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THE ANATOMY OF OFFICIAL  
EXCHANGE-RATE INTERVENTION  
SYSTEMS

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INTERNATIONAL FINANCE SECTION

DEPARTMENT OF ECONOMICS

PRINCETON UNIVERSITY

Princeton, New Jersey

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PETER B. KENEN, *Director*  
*International Finance Section*

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# The Anatomy of Official Exchange-Rate Intervention Systems

After a long period of substantial uniformity, a number of new systems for official exchange-rate intervention have emerged in the last few years. The adjustment and financing implications of these systems are sometimes quite complex. Metaphors such as "the snake in the tunnel" and "the worm in the snake" reflect efforts to reduce these technical arrangements to more simple language. Useful as they may be as a kind of shorthand, however, these metaphors reveal very little about the economics of the adjustment mechanisms.

This essay aims at exploring in a systematic way the adjustment and financing implications of the various arrangements. It should be noted that the concept of "adjustment" as used throughout the essay is not in the teleological sense of progress toward certain balance-of-payments targets; rather, it refers to the reaction of exchange rates, of the required official intervention, of payments balances, and of exchange-rate arbitrage to autonomous changes in balance-of-payments flows.

Though applicable generally (e.g., to a broader system of multi-currency intervention as envisaged by the Group of Twenty), the analysis emphasizes potential relationships between the member countries of the European Economic Community and the rest of the world. For the sake of simplicity it starts with a three-country model—Germany, the Netherlands (which stands for the other EEC countries), and the United States (which stands for the rest of the world). It is assumed that Germany and the Netherlands decide together on their exchange-rate intervention system. Short of all-around floating there are three choices open to them:

I. Each country pegs its currency to the dollar. With this system, official intervention would be limited to keeping the dollar exchange rates of the two currencies within the agreed margins. The exchange-rate band between the mark and the guilder would be determined only indirectly by the exchange-rate ceilings and floors relative to the dollar. If, for example, the two currencies were kept within a band of plus or minus 1 per cent of their dollar parities, the mark/guilder rate would have a range for fluctuation of plus or minus 2 per cent of the mark/guilder cross parity implied by the dollar parities of the two currencies. The mark would be at its implicit upper limit relative to the guilder when it stood at its dollar ceiling if the guilder were simultaneously at

its dollar floor; conversely, the mark would be at its lower limit relative to the guilder when it was at its dollar floor if the guilder stood at its dollar ceiling.

Hence, pegging only to the dollar would in some respects be equivalent to a system of pegging both to the dollar and to the other currency but with the exchange-rate band relative to the other currency exactly twice as wide as that relative to the dollar. This was essentially the system that prevailed up to August 1971, before the dollar was declared inconvertible. The essential characteristic of this system was that, although the mark could be quoted at its dollar ceiling without also being at its implicit guilder ceiling, it was not possible for the mark to be at its implicit guilder ceiling without also being at its dollar ceiling. Therefore, there was never a separate need for Germany to intervene in support of the guilder/mark rate. Using the concept of the "snake in the tunnel," where the "snake" refers to the distance at any point in time between the mark/guilder rate and its cross parity (at most, 2 per cent) and the "tunnel" to the distance between the dollar ceiling and the dollar floor (also 2 per cent), the "snake" if fully stretched completely fills the "tunnel."

II. The mark and the guilder are pegged to each other, while floating relative to the dollar. The existence of exchange-rate ceilings and floors between the Community currencies, of course, also entails a certain degree of joint floating relative to the dollar (there will be a snake without a dollar tunnel). If, as under present Community arrangements, the movement of the mark/guilder rate were kept within plus or minus 2.25 per cent of the mark/guilder parity, the maximum width of the snake would also be 2.25 per cent.

III. The mark and the guilder are pegged to the dollar and to each other. We may call this a system of multicurrency pegs, since the exchange-rate ceilings and floors relative to individual currencies are fixed independently, not indirectly by the ceilings and floors relative to one single currency. The essential characteristic of this system is that the mark can reach its guilder ceiling without being at its upper dollar limit. It should be stressed that the effectiveness of such a system, which is popularly called "the snake in the tunnel," does not require the intra-Community margins to be smaller than the margins for fluctuation of the Community currencies relative to the dollar; the requirement is only that they be less than double the dollar margins. If, for example, the mark/guilder rate were pegged within a band of plus or minus 1.5 per cent of the mark/guilder parity and the exchange rates relative to the dollar were pegged within plus or minus 1 per cent of the dollar parity, the Community snake would still have a maximum width of 1.5 per

cent and would move within a 2 per cent dollar tunnel. (The difference between the sizes of snakes and tunnels is due to the fact that a "snake" is defined by the actual distance from parity at a given point in time, whereas a "tunnel" is defined by the maximum fluctuation over time.) Of course, if the intra-Community margins were plus or minus 2.25 per cent, the snake at its maximum width of 2.25 per cent would be bigger than the 2 per cent dollar tunnel and the mark/guilder peg would be meaningless. The mark could never reach its guilder ceiling, since its upward movement would be stopped by the dollar ceiling, and the need for intervention in favor of the guilder could never arise.

An important point in this context is that if, as in the real world, more than two Community currencies adhere to the arrangement, the relationships between these Community currencies must also be characterized as a system of multicurrency pegs. As will be explained at a later stage, any pair of Community currencies can be considered as forming a snake moving in the "tunnels" implied by the exchange-rate bands relative to other Community currencies. The analysis of system III, although with somewhat different political connotations, is therefore applicable not only to potential relationships between Community currencies and the rest of the world, but also to intra-Community currency relationships themselves.

Since the currencies to which a country's currency is pegged and the currencies used for intervention to maintain these pegs are not necessarily identical, there are several variants of the three systems according to the currency used for intervention. For example, under a joint Community float against the dollar (system II), Germany could maintain the mark within its guilder band not only by intervening in guilders but also by intervening in dollars. With fixed margins between the Community currencies and relative to the dollar (system III), Germany could in certain circumstances keep the mark within its guilder and dollar bands by intervening in both guilders and dollars, only in dollars, or only in guilders. Similarly, with more than two Community currencies, the intra-Community exchange-rate bands could be maintained by using all Community currencies or only one or a limited number for intervention purposes. As will be seen later, the adjustment implications of the individual variants are rather different.

Instead of discussing all these systems and their variants, the analysis can be simplified since the character of the adjustment mechanism under the various alternatives is determined only by four possible types of exchange-rate constellation:

1. The mark and the guilder are inside their bands vis-à-vis each other and the dollar.

2. The mark/guilder rate is at its ceiling or floor, but both currencies are inside their dollar band (if any).
3. One of the two Community currencies is at its ceiling or floor relative to the dollar but is inside the Community band (if any).
4. One of the two Community currencies is at its ceiling or floor relative to the dollar and to the other Community currency.

In system I (pegging only to the dollar), constellations 1 or 3 may occur. In system II (fixed margins only between the Community currencies), the possibilities are constellations 1 and 2, since the dollar band is by definition infinite. In system III (fixed pegs between Community currencies and relative to the dollar), any one of the four constellations is possible, which means that in analyzing a system of multicurrency pegs we will have to cover the other systems as well. The adjustment implications of these four exchange-rate constellations are analyzed below and will be applied in evaluating the systems and their variants.

For expository purposes, a number of simplifying assumptions will be made at first. One is that transactions between any two countries always take place in the currency of one of those two countries. In this case, Germany's dollar balance of payments will also be its balance of payments with the United States, and its guilder balance will be its payments balance with the Netherlands. Moreover, no account will be taken of the impact that changes in payments flows might have in ways other than through exchange-rate effects on these countries' bilateral payments positions and their positions relative to third countries. Furthermore, it is assumed that the countries' payments balances react "normally" to exchange-rate changes in the sense that an appreciation or depreciation in the exchange rate leads to a deterioration or improvement in the country's balance of payments. These assumptions will be dropped later, though it will be seen that, with the partial exception of the last, they do not affect the conclusions very much.

