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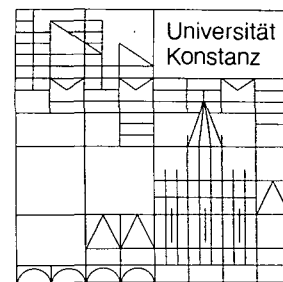
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Diskussionsbeiträge



Juristische
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Fakultät für Wirtschafts-
wissenschaften und Statistik

Jesko Hentschel

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Growth-cum-Debt Models
and Sustainability of Indebtedness**

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NON-OPTIMIZING GROWTH-CUM-DEBT MODELS AND SUSTAINABILITY OF INDEBTEDNESS

Jesko Hentschel

I. INTRODUCTION

In the past few years, the role of international organizations involved in supplying developing countries with capital has changed - not only have they increased their volume of lending, but they have also become catalytic agents stimulating continuing private bank lending to less developed countries. The hesitation of the private banks 'to throw good money after bad money' apparently rests on the evaluation that quite a few developing countries will never be able to pay back the loans or even the interest on them. In order to persuade private banks to increase their loans, international organizations stress that the current debt crisis is one of *illiquidity* rather than *insolvency* - if rescheduling agreements are reached and fresh money is made available to the developing countries, they will eventually be able to service their debt without relying on new loans. Private banks, on the other hand, have begun to judge major debtors as following an explosive debt accumulation path and characterize them as being insolvent in the long run.

Economic models can try to point out the crucial characteristics determining whether a country follows a stable, sustainable debt path and is therefore able to eventually pay back foreign debt or an unstable, unsustainable debt path. In this respect, they might explain why the 'debt-cycle hypothesis' (a country first borrows from abroad and later repays the debt with corresponding balance of payments deficits and surpluses; compare World Bank 1985, p.47) apparently does not apply to quite a few developing countries. This hypothesis rests on the neoclassical production and trade theories and predicts that capital flows to countries or regions where the return to it is high and later leaves these areas, when the built-up capital stock has reduced the marginal productivity of capital. A developing country with a low capital stock first incurs and later repays the debt.

This paper surveys models which try to explain why a country might not be able to service and repay its debt as predicted by the debt-cycle hypothesis. Section II provides the reader with a classification of models dealing with indebtedness. Section III analyses different characteristics of non-optimizing models. Results are reviewed in Section IV and the applicability and critique of these models is discussed in Section V.

II. OPTIMIZING AND NON-OPTIMIZING MODELS

McDonald (1983) distinguishes between 'optimizing' and 'non-optimizing' behaviour of the debtor country; this distinction is taken up here.

Optimizing models (e.g. Bardhan 1967, Hamada 1969, Siebert 1987) specify a national objective function and derive the borrowing behaviour of the debtor country from an intertemporal maximization of an utility function. In most models utility is derived exclusively from consumption. Foreign loans can then either be consumed right away or invested to raise consumption in the future. In the steady state, the marginal cost of borrowing (interest) is equated to the marginal productivity of capital. Borrowing for immediate consumption will take place if the time discount rate of future consumption exceeds the interest charged on the loans. But the underlying utility function could also incorporate other variables, e.g. the level of debt could be a factor of disutility to the society (Bardhan 1967). Since the borrowing agent takes into account the fact that all borrowed funds have to be repaid eventually, only stable paths of debt accumulation exist.

Non-optimizing models, on the other hand, do not treat consumption as a choice variable to maximize utility, but rather specify consumption and savings in a behaviouristic way. This enables them to analyse whether a certain borrowing behaviour combined with specified behaviouristic functions results in 'sustainable' or 'unsustainable' debt paths (Section

IV). It might be helpful to verbally describe a simple non-optimizing framework, so that the reader gets an intuition of the economic scenario behind these models. Solomon's (1977) framework is used for this purpose.

Solomon assumes the government of the borrowing country to target a specific growth rate of domestic output. This desired level of output requires a certain amount of capital investment, since the two variables are linked by a fixed capital-output ratio. Resources allocated to investment can be generated from internal savings or from external borrowing. He assumes domestic savings to constitute a constant fraction of domestic output. Thus for each desired level of output the available domestic resources (savings) and the required resources to achieve the predetermined growth rate can be quantified. The difference, or 'gap', between these two amounts is made up for by borrowing on the international capital markets at an interest rate, which he assumes to be constant. It is then easy to trace the level of debt over time and, for example, look at the ratio of debt to income, which is so often used as a debt indicator.

