On the Use, Misuse and Abuse of the Concept of the Pivot

In the recent literature on the appropriate structure for an international monetary system characterized by either adjustable-peg or gliding-peg exchange rates, a great deal of attention has been directed to the concept of the pivot.[1] Implicit in this literature, and in the various propositions that have been advanced about the pivot, is the conclusion that the pivot point is a crucial concept which merits considerable attention in any discussions and negotiations aimed at establishing a new "permanent" international monetary system under which par values are observed. Unfortunately, a careful examination of the literature on this subject reveals several problems which cast doubt on the usefulness and/or policy importance of most of the propositions developed. In part, this seems to be the result of a semantic ambiguity. The various propositions developed about the pivot actually refer to slightly different concepts. In addition, however, some of the propositions themselves appear to be conceptually unsound, or to rest on assumptions not warranted by even a casual look at the conditions prevailing in the real world.

In an effort to place this literature in proper perspective, this paper critically reexamines the propositions that have been advanced about the pivot and identifies the weaknesses and strengths inherent in each. The organization of the paper is as follows. In Section I the various statements that have been made about the pivot are collected together, restated as formal theorems, and the

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[1] See, for example, the contributions by Cooper (1971), Howle (1973), (1974), Howle and Moore (1971), and Williamson (1971), (1973).

original arguments used in the literature to justify them are outlined. Section II develops the policy implications implicit in the theorems presented in Section I, and distinguishes between those policy implications already presented in the literature and those which can be derived when the various theorems about the pivot are restated in formal terms. Section III presents a critical evaluation of the basic theorems and the policy implications associated with them. Section IV indicates some still unresolved questions about the pivot, and offers some conclusions about the importance that ought to be attached to the whole concept of the pivot in any discussions about a new international monetary system.

I. The Concept of the Pivot and Related Theorems: A Compact Restatement

In its most elementary form, the concept of the pivot has always been implicit in any discussion of systems characterized by the presence of formally stated par values.[2] However, it was not until 1971 that the term and concept of the pivot were formally introduced into the literature in the independent contributions by Williamson (1971) and Howle and Moore (1971). Reduced to its basics, the concept of the pivot rests on the fact that, in general, an infinite number of distinct combinations of currency revaluations and devaluations relative to some given and universally accepted international standard of value will achieve a particular pattern of relative exchange rate changes. However, although an infinite number of combinations will generally be possible, not all of them will be equally desirable on various economic grounds. Thus, the choice of a pivot point around which relative exchange rates are adjusted by devaluations and revaluations is not a matter of indifference. Instead, it is argued, the choice of an appropriate pivot point will (or should) be an integral part of the design of an optimal system of adjustable-peg and/or gliding-peg exchange rates.

Within this general framework, contributions in the literature have focused on establishing the conditions under which (1) the

[2] The concept of the pivot point is clearly in mind in the discussion in IMF (1970), or Cooper (1970a), (1970b).

choice of a particular pivot point is not (or would not be) appropriate, given other objectives of such exchange-rate systems; (2) a single optimal pivot point (or a single uninterrupted range of pivot points) will exist (with the optimality criterion variously defined); and (3) the choice of various numeraires and/or systems of liquidity creation will determine (*de facto*) the location of the pivot point.

In order to facilitate the discussion in subsequent sections of this paper, it is useful to present the principal arguments made in the various studies of the pivot as formal economic theorems and to arrange them in order of the increasing stringency of the assumptions required for their validity.

> *Theorem I:* In any system of adjustable-peg or gliding-peg exchange rates there will exist some pivot point (or, at least, a subset of a set of all possible pivot points) that will minimize either the magnitude of the *range* of per cent changes or the *sum* of absolute per cent changes in par values per time period necessary to maintain balance of payments equilibrium.[3]

Intimately related to Theorem I is the following

> *Corollary I-1:* In an adjustable-peg system, if adjustment costs are positively related either to the magnitude of the range of changes or to the sum of absolute changes in par values, then adjustment costs will also be minimized by the appropriate choice of a pivot point.

Although the original source of interest in the pivot point was the problem of minimizing the magnitude of permissible par value

[3] Theorem I was independently introduced into the literature by Howle and Moore (1971) and Williamson (1971). Howle and Moore were concerned with minimization of the range of changes in par values and, consequently, suggested setting the pivot at the middle of the scale of necessary changes in exchange rates among currencies. Williamson, on the other hand, although much less specific, by advocating setting the pivot at a point corresponding to the modal rate of inflation, appeared to be preoccupied with minimization either of the sum of absolute changes in par values or of the number of currencies whose change in par value would have to be greater than a certain (not clearly specified) norm.

It should be noticed, however, that in Williamson's treatment, the positive relationship between the magnitude of par value changes and the adjustment costs is taken into account explicitly while in the paper by Howle an Moore it is implicit.

changes per time period required to maintain balance of payments equilibrium under a system of gliding parities, Theorem I, which is the most general statement about the pivot point, applies to a system of adjustable-peg exchange rates as well. This theorem rests on the observation that, for a variety of (unspecified) reasons, the maintenance of balance of payments equilibrium among the countries participating in a pegged-rate system (adjustable or gliding) will require periodic changes in the structure of exchange rates.