Unless otherwise stated, it is also assumed that intervention occurs only at the limits of the bands, that the United States does not intervene in the exchange market, and that otherwise the country whose currency is at the ceiling is always the one that intervenes. Finally, it should be stressed that throughout this essay the analysis is conducted in terms of flows.

### **1. Adjustment within the Bands**

As long as the mark and the guilder remain within their bands relative both to the dollar and to each other, the adjustment to given changes in balance-of-payments flows will in certain respects be the same as under



a system of generally floating rates. Let it be assumed for expository purposes that in our three-country world each country's external payments are not only in overall balance,<sup>1</sup> but also in balance with each of the other countries individually. If there is now an autonomous increase in payments flows, such as a capital export from, say, the United States to Germany, how will the system react?

If the world consisted only of Germany and the United States, the mark would appreciate against the dollar up to the point at which the original autonomous increase in payments inflows was offset by induced payments flows in the opposite direction. In our three-country world, the adjustment pattern would be more complex. If the mark/dollar rate were the only one to change, the appreciation of the mark against the dollar would lead to an inconsistent pattern of exchange rates; it would be more expensive to buy guilders directly with marks than to sell the marks for dollars and use the dollars to buy guilders. The upward movement of the mark will therefore give rise immediately to triangular exchange-rate arbitrage flows from the mark through the dollar into the guilder and back into the mark. These arbitrage flows (whose starting point and end point could also be the dollar or the guilder—it is only the direction that matters) will maintain a consistent exchange-rate pattern (a) by moderating the appreciation of the mark against the dollar, (b) by causing a depreciation of the dollar against the guilder, and (c) by causing a depreciation of the guilder against the mark. The new equilibrium pattern of exchange rates will have been reached, first, when the appreciation of the mark against both the dollar and the guilder has induced an increase in payments outflows from Germany (in the form of imports of goods or services or of capital exports) to the United States and the Netherlands large enough to offset the autonomous increase in payments flows from the United States to Germany, and, second, when the depreciation of the dollar against both the mark and the guilder has induced an increase in payments inflows to the United States from both Germany and the Netherlands large enough to offset the original increase in payments outflows to Germany. The fulfillment of these two conditions implies, moreover, that the induced increase in payments flows from Germany to the Netherlands is equal in size to the induced increase in payments flows from the Netherlands to the United States.

Although all countries are again in overall balance, their balances of payments in individual currencies will now show (offsetting) surpluses and deficits. Germany, for example, will have a surplus in its dollar

<sup>1</sup> The balance-of-payments concept used throughout this paper is the official settlements balance.

balance of payments and a corresponding deficit in its guilder balance of payments.<sup>2</sup> It is the exchange-rate arbitrage flows (e.g., from marks through dollars into guilders and back into marks) which offset these imbalances. Without this clearing function of exchange-rate arbitrage, there would be an excess demand for marks in terms of dollars and an excess supply of marks in terms of guilders, and exchange rates would get out of line again.

It should be emphasized that the exchange-rate arbitrage flows (which should not be confused with interest-rate arbitrage) are *not* capital movements. They involve simultaneous buying and selling of the same currency and thus, unlike interest-rate arbitrage flows, do not affect the countries' external net assets and liabilities. They cannot, therefore, finance an overall disequilibrium in a country's balance of payments. They do make it possible, however, for a country to have deficits and surpluses in its balances of payments in individual currencies while being at the same time in overall equilibrium.

Moreover, it should be mentioned that exchange-rate arbitrage may hardly ever occur in its pure form but will quite often be closely bound up with commercial or financial transactions. For example, a German bank that needs guilders for a client or for its own purposes may find it can obtain them more cheaply by going through the dollar instead of buying them directly with marks. For analytical purposes, this transaction can, however, be split into a pure exchange-rate arbitrage flow (purchase of dollars with marks, purchase of guilders with dollars, and repurchase of marks with guilders) and a balance-of-payments flow (purchase of guilders with marks).

Finally, it should be stressed that the new equilibrium pattern of exchange rates will be determined solely by the demand and supply functions for the individual currencies (and the consistency constraint) and not by the exchange-rate arbitrage flows, despite the important role they play in bringing about and maintaining the new pattern. On the con-

<sup>2</sup> In the longer run, the bilateral current-account balances will tend to be influenced not only by the changes in the corresponding exchange rates but also by the cross-rate movements. For example, the appreciation of the mark against the dollar will induce Dutch importers to shift from German to U.S. goods. Similarly, the appreciation of the guilder against the dollar will cause a shift by German importers from Dutch to U.S. goods. Consequently, there will be a reduction in both German exports to and imports from the Netherlands. Since the mark's appreciation against the dollar will be larger than that of the guilder, the likelihood is that, if anything, the contractive impact on German exports will be the greater one. This would imply that the induced deterioration in Germany's current-account balance with the Netherlands is larger than would be expected simply from the change in the mark/guilder rate; correspondingly, the arbitrage flows necessary for multilateral balancing would have to be bigger. In order to simplify the analysis, however, in the rest of this paper these fairly long-run cross-rate effects will be disregarded.

trary, these supply and demand functions will also determine the size of the arbitrage flows (see the Appendix). If, for instance, without exchange-rate arbitrage the supply of guilders against dollars and the supply of marks against guilders were very inelastic, or, in other words, if the balance-of-payments effects of the changes in the dollar/guilder and guilder/mark rates were very small, the size of the arbitrage flow necessary for maintaining a consistent exchange-rate pattern would also be small.

In fact, it is sometimes maintained that exchange-rate arbitrage is unnecessary, since in the event of a change in the mark/dollar rate, foreign-exchange dealers can autonomously adjust the dollar/guilder and guilder/mark cross rates without any exchange transactions occurring. This, of course, would be possible only if the changes in the dollar/guilder and guilder/mark rates had no balance-of-payments consequences. In that case, the exchange-rate pattern would be indeterminate and exchange-rate dealers would be free to adjust the cross rates as they thought fit. There would be no need or room for exchange-rate arbitrage and the adjustment mechanism would be the same as in a two-country world: the mark would appreciate against the dollar until the autonomous increase in payments flows from the United States to Germany was fully offset by induced payments flows in the opposite direction. But if changes in the mark/guilder and guilder/dollar rate had no balance-of-payments impact, the same would probably be true of changes in the mark/dollar rate. This would imply that exchange-rate changes could not play a stabilizing role. Even with the slightest change in balance-of-payments flows, the balance between supply and demand in the exchange markets could be restored only by official intervention. Exchange rates would be permanently stuck at their intervention points, and a system of exchange-rate margins around parity would be of very little use since it would require the same amount of intervention as pegging the exchange rates directly to parity with no leeway.

The experience with the EEC snake demonstrates, however, that even relatively small exchange-rate changes within the bands do, in general, have balance-of-payments consequences and that exchange-rate arbitrage is therefore necessary. Despite a world of extreme uncertainties, most currencies were for most of the time inside their intervention points. This raises the question of the nature of the stabilizing forces that help to bring about such a result.