Other non-optimizing models deviate from Solomon's framework with respect to the growth process, borrowing behaviour, and the specification of the behavioural function. These issues are discussed in the next section.

III. CHARACTERISTICS OF NON-OPTIMIZING MODELS

A. Growth-Process

The model described in the previous section represents a typical 'gap-model'- foreign funds are needed to complement domestically generated resources in order to finance a targeted output growth. All models conceptually following this 'gap' approach, employ a fixed capital-output ratio (<1>,<2>,<4>,<6>,<7>,<11>,<14>,<15>,<16>,<20>,<23>,<25>,<27>,<30>,<31>). A growth process based on a neoclassical production function (<9>,<24>,<28>) would not be consistent with a predetermined output growth rate, as will be discussed below.

An empirically verifiable stable capital-output ratio in a number of developing countries gives support to the use of fixed capital-coefficients. This could be due to Harrod-neutral technical progress with full labor-employment conditions. It could also rest on disguised labor unemployment conditions as encountered in a large part of the developing world. The marginal product of labor is zero in these countries, and it is below some institutionally set money wage corresponding to the average productivity of labor (Lewis 1954).

B. Conditions For Borrowing Behaviour

(a) Deterministic Borrowing in Savings and Trade Gaps

The amount of borrowing is determined by the growth target in all models which use foreign loans to close the gap between resources generated domestically and those needed. Bottlenecks in the development process have been analysed in depth in the literature starting from Avramovicz (1958). In their classical article, Chenery and Strout (1966) distinguish between three of these gaps:

- * the 'human-skill gap' in the early phases of economic development;
- * the 'savings-gap', in which internal savings are not sufficient to meet the required investment volume;
- * the 'foreign-exchange' gap, in which a country is heavily dependent on imported investment goods and inputs and its export proceeds do not cover the imports needed to meet the country's growth target.

Most models not based on maximizing an explicitly incorporated national objective function are in the savings-gap tradition (<1>,<2>,<4>,<6>,<14>,<15>,<16>,<20>,<23>,<25>,<27>,<30>).

These models implicitly assume that the borrowing country produces only one good, which can be consumed or invested. Since domestic savings fall short of investment requirements, foreign loans are taken up, creating a capital account surplus. The balance of payments must balance: the current account worsens and the borrowing country uses the foreign exchange to import. Since in all models the inflowing funds are simply added to domestic savings to determine the amount of resources available, it must be assumed that the imported good exhibits the same marginal productivity of capital as the domestic good, if it is used for investment purposes. Or, if they do not supplement the domestic capital stock directly, the domestic and the foreign goods must be perfect substitutes in consumption. These assumptions are obviously very strong.

Authors examining a trade-gap situation (<4>,<7>,<20>,<30>) claim that even if internal savings could pay for domestic investment goods, the required *composition* of capital goods from internal and external sources might not be achieved. If trade is the bottleneck to growth, the foreign exchange generated from exports can not pay for required capital imports. Thus, while the savings function is the crucial characteristic function in the savings-gap case, both the import and export function assume this importance in the trade-gap situation. It is apparent that the implicitly assumed economic conditions are quite different from the ones discussed in the savings-bottleneck case. While the borrowing

(developing) country, and the lending (industrialized) country, can still produce only one good, they are not perfectly substitutable in the production process. Developing countries are dependent on certain capital goods from the industrialized countries in order to acquire higher incomes; an aspect is added here which is LDC specific and could explain why developing countries in particular have been so hard hit by the world recession, high interest rates, and the oil shocks - these arguments being commonly used to explain the debt crisis (compare Zieseimer, 1987, on this issue).

Policies to relax the growth impediment consequently differ between the two situations described above. Feder (1981), for example, requires a fixed input of imported capital goods in every increment of output growth. Additionally, he models a fixed proportion of total consumption to be imported. It is obvious that not only does a substitution between domestically produced and imported consumption goods relax the foreign exchange shortage in the trade gap case, but so does a reduction of the dependence of the economy on imported capital goods as well. Both of these policies are ineffective in a savings-gap situation.

