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The So-Called Devaluation Bias in a System of Adjustable Pegs*

George B. Henry

It has been argued that the Bretton Woods system of adjustable pegs contains a "devaluation bias" against the dollar. That is, there is a systematic tendency for the U.S. dollar to become progressively overvalued with the passage of time.

The evidence so far raised in support of the hypothesis has been mixed. The most naive have simply counted up the number of devaluations and revaluations over some recent time period, noting that the former far outweigh the latter. Others have rested their case on the supposed asymmetrical pressures placed by the system on countries with undervalued and overvalued currencies. In particular, it is held that a country which is losing reserves is much more likely to be forced into devaluing than is a country which is gaining reserves likely to be forced into revaluing.^{1/} Moreover, since there are

* I have benefitted from numerous conversations with Don E. Roper and the comments of Larry J. Promisel. Neither, however, is at all responsible for any errors in this note.

^{1/} Krause has argued that "the system has inhibited parity changes and in an asymmetric manner; deficit countries have been less successful in avoiding devaluations than surplus countries have been in avoiding appreciations. Sooner or later a deficit country runs out of reserves and exhausts its line of credit. At that point the devaluation decision is forced upon it. There is no natural limit for a surplus country. As long as it is prepared to accumulate reserves, it can maintain the undervaluation of its currency." [Lawrence B. Krause, "Sequel to Bretton Woods: A Proposed Reform of the World Monetary System," September, 1971, p. 3-18.] Katz has argued that "support for the devaluation-bias hypothesis must continue to be looked for in the concepts of international economic theory which postulate that the greater part of the adjustment burden under a fixed-rate system is likely to be borne by the deficit country and in the practical world of affairs where officials in surplus countries widely regard it as appropriate that the deficit countries ought to bear the greater part of the burden of international payments adjustments." [Samuel I. Katz, "Devaluation - Bias and the Bretton Woods System," International Finance Discussion Paper No. 2, August 31, 1971, p. 32.]

political costs associated with changing a parity,, countries will be desirous of leaving a "margin of safety" for the future when they do change parities (they will devalue by a greater amount or revalue by a lesser amount than might be objectively justified.)

This note makes two simple points:

(1) Under the gold-exchange standard, the parities adopted by non-center countries have been their primary means of adjusting their reserve levels. Thus, the "devaluation bias" may simply be a reflection of the "liquidity problem," and is, therefore, inherent in a system of adjustable pegs only to the extent that the "liquidity problem" is inherent in such a system.

(2) If there is a long-run bias in the system of adjustable pegs, it is, and should be more appropriately denoted as, an "inflationary bias."

* * * *

(1) Robert Triffin has noted that "the gold-exchange standard may, but does not necessarily, help in relieving a shortage of world monetary reserves. It does so only to the extent that the key currency countries are willing to let their net reserve position decline ..., "^{2/} and only so far as the other countries of the world

^{2/} Robert Triffin, Gold and the Dollar Crisis [Yale University Press, 1961], p.67.

are prepared to accumulate the liabilities of the key currency countries.

The crucial point is that in a system where dollar accumulations play an important part in the growth of official reserve assets, exchange rate decisions are inextricably meshed with the "liquidity problem." Consider a static world with unchanging incomes and trade flows, and thus presumably an essentially constant quality of international reserve assets demanded. If there is a liquidity shortage, i.e., an outstanding supply of reserve assets less than the quantity demanded, countries will wish to maintain undervalued currencies in order to acquire additional reserves. The undervaluation will be maintained, however, only for some interim period during which dollar liabilities rise to meet an existing excess demand for international reserve assets (the U.S. runs an official settlements deficit). It would appear a clear misnomer to characterize such a situation as a "devaluation bias" or any other bias in the system; ^{3/} it is a purely transitory phenomenon.

In a world of growing incomes and trade flows, and thus an increasing demand for reserve assets, continuously "undervalued" currencies of the non-key countries could be observed. Whether one wished to refer to this latter circumstance as a "devaluation bias" in the system is, I suppose, a matter of taste. Regardless, it would stem from a liquidity shortage under the gold-exchange standard and not from the system of adjustable pegs, per se.

^{3/} There is nothing in this argument, though, to prevent the interim period from being "long."

