# Chapter 21. Exchange Rate Regimes

In July 1944, representatives of 44 countries met in Bretton Woods, New Hampshire, to design a new international monetary and exchange rate system. The system they adopted was based on fixed exchange rates, with all member countries other than the United States fixing the price of their currency in terms of dollars. In 1973, a series of exchange rate crises brought an abrupt end to the system—and an end to what is now called "the Bretton Woods period." Since, the world has been characterized by many exchange rate arrangements. Some countries operate under flexible exchange rates; some operate under fixed exchange rates; some go back and forth between regimes. Which exchange rate regime is best for a country is one of the most debated issues in macroeconomics. This chapter discusses this issue.

Section 21-1 looks at the medium run. It shows that, in sharp contrast to the results we derived for the short run in Chapter 20, an economy ends up with the same real exchange rate and output level in the medium run, regardless of whether it operates under fixed exchange rates or flexible exchange rates. This obviously does not make the exchange rate regime irrelevant—the short run matters very much—but it is an important extension and qualification to our previous analysis.

Section 21-2 takes another look at fixed exchange rates, and focuses on exchange rate crises. During a typical exchange rate crisis, a country operating under a fixed exchange rate is forced, often under dramatic conditions, to

abandon its parity and to devalue. Such crises were behind the breakdown of the Bretton Woods system. They rocked the European Monetary System in the early 1990s, and were a major element of the Asian Crisis of the late 1990s. It is important to understand why they happen, and what they imply.

Section 21-3 takes another look at flexible exchange rates, and focuses on the behavior of exchange rates under a flexible exchange rate regime. It shows that the behavior of exchange rates, and the relation of the exchange rate to monetary policy, are in fact much more complex than we assumed in Chapter 20. Large fluctuations in the exchange rate, and the difficulty of using monetary policy to affect the exchange rate, make a flexible exchange rate regime less attractive than it appeared to be in Chapter 20.

Section 21–4 puts all these results together and reviews the case for flexible or fixed rates. It discusses two recent and important developments, the move towards a common currency in Europe, and the move towards strong forms of fixed exchange rate regimes, from currency boards to dollarization.

## 21–1. The Medium Run

The results we derived in Chapter 20, where we focused on the short run, drew a sharp contrast between the behavior of an economy with flexible exchange rates and with fixed exchange rates.

- Under flexible exchange rates, a country which needed to achieve a real depreciation, for example to reduce its trade deficit or to get out of a recession, could do so by relying on an expansionary monetary policy and achieving both a lower interest and an increase in the exchange rate—a depreciation.

- Under fixed exchange rates, a country lost both of these instruments: By definition, its nominal exchange rate was fixed, and thus could not be adjusted. And the fixed exchange rate and the interest parity

condition implied that the country could not adjust its interest rate; the domestic interest rate had to remain equal to the foreign interest rate.

This appeared to make a flexible exchange rate regime much more attractive than a fixed exchange rate regime: Why give up two macroeconomic instruments? As we now shift focus from the short run to the medium run, you shall see that this earlier conclusion needs to be qualified. While our conclusions about the short run were valid, we shall see that, in the medium run, the difference between the two regimes fades away. More specifically, in the medium run, the economy reaches the same real exchange rate and the same level of output, whether it operates under fixed exchange rates or under flexible exchange rates.

The intuition for this result is straightforward. Recall the definition of the real exchange rate:

$$\epsilon = \frac{EP}{P^*}$$

The real exchange rate, $\epsilon$, is equal to the nominal exchange rate, $E$, (the price of domestic currency in terms of foreign currency) times the domestic price level, $P$, divided by the domestic price level, $P^*$. There are, therefore, two ways in which the real exchange rate can adjust:

- Through a change in the nominal exchange rate $E$: This can only be done under flexible exchange rates. And if we assume the domestic price level $P$ and the foreign price level $P^*$ do not change in the short run, it is the only way to adjust the real exchange rate in the short run.

- Through a change in the domestic price level $P$ relative to the foreign price level $P^*$. In the medium run, this option is open even to a country operating under a fixed (nominal) exchange rate. And this is indeed what happens under fixed exchange rates: The adjustment

takes place through the price level rather than through the nominal
exchange rate.[1]

Let us go through this argument step by step. To begin, let us derive the
aggregate demand and aggregate supply relations for an open economy
under a fixed exchange rate.

**Aggregate Demand Under Fixed Exchange Rates**

In an open economy with fixed exchange rates, we can write the aggregate
demand relation as[2]

$$Y = Y(\frac{\bar{E}P}{P^*}, G, T) \qquad (21.1)$$
$$(\quad - \quad, +, -)$$

Output, $Y$, depends on the real exchange rate, $\bar{E}P/P^*$ ($\bar{E}$ denotes the fixed
nominal exchange rate, $P$ and $P^*$ denote the domestic and foreign price
levels respectively), government spending, $G$, and taxes, $T$. An increase in
the real exchange rate—a real appreciation—leads to a decrease in output.
An increase in government spending leads to an increase in output, an
increase in taxes to a decrease in output.

The derivation of equation (21.1) is better left to the appendix to this
chapter called "Deriving Aggregate Demand under Fixed Exchange Rates".
The intuition behind the equation is straightforward however:

Recall that, in the closed economy, the aggregate demand relation took the
same form as equation (21.1), except for the presence of the real money

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1. There are three ways in which a U.S. car can become cheaper relative to a Japanese
car: First, through a decrease in the dollar price of the U.S car. Second, through an
increase in the yen price of the Japanese car. Third, through a decrease in the nominal
exchange rate—a decrease in the value of the dollar in terms of yens.
2. Recall that the aggregate demand relation captures the effects of the price level on
output. It is derived from equilibrium in goods and financial markets.

stock $M/P$ instead of the real exchange rate $EP/P^*$.[3]

- The reason for the presence of $M/P$ in the closed economy was the following: By controlling the money supply, the central bank could change the interest rate and affect output. In an open economy, and under fixed exchange rates and perfect capital mobility, the central bank can no longer change the interest rate—which is pinned down by the foreign interest rate. Put another way, under fixed exchange rates, the central bank gives up monetary policy as a policy instrument. This is why the money stock no longer appears in the aggregate demand relation.

- At the same time, the fact that the economy is open implies that we must include a variable which we did not include when looking at the closed economy earlier, namely the real exchange rate, $\bar{E}P/P^*$. As we saw in Chapter 20, an increase in the real exchange rate leads to a decrease in the demand for domestic goods and thus a decrease in output; a decrease in the real exchange rate leads to an increase in output.

Note that, just as in the closed economy, the aggregate demand relation (21.1) implies a negative relation between the price level and output. But, while the sign of the effect of the price level on output remains the same, the channel is very different:

- In the closed economy, the price level affects output through its effect on the real money stock and in turn, its effect on the interest rate.

- In the open economy under fixed exchange rates, the price level affects output through its effect on the real exchange rate. Given the fixed nominal exchange rate, $\bar{E}$, and the foreign price level, $P^*$, an increase in the domestic price level, $P$, leads to an increase in the real exchange rate $\bar{E}P/P^*$—a real appreciation. This real appreciation

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3.  See equation (7.3)

leads to a decrease in the demand for domestic goods, and, in turn, a decrease in output. Put simply: An increase in the price level makes domestic goods more expensive, thus decreasing the demand for domestic goods, and in turn decreasing output.[4]

### Equilibrium in the Short Run and in the Medium Run

The aggregate demand curve implied by equation (21.1) is drawn as the $AD$ curve in Figure 21–1. It is downward sloping: An increase in the price level decreases output. As always, the relation is drawn for given values of the other variables, in this case for given values of $\bar{E}, P^*, G$ and $T$.

