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STRUCTURAL DEFICITS, THE DEBT
CYCLE HYPOTHESIS AND THE
TRANSFER OF REAL RESOURCES

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The principal objectives of this paper are to examine the notion of structural deficits on the current account of the balance of payments and derive the conditions under which a country would move from a position of a net importer of capital to a position of a net exporter of capital.

Structural Deficits

Balance of payments deficits on current account may be caused by a number of different factors. A current account deficit may result, for instance, from excessively expansionary policies. It may also result from policies that lead to an overvalued exchange rate. In both cases, however, current account deficits may be said to be caused by short-run policy mismanagement.

Current account deficits may also be caused by transitory external and internal shocks. In this case, foreign borrowing may be used to spread out the effects of the shock on consumption. However, a current account deficit that is not caused by a transitory shock, but whose existence is a necessary condition for sustaining a target rate of growth (1) that is compatible with rising living standards for the working population, is often referred to in the literature as a structural current account deficit. A current deficit is a necessary condition for sustaining a particular target rate of growth, when the factors that determine the deficit are the product of adverse developments or changes in the structure of consumption and production in the country or abroad that are relatively autonomous with respect to the actions of policy makers (2).

A structural current account deficit may reflect a savings or a foreign exchange constrained economy. These two types of constraints to economic growth are the central focus of what has become known in the literature as the two-gap model (3).

The important point here is to stress that, regardless of which constraint is the binding one, there might be a case for external finance whenever a current account deficit is thought to be structural in character. External finance is not only necessary to

sustain an adequate rate of growth in the short-term, in this case, but can also provide the time, means, and resources for the implementation of effective adjustment policies designed to gradually counteract those adverse and autonomous developments or changes in the structure of consumption and production, taking place inside and/or outside the country, and which are at the root of the deficit (4).

Before going further into the concepts of structural deficits or constraints to growth, it should be emphasized that an ex-post deficit on current account is neither a necessary nor a sufficient condition for the existence of a savings or a foreign exchange constraint. It is not necessary because a deficit can exist only if it can be financed. Inability to finance a deficit is no proof that economic growth can not be sustained at satisfactory levels without such finance being made available. It is not sufficient because the deficit may simply be a reflection of inadequate domestic policies (5).

Although the concepts of structural deficits and constraints to economic growth may be acceptable at a theoretical level, identification of a structural current account deficit will almost certainly involve some degree of judgement and very often will become a controversial issue. Indeed, to identify a structural current account deficit one has to assess if the deficit is in fact not caused by a transitory shock and is, indeed, necessary to sustain what may be judged as a satisfactory rate of growth. Furthermore, one has to assess to what extent the factors behind the deficit are in fact the product of developments of a relatively autonomous kind with respect to the actions of policy-makers - i.e., they cannot be offset by short-run adjustment policies (6), unless if at the expense of sustaining the rate of growth at satisfactory levels. Such an assessment is bound to require some degree of judgment.

Note too that there are costs involved in the use of external finance. These costs may be raised unnecessarily if part of the deficit is wrongly regarded as structural in character, when, in fact, external finance is partly or completely being used to postpone necessary reforms or relax effective short-run adjustment policies (7).

The concept of a structural current account deficit - be it caused by a saving or a foreign exchange constraint - is closely

related to particular stages of development.

A saving constrained economy is usually associated with underdevelped countries at initial stages of development (8). Such an economy is often characterized by the following features:

(i) the national savings rate is historically low compared to the levels in other countries even when the level of capacity utilization is high;

(ii) the country's tax system needs basic structural reforms;

(iii) the country's capital stock is small;

(iv) the population live largely at subsistence level;

(v) there is no domestic supply of long-term finance; and

(vi) there is a general lack of technology and skilled labour and entrepreneurship;

The concept of a savings constrained economy is closely linked to underdevelopment and, therefore, such a diagnosis ought not be related to short-term economic fluctuations.

External finance has the potential to help to increase investment and the capital stock, to improve living standards, to provide technology and entrepreneurship, and allow the government to implement basic fiscal reforms and stimulate the development of a domestic capital market. External finance may, therefore, accelerate growth and development.

