9 Japan's Imbalance of Payments

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9.1 Introduction

9.1.1 Global Financial Imbalances

The financial imbalance between America and Asia has reached a critical level in recent years. Since the mid-1990s, the United States has been running an enormous deficit on its balance on current account (in recent years to the tune of $500 billion, or 6% of world trade), piling up foreign debt on an unprecedented scale. Among America's most generous lenders are the East Asian economies, particularly Japan and China. However, the sustained slide of the dollar that started in early 2002 is a sign that the country finds it now much harder than before to attract foreign capital.

That the dollar did not fall more quickly is in large part due to the heavy intervention by the central banks of Japan, China, Hong Kong, Taiwan, and South Korea, who have become passionate purchasers of American government debt of late. Collectively, these five central banks hold around $1.5 trillion in official reserves, almost half the global total, most of them in dollar assets; in 1990 for comparison, the same share had been only 24 percent. Between 2000 and 2004 China's reserves have tripled and Japan's doubled.

By now, many observers see a problem in those developments. They point out that by buying dollars and keeping the dollar strong, the Asian economies are delaying the inevitable adjustment in the US trade balance. In other words, allowing America to continue to accumulate foreign debt at an ever faster rate means that the eventual adjustment will be correspondingly bigger.

However, it would be wrong to portrait current developments as an isolated episode. What this chapter seeks to show instead is that the

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interaction between current account imbalances, capital flows and exchange rates is but a recurrent economic phenomenon. One country where this is particularly evident, and which this chapter focuses on, is Japan, the by far biggest economy in East Asia. Studying the experience of this country is interesting since it has been running the world's largest current account surplus since 1981, with strong fluctuations over the years. As we will see, there has been a close link between Japan's balance of payments and the movements of the yen.

9.1.2 *International Cash Flow and Exchange Rates*

An important hypothesis of this chapter is that international payment flows are a central determinant of exchange rates. In business terms, cash flow is the flow of liquid assets in and out of a company over a period of time, after deduction of expenses and debt service payments. Similarly one can think of a country's international cash flow as the sum of cross-border monetary payments arising from its commercial and financial transactions. Since a country's international cash flow shapes the demand and supply conditions of its currency in the foreign exchange market, we should expect it to play a central role in the determination of exchange rates.

In practice, the problem is that a country's cash flow cannot be easily measured. It is neither determined solely by the current account, nor solely by the capital account. Most of the monetary transactions are recorded in a subcategory of the financial account of the balance of payments, the so-called other investment balance. However, "other investment" also includes other, less liquid, means of international financing, such as bank loans. Disaggregated data are hard to come by, even for a country like Japan. This means that it is normally impossible to construct international cash flow series directly from balance of payments data.

This chapter develops a methodology to infer the likely movement of a country's cross-border payment flows from the joint fluctuations of its current account and debt balance. Applying the method to Japan, it finds that the Japanese cash flow variable traces the movements of the yen exchange rate remarkably well over recent decades.

9.1.3 *Plan of the Chapter*

The chapter is organized as follows. Section 9.2 develops a simple model to capture the dynamic interaction between the balance of pay-

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ments, international cash flow and the exchange rate, in particular, highlighting the role foreign debt and lending in the adjustment of the exchange rate. Section 9.3 provides time series evidence from Japan, Germany, and Korea corroborating the model's conclusions. Section 9.4 presents the methodology for simulating cross-border payment flows and applies it to the case of Japan. Section 9.5 considers the implications of the chapter's analysis for Japan's persisting economic crisis. Section 9.6 provides overall conclusions.

9.2 A Model of International Cash Flow

Most financial analysts and economic journalists carry in the back of their heads a basic model of international adjustment featuring a two-way feedback between the balance of payments of a country and its exchange rate. On the one hand, it is generally taken for granted that the real exchange rate influences the trade balance, and thus the current account. By making a country more competitive, a weak currency encourages exports and discourages imports and thus improves the trade balance. On the other hand, it is believed that current account surpluses, and likewise capital inflows, generate inflows of foreign currency, which push up a country's currency.

Leaving capital flows aside for a moment, the common premise is that there is a negative effect of the real exchange rate on the current account and a positive effect of the current account on the nominal exchange rate. These economic mechanisms are not new. For instance, both were already present in the traditional flow market model of the exchange rate, which was first formalized by Robinson (1937) and Machlup (1939, 1940). In this model the exchange rate is determined by the supply and demand conditions in the foreign exchange market, which in turn depend on the trade balance. Up to the 1970s the flow market model was very popular, and economists applying it spent considerable time estimating the exchange rate sensitivities of exports and imports in order to determine the equilibrium in the foreign exchange market. Although authors also considered various shifts of the supply and demand curves of the currency market, the model remained essentially static in nature (e.g., for textbook treatments, see Kenen 2000; Abel and Bernanke 2003).

The static nature of the flow market model is unsatisfactory for two reasons. First, empirical and theoretical evidence suggests that trade flows adjust only gradually to exchange rate changes (e.g., see Dixit 1989). Second, what we really want to know are answers to dynamic

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questions. For example, we are often interested to know for how long a current account deficit of a particular country will persist, or how fast its currency will depreciate. The duration and magnitude of a current account deficit matters, since it determines the amount of external finance a country requires. And the rate of depreciation matters, since a rapidly depreciating exchange rate calls for much larger economic adjustments than a gradually falling one.

In this section we will look at ways to model the bidirectional relationship between the current account and the exchange rate in a dynamic fashion. We will examine a simple benchmark model of an open economy in which the capital account of the balance of payments consists only of direct monetary payments, as well as a variant of the model where current account imbalances are financed by foreign debt.

9.2.1 A Benchmark Model

The benchmark model consists of the following equations:

$$s_t = -\xi c_t, \tag{1}$$

$$q_t = s_t, \tag{2}$$

$$z_t + c_t = 0, \tag{3}$$

$$z_t = z_{t-1} - \phi q_{t-1}, \tag{4}$$

where q_t is the real exchange rate, s_t is the nominal exchange rate, z_t is the current account, c_t is the monetary account, or minus the country's cash flow, and ξ and ϕ are positive constants. Note that the exchange rate is defined as the price of the domestic currency in terms of a foreign currency; that is, a rise in the nominal exchange rate implies a nominal appreciation of the currency, and similarly for the real exchange rate.

The four equations are interpreted as follows: Equation (1) assumes that the nominal exchange rate is driven by international payment flows in the foreign exchange market. The domestic currency appreciates when a country receives payments for its exports from abroad, and vice versa. (Note that the alternative assumption that exchange rates are driven by cumulative payment flows would also be plausible; however, it is not adopted here.) Equation (2) states that the real and nominal exchange rates are equal, implying similar inflation rates at home and abroad. Equation (3) is the balance of payments. The current

account balance, which comprises only the trade balance, is equal to the country's international cash flow since exports and imports are paid for in cash. Equation (4) describes the dynamic adjustment process of the current account. Net exports rise gradually when the local currency is cheap, and vice versa.