(2) Suppose now the existence of an adequate supply of international reserve assets met by say, SDR creations. Consider the impact of disturbances to the world economy, such that some countries are running surpluses and others deficits. The devaluation bias arguments imply that on balance the deficit countries will be forced into devaluing more often and by greater amounts than the surplus countries (who will in large part simply accumulate reserves).

Over a relatively long time period, a random series of such disturbances would, *ceteris paribus*, leave the world with an excess supply of reserves, and, in fact, would lead to the inflation of other nominal magnitudes.^{4/} If then there is a systematic bias in the system of adjustable pegs consequent upon the ~~asymmetrical~~ pressures (political and otherwise) placed on surplus and deficit countries, it would seem appropriate to label it an inflationary, rather than a devaluation, bias.

If the above analysis is correct, we reach the ironic conclusion that one of the supposed important virtues^{5/} of the adjustable peg system (promoting world price stability) is non-existent; and indeed, that the system may have subverted price stability.

^{4/} It is commonly accepted that monetary authorities cannot always completely offset the inflationary impact of increases in their foreign reserves. See, for example, the Monthly Report of the Deutsche Bundesbank, Vol. 22, No. 7 and Vol. 23, No. 6.

^{5/} This view has been clearly stated in International Monetary Arrangements: The Problem of Choice where it is held that "a system of flexible exchange rates... would remove the anti-inflationary anchor provided by the discipline implied in the fear of dwindling reserves, and would therefore allow cumulative upward trends in prices." (International Finance Section, Princeton University, 1964), pp. 90-91.

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The Theory of the Devaluation Bias*

Don E. Roper

The belief has arisen in recent years that there exists a bias in the international monetary system against the U.S. dollar. Specifically, it is thought that there is a tendency for the dollar to become and remain overvalued with respect to other currencies. This belief is a particular implication of the more general proposition that, in an adjustable parity system, there exists a devaluation bias against the currency that is used as an intervention asset. If correct, this notion implies that the revaluations negotiated in the fall of 1971 to restore the competitive position of the U.S. will be undermined over time as other countries, on the average, depreciate their currencies (relative to the dollar) more than is suggested by relative inflation rates.

The devaluation bias has been attributed to at least two causes.^{1/} In the first place it is well known that it is easier for surplus countries with large reserves to resist revaluation than it is for deficit countries with low reserves to withstand devaluation pressures. Consequently, when countries' reserves are buffeted by external shocks, those countries whose reserves are reduced are more likely to devalue than those countries that suddenly find themselves with excess reserves are likely to revalue. Thus, if the world begins

* The argument of this paper has been improved by the author's discussions with Lance Girton and George Henry although neither are responsible for remaining errors.

^{1/} A good discussion of both causes is found in Samuel Katz "Devaluation-Bias and the Bretton Woods System," Banca Nazionale Del Lavoro Quarterly Review (forthcoming).

with a set of exchange rates consistent with payments balance^{2/} for the center country, random shocks will produce more devaluations than revaluations such that the center country is left with a currency overvalued with respect to the rest of the world.

A second argument for a devaluation bias is based on the fact that non-center countries tend to devalue by a greater magnitude than they revalue. Of course, governments do not alter their exchange rates unless events force them to do so. But when they do make parity changes, they tend to undershoot (the equilibrium rate) when they revalue and overshoot when they devalue. A major cause of this behavior is probably the fact that those groups (predominantly the traded goods industries) with special interests in an undervalued currency are more concentrated (and, therefore, find it easier to exert more political power) than those groups (especially consumers) with an interest in an overvalued currency.

Empirical evidence for a devaluation bias against the U.S. dollar is difficult to assemble because such a bias, if it exists, is hard to distinguish from the effect of a shortage of international liquidity. Clearly, if there is an inadequacy of international reserves and part or all of this excess demand is to be satisfied by dollars, then the non-center countries will, on the average, retain undervalued currencies to satisfy that demand. Consequently, one can not just compare the number and magnitude of devaluations versus revaluations

^{2/} The most appropriate measure of balance of payments disequilibria in the context of this paper is the official settlements basis.

and conclude that a devaluation bias exists if, in some sense, the former outweigh the latter.^{3/} In fact, it seems premature to search for an empirical method for discriminating between a devaluation bias versus a liquidity shortage until we clear up the theoretical basis for the devaluation bias. In this paper I would like to argue that, from a theoretical viewpoint, the arguments for a devaluation bias do not imply that such a bias exists except during a transitional period.

