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No. 140, December 1980

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EXCHANGE-RATE POLICY,  
MONETARY POLICY, AND  
REAL EXCHANGE-RATE VARIABILITY

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INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS

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Princeton, New Jersey

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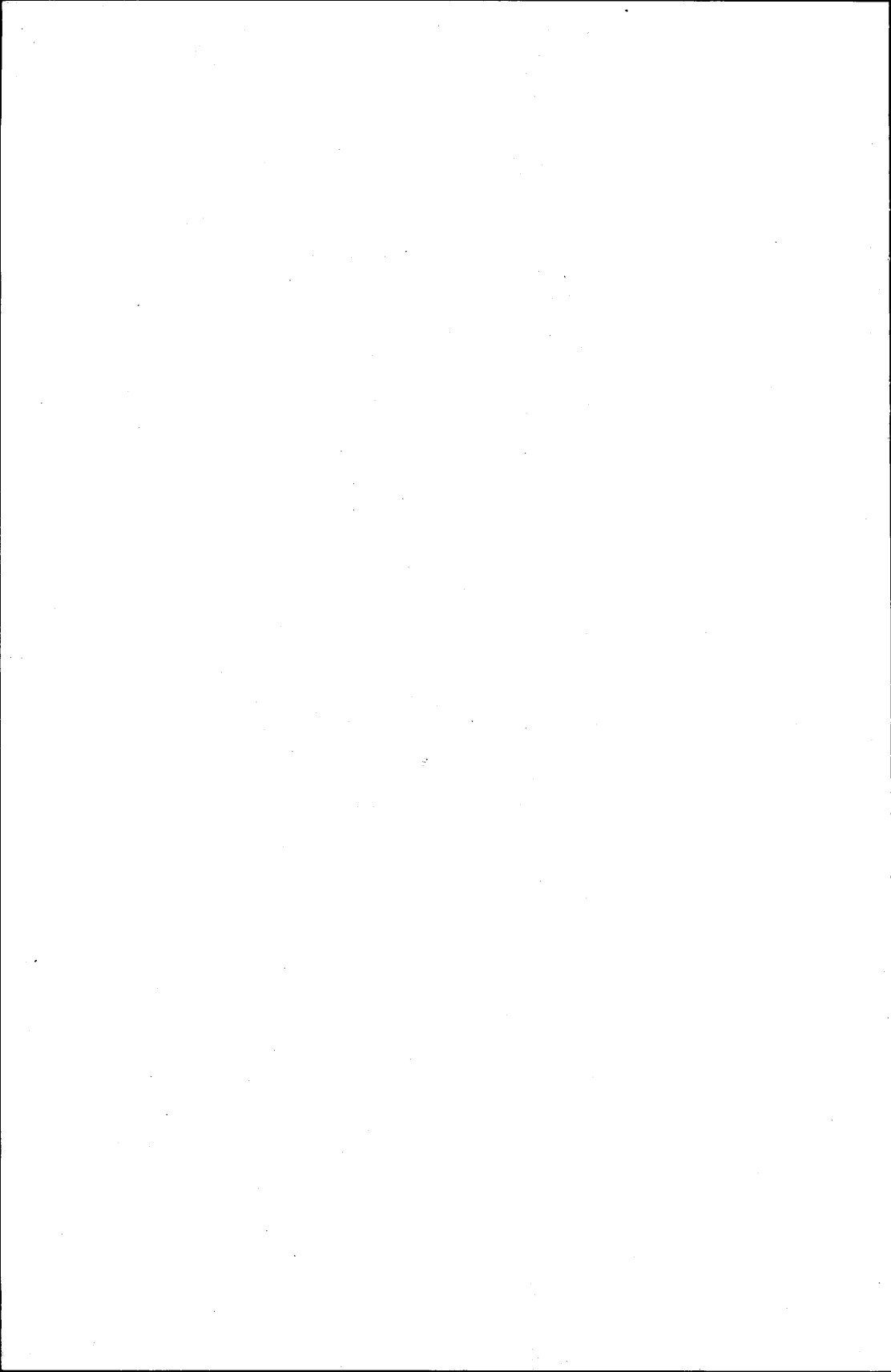
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## 1 Introduction

