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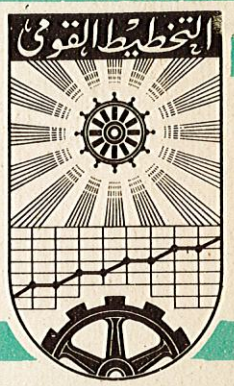

Memo. No. 779

FOREIGN LOANS AND ECONOMIC DEVELOPMENT

PART I

RESTATEMENT OF QAYUM'S MODEL

by

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"Opinions Expressed and Positions Taken by Authors are Entirely their Own and do not Necessarily Reflect the Views of the Institute of National Planning".

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I- Introduction

Growth models usually single out the factor "capital" as the major determinant of economic growth. Since capital has to be produced, its scarcity makes itself severely felt at the early stages of development. The natural deduction is that it has to be imported, provided that it can "pay itself back" later. Capital importation can take one of many forms:

1) It can be imported against exports of non-capital goods. This possibility is quite limited, since it assumes the ability of the economy to produce a sufficient surplus over and above its current consumption needs.
2) Grants provided free of charge form a net addition. In principle, grants for consumption purposes can play the same role since they can free other resources for investment purposes. However, these are usually given under conditions of difficulty in meeting current consumption requirements. Hence, unless coupled with careful planning, they might eventually vanish through increased consumption.
3) During the last two centuries the accelerated rate of capital formation in the prospering industrial and commercial countries has set private capital wandering around looking for investment opportunities in the underdeveloped world. The success of such movement went hand in hand with expansionary imperialistic activities. The history of colonialism is partly that of foreign capital movements. This source went on the downswing towards the middle of the present century.
4) After the end of the Second World War, the trend shifted towards borrowed capital. This took place at the same time when many ex-colonies gained their independence, and started more systematic action geared towards economic and social development of their economies.

Thus the desire to establish high rates of growth has initiated a world-wise flow of borrowed capital tied up to development plans. It seems, however, that in less than two decades, some sort of a policy reconsideration is taking place both in the creditor and debtor countries. The fact that loans are usually negotiated on governmental or semi-governmental levels has eventually given the lead to political factors. Even if we dismiss this side of the problem, the flow of borrowed foreign capital need not conform exactly with the plans of the developing countries. Criteria for choice of investments which creditor countries use in judging their loans, normally differ from those obtaining first priority in developing countries.

It is not our intention to discuss the political issues involved, important as they may be. Further, we shall also assume that the choice of investment projects is not unduely affected by the whims of creditor countries. Granting that loans are concluded under the most reasonable conditions both from the political point of view, and with no economic disadvantages as far as the selection of projects is concerned, the question can be raised: What are the effects of the terms of the loan on the development of the borrowing country? Which is the party really gaining from the loan activity?

The answers to these questions are of vital importance for the long-run development of the developing world. It is not sufficient, however, to investigate criteria for judging foreing loans. What is really needed is to introduce the effects of both the loans and of their service explicitly in growth models. Elementary growth models on the Harrod-Domar lines, are usually presented to developing countries as a manageable device for building up the general frames of their plans.[1] Such models emphasize the contribution of a deficit in the balance of payments, i.e., loans. But they usually leave it at that, without indicating the necessary surplus which has to follow in order to provide for the debt service, and the adverse effects of that surplus on the rate of growth.

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1) See for example Ichimura's model; Appendix to ch.II of, ECAFE: Programming Techniques for economic development.

The I.N.P.C. has already made a start towards the investigation of the role of foreign loans in long-term development. During his attachment to the Staff of the Institute, Mr. Qayum prepared two memos. dealing with some aspects of foreign loans:

- Memo.570: "Economic Criteria for Foreign Loans" (May 1965)
- Memo.579: "Size of Foreign Loan, Annual Repayment, and Exchange Rate in Programs of Economic Development" (June 1965).

