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THE INDEBTED GROWTH PROCESS

Amit Bhaduri

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by

Amit Bhaduri

Centro de Estudios Económicos

El Colegio de México

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A B S T R A C T

This paper is concerned with the question of sustainability rather than optimality of external borrowing, Using macroeconomic accounting of standard growth models, it shows how a country manages to service its growing debt despite remaining permanently indebted. The possibility of such an indebted growth process raises practical questions about the wisdom of imposing quantity - or price-rationing of credit by the lenders on the one hand and, the political issue of self-reliance versus dependence in achieving higher than autarkic rate of growth for the country concerned on the other.

R E S U M E N

En este trabajo se analizan las condiciones bajo las cuales un país puede mantener su nivel de endeudamiento externo pero no se considera la determinación de la cantidad óptima de deuda. Haciendo uso de la contabilidad macroeconómica de modelos de crecimiento estandard, se muestra cómo un país puede servir su deuda y permanecer endeudado. La viabilidad de un proceso de crecimiento con endeudamiento externo cuestiona la imposición de restricciones en la cantidad -ó el costo- del crédito por parte de los prestatarios. Asimismo, subraya la necesidad del análisis político de los modelos de autosuficiencia (por oposición a los de dependencia) en la medida en que se quiera maximizar la tasa de crecimiento del producto.

I. Introduction

Not long ago several Latin American governments adopted a strategy of heavy commercial borrowing abroad to finance domestic growth under a liberalized trade regime. It resulted in mounting external debt, a significant proportion of which was contracted under flexible interest arrangement.[1] As interest rates soared high and export revenue of these countries failed to grow in line due to lack of adequate export markets and collapsing commodity prices in a recessionary world, the problem of servicing debt became increasingly troublesome for these countries. The result has been an awkward situation that may quite approprietely be described as a "two-sided debt-trap": the borrowing country has to go on contracting fresh loans to service old debt while the lenders are compelled to continue lending simply to make the servicing of external debt possible. The end of this tunnel is nowhere in sight, neither from the borrowers' nor from the lenders' point of view.

The operation of such a debt-trap in the real world is of course complicated both by quantity -and by price- rationing of credit by the lenders. As the quantity of credit is rationed, the borrowing country is forced into various types of economic austerity programmes, with or without the active support of the I.M.F. On the other hand, if the cost of borrowing finance is increased[2] to provide the lenders with their psychological "safety margin" on fresh negot-

iated loans, the grip of the debt-trap tightens further on the borrower and perhaps, even on the lenders in the longer run. Undoubtedly, such "adjustments" forced through quantity -and/or price-rationing of credit is an essential part of any contemporary real world description of the operation of the external trap of debt. Nevertheless, it seems analytically worthwhile to trace the consequences and the evolution of the debt-trap through time when neither quantity- nor price-rationing of credit is imposed. For, such an analysis would be capable of providing the necessary benchmark, exhibiting how an economy would evolve without those forced "adjustments", starting from an initial position of significant indebtedness. This indeed is the motivation of the present paper: in terms of simple macro-economic accounting it traces the time-path of an economy with significant initial debt to analyse how the debt-trap could evolve through time without either quantity- or price-rationing of international credit. The argument is presented in terms of a stylized macroeconomic model in the next section II, while the final section III provides some brief comments on the broader implications of the analysis.

II. The Model

Abstracting from the problem of depreciation so that, no distinction between gross and net items needs be made, we measure in local currency:

Y = national product

X = domestic product

Z = net factor payment abroad.

For the purpose of the model, net factor payment abroad is identified exclusively as interest payment on outstanding external debt so that, if z' = interest payment in dollars and r = the exchange rate[3] (i.e. local currency per unit of dollar) then, $Z = rz'$.

From definition,

$$Y = X - Z \qquad (1)$$

Domestic savings is related to the national product by the simple relation,

$$S = s_p hY \qquad (2)$$

where, s_p = marginal and average propensity to save out of profits, $1 \geq s_p > 0$. (No saving out of wages) and, h = share of profits in national product.

If, I = level of domestic investment and, ν = constant marginal capital output ratio then,

$$\frac{dX}{dt} \equiv \dot{X} = \frac{I}{\nu} \qquad (3)$$

On the financing side of investment we have,

$$I = S + F \qquad (4)$$

where, F = net inflow of foreign loans denominated in local currency so that, F = rF', where F' is the inflow of foreign loan denominated in dollars.