It might seem that the distinction between the different bottlenecks is quite artificial, since - as Tinbergen (1965) and Fei and Ranis (1968) pointed out after the rise of the gap-literature - the savings and trade gaps have to be equal *ex post*, as can be easily seen from national income accounting:

Since

$$(1) Y = C + S = C + I + X - M$$

where Y, C, S, I, X, and M represent national income, consumption, savings, investment, exports, and imports, respectively. It follows that

$$I - S = M - X$$

Thus, if *ex ante* the trade gap dominates, internal savings will fall short of potential savings. Vice versa, if the savings gap is larger than the trade gap, imports will exceed their minimum level and/or exports will fall short of their potential maximum (compare UNIDO, 1984, p. 4).

Since the trade and the savings gap have to be equal *ex post*, it is difficult to determine which one represents the restriction. Thus all models assume one to be dominant and then simulate the debt path based on this assumption. The estimation of behavioural relationships (savings or import function) might be inappropriate if the restriction of the economy is misspecified.

Kharas (1984) uses a fixed coefficient production function and analyses borrowing behaviour under a savings shortage. He does not specify a growth target though, but assumes that "...the authorities strive to maximize the growth rate of income,....,

subject to an independence objective, modelled by associating a loss with endplan debt outstanding." (p.437). This specification implies that borrowing per period is determined by a political process (Zieseimer 1987, p.130).

(b) Endogenously Determined Borrowing Level

In the deterministic models reviewed above, a constant marginal (=average) productivity of capital and a fixed interest rate were encountered (an implicit condition for viable investments is that the former exceeds the latter). Since the two variables can never be equated, the amount of loans borrowed per period must be determined exogenously.

If a neoclassical production function ($\langle 9 \rangle, \langle 24 \rangle, \langle 28 \rangle$) is incorporated, an endogenously determined level of debt and output exists, since the marginal productivity of capital declines with capital accumulation and will not fall below the interest rate under profit maximization (compare Glick and Kharas, 1986, on this issue).

An endogenously determined borrowing level can also be achieved if the supply of capital is not assumed perfectly elastic at a given interest rate. Lenders could base their availability of credit on creditworthiness indicators (e.g. Feder 1980). Tagaki (1981) tries to incorporate such credit rationing by using 'aid functions', where official development assistance (on a concessional basis) is positively linked to policy parameters

of the debtor country, and negatively linked to per capita GNP. The private credit function (market interest rate) is positively linked to GDP and negatively to debt outstanding.

C. The Behavioural Functions

(1) The Savings and Consumption Function

The specification of the savings function in models analysing the savings-bottleneck gave rise to controversy in the literature.

It is easier to use a consumption function to demonstrate the different approaches (compare Glick and Kharas 1986, p.286). Consider total consumption C_t to be

$$(2) \quad C_t = a + c_1 Y + c_2 (iB) + c_3 (G - iB)$$

where Y , i , B , and G stand for national income, the interest rate, the stock of debt, and the net capital inflow, respectively. The term $(G-iB)$ determines the net resource transfer which could also be thought of as the trade account deficit (if factor incomes and services other than interest due on external debt are neglected), whereas the net flow of capital, G , represents the capital account balance (if all capital flows are of credit nature). Adding national income and interest due on foreign debt generates domestic output:

$$(3) \quad Y + iB = Q$$

The first issue of great importance is the assumption made by the initiators of the gap theory (Avramovicz 1958, McKinnon 1964, Chenery and Strout 1966) that all inflowing funds are going to be invested and not used to raise the consumption level of the society ($c_3 = 0$, above). This touches on the frequently heard argument that foreign savings are 'substituted for' domestic savings. A negative impact of aid and loans on the domestic savings behaviour is implied.

In a neoclassical world such a behaviour would be expected. Inflowing capital lowers the marginal productivity of capital and the interest rate, which in turn depresses the savings level of the economy.

But a depression of the domestic savings effort (c_1 increases) need not necessarily occur, even if part of the foreign capital is consumed ($0 < c_3 < 1$). This is unlikely to be the case; only if one a priori assumes that all foreign capital is invested, and therefore defines domestic savings to be the residual of total investment and capital inflow, would internal savings decline. A negative impact in this context has been empirically found by Grinols and Bhagwati (1976) and Wascow (1979). Both studies outline a savings-gap model and derive a savings function in the presence of capital inflows. They then explore how much

time is needed for the domestic savings level in relation to GDP in the presence of capital inflows to reach the same level as would be attained without capital inflows.