The titles chosen indicate that the main purpose was the discussion of foreign loans in the first place. Although he produced another memo (563) at the same time on "Long term growth of a developing economy", he failed to integrate the various aspects of loans in a more elaborate model of economic growth.[2)]

The present memo. is a review of Qayum's approach, meant to rectify certain fundamental errors involved. It is the first in a series which aim at investigating the implications of foreign loans in order to pave the way for more elaborate models of economic growth. In a following part we shall deal with the problem of loans under the fixed instalment assumption. A third one will deal with the terms of trade factor which is quite important when dealing with a span of time such as that involved in loan repayments. This will be followed by a study of the relative advantage accruing to both the debtor and creditor countries. Sophistication of the behaviour of the parameters of the economy will be introduced at a later stage.

II- Notation:

In this and the following memos we shall adopt a system of notation whose main elements are summarized as follows:

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2) See section III below. The three memos were reproduced in a recent book by Qayum: Numerical Models of Economic Development. Rotterdam University Press 1966. Memo.570 was further published in the E.J., June, 1966 pp.358-369, with some minor variations, as will be shown later.

Y = G.D.P.

S = Gross domestic savings

I = Gross domestic capital formation

$J = S_0$ = Base year savings

L = The Size of loan in national currency

M = Increase in G.D.P. due to base year savings

N = Increase in G.D.P. caused directly by the loan

A = Annual instalment for loan repayment

Δ = Cumulative domestic investments created by the loan during the repayment period

V = The increase in G.D.P. at the end of repayment period due to the loan and to Δ.

r = Rate of interest per annum

e = Repayment period, in years

f = Gestation period of loan-financed investments

h = Repayment lag in years

k = Replacement period for loan-financed capital

γ = Gross capital coefficient (marginal)

σ = Overall marginal propensity to save

α = Marginal propensity to save out of incomes generated by domestic investments

β = Marginal propensity to save out of income created directly by the loan

s = Base year average propensity to save

a = Ratio of annual instalment to the base year G.D.P.

λ = Ratio of the loan to base year G.D.P.

δ = Ratio of Δ to the loan

v = Ratio of V to the output of the loan

$\varepsilon = \delta + 1$ = total increase in domestic capital due to the loan related to its size

η = Value of δ adapted for existence of gestations and repayment lags

μ = Value of ε similarly adapted = $\eta + 1$

ρ = Ratio of r to $\frac{\sigma}{\gamma}$

b = Ratio of annual instalment to the loan

In equation (32) we introduce the following abbreviations:

$$d = s\left(1 + \frac{\sigma}{\gamma}\right)$$

$$p = e - \frac{\gamma}{\sigma}$$

$$q = \frac{\sigma}{\gamma} - r$$

and for $\left(1 + \frac{\sigma}{\gamma}\right)$ raised to any power, the corresponding capital letter is used:

$$E = \left(1 + \frac{\sigma}{\gamma}\right)^{e}$$

$$F = \left(1 + \frac{\sigma}{\gamma}\right)^{f}$$

$$H = \left(1 + \frac{\sigma}{\gamma}\right)^{h}$$

$$K = \left(1 + \frac{\sigma}{\gamma}\right)^{k}$$

Further in (61) we have :

$$k^{*} = k + f - h$$

$$K^{*} = \frac{KF}{H} = \left(1 + \frac{\sigma}{\gamma}\right)^{k+f-h}$$

For investment, output and savings, the values in the no-loan case are denoted by the same symbols primed : I', Y', S'

III - Mr. Qayum's Approach

In a footnote to his article on "Economic Criteria for Foreign loans" (Memo.570), Mr. Qayum stated that he was "motivated to study this problem by the various statements made by the U.A.R. leaders about the terms of West German loans to this country". His findings were in line with those statements.

Further, he defined his objective as follows:[3]

"The purpose of this note is to study the terms and conditions that are generally involved in these (development) loans, from whatever sources they may be, in the light of the long term economic advantage that accrues to the borrowing country".

His main findings can be summarized as follows:

The benefits of the loan are positively correlated with the magnitude of:

- the marginal propensity to save
- the repayment period
- the repayment lag

and they are negatively correlated with:

- the capital/output ratio
- the gestation period of investments financed by the loan
- the rate of interest charged on the loan.

