

Chapter 17

Fixed Exchange Rates and Foreign Exchange Intervention

■ Chapter Organization

Why Study Fixed Exchange Rates?

Central Bank Intervention and the Money Supply

The Central Bank Balance Sheet and the Money Supply

Foreign Exchange Intervention and the Money Supply

Sterilization

The Balance of Payments and the Money Supply

How the Central Bank Fixes the Exchange Rate

Foreign Exchange Market Equilibrium Under a Fixed Exchange Rate

Money Market Equilibrium Under a Fixed Exchange Rate

A Diagrammatic Analysis

Stabilization Policies with a Fixed Exchange Rate

Monetary Policy

Fiscal Policy

Changes in the Exchange Rate

Adjustment to Fiscal Policy and Exchange Rate Changes

Balance of Payments Crises and Capital Flight

Managed Floating and Sterilized Intervention

Perfect Asset Substitutability and the Ineffectiveness of Sterilized Intervention

Box: Brazil's 1998–1999 Balance of Payments Crisis

Foreign Exchange Market Equilibrium Under Imperfect Asset Substitutability

The Effects of Sterilized Intervention with Imperfect Asset Substitutability

Evidence on the Effects of Sterilized Intervention

Reserve Currencies in the World Monetary System

The Mechanics of a Reserve Currency Standard

The Asymmetric Position of the Reserve Center

The Gold Standard

The Mechanics of a Gold Standard

Symmetric Monetary Adjustment Under a Gold Standard

Benefits and Drawbacks of the Gold Standard

Bimetallic Standard

The Gold Exchange Standard

Case Study: The Demand for International Reserves

Summary

APPENDIX 1 TO CHAPTER 17: Equilibrium in the Foreign-Exchange Market with Imperfect Asset Substitutability

Demand

Supply

Equilibrium

APPENDIX 2 TO CHAPTER 17: The Timing of Balance of Payments Crises

Online Appendix: The Monetary Approach to the Balance of Payments

Online Appendix: Fixing the Exchange Rate to Escape From a Liquidity Trap

■ Key Themes

Although we use the same equations (and thus, the same model) to characterize the goods market and the money market whether an economy has fixed or flexible exchange rates, in some important ways the analysis of an economy that has a fixed exchange rate reverses the analysis of an economy with floating exchange rates. Under fixed exchange rates, an analysis considers the effects that policies have on the balance of payments (and the domestic money supply), taking the exchange rate as given. Conversely, under flexible exchange rates with no official foreign exchange intervention, the balance of payments equals zero, the money supply is a variable chosen by policy makers, and analysis focuses on exchange-rate determination. In the intermediate case of managed floating, both the money supply and the exchange rate become, to an extent which is determined by central bank policies, variables that are outcomes of the model.

This chapter analyzes various types of monetary policy regimes under which the degree of exchange-rate flexibility is limited. It has been more than 20 years since the United States stopped participating in the fixed exchange rate Bretton Woods system, but the analysis presented in this chapter has current relevance. Many industrial economies attempt to manage their exchange rates through foreign exchange intervention. Fixed exchange rates are common among developing countries. Regional currency arrangements, most notably the Exchange Rate Mechanism (ERM) through which some European countries peg to the euro, represent important institutional arrangements, and the euro area itself represents irrevocably fixed exchange rates (this is discussed more in Chapter 20). Finally, there are recurrent calls for a new international monetary regime based upon more aggressive exchange-rate management.

The chapter begins with an analysis of a stylized central bank balance sheet to show the link between the balance of payments, official foreign exchange intervention, and the domestic money supply. An important point to remember here is that any change in the holdings of an asset by the central bank must be balanced by an offsetting change in the central bank's liabilities or by its holdings of another asset. When the central bank's liabilities change there is a change in the economy's money supply. Combining this link between the central bank's liabilities and the money supply with the exchange-rate determination

analysis of Chapter 14 demonstrates how a central bank alters the money supply to peg the nominal exchange rate. A key point here is that if the central bank's focus is to peg the exchange rate then it must devote monetary policy to this goal, giving up the use of monetary policy for other purposes. Thus under fixed exchange rates the central bank does not control the money supply since it must fix the exchange rate.