The model can be transformed into a first-order difference equation in the current account variable, z_t:

$$z_t = (1 - \phi\xi)z_{t-1}. \tag{5}$$

The solution to this equation is

$$z_t = A(1 - \phi\xi)^t, \tag{6}$$

where A is an arbitrary constant. The dynamic behaviour of the nominal and real exchange rate, s_t and q_t, and the international cash flow variable, c_t, is then readily derived from equations (1), (2), and (3). The movements of the current account and the international cash flow variable mirror each other, and up to a scaling factor, all variables follow the same dynamic process.

Three things are worth noting regarding the dynamic behaviour of the variables in this model. First, when the product of the model's coefficients is greater than one—that is, when $\phi\xi > 1$—the current account and all the other variables in the model start to oscillate from one period to the next. This is intuitive, since $\phi\xi$ is measuring the feedback between the current account and the exchange rate. When $\phi\xi > 1$, either international cash flow strongly influences the nominal exchange rate or the real exchange rate has a big impact on the current account, or both. So there may be cycles as an external surplus generates payment inflows that lead to a strong appreciation; this in turn gives rise to a deficit in the current account, and so on.

The parameters ϕ and ξ will generally take different values across countries and may even change over time. The parameter ϕ measures the exchange rate sensitivity of trade flows and depends for instance on the openness of a country, the shares of exports and imports relative to GDP and the degree of exchange rate pass-through. The parameter ξ describes the setting of the exchange rate in the foreign exchange market and may be related, among other things, to the level of intervention by the monetary authorities. It depends mostly on the institutional setting of the foreign exchange market and thus probably varies less than ϕ. However, given the worldwide liberalization of trade flows over the past decades, we should expect ϕ to have risen in many

countries. Large swings in the external accounts and in exchange rates are therefore more likely than they were a few decades ago.

The second point to note regarding the model's dynamics is its potentially explosive behavior. As soon as $\phi\xi$ exceeds two, mutual feedbacks reinforce each other so that the balance of payments and the exchange rate fluctuate more and more strongly over time. According to the model, countries are risking economic and financial instability when they open up their markets to the outside world.

A third and final conclusion from the model is that the current account, z_t, and the real exchange rate, q_t, are positively correlated. This theoretical finding is in direct contradiction to the widespread belief the relationship is negative, that is, that strong exports are associated with a weak, competitive exchange rate.

Thanks to its dynamic nature, this introductory model yields predictions that could not be obtained with the conventional flow market approach. Because of its fundamentally static perspective, the flow market model can neither account for dynamic adjustment paths—whether they are smooth, oscillatory, or explosive—nor does it in general predict a positive association between the current account and the exchange rate.

9.2.2 *A Model with International Debt*

Direct monetary payments form only a fraction of countries' financial transactions. Countries normally finance a large part of their external deficits by borrowing from abroad. The fact that gross foreign asset positions in a worldwide cross section of countries consist mostly of foreign loans rather than foreign equity (Kraay et al. 2000) implies that countries prefer trade credits, bank loans, or bond issuance to other forms of external finance. In the following model, which is a variant of the previous benchmark model, we therefore consider what happens when a country uses debt to cover its financing requirements.

Another assumption that we will adopt in the new model is that debt flows are accommodating imbalances on the current account side of the balance of payments. This is in line with the old view that the capital account adjusts to movements in the current account, rather than vice versa (Keynes 1929). The assumption is still often realistic despite the recent rise in capital mobility worldwide. However, as our empirical examples in the next section will show, there are occasions

when capital flows are obviously moving in an independent fashion. Further below, we will discuss the implications of such autonomous capital flows.

Accommodating debt flows can be introduced into the previous model as follows:

$$s_t = -\xi c_t, \tag{7}$$

$$q_t = s_t, \tag{8}$$

$$z_t + d_t + c_t = 0, \tag{9}$$

$$d_t := d_t^1 - d_{t-1}^1, \tag{10}$$

$$c_t = d_{t-1}^1, \tag{11}$$

$$z_t = z_{t-1} - \phi q_{t-1}, \tag{12}$$

where d_t is the debt balance in the balance of payments and d_t^1 is the flow of foreign debt with a one-period maturity that is created in period t. Equations (7), (8), and (12) are the same as equations (1), (2), and (4), respectively. Equation (9) is the balance of payments, which now includes the debt balance. Equation (10) defines the debt balance as the difference between newly incurred foreign debt and foreign debt incurred in period $t-1$ and falling due in period t. Equation (11) states that in each period, all of the debt incurred in the previous period is repaid.

It should be noted that the assumption that foreign debt has a fixed, one-period maturity is made for simplicity only and that it does not affect the model's conclusions. Moreover it is always possible to redefine the maturity length by changing the unit of time, say from one year to two years or to six months.

In analyzing the model, we observe that equations (9), (10), and (11) imply that countries pay for their imports and receive payments for their exports always after one period:

$$c_t = -z_{t-1}. \tag{13}$$

The deferred payments imply that the model can now be reduced to a second-order difference equation in the current account variable, z_t:

$$z_t = z_{t-1} - \phi\xi z_{t-2}. \tag{14}$$

As long as $\phi\xi > \frac{1}{4}$, the solution to this equation is the following trigonometric function:

$$z_t = B_1 r^t \cos(\theta t + B_2), \tag{15}$$

where

$$r := \sqrt{\phi\xi},$$

$$\theta := \arccos\left(\frac{1}{2\sqrt{\phi\xi}}\right),$$

$$\theta \in [0, \pi].$$

There are important parallels, as well as differences, between this model, which incorporates international debt flows, and the previous model, which assumed away those flows. First, the variables of the model are again moving in a cyclical fashion. In contrast to the previous model, however, oscillating behavior occurs already when the product of ϕ and ξ exceeds one-fourth. The higher tendency of the variables to move in a cyclical manner results from the desynchronization of the current account and the exchange rate: A strong current account, for instance, produces payment inflows in the next, rather than the current, period. Consequently it takes longer for the exchange rate to appreciate and to reverse the export boom. Eventually though, the trade balance, and thus the current account, move into deficit. The same process starts again, this time with opposite sign.