For the aggregate supply curve, we rely on the relation we derived in the core. Going back to the *aggregate supply relation* we derived in Chapter 7, equation (7.2)[5]

$$P = P^e \, (1 + \mu) \, F(1 - \frac{Y}{L}, z) \tag{21.2}$$

The price level $P$ depends on the expected price level $P^e$, and on the level of output $Y$. Recall the two mechanisms at work:

- The expected price level matters because it affects nominal wages, which in turn affect the price level.
- Higher output matters because it leads to higher employment, which leads to lower unemployment, which leads to higher wages, which lead to a higher price level.[6]

The aggregate supply curve is drawn as the $AS$ curve in Figure 21–1 for a given value of the expected price level. It is upward sloping: Higher output leads to a higher price level.

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4.   Aggregate demand relation in the open economy under fixed exchange rates: $P$ increases $\Rightarrow \bar{E}P/P^*$ increases $\Rightarrow Y$ decreases.
5.   Recall that the aggregate supply relation captures the effects of output on the price level. It is derived from equilibrium in labor markets.
6.   Aggregate supply relation: $Y$ increases $\Rightarrow P$ increases.

*Figure 21–1. Aggregate Demand and Aggregate Supply in an Open Economy Under Fixed Exchange Rates. (Caption. An increase in the price level leads to a real appreciation and a decrease in output: The aggregate demand curve is downward sloping. An increase in output leads to an increase in the price level: The aggregate supply curve is upward sloping.)*

The short–run equilibrium is given by the intersection of the aggregate demand curve and the aggregate supply curve, point $A$ in Figure 21–1. As was the case in the closed economy, there is no reason why the short–run equilibrium level of output, $Y$, should be equal to the natural level of output, $Y_n$. As the figure is drawn, $Y$ is smaller than $Y_n$, so output is below the natural level of output.

What happens over time? The basic answer is familiar from our earlier look at adjustment in a closed economy, and is shown in Figure 21–2. So long as output remains below the natural level of output, the aggregate supply shifts down. The reason: When output is below the natural level of output, the price level turns out to be lower than was expected.[7] This leads wage setters to revise their expectation of the price level downwards, leading to a lower price level at a given level of output, and thus a downward shift of the aggregate supply curve. So, starting from $A$, the economy moves over time along the aggregate demand curve, until it reaches $B$. At $B$, output is equal to the natural level of output. The price level is lower than it was at $A$; by implication the real exchange rate is lower than it was at $A$. In words: So long as output is below the natural level of output, the price level decreases. The decrease in the price level over time leads to a steady real depreciation. This real depreciation leads to an increase in output until output has returned to its natural level.[8]

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7.  Make sure you understand this step. If you need a refresher, return to Section 7–1.
8.  The result that the price level decreases along the path of adjustment comes from our assumption that the foreign price level is constant. If we had assumed instead that the foreign price level was increasing over time, what would be needed would be for the

In the medium run, despite the fact that the nominal exchange rate is fixed, the economy still achieves the real depreciation needed to return output to its natural level. This is an important qualification to the conclusions we reached in the previous chapter—where we were focusing only on the short run:

- In the short run, a fixed nominal exchange rate implies a fixed real exchange rate.
- In the medium run, a fixed nominal exchange rate is consistent with an adjustment of the real exchange rate. The adjustment is achieved through movements in the price level.

*Figure 21–2. Adjustment Under Fixed Exchange Rates (Caption. The aggregate supply curve shifts down over time, leading to a decrease in the price level, to a real depreciation, and to an increase in output. The process ends when output has returned to its natural level.*

### The Case For and Against a Devaluation

The result that, even under fixed exchange rates, the economy returns to the natural level of output in the medium run, is important. But it does not eliminate the fact that the process of adjustment may be long and painful, during which output remains too low and unemployment remains too high for a long time. This raises the issue of whether there are faster and better ways to return output to normal. The answer, within the model we have just developed, is a clear yes:

Suppose that the government decides, while keeping the fixed exchange rate regime, to allow for a one–time devaluation. For a given price level, a devaluation (a decrease in the nominal exchange rate) leads to a real

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domestic price level to increase less than the foreign price level, or, put another way, for domestic inflation to be lower than foreign inflation for some time.

depreciation (a decrease in the real exchange rate), and thus to an increase in output. In other words, a devaluation shifts the aggregate demand curve to the right: Output is higher at a given price level.

This has a straightforward implication: A devaluation of the right size can take the economy directly from $Y$ to $Y_n$. This is shown in Figure 21–3. Suppose the economy is initially at $A$, the same point $A$ as in Figure 21–2. The right size depreciation shifts the aggregate demand curve from $AD$ to $AD'$, taking the equilibrium from $A$ to $C$. At $C$, output is equal to the natural level of output $Y_n$. The real exchange rate is the same as at $B$. (We know this because output is the same at points $B$ and $C$. From equation (21.1), and without changes in $G$ or $T$, this implies that the real exchange rate must also be the same.)

*Figure 21–3. Adjustment with a Devaluation. (Caption. The right size devaluation can shift aggregate demand to the right, leading the economy to go to point C. At point C, output is back to the natural level of output.)*

That the "right size" devaluation can return output to the natural level of output right away—rather than over time as was the case absent the devaluation—sounds too good to be true—and, in practice, it is. Achieving the "right size" devaluation—the devaluation which takes output to $Y_n$ right away—is easier to achieve in a graph than in reality:

- In contrast to our simple aggregate demand relation (21.1), the effects of the depreciation on output do not happen right away: As you saw in Chapter 19, the initial effects of a depreciation on output may be contractionary, as people pay more for imports, and the quantities of imports and exports have not adjusted yet.[9]

- Also, in contrast to our simple aggregate supply relation (21.2), there is likely to be a direct effect of the devaluation on the price

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9. See Section 19–5 on the J curve.

level. As the price of imported goods increases, the price of a consumption basket increases. This increase is likely to lead workers to ask for higher nominal wages, forcing firms to increase their prices as well.

But these complications do not affect the basic conclusion: A devaluation can hasten the return of output to its natural level. And so, whenever a country under fixed exchange rates faces either a large trade deficit or a large recession, there is a lot of political pressure either to give up the fixed exchange rate regime altogether, or, at least, to have a one–time devaluation. Perhaps the most forceful presentation of this view was made 80 years ago by Keynes, who argued against Winston Churchill's decision to return the British pound in 1923 to its pre-World War I parity. His arguments are presented in the Focus Box "The Return of Britain to the Gold Standard: Keynes versus Churchill." Most economic historians believe that history proved Keynes right, and that overvaluation of the pound was one of the main reasons for Britain's poor economic performance after World War I.

Those who oppose a shift to flexible exchange rates or who oppose a devaluation argue that there are good reasons to choose fixed exchange rates, and that too much willingness to devalue defeats the purpose of adopting a fixed exchange rate regime in the first place. They argue that too much willingness on the part of governments to consider devaluations actually leads to an increased likelihood of exchange rate crises. To understand their arguments, we now turn to these crises: What triggers them, and what their implications might be.