There is a fairly broad consensus that, in the short run and particularly in the case of small movements, current-account balances are rather unresponsive to exchange-rate changes. At first they may even react perversely—the so-called “J-curve.” This implies that the balancing effects

of exchange-rate changes depend, at least in the short run, on capital flows. There are two principal types of capital flows that may fulfill this stabilizing role:

a. To come back to the example of an autonomous increase in payments flows from the United States to Germany, the appreciation of the mark against the dollar and the induced appreciations of the guilder against the dollar and of the mark against the guilder will tend under stable exchange-rate expectations to give rise to stabilizing "speculative" capital flows. These will go from the mark and the guilder into the dollar and from the mark into the guilder. For example, exchange brokers, banks, and nonbank firms may go short of marks because they think that the appreciation of the mark is only temporary; or there may be hedging or "unhedging" by importers or exporters, or shifts in terms of payments.

b. The change in spot exchange rates will have an impact on the forward market. For example, under stable expectations the appreciation of the mark against the dollar will tend to increase the demand for forward dollars. The banks may meet this demand and cover themselves by borrowing marks and selling them spot against dollars, and/or there will be an increase in the dollar forward premium (or reduction in the forward discount), which will tend to induce covered interest arbitrage. In both cases, the result will be a short-term capital flow from Germany to the United States.

Thus the autonomously increased payments flow from the United States to Germany will have as its counterpart not only exchange-rate arbitrage from the mark into dollars but stabilizing short-term capital flows from the mark into dollars. Similarly, exchange-rate arbitrage from the dollar through the guilder into the mark will have as its counterpart stabilizing short-term capital flows in the opposite direction. Of course, this whole offsetting mechanism will work satisfactorily only if there is a reasonable degree of confidence in the prevailing exchange-rate pattern, that is, when a given change in spot exchange rates does *not* give rise to expectations of an equally large or even larger change in future spot exchange rates. If the market expects parity changes, there will be no balancing mechanism within the bands, and the exchange rates will be stuck at their intervention points.

For curiosity's sake, it may be added as a kind of footnote that, with normal balance-of-payments reactions to exchange-rate changes, there is only one rather hypothetical situation in which the consistency of the exchange-rate patterns could be maintained without exchange-rate arbitrage. In the example of an autonomous increase in capital flows from the United States to Germany, this situation would obtain when the

resulting appreciation of the mark against the dollar gave rise to expectations of a corresponding appreciation of the guilder against the dollar and a depreciation of the guilder against the mark, thereby inducing speculative capital flows from dollars into guilders and from guilders into marks. If these flows were of exactly the required size, they would restore the consistency of the exchange-rate pattern without arbitrage flows. However, this kind of speculative capital flow could serve only as a temporary substitute for exchange-rate arbitrage; the incentive would disappear as soon as a consistent exchange-rate pattern had been restored through the induced adjustment of the guilder/dollar and guilder/mark rates. Thus, even if the new consistent pattern of exchange rates is brought about through the anticipatory reactions of exchange-market participants, there will have to be the same amount of arbitrage to maintain it. Moreover, exchange-rate arbitrage works fairly instantaneously and, in general, prevents the development of major inconsistencies in the exchange-rate pattern to start with; in other words, the induced appreciation of the guilder against the dollar and its depreciation against the mark will occur virtually simultaneously with the appreciation of the mark against the dollar. As a result, there will be hardly any time for the formation of the kind of expectations assumed above.

The main conclusion to be drawn from the adjustment process under floating rates is that, though the original change in balance-of-payments flows concerned only the United States and Germany, it has immediate repercussions on other countries—in our model, on the Netherlands. By maintaining a consistent exchange-rate pattern, exchange-rate arbitrage flows limit the change in the mark/dollar rate and spread out the adjustment to other currencies; instead of going up only relative to the dollar, the mark will tend to appreciate generally. From the point of view of the EEC, Germany and the Netherlands taken together will still be in overall balance with the United States, the remainder of Germany's autonomous surplus vis-à-vis the United States being offset by the Netherlands induced deficit.

## **2. Adjustment at the Limits of the Community Band but within the Dollar Band<sup>3</sup>**

### *a. Intervention in Community Currencies*

Let it be assumed that, under the present currency arrangements between the EEC countries, the mark has just reached its upper guilder intervention limit and that, again, there occurs an autonomous increase

<sup>3</sup> The analysis also applies of course to system II, where the Community currencies are floating against the dollar.

in the capital flow from the United States to Germany. As with all-round floating rates, the resultant upward movement of the mark against the dollar will immediately give rise to exchange-rate arbitrage flows (e.g., from the mark through the dollar into guilders and back into marks). Here again the arbitrage flow will moderate the appreciation of the mark against the dollar and will cause an appreciation of the guilder against the dollar; however, what is now different is the guilder/mark link. Since the mark is by assumption already at its guilder ceiling, the German monetary authorities will have to intervene by buying guilders, and the whole arbitrage flow on its way from guilders into marks will give rise to an equivalent increase in German official reserves.

The fixity of the guilder/mark rate has several important consequences. Since the consistency of the exchange-rate pattern can now be maintained only through adjustments in the guilder/dollar and the dollar/mark rate, the mark will on balance go up *less* in terms of the dollar, whereas the guilder must go up by *more*. This implies that Germany's residual dollar surplus and the equivalent dollar deficit of the Netherlands will be larger than under all-round floating; correspondingly, the arbitrage flow necessary for multilateral balancing and for preserving a consistent exchange-rate pattern will also have to be larger. Second, the Common Market countries are no longer in balance-of-payments equilibrium *individually*, although the group *as a whole* is still in overall equilibrium, since Germany's surplus toward the United States has a counterpart in the Netherlands' induced deficit toward the United States. However, unlike the situation obtaining with all-round floating, Germany's surplus toward the United States is no longer offset by an induced German deficit toward the Netherlands but has to be financed through official guilder purchases. Conversely, the induced deficit of the Netherlands toward the United States is no longer offset by an induced surplus toward Germany but entails a reduction in its net official reserve position.

It will have been noticed that, despite the common float against the dollar, Germany can still experience an increase in its reserves owing to autonomous changes in its balance of payments with the dollar area. But, unlike the situation obtaining with fixed rates relative to the dollar, this inflow will now be financed solely by intervention in Community currencies. It should be mentioned, moreover, that the same official financing operations (i.e., Bundesbank purchases of guilders) would be required if the autonomous increase in payments flows to Germany did not originate from the United States but came from the Netherlands. With the mark already at its upper guilder limit, all of these increased flows would have to be absorbed into German reserves. However, there would be no

induced exchange-rate adjustment and no arbitrage flows; neither Germany's nor the Netherlands' payments balance with the United States would be affected.

These results may be generalized. Under a system of fixed exchange rates within the Community and floating rates with the outside world, the individual countries within the group may be in surplus or deficit, but these surpluses and deficits will add up to zero for the Community as a whole. Moreover, it makes no difference for official settlements whether an individual country's surplus (or deficit) is toward the group or the outside world; the country will have to finance its surplus in both cases by buying Community currencies. Naturally, this result applies only when some Community currencies have reached the limits of the band and when there is some official intervention. Otherwise, the situation is the same as under a system of all-round floating, as sketched in the preceding section.

#### *b. Intervention in Dollars*

After considering the normal case of intervention in guilders, we shall now explore the workings of the adjustment and intervention mechanism when intervention to prevent the mark from going above its guilder ceiling is effected in dollars.

Let us start with the case of an autonomous increase in capital flows from the Netherlands to Germany. In order to keep the mark within its guilder band, the German authorities start selling marks for dollars. The resulting downward movement of the mark against the dollar will immediately give rise to exchange-rate arbitrage flows (e.g., from marks through guilders into dollars and back into marks). The new equilibrium position will be reached when German official dollar purchases have reached a rate at which they induce an arbitrage flow from marks into guilders large enough to offset the autonomous increase in capital flows from the Netherlands to Germany.