If ι = the constant rate of interest on foreign borrowing (recall no quantity or price rationing of credit, for reasons mentioned in section I) then, the increase in the liability of interest payment, measured in local currency at constant exchange rate, is given as,

$$\frac{dZ}{dt} \equiv \dot{Z} = \iota F \qquad (5)$$

From equations (1) to (5) above, it is possible to depict the time behaviour of domestic savings for any autonomously given time-path of net inflow of foreign loans. Thus, differentiating equation (2) with respect to time and using (1) we have,

$\dot{S} = s_p h (\dot{X} - \dot{Z})$, s_p and h assumed constant. Or, using (3), (4) and (5) in the above equation[4],

$$\dot{S} = \frac{\delta ph}{v} S + \delta ph \left(\frac{1}{v} - i\right) F \qquad (6)$$

If we now consider the balance of international payments in local currency at constant exchange rate, then,

$$F = M + Z - E \qquad (7)$$

where, M = local currency import bill

E = local currency export revenue and, the net inflow F must balance the payments on current account including interest payments (Z) on outstanding external debt.

We assume import bill to be related to the level of domestic output in a simple linear manner i.e.,

$$M = mX + A \qquad (8)$$

where, m = marginal propensity to import

and, A = arbitrary constant.

Export revenue, on the other hand is assumed to depend on domestic production as well as on the ability to penetrate foreign markets which, in turn, is facilitated by borrowing abroad. Because, it is often presumed that foreign finance creates access to new technology and products or even marketing facilities (especially, in the case of trade-related finance) that promote exports to some extent[5]. Thus, the export function is written as,

$$E = f(X, D) + B, \quad f_X > 0, \; f_D > 0 \qquad (9)$$

where, D = stock of external debt outstanding

B = arbitrary constant.

Differentiating (9) with respect to time, we obtain,

$$\frac{dE}{dt} = \dot{E} = f_X \dot{X} + f_D F \quad \text{because,} \quad \frac{dD}{dt} = F \qquad (10)$$

Differentiating (7) and (8) with respect to time and combining them with (3), (4), (5) and (10) we obtain,

$$\dot{F} = \frac{1}{v}(m - f_X) S + \left[\frac{1}{v}(m - f_X) + (i - f_D)\right] \qquad (11)$$

The above equation (11) can be made mathematically easily tractable by assuming the relevant partial derivatives in the "export function" (10) to be rough constants. The constancy of f_X means a constant "propensity" to export out of domestic product, provided foreign market penetration through foreign borrowing remains constant. Similarly, constancy of $f_D \equiv \frac{\partial E}{\partial D}$ implies a constant marginal contribution of external debt to export earning, when the level of domestic production is unaltered.

If these (rather implausible) assumptions of constancy of the relevant partial derivatives are made, we have a coupled system of linear differential equations in (6) and (11), whose time behaviour is easy to analyse.

For ready reference, this coupled system is rewriteen as,

$$\begin{pmatrix} \dot{S} \\ \dot{F} \end{pmatrix} = \begin{pmatrix} \frac{s ph}{v} & s ph\left(\frac{1}{v} - i\right) \\ \frac{1}{v}(m - f_X) & \frac{1}{v}(m - f_X) + (i - f_D) \end{pmatrix} \begin{pmatrix} S \\ F \end{pmatrix} \tag{12}$$

having the characteristic polynomial,

$$\lambda^2 - (Tr)\,\lambda + Det = 0 \tag{13}$$

where, the trace of the matrix is,

$$Tr = \frac{s ph}{v} + \frac{1}{v}(m - f_X) + (i - f_D) \tag{14}$$

and its determinant is,

$$Det = \frac{s ph}{v}\left[i(m - f_X) + (i - f_D)\right] \tag{15}$$

For <u>given</u> numerical values of the relevant parameters, it would be straight foward to compute the time path of the system along the above lines. Nevertheless, it is economically more instructive in the present context to <u>qualitatively</u> analyse the system under alternative configurations of the parameter values.

First, it will be noted that the homogeneous system depicted by (12) has a stationary (equilibrium) solution at the origin (0, 0). However, this economically unacceptable solution may be ruled out as unstable under reasonable assumptions[6].

