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CENTER DISCUSSION PAPER NO. 55

DEVALUATION AND AGGREGATE DEMAND

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It is generally regarded as a truism that currency devaluation is inflationary, except under those circumstances when a devaluation would perversely worsen a country's balance on goods and services. The reasoning underlying this proposition is simple and straightforward: a successful devaluation will increase export receipts and/or divert import demand to domestic substitutes, on both counts adding to the total monetary demand in the economy. But increases in aggregate demand reinforced by multiplier effects may be expected, by itself, to worsen the current account. It follows that conscious policies of demand deflation must be undertaken if the beneficial effects of devaluation are not to be partially or even wholly eroded through devaluation-induced increases in total demand.

This paper challenges the theoretical proposition that successful devaluation is always ^{1/}inflationary and sets out conditions under which the opposite will be true.

The Currency of Measurement

A devaluing country is typically interested in improving the current account of its balance of payments in terms of foreign currency. Foreign exchange is the scarce resource, of which supplies to the country are inadequate. But the impact of a devaluation on the country's total money demand must be measured in terms of domestic currency; that

is the unit of measurement for domestic output, income, and expenditure and for any gaps between output and expenditure. For many purposes this distinction between foreign and domestic currencies is of minor consequence. A current account balanced in one currency will be balanced in the other; a deficit eliminated in foreign currency will also be eliminated in domestic currency. When the relationship between currencies changes, however, the distinction between currencies is of considerable importance in a significant class of circumstances, and much conventional analysis of devaluation is substantially modified by taking it into account. In particular, devaluations that are successful in the sense of improving a country's current account position in terms of foreign currency may nonetheless be deflationary in the sense of reducing aggregate monetary demand (measured in domestic currency) within the devaluing country. This outcome is not merely a theoretical possibility; it is a likely one in many less developed countries -- capital-importing countries with rather low elasticities of demand for imports.

The possibility of deflationary devaluation can be seen most simply by considering the relationship $B = rB_d$, where $B = X - M$ is the balance on goods and services measured in terms of foreign currency, r is the foreign-currency price of a unit of domestic currency, and B_d is the balance on goods and services measured in terms of domestic currency. A devaluation by $\Delta r < 0$ will change the balance measured in either currency, leading to the relationship :

$$(1) \quad \Delta B = (r + \Delta r)\Delta B_d + B_d \Delta r,$$

where Δ indicates a change in the variable it precedes. It is clear from equation (1) that even when ΔB is positive, implying an improvement in the foreign balance, ΔB_d may be negative, implying a reduction in aggregate money demand in the devaluing country, so long as B_d is negative, that is, so long as imports exceed exports -- a condition usually met in devaluing countries. Most analysis of devaluation has neglected this possibility because it assumes that trade is initially balanced ($B = B_d = 0$) and/or that the magnitude of the devaluation is "small," so that the quantitative impact of Δr can be neglected.^{2/} On either assumption the second term on the right-hand side of equation (1) can be neglected, and the change in the balance must have the same sign no matter what the currency of measurement.

The movement in opposite directions of the balance measured in the two currencies arises because the relationship between the currencies has changed, so that the magnitude of the deficit measured in domestic currency will rise as a result of devaluation, before any allowance for economic adjustments in response to the devaluation.

is actually deflationary

Whether or not devaluation/depends on the responsiveness of the balance on goods and services to changes in relative prices. The more responsive the balance to changes in the exchange rate, the less likely devaluation is to be deflationary. But it will be shown below that devaluation can be deflationary even when the conventional Marshall-Lerner

conditions are met, i.e., even when the sum of the country's price elasticity of demand for imports and the world's price elasticity of demand for the country's exports exceeds unity.

To reduce the task of setting out the conditions under which successful devaluation will be deflationary ($\Delta B > 0$; $\Delta B_d < 0$) to manageable proportions, it will be assumed that the price elasticity of supply of the devaluing country's imports is infinitely large. Most countries are certainly price-takers for their imports, the exceptions being mainly confined to the largest countries such as the United States and possibly Britain and Germany.