However, in comparison with the system of intervention in Community currencies, this variant is in some respects quite inefficient. First, unlike the case of intervention in guilders, there are now unintended balance-of-payments side effects. The depreciation of the mark against the dollar, resulting from official dollar purchases, will give rise to a German payments surplus toward the United States, while the exchange-rate arbitrage flow on its way from guilders into dollars will push down the guilder/dollar rate and thus induce also a Netherlands payments surplus toward the United States. Second, the amount of official intervention necessary will now be larger. Look at the changes in balance-of-payments flows that have occurred: Germany's guilder balance of payments

records an increased capital inflow offset by the arbitrage flow from marks into guilders; its dollar balance of payments registers an induced surplus as well as an arbitrage inflow from dollars into marks, both of which are financed by official dollar purchases. If the autonomous increase in capital inflows from the Netherlands were, say, 5 expressed in guilders and the induced German surplus toward the United States were 3, the total amount of official intervention would be 8 (instead of 5 when the guilder was used as the intervention currency). With the mark/guilder rate stuck at the upper limit of the band, the two currencies must move in parallel against the dollar, and intervention in dollars is particularly inefficient if Germany's dollar balance of payments is much more responsive to exchange-rate changes than the dollar balance of payments of the Netherlands. Third, the Community will no longer be in overall balance-of-payments equilibrium with the United States, since the depreciation of both the guilder and the mark in terms of dollars will give rise to a combined surplus toward that country. In the numerical example given above, the surplus of the Netherlands would be equal to the size of the arbitrage flow from guilders into dollars, 5, and Germany's surplus would be 3. The financing of a capital flow of 5 within the Community would thus induce a surplus of 8 toward the United States.

A third point to be mentioned is that, unlike the case where Germany intervenes in guilders, the official net reserve position of the Netherlands is not affected, its autonomous deficit toward Germany being offset by its induced surplus toward the United States. In contrast, Germany's official net position will reflect its autonomous surplus toward the Netherlands and its induced surplus toward the United States. However, these results would be completely reversed if, contrary to the assumption made on page 4, it was the Netherlands that intervened in order to prevent the guilder from dropping below its mark floor. In that case, the sale of dollars by the Dutch authorities would give rise to an appreciation of the guilder against the dollar, with the result that the Dutch authorities would have to finance not only the autonomous deficit toward Germany, but also an induced deficit toward the United States. Now it is Germany whose official net position will not be affected, since the exchange-rate arbitrage flows (e.g., from guilders through dollars into marks and back into guilders) will cause an appreciation of the mark against the dollar, and the resulting deficit toward the United States will offset the autonomous surplus toward the Netherlands.

However, analysis of these two opposite cases, intervention by the country whose currency is at the ceiling and intervention by the country whose currency is at the floor, points the way to a more efficient approach to intervention in third currencies. The important point to keep in mind



is that, when the mark is stuck at its guilder ceiling, consistency of the exchange-rate pattern requires that the two currencies move in exactly the same way against the dollar. Suppose that, in the event of an increase in capital flows from the Netherlands to Germany by the dollar equivalent of 10, the Netherlands Bank sells dollars to the value of 10 for guilders and the Bundesbank buys dollars to the value of 10 with marks; the resulting arbitrage flows (e.g., from guilders through dollars into marks and back into guilders) will prevent both an appreciation of the guilder and a depreciation of the mark against the dollar, and at the same time will offset the autonomous increase in the capital flow from the Netherlands to Germany. Since the exchange rates relative to the dollar do not move, there are no induced changes in the payments balances with the United States, and the only difference from the case of intervention in guilders is that the capital flow is now financed through a transfer of official dollar balances from the Netherlands to Germany instead of through an increase in the net official guilder indebtedness of the Netherlands. These findings are of considerable importance, because they imply that, at least in theory, narrow margins between the Community currencies could be efficiently implemented by intervention in dollars alone. There can be little doubt, however, that such a system, requiring concerted action by several central banks, would be more difficult to administer than a quasi-automatic system of intervention in Community currencies, particularly if there were a large number of Community currencies and cross rates.

Finally, let us briefly explore the consequences of intervention in dollars when the mark is at its guilder ceiling but the original disturbance comes from an increase in the capital flow from the United States to Germany. The upward pressure on the mark against the dollar will immediately tend to give rise to exchange-rate arbitrage flows (e.g., from marks through dollars into guilders and back into marks). This flow will exert upward pressure on the mark/guilder rate, and the German authorities will have to buy dollars to prevent the mark from going above its guilder ceiling. Since the mark/guilder rate cannot move upward any further and there can thus be no offsetting balance-of-payments flows, the new "equilibrium" situation will be reached when the German authorities buy enough dollars to prevent any arbitrage flows from occurring. Thus the somewhat surprising conclusion emerges that the new equilibrium situation will be reached only when the German authorities have purchased enough dollars to preclude any depreciation of the dollar. In other words, when the mark is at its guilder ceiling, and with intervention in dollars only, the pattern of financing under joint floating against the dollar will be the same as under fixed rates relative to the dollar:

the authorities must absorb into their reserves the whole of the autonomous increase in capital inflows from the United States. Similarly, when a currency is at its floor relative to one or more of the other Community currencies, as in the case of the Italian lira during part of the period from June 1972 to March 1973, any autonomous increase in net payments outflows to the United States will have to be fully financed through sales of dollars.

The result is quite different when, in the case of an autonomous increase in capital flows from the United States to Germany, the intervention is carried out by the Dutch authorities. To prevent the guilder from dropping below its mark floor, the Dutch authorities will have to sell dollars in amounts that will lead to an appreciation of the guilder against the dollar by exactly the same percentage as the mark, while the mark will appreciate against the dollar until Germany's dollar payments are again in overall balance. In that way, a consistent exchange-rate pattern is maintained without arbitrage flows, and for Germany the outcome will be the same as under all-round floating. But since the induced appreciation of the guilder against the dollar and thereby also the induced deterioration of the balance of payments of the Netherlands with the United States will now be larger, the official net position of the Netherlands will be worse than with intervention in Community currencies.

Here, again, a result somewhat similar to intervention in Community currencies could be achieved if both the Dutch and German authorities intervened at the same time, the former selling dollars and the latter buying them. Apart from this possibility, the main conclusion is that, if the dollar is used as an intervention currency to keep the Community currencies within their bands against each other, the Community will no longer be in overall balance-of-payments equilibrium despite its float against the dollar. It will have an overall surplus or deficit toward the outside world, since the surpluses and deficits of individual member countries toward the dollar area will no longer cancel out. In some situations, the results will even be the same as under a system of fixed rates relative to the dollar. This shows that it is generally not possible to pursue independent exchange-rate targets for two currencies using only one intervention currency. As our example has shown, pegging the exchange rates between the Community currencies by using only the dollar for interventions may entail undesirable side effects on the dollar exchange rates.

As already mentioned in the introductory section, the same kind of analysis applies if, as in the actual world, the Community is more than a two-currency area and if, in contrast to present arrangements, only one Community currency is used for intervention purposes, for example, if

mark purchases or sales are used to keep the guilder within its band relative to the Belgian franc. Assume that the franc is at its upper guilder limit. If there is now an increase in balance-of-payments flows from Germany to Belgium (and if Belgium and not the Netherlands is doing the intervening), the financing implications for Belgium will be the same as if the franc were at its mark ceiling: it will have to absorb the whole of this payments flow into its reserves. It can therefore be said that, in general, it would not be very efficient to maintain the Community band (the snake) using only one Community currency for intervention purposes—unless the permissible margins of fluctuation between the other Community currencies were determined, as under the former dollar standard, only implicitly by the permissible margins of fluctuation against the intervention currency. In that case, however, the margins of fluctuation between the other Community currencies would be twice as wide as those vis-à-vis the intervention currency, which would probably give the latter undesirable competitive advantages in several respects.