For instance, we may plausibly assume that the incremental output capital ratio $(\frac{1}{v})$ exceeds the interest rate (i) so that,

$$(\frac{1}{v} - i) > 0 \qquad (16)$$

which would immediately imply from (6) that domestic savings always increases, starting from positive initial values of S and F. Similarly, if

$$(m - f_X) > 0 \quad \text{and,} \quad (i - f_D) > 0 \qquad (17)$$

it is sufficiently assured from equation (11) that inflow of foreign finance will also increase over time, again starting with positive initial values of S and F[7].

When conditions (16) and (17) hold so that both S and F increase over time, we can present the system in an economically more instructive fashion by noting that equations (6) and (11) can be rewriten respectively as,

$$\frac{\dot{S}}{S} = \frac{s_{ph}}{v} + s_{ph}(\frac{1}{v} - i)\, x\,, \quad x = \frac{F}{S}\,, \quad S > 0 \qquad (6a)$$

$$\frac{\dot{F}}{F} = \frac{(m - f_X)}{vx} + \left[\frac{1}{v}(m - f_X) + (i - f_D)\right]\,, \quad F > 0 \qquad (11a)$$

Since by logarithmic differentiation,

$$\frac{\dot{x}}{x} = \frac{\dot{F}}{F} - \frac{\dot{S}}{S} \qquad (18)$$

it inmediately follow that the ratio of inflow of foreign finance to domestic savings (i.e., $x = \frac{F}{S}$) is governed by the relative (proportional) growth rates of the two components governed by (6a) and (11a). This is shown in Diagram I, by plothing (6a) as a positively sloped straight line (under condition (16)) and, (11a) as a negatively sloped curve with positive second derivate (under condition (17)). The equilibrium at E is stable because in the left of OB, $\dot{F}/F$ exceeds $\frac{\dot{S}}{S}$ so that x increases to OB and, on the right of OB $\dot{S}/S$ exceeds $\dot{F}/F$ making x decrease to OB. Thus, x = OB characterises a stable ratio of inflow of foreign capital to domestic savings which the economy will approach under conditions (16) and (17). Economically, this means a sort of stable debt-trap: the national product grows at the steady rate BE which is higher than the autarkic growth rate OA, where $F = 0$[8]. Nevertheless, the economy finances a steady proportion of its annual investment by borrowing abroad and pays interest on its ever accumulating debt from its increasing domestic product. In short, it is steady growth permanently dependent on foreign inflow of finance, despite relatively high interest rate and propensity to import (condition (17)).

However, even if the economy manages to export more than it imports at the margin, so that, instead of (17) we have,

$$(m - f_X) < 0 \qquad (17a)$$

the possibility of steady growth with permanent dependence on inflow of foreign finance cannot be ruled out, so long as the

initial proportion of investment financed from foreign borrowing (i.e., $x_.$) is relatively high. This possibility is shown in Diagram II, where the $\dot{F}/F$ curve now increase at a diminishing rate by virtue of condition (17a). Even if multiple equilibria exist, as shown in diagram II, only the equilibrium at E is stable[9]. Consequently, for all initial values of x exceeding OD, the economy moves towards a steady rate of growth BE with a constant permanent proportion of foreign borrowing to domestic saving. However, if the initial ratio of foreign financed investment is sufficiently low so that the economy starts with a values of x less than OD, the economy can escape the stable debt trap, but with the growth rate of national product also diminishing towards the autarkic rate OA. Thus, depending on the initial position (of x), the economy might move either towards an autarkic lower growth rate or towards a somewhat higher growth rate, but with permanent dependence on foreign borrowing, even when the ability to export exceeds the import propensity at the margin.