The cyclical movements occur even if the exchange rate sensitivity of trade flows is low or if the influence of changing demand and supply conditions in the currency market on the exchange rate is weak. Low values of the parameters ϕ and ξ simply mean that the mutual, nonsynchronous feedbacks between the current account and the exchange rate are weaker, making the adjustments of those variables more protracted and their cycles longer. In fact, since θ is proportional to the frequency of those cycles, and since the product of the parameters, $\phi\xi$, is positively related to θ, it follows that the frequency of the cycles, say ω, rises with the value of that product. Whereas ω was one-half in the previous model—the variables were oscillating from one period to the next, completing one cycle in two periods—it is easily established that in the model with international debt, ω will always be less than one-half.

The second parallel between this and the previous model concerns the stability of the solution. The present model becomes unstable when the product of ϕ and ξ exceeds one. In the previous model by contrast, the corresponding condition was that the product had to be

greater than two. In other words, balance of payments and exchange rate fluctuations are potentially less stable when countries borrow from, and lend to, each other. Intuitively, international borrowing and lending delays the—inevitable—adjustment of the exchange rate. Therefore balance of payments imbalances can grow larger, implying eventually even bigger exchange rate changes.

A third and final aspect in which the two models are comparable concerns the correlation between the current account and the exchange rate. In the previous model, we established a positive, contemporaneous correlation between both variables. In the model with international debt, the positive relation still holds, except that the exchange rate now lags the movements of the current account. In the following section we will see that the delayed response of the exchange rate to current account movements is an empirically important phenomenon. For terminological simplicity we will refer to it as the adjustment delay.

9.2.3 *Accommodating versus Autonomous Capital Flows*

When a country's capital flows are autonomous—that is, not just adapting to the country's financing needs—the analysis obviously changes. We will not enter upon a formal analysis here (for a dynamical system analysis, see Müller-Plantenberg 2004) but rather build on the intuition from our previous two models.

Autonomous capital flows are driven by a variety of factors. Whatever the underlying cause, capital inflows induce extra cash flow for the recipient country, which pushes up the domestic currency. Capital outflows have just the opposite effects.

Depending on their intensity, capital flows will generally distort the cyclical movements of the current account and exchange rate. Consider capital inflows, for example. By keeping the currency strong, capital inflows can make a current account deficit more persistent. Moreover, apart from the exchange rate channel, capital inflows often coincide with booms in domestic consumption and investment (Calvo, Leidermann, and Reinhart 1996) and thus have adverse effects on the current account (which is defined as the gap between a country's savings and investment).

When a country receives significant capital inflows, we should therefore not be surprised to see an appreciation of the currency even though the current account is weak or deteriorating. On the other hand, due to the buildup of foreign claims we should expect an even

bigger adjustment of the exchange rate sooner or later—once capital flows cease or when they become insufficient to finance the external deficit.

9.3 Empirical Evidence

The purpose of this section is to compare the time series evidence on Japan's external performance with the theoretical predictions of the previous section. To anticipate the outcome, the model with international debt of the previous section fits the data remarkably well—better than one might have expected in fact, given that one would never expect economic relationships to match the real world exactly. This section also takes a look at a number of other countries and episodes to show that the model's conclusions hold elsewhere, too.

9.3.1 Japan

Over the last half-century the yen has been appreciating persistently, in nominal and in real terms. This development has attracted considerable attention, and various theories for it are on offer. What has also been remarkable—and what consequently merits an explanation as well—is that there have been massive fluctuations of the Japanese currency over the years. For instance, between 1985Q3 and 1988Q4, the yen's value shot up by 61 percent in trade-weighted terms (39 percent in the year from 1985Q3 through 1986Q3 alone). In the 1990s, to take another example, the yen rose by 52 percent from 1992Q3 through 1995Q2, then dropped by 35 percent in the following three years through 1998Q3, only to be pushed up once more by 40 percent in the two years thereafter. Fluctuations of these magnitudes can be observed all the way back to the early 1970s when the yen started to float.

Current Account and Exchange Rate Movements

The model in section 9.2 suggests that the large swings in the yen were primarily the result of similarly impressive movements of the Japanese current account. Consider figure 9.1, which plots the current account balances (in US dollar terms) of a number of countries that have, at some stage, achieved high surpluses during the past twenty-five years. It is evident that Japan's surplus—which mirrored the equally impressive current account deficit of the United States—has dwarfed the surpluses of all its competitors; even Germany's export boom of the 1980s

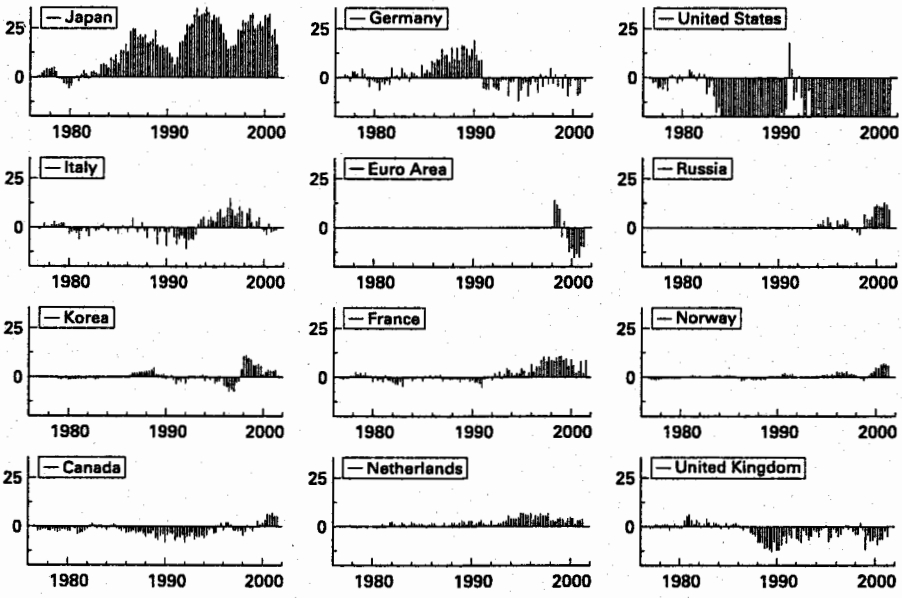

Figure 9.1
Large current account surpluses from 1977Q1 to 2001Q3. Current account balances of countries with large current account surpluses are in billions of US dollars. Countries are selected and ordered according to the highest current account balance they achieved in any single quarter. Source: IMF, *International Financial Statistics*.

appears modest compared with what Japan achieved during the last two decades.

Figure 9.2 illustrates the link between the current account and the nominal effective exchange rate in Japan. It plots the time series of both variables over a period of more than thirty years. As in the text, the nominal exchange rate is defined as the foreign currency price of the domestic currency, that is, a rise in the nominal exchange rate implies an appreciation of the domestic currency.