Solomon (1977, p.498) tries to assess whether countries consume out of inflowing loans by examining the ratio of investments to domestic absorption. He concludes that no fear as to the use of borrowed funds is justified, because most of the countries showed stable values for this ratio. But the investment/absorption ratio will only be constant - and foreign inflow used for investments - if foreign capital inflows do not change in magnitude. An appropriate measure would be to deduct the current account deficit (as a measure of net capital inflow) from total gross investment and set this in relation to national income.

Reference should be made here to Levy (1987) who examined to what extent capital inflows in developing countries are invested. Although a simple fit of the data would suggest that foreign savings are treated as domestic income and only a fraction of them is saved, a decomposition of foreign resource flows into anticipated flows and unanticipated flows (those determined for consumption like relief aid) yields that "most foreign aid that is not of a relief or emergency nature is not consumed and rather invested." (p.456).

We now return to equation (2) and distinguish five cases as to how savings and consumption behaviour of developing countries is modelled:

(a) $c_1 + c_2 + c_3 = 0$

Equation (2) reduces to $C_t = a + c_1 Y$, or own savings $S_H = -a + s_1 Y$. This is the *national savings concept* (<6>, <16>, <23>, <30>) and implies that saving occurs after interest payments to foreigners have been made, thus foreign income (iB) cannot be consumed. In macroeconomic models, savings are most often assumed to be a function of disposable income. King (1968, p. 32) also argues for such a national concept. He mentions that "it is only our curious habits of national income accounting which prevent us from realizing that a sizeable part of GDP never sets foot on shore and is simply not available for consumption. What the country receives is not something less something, but the difference." But Avramovicz (1964, p. 164) criticizes the feature that the volume of saving varies with respect to the interest rate if the national savings concept is applied (since disposable income Y decreases if Q is constant and iB increases).

(b) $c_1 = c_2 + c_3 = 0$

Equation (2) becomes $C_t = cQ$, or $S_H = s_1 Q$, the *domestic savings concept* (<1>, <2>, <7>). Since domestic savings are a function of total output, interest owed to foreigners is treated as consumable income; interest payments must therefore be made out

of domestically generated savings. Thus, if foreign funds are not available in unlimited amounts, interest due might exceed domestic savings and thus hinder growth. Glick and Kharas (1986, p. 284) also argue for the domestic savings concept, since a model based on national savings is not able to analyse the causes of debt servicing problems until interest due exceeds GDP. It has to be pointed out here, though, that debt servicing difficulties will not occur in all those models which assume the supply of foreign funds to be infinitely elastic at a given interest rate.

$$(c) \quad c_1 + c_2 = c_3$$

with $0 < c_1 < 1$. The consumption function now becomes $C_t = a + c_1 Y + c_2 G$. This is one possibility to allow for consumption out of total available resources as discussed above.

Wascow (1979) and Kharas (1981, 1984) choose this specification. Kharas (1984, p. 419) justifies the differential treatment of interest on external debt and domestic income: "An overvalued exchange rate may drive a wedge between the value of foreign exchange and its domestic currency equivalent. Alternatively, the interest obligations may accrue to a different agent than the income stream." Grinols and Bhagwati (1979, p. 154) criticize this approach, since the marginal propensity to consume out of interest and the gross flow differ (in terms of equation 2: $-c_1(iB)$ vs. c_2G if one substitutes $Y = Q - iB$ from equation 3). They instead argue for

(d) $c_1 = c_2 \neq c_3$

with $0 < c_1 < 1$. This creates the complement to the domestic savings and consumption concept already encountered under (b) and yields $C_t = a + c_1 Q + c_3 (G - iB)$. The possibility which would mediate between the national and the domestic savings concept when consumption out of total resources is to be modelled, is that all marginal savings propensities are equal, namely

(e) $c_1 = c_2 = c_3$

(again with $0 < c_1 < 1$) where equation (2) becomes $C_t = a + c_1 (Y + G) = a + c_1 (Q + (G - iB))$. Only Tagaki (1981) chooses this approach. It seems to be very restrictive, since the distribution of foreign loans is probably not going to be the same as the distribution of domestic income, thus marginal saving rates should differ according to the income sources.

