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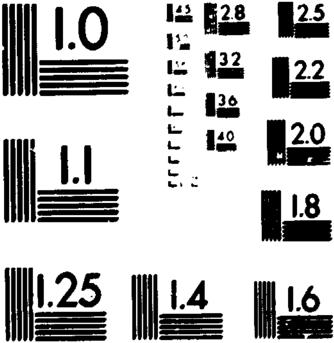

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CONCEPTUAL MODEL FOR DETERMINING A COUNTRY'S DESIRED LEVEL OF EXTERNAL BORROWING FROM THE DEBTOR COUNTRY'S PERSPECTIVE*

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Division for Industrial Studies

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A CONCEPTUAL MODEL FOR DETERMINING A COUNTRY'S DESIRED LEVEL OF EXTERNAL BORROWING FROM THE DEBTOR COUNTRY'S PERSPECTIVE

I. INTRODUCTION

The phenomenal growth in the external indebtedness of the developing countries during the 1970s and the 1980s has stimulated a plethora of both empirical and theoretical research on the Third World debt problem.[1/] Numerous studies and research have covered a wide spectrum of theoretical, technical and policy questions raised by the mushrooming third world debt, ranging in scope from global issues such as the potential dangers that it may pose for the stability of the international financial system and the world economy to country-specific problems such as a country's debt capacity and optimal borrowing. The objective of this paper is to deal with one specific aspect of the much broader problem, namely to answer the question of how much a country should borrow from the borrower's perspective as opposed to the lender's standpoint. Such a desired level of a country's external borrowing is determined within a framework of macroeconomic consistency. The paper is partly motivated by anticipated requests from developing countries of technical assistance on the planning of external debt.

Most of the theoretical works on the problem of optimal foreign borrowing (or lending) are formulated with an intertemporal budget constraint.[2/] They are

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1/ For a comprehensive survey of the literature on the third world debt problems, see McDonald (1982).

2/ For instance, a country obeys its intertemporal budget constraint if the discounted present value of total future expenditure equals the discounted present value of national output, minus initial foreign debt. See Sachs (1982).

mainly concerned with smoothing out consumption over time resulting from fluctuations in income in order to maximize the utility function of consumption (Bardhan, 1967 and Sachs, 1982). While such a highly abstract theoretical approach would undoubtedly contribute to analytical clarity of the fundamental issues involved, we will adopt a more pragmatic traditional approach to this question, which is couched in terms of the growth-cum-debt models. In this context, external capital is exclusively used for investment purposes, although the use of foreign borrowing for consumption purposes may be equally desirable under certain conditions. More specifically, the paper attempts to develop simple aggregate and disaggregate models of growth-cum-external debt and derive therefrom empirical formulas for determining external capital requirements corresponding to a set of investment plans and growth targets.

Apart from the systematic modelling approach to the debt problem of developing countries, there is a growing body of empirical studies that employ ad hoc indicator approaches. Indicator approaches try to identify a set of those characteristics that are generally associated with debt-servicing difficulties and render practical assessment of the country's borrowing capacity based on these indicators. Such indicators include the ratio of borrowing to exports, the growth rate of exports, a reserves/imports ratio, per capita GNP, a debt/amortization ratio, ratio of capital inflow to debt service, import/GNP ratio, an export fluctuations index, etc.[3/] It is apparent that the fundamental weakness of indicator approaches is that they are purely descriptive and lack theoretical underpinnings, which makes it difficult to interpret the role of some variables. Nevertheless, it is a quick, easy,

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3/ For a comprehensive treatment of a wide range of debt indicators, see Nowzad (1981, Appendix).

and economical way of obtaining some rough estimates of a country's debt capacity and a separate report on indicator approaches to this question will be later prepared as a supplement to this study.

Finally, it should be re-emphasized that conceptual models developed here represent the borrower's perception of how much a country should borrow and this may not be consistent with the lender's assessment of the debt capacity and its sustainability of the country under consideration. In short, the supply side of the capital market is not considered and hence a desired level of indebtedness planned by a debtor country may not be necessarily materialized.