The model developed in Chapter 16 is used to demonstrate some important characteristics of a fixed exchange rate regime. Monetary policy cannot be used separately from its goal of maintaining a fixed exchange rate. Fiscal policy, on the other hand, is very effective since the monetary authorities must react to fiscal policy expansion in a way that cancels the "crowding out" effects of an appreciation that occur under floating exchange rates. An additional policy tool that is available under a fixed exchange rate regime is a change in the exchange rate, which is called a devaluation if the currency is made less valuable and a revaluation if it is made more valuable. The short-run and long-run effects of devaluation and revaluation are examined. In the short run, a devaluation makes an economy's exports more competitively priced which improves the trade account, expands output, and raises the money supply (remember that a trade account surplus causes a balance of payments surplus and this, in turn, increases the money supply). Over a longer time horizon, however, prices will rise in the domestic economy and the real exchange rate (which equals EP^*/P), having depreciated because of the devaluation, appreciates back to its original value. This is just another example of how, in the long run, a purely monetary change (such as an increase in the money supply under flexible exchange rates) has no lasting effect on output.

An expected devaluation of a currency can prompt a balance of payments crisis. Such an expectation causes private capital flight as people attempt to buy foreign currency at a relatively good rate and then, after the devaluation, trade the foreign currency back for domestic currency and realize a profit (note that even if the devaluation does not occur trading foreign currency back for domestic currency at the original exchange rate does not cause a loss to speculators; thus speculators have a "one-way bet"). The central bank loses reserves as people attempt to exchange their domestic currency for foreign currency. If the central bank runs out of foreign reserves then it will no longer be able to maintain the exchange rate at its initial level. The chapter explores different explanations of currency crises, both those that result from inconsistent policies and those that are not inevitable, but instead result from self-fulfilling expectations. Appendix 2 to this chapter contains a detailed analysis of the timing of a balance of payments crisis.

Managed floating represents a more realistic intermediate case than the polar cases of fixed and floating rates. An important issue in the study of managed exchange rates is sterilized foreign exchange intervention. We discussed above how a central bank may intervene in the foreign exchange market by changing its asset holdings and, by so doing, altering its liabilities and thus affecting the money supply. A central bank may alternatively trade one type of asset for another, such as a domestic-currency bond for a foreign-currency bond, which does not change in its total amount of assets and thus does not affect the economy's money supply. This sterilized intervention changes the composition of interest-bearing assets held by the central bank, and thus also by the public. The theory of imperfect asset substitutability suggests why this type of policy may affect the exchange rate, even though the money supply has not changed. When we include a risk premium in the model, governments have some scope to run independent exchange rate and monetary policies in the short run. As discussed in the chapter, however, attempts to demonstrate empirically the effectiveness of sterilized foreign-exchange operations are generally negative. Intervention may play a different role, as a "signal" of future policy actions, and thus may affect the exchange rate in this capacity. The case study at the end of the chapter considers how the need for reserves in a crisis—and the potential difficulty of acquiring them during one—leads to a strong incentive to hold reserves in a precautionary manner if they want to cushion a balance of payments crisis.

While we have focused on the distinction between fixed and flexible exchange rate systems, it is important to note that not all fixed exchange rate systems are the same. The gold standard and a reserve-currency system represent two different fixed exchange rate systems. A key distinction between these systems is the asymmetry between the center country and the rest of the world under a reserve-currency system compared to the symmetric adjustment among all countries under the gold standard. Under a

reserve-currency system, the reserve center country's currency is "as good as gold," which gives it exclusive control over world monetary conditions (at least when interest parity links countries' money markets). Under a gold standard only gold is "as good as gold" and thus no one country can control world monetary conditions. The chapter discusses some of the pros and cons of the gold standard and the gold-exchange standard.