In conclusion, it should be said that there is no 'right' or 'wrong' way of modelling the savings behaviour based on national income or domestic output. The experience of the 70's suggests, though, that at least part of the foreign loans are used to overcome income shortfalls and raise consumption. Thus, especially when estimating savings or consumption functions, the possibility to consume out of total available resources should be incorporated.

(2) The Im- and Export Functions

Since most models assume a savings bottleneck to persist in the developing country, the discussion in the literature centered on the specification of the savings function. But as seen under III.B., in a trade-gap case, the import and export functions become the driving force of the indebtedness pattern.

Whereas Chenery and Strout (1966), McKinnon (1964), and the UNIDO study (1984) require a fraction of additional income to be spent on *imports*, Feder (1981) disaggregates the import function and models raw material imports as a fraction of output, capital imports as a fraction of investment, and consumption imports as a fraction of total consumption. If one considers different types of import goods as Feder does, one could think of a situation in which (although foreign exchange scarcity is the impediment to growth) the inflow of capital has no bottleneck-relaxing effect. If export growth is so slow that it cannot keep pace with paying for consumption imports (or raw material imports to uphold current output), then foreign exchange given in relatively small amounts might just help the country "to keep its head above water"; available foreign exchange is needed to pay for imported inputs and for immediate consumption.

Exports, as the determinant of the available amount of foreign exchange to meet import requirements and debt service, are most often assumed to grow at an exogenously given rate

(<4>,<8>,<28>). Only McKinnon (1964) models exports as a function of domestic output, thereby stressing the importance of the production side of the economy; if the home country produces two goods, the structure of production does not change during the growth process. If the exogenously determined export growth rate in other models is higher than the target growth-rate, the economy is ultimately going to produce only for exports. Thus important assumptions are implied by the export specification, which one should be aware of. If idle resources are present in the economy (e.g. disguised unemployment), supply in the export sector can adjust to demand. This builds on the "vent for surplus" role of exports of Adam Smith and Myint (1954,1958). But as soon as factors of production are fully employed, structural reallocations in the production sector have to be triggered by relative price changes, which are assumed non-existent in these models.

IV. SUSTAINABILITY OF DEBT PATHS

Domar (1944) first considered the sustainability of indebtedness in a national context. He concluded that a government could sustain indebtedness if it were able to expand the tax base at least as fast as interest on the debt becomes due. Considering foreign indebtedness, models based on a neoclassical production function have stable equilibrium steady states (constant capital and debt/output ratios) and infeasible debt paths do not exist, since the marginal

productivity of capital never falls below the interest rate (compare here Glick and Kharas, 1986). Since in the real world quite a few countries apparently followed an 'unsustainable' debt path, these models are of limited applicability in pointing out what conditions led to the current malaise.

Models based on a fixed output/capital ratio distinguish between 'stable' and 'unsustainable' paths of debt accumulation. The problem now arises that there does not exist a consensus as to what the characteristics of such a stable or unstable path are.

(a) repayment of debt

Some authors using saving-gap models looked at the conditions which would imply that a country's indebtedness path follows a 'debt cycle' ($\langle 1 \rangle, \langle 2 \rangle, \langle 6 \rangle, \langle 23 \rangle$), as described in the introduction. In order to pay back accumulated debt, a country must be able to reach a self-sustainable rate of growth rather than rely on foreign funds to finance it. Intuitively, the target rate of growth must be smaller than or equal to the long-run *internal* level of income growth. The latter is determined by the marginal savings rate and the capital-output ratio. In order for the internal rate of growth to increase over time, the average rate of savings must rise with higher income levels. Thus a distinction must be made between marginal and average saving rates. The underlying condition to reach the

sustainable debt level is that lenders do not ration their credit and lend continuously despite high debt/GNP or debt-service ratios.

(b) debt/income ratio

Some studies consider the attainability of an upper bound to which the debt/income ratio tends as the relevant criteria for stability ($<7>$, $<16>$, $<27>$, $<30>$). Solomon (1977) finds such an upper bound to be reached if the target rate of growth of the economy is higher than the interest rate charged on the loans. But this would imply that there is a positive net resource transfer in each year. If the debt/GDP ratio is constant, debt (B) grows at the same rate as GDP. If the condition is now $g > i$ (growth of output > interest rate), then $gB - iB > 0$, which implies a positive net resource flow in the debtor country. Rational lenders will not lend under these conditions (Glick and Kharas 1986, p.288).

