Foreign Capital, Income Inequality, Demographic Pressures, Savings and Growth in Developing Countries:

A Cross Country Analysis

Kanhaya L. Gupta*

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

* Professor of Economics, The University of Alberta, Edmonton, Alberta, Canada.

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.

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).

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:

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

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

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

$$(12)\quad TLPR = a_4 + b_4 DR + c_4 y + d_4 ALF$$
$$< 0 \quad < 0 \quad \lesseqgtr 0$$

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

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

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.

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 in direct 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

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.

Table 1

ORDINARY LEAST SQUARES ESTIMATES*

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

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

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

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

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

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

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

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

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

* 't' values are in the parentheses.

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,

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 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

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 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.

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.