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**Focus: The Return of Britain to the Gold Standard: Keynes versus Churchill.**

*In 1925, Britain decided to return to the **gold standard**. The gold standard was a system in which each country fixed the price of its currency in terms of gold and stood ready to exchange gold for currency at the stated parity. This system implied fixed nominal exchange rates between countries.*

*The gold standard had been in place from 1870 until World War I. Because of the need to finance the war, and to do so in part by money creation, Britain suspended the gold standard in 1914. In 1925, Winston Churchill, then Britain's Chancellor of the Exchequer (the English equivalent of Secretary of the Treasury in the United States), decided to return to the gold standard, and to return at the pre–war parity—that is, at the pre–war value of the pound in terms of gold. But, because prices had increased faster in Britain than in many of its trading partners, returning to the pre-war parity implied a large real appreciation: At the same nominal exchange rate as before the war, British goods were now relatively more expensive relative to foreign goods. (Go back to the definition of the real exchange rate, $\epsilon = EP/P^*$: The price level in Britain, $P$ had increased more than the foreign price level, $P^*$. At a given nominal exchange rate, $E$, this implied that $\epsilon$ was higher, that Britain suffered from a real appreciation.)*

*Keynes severely criticized the decision to return to the pre-war parity. In* The Economic Consequences of Mr. Churchill, *a book he published in 1925, Keynes argued as follows: If Britain was going to return to the gold standard, it should have done so at a lower price of currency in terms of gold, at a lower nominal exchange rate than the pre-war nominal exchange rate. In a newspaper article, he articulated his views as follows:*

*"There remains, however, the objection to which I have never ceased to attach importance, against the return to gold in actual present conditions, in view of the possible consequences on the state of trade and employment. I believe that our price level is too high, if it is converted to gold at the par of exchange, in relation to gold prices elsewhere; and if we consider*

*the prices of those articles only which are not the subject of international trade, and of services, i.e. wages, we shall find that these are materially too high–not less than 5 per cent, and probably 10 per cent. Thus, unless the situation is saved by a rise of prices elsewhere, the Chancellor is committing us to a policy of forcing down money wages by perhaps 2 shillings in the Pound.*

*I do not believe that this can be achieved without the gravest danger to industrial profits and industrial peace. I would much rather leave the gold value of our currency where it was some months ago than embark on a struggle with every trade union in the country to reduce money wages. It seems wiser and simpler and saner to leave the currency to find its own level for some time longer rather than force a situation where employers are faced with the alternative of closing down or of lowering wages, cost what the struggle may.*

*For this reason, I remain of the opinion that the Chancellor of the Exchequer has done an ill-judged thing–ill judged because we are running the risk for no adequate reward if all goes well."*

*Keynes' prediction turned out to be right. While other countries were growing, Britain was in recession for the rest of the decade. Most economic historians attribute a good part of the blame to the initial overvaluation.*

*Source: "The Nation and Athenaeum," May 2, 1925.*

## 21–2. Exchange Rate Crises under Fixed Exchange Rates

Suppose a country is operating under a fixed exchange rate. Suppose also that financial investors start believing there may soon be an exchange rate

adjustment—either a devaluation or a shift to a flexible exchange rate regime accompanied by a depreciation.

We just saw why this might be the case:

- The real exchange rate may be too high. Or, put another way, the domestic currency may be overvalued. In this case, a real depreciation is called for. While this could be achieved in the medium run without a devaluation, financial investors may conclude that the government will take the quickest way out—and devalue.

  Such an overvaluation often happens in countries that peg their nominal exchange rate to a country with lower inflation. Higher relative inflation implies a steadily increasing price of domestic goods relative to foreign goods, a steady real appreciation, and so a steady worsening of the trade position. As time passes, the need for an adjustment of the real exchange rate increases, and financial investors become more and more nervous.

- Internal conditions may call for a decrease in the domestic interest rate. A decrease in the domestic interest rate cannot be achieved under fixed exchange rates. But it can be achieved if the country is willing to shift to a flexible exchange rate regime. If a country lets the exchange rate float and then decreases its domestic interest rate, we know from Chapter 20 that this will trigger a decrease in the nominal exchange rate—a nominal depreciation.

As soon as financial markets believe a devaluation may be coming, then to maintain the exchange rate requires an increase, often a large one, in the domestic interest rate. To see this, return to the interest-parity condition we derived in Chapter 18[10]

$$i_t = i_t^* - \frac{(E_{t+1}^e - E_t)}{E_t} \tag{21.3}$$

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10. Because it is more convenient, we use the approximation, equation (18.4), rather than the original interest parity condition, equation (18.2).

In Chapter 18, we interpreted this equation as a relation between the *one-year* domestic and foreign nominal interest rates, the current exchange rate and the expected exchange rate a year hence. But the choice of one year as the period was arbitrary. The relation holds over a day, a week, a month. If financial markets expect the exchange rate to be 2% lower a month from now, they will hold domestic bonds only if the one–month domestic interest rate exceeds the one–month foreign interest rate by 2% (or, if we express interest rates at an annual rate, if the domestic interest rate exceeds the foreign interest rate by 2% x 12 = 24%).

Under fixed exchange rates, the current exchange rate $E_t$ is set at some level, say $E_t = \bar{E}$. If markets expect the parity will be maintained over the period, then $E_{t+1}^e = \bar{E}$, and the interest-parity condition simply states that the domestic and the foreign interest rates must be equal.

Suppose, however, participants in financial markets start anticipating a devaluation—a decrease in the exchange rate. Suppose they believe that, over the coming month, there is a 75% chance the parity will be maintained and a 25% chance there will be a 20% devaluation. The term $(E_{t+1}^e - E_t)/E_t$ in the interest-parity equation (21.3), which we assumed equal to zero earlier, now equals 0.75 x 0% + 0.25 x (-20%) = -5% (a 75% chance of no change plus a 25% chance of a devaluation of 20%.)

This implies that, if the central bank wants to maintain the existing parity, it must now offer a monthly interest rate 5% higher than before— 60% higher at an annual rate (12 months x 5% per month) 60% is the interest differential needed to convince investors to hold domestic bonds rather than foreign bonds!

What, then, are the choices confronting the government and the central bank?

- First, the government and the central bank can try to convince

markets they have no intention of devaluing.[11] This is always the first line of defense: Communiqués are issued, and prime ministers go on TV to reiterate their absolute commitment to the existing parity. But words are cheap, and they rarely convince financial investors.[12]

- Second, the central bank can increase the interest rate, but by less than would be needed to satisfy equation (21.3)—in our example, by less than 60%. Although domestic interest rates are high, they are not high enough to fully compensate for the perceived risk of devaluation. This action typically leads to a large capital outflow, as financial investors still prefer to get out of domestic bonds into foreign bonds. This implies selling domestic bonds, getting the proceeds in domestic currency, going to the foreign exchange market to sell domestic currency for foreign currency, and then buying foreign bonds. If the central bank did not intervene in the foreign exchange market, the large sales of domestic currency for foreign currency would lead to a depreciation. If it wants to maintain the exchange rate, the central bank must therefore stand ready to buy domestic currency and sell foreign currency at the current exchange rate. In doing so, it often loses most of its reserves of foreign currency. (The mechanics of central bank intervention were described in the appendix to Chapter 20.)

- Eventually—after a few hours or a few weeks—the choice for the central bank becomes either to increase the interest rate enough to satisfy equation (21.3) or to validate the market's expectations and devalue. Setting a very high short–term domestic interest rate can have a devastating effect on demand and on output. This course of action makes sense only if (1) the perceived probability of a devalu-

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11. In most countries, the government is formally in charge of choosing the parity, the central bank formally in charge of maintaining it. In practice, choosing and maintaining the parity are joint responsibilities of the government and the central bank.
12. In the summer of 1998, Boris Yeltsin announced that the Russian government had no intention of devaluing the ruble. Two weeks later, the ruble collapsed.

ation is small, so the interest rate does not have to be too high, and (2) the government believes markets will soon become convinced that no devaluation is coming, allowing domestic interest rates to decrease. Otherwise, the only option is to devalue (All these steps were very much in evidence during the exchange rate crisis which affected much of Western Europe in 1992. See the Focus Box "The 1992 EMS crisis.)

To summarize: Expectations that a devaluation may be coming can trigger an exchange rate crisis. Faced with such expectations, the government has two options:

Give in and devalue, or

Fight and maintain the parity, at the cost of very high interest rates and a potential recession. Fighting may not work anyway: The recession may force the government to change policy later on, or force the government out of office.

An interesting twist here is that a devaluation may happen even if the belief that a devaluation was coming was initially groundless. Even if the government initially had no intention of devaluing, it may be forced to devalue if financial markets believe that it will devalue: The cost of maintaining the parity would be a long period of high interest rates and a recession; the government prefers to devalue instead.