### **3. Adjustment at the Limit of the Dollar Band**

#### *a. Intervention in Dollars*

Suppose that the mark has reached an upper intervention point against the dollar while remaining well within its guilder band. Under the system operating up to March 1973, such a situation could arise whenever the snake hit the ceiling or the floor of the tunnel; it could also arise under present arrangements should an EEC country decide that it did not want its currency to appreciate against the dollar beyond a certain level and consequently intervened at that level.

In such a situation, an autonomous increase in payments flows from the United States to Germany would be fully reflected in a corresponding expansion in German official reserves without any exchange-rate changes or arbitrage flows.

The adjustment implications will be more complex, however, when the autonomous increase in payments flows to Germany comes from the Netherlands and not from the United States. The resulting upward pressure on the mark's guilder rate will give rise to exchange-rate arbitrage flows (e.g., from marks through guilders into dollars and back into marks). These flows will moderate the appreciation of the mark against the guilder, will lead to a depreciation of the guilder against the dollar, and, finally, by exerting upward pressure on the mark against the dollar, will end up as dollars in German official reserves. Once the new equilibrium position has been reached, the remaining deficit of the Netherlands toward Germany will be offset by an induced deficit toward

the United States. With the help of the arbitrage flows, Germany's remaining surplus toward the Netherlands will be translated into official dollar purchases.

The curious feature in this constellation is that, while it is the Netherlands that has a surplus toward the United States, the dollars go into the reserves of Germany, which is in balance with the United States. In fact, for Germany the situation is the reverse of that described in section 2a; all its surpluses, whether toward the Community or the outside world, will be financed in dollars. Moreover, contrary to situation 2a, the surpluses and deficits of the individual group members toward the outside area no longer add up to zero. In comparison with all-round floating, the appreciation of the mark against the guilder will be smaller and the induced appreciation of the guilder against the dollar will be larger. While the Netherlands will remain in overall balance, its regional imbalances will be bigger.

#### *b. Intervention in Community Currencies*

The question arises whether certain exchange-rate targets with respect to the dollar could not be achieved through intervention in Community currencies only. Or, in terms of the examples discussed under 3a, would it be possible for Germany to prevent a further appreciation of the mark against the dollar by intervening in guilders? The answer is obviously "Yes" when the upward pressure against the dollar comes from an autonomous increase in payments flows from the Netherlands to Germany. The Bundesbank's guilder purchases would not only prevent any movement in the mark/dollar rate but would also serve to stabilize the mark/guilder rate. In fact, the situation would be the same as if the Community currencies were rigidly pegged to each other without any margin for fluctuation around parity.

The situation is more complex when the increased payments flow to Germany comes from the United States. If the German authorities start buying guilders, the resulting depreciation of the mark against the guilder will give rise to arbitrage flows (e.g., from guilders into marks and through dollars back into guilders), which will ultimately offset the increase in balance-of-payments flows from the United States to Germany and thus prevent an appreciation of the mark against the dollar. However, as with the situation discussed under 2b, this approach would not be very efficient. Germany would have to finance by guilder purchases not only its surplus toward the United States but also its induced surplus toward the Netherlands (owing to the depreciation of the mark against the guilder). Furthermore, this approach would be feasible only if the mark did not fall to the floor of its guilder band (if any). Finally,

intervention in a Community currency for the purpose of protecting the dollar exchange rate of one's own currency would probably run counter to any EEC arrangement, since it would simply shift the upward pressure against the dollar onto other Community currencies. It is obviously not possible to manipulate the dollar exchange rate of Community currencies in general through intervention in Community currencies alone. Moreover, the Netherlands, which would otherwise have remained in overall balance, now has an induced payments deficit toward the United States—the counterpart to the German official guilder purchases.

In short, what has been said under section 2b applies here too. It is not possible through intervention in only one currency to pursue independent exchange-rate targets in more than one currency. If the German authorities pegged the mark/dollar rate through intervention in guilders, they would have to put up with side effects on the intra-Community exchange rates. Except in some special circumstances, there seems therefore to be little room in any EEC arrangement for intervention in Community currencies for the purpose of influencing dollar exchange rates.

#### **4. Adjustment at the Limit of Both the Guilder and the Dollar Bands**

##### *a. Multiple-Currency Intervention*

Assume that under the snake-in-the-tunnel system the mark has just reached its upper ceiling vis-à-vis both the guilder and the dollar and that the German authorities intervene in guilders to keep the mark from rising above its guilder ceiling and in dollars to keep the mark from rising above its dollar ceiling.

In a sense, the adjustment implications of such a constellation are the most logical, since an increase in payments flows from the United States to Germany will now simply be reflected in an increase in the rate of Germany's dollar accumulation without any repercussions on the other countries within the group. Similarly, an increase in payments flows from the Netherlands to Germany will now merely give rise to an increased guilder intake by the Bundesbank without any direct repercussions on the Community's economic interrelationships with the outside world. In fact, it is only under such an exchange-rate constellation that the currency composition of changes in Germany's rate of reserve accumulation would truly reflect the geographical structure and sources of the underlying autonomous changes in balance-of-payments flows.

### *b. Intervention in a Single Currency*

The result would again be quite different if only one currency were used for intervention purposes. Let us assume that this currency is the dollar and that the disturbance comes from an increase in payments flows from the Netherlands to Germany. The Bundesbank's dollar purchases would push the mark down from its dollar ceiling, and here again Germany would have to finance not only its autonomous surplus toward the Netherlands but also its induced surplus toward the United States. The exchange-rate arbitrage flows would also lead to a depreciation of the guilder against the dollar that, in view of the immobility of the mark/guilder rate, would be of the same size as that of the mark. What was said in sections 2 and 3 about the drawbacks of using only one currency to maintain separate exchange-rate bands in two or more currencies also applies here.

There is, however, one important case in which it makes very little difference which currency is used for intervention—when the permissible margins for fluctuation between other currencies are exactly twice as large as those relative to the dollar, as under the currency arrangements prevailing up to August 1971, or, in other words, when the exchange-rate ceilings and floors relative to other currencies are fixed only implicitly by the intervention points relative to the dollar. In that case, the circumstance that the mark is at its guilder ceiling necessarily implies that it is also at its dollar ceiling and that the guilder is at its dollar floor. If, in the event of an increase in payments flows from the Netherlands to Germany, the German authorities buy dollars in an effort to prevent the mark from rising above its guilder ceiling, the downward pressure on the mark vis-à-vis the dollar will immediately give rise to exchange-rate arbitrage flows (e.g., from marks through guilders into dollars and back into marks). These flows will exert downward pressure on the guilder vis-à-vis the dollar, and, with the guilder already at its dollar floor, the Dutch authorities will have to sell dollars. The constancy of the mark/guilder rate implies an arbitrage flow that is large enough to offset on its way from the mark into the guilder all the autonomous increase in payments flows from the Netherlands to Germany. On its way from guilders into dollars and from dollars into marks, this flow will have as its counterpart dollar sales by the Dutch authorities and dollar purchases by the German authorities. Since with the guilder stuck at both its mark and dollar floors the mark cannot move below its dollar ceiling, there are no induced exchange-rate changes and no secondary balance-of-payments effects; the result is thus the same as if the Bundesbank had intervened directly in guilders, except

that Germany's surplus toward the Netherlands is now financed in dollars instead of guilders.