A foreign exchange constrained economy is more often associated with semi-industrialized economies at some sort of intermediate stage of development (9). The following signs may indicate a foreign exchange constrained economy:

(i) deteriorating terms of trade;

(ii) technological dependence reflected in a high import content of investment expenditures;

(iii) imports consist largely of essential non-competitive imports;

(iv) consumption and production patterns are very much integrated with and influenced by those of advanced economies;

(v) the rate of growth of export revenue is constrained by world demand and by relatively autonomous domestic consumption patterns rather than by excessive domestic absorption; and

(vi) rapid rate of population growth.

External finance has the potential to help to sustain the levels of investment and savings by raising the country capacity to import.

It must be emphasized, however, that there is nothing automatic about the effects of external finance, regardless of which constraint is binding. External finance should be used if and only if it can work as a catalyst of the necessary changes for effective development and long-term adjustment.

Different facts have contributed to the development of foreign exchange constrained economies.

The relatively slow growth of non-oil primary product export revenue has been a very important factor behind foreign exchange constrained economies, especially in Latin America, which has traditionally been specialized in this trade area (10). This slow growth has partly been the result of terms of trade deterioration - particularly during the 50s and 80s - and partly the result of slow-growing export volume. In any case, "this unsatisfactory performance was largely, though not exclusively, the product of developments of a kind which were relatively autonomous with respect to the actions of policy-makers" (11).

It should be noted that even when a country has some

'monopoly' power over a particular primary commodity, represented by a large market share, the performance of export revenue may be quite unsatisfactory. This seems to have been the case of coffee exports from Brazil. In attempting to sustain the international price of coffee under unfavourable demand conditions and growing competition from other suppliers, Brazil has lost a substantial part of her market share and has, therefore, been unable to sustain its export earnings from coffee (12).

Moreover, the unsatisfactory performance of export earnings has not been restricted to non-oil primary commodities. More recently, some countries that have managed to develop comparative advantages in some industries such as traditional non-durable consumer goods industries (basically food processing and textiles) and some non-traditional intermediate goods industries (steel, non-ferrous metals, chemicals and petrochemicals) have also faced adverse world demand conditions.

Some developing countries - and Brazil seems to be a typical case - have heavily invested in these industries, which may generally be characterized by being energy-intensive, raw material-intensive and also pollution-intensive industries. It should be emphasized that the development of such industries was a perfectly rational decision in a country such as Brazil (13), endowed with raw materials and energy sources (especially hydropower), and a much more 'liberal' approach to anti-pollution measures than the advanced economies.

Note, however, that the rapid expansion of industrial capacity in these sectors that took place in the 70s and early 80s in some developing countries, at the same time as factories where being closed in the advanced economies, was mostly concentrated on the production of basic intermediate goods with a somewhat low technological content. As world demand collapsed in the early 1980s, these semi-industrialized developing economies found themselves competing against each other in world markets

with excess supply. These markets, in fact, have behaved in a fashion very similar to the standard behaviour of commodity markets, and as a result of excess supply, the price of these manufactured intermediate goods collapsed along with world demand. Indeed, in this sense, one could say that these low-tech manufactured goods have undergone a process of "commoditization" in recent years. Consequently, the analytical meaning of the category "exports of manufactures" has been losing its relevance for the so-called newly industrializing countries, at the same time as the separation between low-tech and high-tech manufactures has been gaining importance.

It is as though these developing countries have managed to 'graduate' as industrialized countries (14) just to find that the advanced economies are in the process of 'post-graduating' in high-tech industries and services. Furthermore, their 'graduation' coincided with a deep recession in the world economy, which forced large parts of their new industrial capacity to be left unemployed. Although some may argue that such 'graduation' was not worthwhile, it is important to observe that LDC countries that have not industrialized have performed much more badly and find themselves in a much more difficult position at the present time (15).

This seemms to confirm the idea that these developing countries are continuously vulnerable to external technological developments that work as a sequence of external shocks to their economies. The lack of autonomous technical progress is indeed one the major differences between these countries and the advanced economies, and it is for this reason that the concept of a foreign exchange constrained economy is particular of developing countries. That is not to say that advanced economies at some stage do not find difficult to reconcile external equilibrium with full employment. However, in this case, one may well say that the tradeable sector of this advanced economy, for one reason or another, has simply fallen behind and lacks competitiveness in world markets. It is in this sense that the concept of a foreign exchange constrained economy is so closely related to the hard process of industrialization and development. To regard the concept of a foreign exchange constrained economy as synonymous with lack of competitiveness of its tradeable sector would be to trivialize the concept. Therefore, the foreign exchange constraint concept should not be applied to advanced economies.