In general, these changes in exchange rates will require changes in par values ranging from *0* to a maximum of *n* percent per time period. Then, obviously, unless the pivot point is set at n/2 percent, a greater range of fluctuations in par value changes per period of time will have to be permitted in order to maintain equilibrium than otherwise would be required. However, setting the pivot at n/2 per cent will not, in general, ensure the lowest possible sum of absolute changes in par values.

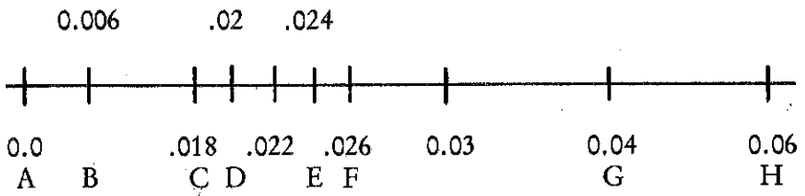
Theorem I can perhaps be made clearer by an example.[4] Consider a system of eight countries, A through H, where differing internal rates of inflation are the only source of payments imbalances, and where *relative* rates of inflation between countries remain constant. If the country with the highest rate of inflation has an annual inflation rate 6 percent greater than the country with the lowest such rate, then, on average, relative exchange rates must change by an amount between 0 and 6 percent (.00 to .06) annually. If the inflation rates of the eight countries are arrayed as in Table 1, then a pivot at .03, with countries A, B, C, D, E and F revaluing (A by .03 per year, B by .024, C by .012, D by .01, E by .006 and F by .004) and countries G and H devaluing (G by .01 and H by .03) will permit the bands on acceptable par value changes to be minimized at plus or minus 3 per cent per year. The sum of absolute per cent changes in par values will be in this case 12.6 per cent.

If, on the other hand, the pivot is set at .022, then the band on permissible par value changes would have to be increased to 3.8 per cent per year but the sum of absolute per cent changes in par values will be minimized at 10.6 per cent.

[4] The example is based on Howle and Moore (1971).

Table 1

HYPOTHETICAL DISTRIBUTION OF RELATIVE RATES OF INFLATION



Whatever the optimality criterion used, from Theorem I no method other than fiat can be deduced whereby exchange rate changes can be forced to pivot at the appropriate point. Identification of a mechanism to set the pivot point under a regime of adjustable-peg exchange rates is the objective of Theorem II.

> *Theorem II:* If par values are defined in terms of an asset like gold; if this asset is the only form of international reserves; if balance of payments equilibrium requires that countries have constant average relative rates of change in their exchange rates; if countries which must devalue to maintain balance of payments equilibrium desire a smaller ratio of real reserves to real imports than do countries which must revalue; and if the overall desired ratio of real reserves to real imports for devaluing countries as a group is independent of the location of the pivot, and likewise for revaluing countries, then the quantity of real reserves in existence relative to real imports will determine the location of the pivot point.[5]

As is readily apparent, Theorem II makes much more stringent assumptions than does Theorem I. In the literature, (Howle 1974), Theorem II is established[6] by defining a to be the desired ratio of real reserves to real imports for devaluing countries; b to be the same ratio for revaluing countries; R to be total real reserves; M^d to be the real imports of devaluers; M^r to be real imports of revaluers, and M to be the sum of M^d and M^r. Then total desired reserves are

[5] This theorem, and the following two corollaries, were developed by Howle (1974).

[6] In the following outline of the proof used to establish Theorem II, we follow the line of argument developed in the literature. A discussion of its soundness is reserved for Section III below.

$$R = aM^d + bM^r, \tag{1}$$

or, rearranging terms to consider the ratio M^r/M^d,

$$\frac{M^r}{M^d} = \frac{(R/M) - a}{b - (R/M)}, \tag{2}$$

and where $b \geq R/M \geq a$. If $R/M = a$, then $M^r/M^d = 0$ and only devaluations occur. Now assume that R/M rises through an addition to the world's stock of reserves so that $b \geq R/M \geq a$. In this case, potential devaluers will postpone devaluations, thus tending to lower their reserve to import ratio back toward *a*. However, Howle continues, countries with a desired reserve to import ratio of *b* will begin to revalue to prevent their actual reserve to import ratio from rising above *b*, and the pivot will rise. This process will continue until enough countries have become revaluers that M^r will have risen to the point where (2) again holds.

Directly related to Theorem II are the following two corollaries.

> *Corollary II-1:* In a world where Theorem II holds, the rate of growth of real reserves is independent of the rate of growth of nominal reserves in the long run. Changes in the rate of growth of nominal reserves can only temporarily change the rate of growth of real reserves.

Corollary II-1 follows immediately from the observation that, in the long run, the real purchasing pover of a unit of nominal reserves, in terms of each country's goods, is declining at a rate equal to the value of the pivot. Or,

$$r = n - p, \tag{3}$$

where r is the growth rate of real reserves, n is the growth rate of nominal reserves, and p is the pivot. If real reserves grow faster than the demand for real reserves, R/M must be rising. By Theorem II, this raises the pivot point. Thus, in long-run equilibrium it must be true that $r = m$, where m is the growth rate in demand for real reserves. This, together with equation (3) implies that

$$p = n - m, \tag{4}$$

and the pivot will vary to insure that, in the long run, real reserves grow only as fast as the demand for them.[7]

> *Corollary II-2*: If differences in internal rates of inflation are the only sources of payments imbalances and if adjustments are carried out by means of internal price adjustments rather than by exchange rate changes, then the rate of growth in nominal reserves determines the (common) world rate of inflation.