Mr. Qayum believes that the most effective elements are the marginal propensity to save, (net) capital coefficients and the rate of interest[4]. His own "guess" is that the marginal propensity to save seems to affect the situation more than others.

These findings conform with what can be expected a priori. The model used is quite simple based on a fixed propensity to save and a fixed capital coefficient. In memo.579, he used a more sophisticated model including a Cobb-Douglas production function, thus allowing for a varying capital/

3) See for example, his "Numerical Models" pp.63-64

4) E.J., 1966, p.368

output ratio, as well as a changing marginal propensity to save. Although he used that model to determine the size of foreign loans necessary to achieve a certain income target, thus taking one step towards the formulation of a development model which allows for loans explicitly, he did not account at the same time for the repayment phase. "Once the size of the foreign loan has been decided, the question about its repayment arises."[5] At this stage he shifted to another problem, which is the necessary change in the rate of exchange required to encourage exports in order to provide for repayment. It may be noticed here that this treatment is not systematic, especially as the original model assumed savings to be equal to investments, i.e., a balanced balance of payments. To account for the difference he appended the discussion with a consideration of the impact on final consumption. This means that his propensity to save is in fact a propensity to invest. The resultant saving propensity has still to be tested for feasibility, in spite of the fact that the change in the exchange rate has been already determined.

The same article suffers from another error. Table III gives unacceptable values for annual values, which led him to the absurd result that a loan of 1000 at 4% can be repaid over 20 years at the rate of 44 annually, thus being paid back at 88% of its initial value. The reason is the introduction of an extra term (tE) which is redundant. The correct formula would be (in our notation):

$$b_t = b = \frac{(1+r)^e}{(1+r)^e - 1} \qquad (t = 1,\ldots,e)$$

Table III has to be corrected accordingly.[6] But the question has still to be asked whether the compound interest rule is the suitable basis for calculation of instalments.

Let us, therefore, go back to memo.570, and its E.J. version. Consider

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5) Memo.579, p.7; or "Numerical Models" p.57

6) p.7. The correction given in the text was made in the reprint in "Numerical Models", and Table III was corrected accordingly.

first the criterion chosen for judging the benefits of the loan. In our terminology he first used the criterion Δ, i.e., the cumulative investments created by the loan over the repayment period. This was replaced by another criterion $\Delta + L$ in the E.J. version with the gross concepts replaced by net concepts.[7] In both instances the rule was that the given criterion chosen should be non-negative if the loan is to be "worthwhile from the very long-term point of view". Thus in one case the loan is considered favourable if after repayment it leaves the economy in possession of a capital capacity exceeding that which would have been created in the absence of the loan by at least the amount of the loan. In the second the loan is worthwhile if it leaves to the economy the same capital stock that could be obtained without the loan; the capital due to the loan being eaten up by repayments. A more careful discussion of the choice of the criterion seems warranted, and we shall take it in the following section.

The most serious error, however, is in the formula used for expressing the advantage criterion. While it follows the cumulation rule in the first two rounds, it falls back simply to the additional effects in the following rounds. This can be seen as follows:

Let the loan L yield the output N

$$N = \frac{L}{\gamma} \qquad (1)$$

With a marginal propensity to save σ, an amount σN is saved. If A_t is the annual instalment to be repaid in year t, the residual for capital formation in any year t is, say

$$R_t = \sigma N - A_t$$

This raises a new income $\left(\frac{1}{\gamma} R_t\right)$ in year t + 1, out of which $\left(\frac{\sigma}{\gamma} R_t\right)$ is saved. Of course we have to add to this R_{t+1} defined in the same manner. This is correct so far. The slip starts from the consideration of year t+2. Instead of considering the direct and indirect effects of R_t, i.e., the $\left(\frac{\sigma}{\gamma} R_t\right)$ itself obtained in t+1, hence continuing subsequently

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7) E.J., 1966, p.361. These were the main corrections made there, probably after consultation with Prof.R.C.O.Matthews who "pointed out very crucial slips"