Three other structural factors on the demand side have been mentioned as contributing to external imbalance in Latin America (16). One of these factors is the rapid growth of domestic demand for primary products of all kinds (food, raw materials and fuel) that have taken place in the region. This development has to a large degree been structural in character, in the sense that they have been mainly the consequence of the particular stage of economic development through which large parts of Latin America have recently been passing.

Another factor is the so-called demonstration effect or the influence of consumption patterns in advanced economies on the consumption pattern of developing countries. Changes in consumption patterns of advanced economies, largely as a result of the introduction of new products often associated with new technology, tend to spread rapidly through developing countries, renewing the pressure on their import bill.

The last factor has been the exceptionally rapid rate of population growth. This may also be largely ascribed to a structural demographic transition associated with the stage of development in Latin America.

CICLO DA DÍVIDA

The Debt Cycle Hypothesis and the Transfer of Real Resources

So far, we have focussed on the conditions under which foreign financing may help economic development. However, the financing of current account deficits means an increase in the country's net liabilities to the rest of the world. Therefore, somehow, the initial conditions which have made foreign financing necessary in the first place must be changed at a later stage, in order to generate the commercial surpluses that will be necessary to service the foreign debt (17). This is the basis of what is known in the literature as the debt cycle hypothesis (18).

The so-called debt cycle hypothesis assumes that a country will move through stylized balance of payments and debt stages, starting off as a net capital importer, gradually reducing its need for external finance, and, eventually, turning itself into a net capital exporter.

Here, we focus on the conditions under which a country could move through the different stages of the debt cycle hypothesis. The

principal objective of this section is to consider a simple model which can illustrate the main determinants of the behaviour of the foreign debt through time and formally derive the necessary conditions for the debt cycle hypothesis. However, little attention is paid to causality links between the variables or to parameters in the model (19).

Let us start by writing down the following national accounting identities (20).

$$Q_t = C_t + I_t + X_t \qquad (1)$$
$$Q_t = Y_t + \Pi_t \qquad (2)$$
$$S_t = Y_t - C_t \qquad (3)$$
$$F_t = \Pi_t - X_t \qquad (4)$$

where, Q_t is domestic product, C_t is domestic consumption, I_t is capital formation, X_t is the trade balance on goods and commercial services, Y_t is national income, Π_t is net factor income sent abroad, S_t is national savings, and F_t is the current account deficit or the net inflow of foreign capital, all at time t.

Assuming that the net factor income sent abroad is equal to the international interest rate applied to the net foreign debt of the previous period, we can write:

$$D_t = D_{t-1} + F_t \qquad (5)$$
$$\Pi_t = i.D_{t-1} \qquad (6)$$

where D_t is the net foreign debt and i is the international interest rate.

. Investment-limited growth (21)

Let us now assume that economic growth is constrained by savings, but the marginal propensity to save is greater than the

average propensity to save.

$$S_o = sY_o \qquad (7)$$

$$S_t = S_{t-1} + s'(Y_t - Y_{t-1}) \qquad (8)$$

where s is the initial savings rate and s' is the marginal savings rate and s<s'.

Assume now that the incremental capital-output ratio (cor) is constant:

$$I_t = cor.(Q_{t+1}-Q_t) = 1/r.(Q_{t+1}-Q_t) \qquad (9)$$

and r= 1/cor is the rate of return on investment.