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**Focus. The 1992 EMS Crisis**

*An example of the problems we discussed in this section is the exchange rate crisis which shook the European Monetary System in the early 1990s.*

*At the start of the 1990s, the European Monetary System (EMS) appeared to work well. Started in 1979, it was an exchange rate system based on*

fixed parities with bands: Each member country (among them, France, Germany, Italy, and starting in 1990, the United Kingdom) had to maintain its exchange rate vis–a–vis all other member countries within narrow bands. The first few years had been rocky, with many realignments—adjustment of parities—among member countries, but, from 1987 to 1992, there were only two realignments. There was increasing talk about narrowing the bands further and even moving to the next stage—to the adoption of a common currency.

In 1992, however, financial markets became increasingly convinced that more realignments were soon to come. The reason was one we have already seen in Chapter 20, namely the macroeconomic implications of German re-unification. Because of the pressure on demand coming from reunification, the Bundesbank (the German central bank) was maintaining high interest rates to avoid too large an increase in output and an increase in inflation in Germany. While Germany's EMS partners needed lower interest rates to reduce a growing unemployment problem, they had to match the German interest rates to maintain their EMS parities. To financial markets, the position of Germany's EMS partners looked increasingly untenable. Lower interest rates outside Germany, and thus devaluations of many currencies vis-à-vis the DM, appeared increasingly likely.

Throughout 1992, the perceived probability of a devaluation forced a number of Germany's trading partners to maintain higher nominal interest rates than Germany's. But the first major crisis did not come until September 1992. The belief that a number of countries were soon going to devalue led, in early September, to speculative attacks on a number of currencies, with financial investors selling in anticipation of an oncoming devaluation. All the lines of defense described earlier were used by the monetary authorities and the governments of the countries under attack. First, solemn communiqués were issued, but with no discernible effect. Then, interest rates were increased, up to 500% for the overnight interest rate (the rate for lend-

*ing and borrowing overnight) in Sweden (expressed at an annual rate). But they were not increased enough to prevent capital outflows and large losses of foreign exchange reserves by the central banks under pressure. Next were different courses of action in different countries: Spain devalued its exchange rate, Italy and the United Kingdom suspended their participation in the EMS, and France decided to tough it out through higher interest rates until the storm was over. Figure 1 shows the evolution of the exchange rates vis–a–vis the DM for a number of European countries from January 1992 to December 1993: You can clearly see the effects of the September 1992 crisis and the ensuing depreciations/devaluations.*

*Figure 1. Exchange Rates of Selected European Countries vis–a–vis the Deutsche Mark, January 1992 to December 1993.*

*By the end of September, financial markets believed no further devaluations were imminent. Some countries were no longer in the EMS, others had devalued but remained in the EMS, and those that had maintained their parity had shown their determination to stay in the EMS, even if this meant very high interest rates. But the underlying problem—the high German interest rates—was still present, and it was only a matter of time before the next crisis started. In November 1992, further speculation forced a devaluation of the Spanish peseta, the Portuguese escudo, and the Swedish krona. The peseta and the escudo were further devalued in May 1993. In July 1993, after yet another large speculative attack, EMS countries decided to adopt large fluctuation bands (plus or minus 15%) around central parities, in effect moving to a system that allowed for very large exchange-rate fluctuations.*

*This system with wider bands was kept until the adoption of a common currency in January 1999.*

*To summarize:*

*The 1992 EMS crisis came from the perception by financial markets that the high interest rates forced by Germany upon its partners under the rules of the EMS were becoming very costly.*

*The belief that some countries might want to devalue or get out of the EMS led investors to ask for even higher interest rates, making it even more costly for those countries to maintain their parity.*

*In the end, some countries could not bear the cost; some devalued, some dropped out. Others remained in the system, but at a substantial cost in terms of output. (For example, average growth in France from 1990 to 1996 was 1.2%, compared to 2.3% for Germany over the same period.*

## 21−3. Exchange Rate Movements under Flexible Exchange Rates

In the model we developed in Chapter 20, there was a simple relation between the interest rate and the exchange rate: The lower the interest rate, the lower the exchange rate. This implied that a country that wanted to maintain a stable exchange rate just had to maintain its interest rate close to the foreign interest rate. A country that wanted to achieve a given depreciation just had to decrease its interest rate by the right amount.

In reality, the relation between the interest rate and the exchange rate is not so simple. Exchange rates often move even in the absence of movements in interest rates. The size of the effect of a given decrease in the interest rate on the exchange rate is hard to predict, making it much harder for monetary policy to achieve its desired outcome.

To see why things are more complicated, we must return once again to the interest parity condition we derived in Chapter 18 (equation 18.2)

$$(1 + i_t) = (E_t)(1 + i_t^*)\left(\frac{1}{E_{t+1}^e}\right)$$

As we did in Chapter 20 (equation [20.5]), multiply both sides by $E_{t+1}^e$, and reorganize to get

$$E_t = \frac{1 + i_t}{1 + i_t^*} E_{t+1}^e \tag{21.4}$$

Think of the time period (from $t$ to $t+1$) as one year. The exchange rate this year depends on the one–year domestic interest rate, the one–year foreign interest rate, and the exchange rate expected for next year.

We assumed in Chapter 20 that the expected exchange rate next year $(E_{t+1}^e)$ was constant. But this was a simplification. The exchange rate expected one year hence is not constant. Using equation (21.4), but now for next year, it is clear that the exchange rate next year will depend on next year's one–year domestic interest rate, the one–year foreign interest rate, and the exchange rate expected for the year after, and so on. So, any change in expectations of *current and future* domestic and foreign interest rates, as well as changes in the expected exchange rate in the far future, will affect the exchange rate today.

Let's explore this more closely. Write equation (21.4) for year $t+1$ rather than for year $t$:

$$E_{t+1} = \frac{1 + i_{t+1}}{1 + i_{t+1}^*} E_{t+2}^e$$

The exchange rate in year $t+1$ depends on the domestic interest rate and the foreign interest rate for year $t+1$, as well as on the expected future exchange rate in year $t+2$. So, the expectation of the exchange rate in year $t+1$, held as of year $t$, is given by:

$$E_{t+1}^e = \frac{1 + i_{t+1}^e}{1 + i_{t+1}^{*e}} \, E_{t+2}^e$$

Replacing $E_{t+1}^e$ in equation (21.4) with the expression above gives:

$$E_t = \frac{(1 + i_t)(1 + i_{t+1}^e)}{(1 + i_t^*)(1 + i_{t+1}^{*e})} \, E_{t+2}^e$$

The current exchange rate depends on both this year's and next year's expected domestic and foreign interest rates, and on the expected exchange rate two years from now. Continuing to solve forward in time in the same way (by replacing $E_{t+2}^e, E_{t+3}^e$, and so on until, say, year $t+n$) we get:

$$E_t = \frac{(1 + i_t)(1 + i_{t+1}^e)...(1 + i_{t+n}^e)}{(1 + i_t^*)(1 + i_{t+1}^{*e})...(1 + i_{t+n}^{*e})} \, E_{t+n}^e \qquad (21.5)$$

Suppose we take $n$ to be large, say 10 years (equation (21.5) holds for any value of $n$). This relation tells us that the current exchange rate depends on two sets of factors:

- Current and expected domestic and foreign interest rates for each year over the next ten years.
- The expected exchange rate ten years from now.

For some purposes, it is useful to go further and derive a relation between current and expected future domestic and foreign *real* interest rates, the current *real* exchange rate, and the expected future *real* exchange rate. This is done in the appendix to this chapter. (The derivation is not much fun, but it is a useful way of brushing up on the relation between real interest rates and nominal interest rates, and real exchange rates and nominal exchange rates). Equation (21.5) is sufficient however to make the three points I want to make here:

**Exchange Rates and the Current Account**

Any factor which moves the expected future exchange rate $E^e_{t+n}$ moves the current exchange rate $E_t$. Indeed, if the domestic interest rate and the foreign interest rate are expected to be the same in both countries from $t$ to $t+n$, the fraction on the right in equation (21.5) is equal to one, so the relation reduces to $E_t = E^e_{t+n}$: The effect of any change in the expected future exchange rate on the current exchange rate is one–for–one.

