Foreign Capital, Income Inequality, Demographic Pressures, Savings and Growth in Developing Countries: A Cross Country Analysis

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I. Introduction

The role of domestic versus foreign resources in the growth of developing countries continues to be a topic of serious debate among scholars, politicians, policy makers, and even members of the general public.[1] In addition, two other factors have attracted special attention. These are demographic variables and income inequality. Regarding the first, the main issue has been whether pressures exerted by rapid population growth (as sometimes approximated by dependency rates) has led to a lower saving rate, which in its turn may cause slower growth rates.[2] As for the second, the thrust of most empirical literature has been on the historical experience of countries about income inequality during the process of economic growth.[3] Significantly less attention has been paid to the role of income inequality as a *causal* factor in accelerating (decelerating) rate of growth and other variables affecting growth. For example, if dependency rates are affected by birth rates, among other factors, which in their turn are affected by income inequality,[4] it follows that income inequality can affect growth rates

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1 See Todaro and references cited therein. Also see Gupta, Islam.
2 Leff, but see Gupta (1970a).
3 See Fields for an extensive survey.
4 See Flegg, Bhattacharya and Repetto.

not only directly, as asserted by the neoclassical paradigm, but also indirectly.

This paper is an attempt to bring these various strands of thought together into a single model. More specifically, the aim of this paper is to specify and estimate, using international cross-section data for a set of developing countries, a simultaneous equations model in which saving and growth rates and demographic factors are treated as being endogenous variables and which explicitly allows for the role of income inequality through a variety of channels.[5]

The general approach in the areas being explored in this paper has been that of single equation models which allow only for the *direct* effect of a given exogenous variable on an endogenous variable. However, it is easy to show that once we allow for indirect effects — due to simultaneity —, the predictions of single equation models can lead to misleading conclusions. For example, it is shown below that by ignoring the indirect effects, single equation studies have underestimated the negative effect of dependency rates and have, at least, grossly overstimated the negative impact of foreign capital inflows on domestic savings.

The scheme of this paper is as follows. In Section II, we discuss the implications of using simultaneous equations model for questions under discussion. In Section III, we specify the complete model to be estimated. The results are presented and discussed in Section IV. In this section, we solve the model for its reduced form and use elasticity multipliers to compare the *direct* and *total* (*direct* and *indirect*) effects of a variety of exogenous variables on the endogenous variables of interest, particularly saving and growth rates. The results are briefly summarized in the final section. The data and the sample of the countries used are discussed in the Appendix.

II. Implications of Simultaneity

In this section, we show the implications of the direct and indirect effects of population growth, as represented by dependency

5 This approach is in some way similar to the used in Gupta (1975).

rates, and foreign capital inflows on saving rate.[6]

We first consider the effect of dependency rate. For this purpose we start with Leff's saving function (Leff)

$$(1)\quad \frac{S}{Y} = a_0 + b_0 y + c_0 G + d_0 DR,$$

$$b_0 > 0 \quad c_0 > 0 \quad d_0 < 0$$

where S/Y is saving rate, y per capita income, G growth rate of income and DR dependency rate defined as percentage of population in the 0-14 years age bracket.

This equation shows the *direct* effect of dependency rate on saving rate. As Leff has shown, this effect operates from the demand side.

In order to allow for the *indirect* effect, we proceed as follows:

Consider the following production function:

$$(2)\quad Y = F(K, L)$$

where Y, K, and L are GNP, capital and labor, respectively. Assuming that the production function (2) is linear and homogeneous of degree one, it may be written in per capita terms as

$$(3)\quad y = b_1 k + c_1 TLPR, \quad b_1 > 0 \quad c_1 > 0$$

where $y = Y/N$, $k = K/N$, and $TLPR = L/N$.

Following demographic theory, let's postulate that TLPR depends, among other factors, on dependency rate, such that

$$(4)\quad TLPR = a_2 + b_2 DR, \quad b_2 < 0\,.$$

Substituting (4) into (3) and then (3) in (1) for y, we get

6 The section draws heavily on Gupta (1975).

$$(5)\quad \frac{S}{Y} = (a_0 + b_0 c_1 a_2) + b_0 b_1 k + c_0 G + (b_0 c_1 b_2 + d_0)\, DR.$$

Taking into consideration the signs of b_0, c_1 and b_2, we can see that $b_0 c_1 b_2 < 0$ and therefore the coefficient of dependency rate in equation (5) is less than corresponding coefficient in (1). Thus it follows that equation (1) understimates the effect of dependency rates to the extent that it does not allow for the adverse effect of population growth on per capita income and hence on saving rate. Our formulation thus allows for both the demand and the supply side effects of dependency rates.

We now turn to the *total* effect of foreign capital inflows. For this purpose, let us modify equation (1) by including foreign capital inflows as an additional variable, so that (1) now becomes

$$(6)\quad \frac{S}{Y} = a_0 + b_0 y + c_0 G + d_0 DR + e_0 F,$$

$$b_0 > 0 \quad c_0 > 0 \quad d_0 < 0 \quad e_0 < 0$$

where F represents foreign capital inflows as a proportion of GNP. The partial effect of F, following the findings of others, is assumed to be negative.