Appendix 1 presents a more detailed model of exchange-rate determination with imperfect asset substitutability. Appendix 2 provides an analysis of the timing of balance of payments crises. Two online appendices are available, one considering liquidity traps and another which describes the monetary approach to the balance of payments and its usefulness as a tool of policy analysis.

■ Key Terms

Define the following key terms.

1. Sterilized Foreign Exchange Intervention _____

_____.
2. Imperfect Asset Substitutability _____

_____.
3. Gold Standard _____

_____.
4. Gold-Exchange Standard _____

_____.
5. Risk Premium _____

_____.
6. Balance of Payments Crisis _____

_____.

■ Review Problems

1. The tropical country of Humidor exports cigars and imports air conditioners. In 2000, Humidor exported H\$10 million worth of cigars and imported H\$9 million worth of air conditioners, where H\$ represents the national currency, called the Humid dollar.
- a. Fill in the following balance of payments equation if the central bank does not intervene in the foreign exchange market, neither buying nor selling foreign currency (assuming, as we typically do that the capital account is zero).

$$\text{Balance of Payments} = \text{Current Account Surplus} + \text{Financial Account Surplus}$$

$$\text{H\$ } \underline{\hspace{2cm}} = \text{H\$ } \underline{\hspace{2cm}} + \text{H\$ } \underline{\hspace{2cm}}$$

- b. The balance sheet for the central bank of Humidor at the end of 2000 is given below. Under the assumption given in Part (a) demonstrate how this balance sheet changes, and thus what happens to the money supply of Humidor, by the end of 2001 (assume that the central bank does not undertake any open market operations unrelated to the balance of payments).

Balance Sheet of the Central Bank

on December 31, 2000		on December 31, 2001	
Assets	Liabilities	Assets	Liabilities
Domestic		Domestic	
H\$100 mil.	H\$_____mil.	H\$ 100 mil	H\$_____mil.
Foreign		Foreign	
H\$ 20 mil.		H\$_____mil.	

- c. Now fill in the following balance of payments equation if Humidor has a fixed exchange rate and now there are no private financial flows and no capital account movements.

$$\text{Balance of Payments} = \text{Current Account Surplus} + \text{Financial Account Surplus}$$

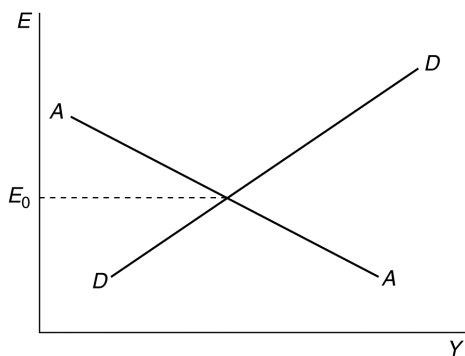
$$\text{H\$ } \underline{\hspace{2cm}} = \text{H\$ } \underline{\hspace{2cm}} + \text{H\$ } \underline{\hspace{2cm}}$$

- d. Under the assumptions that Humidor has a fixed exchange rate and that there are no private financial flows, demonstrate how the balance sheet of the central bank changes, and thus what happens to the money supply of Humidor, between the end of 2000 and the end of 2001.

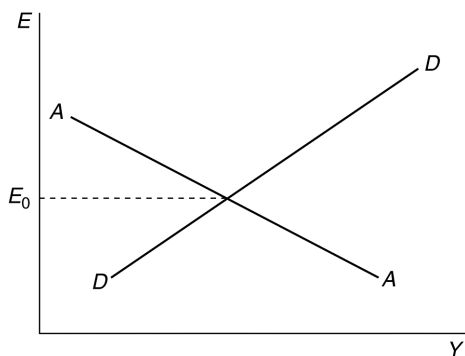
Balance Sheet of the Central Bank

on December 31, 2000		on December 31, 2001	
Assets	Liabilities	Assets	Liabilities
Domestic		Domestic	
H\$100 mil.	H\$ 120 mil.	H\$_____mil.	H\$_____mil.
Foreign		Foreign	
H\$ 20 mil.		H\$_____mil.	