The formal relationships between devaluation, prices elasticities, and the change (in either currency) in the balance of goods and services are shown in an appendix. In the case of infinitely elastic supply of imports and for a devaluation that is negligibly small, the following condition must be met if devaluation is to have no effect on the balance measured in foreign currency:

$$\Delta B = kM \left\{ \frac{X\eta_x(1-\epsilon_x)}{M(\eta_x + \epsilon_x)} - \epsilon_m \right\} = 0$$

or (2)
$$\epsilon_m = \frac{X}{M} \left[\frac{\eta_x(1-\epsilon_x)}{\eta_x + \epsilon_x} \right]$$

Here ϵ_x is the foreign price elasticity of demand for the country's exports, η_x is the country's price elasticity of supply for exports, and ϵ_m is the country's price elasticity of demand for imports, all defined to be non-negative. X/M is the ratio of exports of goods and

services to imports of goods and services before the devaluation; this ratio is of course insensitive to the currency of measurement.

$k = (\Delta r/r)$ is the proportional devaluation.

An analogous condition must be met if devaluation is to have no effect on the balance measured in domestic currency ($\Delta B_d = 0$):

$$(3) \quad \epsilon_m = 1 - \frac{X}{M} \left[\frac{\epsilon_x (1 + \eta_x)}{\eta_x + \epsilon_x} \right]$$

Equations (2) and (3) form two boundaries defining three regions, one in which the balance deteriorates in terms of both currencies (the conventional case of "perverse" elasticities), one in which the balance improves in terms of both currencies, and one in which the balance improves in terms of one currency but deteriorates in terms of the other. These boundaries are plotted in Figure 1, treating η_x and X/M as parameters.

It can be seen from Fig. 1 that there may be a substantial range of values for the two demand elasticities for which a successful devaluation ($\Delta B > 0$) may nonetheless be deflationary. This outcome cannot occur if $\epsilon_m > 1$, but it can occur for values of ϵ_x greater than unity.

If $X/M = 1$, that is if trade is initially balanced, then equations (2) and (3) are identical, the two boundaries coincide, and the demand-elasticity field is divided into only two regions. The curvature of the two boundaries is the same for $\frac{(\text{values of})}{\epsilon_x} < 1$, and is determined by the supply elasticity for exports, η_x . If this is infinitely large, ^{as} ~~and~~ would be the case when there was widespread unemploy-