If we think of $n$ as large (say 10 years or more), we can think of $E^e_{t+n}$ as the exchange rate required to achieve current account balance in the medium or long run: Countries cannot borrow—run a current account deficit—forever, and will not want to lend—run a current account surplus—forever either. Thus, any news that affects forecasts of the current account balance in the future is likely to have an effect on the expected future exchange rate, and in turn on the exchange rate today. For example, the announcement of a larger-than-expected trade deficit may lead investors to conclude that a depreciation will eventually be needed to reestablish trade balance. Thus, $E^e_{t+n}$ will increase, leading in turn to an increase in $E_t$ today.[13]

**Exchange Rates, and Current and Future Interest Rates**

Any factor which moves current or expected future domestic or foreign interest rates between year $t$ and $t+n$ moves the current exchange rate. For example, given foreign interest rates, an increase in current or expected future domestic interest rates leads to an increase in $E_t$—an appreciation.[14]

This implies that any variable which leads investors to change their expectations of future interest rates will lead to a change in the exchange rate today. For example, the "dance of the dollar" in the 1980s we discussed in

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13. News about the current account are likely to affect the exchange rate.
14. News about current and future domestic and foreign interest rates are likely to affect the exchange rate.

earlier chapters[15]—the sharp appreciation of the dollar in the first half of the decade, followed by an equally sharp depreciation later—can be largely explained by the movement in current and expected future U.S. interest rates relative to interest rates in the rest of the world during that period. During the first half of the 1980s, tight monetary policy and expansionary fiscal policy combined to increase both U.S. short–term interest rates and long–term interest rates, with the increase in long–term rates reflecting anticipations of high short–term interest rates in the future.[16] This increase in both current and expected future interest rates was in turn the main cause of the dollar appreciation. Both fiscal and monetary policy were reversed in the second half of the decade, leading to lower U.S. interest rates, and a dollar depreciation.

**Exchange Rate Volatility**

The third implication follows from the first two. In reality, and in contrast to our analysis in Chapter 20, the relation between the interest rate $i_t$ and the exchange rate $E_t$ is all but mechanical. When the central bank cuts the interest rate, financial markets have to assess whether this action signals a major shift in monetary policy and the cut in the interest rate is just the first of many such cuts, or whether this cut is just a temporary movement in interest rates. Announcements by the central bank may not be very useful: The central bank itself may not even know what it will do in the future. Typically, it will be reacting to early signals, which may be reversed later. Financial markets also have to assess how foreign central banks will react, whether they will stay put, or follow suit and cut their interest rates. All this makes it much harder to predict what the effect of the change in the interest rate will be on the exchange rate.

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15. See Chapter 18 and 20.
16. For more on the relation between long–term interest rates and current and expected future short–term interest rates, go back to Chapter 15.

Let's be more concrete. Go back to equation (21.5). Assume that $E^e_{t+n} = 1$. Assume that current and expected future domestic interest rates, and current and expected future foreign interest rates, are all equal to 5%. The current exchange rate is then given by:

$$E_t = \frac{(1.05)^n}{(1.05)^n} \, 1 = 1$$

Now consider a monetary expansion, which decreases the current domestic interest rate $i_t$ from 5% to 3%. Will this lead to a decrease in $E_t$—to a depreciation—and if so by how much? The answer: It all depends:[17]

Suppose the interest rate is expected to be lower for just one year, so the $n-1$ expected future interest rates are unchanged. The current exchange rate then decreases to:

$$E_t = \frac{(1.03)(1.05)^{n-1}}{(1.05)^n} = \frac{1.03}{1.05} = 0.98$$

The expansionary monetary policy leads to a decrease in the exchange rate—a depreciation—of only 2%.

Suppose instead that, when the current interest rate declines from 5% to 3%, investors expect the decline to last for five years (so $i_{t+4} = ... = i_{t+1} = i_t = 3\%$.) The exchange rate then decreases to:

$$E_t = \frac{(1.03)^5(1.05)^{n-5}}{(1.05)^n} = \frac{(1.03)^5}{(1.05)^5} = 0.90$$

The expansionary monetary policy now leads to an increase in the exchange

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17. If this reminds you of our discussion of the effect of monetary policy on stock prices in Chapter 15, you are right. This is more than a coincidence: Like stock prices, the exchange rate depends very much on expectations of variables far into the future. How expectations change in response to a change in a current variable (here, the interest rate) very much determines the outcome.

rate—a depreciation—of 10%, a much larger effect.

You can surely think of yet other outcomes. Suppose investors had anticipated that the central bank was going to decrease interest rates, and the actual decrease turns out to be smaller than they anticipated. They will revise their expectations of future nominal interest rates *upwards*, leading to an appreciation rather than a depreciation of the currency...

When, at the end of the Bretton Woods period, countries moved from fixed exchange rates to flexible exchange rates, most economists had expected that exchange rates would be stable. The large fluctuations in exchange rates which followed (and have continued to this day) came as a surprise. For some time, these fluctuations were thought to be the result of irrational speculation in foreign exchange markets. It was not until the mid–1970s that economists realized that these large movements could be explained, as we have here, by the rational reaction of financial markets to news about future interest rates and the future exchange rate. This has an important implication:

A country which decides to operate under flexible exchange rates must accept the fact that it will be exposed to substantial exchange rate fluctuations over time.

## 21–4. Choosing Between Exchange Rate Regimes

Let us now return to the question which motivates this chapter: Should countries choose flexible exchange rates or fixed exchange rates? Are there circumstances when flexible rates dominate, others when fixed rates dominate?

Much of what we have seen in this and the previous chapter would seem to favor flexible exchange rates:

- Section 21–1 argued that the exchange rate regime may not matter in the medium run. But it is still the case that it does in the short run. In the short run, countries which operate under fixed exchange rates and perfect capital mobility, give up two macroeconomic instruments, the interest rate and the exchange rate. This not only reduces their ability to respond to shocks, but may also lead to exchange rate crises.
- Section 21–2 argued that, in a country with fixed exchange rates, the anticipation of a devaluation leads investors to ask for very high interest rates, making the economic situation worse, and putting more pressure on the country to devalue. So, another argument against fixed exchange rates.
- Section 21–3 introduced one argument against flexible exchange rates, namely that, under flexible exchange rates, the exchange rate may move a lot and may be difficult to control through monetary policy.

On net, it would appear that, from a macroeconomic viewpoint, flexible exchange rates dominate fixed exchange rates. This indeed appears to be the consensus which has emerged among economists and policy makers. The consensus goes like this:

In general, flexible exchange rates are preferable. There are however two exceptions: First, when a group of countries is already tightly integrated, in which case a common currency may be the right solution. Second, when the central bank cannot be trusted to follow a responsible monetary policy under flexible exchange rates. In this case, a strong form of fixed exchange rates, such as a currency board or dollarization, may provide a solution.

Let me discuss each of these two exceptions.

**Common currency areas**

Countries that operate under a fixed exchange rate regime are constrained to have the same interest rate. But how costly is that constraint? If the countries face roughly the same macroeconomic problems and the same shocks, they would have chosen similar policies in the first place. Forcing them to have the same monetary policy may not be much of a constraint.

This argument was first explored by Robert Mundell, who looked at the conditions under which a set of countries might want to operate under fixed exchange rates, or even adopt a common currency.[18] For countries to constitute an **optimal currency area**, Mundell argued, they need to satisfy one of two conditions:

- The countries have to experience similar shocks. We just saw the rationale for this: If they have similar shocks, then they would have chosen roughly the same monetary policy anyway.
- Or, if the countries experience different shocks, they must have high factor mobility. If workers for example are willing to move from countries which are doing poorly to countries which are doing well, factor mobility rather than macroeconomic policy can allow countries to adjust to shocks. When the unemployment rate is high in a country, workers leave that country to take jobs elsewhere, and the unemployment rate in that country decreases back to normal. If the unemployment rate is low, workers come to the country, and the unemployment rate in the country increases back to normal. The exchange rate is not needed.