A remarkable feature of the data is the recurrent oscillation of both variables. The current account, in particular, experienced five large upswings and downswings, with clear turning points. The exchange rate went through similar upward and downward movements. In general, the exchange rate seems to have followed the movements of the current account, normally with a lag of up to two years. Another way to see this is by noting that the exchange rate increased most strongly in the years when the current account reached a peak. These peaks occurred in 1971–1972, 1977–1978, 1985–1986, 1992–1993, and in 1999.

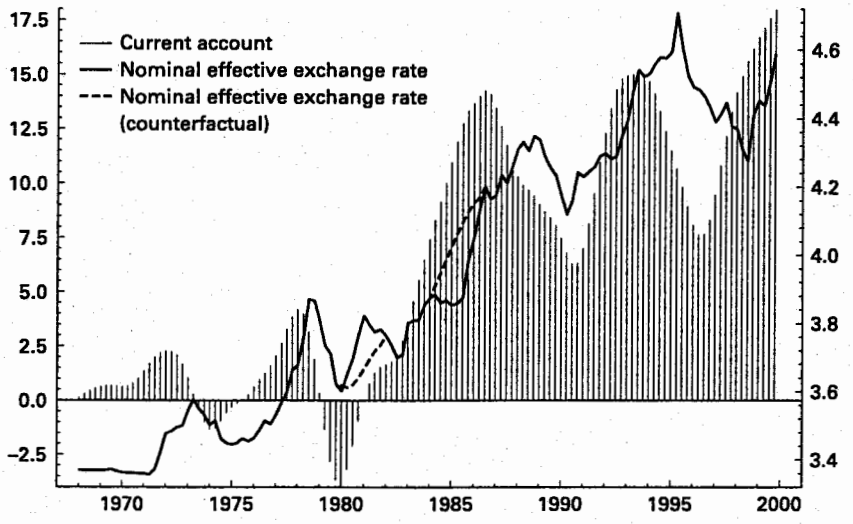

Figure 9.2
Japanese current account and counterfactual exchange rate. Japanese current account (left scale) in trillions of yen, transformed from biannual to quarterly frequency data using a natural cubic spline smooth, and nominal effective exchange rate (right scale, in logarithms) from 1968Q1 to 1999Q4. The exchange rate is plotted along with counterfactual estimates for 1980Q1 to 1981Q4 and 1984Q2 to 1986Q2 when measures to liberalize Japan's capital account started to take effect. The counterfactual series was calculated by removing the exchange rate observations during years of increased capital in- and outflows and filling the missing values with the estimates from a natural cubic spline smooth based on all remaining observations. Sources: OECD, *Economic Outlook*, IMF, *International Financial Statistics*, and own calculations.

The time series plot in figure 9.2 thus confirms central predictions of the model in section 9.2.2. First, we can observe that the current account and exchange rate are jointly going through long cycles. Second, the exchange rate is positively correlated with the current account during those swings. Third, the exchange rate has lagged the current account due to the adjustment delay.

Liberalization of the Capital Account

Important changes were brought to Japan's economic environment in the early and mid-1980s when the country opened its financial markets to the outside world. The tight regulation of the financial system, which Japan had maintained from the end of World War II to the mid-1970s, was significantly reduced in two phases. The first phase of liberalization started in the late 1970s when the Japanese—concerned about the yen's extraordinary appreciation in 1977 and 1978—began to re-

move restrictions on foreign purchases of domestic assets. However, when the yen depreciated rapidly in 1979, the Japanese moved quickly to reduce controls on capital inflows, making it possible for foreigners to hold Japanese securities (Frankel 1984). The liberalization of capital inflows appears to have been particularly effective: portfolio inflows rose substantially between 1980Q1 and 1981Q4, putting upward pressure on the yen.

The second phase of liberalization started when the Japanese—following requests of the US Treasury—began to remove restrictions on international capital flows further in May 1984. This time the removal of capital controls triggered strong capital outflows, mainly between 1984Q2 and 1986Q2, contributing to the remarkable strength of the US dollar at the time.

The capital flows that were set off by the Japanese liberalization measures are typical examples of autonomous capital flows. No one knows how the yen would have behaved without those additional flows. However, figure 9.2 illustrates what happens when we remove the exchange rate data during the episodes of increased capital inflows and outflows and simply link up the remaining observations. Manipulating the original exchange rate series in this way, what we obtain is a counterfactual exchange rate series that follows the movements of the current account even more smoothly. Instead of being subject to various shifts as in the original time series, the yen is now appreciating steadily between 1980 and 1988 and gradually following the movement of the current account during the early and mid-1980s.

The model with accommodating capital flows from section 9.2.2 thus seems to be confirmed once more. Another prediction of the model—namely that the introduction of debt flows can lead to greater cyclical movements of the variables over time—appears to be borne out by the data, too: the swings in the Japanese current account have by and large become greater over time.

9.3.2 Other Countries

We conclude this section by considering evidence from a few other countries. One conclusion from the model in section 9.2.2 was that the cycle frequency should increase with the product of the two parameters, ϕ and ξ. Note that ϕ is measuring the impact of the exchange rate on net exports. We said that this parameter should rise with a country's share of trade in GDP, since a proportional change in exports and

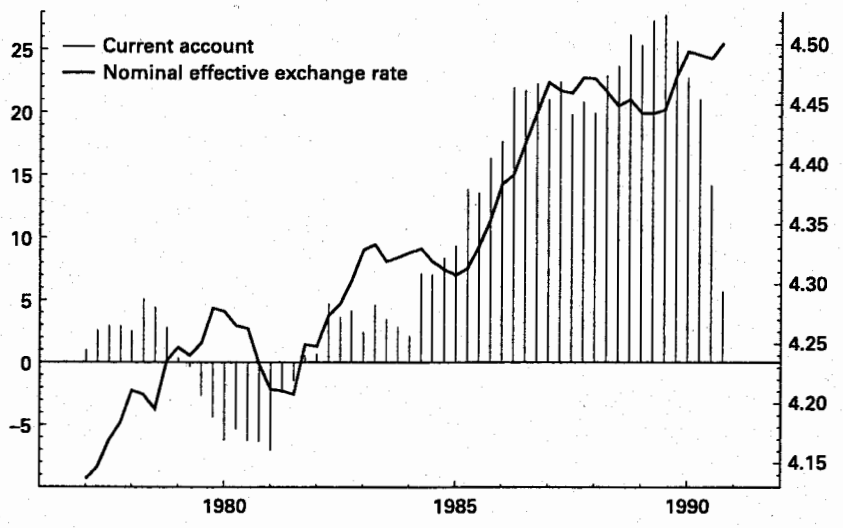

Figure 9.3
German current account and nominal exchange rate in the 1980s. German current account (left scale, in German marks) and nominal effective exchange rate (right scale, in logarithms) from 1977Q1 to 1990Q4. Source: IMF, *International Financial Statistics*.

imports leads to a greater movement in the trade balance when this share is large than when it is small.