Fig. 1

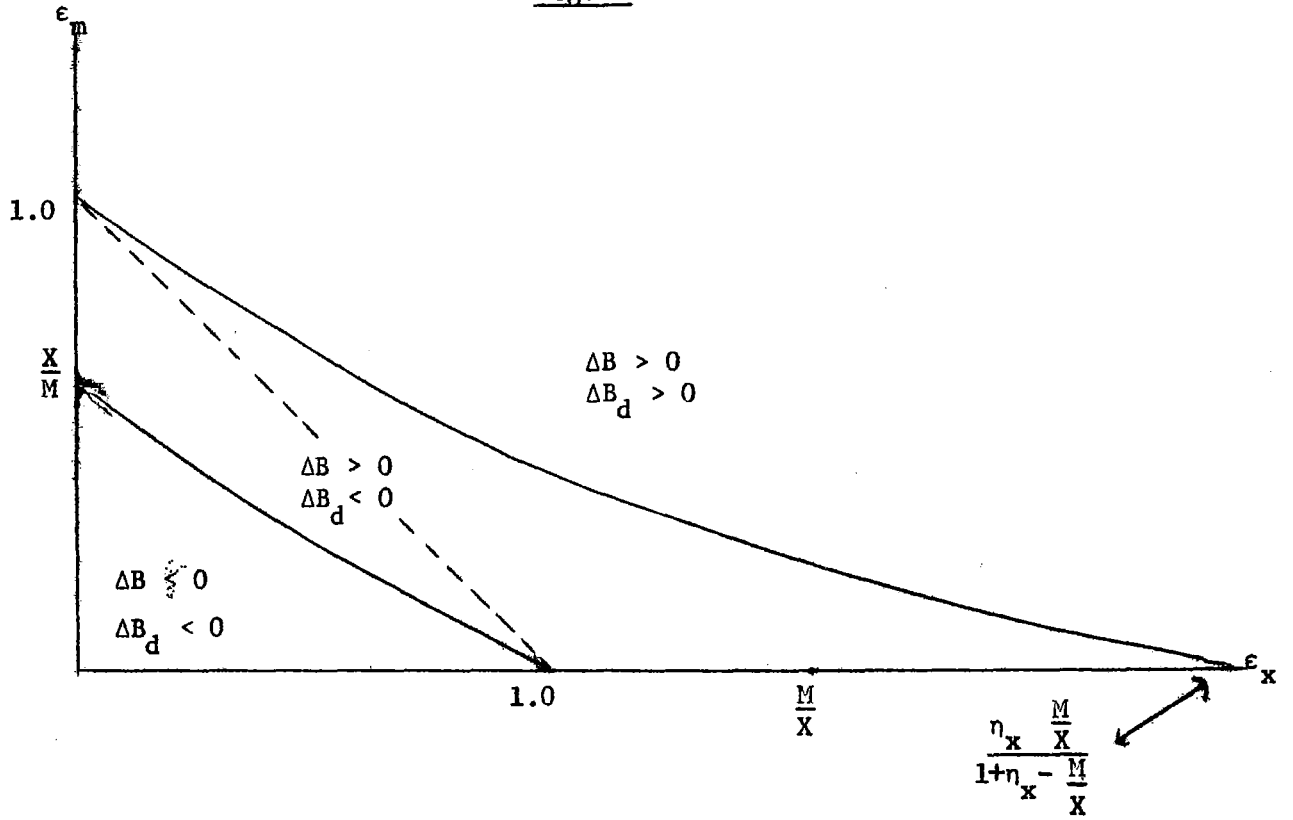
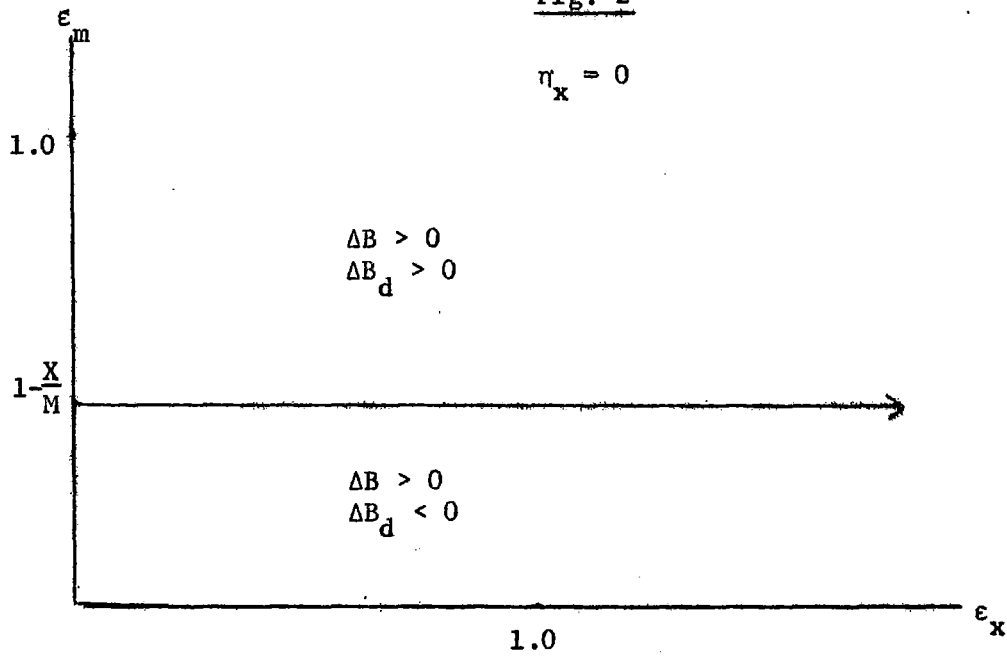


Fig. 2



ment and under-utilized capacity, then the boundaries become straight lines and the terminal point of the upper boundary ($\Delta B_d = 0$) on the ϵ_x - axis is M/X . In this case if $X/M = 1$ the boundaries coincide in the conventional Marshall-Lerner condition for no change in the balance, $\epsilon_x + \epsilon_m = 1$, shown as a dotted line in Fig. 1. Thus there is a substantial sub-region in which this condition is met and devaluation is nonetheless deflationary. Smaller supply elasticities result in greater curvature toward the origin, and in the limiting case of $\eta_x = 0$ result in the two regions shown in Fig. 2. In this case devaluation will always improve the foreign balance (provided $\epsilon_m \neq 0$), but it will also always be deflationary if ϵ_m is smaller than $1-(X/M)$, regardless of the value of ϵ_x .