## **5. Composite Adjustment Processes**

So far, it has been assumed that the adjustment to autonomous balance-of-payments disturbances and the financing of the resulting imbalances will be limited to one of the four exchange-rate constellations discussed in the four previous sections. In practice, however, it is quite possible for adjustment to cut across two or three of these constellations. By way of illustration, let us suppose that under a system of narrower margins between the Community currencies and wider margins relative to the dollar, with intervention in both dollars and Community currencies, the mark is originally quoted below its upper limit vis-à-vis both the dollar and the other Community currencies. Let us further suppose that an increase in payments inflows from the United States pushes the mark first to its guilder ceiling and subsequently also to its dollar ceiling. Before the mark touches its guilder ceiling, the adjustment will be as described in section 1; when the mark reaches its guilder ceiling, the adjustment will continue along the lines sketched under 2a until the upper dollar limit is also reached, when the mechanism described under 4a will operate. The total adjustment to the original increase in balance-of-payments flows from the United States to Germany will thus be composed of the following elements: (a) appreciation of the mark against the dollar and induced deterioration in Germany's balance of payments with the United States, which partly offsets the original autonomous improvement (constellations 1 and 2); (b) appreciation of the mark against the guilder and induced deterioration of Germany's balance of payments with the Netherlands (constellation 1); (c) accumulation of guilders by the German authorities (resulting from constellations 2 and 4); (d) accumulation of dollars by the German monetary authorities (resulting from constellation 4). The implications for the guilder will be the following: (a) depreciation against the mark and a resultant improvement in the balance of payments of the Netherlands with Germany (constellation 1); (b) appreciation against the dollar and a resultant deterioration of the balance of payments of the Netherlands with the United States (constellations 1 and 2); (c) increase in official indebtedness toward Germany (resulting from constellations 2 and 4).

## **6. Some Complications**

It is now time to drop the simplifying assumptions made at the outset of this essay and allow for some of the intricacies of real economic life.

a. One assumption was that transactions between two countries would always take place in one of the two currencies concerned. However, an increase in the net capital flow from, say, the Netherlands to Germany might be in dollars. Dutch residents might acquire dollars and lend them to German residents, who convert them into marks. This type of operation, though usually effected by banks as intermediaries, does in fact occur in the Eurocurrency market. Assuming that the system is at constellation 1, this chain of transactions will lead directly to a depreciation of the guilder against the dollar and a depreciation of the dollar against the mark. These exchange-rate movements will, however, immediately give rise to arbitrage flows (e.g., from marks through dollars into guilders and back into marks), which will lead to a corresponding appreciation of the mark against the guilder.

It should be noted that, in comparison with the situation where the capital flow from the Netherlands to Germany was in marks or in guilders (we shall call this the "normal" case), the role of arbitrage has in a way been reversed. In the normal case, it is the mark/guilder rate that is directly affected, while the other two exchange rates are brought into line by the arbitrage flows. In the present situation, the direct impact is on the guilder/dollar and dollar/mark rates, and it is the mark/guilder rate that will be adjusted by arbitrage; moreover, the arbitrage flow now runs in the opposite direction and will generally be different in size.<sup>4</sup> But the ultimate impact on exchange-rate patterns, trade patterns, overall balances, and, in constellations 2 to 4, official financing operations will be the same as in the normal case (as can easily be seen by going in detail through the various possibilities), and there is no need to alter the conclusions reached. The only difference is that Germany's guilder balance of payments and its balance of payments with the Netherlands will no longer be identical.

b. The second assumption to be dropped is the absence of secondary balance-of-payments repercussions. Returning to the example of an autonomous increase in balance-of-payments flows from the United States to Germany, let us suppose that, through its effects on interest rates, aggregate demand, and prices, this inflow results in a deterioration of Germany's balance of payments with the Netherlands. This deficit will exert upward pressure on the rate for the guilder against

<sup>4</sup> Assume that the autonomous increase in the capital flow from the Netherlands to Germany is 10 and that the induced appreciation of the mark against the guilder will induce an offsetting balance-of-payments flow of 6. In the normal case, the arbitrage demand for guilders against marks will offset the residual imbalance of 4. However, with the capital flow to Germany occurring through the dollar, the arbitrage demand for marks against guilders will have to offset the induced change of 6 in Germany's guilder balance of payments, that is, the arbitrage flow will be 6 instead of 4.



the mark; hence in constellation 1 it will tend to drive the guilder/dollar cross rate even more out of line than under the original assumptions. This means that the arbitrage flow necessary to maintain a consistent exchange-rate pattern will now be larger, that the appreciation of the mark against the dollar will be smaller, and that Germany's residual surplus toward the United States and its offsetting deficit toward the Netherlands will be bigger.

c. The assumption that payments balances will react normally to exchange-rate changes even in the short run (i.e., that a depreciation of its currency will improve a country's balance of payments, and vice versa) is necessary for the analysis of a system of generally floating rates without any exchange-rate floors and ceilings; though small exchange-rate movements may of course have negative effects, there will always be an exchange-rate change large enough to evoke the balancing mechanisms described on pages 7 and 8. However, under a system where exchange-rate fluctuations are limited by rate ceilings and floors and there is little confidence in the existing parities or central rates, it is quite possible that within these limits balances of payments will react negatively to exchange-rate changes.

Assume that the mark is originally quoted well below its dollar and guilder ceilings and that an autonomous increase in payments flows occurs from the United States to Germany. If there were negative balance-of-payments reactions to exchange-rate changes, the mark would be pushed to its upper ceiling vis-à-vis both the guilder and the dollar. Once these ceilings were reached, the analysis sketched in section 4 would apply; on the way to these ceilings, the relevant analysis would be of the kind outlined in section 1 and, depending on whether the guilder or the dollar ceiling were reached first, in section 2 or 3. The main difference in results is that, given normal reactions, the autonomous change in balance-of-payments flows (under a system of intervention in both dollars and Community currencies) is offset both by induced balance-of-payments changes and by official intervention, with exchange-rate arbitrage flows serving to achieve multilateral balance, whereas, given negative balance-of-payments reactions, official intervention will have to finance not only the whole of the autonomous change in balance-of-payments flows but also the induced negative balance-of-payments effects, and there will be need for larger arbitrage flows as well.

It might be noted, moreover, that under a system of fixed margins between the Community currencies only, and with payments balances reacting negatively to exchange-rate changes, even the slightest autonomous increase in payments flows from the United States to Germany would push the mark to its guilder ceiling. The appreciation of the mark

against the dollar would induce an appreciation of the mark against the guilder, thus leading to a surplus in Germany's guilder balance that would cause a further appreciation of the mark against the guilder, etc. Once the mark reached its guilder ceiling, both currencies would move upward in parallel against the dollar until finally an exchange-rate level was reached at which the majority of speculators and hedgers felt that the dollar was no longer overvalued. By this time, however, official German support purchases of guilders might be quite large. This would be especially true in a situation where there was less euphoria about the guilder than about the mark, that is, where the dollar balance of payments of the Netherlands tended to react normally to exchange-rate changes and the supply of guilders against dollars was very elastic. In that event, the arbitrage flows necessary to maintain a consistent exchange-rate pattern by pulling up the guilder along with the mark might be very large indeed.

d. The addition of further countries and currencies greatly complicates the analysis without much affecting the conclusions. If, for example, seven countries within the Community are now allowed for, while the outside world is considered as a single dollar area, there will be  $\binom{8}{2} = 28$  different exchange-rate relationships that might all have to adjust to some extent in constellation 1. In the event of an autonomous increase in U.S. capital exports to Germany, all seven currencies would normally appreciate against the dollar, and the mark would appreciate against the six other Community currencies. Nothing can be said, of course, about the cross rates between these other currencies, except that their movements would in general be much smaller.

Moreover, it is now possible, even likely, that the mark is in different positions vis-à-vis the other Community currencies. Let it be assumed that the U.S. capital inflow into Germany pushes the mark to its ceiling against the Belgian franc but not against the guilder. Whereas Belgium would now have an induced deficit toward the outside area that would not be fully offset by a surplus toward the other Community countries, the external payments of the Netherlands would still be in overall balance and the Bundesbank would not have to accumulate guilders but only Belgian francs.