Finally, we assume that at t=0, domestic output is equal to national income (i.e., $Q_o=Y_o$ or $D_{-1} = 0$), and that there is a target equal to g for the rate of growth of national income:

$$Y_t = Y_o (1 + g)^t, \quad \text{where } g > 0 \qquad (10)$$

From identities (1) to (4):

$$F_t = I_t - S_t \qquad (11)$$

and from (9) $F_t = 1/r(Q_{t+1}-Q_t) - S_t = 1/r(Y_{t+1}-Y_t + \Pi_{t+1} - \Pi_t) - S_t$ (12)

but from (7) and (8): $S_t = s'Y_t-(s'-s) Y_o$ [22] (13)

and so: $F_t = 1/r(Y_{t+1}- Y_t + \Pi_{t+1} - \Pi_t) - s'Y_t - (s-s') Y_o$ (14)

After using (5) and (6) and rearranging, equation (14) can be written as:

$$F_t/Y_t = [(g-s'r)/(r-i)] - [(s-s')r/(r-i)(1+g)^t] \qquad [23] \quad (15)$$

At time t = 0: $F_o/Y_o = (g-sr)/(r-i)$ [24] (16),

which is greater than zero (or the country is a net capital importer) when

g > sr   and   r > i ,   or   r>i   g>sr

g < sr   and   r < i`   r<i   g <sr

On the other hand, the limit of F_t/Y_t as t goes to infinity is:

$$\lim_{t=\infty} F_t/Y_t = (g-s'r)/(r-i) \qquad (17),$$

which is negative (the country becomes a net capital exporter) when

g < s'r   and   r > i,   or

g > s'r   and   r < i.

Note, however, that since s'r is greater than sr, then r must be greater than i, if F is to change signs or, in other words, if the country is to move from a position of net capital importer to a position of net capital exporter (25).

Therefore, the two basic conditions for the debt cycle hypothesis are: (i) that the return on investment (or the inverse of the incremental capital-output ratio) be greater than the cost of borrowing (or the international interest rate)and; (ii) that the rate of growth of net national be smaller than the marginal savings rate times the return on investment - i.e., savings must be an increasing proportion of income, and the marginal savings rate must be higher, the higher the target rate of growth and the lower the rate of return on investment.

If the national savings rate does not rise sufficiently to finance the target rate of growth of real income, given the rate of return on investment (g>s'r), the country will remain a net capital importer, despite the fact that the rate of return on investment is greater than the rate of interest on the foreign debt.

An expression for the ratio of the net foreign debt to the national income can now be easily found:

$$D_t = \sum_{t=0}^{t=t} F_t \text{ , which from equation (15) can be written:}$$

$$D_t = \sum_{t=0}^{t=t} \{[(g-s'r)Y_0 (1+g)^t/(r-i)] - [(s-s')rY_0/(r-i)]\} \quad (18)$$

After some manipulation (26), it follows that

$$D_t/Y_t = [(1+g)/g - 1/g(1+g)^t] (g-s'r)/(r-i) - (s-s')r(t+1)/(r-i)(1+g)^t \quad (19)$$

Hence, the limit of D_t/Y_t as t goes to infinity is:

$$\text{limit}_{t=\infty} D_t/Y_t = (1+g)(g-s'r)/g(r-i) \quad {}^{(27)} \quad (20),$$

which is negative for r>i and g<s'r - i.e., the country tends to become a net creditor.

Likewise, $\text{Limit}_{t=\infty} \Pi_t/Y_t = i(g-s'r)/g(r-i)$ ${}^{(28)}$ (21)

which is again negative for r>i and g<s'r - i.e., the country tends to become a net receiver of factor income.

An interesting result concerns the limit of the trade balance on goods and commercial services as t goes to infinity:

$$\text{limit}_{t=\infty} X_t/Y_t = \text{limit}_{t=\infty} \Pi_t/Y_t - \text{limit}_{t=\infty} F_t/Y_t =$$

$$= i(g-s'r)/g(r-i) - (g-s'r)/(r-i) =$$

$$= (i-g)(g-s'r)/g(r-i) \quad (22)$$

which is positive for g>s'r, r>i and i>g.

Therefore, if the rate of interest on the foreign borrowing is greater than the rate of growth, a country will remain a net capital importer (g >s'r and r >i), despite generating trade surpluses on goods and non-factor services. This is known in the literature as the "debt trap".

. Trade-limited growth

We can now assume that economic growth is limited by a foreign exchange constraint. Considering that external finance is always forthcoming at a given rate of interest, we may assume that the potential savings rate will be fully realised. We therefore replace equations (7), (8) and (9) by:

$$S_t = sY_t \quad (7a)$$

$$I_t = 1/r_t (Q_{t+1} - Q_t) \quad (8a),$$

where r_t is: for t=0, $r_t = r_0$;

for t≥ t', $r_t = r'$, $r' > r_0$;

for 0< t< t', $r_t = r(t)$, $(\Delta r/\Delta t) > 0$.