In this essay I discuss in broad outline the main sources of the exchange-rate variability that characterized the 1970s. I try to distinguish between the sources of nominal exchange-rate movements, such as differential growth rates of money per unit of output, and the sources of real exchange-rate movements, such as the discovery and exploitation of North Sea oil and natural gas. Following that, I consider the possible role of monetary policy in preventing such nominal and real exchange-rate movements from occurring or affecting the spot rates of exchange. Specifically, I want to raise these questions: What monetary policies are required to obtain exchange-rate and price-level stability? Are pegged-parity arrangements like the current EMS of any help in this respect? Is exchange-rate stability compatible with price-level stability and, if not, which is more important? Finally, can exchange-rate changes be instrumental in changing a country's competitive position and equilibrating its balance of payments?

## 2 Sources of Exchange-Rate Variability

Most economists seem to agree that the sources of change in the spot (or market) rate of exchange between two monies are both nominal and real.<sup>1</sup> Nominal changes in exchange rates occur when the rate of inflation differs between countries. For instance, if the rate

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A slightly different version of this paper was presented at the conference on Exchange Rate Policy organized by the Centre for Banking and International Finance of the City University of London in October 1980. It will appear in a conference volume edited by Geoffrey E. Wood and Roy A. Batchelor entitled *Exchange Rate Policy—The U.K. Options for the 1980s*, to be published by Macmillan, London.

<sup>1</sup> I prefer not to follow the common terminological practice of calling the spot (or market) rate of exchange the nominal exchange rate. Instead I separate changes in the spot rate of exchange into a nominal and a real component. Changes in the spot rate of exchange between the currencies of two countries are called nominal if they reflect nominal sources: diverging inflation rates between countries. Changes in the spot rate of exchange are called real if they reflect real sources: diverging developments in technology, resources, institutions, and trading patterns between countries. With  $e$  the spot rate of exchange (defined as the number of domestic currency units per unit of foreign currency),  $p$  the domestic price level,  $p^*$  the foreign country's price level,  $er$  the real exchange rate defined as  $er = e/(p/p^*)$ , and with hats ( $\hat{\cdot}$ ) indicating percentage rates of change, it follows that  $\hat{e} = \hat{er} + (\hat{p} - \hat{p}^*)$ , where  $\hat{er}$  reflects the real sources and  $(\hat{p} - \hat{p}^*)$  the nominal sources of change of the spot rate of exchange.

of inflation in the United Kingdom is persistently above that of its trading partners, and the German rate of inflation is persistently below that of its trading partners, then the pound sterling will depreciate and the deutsche mark will appreciate against the currencies of these trading partners at a rate reflecting the relevant inflation differentials. The reason is that investors continuously reshuffle their portfolios by shifting out of assets denominated in currencies that are weak and into assets that are strong in terms of expected purchasing power. But even if inflation rates are the same everywhere, real changes in exchange rates between currencies may occur owing to specific diverging structural developments between countries, such as international shifts in technology and trading patterns. For instance, if North Sea oil is discovered in the United Kingdom and natural gas in the Netherlands and these fuels are subsequently exported abroad, replacing energy imports, then the pound and the guilder will tend to appreciate against all other currencies. And if international demand for tradables shifts away from the exportables produced by the United Kingdom toward those of its trading partners, the pound will depreciate against the other currencies. Finally, if productivity in the British tradables sector grows more slowly than productivity in its non-tradables sector, the pound will tend to depreciate against all other currencies.

Before proceeding, let us pause to look at the evidence on the nominal and real sources of exchange-rate changes. Columns (1) to (3) of Table 1 tell the story. Column (1) shows the speed with which the spot exchange rates of the major Economic Community currencies and the dollar changed against the DM on average over the period 1970-79. In part the changes in these spot exchange rates are nominal and can be attributed to inflation differentials with respect to Germany, but in part they are real and cannot be attributed to these differentials. The real changes are shown in column (2). For each country, the difference between columns (1) and (2) equals that country's average inflation differential with Germany. Average inflation rates during the period 1970-79 are shown in column (3). As an example, let us look at the British-German inflation-exchange-rate complex. From 1970 to 1979, the pound depreciated at an average annual rate of 9.4 per cent, whereas the average annual British inflation rate exceeded the German inflation rate by 7.7 percentage points. The average annual rate of depreciation of the pound against the DM of 9.4 per cent thus consisted of a *nominal* annual rate of depreciation of 7.7 per cent and a *real* annual rate of depreciation of 1.7 per cent. As a result of real forces, the pound depreciated against the DM at



