Income Distribution and Economic Growth:
Some Empirical Evidence**

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Income distribution and economic development are considered two desirable objectives of public policy. One would be tempted to pursue both objectives simultaneously but the difficulty arises if there exists a trade-off between income equality and economic growth. In general, income inequality has been considered as a "necessary evil" in the sense that to achieve a faster rate of economic expansion a certain level of deterioration in the distribution of income must be tolerated at least up to a certain point in time. Time coventional wisdom has been to recognize the existence of the conflict in formulating national economic policies. As a consequence, in the post-war period, many developing countries pursued a growth-oriented development strategy in which income distribution was given only a passing reference in the expectation that the latter will be corrected in the course of time when the size of the cake had grown sufficiently large which was essentially a sequential approach to the problem. This mode of thinking was broadly consistent with the historical pattern observed by Kuznets (14) for selected developed capitalist economies. An essential feature of what is now known as the 'Kuznets Hypothesis' is that in-

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equality tends to widen in the early stages of development with a reversal of this tendency in the later stages. But, the growth experience of the majority of the developing countries during the past three decades has been less than satisfactory in spite of heavy reliance on growth-oriented strategies. Although equity considerations were given secondary importance in the past, in recent years, there appears to have been emerging a change of income distribution as a goal of development policy, see, Chenery et.al. (5), Ahluwalia (1), among others. The basic issue evolves around the nature of the conflict (if any) and its magnitude. The present paper is an attempt to understand this issue empirically within the framework of a simultaneous equations model with explicit recognition for the role of income distribution in generating the process of economic growth. Within the framework of this model, we will try to answer the following questions:

(a) What are the mechanisms through which income distribution is related to economic growth?
(b) To what extent, if at all, is there a trade-off between income distribution and economic growth? and
(c) Is there a critical level in the stages of development above or below which there may or may not exist the trade-off?

The plan of the paper is as follows. In section I, we present a discussion of the mechanism through which income distribution is related to economic growth. The model is presented in section II followed by a discussion of empirical results in section I"I. Multiplier analysis is discussed in section IV and finally, section V summarizes the main conclusions.

I. Relationship Between Income Distribution, Savings and Economic Growth

The study of the relationship between income distribution and economic development has been the subject of controversy for a long period of time. The issue was accorded a central importance in the classical economic thinking. In the classical theory, growth and distribution were intimately related and, in fact, the causal link was conceived to run from distribution to growth in the sense that national income to be distributed was not independent of the way in which it was distributed among the three broad classes of society: capitalists, landlords and workers. Ricardo, for example, believed that a higher share of profits would result in a higher proportion of income being saved and invested, this contributing to a higher rate of economic expansion. In both classical and neoclassical models of growth, one extreme form of this argument assumes that workers have zero marginal propensity to save and a moderate version of it assumes that marginal propensity to save out of profit income is higher than out of wage income. From the above discussion, it is evident that savings propensity provides an intermediate link in the relationship between distribution and growth. Thus, the causal link runs as follows: income distribution → savings → growth. More formally, the trade-off is said to exist if the inequality holds.

$$\frac{\partial \text{ (savings)}}{\partial \text{ (inequality)}} > 0 \qquad \text{(i)}$$

It should be mentioned here that income inequality does not affect growth diretly, but indirectly through savings. Considering indirect effects, we can say that trade-offs exist if the following inequality holds.[1]

$$\frac{\partial \text{ (growth)}}{\partial \text{ (inequality)}} > 0 \qquad \text{(ii)}$$

If (i) and (ii) do not hold, the existence of the trade-off cannot be confirmed.[2] Inequalities (i) and (ii) will be the major focus of attention in our analysis and they provide the basic hypotheses to be tested.

II. The Model

In this section, we formulate a simultaneous equations model of economic growth with explicit allowance for the role of income

1 The relationship (ii) can be derived from the reduced form of the model as explained in section IV.

2 It should be mentioned here that if (i) and (ii) are expressed in terms of income equality (such as income share of bottom 40%) instead of inequality (such as the Gini coefficient) in the denominator, the signs of (i) and (ii) will be of opposite sign to indicate the existence of the trade-off.

distribution in influencing the process of economic development. Kuznets (14), Chenery et. al. (5), Ahluwalia (1), have tried to explain the observed distribution of income by differences in the stages of economic development including other variables. In their works income distribution is kept endogenous. We propose to treat it as an exogenous variable in our model for two reasons: (i) As already explained in section I, treating income distribution as exogenous is consistent with the mechanism relating distribution to growth via savings: and (ii) secondly, income distribution itself can be used as a tool of public policy towards achieving certain desired economic goals such as growth or savings. It is widely recognized that governments can change the pattern of income distribution by direct intervention such as land reform and/or by indirect methods such as monetary and/or fiscal policies.

