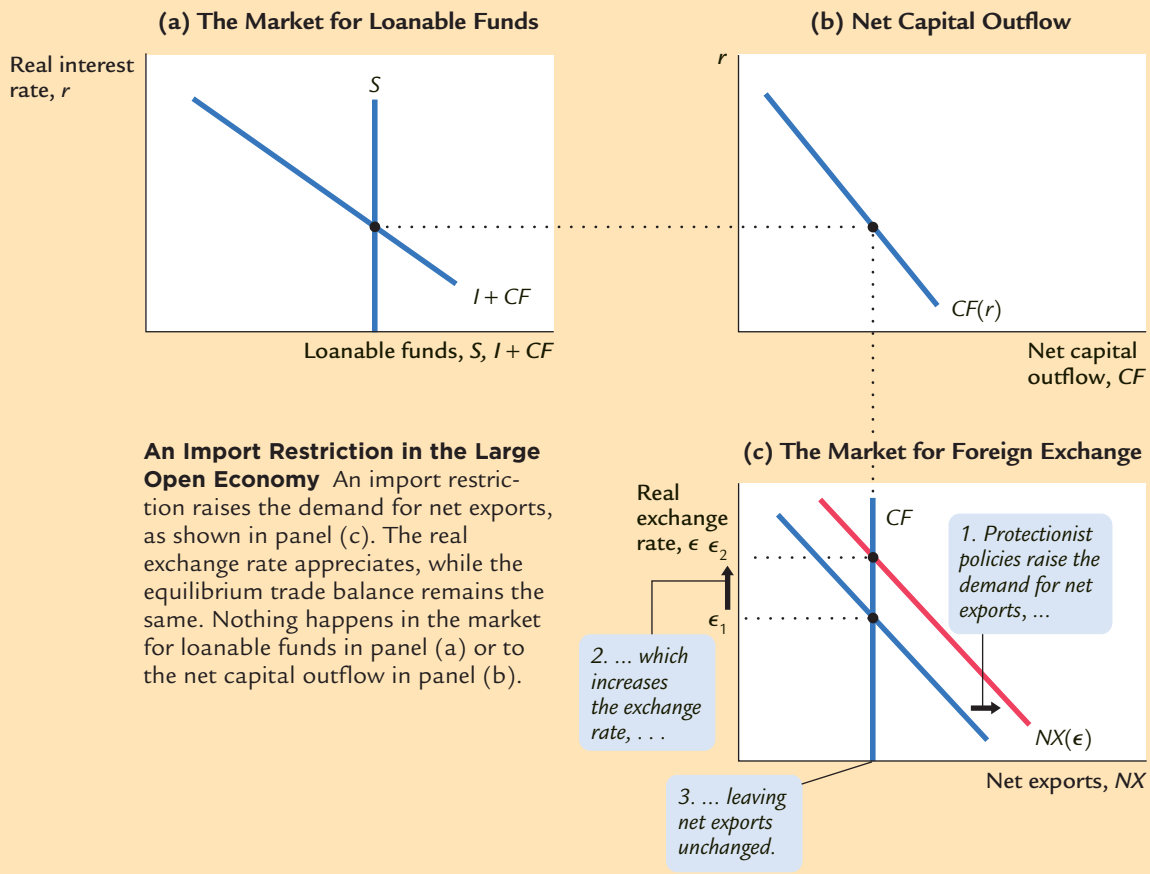


An Increase in Investment Demand in the Large Open Economy Panel (a) shows that an increase in investment demand raises the interest rate. Panel (b) shows that the higher interest rate lowers the net capital outflow. Panel (c) shows that a lower capital outflow causes the real exchange rate to appreciate and net exports to fall.

Shifts in Investment Demand Suppose that the investment demand schedule shifts outward, perhaps because Congress passes an investment tax credit. Figure 5-21 shows the effect. The demand for loanable funds rises, raising the equilibrium interest rate. The higher interest rate reduces the net capital outflow: Americans make fewer loans abroad, and foreigners make more loans to Americans. The fall in the net capital outflow reduces the supply of dollars in the market for foreign exchange. The exchange rate appreciates, and net exports fall.