Now, following Papanek, we specify the following equations for G:

$$(7)\quad G = a_3 + b_3 \frac{S}{Y} + c_3 F, \quad b_3 > 0 \quad c_3 > 0.$$

Substituting (7) in (6) we get

$$(8)\quad \frac{S}{Y} = \frac{1}{(1 - b_3 c_0)} \left[(a_0 + c_0 a_3) + b_0 y + d_0 DR + (c_0 c_3 + e_0) F \right]$$

Now $c_0 > 0$, $c_3 > 0$ and $e_0 < 0$. Therefore, it follows that $(c_0 c_3 + e_0) \gtreqless 0$ depending on whether $c_0 c_3 > e_0$ or $c_0 c_3 < e_0$, respectively. Hence, unlike the direct effect, it is no longer possible to predict the direction of the total effect. Even if we were to assume that $c_0c_3 < e_0$ so that the total effect of foreign capital inflows was negative, it still follows that this total effect will be smaller than the direct effect. In other words, works which concentrate on direct effects alone tend to exaggerate the adverse impact of foreign capital inflows on saving rate of developing countries.

From this brief demonstration, it is clear that a simultaneous equations approach is preferable to the single equation approach if we want to examine the impact of foreign capital and population growth on the economic growth of developing countries. Additional implications of this approach will become clear when we look at the structure of the complete model.

III. The Model

In this section, we specify and discuss the model to be estimated.[7]

The complete model is given by the following equations. The expected signs of the various coefficients are given below each coefficient:

$$(9)\quad s = a_1 + \underset{>0}{b_1}\, y + \underset{>0}{c_1}\, G + \underset{<0}{d_1}\, DR + \underset{\lessgtr 0}{e_1}\, AID + \underset{\lessgtr 0}{f_1}\, FPI + \underset{\lessgtr 0}{g_1}\, RFI + \underset{>0}{h_1}\, IQ$$

$$(10)\quad G = a_2 + \underset{>0}{b_2}\, s + \underset{>0}{c_2}\, AID + \underset{>0}{d_2}\, FPI + \underset{>0}{e_2}\, RFI + \underset{>0}{f_2}\, GL + \underset{<0}{g_2}\, LIT$$

$$(11)\quad y = a_3 + \underset{>0}{b_3}\, EN + \underset{>0}{c_3}\, TLPR + \underset{>0}{d_3}\, LIT + \underset{>0}{e_3}\, SEC + \underset{<0}{f_3}\, DEN$$

$$(12)\quad TLPR = a_4 + \underset{<0}{b_4}\, DR + \underset{<0}{c_4}\, y + \underset{\lessgtr 0}{d_4}\, ALF$$

$$(13)\quad DR = a_5 + \underset{>0}{b_5}\, BR + \underset{<0}{c_5}\, y$$

[7] In some respects this model draws upon Gupta (1975) and Gupta-Islam.

$$(14)\quad BR = a_6 + b_6\, y + c_6\, FPR + d_6\, LIT + e_6\, SEC + f_6\, U + g_6\, IMR + h_6\, IQ$$

$$<0 \quad <0 \quad <0 \quad <0 \quad <0 \quad >0 \quad >0$$

$$(15)\quad FPR = a_7 + b_7\, DR + c_7\, ALF + d_7\, SEF$$

$$<0 \quad >0 \quad <0$$

$$(16)\quad IMR = a_8 + b_8\, LIT + c_8\, y + d_8\, ALF + e_8\, CAL + f_8\, IQ$$

$$<0 \quad <0 \quad >0 \quad <0 \quad >0$$

$$(17)\quad ALF = a_9 + b_9\, y + c_9\, AID + d_9\, FPI + e_9\, RFI$$

$$<0 \quad <0 \quad <0 \quad <0$$

List of the variables used

s: gross domestic saving rate
y: real per capita income
G: growth rate of GNP
DR: dependency rate, defined as the percentage of population between 0-16 years and over 65 years of age
AID: net transfers received by governments plus official longterm government borrowing as percentage of GNP
FPI: foreign private investment which includes private longterm borrowing plus net private direct investment as percentage of GNP
RFI: other foreign capital inflows which include net private transfers, net short-term borrowing, other capital (net), and errors and omissions in the balance of payments as percentage of GNP.
IQ: Atkinson's index of inequality
GL: rate of growth of labor force
LIT: literacy rate
EN: per capita energy consumption (measured in kilograms per capita coal equivalents)
TLPR: total labor force participation rate
SEC: secondary education rate
DEN: population density
ALF: percentage of labor force in agriculture
BR: birth rate (per 1,000)

FPR: female labor force participation rate
U: percentage of urban population
SEF: secondary female education rate
IMR: infant mortality rate
CAL: calories intake as percentage of requirement

The logic of the model was briefly explained in Section II. Equations (9) and (10) allow for the interdependence between saving and growth rates. By treating per capita income as an endogenous variable, as was shown above, we are able to allow for the indirect effect of the dependency rate. This accounts for equations (11) and (12). Leff, in his single equation model, had used the dependency rate as an exogenous variable. However, it is clear that in no sense can it be regarded as a policy variable. Rather, it is more appropriate to regard it as an endogenous variable[8] and allow for its effect on the saving rate to be reflected through its determinants. This is the approach adopted in this paper. This accounts for equation (13) and the rest of the equations.

Thus the model consists of nine simultaneous equations in which the saving rate, growth rate, per capita income, total labor force participation rate, infant mortality rate, dependency rate, birth rate, female participation rate and the share of labor force in agriculture are the endogenous variables (nine in all).