TABLE 1  
EXCHANGE-RATE MOVEMENTS, INFLATION, MONETARY EXPANSION, AND OUTPUT GROWTH  
IN THE MAIN EC COUNTRIES AND THE UNITED STATES, 1970-79

(average annual percentage rate of change)

| Country         | Rate of Appreciation (-)<br>or Depreciation (+) of<br>Currency against the DM |  | Rate of<br>Consumer<br>Price<br>Inflation | Growth<br>Rate of<br>Money<br>Supply (M1) | Growth<br>Rate of<br>Gross Real<br>Domestic<br>Product | Growth<br>Rate of<br>Real<br>Output<br>Growth <sup>b</sup> | Money<br>Growth in<br>Demand<br>Excess of<br>Real<br>Money-<br>Demand<br>Growth<br>(4) - (6) | Inflation/<br>Money<br>Ratio<br>(3)/(7) | Inflation<br>Consistent<br>with Stable<br>Spot<br>Exchange<br>Rates<br>against<br>the DM <sup>c</sup> | Money<br>Growth<br>Consistent<br>with Stable<br>Spot<br>Exchange<br>Rates<br>against<br>the DM<br>[(9)/(8)] + (6) |
|-----------------|---|--|---|---|--|--|--|---|---|---|
|                 | Spot<br>Exchange<br>Rate<br>(1)   | Real<br>Exchange<br>Rate <sup>a</sup><br>(2) |   |   |  |  |  |   |   |   |
| Belgium         | 2.3   | 0.1  | 7.1                                       | 7.9                                       | 3.8  | 2.8  | 5.1  | 1.39                                    | 4.8   | 6.3   |
| Denmark         | 4.2   | -0.2   | 9.3                                       | 10.1                                      | 2.6  | 2.9  | 7.2  | 1.29                                    | 5.1   | 6.8   |
| France          | 5.9   | 1.9  | 8.9                                       | 10.2                                      | 4.0  | 3.6  | 6.6  | 1.35                                    | 3.0   | 5.8   |
| Germany         | —   | —  | 4.9                                       | 9.8                                       | 3.2  | 3.5  | 6.3  | 0.78                                    | 4.9   | 9.8   |
| Italy           | 11.2  | 3.8  | 12.3                                      | 19.6                                      | 3.1  | 7.4  | 12.2   | 1.01                                    | 1.1   | 8.5   |
| The Netherlands | 1.8   | -0.8   | 7.5                                       | 10.2                                      | 3.5  | 4.2  | 6.0  | 1.25                                    | 5.7   | 8.8   |
| United Kingdom  | 9.4   | 1.7  | 12.6                                      | 12.7                                      | 2.2  | 2.9  | 9.8  | 1.28                                    | 3.2   | 5.4   |
| United States   | 8.1   | 5.9  | 7.1                                       | 5.9                                       | 2.9  | 1.5  | 4.4  | 1.61                                    | -1.0  | 0.9   |

<sup>a</sup> The real rate of appreciation (-) or depreciation (+) of a country's currency against the DM is calculated by subtracting from the rate of change of that country's spot exchange rate against the DM (col. 1) its rate of inflation (col. 3) and adding to it the German rate of inflation.

<sup>b</sup> Calculated by multiplying the long-run real income elasticity of a country's demand for money (M1) by the average growth rate of its output. The values of the real income elasticities of the demand for money used are 0.75 for Belgium, 1.10 for Denmark, 0.90 for France, 1.10 for Germany, 2.40 for Italy, 1.20 for the Netherlands, 1.30 for the U.K., and 0.50 for the U.S. These values are taken from various sources: own estimates; OECD (1979, p. 41); and Fase and Kuné (1975, pp. 414-416).

<sup>c</sup> Calculated by subtracting from the German rate of inflation the rate of change of each country's real exchange rate against the DM in col. (2).

SOURCES: IMF, *International Financial Statistics*, August 1979-October 1980; Commission of the EC, *Annual Economic Review 1978/79*; Federal Reserve Bank of St. Louis, *International Economic Conditions*, June 1979; OECD, *Quarterly National Account Bulletin IV 1979* and *Economic Outlook*, December 1979.

a faster rate than the inflation differential between the two countries would have led one to expect.