The sequence of the analysis is as follows. Section II deals with a simplified investment-saving gap model which is an extended and modified version of those developed by Avramovic and his associates (1964) and Solomon (1979). Section III examines the opposite side of the same coin, a trade gap model of external borrowing requirements. Section IV formulates a disaggregate macromodel for planning sectoral investments and determining their foreign exchange requirements. A comparative assessment of these models and concluding remarks are given at the end.

II. A Simple Investment-Saving Gap Model

Debt-financed economic growth can be viewed as income growth fed by debt, which is also growing over time at compound rates. Debt can be generated by either one of the two gaps derived from the macroeconomic equilibrium condition: the gap between domestic saving and investment, and the gap between imports and exports.[4/] First, we deal with the investment-saving gap model and the trade gap model in the next section. Whatever type of the gap approach may be used, it is assumed that as the gap widens and debt cumulates, the external borrowing of a country must increase initially to service interest charges and refinance maturing debt obligations even if net imports are maintained at a constant level. It is possible, however, that at some point in time, the gap may begin to narrow and the country becomes even a net creditor, as the income growth stimulated by investment spending outpaces the debt growth.

The investment-saving gap model presented below is a variant of the works by Avramovic and his associates (1964) and Solomon (1979), using a difference-equation model specification instead of a differential equation model used by the previous works. More importantly, the present model uses an income specification for saving rather than an output specification used by the previous works, and hence the nature of the results is considerably different. Of course, the income specification of saving behaviour seems more theoretically

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4/ The macroeconomic equilibrium condition for an open economy is

$$Y = E + X - M$$

or

National product = National expenditures + Exports - Imports

where $E = C + I + G$..

Subtracting private and government expenditures for current use $(C + G)$ from both sides of the above equation will give

$$(Y-C-G) = (E-C-G) + (X-M)$$

$$S = I + (X-M)$$

$$\text{or } I-S = M-X = F.$$

Therefore in both ex post identity and equilibrium conditions, the investment-saving gap (I-S) and the trade gap (M-X) should be equal to the capital inflow F, which is equal to the current account balance. Of course, in the context of the two-gap analysis, the ex ante gaps of both types need not be equal. The assumptions underlying the model are: (1) income growth is solely an increasing function of investment and a fixed incremental capital-output ratio; (2) all external borrowing is used to finance the investment-saving gap· (3) all other sources of financing the gap such as changes in reserves and direct investments are ignored and constant prices are maintained; (4) amortization of past loans is ignored, assuming that scheduled loan repayments will be covered by new borrowing.

sound than the output specification.[5/]

Let us begin with the following identity relations:

(1) $Y_t = Q_t - iD_t$

(2) $E_t = C_t + I_t + G_t + (X_t - M_t)$

where

Y = GNP

Q = GDP

D = debt outstanding

i = interest rate

E = total absorption

C = consumption

I = investment

G = Government spending

X = Exports

M = Imports

and the subscript "t" refers to time.

Thus, saving S_t, is equal to

(3) $S_t = Q_t - iD_t - (C_t + G_t)$

From the macroeconomic equilibrium condition, it can readily be shown that

(4) $TB_t = E_t - Y_t = I_t - S_t = D_{t+1} - D_t = F_t$

where TB refers to current account balance, i.e., $M_t - X_t$ and F is the external capital inflow.

Furthermore let us postulate as in the Harrod-Domar growth model that investment is related to output (Q) by an incremental capital output ratio, "k", saving is related to income (Y) by a saving ratio "s" and output grows at a compound

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5/ See McDonald [1982] p.607.

rate, r., i.e.,

$$(5) \quad S_t = sY_t = sQ_t - siD_t = sQ_o\ (1+r)^t - siD_t$$

$$(6) \quad I_t = krQ_t = krQ_o\ (1+r)^t$$

Then, the investment-saving gap can be expressed in first-order linear difference equation as follows:

$$(7) \quad D_{t+1} - D_t = I_t - S_t$$

$$= (kr-s)\ Q_o\ (1+r)^t - siD_t$$

or

$$D_{t+1} - (1+si)D_t = (kr-s)\ Q_o\ (1+r)^t$$

Solving for D_t with $D_o = 0$ will yield

$$(8) \quad D_t = \frac{(kr-s)}{(r-si)} Q_o \left[(1+r)^t - (1+si)^t\right]$$

and the debt-income ratio is

$$(9) \quad \frac{D_t}{Q_t} = \frac{(kr-s)}{(r-si)} \left[1 - \frac{(1+si)^t}{(1+r)^t}\right]$$

and

$$(10) \quad \lim_{t \to \infty} \frac{D_t}{Q_t} = \frac{(kr-s)}{(r-si)}\ , \text{ if } r > si$$