It should be pointed out here that as far as the individual equations are concerned, the specifications given above are those which are reported in the empirical section. To that extent there is some ad-hockery about them. In particular, a number of variables relating to education were tried. But due to severe multicollinearity between them, we had to do some experimenting and the equations above include those education variables which 'worked', that is to say yielded 'correct' signs. A detailed discussion of the individual equations now follows.

Saving Rate Equation

A summary of the arguments for the inclusion of per capita

[8] Leff does suggest this possibility but does not pursue it.

income, rate of growth of income, and dependency rate can be found in the excellent survey article by Mikesell and Zinser. The inclusion of the rate of growth of income has been suggested, among others, by Houthakker, Modigliani, and Swamy. The case for the inclusion of the dependency rate has been persuasively argued by Leff. The role of foreign capital inflows, measured as an aggregate, has been examined by Rahman, Gupta (1970b), Gupta and Islam, Griffin and Enos, Chenery and Eckstein, and Weiskoff, among others. However, Papanek has gone a step further and examined the role of different components of foreign capital inflows. It can be argued *a priori* that since different components of foreign capital are not homogeneous, it follows that their effect need not necessarily be the same, at least quantitatively. In our equation, we have adopted this approach. The inclusion of the variable IQ, measuring the degree of overall inequality of income distribution, is something of a departure for this equation. In the existing literature, as far as I am aware, such a measure has not been used before. There have been attempts to examine the role of the functional distribution of inome, that is the share of profits and wages in national income, on saving rate — see, for example, Williamson, Gupta (1970d) — or the role of the distribution of income between the urban and the rural sectors — see, Gupta (1970c, 1970d) — but the role of size distribution of income has been by and large ignored. But, of course, it can be argued that while functional distribution plays an important role — Kaldor, Pasinetti — the size distribution identifies the role of income distribution from a different and a wider perspective, particularly in case of developing countries, where income inequalities are significantly greater than in the developed countries. Adopting this line of argument I have included an index of income inequality as an explanatory variable. It might have been more appropriate to use a more disaggregate measure, for example the shares of the top 50%, middle 40% and the bottom 40%, etc. However, due to lack of data, this was not possible. It is hypothesized, according to the received theory, that the greater the degree of inequality, the higher the rate of saving.

Growth Rate of Income Equation

This equation embodies the typical neoclassical hypothesis according to which rate of capital formation, rate of growth of labor force and its quality are the prime determinants of the growth rate of income. In order to shed light on the role of foreign capital, domestic saving rate and the three components of foreign capital have been entered as separate variables. In some preliminary runs, a number of other variables representing education were used but did not yield expected signs and therefore are not included. In the result reported the rate of growth of labor force was approximated by the rate of population growth. This is clearly not always the most appropriate measure. However, there was simply no other alternative available.

Per Capita Income Equation

This equation follows from our earlier discussion about the indirect effect of the dependency rate on saving rate. This equation allows for the role of both capital and non-capital resources and for the quality of labor. In this equation, per capita energy consumption is used as a proxy for per capita fixed capital. Population density is used to measure the pressure of population on non-capital resources, although this is only a rough measure as pointed out by Adelman. The general literacy rate and the secondary education rate are used to reflect changes in the quality of labor. Here again some additional education variables were tried but did not work. The inclusion of total labor force participation has already been explained.

Total Labor Force Participation Rate

This variable is specified as being a function of only three factors. An income variable (per capita income), a demographic variable (dependency rate) and a variable representing structural changes in an economy (share of agricultural labor force). Education variables were tried but did not yield useful results and therefore are not included here. The ambiguous sign on the coefficient of the structural variable is best explained by noting that the total labor force participation rate is in fact a weighted average of the male and female participation rates. In the quation for the female participation rate (15), it is hypothesized that the structural variable has a positive effect, from which it follows that we are postulating a negative effect on the male participation rate. Thus depending on whether the negative or the positive effect is the dominant one, the coefficient could have either sign. A possible explanation for these opposite effects is as follows. In agriculture, given the nature of the work involved, women often end up working as part of the regular work force. However, in the non-agriculture sector more often than not the nature of work does not allow for such automatic participation. Consequently, as the share of agriculture labor force declines, so does the rate of female participation. On the other hand, for males, once they migrate from rural to urban sector, the possibility of living off the family farm no longer exists and active participation in the labor force becomes the only possible mode of survival, thus giving the negative relationship. The negative effect of per capita income follows from the fact that at extremely low levels of income almost every member of a family is obliged to work in order to merely subsist. However, as per capita incomes rise, this desperate situation tends to disappear. The negative effect of the dependency rate is essentially a reflection of the negative effect on the female participation rate. This effect could be rationalized in a variety of ways. But a simple explanation will do just as well as some more complicated ones. Given women's dominant role as being responsible for raising and caring for children, it follows that the higher the dependency rate, the lower the possibility of women entering labor force.

Dependency Rate Equation

The effect of birth rate has been ably summarized by Leff. Thus, "demographic theory indicates that a prolonged high birth rate will affect a population's age composition, placing a relatively large percentage of the population in the younger age bracket."[9] The negative effect of per capita income follows from the same considerations as those in the birth rate equation to be discussed below.