Corollary II-2 follows immediately from a reinterpretation of the relative rates of change in exchange rates required to maintain balance of payments equilibrium in Theorem II as the desired rate of inflation relative to the country with the lowest such rate. Then, in Corollary II-1, p becomes the desired rate of world inflation.

The optimality criterion proposed in Theorem I is, of course, not the only criterion that could be used in the selection of a pivot point. In the most explicit proposition about the pivot in an adjustable-peg exchange-rate regime yet published, Howle (1973) selects a different optimality criterion, and suggests a different optimal pivot.

> *Theorem III:* If the maintenance of long-run balance of payments equilibrium requires that countries have average annual relative rates of change in their exchange rates that do not vary; if each country changes the par value of its currency independently of the actions taken by all other countries, so that world-wide par value changes are randomly distributed over time; if all adjustments in trade flows resulting from each par value changes are instantaneous; and if the world burden of adjustment is defined to be the sum of the value of all trade changes occurring; then there is an optimal pivot dividing countries into revaluers and devaluers such that the total world burden of adjustment is minimized.

To establish Theorem III let $S_i [= f(X_i, M_i, \eta_{si}, \eta_{di}, \varepsilon_{si}, \varepsilon_{di})]$ be the absolute value of the trade changes in all countries resulting from an independent change by country $\hat{i}$ of the par value of its

[7] It is perhaps worth noting that, from a strict monetarist point of view, Corollary II-1 might be regarded as trivial. It says that, even though control can be exercised over the nominal money supply, control over the real money supply is, in the long run, impossible.

currency by one percentage point, where X_i and M_i are the values of country i's exports and imports respectively, η_{si} and η_{di} are the elasticities of supply and demand for i's exports, and ε_{si} and ε_{di} are the corresponding elasticities for imports. Let p_i be the average annual relative rate of change in the par value of i's currency needed to maintain balance of payments equilibrium, and let p be the pivot point.[8] Then, since $|p_i - p|$ is the average amount of change in i's par value per time period, the average trade change per period resulting from the change in i's par value will be $S_i|p_i - p|$. Hence, the total value of the absolute changes in world trade per period, resulting from the par value changes of all currencies necessary to maintain payments equilibrium, is

$$T = \sum_{i=1}^{n} S_i|p_i - p| . \tag{5}$$

If $U = \Sigma S_i|p_i - p|$ for all countries for which $p_i < p$, N is the same sum for all countries where $p_i = p$, and D is the sum over all countries where $p_i > p$, then

$$\sum_{i=1}^{n} S_i = U + N + D, \tag{6}$$

so that the change in T resulting from an infinitely small change in p is

$$\frac{\Delta T}{\Delta p} = U + N\frac{\Delta p}{|\Delta p|} - D. \tag{7}$$

From equation (7), it follows that T is minimized if

$$|U - D| \leq N. \tag{8}$$

As Howle notes, this assumes that S_i and p_i values are independent of p, although, obviously, U, N, and D will vary with p. If N is

[8] Notation has been slightly changed from Howle's original article so as to be consistent with the notation used in discussing Theorems I and II.

strictly positive, then there will exist a unique value of p satisfying equation (8). If $N = 0$, then U and D must be equal for (8) to be satisfied. In this case a unique range of p values satisfying (8) will exist.

From equation (8) it is readily apparent that the optimal value of p will be that which divides countries between periodic revaluers and periodic devaluers such that $U = D$.

Intimately related to Theorem III is the following corollary, also due to Howle:

> *Corollary III-1:* If, in addition to the assumptions of Theorem III, all countries have identical elasticities of demands for and supplies of exports and imports and average trade balances equal to zero over time, then the optimal pivot will be the one which divides countries such that the value of trade of periodic revaluers equals the total value of trade of periodic devaluers.

In the special case of Corollary III-1, the ratio $S_i/(X_i + M_i)$ will be identical for every country. In this case, the optimal pivot divides countries such that the total trade of periodic revaluers equals the total trade of periodic devaluers, as asserted in the corollary.

Therorems I through III and the associated corollaries encompass, in a formal sense, all heretofore published statements about the pivot point. We turn, next, to an examination of the policy implications of the theorems and their corollaries.

II. Policy Implications of the Literature on the Pivot

Considering the historical context in which articles about the pivot have appeared, it seems fair to say that their main thrust has been to produce policy statements concerning the design, or at least certain features of the design, of any new exchange-rate regime. In this section, the principal policy statements found in the literature, and also some further policy implications which follow logically from the above theorems, and which have not previously been stated in the literature, are presented. In keeping with our dual objectives of clarifying earlier discussions about the pivot, and of facilitating our critical evaluation of the literature on the pivot in the next section, these policy implications are stated as formal propositions.