2. While in practice the task of maintaining a fixed exchange rate falls to a country's monetary authority, in theory fiscal policy could be set to maintain the fixed exchange rate system, thus enabling monetary policy to pursue other goals. In this problem consider the country of Fiscalia which has a fixed exchange rate equal to E_0 that is maintained through government spending and tax policy.
- a. Suppose there is a sudden, unexpected increase in investment demand in Fiscalia. Demonstrate in the diagram on the next page how this would affect the exchange rate if there were no government intervention. Discuss what must happen to government spending or taxes in Fiscalia under fixed exchange rates when this increase in investment demand occurs.



- b. Suppose there is an unexpected fall in money demand in Fiscalia. Demonstrate this effect in the diagram below and the required fiscal response.



- c. Is fiscal policy effective in altering output in Fiscalia? Does monetary policy have any effect? If your results differ from the standard case studied in the chapter, try to explain the source of this difference.

3. Suppose that the Federal Reserve and the European Central Bank (ECB) agree that it is necessary to have the euro appreciate against the dollar. Neither central bank, however, wishes to have its money supply change as a consequence of this foreign exchange intervention.
- a. Below is a simplified balance sheet of the Federal Reserve in which its assets include dollar-denominated bonds and euro-denominated bonds. Show how the Fed might alter its asset holdings to achieve an appreciation of the euro while keeping the United States money supply fixed.

Balance Sheet of the Federal Reserve

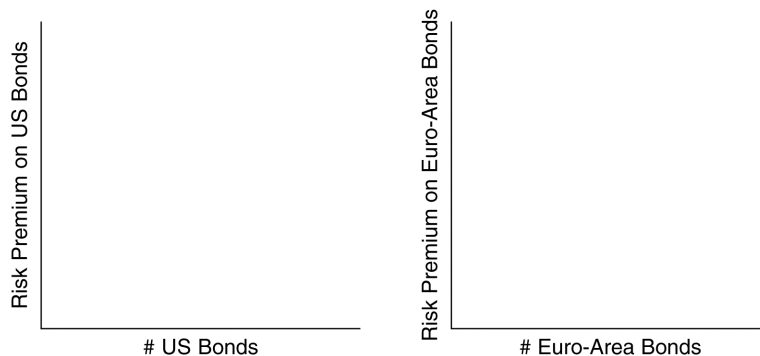
Before Intervention		After Intervention	
Assets	Liabilities	Assets	Liabilities
Domestic		Domestic	
\$500 bil.	\$600 bil.	\$____ bil.	\$____ bil.
Foreign		Foreign	
\$100 bil.		\$____ bil.	

- b. Below is a simplified balance sheet of the ECB. Show how it might alter its asset holdings to depreciate the dollar while keeping the euro-area money supply fixed.