Thus from equations (9) and (10) it is clear that as long as the growth rate of output (r) is greater than the interest rate on loans adjusted for the saving rate (is), the growth of debt-GDP ratio will decelerate and will level off ultimately at the level determined by (kr-s)/(r-si). But it is also clear that if the opposite holds, i.e., $r < si$, the process of debt accumulation obviously becomes increasingly explosive over time. To illustrate a hypothetical case, assume an economy that is growing at a rate of 7 per cent a year with a saving ratio of 20 per cent, an incremental capital-output ratio of 3, and an interest rate of 10 per cent. Then, the debt accumulation will grow continuously until its debt-GDP ratio will reach asymptotically to its maximum limit of 25 per cent $((kr-s)/(r-si) = (3\ (0.07)-(0.2))/(0.07-(0.2)(0.1)) = 0.25)$.

The major advantage of a simple model represented by Eq.(8) is its transparency and manageability. That is, the trajectory of debt accumulation is determined by only a small number of parameters, namely, k, r, s, and i, and the initial condition Q_o. Furthermore, the model permits the delineation of different debt profiles over time by experimenting with different parameter values. In particular, it would help delimit the range of parameter values which is consistent with the sustainability of a country's debt accumulation over time.

If world inflation is allowed for, the debt-accumulation process would, of course, be characterized by higher debt in nominal terms. Then, the real growth rate needs to be changed into the nominal rate by adding the rate of increase of world prices to the real rate and the nominal interest rate may be used if it reflects fully the world inflation.

The major conceptual weakness of the investment-saving gap approach is that there may be some difficulties in transforming domestic output into foreign exchange earnings in developing countries. Put differently, it is most likely that given the limited capacity of developing countries to produce capital goods, the mobilization of domestic savings cannot be translated into physical capital investments most of which must be imported from the industrialized countries with foreign exchange earnings. Therefore, a trade-gap model which focuses on this foreign-exchange gap may be more an appropriate tool for describing the debt-accumulation process of developing countries, assuming that all imports are largely earmarked for investment purposes. The following section will discuss such a trade-gap approach to the debt-accumulation problem of developing countries.

III. An Aggregate Trade-Gap Model

Let the trade gap be denoted by

$$(11)\quad TB_t = M_t - X_t = B_t - iD_t - A_t$$

where TB is the current account balance, B the gross borrowing, D debt outstanding, "i" interest rates, and A amortization. Assume that imports are a function of GDP and exports are exogenously determined, namely

$$(12)\quad M_n = aQ_n = aQ_o e^{rn} = M_o e^{rn}$$

where $a = M_o/Q_o$, i.e., a constant import/GDP ratio, and

$$(13)\quad X_n = X_o e^{gn}$$

where g is an exogenously determined growth rate of exports.

Then, debt outstanding "D" at time "T" is

$$(14)\quad D_T = \int_o^T (M_n - X_n)\, e^{i(T-n)} dn$$

$$= \int_o^T (aQ_o e^{rn} - X_o e^{n})\, e^{i(T-n)} dn$$

$$= \frac{M_o}{r-i}(e^{rT} - e^{iT}) - \frac{X_o}{g-i}(e^{gT} - e^{iT})$$

and the ratio of debt to income is

$$(15)\quad \frac{D_T}{Q_T} = \frac{1}{Q_o e^{rT}} \left\{ \frac{Mo}{r-i}(e^{rT} - e^{iT}) - \frac{Xo}{g-i}(e^{gT} - e^{iT}) \right\}$$

$$= \frac{a}{r-i}(1 - e^{-(r-i)T}) - \frac{b}{g-i}(e^{-(r-g)T} - e^{-(r-i)T})$$

where $a = Mo/Qo$ and $b = Xo/Qo$.