It is important to note at this point the nature of these elasticities, and particularly of the elasticity of demand for imports, ϵ_m . These should be regarded as quasi-ex post elasticities rather than as elasticities describing the underlying demand conditions. Many less developed countries restrict imports severely through quotas and exchange controls; these controls typically ensure a low value of ϵ_m . In these circumstances devaluation may be deflationary even when the elasticity of demand for exports is quite high. The elasticities are only "quasi" because these ex post elasticities should not encompass the impact on imports arising from changes in the level of total demand.

Moreover, there is an important element of timing. Price responsiveness, both of supply and of demand, is likely to be higher after economic units have had time to adjust to the new situation. The supply of exports may be quite inelastic in the short run but will become more responsive with the passage of time. If the elasticity of demand for imports is also low, devaluation by a country in deficit may be expected to be deflationary in the short run, as indicated in Fig. 2. With the passage of time, the boundaries of the middle zone will shift northeastward as supply responds increasingly to the new opportunities. As this occurs, the values for ϵ_m consistent with deflation also increase. The values of ϵ_x consistent with deflation decline, but may remain quite high (compare Fig. 1 with Fig. 2).

Discrete Devaluations

The foregoing analysis has assumed that the devaluation is sufficiently small that its magnitude can be neglected in the analysis. Yet in the "adjustable peg" regime of fixed exchange rates prevailing in most of the world most of the time this assumption possibly introduces important error, since devaluations are usually non-negligible in amount, typically ranging from 10 to 40 percent. In fact, however, allowance for discrete devaluation does not require substantial modification of the above results except for very large devaluations.

The analogues to equations (2) and (3) become quite complex when the effects of a discrete devaluation are taken into account (see the Appendix); certain terms normally neglected must be included,

and of course the results depend on the size of the devaluation itself. Figures 3 and 4 sketch out boundaries defined by $\Delta B = 0$ and $\Delta E_d = 0$, dividing the field into three (or two) regions, as before. Here k and ϵ_m are measured along the axes, and ϵ_x and X/M are treated as parameters. Figure 3 is drawn for $\eta_x = \infty$ and Fig. 4 for $\eta_x = 0$, the two extreme conditions with regard to export supply. The rightmost terminal points on the boundaries in Fig. 3 terminate on the boundary lines of Fig. 1 (Fig. 3 has been drawn for $\epsilon_x = 0.5$), where the magnitude of the devaluation is negligibly small. The three elements ϵ_x , ϵ_m , and k form a three-dimensional region which can be imagined by putting the k -axis perpendicular to the page (the $\epsilon_x - \epsilon_m$ plane) in Fig. 1, and Fig. 3 represents one cross-section of that region.

It can be seen in Fig. 3 that the region of deflationary devaluation narrows as the magnitude of the devaluation increases, but it remains substantial except for very large devaluations. For values of $\epsilon_x > .5$, however, the middle regions first increases its vertical dimension as the devaluation gets larger, then subsequently decreases. Thus in this case a discrete devaluation runs a somewhat larger chance of being deflationary than is evident from Fig. 1.

Fig. 4 shows the opposite extreme case where exports are completely inelastic in supply, adding a third dimension, k , to Fig. 2. Here the region of deflationary devaluation is obviously insensitive to the elasticity of demand for exports. As already noted, in this case devaluation will always improve the balance measured in foreign currency.