Trade Policies Figure 5-22 shows the effect of a trade restriction, such as an import quota. The reduced demand for imports shifts the net exports schedule outward in panel (c). Because nothing has changed in the market for loanable funds, the interest rate remains the same, which in turn implies that the net capital outflow remains the same. The shift in the net-exports schedule causes the exchange rate to appreciate. The rise in the exchange rate makes U.S. goods expensive relative to foreign goods, which depresses exports and stimulates imports. In the end, the trade restriction does not affect the trade balance.

FIGURE 5-22



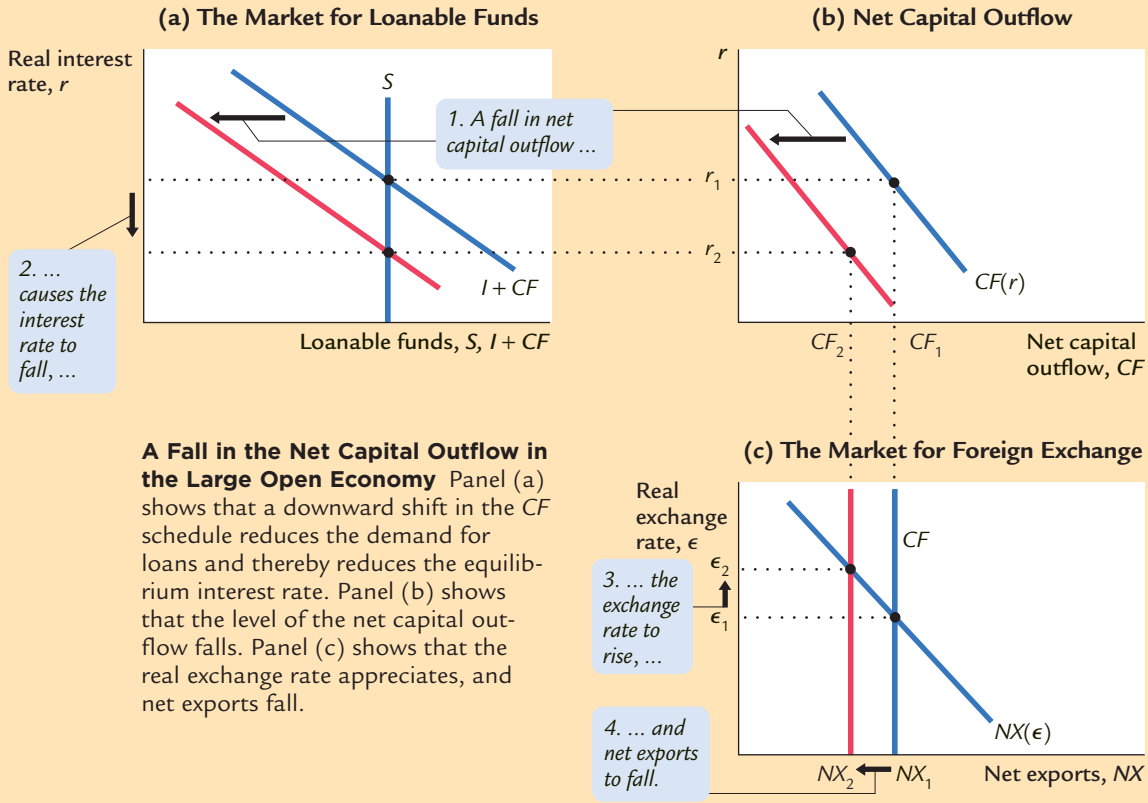
An Import Restriction in the Large Open Economy An import restriction raises the demand for net exports, as shown in panel (c). The real exchange rate appreciates, while the equilibrium trade balance remains the same. Nothing happens in the market for loanable funds in panel (a) or to the net capital outflow in panel (b).

Shifts in Net Capital Outflow There are various reasons that the *CF* schedule might shift. One reason is fiscal policy abroad. For example, suppose that Germany pursues a fiscal policy that raises German saving. This policy reduces the German interest rate. The lower German interest rate discourages American investors from lending in Germany and encourages German investors to lend in the United States. For any given U.S. interest rate, the U.S. net capital outflow falls.

Another reason the *CF* schedule might shift is political instability abroad. Suppose that a war or revolution breaks out in another country. Investors around the world will try to withdraw their assets from that country and seek a "safe haven" in a stable country such as the United States. The result is a reduction in the U.S. net capital outflow.