The idea is that, although potential national savings is high, it can only be realised if external finance is forthcoming. The incremental capital-output is assumed to be initially high but decreasing (or the rate of return on investment is low but rising), due to an unfavourable internal or external shock and to the fact that it takes time to develop competitiveness in newly-installed industries designed to replace imports (import substitution) or to gain new markets abroad (export promotion). This may be reinforced by the need for infrastructure projects which typically require lengthy periods of gestation.

After manipulating equations (7a) and (8a), it can be written that:

$$F_t/Y_t = (g-sr_t)/(r_t-i) \quad (29), \text{ hence}$$

$$F_o/Y_o = (g-sr_o)/(r_o-i), \text{ which is} > 0 \text{ if } g > sr_o \text{ and } r_o > i, \text{ and}$$

$$\text{for } t \geqslant t', \ F_t/Y_t = (g-sr')/(r'-i), \text{ which is} < 0 \text{ if } g < sr' \text{ and } r' > i.$$

Therefore, the country will move from a position of net capital importer to a position of net capital exporter if and only if $sr < g < sr'$ and $r' > r_o > i$ -i.e., the rate of return on investment must be greater than the rate of interest and must rise sufficiently to finance the target rate of growth of national income, given the national savings rate.

Note that, in contrast with other models that deal with trade-limited growth (30), we have made no explicit assumption about the behaviour of exports and imports. However, by assuming that the net inflow of foreign capital (F_t) becomes eventually negative, we are assuming that net exports of goods and commercial services (X_t) become greater than the net factor income sent abroad (Π_t). Furthermore, by focussing on the investment-savings relationship we are implicitly assuming that change in the current account of the balance of payments reflect changes in the investment-savings balance rather than the other way around (31).

Indeed, the assumption that the economy becomes more

'efficient' as time goes by-which is assumed to be reflected in a rising propensity to save out of income, in the case of investment-limited growth, and in a rising rate of return on investment, in the case of trade-limited growth - is equivalent to an increase in the economy's international competitiveness (rising net exports). Therefore, it must be stressed that all variables must be measured at international prices (or shadow prices).

The fact that a country is momentaneously being able to sustain a high rate of growth of current output and balance of payments surplus on current account is no evidence that it has got to a position of a net capital exporter. This would only be the case if relative prices (particularly between traded goods and non-traded goods) were not distorted by subsidies (32), and that the rate of growth of potential output could be sustained at a satisfactory level, given the level of domestic investment which is being undertaken.

The conditions for the country to become a net creditor and a net receiver of factor income in the long run are again: that the rate of return on investment be greater than the rate of interest $(r' > i)$, and that the product of the national savings rate times the rate of return on investment be greater than the rate of growth of national income $(g < sr')$ (33).

As to the trade balance on goods and non-factor services, it can be written that:

$$\lim_{t=\infty} X_t/Y_t = [(g-sr')/(r'-i)] \ [i-g/g] \quad (34)$$
,which is positive for

$g > sr', r' > i$ and $i > g$. In other words, a country may remain a net capital importer forever, despite the fact that is making substantial transfers of real resourses to the rest of the world. Note that the rate of interest condition for that to happen is very much within the range of figures that have recently been observed in the world economy.

Finally, it should be emphasized that we have so far focussed on the conditions for the debt cycle hypothesis from the view point of the borrowing country. However, it must be said that the transfer of savings from lending to borrowing countries must be mutually beneficial for it to take place. This would be warranted under the assumption that the expected rate of return on investment (the inverse of the capital-output ratio) in the borrowing country is

perceived by both lenders and borrowers as being higher than in the lending country. Although, from a historical perspective (35), the experience of foreign borrowing has often been one of debt service difficulties rather than a smooth progression to a net capital export position, insofar as the expected rate of return on investment is higher in poor countries than in rich countries, then the transfer of resources from rich to poor countries which underlies the debt cycle hypothesis is not only morally justifiable, but can also be economically rational.