Following Mundell's analysis, most economists believe, for example, that the common currency area composed of the 50 states of the United States is close to an optimal currency area.[19] True, the first condition is not satisfied:

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18. This is the same Mundell who put together the "Mundell–Fleming" model you saw in Chapter 20.
19. Each U.S. state could have its own currency which freely floated against other state

Individual states suffer from different shocks. California is more affected by shifts in demand from Asia than the rest of the United States. Texas is more affected by what happens to the price of oil, and so on. But the second condition is largely satisfied. There is considerable labor mobility across states in the United States. When a state does poorly, workers leave that state. When it does well, workers come to that state. State unemployment rates quickly return to normal, not because of state–level macroeconomic policy, but because of labor mobility.

And there are clearly many advantages to the use of a common currency. For firms and consumers within the United States, the benefits of having a common currency are obvious; imagine how complicated life would be if you had to change money every time you crossed a state line. The benefits go beyond these lower transaction costs. When prices are quoted in the same currency, it becomes much easier for buyers to compare prices, and competition between firms increases, benefiting consumers. Given these benefits and the limited macroeconomic costs, it makes good sense for the United States to have a single currency.

In adopting the Euro, Europe has made the same choice as the United States. When the process of conversion from national currencies to the Euro ended in early 2002, the Euro became the common currency for at least 12 European countries (Look at the Focus box "The Euro. A Short History".) Is the economic argument for this new common currency area as compelling as it is for the United States?

There is little question that a common currency will yield for Europe many of the same benefits that it does for the United States. A report by the European Commission estimates that the elimination of foreign exchange transactions within the Euro area will lead to a reduction in costs of 0.5% of the combined GDP of these countries. There are also clear signs that

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currencies. But this is not the way things are: The United States is a common currency area, with one currency, the U.S. dollar.

the use of a common currency is already increasing competition. When shopping for cars for example, European consumers are now looking for the lowest Euro price anywhere in the Euro area. This has already led to a decline in the price of cars in a number of countries.

There is, however, less agreement on whether Europe constitutes an optimal common currency area. This is because neither of the two Mundell conditions appears to be satisfied. While the future may be different, European countries have experienced very different shocks in the past; recall German reunification, and how differently it has affected Germany and the other European countries. Furthermore, labor mobility is very low in Europe, and likely to remain low. Workers move much less *within* European countries than they do within the United States. Given the language and cultural differences between European countries, mobility *between* countries is likely to be even lower. The risk is therefore that, at some time in the future, one or more Euro members suffers from a large decline in demand and output, and can use neither the interest rate or use the exchange rate to increase activity. As we saw in Section 21–1, the adjustment will still take place in the medium run. But, as you also saw there, this adjustment may be long and painful. So far, such a pessimistic scenario has not yet taken place, but some economists worry that it will in the future.

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**Focus. The Euro. A Short History.**

- *As the European Union celebrated its 30th birthday in 1988, a number of governments decided that the time had come to plan a move to a common currency. They asked Jacques Delors, the President of the European Union to prepare a report, which he presented in June 1989.*
  *The Delors report suggested moving to a European Monetary Union*

(EMU) in three stages: Stage I was the abolition of capital controls. Stage II was the choice of fixed parities, to be maintained except for "exceptional circumstances". Stage III was the adoption of a single currency.

- Stage I was implemented in July 1990.

- Stage II started in 1994, after the exchange rate crises of 1992-1993 had subsided. A minor but symbolic decision involved choosing the name of the new common currency. The French liked "Ecu" (European currency unit), which is also an old French currency name. But its partners preferred **Euro**, and the name was adopted in 1995.

- In parallel, EU countries held referendums on whether they should adopt the **Maastricht treaty.** The treaty, negotiated in 1991, set three main conditions for joining the EMU: low inflation, a budget deficit below 3%, and a public debt below 60%. The treaty was not very popular and, in many countries, the outcome of the popular vote was close. In France, the treaty passed with only 51% of the votes. In Denmark, the treaty was rejected.

- In 1996-1997, it looked as if few European countries would satisfy the Maastricht conditions. But a number of countries took drastic measures to reduce their budget deficit. When the time came to decide, in May 1998, which countries would be members of the Euro, eleven countries made the cut: Austria, Belgium, Finland, France, Germany, Italy, Ireland, Luxembourg, the Netherlands, Portugal, and Spain. The United Kingdom, Denmark and Sweden decided to stay out, at least at the beginning. Greece did not qualify.

- Stage III started in January 1999. Parities between the 11 currencies and the Euro were "irrevocably" fixed. The new **European Central Bank** (ECB) based in Frankfurt became responsible for monetary policy for the Euro area. In 2001, Greece finally qualified and joined.

*From 1999 to 2002, the Euro existed as a unit of account but Euro coins and bank notes did not exist. In effect, the Euro area was still functioning as an area with fixed exchange rates. The next and final step was the introduction of Euro coins and bank notes in January 2002. For the first few months of 2002, national currencies and the Euro then circulated side by side, before national currencies were taken out of circulation later in the year.*

*Today, the Euro is the only currency used in the Euro area. The Euro area, as the group of member countries is called, has become a common currency area.*

*For more on the Euro, go to http://www.euro.ecb.int/*

*Picture of the Euro bills. (Source: ECB).*

**Hard Pegs, Currency Boards, and Dollarization**

The second case for fixed exchange rates is very different from the first. It is based on the argument that there may be times when a country may want to limit its ability to use monetary policy. We shall look at this argument in more detail in Chapter 23, where we look at the dynamics of hyperinflation, and in Chapter 25, where we look at monetary policy in general—but the essence of the argument is simple:

Look at a country which has had very high inflation in the recent past. This may be, for example, because it was unable to finance its budget deficit by any other means than through money creation, resulting in high money growth and high inflation. Suppose the country decides to reduce money growth and inflation. One way of convincing financial markets that it is serious about doing this is to fix its exchange rate: The need to use the money supply to maintain the parity then ties the hands of the monetary

authority. To the extent that financial markets expect the parity to be maintained, they will stop worrying about money growth being used to finance the budget deficit.

Note the qualifier "To the extent that financial markets expect the parity to be maintained". Fixing the exchange rate is not a magic solution. The country needs to convince financial investors that, not only is the exchange rate fixed today, but also that it will remain fixed in the future. This has two implications:

- Fixing the exchange rate must be part of a more general macroeconomic package. Fixing the exchange rate while continuing to run a large budget deficit will only convince financial markets that money growth will start again, and that a devaluation is soon to come.

- Making it symbolically or technically harder to change the parity may also be useful, an approach known as a **hard peg**.

  An extreme form of a hard peg is simply to replace the domestic currency with a foreign currency. Because the foreign currency chosen is typically the dollar, this is known as **dollarization**. Few countries are willing, however, to give up their currency and adopt the currency of another country[20] A less extreme way is the use of a **currency board**. Under a currency board, a central bank stands ready to exchange foreign currency for domestic currency at the official exchange rate; furthermore it cannot engage in open market operations, that is buy or sell government bonds.

  Perhaps the best known example of a currency board is that adopted by Argentina in 1991, but abandoned in a crisis at the end of 2001. The story is told in the Focus Box "Argentina's Currency Board". Economists differ on what conclusions one should draw from what happened in Argentina. Some conclude that currency boards are

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20. When Israel was suffering from high inflation in the 1980s, an Israeli finance minister proposed such a measure as part of a stabilization program. His proposal was perceived as an attack on the sovereignty of Israel, and he was quickly fired.

not *hard* enough: They do not prevent exchange rate crises. So, if a country decides to adopt a fixed exchange rate, it should go all the way and dollarize. Others conclude that adopting a fixed exchange rate is a bad idea. If currency boards are used at all, they should be used only for a short period of time, until the central bank has reestablished its credibility and the country returns to a floating exchange rate regime.