## **7. Intra-Community Relationships**

As mentioned in the introductory section, the relationship between Community currencies is similar from an analytical viewpoint to that between Community currencies and the dollar. Assuming, for example,

three Community currencies, the mark, the Belgian franc, and the guilder, there are the same four basic exchange-rate constellations: the mark might be within its band in terms of both the franc and the guilder, it might be at the limit of its band in terms of the franc, it might be at the limit of its band in terms of the guilder, or it might be at the limit of its band in terms of both the guilder and the franc. The analysis is the same as outlined in sections 1 to 4; all that is necessary is to substitute the franc for the dollar. To give just one example: When the mark is already at its franc ceiling but still well within its guilder band (constellation 2), Germany will have to intervene, buying francs not only when there is an autonomous increase in payments inflows from Belgium but even when the original disturbance comes from an increase in payments flows from the Netherlands to Germany.

In fact, any two Community currencies may be regarded as forming a "snake" that moves in the "tunnels" implied by their upper and lower intervention points vis-à-vis the other Community currencies. Under present arrangements, these snakes when fully stretched are 2.25 per cent wide, whereas the width of the tunnels is 4.5 per cent. Moreover, it makes very little difference to the results of the analysis if the exchange-rate bands between the Community currencies are of different sizes—if, as under present arrangements, the exchange-rate movements between the Belgian franc and the guilder are kept within narrower bands ( $\pm 1.5$  per cent of parity) than the movement of these two currencies vis-à-vis the other Community currencies ( $\pm 2.25$  per cent of parity). This merely means that there are now within the Community snakes and tunnels of different sizes. Thus the Belgian-franc/guilder snake will have a maximum width of 1.5 per cent and will move within a tunnel of 4.5 per cent against the mark. The snake formed by the mark and the guilder is a more sophisticated animal; with a maximum thickness of 2.25 per cent, its guilder skin moves against the Belgian franc within a tunnel of 3 per cent, while the movements of its mark skin are contained only by a Belgian franc tunnel of 4.5 per cent.

Zoology aside, it follows from the analysis sketched in sections 1 to 4 that the narrower margin arrangement of the Benelux has two principal effects: Seen from the point of view of the guilder, it increases the likelihood that, as a result of autonomous changes in payments flows between the Netherlands and other countries, the guilder will be pushed to its upper or lower limit relative to the Belgian franc, but by the same token it reduces the likelihood that the guilder will be pushed to its intervention limits relative to other Community currencies. In other words, the Dutch authorities will tend to have to intervene more in Belgian francs but less in other Community currencies.

## 8. Split Exchange Markets

Finally, it is necessary to make allowance for dual exchange-rate systems, as they exist for example in Belgium. Under these arrangements, the exchange market is split into two compartments, the "official" or "commercial" market where the exchange rate is determined essentially by current-account transactions, and the "free" or "financial" market, which embraces all other transactions. In theory, official intervention is limited to the official market, while the financial market is left to find its own equilibrium; in practice, the authorities may also intervene in the financial market.

Such a system of split exchange markets is in one sense something of a paradox. It was mentioned in section 1 that, at least in the short run, the current account will not be very responsive to exchange-rate changes and that the balancing mechanisms will depend mainly on stabilizing short-term capital flows. If that is the case, limiting the official market only to current-account transactions renders this market inherently unstable; even if the market starts in equilibrium, the slightest change in current-account flows could push the official rate to an intervention point, and it would probably stay there most of the time. The fact that this is not always the case in practice is due to the circumstance that a neat separation between current-account and capital transactions is not possible; the official market will embrace capital flows at least in the form of shifts in the terms of payment, and some commercial transactions will escape into the financial market. Nevertheless, it is likely that the balancing mechanism will be less flexible in the official compartment of a split market than in a unified exchange market; on the other hand, the official market is of course less exposed to influences emanating from autonomous changes in capital flows.

Apart from these considerations, the analysis proceeds essentially along the same lines as in sections 1 to 5. There will now have to be two consistent exchange-rate patterns, one for the official rate and one for the financial rate, and there will be two more or less separate arbitrage circuits, one going through the official market and the other through the financial market. To give just one example, suppose that there is an autonomous increase in capital flows from Belgium to Germany. The resulting depreciation of the financial franc against the mark will immediately give rise to exchange-rate arbitrage flows (e.g., from marks through financial francs into guilders and back into marks). These arbitrage flows will maintain the consistency of the exchange-rate pattern by moderating the appreciation of the mark against the financial franc and by leading to an appreciation of the guilder against the fi-

nancial franc and of the mark against the guilder. However, since the mark/guilder exchange rate has to be the same in both exchange-rate patterns, the appreciation of the mark against the guilder will render inconsistent the exchange-rate pattern embracing the official franc and thus will immediately give rise to exchange-rate arbitrage flows from guilders through the *official*-franc market into marks and back into guilders. These arbitrage flows will maintain a consistent exchange-rate pattern embracing the official franc by leading to an appreciation of the official franc against the guilder and of the mark against the official franc, and by moderating the appreciation of the mark against the guilder. The fact that the mark/guilder cross rate is the same for both exchange-rate patterns implies that the new equilibrium will be reached when the discount of the financial franc relative to the official franc reaches the same size in the guilder market as in the mark market.

Thus we arrive at the somewhat surprising conclusion that, even without any illicit links between the official and financial markets, an autonomous increase in payments flows from, say, Belgium through the financial market to Germany will automatically lead not only to a depreciation of the financial franc but even to a depreciation—though a smaller one—of the official franc against the mark. Correspondingly, as the reader can easily prove for himself, an autonomous increase in payments flows from Belgium to Germany through the official market will automatically lead not only to a depreciation of the official franc but also to some depreciation of the financial franc against the mark. The explanation is that the two arbitrage circuits—one through the financial market and the other through the official market—will flow in opposite directions. [Of course, no such secondary effects on the official (financial) rate will ensue when the autonomous increase in payments outflows from Belgium is to both Germany and the Netherlands and leads at the start to an equal depreciation of the financial (official) franc against both the mark and the guilder. In that case, the two exchange-rate patterns remain consistent and there is no room for exchange-rate arbitrage flows.]

The reader is left to work out for himself what will happen in the above example (a) when the official-franc rate is already at its mark floor, (b) when the official-franc rate is at its guilder ceiling, (c) when the mark is at its guilder ceiling. To sum up just the main results in case (a), the autonomous increase in balance-of-payments flows through the financial market from Belgium to Germany will give rise to support purchases of francs against marks in the official market; in case (b) it will give rise to support purchases of guilders against francs; and in case (c) it will necessitate support purchases of guilders against marks.

Since the mark/guilder rate does not change in case (c), there will be no arbitrage flow through the official franc and thus no repercussions on the official-franc market. In cases (a) and (b), however, autonomous changes in capital flows will, in flagrant contradiction to the spirit of the system, automatically entail official intervention in the official market! As already indicated, these spillage effects are due to the fact that the two exchange-rate patterns, the one including the official-franc rates and the one including the financial-franc rates, are linked together through the common mark/guilder cross rate. Of course, if Germany or the Netherlands or both countries were also to use a system of separate markets for official and financial transactions, there would be two mark/guilder rates, and the two exchange-rate patterns—financial and official—would be independent of each other; arbitrage flows through the financial circuit would not give rise to offsetting arbitrage flows through the official circuit and there would be no linkage effects. It would thus appear that, in order fully to achieve its purpose, a system of split exchange markets would have to be applied on a general basis, not only by one or two countries in isolation.