Birth Rate Equation

This equation embodies the hypotheses put forward by Adelman, Becker, Mincer, Cain, Schultz, Bhattacharya, Repetto and Flegg, among others. Very briefly, the inclusion of per capita

[9] Leff, 887.

income follows from the theory of consumer choice, as for example, argued by Becker. Female participation rate is included as a proxy for the "opportunity income of women and their access to the labor market."[10] The role of education influencing fertility behavior has been discussed extensively and is not elaborated here. We tried a number of variables and the ones included here yielded the most satisfactory results. It has been argued that agricultural activity is more conducive to higher birth rates than non-agricultural activity.[11] This effect was taken into account by alternately introducing two structural variables, the share of agricultural labor force or the share of urban labor force. The latter is reported in the specification because the former did not perform reasonably due to problems of multicollinearity. The inclusion of infant mortality is justified in terms of the replacement needs of a family for children.[12] Finally, the inclusion of income inequality as a variable has been extensively discussed by Bhattacharya, Repetto and Flegg. It could be rationalized by saying that not only per capita income but its dispersion should also be included. Be that as it may, these authors have posited a positive relationship between income inequality and birth rate and we test this hypothesis here.

Female Participation Rate

The effect of dependency rate and the structural variable (the share of agricultural labor force) was explained above in the equation for total labor force participation rate and, therefore, is not repeated here. The role of female secondary education is straightforward. The positive sign of this variable follows from the application of argument due to investment in human capital.

Infant Mortality Equation

This equation is somewhat similar to that used by Adelman, except the variable income inequality. Its inclusion is due to Repetto.

Share of Agricultural Labor Force Equation

10 Schultz, 155. See also Mincer and Cain.

11 Schultz, 155.

12 Schultz, 155.

From the works of Clark, Chenery and Kuznets, among others, we know by now that during the process of economic development, the relative proportions of agricultural and non-agricultural activities tend to change. More specifically, the share of the former tends to decline. Using per capita income as an indicator of the level of development, we posit a negative relationship between the two variables. The use of foreign capital inflows in this equation is somewhat novel. It is suggested that most of the foreign capital inflows are directed towards the expansion of the non-agricultural sector, so that, *ceteris paribus,* the share of the agricultural sector will tend to decline. Thus once again we postulate a negative relationship between foreign capital inflows (and its components) and the share of agricultural labor force.

IV. The Results

The model was estimated for a sample of thirty-four developing countries using cross-section data for the early seventies. The exact sample and the sources of the data and other details are given in the Appendix. The model was estimated using both ordinary and two stage least squares estimators.

The results for the two estimators are given in Tables 1 and 2. For equations for s, G, y, FPR and ALF, the two estimators give the same results as far as the signs of the coefficients are concerned. However, for the other equations there are a number of differences. It is not quite clear why the two-stage least squares should give results different from the OLSQ results in this respect. Be that as it may, the results based on OLSQ in Table 1 yield all coefficients with expected signs.

Before proceeding to the solution of the model, it is interesting to look at some of the equations and the structural coefficients. The two main equations of interest in this paper are those of the saving and the growth rate and the three exogenous variables of utmost interest are: dependency rate, foreign capital inflows and the index of income inequality. Concentrating on these equations and the variables, we observe a number of interesting things:

(i) The most intriguing result is that relating to the dependency rate. Contrary to most of the studies on this topic,[13] its

[13] Leff, 887.

Table 1

ORDINARY LEAST SQUARES ESTIMATES*

1. $$s = -3.7916 + \underset{(.336)}{.0048y} + \underset{(2.511)}{.8953G} + \underset{(2.801)}{.2135DR} - \underset{(.831)}{.6988AID}$$
$$\underset{(1.313)}{} \quad -\underset{(.648)}{.3605FPI} - \underset{(1.754)}{1.2690RFI} + \underset{(1.115)}{.8928IQ} \qquad R^2 = .476, \ SEE = 3.968$$

2. $$G = -.3416 + \underset{(.217)}{.1488s} + \underset{(1.776)}{.2968AID} + \underset{(1.067)}{.3180FPI} + \underset{(1.152)}{.4577RFI}$$
$$\underset{(1.245)}{} \quad + \underset{(1.328)}{.3878LG} + \underset{(1.346)}{.0205LIT} \qquad R^2 = .409, \ SEE = 2.062$$

3. $$y = -79.4318 + \underset{(.345)}{.3708EN} + \underset{(6.393)}{6.8423TLPR} + \underset{(1.283)}{8.4262LIT} + \underset{(4.567)}{1.9623SE}$$
$$\underset{(.690)}{} \quad -\underset{(5.766)}{2.5764DEN} \qquad R^2 = .881, \ SEE = 170.018$$

4. $$TLPR = 45.2377 - \underset{(3.365)}{.5526DEP} + \underset{(2.182)}{.0044y} + \underset{(1.413)}{.2331ALF} \qquad R^2 = .407, \ SEE = 5.0$$
$$(3.826)$$

5. $$DR = 27.514 + \underset{(7.276)}{.4405BR} - \underset{(5.950)}{.0019y} \qquad R^2 = .617, \ SEE = 2.457$$
$$(1.462)$$

6. $$BR = 43.0097 - \underset{(8.866)}{.0059y} - \underset{(1.677)}{.0498FPR} - \underset{(1.129)}{.0618LIT} - \underset{(1.317)}{.1168SEC}$$
$$\underset{(1.809)}{} \quad -\underset{(.617)}{.0463U} + \underset{(.829)}{.0162IMR} + \underset{(4.463)}{2.7994IQ} \qquad R^2 = .820, \ SEE = 3.869$$

7. $$FPR = 34.6492 - \underset{(.889)}{.7320DR} + \underset{(.932)}{.3859ALF} + \underset{(2.226)}{.0538SEF} \qquad R^2 = .201, \ SEE = 16.$$
$$(.234)$$

8. $$IMR = 240.1600 - \underset{(2.844)}{1.3057LIT} - \underset{(3.362)}{.0262y} - \underset{(.927)}{.6662ALF}$$
$$\underset{(1.243)}{} \quad -\underset{(.202)}{.1756CAL} + \underset{(.207)}{1.340IQ} \qquad R^2 = .487, \ SEE = 38.251$$

9. $$ALF = 84.2815 - \underset{(12.750)}{.0349y} - \underset{(6.131)}{1.1903AID} - \underset{(.645)}{.0040FPI} - \underset{(.002)}{5.4920RFI}$$
$$(2.208) \qquad R^2 = .652, \ SEE = 14.209$$

* 't' values are in the parentheses.