In formulating the model, we start with the Harrod-Domar model of growth which says:

$$G = \frac{s}{k} \qquad \text{(iii)}$$

where G is the aggregate growth rate, s is the national savings rate and k is the capital-output ratio. Disregarding k, equation (iii) has usually been interpreted as a causal relationship in which causality runs from s to G. Higher savings rate has been considered as the fundamental prerequisite for higher growth rate. Following this interpretation, in many empirical studies, researchers have followed a single equation model of growth in which savings rate was treated as an exogenous variable, (Papanek (18), Chenery and Strout (3), Weisskopf (22), Stoneman (20)). On the contrary, there exists, by now, a considerable amount of literature, both theoretical and empirical, to suggest that savings rate itself is determined by the growth rate. For example, in studying savings behaviour, the inclusion of the rate of growth of income (following life-cycle hypothesis of consumption) as an explanatory variable has been suggested, among others, by Houthakker (13), Modigliani (17) and Swamy (21). It is, then, clear from the above discussion that savings rate and growth rate affect each other and, therefore, in any theoretical or empirical framework, they should be kept as jointly dependent variables. In other words, the model should specify two relations of the form:

$$G = G(s, \text{ other variables}) \qquad \text{(iv)}$$
$$s = s(G, \text{ other variables}) \qquad \text{(v)}$$

as parts of the simultaneous system. We should expect that $\frac{\partial G}{\partial s}$ and $\frac{\partial s}{\partial G}$ will both be positive which will indicate the existence of feedback.

We now specify the growth and savings functions in more detail[3] and bring out the role of income distribution. The two equations are specified as follows:

$$G = \alpha_0 + \alpha_1(s) + \alpha_2(F) + \alpha_3(GL) + \alpha_4(LIT) + \text{error} \qquad \text{(vi)}$$

$$\alpha_1 > 0; \alpha_2 > 0; \alpha_4 > 0;$$

$$s = \beta_0 + \beta_1(y) + \beta_2(y^2) + \beta_3(DR) + \beta_4(F) + \beta_5(G) + \beta_6(GC) + \text{error} \qquad \text{(vii)(a)}$$

$$\beta_1 > 0; \beta_2 < 0; \beta_3 < 0; \beta_4 < 0; \beta_5 > 0; \ \beta_6 > 0$$

$$s = \beta_0 + \beta_1(y) + \beta_2(y^2) + \beta_3(DR) + \beta_4(F) + \beta_5(G) + \beta_7(R_1) + \beta_8(R_2) + \text{error} \qquad \text{(vii)(b)}$$

$$\beta_1 > 0; \beta_2 < 0; \beta_3 < 0; \beta_4 < 0; \beta_5 > 0; \beta_7 < 0; \beta_8 < 0$$

where:

- G = aggregate growth rate of GNP;
- s = aggregate domestic savings rate (% of GNP);
- F = current account balance (as % of GNP);
- GL = rate of growth of labour force;
- LIT = literacy rate;
- y = per capita GNP;
- y^2 = squared per capita GNP;
- DR = dependency rate (% of population below 14 years of age and above 65 years of age);
- GC = Gini coefficient as a measure of income inequality;
- R_1 = ratio of the income share of the bottom 40% of the population as a percentage of the income share of the top 20% of the population;
- R_2 = ratio of the income share of the middle 40% of the population as a percentage of the income share of the top 20% of the population.

3 For details about these equations, see Gupta (7) and Gupta-Islam (8).

In addition to the above variables, we will also use two dummy variables D_1 and D_2 for socialist countries.

The expected signs of the coefficients are shown immediately below the respective equation. It should be mentioned here that we have two versions of the savings equation in our model: (vii)(a) and (vii)(b). In (vii)(a) we have used Gini coefficient of inequality as a measure of income distribution in the savings function and in this case, to indicate the existence of a trade-off, $\frac{\partial(s)}{\partial(GC)}$ should have positive sign. While the Gini coefficient[4] represents an aggregate summary measure of income inequality, it may conceal a good deal of useful information about income data. Further, a richer body of data on income shares of different population groups are now available for many countries. Use of these shares, instead of the Gini coefficient, may provide more useful insights into the pattern of relationships between income distribution and savings. Consequently, we have constructed two other variables, R_1 and R_2 from income shares data and have used them to estimate an alternate version of the savings function as in (vii)(b) above. It should be pointed out that R_1 and R_2 are expressed as percentages of the income share of the top 20% of the population and hence, they represent measures of income equality,[5] rather than inequality as in the Gini coefficient. Consequently, to detect trade-off, the expected signs of their coefficients should record signs which are opposite to that of the Gini coefficent, that is, for the trade-off to exist, $\frac{\partial s}{\partial R_1}$ and $\frac{\partial s}{\partial R_2}$ should have negative signs.