From columns (1) to (3) a number of additional observations can be made:

1. It appears that on average all currencies depreciated against the DM in nominal terms during the 1970s.

2. There were wide differences in the rate at which currencies depreciated against the DM, with the Belgian franc, the Danish krone, and the Dutch guilder depreciating at low speed, and the Italian lira, the U.K. pound, and the U.S. dollar depreciating at high speed.

3. Whereas the spot exchange rates of the EC currencies against the DM moved largely to accommodate inflation differences with Germany (nominal changes), the spot exchange rate of the dollar against the DM moved largely to accommodate structural shifts in productivity and trade patterns (real changes).

4. Whereas all currencies depreciated against the DM in nominal terms, the currencies of Denmark and the Netherlands slightly appreciated against the DM in real terms.

5. The dollar depreciated against the DM in real terms faster than any of the other currencies reviewed, implying that during the 1970s all EC currencies appreciated on average against the dollar in real terms.

Let us summarize our findings. During the 1970s, spot-rate movements of most EC currencies against the DM were in large part nominal, whereas spot-rate movements of most EC currencies against the dollar were for the most part real. Exchange-rate stability against the DM thus would largely involve turning off the nominal sources of exchange-rate changes, whereas exchange-rate stability against the dollar would largely involve turning off the real sources. The policy questions then are: Can either nominal or real sources be turned off at all, and, if so, what would that mean for policy and policy cooperation?

### **3 The Sources of Nominal Exchange-Rate Changes**

If spot exchange rates between the currencies of countries change to accommodate the differences in the countries' inflation rates, what are the causes of inflation? There is wide agreement among economists that a country's inflation rate mirrors the rate at which it produces money relative to the rate at which it produces goods and services. Broadly speaking, if money is persistently produced faster than real

output, the result is inflation. More precisely, if the money supply persistently grows faster than the real demand for money arising from growth of real output, the inevitable result is inflation.<sup>2</sup> Whether the monetary authorities produce money too fast in order to finance a war or the welfare state, to keep interest rates low or exchange rates fixed, or to prevent wage claims in excess of productivity from being translated into unemployment, the unavoidable consequence of monetary growth persistently in excess of output growth is inflation.

Let us pause once again to look at the evidence. Columns (3) to (5) of Table 1 summarize the inflation rate, the growth rate of money, and the growth rate of output that actually occurred in the EC economies and the United States on average during the period 1970-79. Increases in production raise the demand for money balances. For each country, the rate at which its real demand for money increased on average during the 1970s as a result of real output growth is given in column (6). Actual monetary growth in excess of growth of the real demand for money determines a country's *underlying* (or potential) rate of inflation.<sup>3</sup> From column (7) of Table 1, it appears that in all countries reviewed money has grown much faster on average during the 1970s than has the real demand for money. When the *actual* average rate of increase of prices for each country during the 1970s in column (3) of Table 1 is compared with the *potential* (or underlying) rate of inflation in column (7), two conclusions emerge: (1) Roughly speaking, a country's inflation rate in large part mirrors the excess of that country's money growth over its output growth. (2) Again roughly speaking, inflation differentials between most countries are in large measure due to differences in the rates at which countries produce money relative to output.

#### 4 Turning Off the Sources of Nominal Exchange-Rate Variability

In order to turn off the nominal exchange-rate changes that are a major source of variability in spot exchange rates, inflation differentials among the EC countries and between these countries and the United States must be eliminated. This raises a basic issue of coordination of monetary policy among these countries—agreement on the common inflation rate at which each country should aim in order to

<sup>2</sup> The exchange-rate effects of differential growth rates of domestic and foreign money and domestic and foreign output are further investigated in Bomhoff and Korteweg (1980).

<sup>3</sup> It is assumed here that changes in interest rates and their effects on velocity can be disregarded in the long run.

produce at least *nominal* exchange-rate stability. A common inflation rate of zero per cent, implying price-level stability everywhere, would in my view be the most desirable. But consensus on a zero inflation rate may be difficult to reach. The next best consensus inflation rate for current and prospective EMS members would seem to be what Germany, as the hegemonial-currency country, has frequently stated to be its maximum tolerable level of inflation, 2 per cent per year.