Figure 3

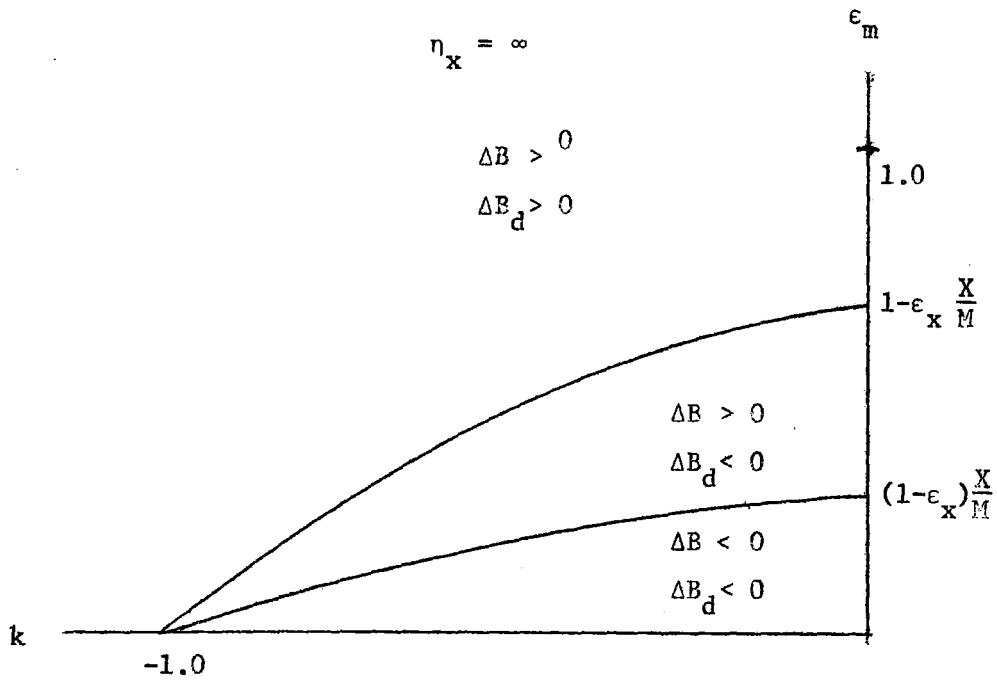


Figure 4

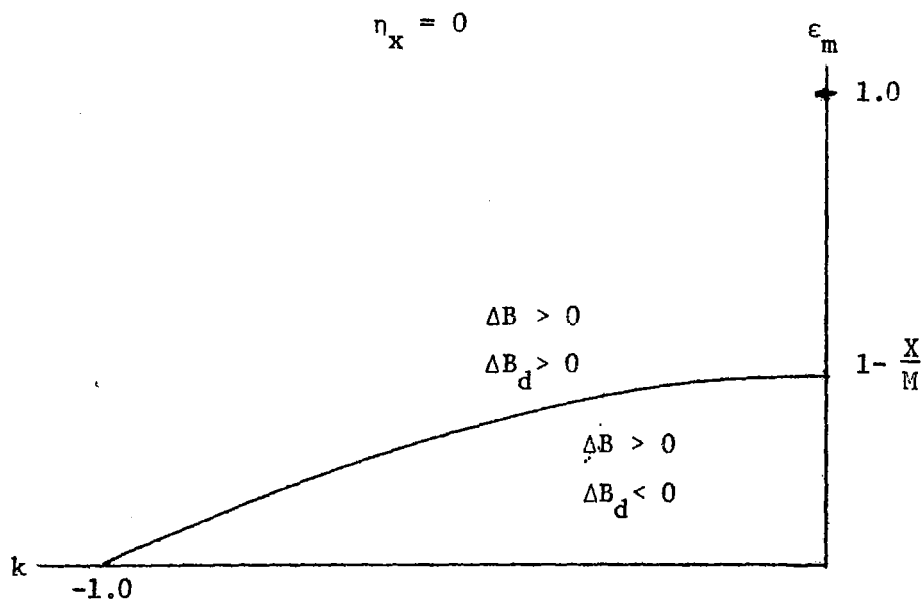


Figure 3 brings out the fact that a sufficiently large devaluation will always improve the trade balance (within the framework of this static analysis), regardless of the size of the demand elasticities (so long as $\epsilon_m > 0$), even when export supply is elastic. Thus the "stability conditions" so frequently discussed in the literature on exchange rates are not applicable to discrete changes in exchange rates; certain effects that grow with the magnitude of the devaluation and eventually assure an improvement in the balance are normally neglected. In particular, for a given (discrete) devaluation, the percentage decline in export prices (leading to loss of foreign earnings if $\epsilon_x < 1$) will be smaller than the percentage increase in domestic prices of imported goods (leading to a fall in demand for imports), and this discrepancy will grow with the size of the devaluation. This effect pointing toward improvement is reinforced if $X < M$, since the decline in export earnings applies to a smaller base than the decline in import volume.^{3/}