The present situation in which poorer countries are being forced to make huge transfers of real resources to richer countries through a reduction in their capacity to invest makes neither economic sense nor can it be morally justifiable.

Notes:

(1) We refer to the rate of growth of effective and potential product;

(2) See Wells (1988), chapter 2, p. 29;

(3) See Chenery and Bruno (1962), Chenery and Strout (1966), and McKinnon (1964) for the early works, or, Bacha (1982), Williamson (1983) and Taylor (1983) for more recent presentations;

(4) Such policies are sometimes referred to in the literature as structural policies. See, for instance, Khan (1987);

(5) See Joshi (1970), p. 117;

(6) We refer to expenditure-reducing and expenditure-switching policies;

(7) On that see Griffin (1970) and Griffin and Enos (1970);

(8) See Chenery and Strout (1966);

(9) Ibid;

(10)Wells (1988), p. 70;

(11)Ibid, p. 30;

(12)Wells (1986);

(13)Both from the viewpoint of Brazil's industrialization process as well as from the viewpoint of a new international division of labour largely conducted by multinational companies;

(14)The industrial sector of some developing countries is comparable in size with those of the advanced economies;

(15)Especially, the countries in the Southern Cone of Latin America:

Argentina, Chile and Uruguay;

(16) See Wells (1988);

(17) Including profits and dividends;

(18) See McKinnon (1964), Avramovic et. all (1964), Chenery and Strout (1966), and World Development Report (1985);

(19) The literature on the controversy about the relationship between national and foreign savings is quite extensive. See, for instance, Rahman (1968), Griffin (1970), Griffin and Enos (1970), Kennedy and Thirlwall (1970), Papanek (1972) & (1973), Permazoglu, J. (1972), and Weisskopf (1972);

(20) All variables are in real terms;

(21) This expression was used by Chenery and Strout (1966) to denote a savings constrained economy;

(22)
$$S_0 = s'Y_0$$
$$S_1 = s'(Y_1-Y_0)+S_0 = s'Y_1-(s'-s)Y_0$$
$$S_2 = s'(Y_2-Y_1)+S_1 = s'Y_2-s'Y_1 + s'Y_1-(s'-s)Y_0 = s'Y_2-(s'-s)Y_0$$
$$S_3 = s'(Y_3-Y_2)+S_2 = s'Y_3-s'Y_2 + s'Y_2 - (s'-s)Y_0 = s'Y_3-(s'-s)Y_0$$
Which can then be generalized as: $S_t = s'Y_t-(s'-s)Y_0$

(23) From equations (5) and (6): $\Pi_{t+1} - \Pi_t = i(D_t-D_{t-1})= i.F_t$, hence $F_t = 1/r(Y_{t+1}-Y_t+i.F_t)-s'Y_t-(s-s')Y_0$, which divinding through by Y_t gives $F_t/Y_t=1/r(g+i.F_t/Y_t)-s' - (s-s')Y_0/Y_t$, or
$(F_t/Y_t)(r-i)/r = (g-s'r)/r - [(s-s')r/(r-i)(1+g)^t]$;
$F_t/Y_t = [(g-s'r)/(r-i)] - [(s-s')r/(r-i)(1+g)^t]$;

(24) $F_0/Y_0 = (I_0-S_0)/Y_0=I_0-S_0-s=1/r(Q_1-Q_0)/Y_0 - s =$
$= 1/r(Y_1-Y_0)/Y_0-s+\Pi_1/Y_0=(g-sr)/r+iF_0/rY_0$, thus $(F_0/Y_0)(r-i)/r =$
$= (g-sr)/r$, and, $F_0/Y_0 = (g-sr)/(r-i)$;

(25) If $r <i$ and $F_0/Y_0 >0$ then $g <sr$. If $\lim_{t=\infty} F_t/Y_t< 0$ then $g> s'r$ and hence $sr >s'r$, which contradicts our assumption that $s< s'$;