Whether the debt/income ratio in Eq.(15) will be explosive or will level off to a constant ratio depends on the relative magnitudes of the parameters involved. We will examine three different special cases in the following:

Case i: $r > i,\ r > g$

It is clear from Eq. (15)

$$(16)\quad \lim_{T\to\infty} \frac{D_T}{Q_T} = \frac{a}{r-i}$$

Therefore, if the growth rate of output exceeds both that of exports and interest rates, the debt-income ratio will eventually settle down to a constant level $a/(r-i)$, and the higher the level of a stationary position will be, the greater the import/GDP ratio is; and the lower it will be, the larger the positive gap between "r" and "i" is. It is worth noting that while the export performance has a significant bearing on the debt capacity of a country in the short run, it will play no role in determining the long-run position of a country's indebtedness, if $r > g$.

Case ii: $r = g > i$

Now assume that the growth rates of output and exports are exactly or almost equal for all practical purposes and both rates exceed interest rates. Then

$$(17)\quad \lim_{T\to\infty} \frac{D_T}{Q_T} = \frac{a}{r-i} - \frac{b}{g-i} = \frac{1}{r-i}\ (a-b)$$

where $a = Mo/Qo$ and $b = Xo/Qo$.

Eq. (17) corresponds to the present value of net import gaps (a-b) discounted to the infinity where the discount rate used is the net growth rate of output in excess of interest rates. It is clear from Eq. (17) that when the export/GDP ratio (b) and the import/GDP ratio (a) are permitted to vary over time and the exports grow faster than the imports at some point in time, i.e., $b > a$, the debt/GDP ratio will become negative, that is, the debtor country in question will become a net capital exporter.[6/] It is also equally apparent that

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6/ Such historical cases abound. For instance, the United States in the late nineteenth century transformed from a net capital importer to a net capital exporter, presumably as a result of changes in such parameters as "a", "b", "g" or "r" that are treated as constants in the abstract model.

the level at which the debt/income ratio will level off in the long run is positively related to the import-export gap and inversely related to the gap between the growth rate of output and interest rates.

Case iii: $g > r > i$

If $g > r > i$, from Eq.(15),

$$(18) \quad \lim_{T \to \infty} \frac{D_T}{Q_T} = \frac{a}{r-i} - \infty = -\infty$$

and hence the debt/GDP ratio will become negative or the country in question will become a net capital exporter at some point in time. The crucial question is when the indebtedness of the country in question vanishes and becomes a net capital exporter. To answer this question, we have to solve for T by setting $D_T = 0$ in Equation (14), i.e.,

$$(19) \quad D_T = \frac{Mo}{r-i} \left(e^{rT} - e^{iT}\right) - \frac{Xo}{g-i} \left(e^{gT} - e^{iT}\right) = 0$$

or

$$\frac{e^{rT} - e^{iT}}{e^{gT} - e^{iT}} = m \frac{(r-i)}{(g-i)}$$

where $m = Xo/Mo$

Since Eq.(19) involves exponential variables and hence not directly algebraically solvable, we resorted to an approximate solution by a Taylor series expansion method. Namely, each exponential variable in Eq.(19) was approximated by Taylor series expansion up to the quadratic terms, and then the resultant quadratic equation was solved for the variable T. Omitting all the intermediate solution steps, the final approximate solution can be expressed as

$$(18) \quad T = \frac{(1-m)}{m(g-r)}$$

where $m = Xo/Mo$ is an intial export/import ratio.

Therefore, the length of time required for a country's cumulative debt to diminish to zero depends on the initial export/import ratio, Xo/Mo, and the export/output growth rate differential. For instance, using hypothetical parameter values for illustrative purposes, let $g = 0.08$, $r = 0.04$, and $m = Xo/Mo = .5$, then $T = 25$. That is, if a country begins with a trade gap opened by its imports exceeding its exports twice as much, and its exports grow faster than its output by 4 percentage points per year, it will take approximately 25 years to retire all the debts it accumulated to finance the trade gap every year and become a net capital exporter thereafter.