In order to analyze the implications of the two arguments given above for a devaluation bias, we need to separate the two alleged sources of the bias from a liquidity shortage. Since the growth in the demand for international reserves (that is insufficiently supplied by reserve assets other than dollars) can cause undervalued exchange rates, we should abstract from the major causes of this growing demand. In particular, we will assume that capital mobility, world trade, and

^{3/} A more sophisticated approach is to weigh the revaluations and devaluations by some index that reflects the importance of the U.S. trade with each country. Fred Hirsch and Ilse Higgins, "An Indicator of Effective Exchange Rates," IMF Staff Papers, November, 1970, have used such a procedure and found that the effective exchange rates of 13 other industrial countries depreciated in terms of the dollar between 1959 and 1969 by 4.7%. Oddly enough, they concluded that "there has been no such devaluation bias" (p. 474) because they did not find a devaluation or revaluation bias within the group of industrialized countries as a whole. But, as Samuel Katz, op.cit., has pointed out, there can not be a devaluation or revaluation bias within the system as a whole if the weighting scheme is consistently applied. Consequently, if one uses the empirical criterion employed by Hirsch and Higgins, one should conclude that there has been a devaluation bias against the dollar of 4.7% since the European return to convertibility. Even if this criterion were properly modified to incorporate differential rates of inflation in traded goods, it would still not discriminate between a devaluation bias and a liquidity shortage.

wealth are not growing and that price levels are stable. That is, we will assume that determinants of the demand for international reserves are unchanging such that the desired level of reserves of the non-center countries is stable at the value, R^* . In addition, we will assume that there are no net additions to the non-center countries reserves unless they accumulate foreign exchange -- i.e., run a surplus vis-a-vis the center country.

The first two arguments can be given an analytical interpretation by postulating a policymakers' preference or disutility function for non-center countries.^{4/}

$$(1) D = D[R-R^*, P(e-e^*)]$$

where R = aggregate reserve level of non-center countries,

P = an index of (net) political pressure to change the rate,

e = exchange rate of the non-center countries vis-a-vis the dollar (i.e., a weighted average of the dollar price of the pound, the dollar price of the franc, and so on),

e^* = the exchange rate desired by the non-center countries where their "desires" include all considerations except their reserve level. Since R^* is already included separately in $D[\dots]$, it should be omitted from the determination of e^* ,

e_0 = equilibrium exchange rate (i.e., $\dot{R}(e_0) = 0$); $e^* + b = e_0$,

^{4/} In order to use an aggregate disutility function that is unaffected by the distribution of reserves among the non-center countries, we can assume that the disutility functions of each country's policymakers are identical and homothetic.

b = the "bias" between the equilibrium and desired exchange rate > 0 .

$R = dR/dt$ = balance of payments of the non-center countries vis-a-vis the center country.

This preference function clearly excludes many policymakers' concerns but it does include the independent variables that are necessary for an analysis of the devaluation bias. The further e is from e^* the greater the political pressures upon policymakers and the greater their disutility. The preferential trade-off between reserve disequilibrium and exchange rate disequilibrium is shown in Figure I.