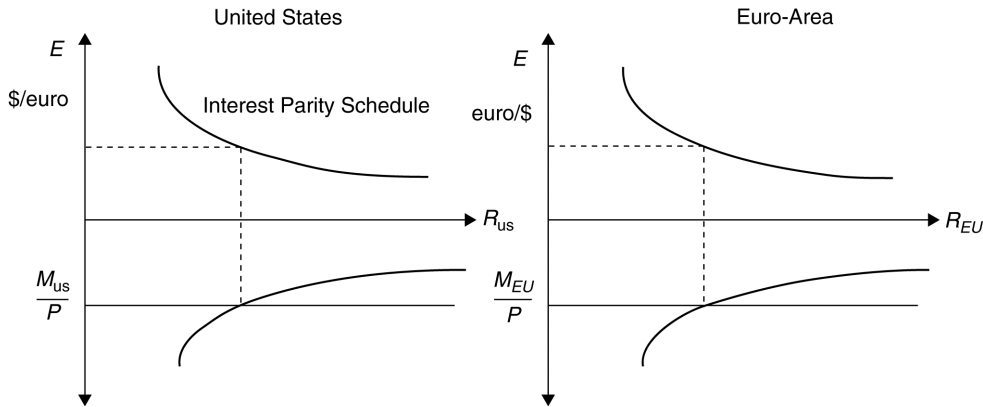
Balance Sheet of the ECB

Before Intervention		After Intervention	
Assets	Liabilities	Assets	Liabilities
Domestic		Domestic	
€2000 bil.	€2800 bil.	€____ bil.	€____ bil.
Foreign		Foreign	
€800 bil.		€____ bil.	

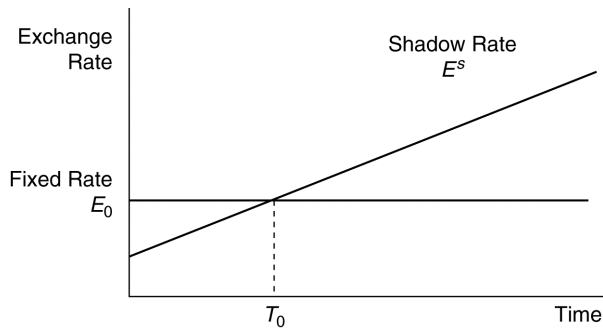
- c. Demonstrate how the risk premium on U.S. bonds changes with the policy described in Part (a) in the diagram on the right. Demonstrate how the risk premium on euro-area bonds changes with the policy described in Part (b) in the diagram on the right.



- d. Use the diagram on the right below to show the effects on the dollar/euro exchange rate of the change in asset holdings by the Federal Reserve, and the diagram on the left to show the effect of the change in asset holdings by the ECB.

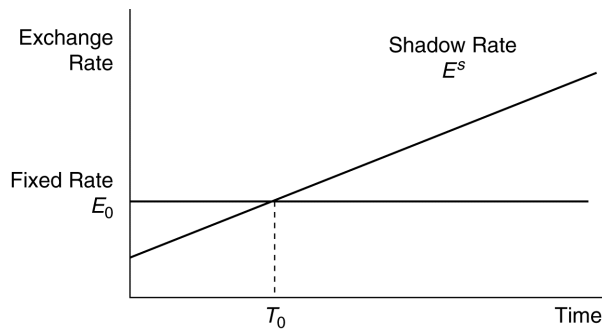


4. In the appendix describing the timing of a balance of payments crisis, the crisis occurs (that is, the central bank loses all its reserves) at the time when the line representing the shadow floating exchange rate crosses the fixed rate. In the diagram below, this is at time T_0 .
- a. The slope of the shadow floating exchange rate represents the rate of growth of the money supply. Demonstrate in the diagram how the time when the balance of payments crisis occurs is affected by a slowing of the rate of growth of the money supply.



- b. Is there a positive rate of growth of the money supply that will be small enough such that there is never a balance of payments crisis?

- c. The y -intercept of the shadow floating exchange rate schedule decreases with an increase in the initial holdings of foreign reserves by the central bank. Show how an increase in initial reserve holdings by the central bank affects the timing of the speculative attack using the diagram below.
- d. If there is a positive rate of growth of the money supply, is there a level of reserves large enough to avoid ever having a balance of payments crisis?

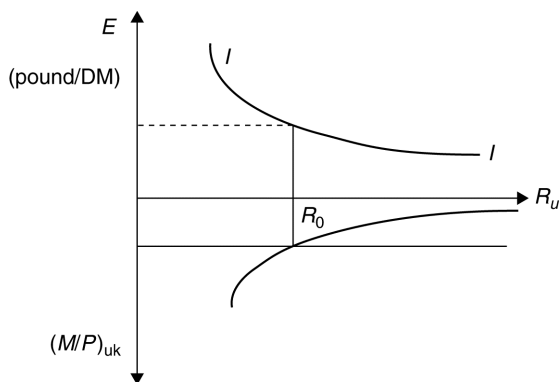


5. In reality, attacks do not happen in one instant. When they start, a government may raise interest rates to defend their currency.
- a. Using our models, explain why raising interest rates would help stave off a speculative attack.