Obviously, besides three cases illustrated above, many other different forms of debt accumulation process may result from various permutations of the parameter values assumed. The utility of the model described here is not that infinitely many different forms of debt profile can be generated by the model, but that the model is capable of providing planners and policymakers with a crude but operational formula for estimating the external borrowing requirements of certain investment programmes which must be implemented largely by the imports of capital goods and intermediate goods from abroad. Thus, equipped with an independent estimate of a country's future output and exports growth potentials, one can readily arrive at the feasibility of such an investment programme and the sustainability of debt accumulation caused by it.

IV. A Disaggregate Macro-planning Model of the External Borrowing

The models developed so far are highly aggregative, and hence do not permit the sectoral breakdown of investment and production, and differentiation of imports by major commodity groups. The disaggregative model shown below purports to remedy these shortcomings.

The model consists of two sectors, production and expenditures, and the external sector. Money market and prices, and labour market are omitted for analytical convenience without the loss of generality. The salient feature of the model is the prominent role assigned to investment as a major policy instrument, which is usually the most important feature of the growth-cum-debt model. The model is basically driven by assigning specific values to sector investments, i.e., policy-determined exogenous variables, although it is equally amenable to experiment through changes in other parameters such as import coefficients and export growth rates. Trajectories of debt accumulation along with other endogenous variables such as GDP, sectoral output and imports by various commodity groups can be projected in response to sectoral investments planned.