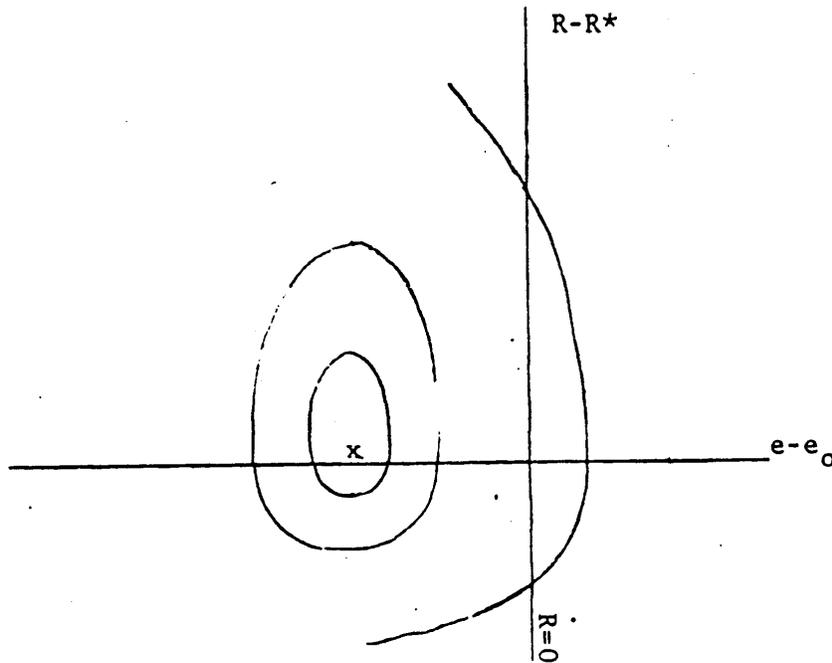


Figure I: Indifference Map Between Reserves and Exchange Rates

The first argument for a devaluation bias is based upon the fact that countries face a tougher constraint when they run short of reserves than when they have too many reserves. As Larry Krause argues.^{5/}

. . . the system has inhibited parity changes and in an asymmetric manner; deficit countries have been less successful in avoiding devaluations than surplus countries have been in avoiding appreciations. Sooner or later a deficit country runs out of reserves and exhausts its lines of credit. At that point the devaluation decision is forced upon it. There is no natural limit for a surplus country. As long as it is prepared to accumulate reserves, it can maintain the undervaluation of its currency.

Consequently, a country with a shortage of international reserves, $(R-R^*) < 0$, will feel more uncomfortable and will have to worry more about the prospects about being forced to devalue than a country with an excess of reserves (of the same magnitude) will have to worry about the pressure to revalue. This asymmetry in their feelings engendered by being away from their reserve targets is accentuated by the behavior of speculators. Despite the fact that governments try to keep reserve levels and borrowings secret when they are running short, speculators can still sense when a deficit country is low on reserves and vulnerable to attack. But they are much less certain when a surplus country's reserves are "too high." The probability of speculative attacks will probably increase faster as R drops below R^* than when R rises above R^* . For these reasons it seems clear that government authorities will experience greater discomfort or disutility when they are below R^*

^{5/} "A Sequel to Bretton Woods: A Proposed Reform of the World Monetary System," Brookings Staff Paper, September, 1971, p. 3-13.

than when they are above R^* by the same amount. This asymmetry is incorporated in Figure I in which each indifference curve (ellipse) stretches further above than below R^* .

The second argument for a devaluation bias -- that political pressures favor a rate, e^* , that is lower than the equilibrium rate, e_0 , -- is incorporated in the disutility function (1) with the insertion of the political pressure variable, $P(e-e^*)$ where $e^* + b = e_0$. The second or political-pressure argument is reflected in Figure I by the fact that the point of minimum disutility, x , is drawn to the left of the origin. The distance between point x and the origin is b ; $a = e^*$ at point x .

Having incorporated the asymmetry of the demand for international reserves and the distinction between the equilibrium and desired exchange rate into our analysis, we want to show that these two features do not imply a devaluation bias. We can begin the argument by assuming that the non-center countries are initially at point x , the position of minimum disutility. Of course, point x is not a static equilibrium position since the non-center countries are acquiring excess reserves. In order to accumulate reserves at a slower rate the non-center countries can appreciate their currencies. The actual path that they will pursue over time can be found by minimizing the discounted value of the disutility function. That is, find the time path of $e(t)$ such that

$$(2) \quad \int_0^t \exp^{-r\tau} D[R(\tau) - R^*, P(e(\tau) - e^*)] d\tau \quad \text{is minimum.}$$

Since we regard the rate of change of reserves, \dot{R} , to be inversely related to $(e - e_0)$ such that $\dot{R} = \dot{R}(e - e_0)$, then (if $\dot{R}(\dots)$ is monotonic) $e - e_0 = f(\dot{R})$. Substituting $e - e_0 = f(\dot{R})$ and $e^* = e_0 - b$ into (2) we obtain

$$(3) \quad \int_0^t \exp^{-r\tau} D [R(\tau) - R^*, P(f(\dot{R}) - b)] d\tau.$$

The condition for the minimization of (3) is found by substituting into the Euler equation to obtain $D_R = -r D_P P f_e$ or (since $f_e = (\dot{R}_e)^{-1}$)

$$(4) \quad - \frac{D_e}{D_R} = \frac{\dot{R}_e}{r}$$

where $D_e = (\partial D / \partial P)(\partial P / \partial e)$, $D_R = \partial D / \partial R$, and $\dot{R}_e = \partial \dot{R} / \partial e$.