The most immediate policy prescription to emerge from the literature follows directly from Theorem I, and was first presented by Howle and Moore (1971).

> *Proposition I:* In general, in a world described by Theorem I, an exchange rate system pegged to the U.S. dollar (or, for that matter, any other reserve currency) might not place the pivot at its optimal point *as defined by that theorem.* Therefore, it follows that par values ought to be pegged to some other asset, [such as gold].

The first part of the proposition (before the brackets) follows directly from Theorem I, since in a world of *n* countries a particular reserve currency need not fall at the exact midpoint of the required range of relative changes in par values or have a modal rate of inflation. Moreover, even if the numeraire currency initially met either of the optimality criteria of Theorem I, it is highly unlikely that it would continue to meet this criterion indefinitely.

Although the first part of the proposition follows directly from Theorem I, the second part (in brackets) does not. Instead it either rests on a confusion over terminology, or requires another assumption. However, discussion of this point is deferred to Section III.

Theorem I and the associated proposition I can be viewed from another perspective. As Cooper (1971) notes, they imply that, in general, a system of gliding parities with pre-established bands on the changes in par values permitted per time period will, unless the bands are extremely wide, fail to accommodate within the rules of the game all changes in par values necessary to bring about equilibrium in countries' balances of payments. This, in turn, either increases the likelihood of periodic crises, and, therefore, the likelihood that some changes violating the rules will be necessary to restore the system to equilibrium, or makes it necessary for certain countries to resort to other, perhaps less desirable, means, like inflation or deflation, to restore their equilibrium.

Under the more restrictive assumptions of Theorem II and its corollaries several additional policy conclusions emerge. From Theorem II it is possible to deduce the following:

> *Proposition II:* If the creation of nominal reserves is under the control of some central international agency, then by varying the rate at which new reserves are introduced into the system, in the long run the central agency can place the pivot point wherever it desires.

This proposition, which was presented by Howle (1974) follows trivially from Theorem II, and does not require further discussion.

> *Proposition III:* In a world such as that described by Theorem II and Corollary II-1, and in particular in a world in which countries are not reluctant to change par values of their currencies in order to preserve or restore their desired ratio of real reserves to real imports, the problem of adequacy of international liquidity is solved automatically.

Although this proposition has not previously been stated in the literature, it follows logically from Theorem II and Corollary II-1. Given the assumptions behind Corollary II-1, any divergence between desired and actual rates of growth of real reserves will be eliminated in the long run by a change in the location of the pivot point. For example, even in the extreme case where $n = 0$ (in equation (4)), so that no new nominal reserves are introduced into the system, $p = -m$, and in the long run all countries devalue at differing rates sufficient to keep the real value of the existing stock of reserves rising as fast as demand.

As with Theorem II and Corollary II-1, an assessment of the reasonableness of Proposition III is postponend until the next section.

> *Proposition IV:* In a system of gliding parities, there is a potential conflict between the size of the band on permitted changes in par values per time period and the desired rate at which new nominal reserves are to be injected into the system. The rate of reserve creation and the setting of bands on acceptable par value changes are not independent.

As with Proposition III, Proposition IV has not previously been stated in the literature. However, it follows directly from Theorems I and II, and Corollary II-1. If reserves are being created at a faster or slower rate than the rate at which the demand for reserves is growing, then by Theorem II and Corolla-

ry II-1, together with the assumption that p_i values are independent of p, the pivot point must move to equilibrate the system. However, bands on permitted par value changes limit the range over which the pivot point can move.

In the extreme case, when there are currencies devalued and revalued periodically at the maximum permissible rate, any movement of the pivot away from the midpoint of the band will force the issuers of the currencies at one of the limits of the band to break continually "the rules of the game". It can be seen therefore, that the setting of band widths and the establishment of the rate of creation of new reserves are not independent.

The preceeding four policy implications are based on Theorems I and II and their corollaries. For the most part, Theorem III and Corollary III-1 comprise their own policy prescriptions. The obvious implication of Theorem III is that, if the optimality criterion proposed, and the proof of the theorem are accepted, then, given the assumptions of Theorem III, the optimal value of the pivot is known. Howle also concludes that Corollary III-1 will be approximately true even if all the assumptions are not met, and that, therefore, the pivot ought to be set such that the total value of trade of revaluers is approximately equal to the total value of trade of devaluers, since not all of the relevant elasticities needed to compute a true optimal pivot are known.

Having outlined the basic theorems about the pivot, and examined their policy implications, we turn now to a critical evaluation of the entire literature dealing with these subjects.

III. The Pivot Evaluated

In critically evaluating the theorems and policy propositions associated with the pivot point there are a variety of ways to proceed. Theorem III and Corollary III-1 contain the most powerful statements about the pivot. The Theorem proposes the most meaningful objective function, i.e., to minimize the adjustment burden, and demonstrates that a pivot satisfying this criterion exists, while the corollary specifies the value of this optimal pivot. Since, at the same time this theorem and its corollary are the easiest of the statements about the pivot to refute, we begin our critique with them.

Theorem III

Consider, first, the assumption of non-simultaneity of exchange rate changes without which Theorem III loses its meaning. On at least three grounds, this assumption must be rejected.