(the same as with N itself), plus the saving out of the extra income generated by it, namely $(\frac{\sigma}{\gamma})$ out of it, or $(\frac{\sigma}{\gamma})^2 R_t$; Mr. Qayum takes into consideration this latter extra effect only. His definition of the total investments due to the effect R_t is [8]

$$T_t = R_t \left[1 + \frac{\sigma}{\gamma} + (\frac{\sigma}{\gamma})^2 + \ldots + (\frac{\sigma}{\gamma})^{e-t} \right]$$

$$= R_t \times \frac{\gamma}{\gamma - \sigma} \times \left[1 - (\frac{\sigma}{\gamma})^{e-t} \right]$$

The increase in the capital stock due to the investments generated by the loan, excluding the loan itself is denoted by S^*,

$$S^* = \sum_{t=1}^{e} T_t$$

No attempt was made to express this sum as a function of the data and parameters, since numerical solutions were in view.

Now, since R_t always included σN, we have to investigate the extra savings generated. In year t+1 they are $\frac{\sigma}{\gamma} R_t$. In year t+2, we still have this $\frac{\sigma}{\gamma} R_t$ plus $\frac{\sigma}{\gamma}$ out of it or $\frac{\sigma}{\gamma}(1 + \frac{\sigma}{\gamma})R_t = \frac{\sigma}{\gamma} R_t + (\frac{\sigma}{\gamma})^2 R_t$. In t+3 we again have this latter plus $\frac{\sigma}{\gamma}$ out of it, or $\frac{\sigma}{\gamma}(1 + \frac{\sigma}{\gamma})^2 R_t$ and so on. In year e, the effect will be $\frac{\sigma}{\gamma}(1+\frac{\sigma}{\gamma})^{e-t-1} R_t$

Thus the total for any year's investments is

$$T'_t = R_t \left[1 + \frac{\sigma}{\gamma} + \frac{\sigma}{\gamma}(1 + \frac{\sigma}{\gamma}) + \ldots + \frac{\sigma}{\gamma}(1+\frac{\sigma}{\gamma})^{e-t-1} \right]$$

$$= R_t (1 + \frac{\sigma}{\gamma})^{e-t} \qquad (2)$$

The sum S^*, or (in our notation) Δ, can be obtained by summation. First we notice that the annual instalment is:

$$A_t = \frac{L}{e} \left[1 + (e-t+1)\gamma \right] \qquad (3)$$

Putting $j = e - t$, then $t = e - j$ Hence

$$R_t = L \frac{\sigma}{\gamma} - \frac{L}{e} \left[1 + \gamma e + \gamma - \gamma (e-j) \right]$$

$$= \frac{L}{e} (C - \gamma j)$$

where, $C = \frac{\sigma}{\gamma} e - \frac{1}{1 - \gamma}$

8) There is a printing error in the power of the last term in memo.570, which was corrected in the "Numerical Analysis". It was given as (e-t-1) instead of (e-t).

Further, we notice that:

$$\sum_{j=o}^{e-1} j(1+\frac{\sigma}{\gamma})^j = \sum_{1}^{e-1} j\,(1+\frac{\sigma}{\gamma})^j = \frac{\gamma}{\sigma}\left[e(1+\frac{\sigma}{\gamma})^e - (1+\frac{\sigma}{\gamma})\right]$$

$$- (\frac{\gamma}{\sigma})^2 \left[(1+\frac{\sigma}{\gamma})^{e+1} - (1+\frac{\sigma}{\gamma})^2\right]$$

$$= \frac{\gamma}{\sigma}\left[(1+\frac{\sigma}{\gamma})^e - 1\right]\left[e - \frac{\gamma}{\sigma} - 1\right] + \frac{\gamma}{\sigma} e$$

$$\Delta = \sum_{t=1}^{e} T'_t = \sum_{1}^{e} R_t\,(1+\frac{\sigma}{\gamma})^{e-t}$$