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**Focus Box. Argentina's Currency Board.**

*When Carlos Menem became President of Argentina in 1989, he inherited an economic mess. Inflation was running at more than 30% a month. Output growth was negative.*

*Menem and his economy minister, Domingo Cavallo, quickly came to the conclusion that, under these circumstances, the only way to bring money growth—and by implication, inflation—under control, was to peg the peso (Argentina's currency) to the dollar, and to do this through a very hard peg. So, in 1991, Cavallo announced that Argentina would adopt a currency board. The central bank would stand ready to exchange pesos for dollars, on demand. Furthermore, it would do so at the highly symbolic rate of one dollar for one peso.*

*Both the creation of a currency board and the choice of a symbolic exchange rate had the same objective: To convince financial markets that the government was serious about the peg. And to make it more difficult for future governments to give up the parity and devalue. And so, by making the fixed exchange rate more credible in this way, decrease the risk of a foreign exchange crisis.*

*For a while, the currency board appeared to work extremely well. Inflation, which had exceeded 2,300% in 1990, was down to 4% by 1994! This*

*was clearly the result of the tight constraints the currency board put on money growth. Even more impressive, this large decrease in inflation was accompanied by strong output growth. Output growth averaged 5% a year from 1991 to 1999.*

*Starting in 1999 however, growth turned negative, and Argentina went into a long and deep recession. Was the recession due to the currency board? Yes and no:*

- *Throughout the second half of the 1990s, the dollar steadily appreciated vis–a–vis other major world currencies. Because the peso was pegged to the dollar, the peso also appreciated. By the late 1990s, it was clear that the peso was overvalued, leading to a decrease in demand for goods from Argentina, a decline in output, and an increase in trade deficit.*

- *Was the currency board fully responsible for the recession? No; there were other causes. But the currency board made it much harder to fight it: Lower interest rates and a depreciation of the peso would have helped the economy recover; but, under the currency board, this was not an option.*

*In 2001, the economic crisis turned into a financial and an exchange rate crisis, along the lines we described in Section 21–2:*

- *Because of the recession, the fiscal deficit had increased, leading to an increase in government debt. Worried that the government might default on its debt, financial investors started asking for very high interest rates on government debt, making the fiscal deficit even larger, and, by doing so, further increasing the risk of default.*

- *Worried that the government would give up the currency board and devalue in order to fight the recession, financial investors started asking for very high interest rates in pesos, making it more costly for the government to sustain the parity with the dollar, and so making it more likely that the currency board would be abandoned.*

*In December 2001, the government defaulted on part of its debt. In early 2002, it gave up the currency board, and let the peso float. The peso sharply depreciated, reaching 3.75 pesos for 1 dollar by June 2002! People and firms which, given their earlier confidence in the peg, had borrowed in dollars found themselves with a large increase in the value of their debts in pesos. Many went bankrupt. The banking system collapsed. Despite the sharp real depreciation, which should have helped exports, GDP fell by 11% in 2002, unemployment increased to nearly 20%. Output growth turned positive in 2003, but it will take some time before GDP gets back to its 1999 level.*

*Does this mean that the currency board was a bad idea? Economists still disagree.*

- *Some argue that it was a good idea, but it did not go far enough. Argentina should have simply dollarized, i.e. adopted the dollar as the currency, and eliminated the peso altogether. By eliminating the domestic currency, this solution would have eliminated the risk of a devaluation. The lesson, they argue, is that even a currency board does not provide a sufficiently hard peg for the exchange rate. Only dollarization will do.*
- *Others argue that the currency board may have been a good idea at the start, but that it should not have been kept for so long. Once inflation was under control, Argentina should have moved from a currency board to a floating exchange rate regime. The problem is that Argentina kept the fixed parity with the dollar for too long, to the point where the peso was overvalued, and an exchange rate crisis was inevitable.*

*The debate is likely to go on. Meanwhile, Argentina has to reconstruct its economy.*

*(For more on Argentina, go to Nouriel Roubini's web site at www.stern.nyu.edu/globalmacro/ and go to the country page on Argentina)*

**Summary**

- Even under a fixed exchange rate regime, countries can adjust their *real* exchange rate in the medium run. They can do by relying on adjustments in the price level. Nevertheless, the adjustment may be long and painful. Exchange rate adjustments can allow the economy to adjust faster, and thus reduce the pain that comes from a long adjustment.

- Exchange rate crises typically start when participants in financial markets believe a currency may soon be devalued. Defending the parity then requires very high interest rates, with potentially large adverse macroeconomic effects. These adverse effects may force the country to devalue, even if there were no initial plans for such a devaluation.

- The exchange rate today depends on both (1) the difference between current and expected future domestic interest rates, and current and expected future foreign interest rates, and (2) the expected future exchange rate.

  Any factor which increases current or expected future domestic interest rates leads to an increase in the exchange rate today.

  Any factor which increases current or expected future foreign interest rates leads to a decrease the exchange rate today.

  Any factor which increases the expected future exchange rate leads to an increase in the exchange rate today.

- There is wide agreement among economists that flexible exchange regimes generally dominate fixed exchange rate regimes, except in two cases:

1. When a group of countries is highly integrated and forms an optimal currency area. (You can think of a common currency for a group of countries as an extreme form of fixed exchange rates among this group of countries.) For countries to form an optimal currency area, they must either face largely similar shocks, or there must be high labor mobility across these countries.

2. When a central bank cannot be trusted to follow a responsible monetary policy under flexible exchange rates. In this case, a strong form of fixed exchange rates, such as dollarization or a currency board, provides a way of tying the hands of the central bank.

**Key terms**
- gold standard
- float
- optimal currency area
- Euro
- Maastricht treaty
- European Central Bank (ECB)
- hard peg
- dollarization
- currency board

## Appendix. The Real Exchange Rate, and Domestic and Foreign Real Interest Rates.

We derived in Section 21–3 a relation between the current nominal exchange rate, current and expected future domestic and foreign nominal interest rates, and the expected future nominal exchange rate (equation [21.5]). This appendix derives a similar relation, but in terms of real interest rates and the real exchange rate. It then briefly discusses how this alternative relation can be used to think about movements in the real exchange rate.

### Deriving the Real Interest Parity Condition

Start from the nominal interest parity condition, equation (18.2):

$$(1 + i_t) = (1 + i_t^*)\frac{E_t}{E_{t+1}^e}$$

Recall the definition of the real interest rate from Chapter 14, equation (14.3):

$$(1 + r_t) \equiv \frac{(1 + i_t)}{(1 + \pi_t^e)}$$

where $\pi_t^e \equiv (P_{t+1}^e - P_t)/P_t$ is the expected rate of inflation. Similarly, the foreign real interest rate is given by:

$$(1 + r_t^*) = \frac{(1 + i_t^*)}{(1 + \pi_t^{*e})}$$

where $\pi_t^{*e} \equiv (P_{t+1}^{*e} - P_t^*)/P_t^*$ is the expected foreign rate of inflation.

Use these two relations to eliminate nominal interest rates in the interest-parity condition, so:

$$(1 + r_t) = (1 + r_t^*) \left[ \frac{E_t}{E_{t+1}^e} \frac{(1 + \pi_t^{*e})}{(1 + \pi_t^e)} \right] \qquad (21.A1)$$

Note from the definition of inflation that $(1 + \pi_t^e) = P_{t+1}^e / P_t$ and, similarly, $(1 + \pi_t^{*e}) = P_{t+1}^{*e} / P_t^*$.