First, at the most trivial level it can be noted that, prior to August, 1971, practically all minor currencies were rigidly linked to some major currency. This, in turn, meant that any change in the par value (relative to gold) of a major currency was virtually instantaneously translated into par values changes of a number of minor currencies. Thus, for example, the devaluations of the British pound in 1967 and the French franc in 1969 were quickly translated into devaluations of other currencies tied to the pound and franc, respectively. Clearly, complete randomness of exchange rate changes did not characterize the Bretton-Woods system; there is no reason to assume that it would characterize any new system of fixed rates that might emerge in the future. Moreover, the smaller is the number of currency blocs the smaller is the number of non-simultaneous changes in currencies' par values throughout the world.[9]

This line of reasoning does not rule out the possibility that two minor currencies' may be non-simultaneously devalued or revalued relative to two corresponding major currencies. However, as a general rule, the trade between two small countries that are members of different currency blocs is minuscule, and any adjustments in their trade resulting from such uncoordinated changes in par values barely affect the total world burden of adjustment.

Of course, the foregoing discussion shows only that not all exchange rate changes are independent. It might be argued that,

[9] Even under the floating system in use for the past few years it is possible to distinguish several currency blocs. According to the various issues of the *IMF Survey*,of the 129 currencies listed, about 90 are pegged or informally tied to some major currency. According to the *Survey* of November 10, 1975, there are 54 currencies in the dollar bloc (including the U.S. dollar itself), 9 currencies in the sterling bloc, and 14 in the (French) franc bloc. In addition, one currency *de jure* and two more currencies *de facto* are pegged to the South African rand, while eight belonged to the European snake (dominated by the German mark). If we include the Japanese yen, there are six currency blocs of different importance. Excluding the leading country in each bloc, the members of the bloc are primarily interested in the relationship between their currency and that of the leader of the bloc. This interest, moreover, is apparently independent of the question of to what the leader is pegged, or around what point it is pivoting.

the linking of minor currencies notwithstanding the par values of the major currencies are changed independently, and, therefore, that some weaker variant of Theorem III may still be relevant. Williamson (1971), for example, contends that simultaneous changes in major currencies' parities are difficult to arrange, even among countries with very close economic ties. His example is the devaluation of the French franc in August, 1969, and the revaluation of the *Deutschmark* in October of the same year.

Under the assumptions of Theorem III of literally instantaneous changes in trade flows (being the source of adjustment costs) these two changes would have to be ranked as non-simultaneous. However, as every empirical study ever attempted has demonstrated, trade flows do not adjust instantaneously. In fact, in light of the long lags in adjustment actually observed, for all practical purposes these two changes in par values can be regarded as simultaneous. Moreover, such examples as are available are not relevant to Theorem III. As Howle emphasizes in his discussion of Theorem III, what is relevant are non-simultaneous *and* unnecessary changes in parities. This occurs if, for example, one currency is devalued relative to another, and then the latter is devalued relative to the former. In 1969, the changes in the par values of the franc and *Deutschmark*, although non-simultaneous, were in the "correct" directions. That is, the ultimate change in the exchange rate between the two currencies can be thought of as taking place in two stages. At no point would there have been an unnecessary and later reversed change in trade patterns.[10]

Changes in exchange rates that were ultimately reversed (e.g., the British pound in 1967 or the French franc in 1969), were mainly depreciations relative to the dollar — the pivot currency of the sixties. The reversal occured in 1971-1973 when the existing monetary order disintegrated and, unlike in the sixties, the U.S. Government acquired the capability to pursue an active exchange rate policy.

More important than these examples from the era of Bretton-Woods system, are the lessons from the more recent past. Here,

[10] In fact, in a world where the "correct" relative rates of exchange between currencies are unknown, and where there are long lags in trade flow adjustments, it may make good sense to adjust relative rates gradually, rather than instantaneously.

the major countries have shown a clear desire to cooperate in orderly, and, sometimes, simultaneous, changes in exchange rates. The Smithsonian agreement, although ill-fated, is one example; existing informal understandings between various central banks about target exchange rates and their joint support are another example. In all cases, the tendency has been toward greater cooperation and more simultaneity.[11]

Finally, aside from the evidence of history, there is an even more compelling reason for rejecting Theorem III. On purely theoretical grounds the Theorem cannot hold without another, virtually untenable, assumption. In a world where par values are supposed to adjust according to differences in relative rates of inflation, any change in exchange rates which does not reflect the differences in relative rates of inflation will trigger a flow of hot money out of overvalued currencies and into undervalued ones. This, in turn, will tend to force the governments in question to adjust the parities of their currencies. Moreover, since only differences in relative rates of inflation necessitate exchange rate changes, there is *zero* risk to speculators. Only if speculative movements of short-term capital are assumed away, or if it is assumed that speculators are ignorant of either true rates of inflation, or of the fact that par value changes must reflect differences in relative rates of inflation, will this objection be unwarranted.