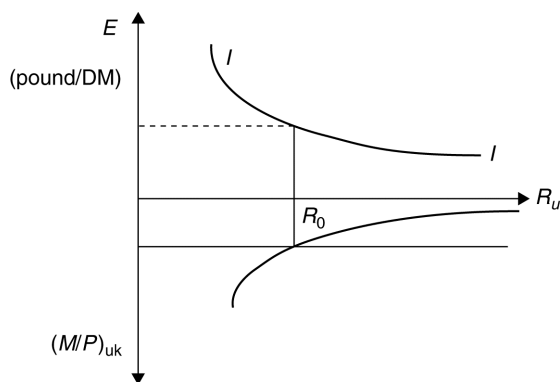
- b. How can the government's defense cause other investors to now see the exchange rate as untenable (even if they had not felt that way before)?

- c. Could an otherwise stable currency collapse because of an attack even if the attack was originally not warranted?

6. A politically charged issue in Britain at the end of the 1980s and in the early 1990s was potential membership in the exchange rate mechanism of the European Monetary System (EMS). Opponents of membership said that it would force British monetary policy to be the same as German monetary policy, curtailing British autonomy. Assume it is 1991 as you answer the following questions (that is, the euro does not yet exist and the United Kingdom is in the EMS).
- a. In the diagram below, demonstrate how an expansion of the money supply in Britain would affect the pound/Deutschemark exchange rate and discuss why, as members of the (mostly) fixed rate EMS Britain would have less latitude for conducting monetary policy.



- b. The Deutschemark appeared to be the reserve currency for the EMS. Use the diagram below to demonstrate the effect of a contraction of the German money supply on the policy of the British monetary authorities.



- c. How would the shift from the EMS-reserve currency regime to a single currency (the euro) affect the concerns regarding German domination of monetary policy? (This subject will be addressed in detail in Chapter 20.)

7. a. Using the monetary approach to the balance of payments, described in Appendix 2 of this chapter, discuss the effect of an increase in output on the level of foreign reserves held by the central bank. What is the net effect on the domestic money supply?

- b. Again using the monetary approach to the balance of payments discuss the effect on the balance of payments of an increase in the rate of growth of domestic-currency assets held by the central bank. What is the effect of this increase in the rate of growth of domestic currency assets held by the central bank on the rate of growth of the domestic money supply?

- c. Discuss the effects of maintaining balance of payments equilibrium using monetary tools in the face of a fall in money demand. Then discuss the effects of maintaining balance of payments equilibrium using monetary tools when there is an economic downturn due to a fall in investment. Do you expect unemployment to be similar or different in these two examples?

■ Answers to Odd-Numbered Textbook Problems

1. An expansion of the central bank's domestic assets leads to an equal fall in its foreign assets, with no change in the bank's liabilities (or the money supply). The effect on the balance-of-payments accounts is most easily understood by recalling how the fall in foreign reserves comes about. After the central bank buys domestic assets with money there is initially an excess supply of money. The central bank must intervene in the foreign exchange market to hold the exchange rate fixed in the face of this excess supply: the bank sells foreign assets and buys money until the excess supply of money has been eliminated. Since private residents acquire the reserves that the central bank loses, there is a noncentral bank capital outflow (a financial-account debit) equal to the increase in foreign assets held by the private sector. The offsetting credit is the reduction in central bank holdings of foreign assets, an official financial inflow.