Between 1980 and 2003 Japan's shares of exports and imports relative to GDP have been 10 and 8 percent respectively on average. Now consider Germany, the world's next-strongest export performer, where the same shares were 26 and 23 percent. From figure 9.3 we see that Germany experienced similar swings in the current account and the exchange rate during the 1980s. In line with our theoretical prediction, however, the swings were of a higher frequency—and thus of a shorter duration—than in Japan.

Another aspect of the theoretical model for which we find even more evidence in the data of other countries is the role of autonomous capital flows. An interesting example is South Korea, Japan's neighbor. Figure 9.4 plots the Korean current account and exchange rate series, with the data spanning almost two and a half decades. Throughout the whole period current account deficits are accompanied by (or due to the adjustment delay followed by) depreciations of the won, and vice versa. This is true for the two episodes during which the Korean currency declined substantially—first in 1985–1986 and later in 1987 during the Asian crisis—and likewise for the two episodes during

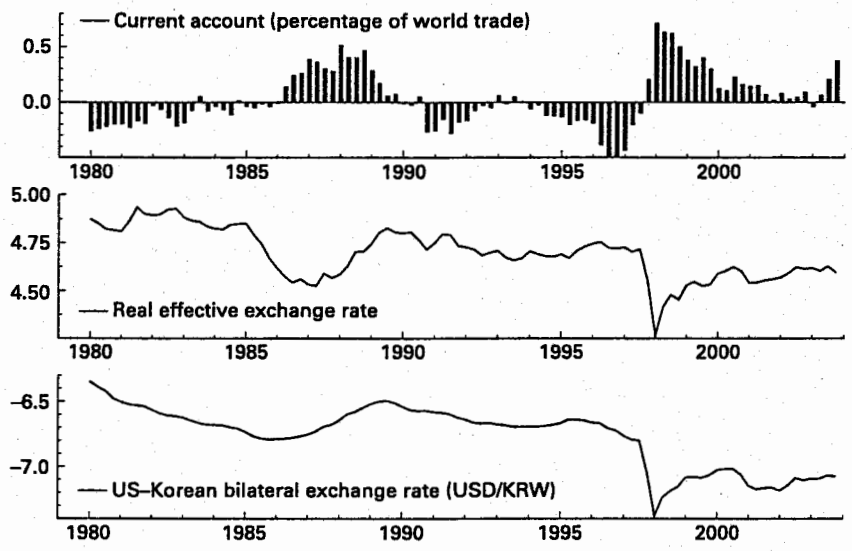

Figure 9.4
Korea's current account and exchange rate. South Korean current account, South Korean real effective exchange rate, and US–Korean bilateral exchange rate from 1980Q1 to 2003Q3. The current account variable is measured as a percentage of world trade. Sources: OECD, *Economic Outlook* and *Main Economic Indicators*.

which the currency rose strongly—namely in the late 1980s, from 1958 to 2000. What merits attention, though, is the fact that the won kept strong during most of the 1990s despite a rapidly worsening current account deficit. Clearly, the explanation lies in the strong private capital inflows that Korea and other East Asian economies received in the years before the Asian crisis (Grenville 1998). In keeping the won strong, these capital inflows contributed to the deterioration of the current account. The inevitable result was the Korean currency crisis in 1987, which was made worse through the panic among foreign investors.

Looking at currency crises more generally, it is rather common that countries run large current account deficits prior to their crises, which are only sustained due to large capital inflows. When capital inflows dry up, however, the national currencies tend to get into trouble. Eichengreen (2003, ch. 8) and Bussiere and Mulder (1999), for instance, have shown that a small set of variables—including the current account as a percentage of GDP, export growth, international reserves, and short-term foreign debt relative to reserves—do a very good job in predicting the EMS crisis in 1992–1993, the Mexican crisis in 1994–1995 as well as the Asian crisis in 1997.

As a final example of how autonomous capital flows matter for a country's external performance, consider the United States. In the early 1980s a massive deficit emerged in the US current account balance. Thanks to strong capital inflows, the dollar appreciated considerably until 1985. In that year, however, the adjustment could no longer be delayed, with the result of a sustained depreciation of the dollar, which lasted several years. An even larger deficit in the US current account developed in the latter half of the 1990s. Again, the deficit did not seem to harm the dollar, which once more kept on appreciating. Yet things eventually changed in early 2002 when the dollar started to depreciate rapidly.

9.4 Simulating International Cash Flow

9.4.1 A Model of International Cash Flow

The goal of this section is to simulate the flows of monetary payments between Japan and the rest of the world. For this purpose the following empirical model has been set up. As in the theoretical models of section 9.2, z_t denotes the current account, d_t the debt balance, and c_t the flow of cross-border payments, or cash flow. Suppose that current account transactions in a given period are either immediately paid for or financed through debt of different maturities:

$$\begin{aligned} c_t^0 &= -\mu_0 z_t, \\ d_t^1 &= -\mu_1 z_t, \\ d_t^2 &= -\mu_2 z_t, \\ d_t^3 &= -\mu_3 z_t, \\ &\dots, \end{aligned} \tag{17}$$

where debt issued in period t is indexed by its maturity and denoted as d_t^i, with $i = 1, 2, \dots, \infty$. Debt maturity is defined here as the actual, or ex post, maturity. For example, if foreign debt held by Japanese investors has a one-year maturity and is rolled over twice, the actual maturity is taken to be three years.

Consequently cash payments in any given period have to be made for part of the current commercial transactions as well as for any debt falling due:

$$
\begin{aligned}
c_t^0 &= -\mu_0 z_t, \\
c_t^{-1} &= d_{t-1}^1, \\
c_t^{-2} &= d_{t-2}^2, \\
c_t^{-3} &= d_{t-3}^3, \\
&\ldots.
\end{aligned} \tag{18}
$$

Here c_t^{-i} represents that part of the cash flow in period t that results from debt issued i periods ago. It follows from equations (17) and (18) that the overall cash flow in period t depends on all the present and past current account balances:

$$
c_t = \sum_{i=0}^{\infty} c_t^{-i} = -\mu_0 z_t + \sum_{i=1}^{\infty} d_{t-i}^i = -\sum_{i=0}^{\infty} \mu_i z_{t-i}. \tag{19}
$$

The debt balance, d_t, is the sum of the debt incurred in period t, less all debt repaid in that period:

$$
\begin{aligned}
d_t &= \sum_{i=1}^{\infty} d_t^i - \sum_{i=1}^{\infty} c_t^{-i} \\
&= -\sum_{i=1}^{\infty} \mu_i z_t + \sum_{i=1}^{\infty} \mu_i z_{t-i}.
\end{aligned} \tag{20}
$$

The debt balance is thus also a function of present and past current account balances:

$$
d_t = \sum_{i=0}^{\infty} \alpha_i z_{t-i} = \alpha(L) z_{t-i}, \tag{21}
$$

where

$$
\alpha_0 = -\sum_{i=1}^{\infty} \mu_i \quad \text{and} \quad \alpha_j = \mu_j \quad \text{for } j = 1, 2, \ldots. \tag{22}
$$

In equation (21), L is the lag operator and $\alpha(L) = \alpha_0 + \alpha_1 L^1 + \alpha_2 L^2 + \cdots$.