Figure 5-23 shows the impact of a leftward shift in the *CF* schedule. The reduced demand for loanable funds lowers the equilibrium interest rate. The lower interest rate tends to raise net capital outflow, but because this only partly

FIGURE 5-23



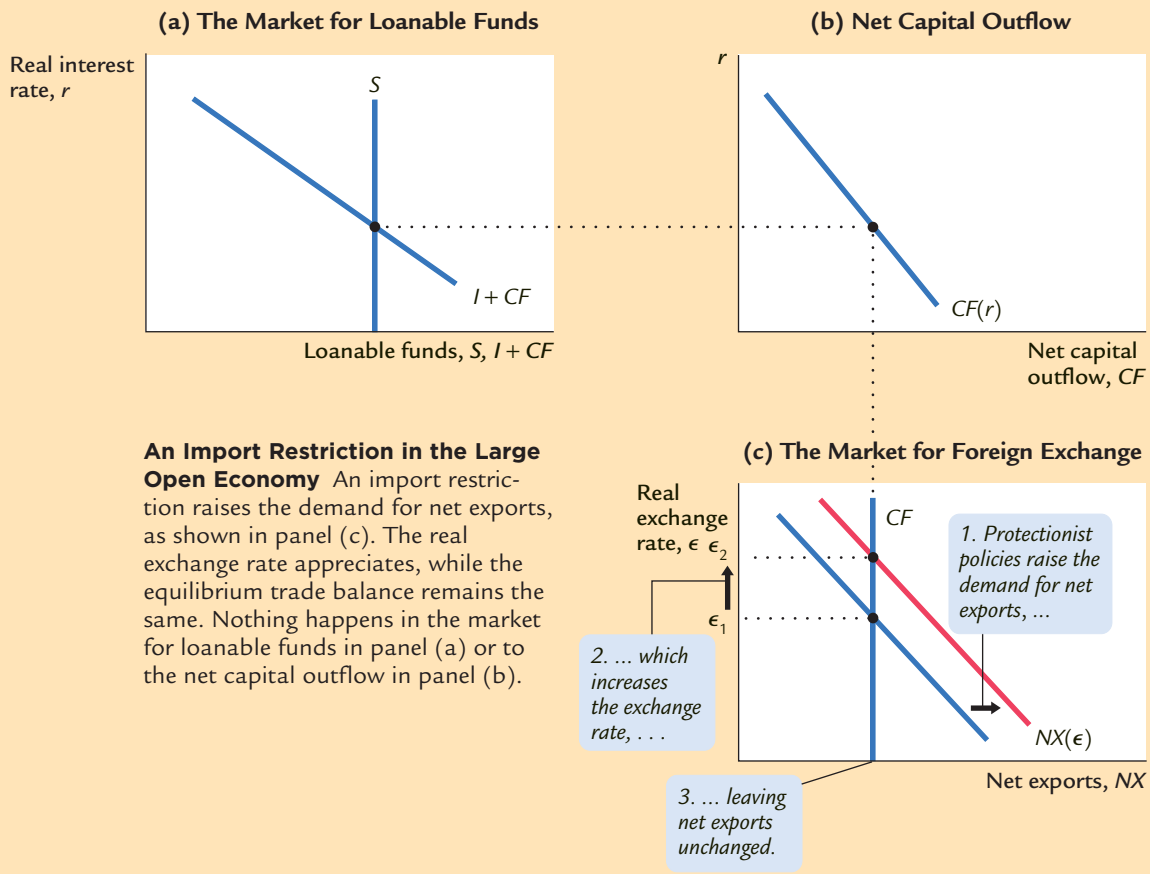
A Fall in the Net Capital Outflow in the Large Open Economy Panel (a) shows that a downward shift in the *CF* schedule reduces the demand for loans and thereby reduces the equilibrium interest rate. Panel (b) shows that the level of the net capital outflow falls. Panel (c) shows that the real exchange rate appreciates, and net exports fall.

mitigates the shift in the *CF* schedule, *CF* still falls. The reduced level of net capital outflow reduces the supply of dollars in the market for foreign exchange. The exchange rate appreciates, and net exports fall.

Conclusion

How different are large and small open economies? Certainly, policies affect the interest rate in a large open economy, unlike in a small open economy. But, in other ways, the two models yield similar conclusions. In both large and small open economies, policies that raise saving or lower investment lead to trade surpluses. Similarly, policies that lower saving or raise investment lead to trade deficits. In both economies, protectionist trade policies cause the exchange rate to appreciate and do not influence the trade balance. Because the results are so similar, for most questions one can use the simpler model of the small open economy, even if the economy being examined is not really small.