## **9. Concluding Remarks**

The focus of this essay has been on a system of multicurrency pegs such as currently exists among certain EEC member countries and as envisaged by the Group of Twenty for worldwide application. It has been shown that, although it is often possible to operate such a system by using only one intervention currency, it is in general more expedient to intervene in whatever currency reaches its exchange-rate ceiling or floor. Even then, however, the currency structure of the reserve accruals or losses does not necessarily disclose anything about the geographical pattern of the underlying balance-of-payments flows. Under a system of separate margins for the dollar and for other Community currencies, for example, an increase in Germany's official guilder intake could reflect changes in balance-of-payments flows vis-à-vis the United States, while at some other time dollar reserve accruals could be due to increased balance-of-payments inflows from the Netherlands. In fact, as long as the mark is at its ceiling relative only to the guilder, any improvement in Germany's balance of payments, whether toward the Netherlands or the United States, will be reflected in increased German official purchases of guilders. Similarly, as long as the mark is at its ceiling relative only to the dollar, any improvement in Germany's balance of payments, whether toward the United States or EEC members, will require official dollar purchases.

In the present state of affairs, the most interesting situation is the one in which a currency is at its ceiling relative to the other Community currencies but still within its band or floating relative to the dollar. In such a case, a Community country's surplus toward the outside world (i.e., the dollar area) must have as a counterpart a corresponding overall deficit on the part of the rest of the Community toward the outside world, with the financing being effected through the transfer of Community currencies.

It is apparent that such a system may raise difficulties. An increase in capital inflows from outside the Community to, say, Germany would reduce not only Germany's competitive position vis-à-vis the rest of the world but that of the Community as a whole. The same would also happen to some extent in a system of generally floating rates. Here, however, the mark would be free to appreciate against the other Community currencies, and the other Community members would be compensated for their loss of competitiveness with the outside world by an improvement in their competitive position with Germany.

The loss in the other member countries' overall competitiveness as a result of an increase in capital flows from the outside world to one member country could be particularly serious if they were suffering from recessionary tendencies, or if they had major areas of relative underdevelopment and unemployment. One of the conditions for the stability of a joint float against the outside world would therefore seem to be a coordination of policies with respect to capital flows, with the chief aim of avoiding large and sudden shifts in individual countries' capital flows from or to the outside world.

Another point to note in this connection is that, unlike generally floating rates, a regional fixed system floating relative to the rest of the world does not protect the individual countries within the group against major shifts in capital flows and consequently does not give a country autonomy in domestic monetary policy. This is apparent as regards capital flows within the group, namely, when the country's currency has reached its limit relative to the other Community currencies, but it also applies to capital flows from or to the outside world. The reason is that only the group as a whole and not the individual member country is in balance with the outside world. For example, an autonomous increase in capital flows from the United States to Germany will be only partly accommodated by an appreciation of the mark against the dollar and the resulting adjustment in Germany's balance of payments with the United States. A further consequence will be a strengthening of the exchange rates of the other Community countries relative to the dollar, and therefore an induced deterioration of their balances

of payments with the United States. And once the mark has reached its upper limit relative to other Community currencies, the induced payments outflows from these other countries to the United States will be reflected in support purchases of their currencies by Germany. The extent to which Germany would have to accommodate the increase in capital inflows from the outside world through the purchase of other Community currencies could be quite large when the market was less optimistic about these other Community currencies than about the mark and when even a modest appreciation of these currencies therefore induced major payments flows from these countries to the United States.



## APPENDIX

In our three-country model there are three exchange markets—the dollar/mark, guilder/dollar, and mark/guilder markets. The conditions for equilibrium in these markets are:

$$\begin{aligned} (1) \quad & S_{\$/M} (p_{\$/M}, p_{G/\$}, p_{M/G}) - D_{\$/M} (p_{\$/M}, p_{G/\$}, p_{M/G}) = a_{\$/M} \\ (2) \quad & S_{G/\$} (p_{G/\$}, p_{\$/M}, p_{M/G}) - D_{G/\$} (p_{G/\$}, p_{\$/M}, p_{M/G}) = a_{G/\$} \\ (3) \quad & S_{M/G} (p_{M/G}, p_{G/\$}, p_{\$/M}) - D_{M/G} (p_{M/G}, p_{G/\$}, p_{\$/M}) = a_{M/G}, \end{aligned}$$

where  $S_{\$/M}$  is the functional symbol for the supply of dollars against marks as determined by the dollar/mark rate  $p_{\$/M}$  (price of dollars in terms of marks) and the guilder/dollar and mark/guilder cross rates,  $p_{G/\$}$  and  $p_{M/G}$  respectively. Similarly,  $D_{\$/M} (p_{\$/M}, p_{G/\$}, p_{M/G})$  expresses the demand for dollars against marks as a function of the various exchange rates. The term  $a_{\$/M}$  stands for the arbitrage demand for dollars against marks or, put another way, the arbitrage supply of marks against dollars. Equation (1) states that in equilibrium the excess supply of (demand for) dollars against marks will be equal to the arbitrage demand for (supply of) dollars against marks; equations (2) and (3) illustrate the same relationship between guilders and dollars and between marks and guilders.

In addition to these three equilibrium conditions, there are three constraints:

$$\begin{aligned} (4) \quad & p_{\$/M} \cdot p_{G/\$} \cdot p_{M/G} = 1 \\ (5) \quad & a_{\$/M} \cdot p_{\$/M} = a_{M/G} \\ (6) \quad & a_{\$/M} = p_{G/\$} \cdot a_{G/\$} \cdot \end{aligned}$$

Equation 4, which can also be written  $p_{\$/M} \cdot p_{G/\$} = 1/p_{M/G} = p_{G/M}$ , states the condition that the exchange-rate pattern must be consistent (i.e., that the guilder/mark exchange rate must be the same as the cross rate implied by the dollar/mark and the guilder/dollar exchange rates).

Equation 5 states that the arbitrage supply of marks against dollars must be equal to the arbitrage demand for marks against guilders, and likewise with equation 6. From equations 5 and 6 it also follows that  $a_{G/\$} = a_{M/G} \cdot p_{M/G}$ .

There are six independent equations and six dependent variables,  $p_{\$/M}$ ,  $p_{G/\$}$ ,  $p_{M/G}$ ,  $a_{\$/M}$ ,  $a_{G/\$}$ , and  $a_{M/G}$ . This implies that there are no degrees of freedom in the system. Moreover, it follows that the exchange-rate arbitrage flows have no influence on the equilibrium pattern of exchange rates but are themselves determined, along with the exchange rates, by the various demand and supply functions. Another point

that clearly emerges is that exchange-rate arbitrage is in general indispensable. Without arbitrage, we would be left with four equations [i.e., equations (1) to (4), with the right-hand side of equations (1) to (3) now being zero] but with only three dependent variables, the three exchange rates. The system would thus be overdetermined.

If one of the exchange rates, say  $p_{M/G}$ , reaches its intervention point, it will turn into a constant  $\bar{p}_{M/G}$  and there will be a new variable  $i_{M/G}$ , which stands for the amount of official intervention. Equation (3) would now have to be rewritten as

$$(3) \quad S_{M/G}(\bar{p}_{M/G}, p_{G/\$}, p_{\$/M}) - D_{M/G}(\bar{p}_{M/G}, p_{G/\$}, p_{\$/M}) + i_{M/G} = a_{M/G}.$$

This states that the excess supply of marks against guilders plus the intervention sales of marks against guilders is equal to the arbitrage demand for marks against guilders. Except for the bar over  $\bar{p}_{M/G}$ , the other five equations remain unchanged. If the effects of changes in the cross rates  $p_{G/\$}$ ,  $p_{\$/M}$  on the value of the function  $S_{M/G}(\dots) - D_{M/G}(\dots)$  add up to zero, as has been assumed in the text for the sake of simplicity, then a change in  $a_{M/G}$  induced by shifts in the supply and demand functions of equations (1) or (2) will give rise to an identical change in the necessary amount of official intervention.

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