Before proceeding to the empirical results, a few comments about the model are in order. One important feature of the model is that savings rate and growth rate are jointly determined within the model. Another feature is that income distribution appears explicitly only in the savings function and, therefore, income distribu-

4 Gini coefficient is a measure of income inequality. Its value ranges from zero to unity, the closer the coefficient to unity, the higher is the income inequality.

5 Initially we tried to incorporate three income shares: income share of the bottom 40%, middle 40% and the top 20% in the savings function. The attempt was not successful because of severe multicollinearity between the three income shares. Therefore, as a compromise, we decided to use R_1 and R_2.

6 The reduced form of structural model can be derived by solving the structural equations for endogenous variables in terms of the exogenous variables of a model. see, for example, Maddala (16).

tion can affect growth, in our model, only through the savings function. The effect of income distribution on growth can be observed through the reduced form coefficient of the income distribution variable in reduced form of the growth equation.[7] Let us now indicate the expected signs of the explanatory variables in our model. In the growth equation, savings is expected to have positive sign. F is incorporated in the growth equation to reflect the effect of foreign capital flows on GNP and this variable is expected to make a positive contribution to growth. GL is used as a proxy for the growth of the labour force ($\alpha_3 > 0$) and LIT is used to capture quality differences in the labour force ($\alpha_4 > 0$). In the savings function, in addition to the income distribution variable, per capita income is used following Keynesian theory of consumption behaviour and the squared per capita income is allowed to capture possible non-linearity in the income savings relationship. As a result, we would expect β_1 to be positive and β_2 to be negative. Following Leff (15), dependency rate is expected to have a negative effect on savings and following Haavelmo (10) and Rahman(19), we expect F to have negative effect on the savings rate. As has already been explained, β_5 is expected to be positive.

III. Empirical Results

The sample, the data and the methodology used is discussed in detail in the Data Appendix. The model is estimated by the method of ordinary least squares and two stage least squares method using a sample of 58 countries, of which 13 are developed capitalist countries, six socialist countries and 39 developing countries. The size of the sample was dictated by the availability of data on the income distribution variable. The model is estimated for the total sample as well as for two groups, one consisting of developed countries and the other for the remaining countries. The regression estimates for the total sample are reported in Table 1 and for the two groups in Table 2. From Table 1 and Table 2, we can note the following:

(i) The explanatory power of the model as judged by R^2 is quite satisfactory. In general, the savings equation per-

7 For more analysis, see Section IV.

Table 1
Estimates of the Structural Model Using OLS and 2SLS Method*

Explanatory Variables	Growth Equation		Savings Equations With: Ratio of Income Shares		Savings Equations With: Gini Coefficient	
	OLS	2SLS	OLS	2SLS	OLS	2SLS
constant	1.53 (1.23)	1.19 (0.63)	27.04 (2.12)	27.33 (1.88)	11.79 (1.02)	8.87 (0.67)
s	0.09 (2.25)	0.115 (1.15)				
F	0.71 (2.07)	0.76 (1.83)	-2.38 (-2.16)	-2.37 (-2.03)	-2.56 (-2.49)	-2.67 (-2.51)
GL	0.82 (2.50)	0.83 (2.50)				
LIT	0.008 (0.58)	0.006 (0.42)				
Y			0.008 (2.22)	0.0080 (2.10)	0.008 (2.03)	0.008 (2.06)
Y^2			-0.0000014 (-2.33)	-0.0000014 (-2.31)	-0.0000013 (-2.16)	-0.0000013 (-2.17)
DR			-0.24 (-1.01)	-0.24 (-1.01)	-0.23 (-1.01)	-0.23 (-0.97)
G			0.93 (2.27)	0.89 (0.95)	1.03 (2.57)	1.41 (1.55)
R_1			0.002 (0.14)	0.024 (0.15)		
R_2			-0.11 (-1.01)	-0.107 (-0.98)		
GC					0.188 (1.88)	0.196 (1.91)
D_1	-0.72 (-0.82)	-0.85 (-0.89)	1.71 (0.30)	1.81 (0.30)	1.22 (0.23)	0.45 (0.08)
D_2	1.32 (1.21)	1.21 (1.02)	6.25 (1.26)	6.29 (1.24)	5.75 (1.31)	5.33 (1.18)
R^2	0.24	0.23	0.51	0.51	0.51	0.51
F	2.61	2.56	5.54	5.53	6.44	6.22
no. of observations	58	58	58	58	58	58

* *Note:* The figures in the parentheses are t-values.