$$= \frac{L}{e}\left[\sum_{j=o}^{e-1} o\,(1+\frac{\sigma}{\gamma})^j - \sum_{1}^{e-1} r\,j\,(1+\frac{\sigma}{\gamma})^j\right]$$

$$= \frac{L}{e}\frac{\gamma}{\sigma}\left[(1+\frac{\sigma}{\gamma})^e - 1\right]\left[\frac{\sigma}{\gamma} e + \frac{\gamma}{\sigma} r - 1 - er\right] - \frac{L}{e}\frac{\gamma}{\sigma} er$$

$$\Delta = \frac{L}{e}\frac{\gamma}{\sigma}\left\{\left[(1+\frac{\sigma}{\gamma})^e - 1\right](e - \frac{\gamma}{\sigma})(\frac{\sigma}{\gamma} - r) - er\right\} \quad (4)$$

Qayum's other formulae for the cases where gestation periods and payment lags are involved, have to be corrected in the same manner. On the other hand if we choose the alternative criterion, we have to add L to Δ. This brings us back to the problem of choice of the rule suitable for judging the benefit of the loan.

IV- The Advantage Criterion

The immediate effect of the loan is to raise G.D.P. by its full output. Later on, this extra income initiates a series of domestic investments which help to increase G.D.P. further. On the other hand, repayments work in the adverse direction. This latter ceases when the full repayment is over, i.e., starting year (e+1). From there onwards, the economy develops at its own inertia, determined by the ratio ($\frac{\sigma}{\gamma}$). Five cases can be distinguished; as indicated in Fig.(1)

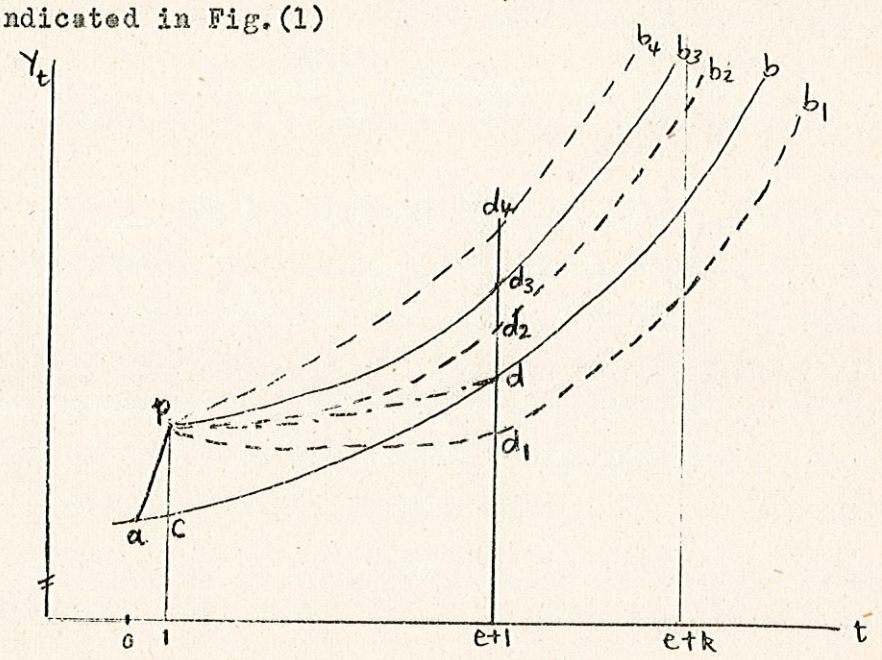

Figure (1)

Let a represent Y_0 and c represent Y_1 if no loan was taken, while p is Y_1 including the output cp of the loan. The curve acdb represents the path of Y in the no-loan case, where d is the value of Y in year e+1 after repayment period. The five cases are indicated by the following paths:

1) path pd_1b_1. Here Y_{e+1} is d_1 which is less than d. For all $j > o$, the value of Y_{e+j} is systematically lower than the value obtained without the loan. The segment d_1b_1 is parallel to the segment db with equal horizontal distances which means increasing vertical