Note that, once governments know that speculators know what governments know, then the whole process can be prevented by the simple measure of agreeing to simultaneous par value changes. Should the governments fail to agree to a simultaneous change, then (barring the presence of reserve "tap" and reserve "sink" countries) speculative capital flows will tend to force virtual simultaneity (i.e., relative to lags in the adjustment of trade flows) anyway. Moreover, this problem arises with any formula-dependent scheme for exchange rate changes, as long as the formula is known, or can be guessed at with reasonable accuracy by private parties. It also suggests a further reason for rejecting

[11] Parenthetically, it is perhaps worth noting that the desire to coordinate changes in exchange rates is not the result of any attempt to minimize the total cost of adjustment. Rather, it results from the unwillingness of most governments to see exchange rates depart from what are felt to be optimal, or supportable values.

the assumption that there will be substantial unnecessary adjustments of trade flows. As long as the factors determining required relative changes in exchange rates are representable by some formula, private exporters and importers will be able to ascertain the "correct" parities for various currencies. Having done so, they will have no incentive to adjust trade flows to "incorrect" parities, but, rather, will tend to wait until all expected adjustments have materialized before responding.

In light of this discussion, it seems clear that two assumptions underlying Theorem III — the assumptions of non-simultaneity and of instantaneous adjustments in trade flows — must be rejected on both conceptual and operational grounds. Moreover, since the theorem and its corollary cannot stand without these assumptions, their validity must be rejected.

Theorems I and II. Problems which arise in connection with Theorems I and II (and, of course, their corollaries) throw considerable doubt on their validity and relevance as well. Among the most serious of these problems are: (1) questions related to the time span relevant for the analysis of balance of payments adjustment and sufficiency of reserves versus the time span implicit in the literature on the pivot; (2) questions of other costs of adjustment (or of its prevention) versus the criteria proposed in the theorems; and (3) questions related to the very important distinction between "pegging to" an asset and "pivoting around" a point.

Discrete versus Continuous Changes. The first of these problems relates to the nature of the adjustment process assumed in Theorem II. According to Howle (1973), the concept of the pivot is irrelevant for a world of flexible exchange rates, since with flexible rates a balance of payments disequilibrium in the usual sense cannot arise. However, in equations (3) and (4) of Section I, all variables are defined as rates of change. Insofar as the logic of the equations is concerned, this is necessary for the dimensionality of the variables in the equations to be consistent. However, using rates of change in these equations implies that exchange rates change continuously, or, in other words, are flexible. If, instead of flexible rates, a system based on fixed exchanges rates is assumed, then some variables in these equations will have the

dimensions of continuous rates of change, while others will be discrete changes, and the equations will make no sense.

It has been argued that it is legitimate to look at the "average annual rate of change" in exchange rates required to maintain balance of payments equilibrium, even though a fixed exchange rate system is under consideration. Even if this argument is acceptable, however, recognition of the fact that exchange rates actually change at discrete intervals raises problems for Theorem II and its corollaries.

Consider, for example, the interpretation of equation (3), used to establish Corollary II-1. This equation is supposed to give the short-run relationship between the rate of growth of real reserves and that of nominal reserves because in the long run the pivot is supposed to adjust so as to equalize the rate of growth of real reserves and the rate of growth of the demand for real reserves (equation (4)). In the short run, therefore, the pivot is supposed to be the deflator for nominal reserves. Observe, however, that unless changes in par values are continuous, in general the pivot will not correspond to the weighted average rate of inflation. To see this, consider Table 2.

TABLE 2

Currencies	Absolute Rates of Inflation (%)	% of Devaluation (+) or Revaluation (−)	Trade Shares (%)	Trade Weighted Rates of Inflation (%)
A	30	23.5	1	0.3
B	20	13.5	1	0.2
C	15	8.5	8	1.2
D	7	0.5	40	2.8
Pivot	6.5	–	–	–
E	6	− 0.5	15	0.9
F	6	− 0.5	10	0.6
G	5	− 1.5	20	1.0
H	5	− 1.5	5	0.25
				7.25

In Table 2, the pivot point has been set so as to divide countries such that the total trade of periodic revaluers equals the total trade of periodic devaluers. This generates a pivot of, say, 6.5. However, with the assumed trade shares, the weighted average world rate of price inflation is 7.25 per cent. In this example, therefore, in the absence of any exchange rate changes and assuming that no new nominal reserves are injected into the system, real reserves decline at a rate of 7.25 per cent. At *discrete intervals,* and if all adjustments are simultaneous, exchange rates change so as to insure that real reserves *on average* have only lost value at a 6.5 per cent annual rate. If adjustments are not simultaneous, then it is only in the very long run that this average 6.5 per cent rate of decline in the value of real reserves occurs.

Two problems arise here. First, it is only at discrete intervals, that the pivot point serves as the deflator of nominal reserves. Second, between these intervals reserves can be losing real value at a different rate than that given by the pivot point. This is especially significant when it is observed that there is a problem inherent in the proof of Theorem II itself.

The Lenght of the Adjustment Process. Another problem with Teorem II is related to the lenght of the adjustment process. According to the argument used to establish Theorem II, an addition of new (nominal) reserves will result in a postponement of devaluations by periodic revaluers to prevent their R/M ratios from remaining for a long time above *b.* For these revaluations to occur, however, it is necessary that potential revalues be at, or close to, their average desired R/M ratios (b). If they are not, the adjustment process can take a *very* long time indeed.