Table 2

TWO-STAGE LEAST SQUARES ESTIMATES

1. $$s = -21.1467 + .0060y + .6654G + .6439DR - .6532AID$$
$$(.794) \quad (1.965) \quad (1.460) \quad (1.028) \quad (1.156)$$
$$-.3774FPI - .9905RFI + .1104IQ \qquad R^2 = .422,\ SEE = 4.191$$
$$(.619) \quad (1.226) \quad (.083)$$

2. $$G = .6653 + .0607s + .2235AID + .3259FPI + .3709RFI$$
$$(.355) \quad (.503) \quad (.764) \quad (1.156) \quad (.965)$$
$$+.4561GL + .0265LIT \qquad R^2 = .386,\ SEE = 2.104$$
$$(1.495) \quad (1.597)$$

3. $$y = -427.124 + .3589EN + 15.3630TLPR + 9.7094LIT$$
$$(1.053) \quad (5.827) \quad (1.576) \quad (4.272)$$
$$+1.4015SEC - 2.6370DEN \qquad R^2 = .871,\ SEE = 177.606$$
$$(.464) \quad (5.608)$$

4. $$TLPR = 30.5681 - .3310DR - .0070y - .2783ALF$$
$$(1.676) \quad (.870) \quad (1.668) \quad (2.921)$$
$$R^2 = .384,\ SEE = 5.184$$

5. $$DR = 30.7643 + .3771BR + .0010y \qquad R^2 = .612,\ SEE = 2.486$$
$$(6.729) \quad (4.207) \quad (.671)$$

6. $$BR = 56.9150 - .0053y - .1489FPR - .1303LIT - .1717SEC$$
$$(4.955) \quad (.924) \quad (1.147) \quad (1.710) \quad (1.931)$$
$$-.0672U - .0426IMR + 2.7409IQ \qquad R^2 = .738,\ SEE = 4.755$$
$$(.578) \quad (.884) \quad (3.506)$$

7. $$FPR = 30.2775 - .8069DR + .4949ALF + .1472SEF$$
$$(.580) \quad (.683) \quad (2.034) \quad (.572)$$
$$R^2 = .199,\ SEE = 16.119$$

8. $$IMR = 201.578 + .0095y - 1.0131LIT + .3546ALF$$
$$(2.122) \quad (.207) \quad (2.137) \quad (.343)$$
$$-.6373CAL - 2.5407IQ \qquad R^2 = .4217,\ SEE = 40.644$$
$$(.614) \quad (.330)$$

9. $$ALF = 86.0454 - .0371y - 1.2344AID - .0364FPI - 5.2375RFI$$
$$(12.753) \quad (6.265) \quad (.667) \quad (.019) \quad (2.095)$$
$$R^2 = .651,\ SEE = 14.245$$

effect, for our sample of countries, is not negative and further, is not statistically different from zero. While this does not mean that demographic pressures are inconsequential, it does raise serious questions about the generality of the findings reported in the literature. It also raises a rather behavioral question: is it possible that, under certain circumstances, higher dependency rates may generate a higher rate of saving? Of course, it needs to be stressed that the use of dependency rates as a proxy for population pressures is only one possibility and may not be the best proxy. It is quite conceivable that alternate proxies could yield quite different results.

(ii) The role of income inequality seems to get considerable support. For example, in the saving rate equations, for the OLSQ results, its coefficient is greater than its own standard error and is sizeable in magnitude. But equally interesting is its behavior in the birth rate equation where it is highly significant for both estimators — a result which agrees with the findings of Flegg, Bhattacharya, and Repetto. This latter finding implies that to the extent that population pressures, however measured, are a determinant of saving rate, and thus of growth rate, and since ultimately birth rates, *ceteris paribus,* play a dominant role in determining population pressures, ignoring this simultaneity would give incorrect information about the role of income inequality as a determinant of saving and growth rates.

(iii) In terms of the role of foreign capital inflows, the negative sign on all three components for both estimators is in agreement with most other works. However, the insignificant coefficient of foreign private investment is noteworthy.

(iv) Finally, the equation explaining structural change in the economy, (9), turns out to be quite interesting. The signs of the capital inflows coefficients are all negative thus suggesting that foreign capital tends to contribute to an expansion of the relative size of the non-agricultural sector. Or put differently, foreign capital leads to an urban bias in its impact.