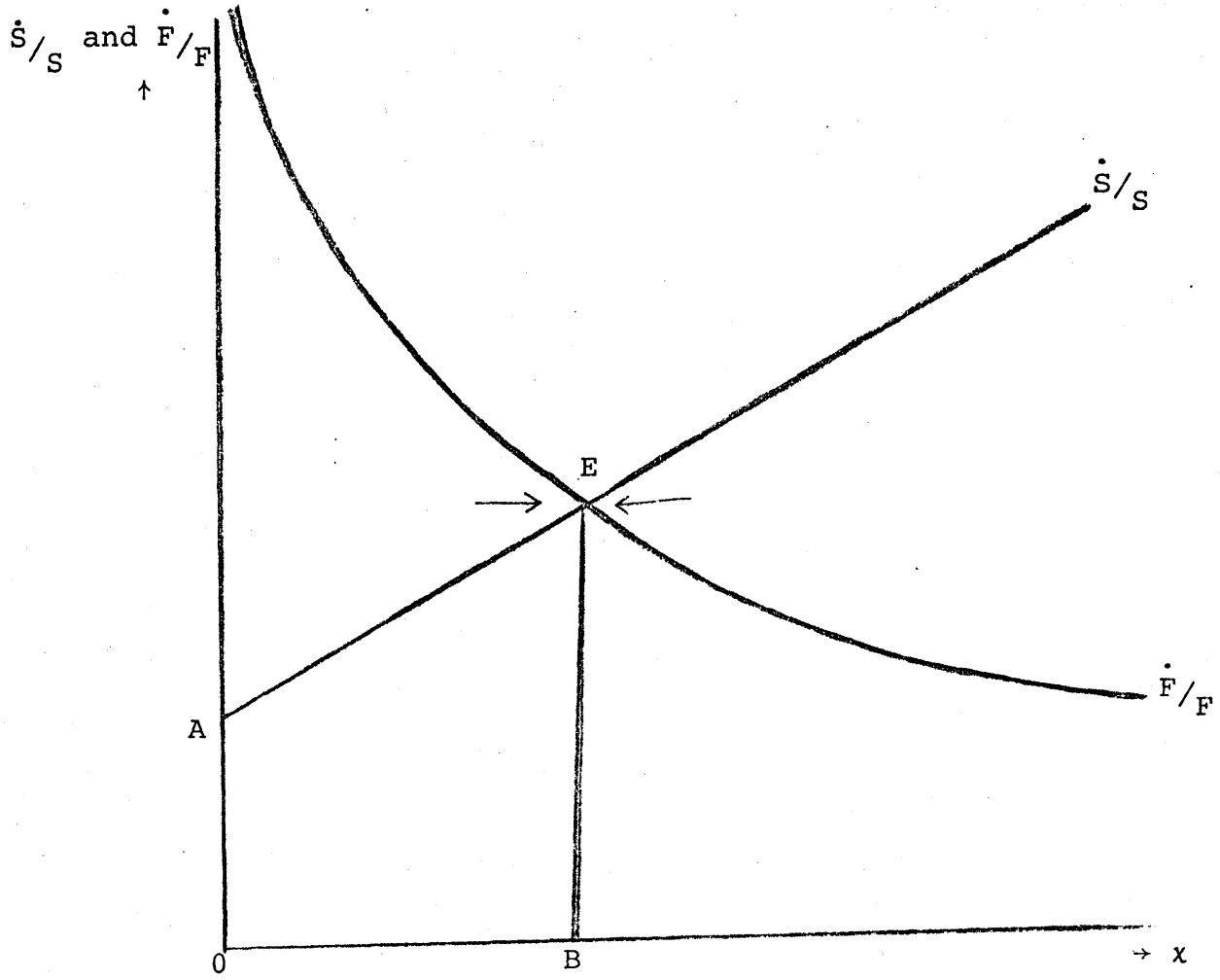
However, if the interest rate to be paid on debt is low enough, then the $\dot{F}/F$ curve asymptotically approaches a lower vertical 'ceiling' in diagram II. A sufficient condition for curve $\dot{F}/F$ to always lie below $\dot{S}/S$ is this ceiling on $\dot{F}/F$ to be actually smaller than OA in diagram II i.e.[10],

$$i - f_D - \frac{(f_X - m)}{v} < \frac{s_{ph}}{v}$$

$$\text{i.e.,} \quad i < \frac{\Delta ph}{\nu} + f_D + \frac{(f_x - m)}{\nu} \qquad (19)$$

when condition (19) is satisfied along with (17a) the debt-trap is broken because $\frac{\dot{S}}{S} > \frac{\dot{F}}{F}$ for all positive initial values of S and F and, x gradually tends to zero over time.