(c) capital/debt ratio

Kharas (1984) derives the relationship between the capital stock and the stock of debt over time. He assumes that a constantly growing flow of loans is chosen by the debtor country and then introduces the possibility that the capital stock is reduced if own savings and new loans cannot cover the debt service payments. An unstable debt path exists if it leads to a capital stock of zero, while the country is still in debt. Kharas departs from the assumption that the country plans the

growth target and borrows the amount needed to reach it; he examines the feasibility of targeted gross borrowing amounts. It is questionable, though, whether this is really the variable policy makers want to influence.

V. CRITIQUE AND APPLICABILITY

Several features of the models described above give rise to doubts about whether they can really capture debt problems in developing countries:

1. The debt situation crucially depends on fixed parameter values like the marginal savings rate, the capital coefficient, or the export-growth rate. In a growth process transforming an economy from subsistence income levels to industrial production, basic economic parameters cannot be a priori assumed to be constant.

2. In most deterministic models loans are assumed to be available in infinite supply at a given interest rate. A situation in which a country is not able to service its debt (a situation a lot of Latin American countries are in right now) cannot be captured. Tagaki (1981, p.325) notes that "the actual debt problem cannot be analysed under the assumption that the amount of aid is exactly the same as that of the gap between necessary investments (or imports) and domestic savings (or exports). Therefore it is not possible in this framework to demonstrate why many LDCs must face the debt problem in the

process of economic development." Tagaki concludes that a supply function for external finance should therefore be derived (Glick and Kharas, 1986, and McDonald, 1983, survey different approaches).

3. The models described above are not able to incorporate strategic behaviour of either the borrower or the lender. This would require a default-cost function for the borrower and the above mentioned supply of finance function for the lender.

4. Models linking a fixed capital-output ratio to fixed-interest foreign supply cannot capture microeconomic efficiency of the investent projects.

5. It has been pointed out several times already that non-optimizing growth models are often built on quite stringent economic conditions. Examples are the implied assumptions about substitutability in production and consumption in the saving-gap models, or the assumption of the exogenously determined export growth rate. The latter implies a structural change if we were to make the realistic assumption that the developing country produces more than one good. Structural change cannot be explained without relative price changes; these are not considered explicitly.

Thus, these models should not be used with the aim of explaining the current debt crisis, in which countries cannot

service their debt. All frameworks reviewed assume supply of finance to be forthcoming in the amount desired, thus debt servicing problems can not arise.

But these simple models are extremely useful in empirical simulation analysis. They can help to analyse *what the debt situation is going to look like, if current trends continue in the future and parameters remain stable*. Additionally, the impact of policies on the debt situation can be analysed; effects of higher domestic saving and increased import-substitution efforts, higher export growth rates and reduced government absorption can be examined. Thus the kind of models under discussion should be primarily regarded as a useful framework to analyse the effect of policies on the external situation of indebted countries.

VI. SUMMARY

This paper examined the characteristics of growth-cum debt models and focused on non-optimizing frameworks employing a fixed capital-output ratio production function. They are powerful in sketching the indebtedness pattern of a developing economy because of their simple deterministic functions and can point out whether countries are heading for insolvency, or whether a cash-squeeze situation leads to foreign exchange shortage. But since most of the models assume external finance

to be forthcoming in infinite supply at a fixed interest rate, they are unable to model why a country is in debt-servicing difficulties and has to reschedule loans.

The difference between savings-gap and trade-gap models was pointed out and it was emphasized that quite different economic scenarios are implicitly assumed in these models. Additionally, only trade gaps entail a developing country specific approach, since they assume the dependence of growth on imported capital goods.

Trade gap models stress the importance of foreign exchange in the growth process. They are built on the assumption that domestic savings, although available in sufficient supply, need not contribute to growth. A similar problem is encountered when countries are in debt servicing problems: the problem of transferring domestic savings into foreign exchange. This was already discussed in the Keynes-Ohlin debate on whether Germany would be able to meet the reparation payments after the first World War. While Ohlin was optimistic about the ability for Germany to meet the reparation payments, Keynes argued for a general debt relief. Obviously, this discussion still continues today.

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