FIGURE 5-22



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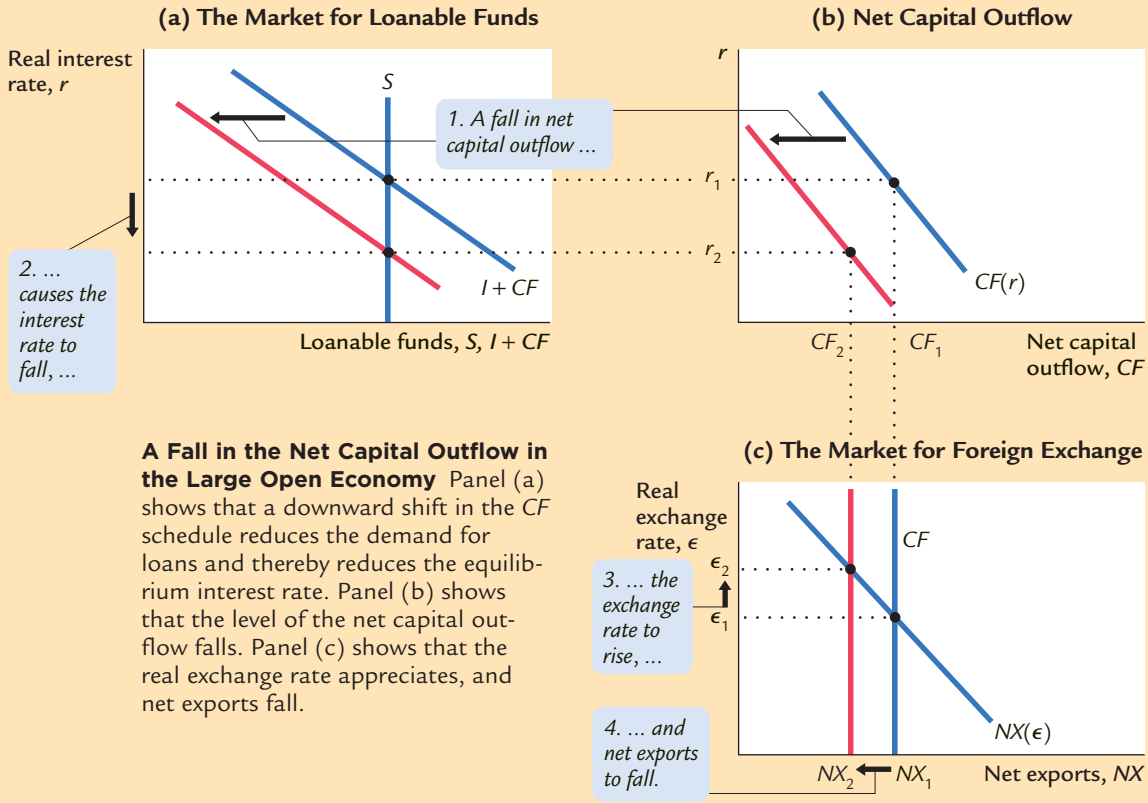

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MORE PROBLEMS AND APPLICATIONS

1. If a war broke out abroad, it would affect the U.S. economy in many ways. Use the model of the large open economy to examine each of the following effects of such a war. What happens in the United States to saving, investment, the trade balance, the interest rate, and the exchange rate? (To keep things simple, consider each of the following effects separately.)

a. The U.S. government, fearing it may need to enter the war, increases its purchases of military equipment.

b. Other countries raise their demand for high-tech weapons, a major export of the United States.

c. The war makes U.S. firms uncertain about the future, and the firms delay some investment projects.

d. The war makes U.S. consumers uncertain about the future, and the consumers save more in response.

e. Americans become apprehensive about traveling abroad, so more of them spend their vacations in the United States.

f. Foreign investors seek a safe haven for their portfolios in the United States.

2. On September 21, 1995, "House Speaker Newt Gingrich threatened to send the United States into default on its debt for the first time in the nation's history, to force the Clinton Administration to balance the budget on Republican terms" (*New York Times,* September 22, 1995, p. A1). That same day, the interest rate on 30-year U.S. government bonds rose from 6.46 to 6.55 percent, and the dollar fell in value from 102.7 to 99.0 yen. Use the model of the large open economy to explain this event.