(26) $D_t= \sum_{t=0}^{t=t} \{[(g-s'r)Y_0(1+g)^t/(r-i)]- [(s-s')rY_0/(r-i)]\} =$
$D_t=-(s-s')rY_0(t+1)/(r-i)+(g-s'r)Y_0/(r-i)\sum_{t=0}^{t=t}(1+g)^t$, but if $\sum_{t=0}^{t=t}(1+g)^t=X$
then $X=1+(1+g)+(1+g)^2+...+(1+g)^t$ and
$(1+g)X=(1+g)+(1+g)^2+...+(1+g)^{t+1}$ thus
$X[1-(1+g)] = 1-(1+g)^{t+1}$, hence $X=[(1+g)^{t+1}-1]/g$. It follows that
$D_t= [(1+g)^{t+1} - 1] (g-s'r)Y_0/g(r-i)-(s-s')rY_0(t+1)/(r-i)$,
Which divided through by Y_t leads to:
$D_t/Y_t=[(1+g)/g-1/g(1+g)^t](g-s'r)/(r-i)-(s-s')r(t+1)/(r-i)(1+g)^t$.

(27) Bearing in mind that the limit $_{t=\infty}1/(1+g)^t=0$ and the $\lim_{t=\infty}(t+1)/(1+g)^t$ is, applying L'Hospital, equal to $\lim_{t=\infty} 1/[(1+g)^t\ln(1+g)]= 0$, we can write that $\lim_{t=\infty} D_t/Y_t=(1+g)(g-s'r)/g(r-i)$;

(28) $\lim_{t=\infty} \Pi_t/Y_t =iD_{t-1}/Y_t = \lim_{t=\infty}i\{(g-s'r)[(1/g)-1/g(1+g)^t]/(r-i)- rt(s-s')/(r-i)(1+g)^t\}= i(g-s'r)/g(r-i)$, since the $\lim_{t=\infty}[1/g(1+g)^t] = 0$ and the $\lim_{t=\infty} [t/(1+g)^t]=\{1/[(1+g)^t\ln(1+g)]\}=0$;

(29) Using equations (2) and (8a), we can write that:
$I_t/Y_t = (Y_{t+1}-Y_t+\Pi_{t+1}-\Pi_t)/(r_tY_t)$, but from (5) and (6):
$\Pi_{t+1}-\Pi_t = i(D_t-D_{t-1})=iF_t$. Hence, $I_t/Y_t=g/r_t+ (iF_t)/(r_tY_t)$. Using equations (1) to (4): $F_t/Y_t+s=g/r_t+(iF_t)/(r_tY_t)$, and finally $F_t/Y_t=(g-sr_t)/(r_t-i)$;

(30) See, for instance, McKinnon (1964);

(31) See Sachs (1981), for some evidence on this hipothesis;

(32) Prices of public goods and services below costs are also considered a form of subsidy;

(33) Let us assume that the accumulated debt until t=t' is equal to A. Therefore, it can be written that: for $t\geq t'$, $F_t=Y_t(g-sr')/(r'-i)$ and
$D_t=A+\sum_{t=t'}^{t=t} F_t = A +\sum_{t=t'}^{t=t}Y_t(g-sr')/(r'-i)= A + (g-sr')/(r'-i)\sum_{t=t'}^{t=t}Y_0 (1+g)^t =$
$= A + Y_0(g-sr')/(r'-i) \sum_{t=t'}^{t=t}(1+g)^t = A+\{Y_0(g-sr')/(r'-i)\}\{(1+g)^{t'}[(1+g)^{t-t'}-1]\}/g$.
Thus $D_t/Y_t=A/Y_t+[(g-sr')/(r'-i)][(1+g)/g-1/g(1+g)^{t-t'}]$, hence
$\lim_{t=\infty} D_t/Y_t=(1+g)(g-sr')/g(r'-i)$, which is negative for $g<sr'$ and $r'> i$.
An expression for the net factor income can be easily found:

$\Pi_t/Y_t = iD_{t-1}/Y_t$, thus $\lim_{t=\infty} \Pi_t/Y_t = i(g-sr')/g(r'-i)$, which is also negative for $g<sr'$ and $r'>i$;

(34) $\lim_{t=\infty} X_t/Y_t = \lim_{t=\infty} \Pi_t/Y_t - \lim_{t=\infty} F_t/Y_t$, thus

$\lim_{t=\infty} X_t/Y_t = i(g-sr')/g(r'-i) - (g-sr')/(r'-i) = [(g-sr')/(r'-i)][(i-g)/g]$;

(35) See World Development Report (1985), p. 12 to 30.

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