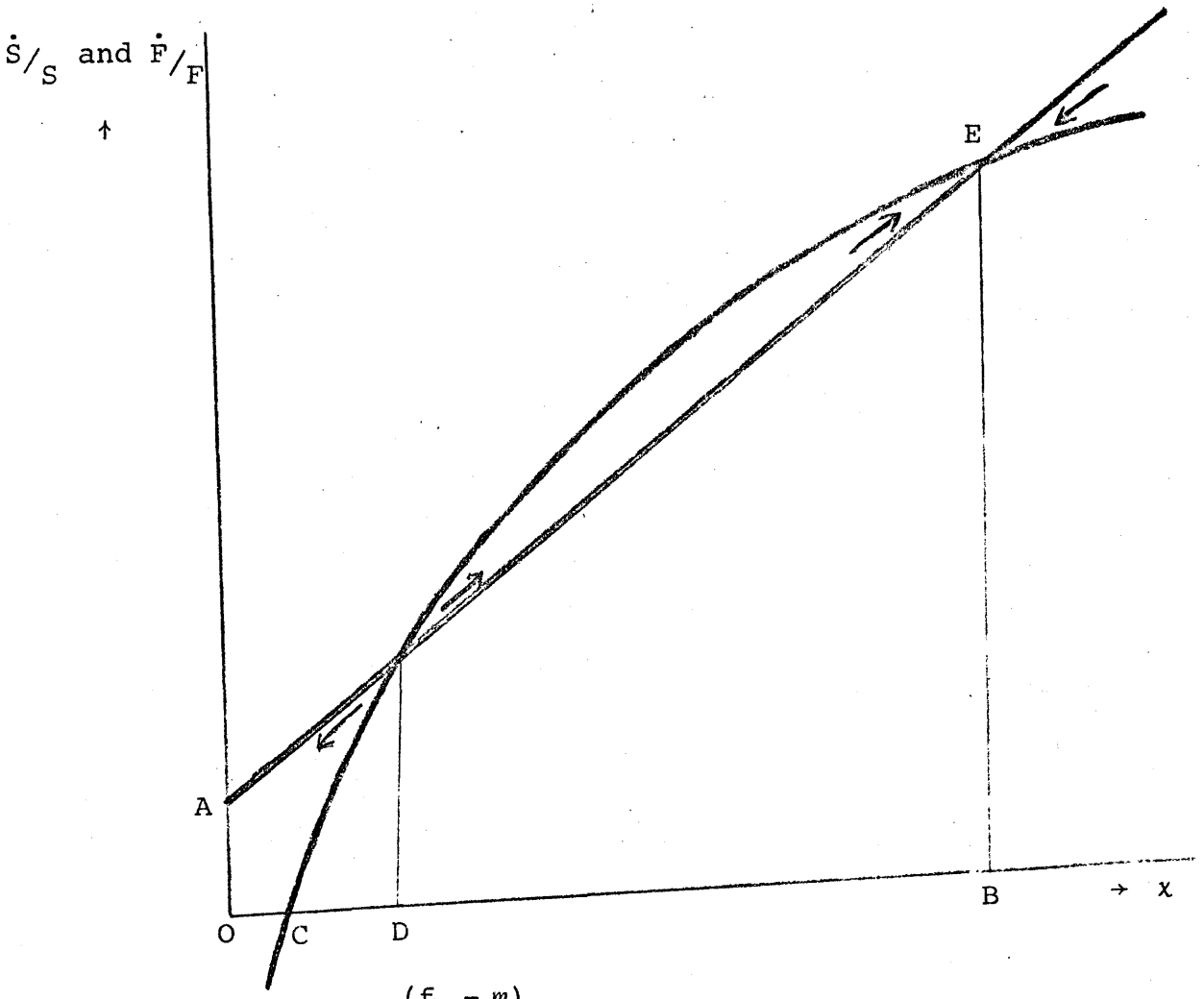
Diagram I. The case of relatively high interest rate ($\frac{1}{v} > i > f_D$) and the propensity to import exceeding the "propensity" to export ($m > f_X$).



$OA = \frac{\delta ph}{v}$ = autarkic growth rate of savings and national product.

Curve $\dot{F}/F$ asymptotically approaches the vertical axis and a horizontal line at intercept, $\frac{1}{v}(m - f_X) + (i - f_D)$.