How can EMS members reach such a low common inflation rate? Since, as we have seen, inflation is the result of too much money chasing too few goods, each country could bring its inflation rate under control by measures aimed at reducing the trend rate of monetary expansion and raising the trend rate of real output growth. To get some idea of the kind of monetary policy required, it may be illustrative to calculate the money growth rates that would have produced a common average inflation rate of 2 per cent as well as nominal exchange-rate stability in the EC countries and the United States during the 1970s. Columns (6) to (8) provide the answer. For a common 2 per cent average inflation rate, monetary expansion would have had to exceed the rate of increase in the real demand for money because of real output growth by about 2.5 percentage points on average in Germany, 2 percentage points in Italy, 1.6 percentage points in the Netherlands, 1.5 percentage points in Denmark, France, and the United Kingdom, 1.4 percentage points in Belgium, and 1.2 percentage points in the United States.<sup>4</sup> It follows that rates of monetary growth would have had to be much lower and much closer to one another, on average, than they actually were, ranging from 4.2 to 6.0 per cent per year for most EC countries except Italy, from 2 to 3 per cent per year for the United States, and from 9 to 10 per cent per year for Italy.

The most promising way for countries to reduce their inflation rates to a common level of 2 per cent and keep them there would seem to be to adopt a *monetary rule*. Such a rule would imply a policy of stable and preannounced rates of monetary expansion for each country

<sup>4</sup> The inflation/money ratios in column (8) were used to calculate these numbers. This involves the assumption that the ratios of  $\hat{V}$  to  $\hat{M} - \eta\hat{y}$  that actually prevailed from 1970 to 1979 in the countries mentioned would have been the same if these countries had expanded their money supplies at the rates specified. (Here,  $\hat{V}$  is the growth rate of velocity,  $\hat{M}$  the growth rate of money,  $\hat{y}$  the growth rate of output, and  $\eta$  the real income elasticity of the demand for money.) From what we know empirically about the determinants of the demand for money, this assumption does not seem too heroic, although it comes close to violating the hypothesis of rational expectations.

that would be roughly equal to the rate at which the real demand for its money increases as a result of normal growth in output plus the common 2 per cent inflation rate.

A first condition for the success of such a policy is that it be followed by all countries. If, say, only Germany and the Netherlands practiced monetary discipline and achieved low rates of inflation, the result might be a rising foreign demand for DM and guilders and appreciation of these currencies. This would leave insufficient monetary growth to satisfy the rising domestic demand for both currencies that would result from a 2 per cent inflation target and a growth target for output of, say, 3 per cent. The prospect of a recession in Germany and the Netherlands owing to the rising international demand for DM and guilders would greatly increase political pressure to raise their monetary growth targets or abandon them altogether, whereas the proper reaction would be for these countries to stick to their monetary targets by accommodating the increase in foreign demand for their currencies.<sup>5</sup> Indeed, such a series of events in 1978 made Germany and Switzerland temporarily abandon their monetary growth targets and led to an unfortunate acceleration of their inflation rates in 1979.

A second condition for the success of monetary targets is that policy-makers be able to convince the public at large that they will be steadfast in generating no more money than is compatible with their declared inflation-growth objectives. If policy-makers start out by moderating monetary expansion but the major market participants are convinced that the authorities, out of fear of recession, will in the end validate any wage and price setting that is agreed to, then a policy of moderate monetary growth will indeed lead to recession.

## 5 The Sources of Real Exchange-Rate Changes

The real exchange rate between the currencies of two countries is defined as the spot exchange rate between the domestic and foreign currencies divided by the ratio of the domestic country's price level and the foreign country's price level,  $e/(p/p^*)$ .<sup>6</sup> Changes in the real exchange rate can therefore occur only when developments affect the spot exchange rate *differently* from the price-level ratio between the two countries. In other words, real exchange-rate changes are those changes in the spot rate that cannot be attributed to inflation differentials between the two countries but instead reflect specific struc-

<sup>5</sup> The usual practice in Europe is to formulate monetary targets in terms of monetary aggregates that do *not* include nonresident money holdings.