3. A one-time unexpected devaluation initially increases output; the output increase, in turn, raises money demand. The central bank must accommodate the higher money demand by buying foreign assets with domestic currency, a step that raises the central bank's liabilities (and the home money supply) at the same time as it increases the bank's foreign assets. The increase in official foreign reserves is an official capital outflow; it is matched in the balance of payments accounts by the equal capital outflow associated with the public's own reduction in net foreign asset holdings. (The public must exchange foreign assets for the money it buys from the central bank, either by selling foreign assets or by borrowing foreign currency abroad. Either course of action is a capital inflow.)

A more subtle issue is the following: when the price of foreign currency is raised, the value of the initial stock of foreign reserves rises when measured in terms of domestic currency. This capital gain in itself raises central-bank foreign assets (which were measured in domestic currency units in our analysis)—so where is the corresponding increase in liabilities? Does the central bank inject more currency or bank-system reserves into the economy to balance its balance sheet? The answer is that central banks generally create fictional accounting liabilities to offset the effect of exchange-rate fluctuations on the home-currency value of international reserves. These capital gains and losses do not automatically lead to changes in the monetary base.

5.
 - a. Germany clearly had the ability to change the dollar/DM exchange simply by altering its money supply. The fact that “billions of dollars worth of currencies are traded each day” is irrelevant because exchange rates equilibrate markets for stocks of assets, and the trade volumes mentioned are flows.
 - b. One must distinguish between sterilized and nonsterilized intervention. The evidence regarding sterilized intervention suggests that its effects are limited to the signaling aspect. This aspect may well be the most important when markets are “unusually erratic,” and the signals communicated may be most credible when the central bank is not attempting to resist clear-cut market trends (which depend on the complete range of government macroeconomic policies, among other factors). Nonsterilized intervention, however, is a powerful instrument in affecting exchange rates.
 - c. The “psychological effect” of a “stated intention” to intervene may be more precisely stated as an effect on the expected future level of the exchange rate.
 - d. A rewrite might go as follows:

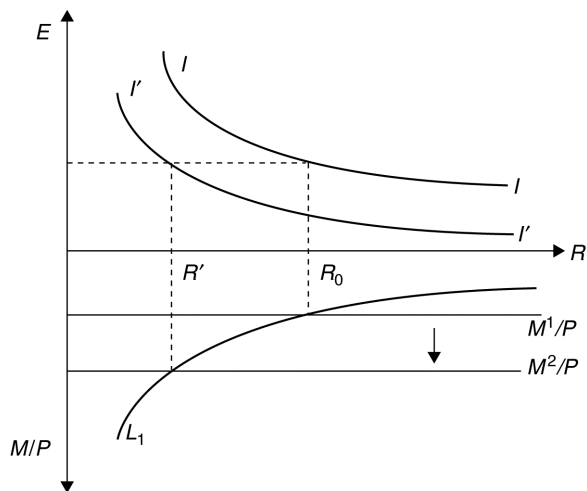
To keep the dollar from falling against the West German mark, the European central banks would have to sell marks and buy dollars, a procedure known as intervention.

Because the available stocks of dollar and mark bonds are so large, it is unlikely that sterilized intervention in the dollar/mark market, even if carried out by the two most economically influential members of the European Community—Britain and West Germany—would have much effect. The reason is that sterilized intervention changes only relative bond supplies and leaves national money supplies unchanged. Intervention by the United States and Germany that was not sterilized, however, would affect those countries' money supplies and have a significant impact on the dollar/mark rate.

Economists believe that the direct influence of sterilized intervention on exchange rates is small compared with that of nonsterilized intervention. Even sterilized intervention can affect exchange rates, however, through its indirect influence on market expectations about future policies. Such psychological effects, which can result from just the stated intention of the Community's central banks to intervene, can disrupt the market by confusing traders about official plans. The signaling effect of intervention is most likely to benefit the authorities when their other macroeconomic policies are already being adjusted to push the exchange rate in the desired direction.