Diagram II. The "propensity" to export exceeds the import propensity ($f_X > m$) but the rate of interest is relatively high ($i > f_D + \frac{(f_X - m}{v}$).



$$OA = \frac{\delta ph}{v} \quad ; \quad OC = \frac{(f_X - m)}{v\left[i - f_D - \frac{f_X - m}{v}\right]} > 0$$

$\dot{F}/F$ curve asymptotically approaches the vertical axis as x tends to zero; as x tends to plus infinity, $\dot{F}/F$ asymptotically approaches a horizontal line with positive intercept at $i - f_D - \frac{(f_X - m)}{v}$.

III. Concluding remarks

It hardly needs emphasis that our starkly schematized model is not a realistic description of the process of growth under foreign borrowing. Its purpose is to serve as a convenient device in sorting out our ideas about the logical plausibility of various arguments on external debt and borrowing. At that level, the model demonstrates how steady growth can coexist with permanent dependence on foreign borrowing, with (diagram II) or without (diagram I) reasonably successful management of foreign trade.

An important implication of this logical demonstration is to point to the fallacy of the view that a "heavily" indebted country must sooner or later go through a programme of economic austerity. Our argument is designed to emphasise the contrary case: if no quantity-or price-rationing is imposed on foreign borrowing, the economy may be able to maintain steady growth at a rate higher than its autarkic rate and still service its growing burden of debt into the indefinite future. At this level, the logic of necessarily imposing an austerity programme through rationing of credit on a heavily indebted country remains unproved.

However, the maintainability of such steady growth with permanent dependence on foreign borrowing assumes a whole configuration of parameter values. Countries that decide to opt for a strategy of such permanently dependent growth and their lenders

need to concentrate far more on the plausibility of these parameter values, rather than taking the short-cut solution in terms of wishful thinking that somehow the debt would be "eventually" paid off, if only sufficient economic austerity is imposed. It is this unfashionable, but logically defensible view, that the present paper wishes to put forward.

An indebted process of steady growth presupposes that the whole set of underlying parameter values would not be suddenly disturbed. However, it would be surprising if, in reality, they are not disturbed from time to time - a prolonged recession squeezing exports and commodity prices, sharp rise in the interest rates or soaring imports and capital flights and similar events can irrevocably interrupt the process of steady growth. The problem of a strategy of growth based on permanent dependence on foreign borrowing is not that it is infeasible in principle, but that it is highly vulnerable in practice. The model (in diagrams I and II) hints at a trade-off where, this external vulnerability may be reduced by opting for a lower rate of autarkic or self-reliant growth. And, the logical format of a model can only exhibit this choice; it cannot tell us what to choose.

Footnotes

1. According to an estimate by the Bank of England (1983) Mexico and Brazil each holds debt of over 50 billion U.S. dollars in flexible interest arrangements, while those two countries together with South Korea and Argentina probably accounts for about 70 per cent of total flexible interest bank loans to developing countries.

2. Usually in the form of higher "spread" and bank fees over the basic London Interbank Offered Rate (LIBOR) or U.S. prime rate.

3. Throughout the paper, the exchange rate is assumed constant and, it does not explicity appear in any of the equations. However, to avoid possible misunderstanding, we explain the currency conversion procedure in the text, whenever necessary.

4. Equations (1) to (6) resemble those of Wasow (1979).

5. The subsequent analysis may be simplified by dropping this rather doubtful link between export level and foreign debt. However, we decided to retin it (in equation 9) because many enthusiasts for an "export-promotion" strategy seem to believe that this link exists. On the other hand, equation (8) for import could also have included debt as an argument to show the import liberalization effect of foreign borrowing.

6. Formally, if the trace of the matrix in equation (14) is assumed positive, then the real parts of the eigenvalues cannot be negative and the origin cannot be a 'sink'. In the text, rather than taking this formal approach, we follow a more transparent, direct economic reasoning.

7. The interested reader could check this by drawing the relevant phase diagrams, where both $\dot{S} = 0$ and $\dot{F} = 0$ represent negatively-sloped rays through the origin which is now a 'source'.

8. From equation (2), $\frac{\dot{S}}{S} = \frac{\dot{Y}}{Y}$ so that, BE also represents the growth of national product.