Deflation Reinforces Devaluation

One general conclusion to be drawn from this discussion is that devaluation-induced changes in aggregate demand, far from undoing the effects of devaluation on the trade balance, actually in certain cases can be expected to reinforce the effects of devaluation on the balance. It is generally assumed that the effects of devaluation will be weakened or even eliminated if aggregate money demand is permitted to respond to the price effects of devaluation. This was the major point of the "absorption approach" to devaluation. But if devaluation worsens the balance in terms of domestic currency, the level of income and expenditure will be depressed and that will contribute toward a further improvement in the balance. In the "Keynesian" case of infinitely elastic supply for both imports and exports, and where no government action is

taken to compensate for the changes in income (but monetary action is taken to neutralize any monetary effects of the current account deficit), the ultimate effect of devaluation on the balance on goods and services (ΔB^*) will be:

$$(4) \quad \Delta B^* = \Delta B - (r + \Delta r) \frac{m}{s+m} \Delta B_d ,$$

where m is the marginal propensity to import out of additional income, s is the marginal propensity not to spend out of additional income, and foreign repercussions are ignored. Clearly if $\Delta B_d < 0$, the "final" improvement in the balance will exceed the "initial" improvement. This contrasts with the more usual formulation under these assumptions, $\Delta B^* = \left[\frac{s}{s+m} \right] \Delta B$, where the final improvement (after allowing for income effects) is clearly less than the initial improvement, and possibly substantially less. This conventional expression is in error even when devaluation is expansionary, since as we have seen ΔB_d cannot be equated with ΔB .

A second general conclusion to be drawn from the analysis is that devaluation, even successful devaluation, may generate unemployment and under-utilization of capacity and hence without corrective policy may lead to a waste of resources. This will occur if devaluation results in increased expenditures (in domestic currency) on imported goods, diverting domestic expenditure away from domestically-produced goods and services, and if the increased foreign expenditure for the country's exports fails to compensate fully for the reduction in domestic purchases. Under these

circumstances the economic authorities may rightly choose to expand total domestic expenditure, contrary to the advice usually given, and they can do so without weakening the "initial" effects of devaluation on the balance (ΔB). Such expansion cannot go very far, however, for the devaluation-induced deflation is limited, and for moderate devaluations will always be less than the initial imbalance, measured in domestic currency.^{5/}

Capital-Exporting Countries

Thus far the analysis has been couched in terms of a country with a continuing deficit on goods and services, as would be characteristic of a country with a normal import of capital. A similar analysis applies to a normal capital-exporting country, a country for which $X/M > 1$. In this case again there are three possible outcomes rather than the two conventionally considered; but here the middle region analogous to that in Fig. 1 involved a deterioration in the balance in terms of foreign currency and an improvement in terms of domestic currency. That is, the boundary $\Delta B = 0$, running from $\epsilon_m = X/M$ to $\epsilon_x = 1.0$, lies wholly above the boundary $\Delta B_d = 0$. A devaluing country falling into the middle region here will find its trade position worsened by the devaluation in the first instance, and the devaluation-induced domestic expansion will tend to worsen the position even further. This perhaps offers one analytical reason, although undoubtedly not the most important one, why developed (capital-exporting) countries are more reluctant to devalue their currencies when in balance-of-payments

difficulty than is true of the less developed (capital-importing) countries. Unless the demand elasticities are markedly higher (as they probably are, however), the prospects for successful devaluation are less good.

Actual Values of the Parameters

Real world relevance is given to the analysis presented here by the fact that many countries do in fact have substantial and continuing deficits in their trade in goods and services. In 1965 no fewer than 19 countries, listed in Table 1, had a ratio of exports to imports of goods and services less than 0.8. (Only three countries, the United States, Uruguay, and Saudi Arabia, had X/M in excess of 1.25 and that for Uruguay was aberrant.) These ratios suggest that the middle region of Fig. 1 (which is drawn for $X/M = 0.6$) could in fact be an important one.

Data on demand and supply elasticities are much more difficult to obtain. As noted above, however, the elasticity of supply of exports and the elasticity of demand for imports are both likely to be small in the period immediately following a devaluation, although they may be expected to increase with time. Thus the timing of collateral measures will be very important. Secondly, the import demand elasticities in many less developed countries are held down both by the composition of those countries' imports (oriented heavily to raw materials, capital goods, and in some cases foodstuffs) and by import policies that do not permit changes in relative prices to express themselves fully in changing the demand

Table 1

Ratio of Exports to Imports, 1965
(Goods and Services)

South Vietnam	.46	Somalia	.70
Tunisia	.52	India ^a	.71
Pakistan	.52	Sierra Leone	.72
Israel	.57	Spain	.74
Jordan	.58	Indonesia ^a	.76
South Korea	.59	Nigeria	.76
Ghana	.62	Bolivia	.76
Greece	.65	United Arab Republic	.79
Costa Rica	.66	Dominican Republic	.79
Haiti	.68		

a 1964

Source: IMF, Balance of Payments Yearbook

for imports. If imports are already rationed through quotas or exchange licensing, raising the domestic price of imports may well have little or no effect on the quantity imported, yet it will reduce purchasing power in the hands of the public. Moreover, if devaluation is accompanied by some liberalization of the import restrictions, the value of imports in foreign currency might actually increase. Analytically, the pre-devaluation ratio X/M can be regarded as having been lowered, and the middle region of Fig. 1 is thereby increased in size. Devaluation under these circumstances is even more likely to be deflationary.