Turning now to the simultaneous nature of our model, we first must solve it to get an idea about the total impact of the exogenous variables on the endogenous variables. For this purpose, we solved the model for its reduced form. The reduced forms for the two estimators are given in Tables 3 and 4. Instead of going through the entire two tables, we concentrate on the impact of some of the exogenous variables on four endogenous variables: s, G, BR, and ALF, using the TSLS reduced form estimates in Table 4. These total effects are compared with the *direct* effects from Table 2. These comparisons are presented in Table 5. From this table, a number of interesting observations can be made:

(i) For the saving rate, the *total* effect of each of the three components of foreign capital inflows is lower than the corresponding *direct* effect. In the case of foreign private investment, the total effect is less than half of the direct effect. It is thus clear that studies which concentrate on the direct impact only, greatly exaggerate the depressing effect of foreign capital on domestic saving rate in developing countries. This finding agrees with earlier results reported by Gupta (1975) and Gupta-Islam. The interesting thing about this similarity is that the sample of countries and/or the time period of these studies was different. In terms of the role of income inequality the *total* effect is almost eight times the *direct* effect! This clearly demonstrates the importance of not only our simultaneous equations approach but also of integrating the usual economic models with demographic factors. Finally, the *total* positive effect of growth of labor force is noteworthy.

(ii) For the growth rate, we first note that the *total* effect of each of the three components of foreign capital is *less* than the corresponding *direct* effect. This finding suggests that concentrating on a single equation models is likely to overstate the impact of foreign capital on growth. This result again supports earlier findings by Gupta (1975) and Gupta-Islam. The *total* effect of literacy and growth of labor force is greater than the corresponding *direct* effect.

(iii) For birth rate, income inequality exerts a greater *total* effect than the *direct* effect. Secondary education has a greater *total* than *direct* effect, while opposite is true for literacy rate. The positive effect of foreign capital is interesting.

(iv) For ALF, the *total* effect of foreign capital is smaller than the *direct* effect. Equally noteworthy is the *total* negative effect of literacy and secondary education. Both of these ef-

Table 3

REDUCED FORMS (OLSQ)

Endogenous Variables	Exogenous Variables											
	AID	FPI	RFI	GL	EN	CAL	LIT	SEC	SEF	DEN	IQ	U
s	-.5058	-.0875	-1.020	.4006	.0019	-.0003	.0563	-.0017	-.0003	-.0133	1.3164	-.0047
G	.2216	.3050	.3059	.4475	.0003	.000	.0289	-.0003	.000	-.0020	.1959	-.0007
y	-1.9137	-.0064	-8.830	.000	.3621	.0047	8.368	2.110	.0044	-2.517	-4.664	.0766
TLPR	-.2797	-.0009	-1.290	.000	-.0013	.0007	-.0085	.0216	.0006	.0087	-6.817	.0112
DR	.0168	.0001	.0774	.000	-.0001	-.0013	-.0406	-.0532	-.0012	.0010	1.265	-.0208
BR	.0465	.0002	.2144	.000	-.0019	-.0029	-.1288	-.1299	-.0027	.0134	2.892	-.0475
FPR	-.4458	-.0015	-2.057	.000	-.0048	.0009	-.0831	.0105	.0546	.1332	-.8631	.0142
IMR	.7985	.0027	3.684	.000	-.0010	-.1756	-1.330	-.0061	.000	.0073	1.354	-.0002
ALF	-1.1235	-.0038	-5.184	.000	-.0127	-.0002	-.2923	-.0737	-.0002	.0879	.1629	-.0027

Table 4

Reduced Forms (TSLS)

Endogenous Variables	Exogenous Variables											
	AID	FPI	RFI	GL	EN	CAL	LIT	SEC	SEF	DEN	IQ	U
s	−.5300	−.1674	−.7931	.3164	.0022	.0069	.0551	−.0349	−.0055	−.0160	.8354	−.0170
G	.1914	.3158	.3228	.4753	.0001	.0004	.0298	−.0021	−.0003	−.0010	.0507	−.0010
y	−5.2299	−.1544	−22.1898	.0000	.3414	−.0519	9.4012	1.6608	.0419	−2.5081	−5.4423	.1284
TLPR	−.3404	−.0101	−1.4444	.0000	−.0011	−.0034	−.0201	.0169	.0027	.0084	−.3543	.0084
DR	.0427	.0013	.1811	.0000	.0000	.0107	−.0333	−.0676	−.0087	−.0003	1.1246	−.0265
BR	.1273	.0038	.5401	.0000	−.0008	.0286	−.1137	−.1838	−.0231	.0060	2.9973	−.0707
FPR	−.5492	−.0162	−2.3304	.0000	−.0063	−.0077	−.1459	.0240	.1535	.0463	−.8074	.0190
IMR	−.4183	−.0124	−1.775	.0000	−.0013	−.6373	−1.0478	−.0061	−.0002	.0093	−2.5210	.0005
ALF	−1.0402	−.0307	−4.4134	.0000	−.0127	.0019	−.3491	−.0617	−.0016	.0931	.2021	−.0048

Table 5

DIRECT AND TOTAL EFFECTS OF SOME OF THE EXOGENOUS VARIABLES ON s, G, BR AND ALF (TSLS ESTIMATES)

Exogenous Variables	Endogenous Variables							
	s		G		BR		ALF	
	Direct Effect	Total Effect	Direct Effect	Total Effect	Direct Effect	Total Effect	Direct Effect	Total Effect
AID	−.6532	−.5300	.2235	.1914		.1273	−1.2344	−1.0402
FPI	−.3774	−.1674	.3259	.3158		.0038	−.0364	−.0307
RFI	−.9905	−.7931	.3709	.3228		.5401	−5.2375	−4.4134
LIT		.0551	.0265	.0298	−.1303	−.1137		−.3491
IQ	.1104	.8354		.0507	2.7409	2.9973		.0931
GL		.3164	.4561	.4753		.0000		.0000
CAL		.0069		.0004		.0286		.0019
SEC		−.0349		−.0021	−.1717	−.1838		−.3491

fects are, of course, indirect because these variables do not enter the structural equation. From this it is clear that educational changes contribute to urbanization or the expansion of the non-agricultural sector.