The problem is that the cash flow variable, c_t, is not directly observed. As mentioned in the introduction, payment flows across international borders do not enter the balance of payments as a separate

item. Instead, they enter various subcomponents. For example, some cash flows, such as changes in bank balances, appear in the "other investment" item in the financial account. However, "other investment" also includes trade credits and loans, thus making it impossible to infer cash flow movements from the movements of "other investment" balance unless disaggregated data is available.

With knowledge of μ_i, $i = 1, 2, \ldots$, however, c_t can be indirectly obtained from equation (19). For $i = 1, 2, \ldots$, the parameters μ_i coincide with the parameters α_i of the infinite lag polynomial in equation (21).

In principle, the current account, z_t, and the debt balance, d_t, could fluctuate independently over time, as long as the gap between the two is made up by movements in other components of the capital account. However, our goal is to simulate the international cash flow of Japan and, as figure 9.5 shows, in this country both the current account and the debt securities balance have moved quite closely together over time. This suggests that other balance of payment components

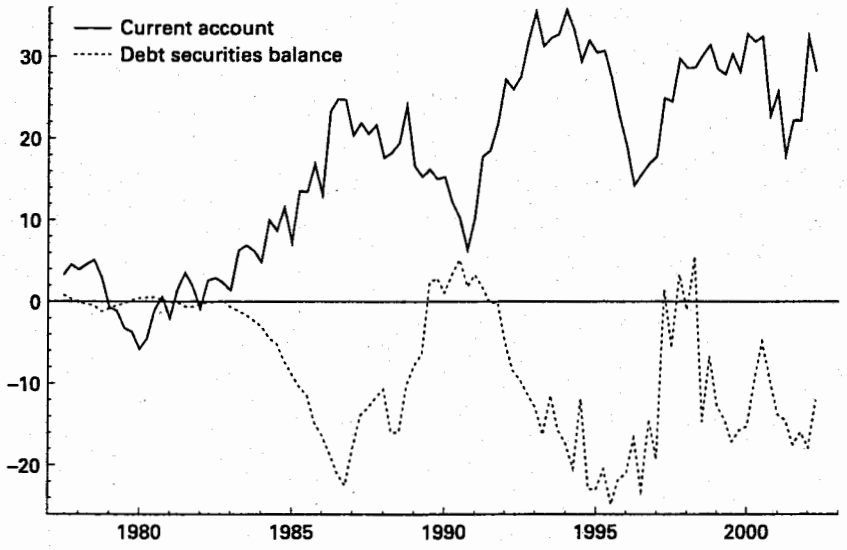

Figure 9.5
Current account and lending to Japan from 1970 to 1998. Japanese current account (left scale) and debt balance (right scale, with reversed sign) in billions of US dollars. The debt balance is defined as the sum of the debt securities balance, other investment, and net errors and omissions. Sources: IMF, *International Financial Statistics*, and Lane and Milesi-Ferretti (1999).

canceled each other out, at least roughly; thus, to keep things simple, they are not further considered here.

The reader might wonder why only the debt securities balance is considered at this point. It is certainly the case that the overall debt balance, d_t, contains other components, such as trade credits and loans, in addition to debt securities. The simple reason for not considering those items is that the data for Japan are incomplete. While ignoring certain flows of foreign debt is of course not very satisfactory, it should be pointed out that the debt securities balance—for instance, as recorded through the huge purchases of American bonds by the Japanese now and in the past—has arguably been the most important debt-related item in Japan's balance of payments in the recent decades.

Augmented Dickey-Fuller tests (not reported) show that the null hypothesis of a unit root cannot be rejected for z_t nor for d_t (where d_t is from now on taken to comprise flows of debt securities only). While individually $I(1)$, the Japanese current account and debt securities balance appear to be cointegrated, that is, a linear combination of both variables exists that is $I(0)$. To test for cointegration, Johansen's (1988) procedure is applied, and it is found that the null hypothesis of no cointegration can be rejected at the 1 percent significance level (see table 9.1).

From these results the relationship between the two balance of payments components can be modeled as an autoregressive distributed lag (ARDL) model:

$$d_t = \kappa + \sum_{i=1}^{p} \gamma_i d_{t-i} + \sum_{i=0}^{q} \beta_i z_{t-i} + \varepsilon_t, \qquad \varepsilon_t \sim N(0, \sigma^2). \tag{23}$$

The infinite lag polynomial in equation (21) can then be obtained by dividing the distributed lag polynomial by the autoregressive lag polynomial of the ARDL model:

Table 9.1
Testing for cointegration

H_0	H_A	Trace test	p-Value
$r = 0$	$r > 0$	22.750	[0.003]**
$r \leq 1$	$r > 1$	2.2928	[0.130]

Notes: Testing for the number of distinct cointegrating vectors, using 2 lags. Double asterisks (**) mark significance at the 1 percent level.

$$\alpha(L) = \frac{\beta(L)}{\gamma(L)}, \tag{24}$$

where $\gamma(L) = 1 - \gamma_1 L - \gamma_2 L^2 - \cdots - \gamma_p L^p$ and $\beta(L) = \beta_0 + \beta_1 L + \cdots + \beta_q L^q$.

Quarterly data from 1977 to 2002 were used in the estimation. The data were taken from the IMF's Balance of Payments Statistics. The lag lengths, p and q, in the ARDL model were both set to 3.

9.4.2 Simulation Results

The values of c_t were now simulated, based on equations (19), (22), and (24). Note that we do not have an estimate of μ_0. The solution adopted here is to simply set it equal to α_0, suggesting that current accounts are financed to one-half by direct cash payments, to the other half by debt. This is but a convenient assumption; it was found that raising μ_0 above or below this value does not affect the results too much.

Quarterly data on the Japanese current account from 1968Q1 to 1999Q4 were used in the simulation. These data had previously been constructed from a biannual current account series contained in the OECD's Economic Outlook database. Only the first 8 lags of the polynomial $\alpha(L)$ were used for the simulation, to avoid losing too many observations for the simulation.