Summary

In a range of circumstances likely to be commonly found in many less developed countries, successful devaluation will be deflationary rather than inflationary, as is usually supposed. Devaluation will of course increase the domestic prices of imports and import-competing goods; it is precisely this price increase that is deflationary, since higher money payments for imports withdraw purchasing power and reduce expenditures on domestic goods. The outcome is very much analogous to that created by a rise in excise taxes, which raises prices but also reduces excess demand and is deflationary in that relevant sense.

When these circumstances are met, further deflation through monetary and fiscal policies, usually said to be necessary to make devaluation work, may be both unnecessary and inappropriate. Indeed, there may even be occasions on which expansionary policies might accompany devaluation,

in order to avoid unnecessary waste of resources, although in no case would such expansion be very large. If deflation is desired on domestic grounds, the devaluation will also contribute toward that end, and the resulting deflation will augment the price-switching effects of devaluation on the trade balance.

Although the analysis leading to this conclusion is conventional, it has several limitations. First, it makes no allowance for the effect of devaluation on international capital movements, although unlike the more usual analysis it presupposes continuing capital inflows (or outflows). Purely speculative reversals in capital flows have little or no effect on the analysis. If, however, the devaluing country becomes a more attractive place for location of industry because of the devaluation, this may generate some foreign capital expenditure there that would not otherwise have taken place.

Second, the analysis here has ignored the effect of changes on the terms of trade on aggregate spending (the Laursen-Metzler effect). For all but the smallest countries, successful devaluation may be expected to worsen the terms of trade on the assumptions made here, and this will reduce real incomes in the devaluing country, with a resulting reduction in saving. This effect will be somewhat inflationary; but it can normally be neglected.^{6/}

Finally, the analysis has been static, ignoring entirely dynamic interactions running from a devaluation-induced rise in the cost-of-living to wages and back again.

Appendix

For a change in exchange rate Δr , the balance on goods and services measured in foreign currency (B) may be expected to change by:

$$(A.1) \quad \Delta B = kM \left\{ \frac{X}{M} \frac{\eta_x (1 - \epsilon_x)}{\eta_x + \epsilon_x} - \frac{\epsilon_m (1 + \eta_m)}{\eta_m + \epsilon_m} \right\}$$

The balance measured in domestic currency (B_d) will change by

$$(A.2) \quad \Delta B_d = k M_d \left\{ \frac{X}{M} \frac{\epsilon_x (1 + \eta_x)}{\epsilon_x + \eta_x} + \frac{\eta_m (1 - \epsilon_m)}{\eta_m + \epsilon_m} \right\}$$

where ϵ_m = price elasticity of demand for imports

ϵ_x = price elasticity of foreign demand for the country's exports

η_m = price elasticity of foreign supply of imports

η_x = price elasticity of supply of exports

X = initial level of exports of goods and services

M = initial level of imports of goods and services (subscript

d indicates measurement in domestic currency)

$k = \frac{\Delta r}{r}$ = the proportionate change in exchange rate

Setting (A.1) and (A.2) equal to zero, specifying $\eta_m = \infty$, and rearranging terms yields equations (2) and (3) in the text.

Expression (A.2) was first derived by Joan Robinson [11], and the derivation of both expressions can be found in Alexander [1]. Both of these authors, however, derived the above expressions by neglecting certain interaction terms, a procedure that is justifiable only if k is negligibly small and if interest in the analysis is focussed on stability in the exchange market.