Using these two relations in the term in brackets gives:

$$\frac{E_t}{E_{t+1}^e} \frac{(1 + \pi_t^{*e})}{(1 + \pi_t^e)} = \frac{E_t}{E_{t+1}^e} \frac{P_{t+1}^{*e}}{P_t^*} \frac{P_t}{P_{t+1}^e}$$

Reorganizing terms:

$$\frac{E_t}{E_{t+1}^e} \frac{P_{t+1}^{*e}}{P_t^*} \frac{P_t}{P_{t+1}^e} = \frac{E_t \; P_t / P_t^*}{E_{t+1}^e P_{t+1}^e / P_{t+1}^{*e}}$$

Using the definition of the real exchange rate:

$$\frac{E_t \; P_t / P_t^*}{E_{t+1}^e P_{t+1}^e / P_{t+1}^{*e}} = \frac{\epsilon_t}{\epsilon_{t+1}^e}$$

Replacing in equation (21.A1) gives:

$$(1 + r_t) = (1 + r_t^*) \frac{\epsilon_t}{\epsilon_{t+1}^e}$$

Or equivalently:

$$\epsilon_t = \frac{1 + r_t}{1 + r_t^*} \epsilon_{t+1}^e \qquad (21.A2)$$

The real exchange rate today depends on the domestic and foreign real interest rates this year, and the expected future real exchange rate next year. This equation corresponds to equation (21.4) in the text, but now in terms of the real rather than nominal exchange and interest rates.

**Solving the Real Interest Parity Condition Forward**

The next step is to solve equation (21.A2) forward, in the same way as we did it for equation (21.4), in the text. The equation above implies that the real exchange rate in year $t + 1$ is given by:

$$\epsilon_{t+1} = \frac{1 + r_{t+1}}{1 + r^*_{t+1}} \ \epsilon^e_{t+2}$$

Taking expectations, as of year $t$:

$$\epsilon^e_{t+1} = \frac{1 + r^e_{t+1}}{1 + r^{*e}_{t+1}} \ \epsilon^e_{t+2}$$

Replacing in the previous relation:

$$\epsilon_t = \frac{(1 + r_t)(1 + r^e_{t+1})}{(1 + r^*_t)(1 + r^{*e}_{t+1})} \ \epsilon^e_{t+2}$$

Solving for $\epsilon^e_{t+2}$ and so on gives:

$$\epsilon_t = \frac{(1 + r_t)(1 + r^e_{t+1})...(1 + r^e_{t+n})}{(1 + r^*_t)(1 + r^{*e}_{t+1})...(1 + r^{*e}_{t+n})} \ \epsilon^e_{t+n}$$

This relation gives the current real exchange rate as a function of current and expected future domestic real interest rates, of current and expected future foreign real interest rates, and of the expected real exchange rate in year $t + n$.

The advantage of this relation over the relation we derived in the text between the nominal exchange rate and nominal interest rates, equation (21.5), is that it is typically easier to predict the future real exchange rate than to predict the future nominal exchange rate. If, for example, the economy suffers from a large trade deficit, we may be fairly confident that there will have to be a real depreciation—that $\epsilon^e_{t+n}$ will have to be lower. Whether there will be a nominal depreciation—what happens to $E^e_{t+n}$—is harder to tell: It depends on what happens to inflation, both at home and

abroad over the next $n$ years.

## Appendix. Deriving Aggregate Demand under Fixed Exchange Rates

To derive the aggregate demand for goods, start from the condition for goods market equilibrium we derived in Chapter 20, equation (20.1)

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

This condition states that, for the goods market to be in equilibrium, output must be equal to the demand for domestic goods—that is, the sum of consumption, investment, government spending, and net exports.

Next, recall the following relations:

- The real interest rate, $r$, is equal to the nominal interest rate $i$ minus expected inflation $\pi^e$ (see Chapter 14):

$$r \equiv i - \pi^e$$

- The real exchange rate, $\epsilon$, is defined as (see Chapter 18):

$$\epsilon = \frac{EP}{P^*}$$

- Under fixed exchange rates, the nominal exchange rate $E$ is, by definition, fixed. Denote by $\bar{E}$ the value at which the nominal exchange rate is fixed, so:

$$E = \bar{E}$$

- Under fixed exchange rates and perfect capital mobility, the domestic interest rate $i$ must be equal to the foreign interest rate $i^*$ (see

Chapter 18):

$$i = i^*$$

Using these four relations, rewrite equation (21.1) as:

$$Y = C(Y - T) + I(Y, \ i^* - \pi^e) + G + NX(Y, \ Y^*, \ \frac{\bar{E}P}{P^*})$$

This is a rich—and complicated—equilibrium condition. It tells us that, in an open economy with fixed exchange rates, equilibrium output (or, more precisely, the level of output implied by equilibrium in the goods, financial, and foreign exchange markets) depends on:

- Government spending $G$, and taxes $T$. An increase in government spending increases output. So does a decrease in taxes.
- The foreign nominal interest rate $i^*$, minus expected inflation $\pi^e$. An increase in the foreign nominal interest rate requires a parallel increase in the domestic nominal interest rate. Given expected inflation, this increase in the domestic nominal interest rate leads to an increase in the domestic real interest rate, and so, decreases demand and output.
- Foreign output, $Y^*$. An increase in foreign output increases exports, so increases net exports. The increase in net exports increases domestic output.
- The real exchange rate, $\epsilon$, is equal to the fixed nominal exchange rate, $\bar{E}$, times the domestic price level, $P$, divided by the foreign price level, $P^*$. A decrease in the real exchange rate, equivalently a real depreciation, leads to an increase in net exports, and so, an increase in output.

We shall focus in the text on the effects of only three of these variables: the real exchange rate, government spending and taxes. So we shall write:

$$Y = Y(\frac{\bar{E}P}{P^*}, G, T)$$
$$= ( - , +, -)$$

All the other variables which affect demand are taken as given and, to simplify notation, are simply omitted from the relation. This gives us equation (21.1) in the text.

Equation (21.1) gives us the *aggregate demand relation*, the relation between output and the price level implied by equilibrium in the goods market and in financial markets.

Note that, in the closed economy, we had to use both the *IS* and the *LM* relations to derive the aggregate demand relation. Under fixed exchange rates, we do not need the *LM* relation. The reason is that the nominal interest rate, rather than being determined jointly by the *IS* and *LM* relations, is determined by the foreign interest rate. (The *LM* relation still holds, but, as we saw in Chapter 20, it simply determines the money stock.)
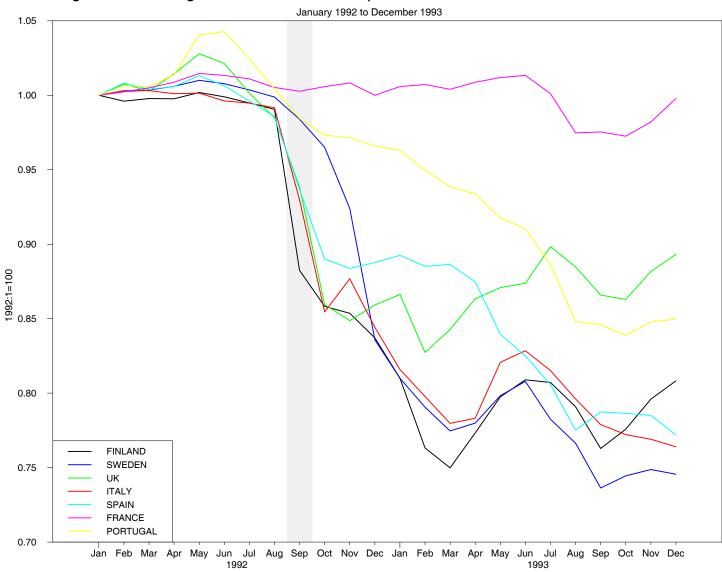
Figure 1. Exchange rates of selected European Countries vis a vis the Deutsche Mark

January 1992 to December 1993