Table 2
ESTIMATES OF THE STRUCTURAL MODEL ON THE BASIS OF DIFFERENT SAMPLE GROUPS: 2SLS ESTIMATES*

	Estimates for DC's			Estimates for LDC's		
		Savings Equation With			Savings Equation With	
Explanatory Variables	Growth Equation	Ratio of Income Shares	Gini Coefficient	Growth Equation	Ratio of Income Shares	Gini Coefficient
constant	-4.84 (-0.37)	23.93 (0.83)	39.66 (1.16)	2.72 (1.40)	11.52 (0.59)	5.66 (0.36)
s	0.4125 (4.007)			0.4724 (0.92)		
F	1.138 (0.96)	-2.5605 (-1.06)	-2.8984 (-1.12)	0.4787 (1.13)	-2.34 (-1.72)	-2.92 (-2.26)
GL	0.9698 (1.80)			0.9396 (2.33)		
LTT	-0.024 (-0.18)			0.0134 (0.94)		
Y		0.008 (1.75)	0.007 (1.64)		0.0320 (1.54)	0.0194 (0.99)
Y^2		-0.0000013 (-2.10)	-0.0000013 (-2.01)		-0.000022 (-1.14)	-0.000022 (-0.64)
DR		-0.6036 (-0.93)	-0.8487 (-1.15)		0.0415 (0.12)	-0.1787 (-0.52)
G		1.18 (1.59)	0.9618 (0.98)		0.4367 (0.31)	1.4821 (1.08)
R_1		-0.3194 (-1.83)			0.3288 (1.12)	
R_2		0.2197 (1.41)			-0.2196 (-1.46)	
GC			0.116 (0.69)			0.164 (1.11)
D_1						
D_2	1.60 (1.19)	7.22 (1.34)	3.78 (0.76)			
R_2	0.62	0.76	0.68	0.18	0.33	0.28
F	3.88	4.01	3.28	1.79	2.15	1.92
no. of observations	19	19	19	39	39	39

* *Note:* Figures in the parentheses are t-values.

forms better than the growth equation.

(ii) Regressions are highly significant as judged by the regression F-values reported along with each regression equation.

(iii) In almost all cases, we find that the coefficients have the expected signs and they are statistically significant judged by conventional t-tests.

(iv) Consistent with our *a priori* expectations, we observe that both savings and growth affect each other significantly.

(v) Foreign capital flows have expected positive effect on growth and negative effect on savings.

(vi) The dependency burden has negative effect on savings and growth of labour force along with literacy rate have positive effect on growth.

(vii) The savings function indicates strong non-linearity with respect to income, that is, savings rate increases at a decreasing rate reaching a maximum at a certain level of per capita income $\overset{*}{y}$.

(viii) The most interesting result for our present purpose is the coefficients of the income distribution variables. In Table 1 and Table 2, we find that, in all cases, the coefficient of the Gini coefficient is positive indicating the existence of the trade-off. But one should be cautious in interpreting this result. If we look carefully, we find that, while its coefficient is significant for the aggregate sample, it is not significant in the case of two groups.

(ix) As has already been explained, more useful insights about the nature and magnitude of the trade-off can be determined on the basis of the income shares data. Interestingly enough, in Table 1, we find that R_1 has an unexpected positive sign although R_2 has the expected negative sign. Before proceeding further, it should be mentioned here that the coefficients are not statistically significant. But this low statistical significance can be mainly attributed to the high degree of collinearity between the two ratios ($\gamma_{R_1R_2} = 0.92$). Given this, we can say that the positive sign of R_1 contradicts the trade-off hypothesis although the sign of R_2 does not. In interpreting these results, we should remember that both R_1 and R_2 are expressed as a percentage of the income share of the top 20% of the population who constitute the richer section of the population. The opposite sign of the two coefficients may, in fact, suggest not only the desirability of income redistribution but also the direction in which the income distribution is to be adjusted without doing any harm to economic efficiency (growth). The results indicate, contrary to conventional thinking, that a redistribution of income from the rich to the poor may, in fact, increase economic efficiency. The negative coefficient of R_2 may suggest that a redistribution from the rich to the middle income groups may not be conducive to economic efficiency. This result can be explained by the fact that the people in the middle income bracket may be highly prone to demonstration effect in consumption and, therefore, any redistribution of income to them may be used to emulate the consumption patterns of the richer section of the society. On the other hand, a transfer from the rich to the poor will result in not only not reducing savings, but may result in increased economic efficiency through better health and education of the lower income people. These latter effects are increasingly emphasized in recent years (N. Hicks (11). Ahluwalia (1)).