It is difficult to compare the different reduced form coefficients (impact multipliers) because their magnitude is dependent upon the unit of measurement employed. To avoid this problem, using the means of the variables, we calculated elasticity multipliers, which, for the two estimators, are given in Tables 6 and 7. Again, instead of examining the entire tables, we concentrate on selected ones. More particularly, we examine those multipliers which correspond to the reduced form coefficients in Table 5. These elasticity multipliers are given in Table 8. From this table, three points stand out. First, the elasticity multipliers with respect to foreign capital are very small, so that unless inflows take place on a very substantial scale, thay are not likely to play a significant role and the debate about their impact would appear to be exaggerated. Second, the role of investment in human capital, as represented by the education variables, seems to be quite important. In particular, the role of general literacy appears to be substantial. In fact, for s, G, and ALF, elasticity multiplier with respect to LIT has the highest value! Third, income inequality is a variable worth looking at. For the birth rate, elasticity multiplier with respect to this variable has the highest value. A 10% reduction in income inequality will lead to a 2.685% reduction in birth rate. This estimate is very close to the one reported by Flegg. The same reduction in inequality will reduce saving rate by about 2%.

Table 6

ELASTICITY MULTIPLIERS (OLSQ)

Endogenous Variables	Exogenous Variables											
	AID	FPI	RFI	GL	EN	CAL	LIT	SEC	SEF	DEN	IQ	U
s	-.0647	-.0065	-.0421	.0656	.0806	-.0019	.2241	-.0032	-.0005	-.0517	.3032	-.0126
G	.0804	.0644	.0359	.2080	.0341	-.0008	.3266	-.0014	-.0002	-.0219	.1281	-.0053
y	-.0046	.0000	-.0069	.0000	.2867	.0006	.6265	.0746	.0001	-.1840	-.0202	.0038
TLPR	-.0158	.0000	-.0235	.0000	-.0234	.0020	-.0150	.0179	.0005	.0150	-.0692	.0132
DR	.0007	.0000	.0011	.0000	-.0021	-.0027	-.0534	-.0330	-.0007	.0013	.0962	-.0183
BR	.0023	.0000	.0034	.0000	-.0315	-.0073	-.1995	-.0950	-.0018	.0202	.2591	-.0493
FPR	-.0411	-.0001	-.0613	.0000	-.1449	.0040	-.2386	.0142	.0661	.0930	-.1434	.0273
IMR	.0168	.0000	.0251	.0000	-.0073	-.1864	-.8729	-.0019	.0000	.0047	.0514	-.0001
ALF	-.0442	-.0001	-.0658	.0000	-.1637	-.0003	-.3577	-.0426	-.0001	.1050	.0115	-.0022

Table 7

ELASTICITY MULTIPLIERS (TSLS)

Endogenous Variables	Exogenous Variables											
	AID	FPI	RFI	GL	EN	CAL	LIT	SEC	SEF	DEN	IQ	U
s	−.0678	−.0124	−.0328	.0518	.0915	.0442	.2195	−.0656	−.0093	−.0621	.1924	−.0454
G	.0695	.0666	.0378	.2210	.0158	.0076	.3371	−.0113	−.0016	−.0107	.0331	−.0078
y	−.0126	−.0002	−.0172	.0000	.2703	−.0063	.7039	.0587	.0013	−.1833	−.0236	.0064
TLPR	−.0192	−.0003	−.0263	.0000	−.0212	−.0096	−.0352	.0140	.0020	.0144	−.0360	.0098
DR	.0018	.0000	.0025	.0000	.0006	.0228	−.0438	−.0420	−.0048	−.0004	.0856	−.0234
BR	.0063	.0001	.0087	.0000	−.0133	.0716	−.1761	−.1343	−.0150	.0090	.2685	−.0735
FPR	−.0507	−.0009	−.0694	.0000	−.1915	−.0357	−.4191	.0326	.1856	.1299	−.1342	.0367
IMR	−.0088	−.0002	−.0121	.0000	−.0088	−.6764	−.6878	−.0019	.0000	.0059	−.0957	−.0002
ALF	−.0409	−.0007	−.0560	.0000	−.1641	.0038	−.4273	−.0356	−.0008	.1113	.0143	−.0039

Table 8

SELECTED ELASTICITY MULTIPLIERS:
Total Effects only based on the TSLS estimates

Exogenous Variables	Endogenous Variables			
	s	G	BR	ALF
AID	-.0678	.0695	.0063	-.0409
FPI	-.0124	.0666	.0001	-.0007
RFI	-.0328	.0378	.0087	-.0560
LIT	.2195	.3371	-.1761	-.4273
IQ	.1924	.0331	.2685	.0143
GL	.0518	.2210	.0000	.0000
CAL	.0442	.0076	.0716	.0038
SEC	-.0656	-.0113	-.1343	-.0356

V. Conclusions

Given the usual limitations of international cross-section data, our simultaneous equations model yields interesting results. In particular, it clearly shows that a single equation approach is highly inadequate in order to examine the role of foreign capital, population pressures and income inequality in the growth of developing countries. Our results show that the debate about the role of foreign capital is somewhat exaggerated and that more attention needs to be given to domestic factors like the role of income inequality and investment in human capital.