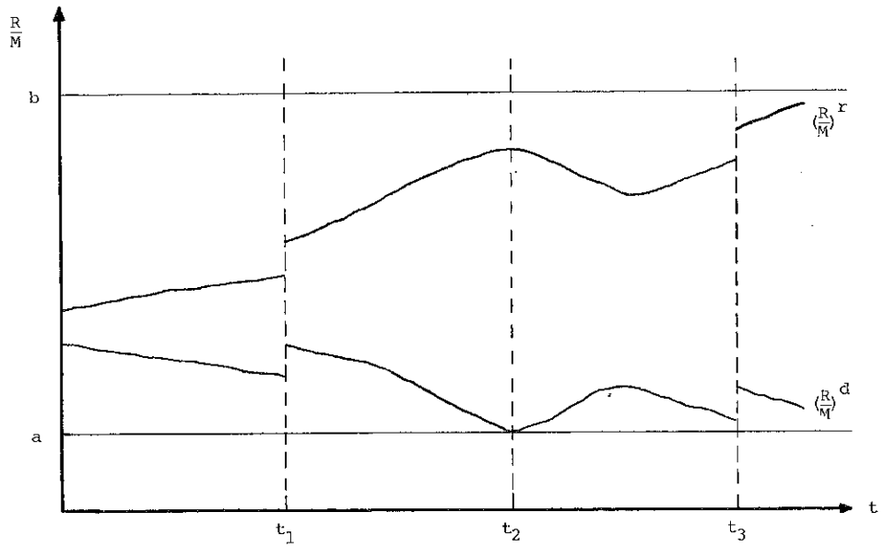
By way of illustration, assume that all periodic revalues are well below their average desired R/M ratios, and that at t_1 a new allocation of reserves occurs. This raises the R/M ratios of both potential revaluers and devaluers. Assume that potential revaluers have R/M ratios which are still well below *b.* Since the periodic devaluers postpone devaluations, they begin to lose their new reserves to potential revaluers. If, however, devaluers fall to their average desired R/M ratios, *a,* well before potential revaluers exceed theirs, *b,* potential devaluers will actually devalue. Since the periodic devaluers are below their desired level of reserves holdings (relative to their imports) and because continuous changes in exchange rates have been ruled out by assumption of a pegged exchange rate system, the percentage of devaluation would have to be such as to permit the devaluers to start building up their reserves positions back to the desired level. Thus, at t_2 their reserves begin to rise and, by implication, the reserves of (potential) periodic revaluers begin to fall, moving further below their desired reserves-to-import ratio given by *b.*

Eventually, of course, the assumed differences in relative rates of inflation offset the exchange rate changes, and the competitive positions of periodic devaluers deteriorates, their trade balances go into deficit, and their reserves decline. Note, however, that potential revaluers have not been forced to do anything. If, now, there is another injection of new reserves at t_3, then, of course, the R/M ratios of potential revaluers increase, moving back closer to *b.* In the very long run, with enough new injections of reserves, the mechanism described in Theorem II will work. However, there is nothing that prevents the situation for potential periodic revaluers, from following the time path portrayed in Figure 1. In such a situation, the adjustment process would stretch out over a considerable period.

In this situation periodic devaluers will tend to devalue more often, or by larger amounts, than would be the case if revaluers were also adjusting their par values. The devaluers, therefore, would feel that there was insufficient liquidity in the system. The devaluers would clamor for creation of additional reserves, and insofar as the accumulation of new reserves can push the revaluers up to their desired ratio, *b,* these demands of devaluers tend to act in a stabilizing fashion. But the potential revaluers have no reason to favor the creation of new reserves as demanded by devaluers, so that the system can hardly be said to be characterized by calm and tranquility. More important, it is conceivable that the only way to increase the reserves of potential revaluers up to their desired ratios, *b,* is to allocate additional reserves to them *alone.* It is possible, therefore, that in order to drive the pivot point up, one would have to give additional reserves to periodic revaluers and to deny them to periodic devaluers! This weird result shows that the question of an appropriate pivot point cannot be discussed independently of such questions as availability of nominal reserves and their distribution.

Furthermore, it is worth noting that the mechanism described

FIGURE 1



above operates under the assumption that required average annual rates of change in exchange rates do not vary. If, instead, countries switch their relative posititions, so that at some points in time countries which, in the very long run, would be revaluers, become instead devaluers, the adjustment process may be stretched out even further.

The Correspondence Between Revaluers (Devaluers) and Surplus (Deficit) Countries. A further problem which arises in connection with Theorems I and II stems from their failure to note fully the distinction between "revaluers" ("devaluers") and "surplus" ("deficit") countries except for the special case of "sink" ("tap") countries which are able to postpone revaluation (devaluation) indefinitely despite continuing surpluses (deficits). However, under the optimality criterion proposed in Theorem I (and in Theorem III in the short run) there is no necessary reason for "revaluers" and "devaluers" to correspond to "surplus" and "deficit" countries, respectively.