7. By raising output, fiscal expansion raises imports and thus worsens the current-account balance. The immediate fall in the current account is smaller than under floating, however, because the currency does not appreciate and crowd out net exports.
9. By expanding output, a devaluation automatically raises private saving, since part of any increase in output is saved. Government tax receipts rise with output, so the budget deficit is likely to decline, implying an increase in public saving. We have assumed investment to be constant in the main text. If investment instead depends negatively on the real interest rate (as in the *IS-LM* model), investment rises because devaluation raises inflationary expectations and thus lowers the real interest rate. (The nominal interest rate remains unchanged at the world level.) The interest-sensitive components of consumption spending also rise, and if these interest-rate effects are strong enough, a current-account deficit could result.
11. If the market expects the devaluation to “stick,” the home nominal interest rate falls to the world level afterward, money demand rises, and the central bank buys foreign assets with domestic money to prevent excess money demand from appreciating the currency. The central bank thus gains official reserves, according to our model. Even if another devaluation was to occur in the near future, reserves might be gained if the first devaluation lowered the depreciation expected for the future and, with it, the home nominal interest rate. An inadequate initial devaluation could, however, increase the devaluation expected for the future, with opposite effects on the balance of payments.
13. A central bank that is maintaining a fixed exchange rate will require an adequate buffer stock of foreign assets on hand during periods of persistent balance of payments deficits. If a central bank depletes its stock of foreign reserves, it is no longer able to keep its exchange rate from depreciating in response to pressures arising from a balance of payments deficit. Simply put, a central bank can either choose the exchange rate and allow its reserve holdings to change or choose the amount of foreign reserves it holds and allow the exchange rate to float. If it loses the ability to control the amount of reserves because the private demand for them exceeds its supply, it can no longer control the exchange rate. Thus, a central bank maintaining a fixed exchange rate is not indifferent about using domestic or foreign assets to implement monetary policy.

15. The monetary authorities can combine a change in the money supply with a purchase or sale of its foreign assets to keep the exchange rate fixed while altering the domestic interest rate. For example, the monetary authorities lower domestic interest rates by increasing the money supply. To maintain a fixed value of the exchange rate, the monetary authority would also sell foreign assets and purchase domestic assets. In the figure below, the increase in the money supply lowers the interest rate from R_0 to R' . The purchase of domestic assets and sale of foreign assets, while having no further effect on the money supply, lowers the risk premium, shifts the interest parity schedule from II to $I'I'$ and maintains the exchange rate at E_0 .



17. Yes, there is some room within a target zone for domestic interest rates to move independently of the foreign rate. For a one-year rate, we might see that when R^* rises 1 percent, the home currency depreciates 1 percent, setting an expected appreciation of the home currency back to the middle of the band, thus offsetting the 1 percent lower interest rate. On a shorter maturity, one could—in theory—expect a change in the exchange rate of up to 2 percent (top to bottom of the band) in three-months. This allows three month rates to be 2 percent apart, meaning annualized rates could be over 8 percent apart. The shorter the maturity, the difference becomes essentially unbounded. But, this would require that the fixed exchange rate remains credible. On a ten-year bond, there can be only a 0.2 percent difference in rates as expected appreciation could be a maximum of 0.2 percent a year for the ten years.
19. Consider an example where France sells domestic assets (DA) for gold. If other central banks want to hold onto their monetary gold, they will raise interest rates (by selling domestic assets to reduce the money supply) to keep gold from leaving their country. The consequence may be that all central banks reduce their DA holdings and still hold the same amount of gold. Put differently, if France tries to sell domestic assets for gold and all other central banks do the same thing, the net effect is that there is still the same amount of gold on the asset side of all central banks' balance sheets combined, but the domestic assets have gone down. Thus, the total assets have declined and there has been a monetary contraction. In contrast, if France buys U.S. dollar assets to hold as reserves in a reserves-currency system, they can buy the dollars on the open market in exchange for domestic assets. If the investors want to hold dollars and the price of dollars begins to rise, the Fed can easily increase the supply of dollars by purchasing foreign assets in exchange for dollars. Thus, both have increased their foreign reserves, and there was no need for the assets side of the balance sheet to decline.