The outcome of the simulation is shown in figure 9.6. The movements of Japan's international cash flow coincide remarkably closely with those of the Japanese exchange rate. The mean lag of $\alpha(L)$, which indicates the average maturity of foreign debt, is 1.653 quarters. The figure also plots net sales of Japanese reserve assets, which appear relatively small compared with the aggregate cash flow facing the Japanese economy.

9.5 Japan's Economic Stagnation

If the proposition underlying the previous three sections is correct—namely that the yen's nominal exchange rate was, by and large, driven by trade and capital flows over the years—what does this imply for the analysis of Japan's current economic problems? And what should we think of proposals to devalue the yen to revive the Japanese economy?

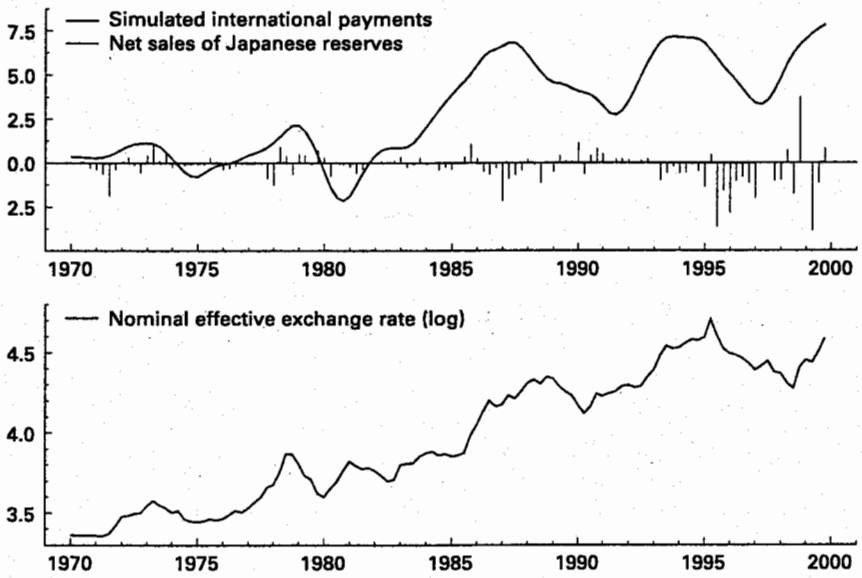

Figure 9.6
Japan's imbalance of payments. Simulated net international payments to Japan, as an indicator of yen order flow, shown together with net sales of reserves (top panel, in trillions of yen, reserve sales drawn as index bars), and nominal effective exchange rate (bottom panel, in logarithms). Sources: OECD, *Economic Outlook*, IMF, *International Financial Statistics*, and own calculations.

9.5.1 The Downside of Success

A Hard Landing

Japan has for a long time been admired across the globe for its economic performance, in particular, for its international competitiveness and export strength. The traditionally high saving rate helped Japan to become the largest creditor nation in the world. The unhappy end of this success story is now evident to everyone. The analysis of this chapter can shed some light on where the downside of success lies.

As I suggested earlier, notwithstanding other factors, Japan's large and sustained current account surpluses are at the root of its current economic problems. By pushing up the yen very strongly over decades, the Japanese government has contributed to the deflationary pressures from which the economy has been suffering from for quite some time.

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Of course, removing the external surplus would fix the problem according to the logic applied here. Yet the current account is not a policy variable, and at any rate a strong demand for Japanese exports seems to provide a welcome stimulus for the economy. Policy makers naturally look for other kinds of remedies, namely for measures they can potentially control.

What Scope for Monetary Policy?

Consider monetary policy. With interest rates hitting zero, the Bank of Japan's only way to induce money growth is to keep printing money. But the BOJ has already bought government bonds, and thus created money, on a large scale. The monetary base has increased at an annual rate of almost 25 percent over the two years to 2003 (*The Economist*, June 19, 2003). Yet this has not led to higher growth in broad money. Instead, bank lending has continued to fall. Banks are reluctant to lend, as they are already piled up with bad loans, a problem that is only slowly being overcome. Moreover indebted firms are unwilling to borrow as long as the deflation environment persists.

An equally important question is whether monetary policy had been too strict prior to the crisis, and thus to what extent it could have been contributing to the overly strong yen. This chapter cannot give a detailed answer to this question. However, an examination of the data suggests that money growth in Japan was actually quite strong in comparison with other countries. According to the OECD's Economic Outlook, the money stock in Japan grew at an annual average of 9.1 percent from 1970 to 2000, compared with 7.3 percent and 7.8 percent in the United States and Germany respectively. For comparison, the volume of GDP in Japan rose on average by 3.2 percent per year, whereas in the United States and Germany, it increased by 2.9 and 2.7 percent, respectively.

There is an interesting parallel to currency crises. In the aftermath of such crises, it is tempting to put the blame on fiscal and monetary policies for being too loose. Yet during the currency crises of the 1990s, macroeconomic policies prior to those crises had been considered sound in many of the countries affected. Instead, currencies collapsed following sharp withdrawals of foreign funds after long periods of foreign lending. There is thus a lesson for Japan. When external imbalances start to shift the relative demand for national monies, it can be just as hard to defend a currency as to keep it from rising.

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9.5.2 *Devalue the Yen?*

Many economists advocate a big depreciation of the yen through intervention in the foreign exchange markets in the current situation (e.g., Svensson 2001). Japanese prices have been falling since 1995, and devaluation is viewed by many as one of the few policy tools left to fight deflation. First, a cheaper yen would boost exports, and this would stimulate the economy. Second, through higher import prices, it would presumably push up inflation, stimulating consumption and investment and decreasing the real value of debt in the economy. However, given that Japan's imports account for only 10 percent of GDP, an ordinary devaluation would not suffice—it would have to be substantial.

The rest of this section will address two questions: First, is a devaluation of the yen feasible? And second, how much would it help, or might it even be harmful?

Magnitude of Intervention

Using foreign exchange intervention to lower the yen seems straightforward. All there is to do for the Japanese authorities is to print large amounts of yen to buy dollar bonds. So isn't this the point where the parallels with currency crises end? When a central bank tries to support a currency, it quickly runs out of reserves. In Japan, however, it would appear that intervention does not face similar limitations.

Yet the facts are that Japan has been acquiring reserves on an unprecedented scale in recent years. What is more, Japan's share of all reserves held worldwide has risen substantially since 1993, as can be seen from figure 9.7. Interestingly, reserve holdings by other industrial countries have declined sharply over the same period. Out of industrial countries' reserves, Japan now holds a share of 45.6 percent (2001M11), up from only 12.0 percent nine years back (1992M9).