Lack of such correspondence is exemplified by the following

array of countries (currencies) ranked according to their relative rates of inflation:

TABLE 3

revaluers								
A	B	C	D	E	p*	F	G	H
0	.01	.02	.03	.04	.05	.06	.07	.08
				deficit countries				

Suppose that the pivot is at .05 and countries E through H suffer from a balance-of-payments deficit. Then country E, although in deficit, will be forced to revalue periodically. It is possible that depreciation of E, relative to A, B, C and D, will more than offset its appreciation relative to F, G and H, so that its overall deficit will be reduced. But, again, it is possible that it will not. Then, in order to induce E to revalue, instead of to devalue, i.e., in order to keep the pivot at .05, enough reserves would have to be created for the E's loss of reserves due to revaluations be made up by new allotments.

From the standpoint of adjustment of balance-of-payments positions, especially on a bilateral basis, this problem is of little consequence: what matters is the change in the exchange rates by whatever combination of revaluations and/or devaluations it is achieved. However, in the real world it may prove impossible to convince some surplus (deficit) countries that in order to achieve long-term equilibrium of their balance-of-payments positions, the appropriate action of their part is a devaluation (revaluation). If, then, there is a lack of perfect correspondence between revaluers and surplus countries, and devaluers and deficit countries, and if appeal is made to Theorem II (i.e., to the claim that countries can be effectively forced to change their par values by the supranational agency having control over the rate of reserve creation), certain difficulties may surface. When deficit countries must be forced to revalue (in order to place the pivot at the appropriate point) reserves would have to be created at the rate sufficient to more than offset their loss of reserves resulting from their balance-

of-payments deficits. On the other hand, when surplus countries must be forced to devalue (again, in order to locate the pivot at the appropriate point), unless the rate of growth in demand for reserves (substantially) exceeds the rate at which such countries accumulate reserves, there is no mechanism, short of outright retirement of reserves, whereby a devaluation can be imposed on such surplus countries. It follows from the above considerations that in the absence of perfect correspondence between revaluers (devaluers) and surplus (deficit) countries, even if one accepts the notion that global liquidity management should be defined as pivot point management, it is highly unlikely that an international agreement on the "appropriate" liquidity policy can be secured.

The Peg and the Pivot. In addition to the above problems, the analysis of Theorems I and II, and their associated policy propositions, reveals a lack of understanding of the distinction between different types of pegs. That not all pegs are equivalent can be seen by contrasting the case of currencies pegged to gold with the situation arising when currencies are pegged to a pure fiduciary asset.

When currencies are pegged to gold, then the official value of gold in terms of a currency is determined by the number of units of the currency for which a unit of gold can be exchanged. At the same time, however, gold has uses as a commodity, and, therefore, has an implicit (shadow) price reflecting its value as a commodity which may or may not be revealed by the market. *A priori,* of course, in absence of deliberate policy by the authorities to keep the market price of gold equal to its official price, there is no reason to expect either that the two values will coincide, or that the price of gold as a commodity will remain invariant over time.[12]

Two implications follow from this observation. First, the pivot point will not, in general, measure the rate at which the commodity price of gold is changing even in the long run. At best, it will only measure the rate at which the official value of gold in any currency is changing. Second, it is unlikely that, with a positive rate of world inflation, the pivot point will remain

[12] Historically, of course, the opposite has been true. The commodity value of gold has tended to diverge almost continuously from the official value.

stable over time. Since the pivot generally will not measure the rate at which the commodity value of gold is changing, over the long run, in order to avoid a two-tier price system for gold, or to prevent depletion of officially held gold stocks, it will be necessary to periodically adjust par values (to devalue all currencies uniformly), to restore equality between official and implicit commodity gold prices. Such an adjustment of all par values, however, by definition involves a displacement of the pivot point.

Contrasted with this is the case of a pure fiduciary asset such as some sort of "paper gold". In this case, since such an asset has no value as a commodity, as long as the relative rates of inflation of various currencies remain constant, the pivot point need not move. In principle, then, in the very long run the pivot point will reflect the rate at which such a fiduciary asset is losing its real value.

IV. Conclusions and Implications

The overriding conclusion which emerges from the discussion above is that the concept of the pivot has been misused and abused more often than it has been properly used in the literature. On several grounds we have found it necessary to reject Theorems II and III, and their associated policy propositions. Only Theorem I emerges as a valid statement (if, indeed, adjustment costs *are* positively related to the magnitude of par value changes), and even its validity must be tempered by the question of what type of an asset is employed as a peg for the monetary system. This question (more specifically, the question of the relation between the choice of a peg and the stability of the pivot) was far from fully analyzed here. For example, the full implications of the use of a composite fiduciary asset, such as the present SDR, in the role of a "peg" have not yet been examined in the literature. The impact of alternate methods of valuation of a currency-basket type SDR on the stability of the pivot has been examined by Dreyer (1977). Results obtained there suggest that the pivot is stable only under one such method, thus suggesting that in a monetary system centered around a currency-basket SDR the usefulness of the whole pivot concept is even further reduced.

Clearly, in light of the Jamaica Agreements, the restoration of a system of adjustably pegged exchange rates is unlikely in the near future. Nevertheless, cleansing the theory of the pivot of the ambiguities by which it has been beset appears to be a worthwhile exercise.

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