Both sides of equation (4) can be given a simple graphical interpretation. The left-hand side, $-(D_e / D_R)$, is the formula for the slope of the indifference curves in Figure I. The slopes are different for different points because D_e depends upon $(e - e^*)$ and D_R depends upon $(R - R^*)$. However, the right hand side, \dot{R}_e / r , can be regarded as a constant. We can easily assume that the rate of discount, r , is constant, and it does not violate reality too much to assume that a given change^{6/} in e affects the balance of payment, \dot{R} , by the same amount for a wide range of values of e . Consequently, \dot{R}_e / r can be regarded as the slope of a family of negative sloped linear curves in exchange rate-reserve

^{6/} e could be defined as the log of the exchange rate in which case a change in e would be a percentage change.

space. These straight lines can be superimposed upon the indifference curves of Figure I in order to give a graphical interpretation of equation (4) as shown in Figure II.

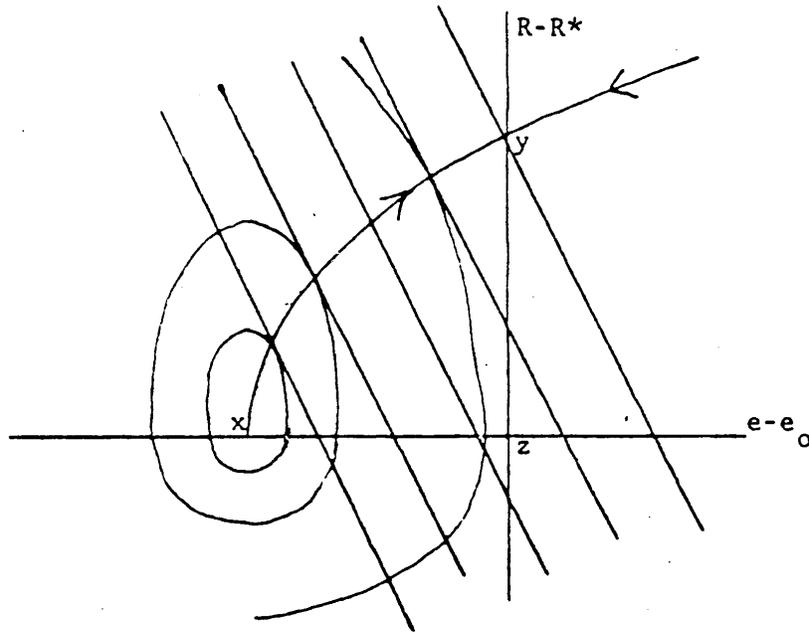


Figure II: Path of Adjustment

The minimization condition (4) requires policymakers to move their exchange rates over time such that the slopes of their indifference curves are tangent to the straight lines drawn in Figure II. The locus of these tangent points traces out the adjustment path.^{7/} As the

^{7/} The analysis here assumes continuous adjustment. If the authorities perceive costs to making parity changes (as they in fact do), then the true adjustment path would be a step function. If the steps are small and frequent enough, the smooth curve drawn in Figure II becomes a good approximation. Since "the exchange rate" of the Western world outside the U.S. is the weighted average of a large number of exchange rates, e moves by a small amount anytime any non-center country's rate moves. Consequently, the continuous process may not be a bad approximation when, as in our case, it is applied to a large number of countries with fairly independent exchange rate policies.

direction of the arrows indicate, adjustment can take place from overvalued as well as undervalued exchange rates and the only point of static equilibrium on this adjustment path is point y.

Thus far we have assumed that the system started from a point on the adjustment path. If there are no costs (as perceived by the authorities) to altering exchange rates, then, if we begin from a point off the adjustment path, the authorities will quickly alter their rates such that the system moves horizontally to the adjustment path. Horizontal movements are completely under the control of the exchange authorities whereas vertical movements are determined by the system on the basis of the value of the exchange rate. Consequently, if authorities are behaving as if they are minimizing a disutility function like ours, they will always be on or near the adjustment path.

Although the non-center countries should move along the adjustment path to point y, the distance between point y and z could be very large or very small. One factor that influences the distance between y and z is the sensitivity of the balance of payments to the level of the exchange rate, \dot{R}_e . The purpose of moving the exchange rate is to slow down the rate of increase (or decrease) of reserves. The greater the effect that exchange rate policy has over the rate of change of reserves, (the larger \dot{R}_e) the greater the incentive to use this policy, the steeper the straight lines in Figure II, and the closer points y and z.