Basic Model Equations and Identities

Production

(1) $QA = a_{10} + a_{11} \sum_{i=0}^{t-1} IA_i + a_{12} RI$

(2) $QMIN = a_{20} + a_{21} \sum_{i=o}^{t-1} IMIN_i$

(3) $QM = a_{30} + a_{31} \sum_{i=o}^{t-1} IM_i + a_{32} MR_{-1}$

(4) $QU = a_{40} + a_{41} \sum_{i=o}^{t-1} IU_i + a_{42} Q$

(5) $QS = a_{50} + a_{51} \sum_{i=o}^{t-1} IS_i + a_{52} Y$

(6) $Q = QA + QMIN + QM + QU + QS$

(7) $Y = Q - iD$

Investment

(8) $IA = IA_{-1} (1 + g_a)$

(9) $IMIN = IMIN_{-1} (1 + g_{min})$

(10) $IM = IM_{-1} (1 + g_m)$

(11) $IU = IU_{-1} (1 + g_u)$

(12) $IS = IS_{-1} (1 + g_s)$

(13) $I = IA + IMIN + IM + IU + IS$

Symbols

QA = value added in agriculture

IA = Gross fixed investment in agriculture

RI = Rainfall index

QMIN = Value added in mining

IMIN = Gross fixed investment in mining

QM = Value added in manufacturing

IM = Gross fixed investment in manufacturing

MR = Imports of raw materials

QU = Value added in public utilities

IM = Gross fixed investment in public utilities

Q = GDP

QS = Value added in services

IS = Gross fixed investment in services

Y = GNP

D = Debt outstanding

i = interest rates

g_a = investment growth rate in agriculture

Consumption

(14) $C = a_{60} + a_{61}Y + a_{62} C_{-1}$

Resource-use Identity

(15) $Q + M - X = C + I + \overline{G}$

Imports and Exports

(17) $MK = m_{10} + m_{11} I + m_{12} MK_{-1}$

(18) $MR = m_{20} + m_{21} QM$

(19) $MFL = m_{30} + m_{31} Q$

(20) $MCG = m_{40} + m_{41} Q$

(21) $M = MK + MR + MFL + MCG + \overline{MS}$

(22) $X = \overline{XC} + \overline{XM} + \overline{XS}$

(23) -(27), $M_i^* = M_i . \overline{PM}_i$, $i = 1, 2, \ldots, 5$

(28) $M^* = MK^* + MR^* + MFL^* + MCG^* + \overline{MS}^*$

(29) -(31), $X_i^* = \overline{X}_i . \overline{PX}_i$, $i = 1, 2, 3.$

(30) $X^* = \overline{XC}^* + \overline{XM}^* + \overline{XS}^*$

Balance of Payments Equilibrium

(31) $M^* - X^* = B^* - iD^* - \overline{A}^*$

(32) $D^*_{t+1} = D^*_t + B^*_t - \overline{A}^*_t$

g_{min} = investment growth rate in mining

g_m = investment growth rate in manufacturing

g_u = investment growth rate in public utilities

g_s = investment growth rate in services

I = Total gross fixed investment

C = Consumption

$\overline{G}$ = Government expenditure

M = Total imports

X = Total exports

MK = imports of capital goods

MFL = imports of fuels

MCG = imports of consumer goods

$\overline{MS}$ = imports of services

$\overline{XC}$ = exports of primary commodities

$\overline{XM}$ = exports of manufactured goods

$\overline{XS}$ = exports of services

M_i^* = ith imports at current prices

$\overline{PM}_i$ = ith import price index

M^* = total imports at current prices

$\overline{X}_i^*$ = ith exports at current prices

$\overline{XP}_i$ = ith export price index

X^* = total exports at current prices

B^* = Gross loans

$\overline{A}^*$ = Loan amortization payments

D^* = nominal debt outstanding

Variables with an asterisk (*) mean current values, those without an asterisk are measured in constant values, and those with a bar (—) are exogenous. All variables can be measured either in dollars or local currency.

The model can be estimated with time series or cross section data or both combined. Although the model primarily relies on the national data sources, it may be necessary to fill data gaps from other secondary sources such as the World Bank, IMF, and UN Statistical Series where national statistics were neither available nor obtainable. The model consists of 32 equations, 10 of which are stochastic equations and the remainder are identites and definitional equations.

Equations (1) to (5) determine sectoral values added as a function of lagged comulative gross investments and other predetermined variables.[7/]

In addition to investment, other explanatory variables appear in each equation except equation (2): rainfall for agriculture, lagged raw material imports for manufacturing, GDP for public utilities and GNP for services. GDP is obtained by summing sectoral values added in equation (6), and GNP is derived by subtracting interest payments from GDP in equation (7).

Equations (8) - (13) are non-stochastic equations for generating sectoral investments. The growth rate parameters for sector investments, g_i, may reflect historical values if the policy implication of the continuation of the present trend is to be explored; or they can be treated as policy variables.

7/ Underlying these sectoral production functions is the simplifying assumption of the constant capital-output ratio, i.e.,

$$Y_i = k_i K_i$$

where k_i is the ith sector constant ouput-capital ratio and K_i is the ith sector capital stock. If it is further assumed, for the sake of simplicity, that depreciation is a constant proportion g_i of the sectoral gross investment, I_i. The capital stock in discrete units at time t will be

$$K_i(t) = K_i(0) + (1-g_i) \sum_{m=0}^{t-1} I_i(m)$$

Then, it follows from the above two equations that sectoral output can be expressed as a function of the cumulative gross investments, i.e.,

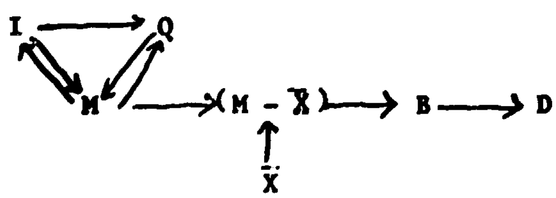
$$Y_i(t) = k_i K_i(0) + k_i (1-g_i) \sum_{m=1}^{t-1} I_i (m)$$

Therefore, given a numerical value of g_i, the incremental output-capital ratio and hence its incremental capital-output ratio (ICOR) can be readily calculated. Furthermore, once k_i is estimated, the initial capital stock $K_i(0)$ can be also determined and hence the capital stock series constructed.

Total investment is then simply the sum of sectoral investments generated in this manner. In equation (14), real consumption is explained by real GDP a la Koyck distributed lag. Equation (15) describes the resource-use balance identity, namely total output plus net imports should be equal to total absorptions, C + I + G. Both the equilbrium and ex post equality of supply and demand is implied in this equation. Imports are disaggregated by major commodity groups - capital goods, raw materials, fuels, consumer goods, and services in equations (17) - (21) and total imports are simply the sum of individual commodity imports in equation (21). Note that capital goods imports are a distributed lag function of gross fixed investments in equation (17); raw material imports are a function of MVA in manufacturing in equation (18); fuels and consumer goods imports are determined by GDP in equations (19) and (20); and service imports are exogenously determined.