For discrete devaluations of non-negligible amount, however, the interaction terms cannot be safely neglected. Unfortunately, including them explicitly involves complex expressions in fractional orders of k and the elasticities. Some idea of the influence of these terms can be gained, however, by considering the two analytically simple cases $\eta_x = \infty$ and $\eta_x = 0$, both for $\eta_m = \infty$, as before. For these cases (shown as Figures 3 and 4) we have:

$$\underline{\eta_m = \eta_x = \infty}$$

$$(A.3) \quad \Delta B = k \bar{M} \left\{ \frac{X}{M} (1 - \epsilon_x) - \frac{\epsilon_m}{1 + k(1 - \epsilon_m)} \right\}$$

$$(A.4) \quad \Delta B_d = k \bar{M}_d \left\{ -\frac{X}{M} \left(\frac{\epsilon_x}{1+k} \right) + \frac{1 - \epsilon_m}{1 + k(1 - \epsilon_m)} \right\}$$

$$\underline{\eta_m = \infty ; \eta_x = 0.}$$

$$(A.5) \quad \Delta B = k M \left\{ \frac{-\epsilon_m}{1+k(1-\epsilon_m)} \right\}$$

$$(A.6) \quad \Delta B_d = k M_d \left\{ -\frac{X}{M} \frac{1}{1+k} + \frac{1-\epsilon_m}{1+k(1-\epsilon_m)} \right\}$$

It should be noted that the demand elasticities in (A.3) - (A.6) are quasi-expost elasticities, and they may therefore vary with the size of the devaluation. The elasticities have been somewhat arbitrarily defined here so as to have the desirable property that $\epsilon_x = 1$ will leave total foreign exchange receipts from exports unchanged and $\epsilon_m = 1$ will leave total domestic currency payments for imports unchanged; thus,

$$\epsilon_x = -\frac{\Delta Q}{Q} \cdot \left(\frac{q+\Delta q}{q} \right) \quad \text{and} \quad \epsilon_m = -\left(\frac{\Delta P}{P + \Delta P} \right) \frac{p}{\Delta p} ,$$

where Q is the quantity of exports and q its price in foreign currency and P is the quantity of imports and p its price in domestic currency. These definitions differ slightly from those normally used for arc elasticities, but the major conclusions from the analysis are not sensitive to this alteration.

Equations (A.3) and (A.5) indicate why some level of devaluation will always succeed in improving the current balance, regardless of the values of the demand elasticities (provided $\epsilon_m > 0$): so long as there is some price sensitivity to the demand for imports, a sufficiently large

devaluation will lead to a fall in import volume that more than compensates for the loss of export receipts, since export receipts will decline by $kX(1-\epsilon_x)$ and import volume (= payments, since foreign prices are assumed constant) will fall by $kM \frac{\epsilon_m}{1+k(1-\epsilon_m)}$. For $k < 0$, $-k$ (the proportionate fall in export prices) $< \frac{-k}{1+k}$ (the proportionate rise in import prices), "so for sufficiently large k the reduction in imports will outweigh any reduction in exports."

Footnotes

- 1/ Changes in the distribution of income arising from devaluation, and the effects of these distributional changes on savings and imports, including the possibility of deflation, have been recognized. See Diaz [3].
- 2/ See the classic analysis by Joan Robinson [11]. Also Alexander [1], Fleming [5], Lausen and Metzler [10], and Tsiang [12]. An exception is Hirschmann [8], who early pointed out the possibility that a change in the balance measured in domestic currency might have the opposite sign from the change in the balance measured in foreign currency, and therefore that successful devaluation might be deflationary both in the devaluing country and in the rest of the world. Haberler [6] and Harberger [7] also state clearly that the two balances may move in opposite directions, but they carry the analysis no further. Day [4] is concerned with the size of the devaluation required to eliminate an initial trade imbalance, and of course a deficit eliminated in one currency will also be eliminated in the other.
- 3/ It should be remembered that the elasticities used here are quasi-ex post elasticities, and that they therefore take on values appropriate to the devaluation in question. These need not be the same as the elasticities evaluated for small changes in relative prices around the pre-devaluation position.

4/ See Alexander [1], Black [2], Tsiang [12].

5/ This follows directly from (1): for successful devaluation ($\Delta B > 0$) of less than 50 percent ($\Delta r/r > -.5$),

$$\Delta B_d < -\left(\frac{\Delta r}{r+\Delta r}\right) B_d < B_d. \quad \text{in absolute magnitudes.}$$

This may not be negligible, however. For a country where imports amount to 20 percent of GNP and exports are only 60 percent as high as imports, the deflationary impact of a successful devaluation might be nearly 8 percent of GNP.

6/ Jones' [9] argument that this effect will in any case be only transitory, on the empirical grounds that the long-run marginal propensity to save is equal to the average propensity to save, is perhaps less applicable to less developed countries.

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