Another factor that determines the volume of excess reserves accumulated by the non-center countries at point y is their rate of discount. If authorities do not discount the future such that $r = 0$, then $-D_e/D_R = \dot{R}_e/r \rightarrow -\infty$ such that the straight lines in Figure II become vertical. In this case the adjustment path will be horizontal and static equilibrium will be (if we start at point x) at point z. Beginning at x, the authorities would have to appreciate very quickly to reach z without acquiring excess reserves. In this case the non-center countries are willing to sacrifice the lower levels of disutility level that can be achieved in static equilibrium over the long run. Conversely, if the authorities discount the future completely such that $r = \infty$, then the straight lines in Figure II become horizontal. In this case the adjustment path will be vertical and static equilibrium will never be reached. Of course, the realistic case is probably somewhere between the two extremes. However, politically sensitive authorities sometimes give considerable weight to the short-run (or the next election) and, therefore, use a high rate of discount to minimize (1). This factor would suggest that the system would probably acquire substantial excess reserves over the long run.

Barring the extreme cases in which authorities act upon an infinite rate of discount and in which the balance of payments is completely insensitive to the exchange rate, it is clear that an undervalued exchange rate is a transitory affair. Of course, the transition could last a long time, but there is not a permanent devaluation bias

in the non-center countries' exchange rates. In short, the absence of a static equilibrium point with $e < e_0$ precludes a devaluation bias that is based upon the asymmetry of the demand for international reserves (argument one) or the lopsided concentration of political power in groups that favor undervalued exchange rates (argument two).

It is, however, interesting to examine the implications of the basic premises of the two arguments for the path of adjustment and the ultimate position of static equilibrium. The asymmetry of the demand for international reserves is reflected in the fact that (the absolute value of) D_R is smaller for positive values of $(R-R^*)$ than for negative values of $(R-R^*)$ of the same absolute magnitude. The smaller D_R when $(R-R^*) > 0$ the steeper the adjustment path. Consequently, although the asymmetry of the demand for international reserves does not imply a devaluation bias, it does imply that the transition period will be longer such that undervalued exchange rates will remain undervalued longer than otherwise.

The second argument implies that the bias between the equilibrium and the desired exchange rate, $e_0 - e^* = b > 0$, is substantial. It is clear from inspection of Figure II that if b were increased while the shape of the ellipses remained intact and the slope of the straight lines remained unchanged, then the adjustment path would extend further and the distance between points y and z would be increased. The larger b the longer the non-center countries' exchange rates can be undervalued because the transitional period will be longer.

The conclusion of this paper is that the so-called devaluation bias is either a transitory phenomena or, if it is a permanent feature, then it must reflect a shortage of international liquidity.^{8/} If it is a transitory condition afflicting the current system, then it has been misnamed because the word "bias" suggests a rather permanent or continuous feature that is inherent in the system. However, the degree to which a liquidity shortage might produce undervaluation and the time required to work out of temporarily undervalued exchange rates might be sufficiently great that the problem of undervaluation is very serious. But these are (important) empirical matters. The argument of this paper is that, from a theoretical point of view, the phrase "devaluation bias" is, at best, a misnomer.

8/ Strictly speaking an overall liquidity shortage is also a transitory phenomena (even when growth is introduced). For suppose that countries found themselves with an excess demand for reserves. In order to achieve their desired reserve levels, they would (i) deflate their national economies and/or (ii) introduce trade restrictions in order to to accumulate international reserves. The reserves that one country acquires from (i) and (ii) comes at the expense of other countries' reserves and, therefore, does not eliminate the overall liquidity shortage (assuming that (i) and (ii) do not induce gold into official hoards). When most or all countries pursue (i) and (ii) they inadvertently (i) place downward pressure on the world price level until the existing reserves rise in real value to meet the countries' desires and/or (ii) increase trade restrictions until the need for reserves is lowered to meet the desired level. However, if this process is as I believe, only operative over the long run, an overall liquidity shortage can produce undervalued exchange rates for a sufficiently long period of time such that the rates appear "permanently" bias downwards compared to the length of time that rates could be biased downwards as a result of the first two arguments for a devaluation bias.