Equation (22) pertains to the export activities categorized by primary commodities, manufactures and services. All exports are assumed to be exogenous because of the extreme difficulties of obtaining empirically stable and meaningful relationships for these exports. All exports and imports are converted in current values in equations (23) - (30) in which all export and import price indices are exogenously given. Finally, equation (31) determines the gross borrowing as a function of the import-export gap in current prices which is derived from a series of computational steps taken earlier. Equation (32) is simply a definition relation describing the process of debt accumulation in each period.

To recapitulate the basic features of the model in a schematic presentation, one gets



Namely, exogenously specified (or policy-determined) sectoral investments determine sectoral output and import requirements, while sectoral outputs depend also partly on the imports of raw materials. Then imports by broad commodity groups determined by investments and output combined with exogenously specified exports will give the size of a trade gap which is needed to be financed by the external borrowing. Finally the gross external borrowing minus amortization will be added to debt outstanding in the preceding period to arrive at the total outstanding debt at the current period.

Once the model is constructed and statistically estimated, the validation of the model through dynamic simulation may be in order. Namely, it may be useful to simulate the model during the period for which historical data for all variables are available, and make a comparison of the original data series with the simulated series for each endogenous variable. The differences between the actual and simulated values arise from two sources: (1) the model deficiency in tracking fully the movements of endogenous variables; and (2) the errors cumulated over time and through successive substitutions of equations for the model solution because of the lagged endogenous variables generated by the model. In addition, the model needs to be tested for its stability. Put differently, if the model is stable in a dynamic equilibrium sense, all the flow variables are expected to return eventually to their original trajectories when the model is subjected to a shock at a point in time.

After the model has been validated and tested for its stability, then model simulations under alternative scenarios of different time-paths of sectoral investments can be carried out to evaluate the external borrowing requirements and the process of debt accumulation as well as the usual macroeconomic impact of alternative investment decisions.

V. Concluding Remarks

The paper developed a conceptual model of growth-cum-external debt, both aggregate and disaggregate. Based on the two-gap analysis, two simplified debt-financed growth models have been constructed. The first one deals with an investment-saving gap model a la Harrod-Domar growth and the second one is a foreign-exchange gap model. The third model is designed with considerable disaggregation in production and trade for the purpose of quantitative assessment of the external borrowing required by alternative sectoral investment plans.

Both the investment-saving gap model and the foreign-exchange gap model entail only a small number of parameters and provide a simple useful empirical formula for estimating the debt-servicing capacity of an economy in response to growth stimulus originating from accelerated domestic investments or imports of capital goods and intermediate goods for investment and other productive purposes. They are particularly suited for obtaining a quick rough estimate of a future debt profile corresponding to specific growth rates of saving and investment or those of imports and exports. The major advantage of these simple models is, of course, modest data requirements, a critical constraint to most empirical studies on the developing countries.

On the other hand, there are severe limitations of these simple models. Apart from oversimplified assumptions of the model with regard to production and trade, the values of key parameters of the model are exogenously determined and the configuration of debt accumulation may prove to be highly sensitive to the parameter specification. This is, however, a problem common to any modelling exercise.

It is worth noting that the investment-saving gap model may not be appropriate for describing the growth process of developing countries. Given the limited capacity of developing countries to produce their own capital goods, the emphasis on the investment-saving gap appears to be misplaced and the analysis of growth-cum-debt should be focused elsewhere, namely the foreign-exchange constraint, since a major bulk of capital goods and intermediate goods needed by developing countries are imported from outside. In this regard, the foreign-exchange gap model is more theoretically sound and empirically useful than the investment-saving gap model.

It is obvious that these simplified aggregate models are not capable of generating the external debt implications of various sectoral priorities in investment decisions. The development of this policy-oriented disaggregative model meets such an evident need as aggregate models are rendered virtually useless in examining the growth process in sectoral details. Yet, despite considerable sectoral disaggregation, the disaggregative model retains the fundamental feature of the growth-cum-external debt. That is, the model is basically driven by policy-determined sectoral investment allocations and trajectories of output growth and debt accumulation are projected in response to these investment stimuli. Empirical implementation of the models developed in this paper using specific country data is the subject matter of further investigation.

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