In the past, strong appreciations of the yen were almost always associated with increases in reserves. Yet even large interventions did not appear to help much to prevent the yen from rising. From the empirical analysis in this chapter, it is clear why. Consider once more figure 9.6, which plots the simulated cash flow together with the changes in Japanese reserves. The impression is that intervention has seldom been more than a small fraction of the economywide payments across the border. It is therefore not surprising that their impact should have been limited.

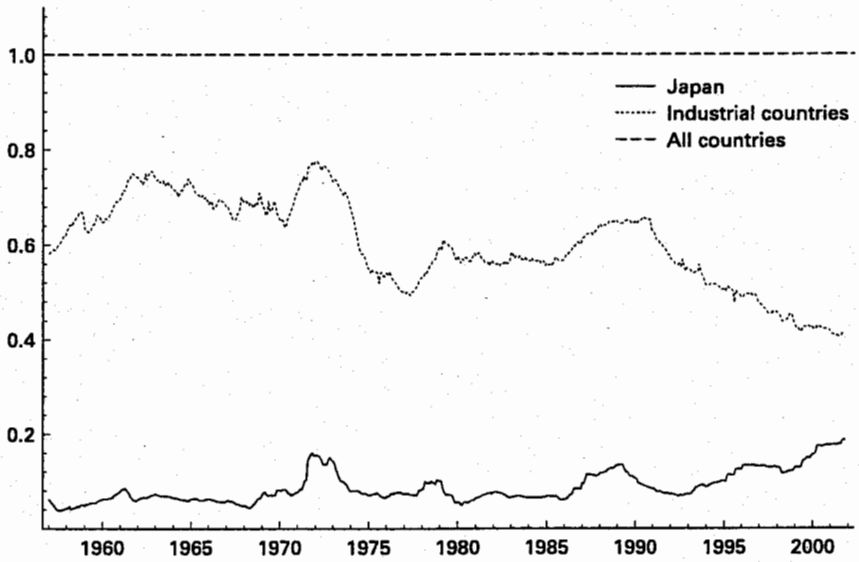

Figure 9.7
Japan's share of world reserves. Japan's share of total reserves of all countries, plotted alongside the industrial countries' share of worldwide reserves (monthly data, excluding gold reserves). Source: IMF, *International Financial Statistics*.

What do the actual market participants think? Cheung and Wong (2000) have recently carried out a survey of practitioners in the interbank foreign exchange markets of Hong Kong, Tokyo, and Singapore. They find that the participants in the Tokyo market "have the most pessimistic views on intervention in terms of restoring equilibrium values, being conducted at the right moment, and achieving the goal." Of the respondents in the Tokyo market, 68.1 percent did *not* think that central bank intervention achieved its goal, whereas in the Hong Kong and Singapore markets, 60.8 and 58.7 percent, respectively, believed that it *did*.

Undesired Effects

When Japan hit an export boom in the past, it usually sent the inflowing revenues abroad straightaway, for example, by investing in US Treasury bonds. It was not until the foreign debt became due that the exchange rate appreciated, just as the model of section 9.2.2 would predict. This is what needs to be kept in mind when contemplating a large-scale intervention to bring down the yen. Intervention needs to

be perpetuated if it is to be effective; otherwise, interest and amortization payments will soon undo its initial effects.

There is also another potential "boomerang" effect that could take effect after a devaluation and that needs to be taken into account. From the model in section 9.2.2, we know that if efforts to devalue the yen succeed, this may spur exports and thus create another wave of incoming cash flow. The relationship between the real exchange rate and current account is not a simple one for Japan—after all, its current account surplus has kept rising despite the long-term appreciation of the yen. However, Müller-Plantenberg (2003) has recently shown that large real exchange rate changes did tend to bring about reversals of the temporary trends of the Japanese current account (rather than its level). Thus once devaluation succeeds to create another export boom, an appreciation of the yen should soon follow. It will not have to come immediately—as we know by now. But it will come.

9.6 Conclusions

Over a long period of time the Japanese exchange rate has followed the movements of the current account quite closely. Long swings in the current account translated into similar swings in the exchange rate. In general, export booms pushed up the yen, while slumps in net exports made it fall. However, it often took some time—usually up to one or two years—until the exchange rate had fully adjusted.

This chapter suggests that flows of international payments between Japan and the rest of the world have been a crucial driving force behind the yen. Importantly, these flows are related to the balance of payments. For instance, current account transactions that have to be paid for straight away lead to an instantaneous flow of cash, whereas debt-financed transactions can give rise to a flow of payments that is spread out over time.

Japan, the world's largest creditor, has used the proceeds of its current account surpluses primarily to lend abroad, investing heavily in foreign debt securities. This chapter shows how it is possible to estimate the maturity structure of this lending based on the information contained in the current account and debt balances. It uses the maturity structure of foreign lending to simulate international payment flows and shows that their movements are remarkably similar to those of the Japanese exchange rate.

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These findings lead directly to the question of whether the present economic crisis in Japan could have been averted or whether something can be done to overcome it. Here the answer is a cautious one. It is pointed out that the strong yen and the deflationary pressure to which it contributed are not necessarily the result of bad policy making. A parallel is drawn to experiences in the 1990s when countries were hit by currency crises, even though they had, in more than one instance, followed sound fiscal and monetary policies. Likewise it is found that the large-scale acquisition of reserves is unlikely to fix the problem. Japan has, as a matter of fact, amassed foreign exchange reserves on an unprecedented scale over recent years.

Going beyond Japan, the findings of this chapter point to a number of potential economic fallacies. They concern fundamental questions such as whether the real exchange rate is driven by the nominal exchange rate, particularly at longer horizons, or vice versa; whether and how exchange rates are linked to economic fundamentals (Meese and Rogoff 1983); or why it is that deviations from purchasing power parity are so large and persistent (Rogoff 1996).

In recent decades the world has witnessed an ever greater integration of its national economies and financial markets. At the same time industrial countries have reduced their inflation rates and committed themselves to inflation levels close to zero. A conclusion of this chapter is that large external imbalances can have a strong and persistent impact on the exchange rates of different monies. Differences in inflation rates are both an outcome of this—as a result of the pass-through of exchange rates on import prices—and a requirement to overcome lasting real exchange rate misalignments. Thus Japan's inflation rate has stayed almost 2 percent below the weighted inflation rate of its trading partners for many years. While low international inflation rates are widely welcomed, one should not overlook that they have likely contributed to Japan's present condition, which is marked by deflation and stagnation.

9.7 Appendix

Data

The data used in this chapter were taken from the *Balance of Payments Statistics* and *International Financial Statistics* of the IMF and from the *Economic Outlook* of the OECD.

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Software

The computations for this chapter were carried out using Ox, version 3.0 (see Doornik and Ooms 2000) and PcFiml (see Doornik and Henry 1997). The programs are available from the author upon request.

Acknowledgments

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