DATA APPENDIX

The sample consists of the following 34 countries: Argentina, Brazil, Chad, Chile, Columbia, Costa Rica, Ecuador, Egypt, El Salvador, Guyana, Honduras, India, Indonesia, Israel, Ivory Coast, Jamaica, Kenya, Korea, Malaysia, Mexico, Pakistan, Panama, Peru, Phillipines, Spain, Sri Lanka, Senegal, Tanzania, Thailand, Turkey, Tunisia, Uruguay, Venezuela, and Zambia.

The data on variables other than BR, y, IQ, IMR, and FPR, were estimated from the various *World Tables* by the World Bank published by the John Hopkins University Press. The data on y, BR, IQ, IMR, and FPR were obtained from Flegg. The data can be obtained from the author upon request.

References

Adelman, Irma, "An Econometric Analysis of Population Growth," *American Economic Review*, June 1963, 314-339.

Becker, Gary S., "An Economic Analysis of Fertility," in: *Demographic and Economic Change in Developed Countries*, Universities-National Bureau Conference Series II, Princeton, N.J., Princeton University Press, 1960.

Bhattacharya, A.K., "Income Inequality and Fertility: A Comparative View," *Population Studies*, 1975, 5-19.

Cain, G.C., *Married Women in the Labor Force: An Economic Analysis*, Chicago, Chicago University Press, 1966.

Chenery, H.B., "Patterns of Industrial Growth," *American Economic Review*, 1960, 624-54.

Chenery, H.B. and P. Eckstein, "Development Alternatives for Latin America," *Journal of Political Economy*, 1970, 966-1006.

Clark, Colin, *The Conditions of Economic Progress*, London, McMillan, 1957.

Fields, G.S., *Poverty, Inequality and Development*, Cambridge, Cambridge University Press, 1980.

Flegg, A.T., "The Role of Inequality of Income in the Determination of Birth Rates," *Population Studies*, 1979, 457-478.

Griffin, K.B. and J.S. Enos, "Foreign Assistance: Objectives and Consequences," *Economic Development and Cultural Change*, 1970, 313-

27.

Gupta, K.L., "Dependency Rates and Savings Rates: Comment," *American Economic Review,* 1970a, 469-71.

———, "Foreign Capital and Domestic Savings: A Test of Havelmo's Hypothesis with Cross-Country Data: A Comment," *Review of Economics and Statistics,* 1970b, 214-16.

———, "On Some Determinants of Rural and Urban Household Saving Behavior," *Economic Record,* 1970c, 578-83.

———, "Personal Saving in Developing Nations: Further Evidence," *Economic Record,* 1970d, 243-49.

———, "Foreign Capital Inflows, Dependency Burden and Saving Rates in Developing Countries: A Simultaneous Equation Model," *Kyklos,* 1975, 358-74.

Gupta, K.L. and M.A. Islam, *Foreign Capital, Savings and Growth: An International Cross-Section Study,* Dordrecht/Boston, D. Reidel Publishing Company, 1983.

Houthakker, H.S., "On Some Determinants of Savings in Developed and Underdeveloped Countries," in E.A.G. Robinson (ed.), *Problems in Economic Development,* New York, MacMillan, 1965.

Kaldor, N., "Alternative Theories of Income Distribution," *Review of Economic Studies,* 1955-56, 83-100.

Kuznets, S., *Modern Economic Growth,* New Haven, Yale University Press, 1966.

Leff, N.H., "Dependency Rates and Saving Rates," *American Economic Review,* 1969, 886-896.

Mikesell, R.F. and J.E. Zinser, "The Nature of the Savings Function in developing countries: A Survey of the Theoretical and Empirical Literature," *Journal of Economic Literature,* 1973, 1-26.

Mincer, Jacob, "Market Prices, Oppertunity Cost and Income Effects," in *Measurement in Economics,* Stanford, Stanford University Press, 1963.

Modigliani, F., "The Life Cycle Hypothesis of Savings: the Demand for Wealth and the Supply of Capital," Paper presented to the Rome Congress of the Econometric Society, 1965.

Pasinetti, L.L., "Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *Review of Economic Studies,* 1962, 267-79.

Papanek, G.F., "Aid, Foreign Private Investment, Savings, and Growth in Less Developed Countries," *Journal of Political Economy,* 1973, 120-30.

Rahman, M.A., "Foreign Capital and Domestic Savings: A Test of Havelmo's Hypothesis with Cross-Country Data," *Review of Economics and Statistics,* 1968, 137-38.

Repetto, R., "The Relationship of the Size Distribution of Income to Fertility, and the Implications for Development Policy," in IBRD, and, *Population Policies and Economic Development,* Baltimore/London, Johns Hopkins University Press, 1974.

Schultz, P.T., "An Economic Model of Family Planning and Fertility," *Journal of Political Economy,* 1969, 153-80.

Swamy, S., "A Dynamic, Personal Savings Function and Its Long-Run Implications," *Review of Economics and Statistics,* 1968, 111-16.

Todaro, M.P., *Economic Development in the Third World,* New York/London, Longman, 1981.

Weiskoff, T.E., "The Impact of Foreign Capital Inflow on Domestic Savings in Underdeveloped Countries," *Journal of International Economics,* 1972, 25-38.

Williamson, J.G., "Personal Saving in Developing Nations: An Intertemporal Cross-Section from Asia," *Economic Record,* 1968, 194-210.