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THE ANATOMY OF OFFICIAL
EXCHANGE-RATE INTERVENTION
SYSTEMS

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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,¹ 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

¹ 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.² 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-

² 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 Band³

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

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