9. Diagram II corresponds to the case, where by substituting (6a) and (11a) in (18), the resulting quadratic equation in x - i.e.,

$$\dot{x} = \frac{(m - f_X)}{v} + \left[\frac{(m - f_X)}{v} + (i - f_D) - \frac{s_{ph}}{v} \right] x - s_{ph} \left(\frac{1}{v} - i \right) x^2$$

has two real, positive roots at $\dot{x} = 0$.

10. See preceding footnote (9); condition (19) imposes sign on the middle term of the quadratic, equation and hence, governs the maximum number of positive roots according to Descartes' 'rule of signs'. If $\dot{F}/F$ curve is always below $\dot{S}/S$ line in the positive quadrant, no positive real root (point of intersection) is possible.

References:

1) Bank of England (1983), Quarterly Bulletin, March and June.

2) Hurewicz, W. (1958), Lectures on Ordinary Differential Equations, M.I.T. Press, Cambridge, Mass.

3) Wasow, B. (1979), 'Dependent growth in a capital-importing economy: the case of Puerto Rico', Oxford Economic Papers, March.

A Mathematical Appendix

This appendix derives a sufficient condition for a country to be permanently trapped in debt under the (simpler and less controversial) assumption that $f_D = 0$.

With $f_D = 0$, the determinant in (15) is positive i.e.,

$$\text{Det} = \frac{s_{ph} i}{v} (1+m-f_X) > o \ , \ 1 > m, f_X > o \ \ldots\ldots\ldots \quad (i)$$

and the trace in (14) becomes,

$$\text{Tr} = i - \frac{1}{v} \left| f_X - (m+s_{ph}) \right| \ \ldots\ldots\ldots\ldots\ldots\ldots \quad (ii)$$

Consequently, the characteristic polynomial in (13) takes the form,

$$\lambda^2 - \left| i - \frac{1}{v} (f_X - m - s_{ph}) \right| \lambda + \frac{s_{ph} i}{v} (1 + m - f_X) = o \ \ldots\ldots\ldots (iii)$$

which, by Ruth-Hurwitz criterion, would have roots with negative real parts, if the trace in (ii) is negative. Therefore, to rule out the origin as a stable 'sink' we need to assume a positive trace in (ii) yielding,

$$i > \frac{1}{v} \left| f_X - (m + s_{ph}) \right| \ \ldots\ldots\ldots\ldots\ldots\ldots \quad (iv)$$

For $i > o$, the above condition is <u>sufficiently</u> satisfied if

$$m + s_{ph} > f_X \text{ i.e., } s_{ph} > (f_X - m) \ldots\ldots\ldots\ldots \quad (v)$$

We now show that inequality (v) is sufficient to generate permanent debt-trap.

Consider the discriminant of characteristic polynomial (iii) namely,

$$\text{Dis} = \left[i - \frac{1}{v}(f_X - m - \delta ph)\right]^2 - \frac{4\delta ph\, i}{v}(1 + m - f_X) \quad \ldots\ldots\ldots \quad (vi)$$

which can be rewritten as,

$$\text{Dis} = \left[i - \frac{1}{v}(f_X - m + \delta ph)\right]^2 + \frac{4\delta ph}{v}\left(\frac{1}{v} - i\right)(m - f_X) \quad \ldots\ldots\ldots \quad (vii)$$

Hence if, $(\frac{1}{v} - i)$ is positive (condition 16 in the next), the positivity of the discriminant is sufficiently ensured when $(m-f_X) > o$. In this case, the roots are real; they are also positive (and distinct) because of signs imposed by conditions (i) and (iv). With both the roots real and positive, the system settles down to a stable ratio F/S as shown in diagram I (and the origin is an unstable node. For elaboration, see Hurewicz (1958) pp. 76-78).

In the obverse case if $(m-f_X) < o$, the positivity of the discriminant is not ensured. However, under condition (v), the minimum value that the discriminant in (vii) can take remains positive. Thus, substituting the minimum value of i (obtained from (iv) by using equality sign) in the square bracketed term as well as the maximum value of $(f_X - m)$ from (v) in expression (vii), the

discriminant reduces to $(2\delta ph)^2$ i > o. Therefore, condition (v) has been shown to be sufficient to guarantee real, positive (and distinct) roots that generate permanent debt-traps (if f_D = o) as displayed by diagram II.

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