<sup>6</sup> See footnote 1.

tural differences in real economic performance between these countries. Let us try to trace the effects of certain developments on the real exchange rate between the currencies of two countries under freely fluctuating spot exchange rates.<sup>7</sup>

We start with the real exchange-rate effects of an *unstable monetary policy*. A sudden unforeseen acceleration or slowdown in a country's rate of monetary expansion will affect its spot exchange rate immediately; because of sticky wages and prices, its inflation rate will not respond until later on. A sudden monetary acceleration, by raising a country's spot exchange rate faster than its inflation rate, will produce a temporary rise in its real exchange rate (i.e. a real currency depreciation). And a sudden monetary slowdown, by lowering a country's spot rate faster than its inflation rate, will produce a temporary fall in its real exchange rate (i.e. a real currency appreciation).<sup>8</sup>

Suppose there is a *rise in the growth rate of a country's productivity in manufactured tradable goods* relative to its productivity in manufactured nontradables. Total output starts rising faster, inducing faster growth in the demand for real money balances. Given the country's rate of monetary expansion, output will grow faster than demand for it. As a result, there is less inflation and prices rise more slowly for both tradable and nontradable goods. Since competition in the world market tends to ensure that traded-goods prices denominated in a common currency are the same everywhere, the country's currency starts to appreciate. The rate of appreciation must exceed the (falling) rate of inflation, since (assuming the same wages are paid in the tradables and nontradables sectors) faster productivity growth in the tradables sector implies a fall in the prices of tradables relative to nontradables. Rising productivity growth in a country's tradables sector thus leads to real appreciation of its currency against all other currencies, a reaction known as the Balassa effect.

Now suppose there is a *shift in international demand* toward a country's traded goods and away from its competitors. Such a shift affects neither the country's rate of monetary growth nor its rate of output growth, given full capacity. As a result, inflation is unaffected. The increased international demand for the country's tradables at

<sup>7</sup> For some empirical results on the determinants of real exchange-rate movements, see Bomhoff and Korteweg (1980). See also the Mathematical Appendix below.

<sup>8</sup> An unstable demand for money has real exchange-rate effects analogous to an unstable monetary policy. A sudden unexpected decline in the demand for a country's money will produce a temporary rise in its real exchange rate, while a sudden unexpected increase in demand will produce a temporary fall.

given world market prices leads to a surplus on its current account and, consequently, to an accumulation of foreign assets for which there is no demand at the going exchange rate. To restore portfolio balance, the prices of these foreign assets expressed in the country's currency have to fall. By implication, the country's spot exchange rate starts to fall against all other currencies, thereby raising the value of its currency against all others. With the inflation rate unaffected, a shift in international demand toward a country's tradables thus results in a real appreciation of that country's currency.

Next, suppose there is a *rise in a country's labor costs* relative to those of its competitors, owing to rapid growth of social security taxes. Faster-rising labor costs will lower profits. One result will be a lower growth in the output of both tradables and nontradables. With the rate of monetary expansion unchanged, lower output growth brings more inflation. More inflation implies that the domestic price of tradables starts rising faster than the world market price of tradables. Since competition tends to ensure that the price of tradables expressed in a common currency will be the same everywhere, the second result of rising social security taxes and labor costs will be a tendency for the country's spot exchange rate to increase (currency depreciation). However, as long as the negative effects of rising social security taxes affect output growth rates of tradables and nontradables equally, nothing will happen to the country's real exchange rate. But if such taxes reduce the output growth rate of nontradables more than that of tradables, the result will be a real appreciation of the country's currency. Conversely, if such taxes reduce the output growth rate of tradables more than nontradables, a real depreciation of the country's currency will result.

Finally, suppose there is a *discovery and exploitation of new natural resources*, such as North Sea oil or natural gas, which attracts demand from abroad and leads to import substitution of energy. One effect is that the country's normal output growth rate increases, leading—if there is no change in the rate of monetary expansion—to a lower inflation rate. Another effect is an improvement in the balance of trade because of increased exports and reduced imports of oil or gas. As a result, foreign assets are accumulated for which there is no demand at the going exchange rate. The country's spot exchange rate will therefore fall against all other currencies, raising the value of its currency against all others and lowering the prices of foreign assets expressed in that currency. A final effect of the discovery and exploitation of a new source of tradables is that the country's tradables