(x) Let us now turn to the disaggregated results. These results provide further insights and additional support for on previous results with respect to income distribution. In the case of LDC's, (Table 2) we observe that the signs of R_1 and R_2 remain the same as in the aggregate sample, whereas they are reversed in the case of DC's. The coefficents in both samples also achieve marginal significance.

The positive sign of R_1 in the LDC sample again contradicts the existence of the trade-off. The opposing signs for R_1 and R_2 and their sign reversal between the two sub-samples suggest that there exists structural differences in the behaviour pattern of the two samples. The results may also indicate that as a country moves from a lower to a higher stage of economic development, there might exist a critical level in the stages of development at which the nature of the trade-off may change qualitatively as well.

IV. Multiplier Analysis

In this section, we present the reduced form of our structural model along with the relevant elasticity multipliers and intercept multipliers. Given a system of equations represented by the equation

$$BY + TX = U \tag{viii}$$

where Y is a vector of endogenous variables, X is a matrix of endogenous variables and U is a vector of error terms. If we solve the system of equations in (viii) for the vector Y, we get the reduced form of the structural system. This is given by:

$$Y = -B^{-1}TX + B^{-1}U = \Pi X + V \tag{ix}$$

assuming B^{-1} exists, and $\Pi = -B^{-1}T$ and $V = B^{-1}U$.

The coefficients in the Π matrix are the reduced form coefficients and they represent the total (direct plus indirect) effects of the relevant exogenous variable on the endogenous variable. Direct effects are given by the coefficent of that variable in the structural equation. For example, let us take the case of the effect of Gini coefficient on savings and growth. Direct effect of GC on G in our model does not exist but the indirect effect (which is also the total effect in this case) is given by $\frac{\alpha_1 \beta_6}{1 - \alpha_1 \beta_5}$ which is positive if $\alpha_1 > 0$, $\beta_6 > 0$ and $(1 - \alpha - \beta_5) > 0$. Similarly, the direct effect of GC on s is given by the structural coefficient $\beta_6 > 0$ and the total effect is given by $\frac{\beta_6}{1 - \alpha_1 \beta_5}$ which is again expected to be positive if $\beta_6 > 0$ and and$(1 - \alpha_1 \beta_5) > 0$. The expression for reduced form coefficients for other exogenous variables can be determined by solving our structural equations. Once again, the sign and magnitude of the reduced form coefficient of the income distribution variable on savings and growth can indicate the nature and extent of the trade-off between distribution and growth.

Direct and total effects of selected exogenous variables on growth and savings rate are presented in Table 3. Elasticity multipliers for the same set of variables are reported in Table 4. These elasticities are calculated using both the reduced form coefficients and structural coefficients at the means of the respective variables.

Table 3

DIRECT AND TOTAL EFFECTS OF SELECTED EXOGENOUS VARIABLES ON SAVINGS AND GROWTH*

Exogenous Variables	Effects on Growth			Effects on Savings		
	Total[1]	Direct[2]	Direct as % of Total	Total[1]	Direct[2]	Direct as % of Total
DR	-0.0316	No direct effect	—	-0.2745	-0.23	83.8
F	0.5406	0.7601	140.6	-1.9077	-2.67	139.9
GL	0.9906	0.8300	83.8	1.3967	No direct effect	—
LIT	0.0072	0.0060	83.3	0.0101	No direct effect	—
R_1	0.0031	No direct effect	—	0.0267	0.024	89.9
R_2	-0.0137	No direct effect	—	-0.1192	-0.107	89.8
GC	0.0269	No direct effect	—	0.2339	0.196	83.8

* Relevant calculations are made using 2SLS estimates.
1. Total effects correspond to the reduced form coefficients.
2. Direct effects correspond to the structural coefficient.

Table 4

ELASTICITY OF SAVINGS AND GROWTH WITH RESPECT TO SELECTED EXOGENOUS VARIABLES*

Exogenous Variables	Elasticity of Growth		Elasticity of Savings	
	Using Reduced Form Coefficients	Using structural Coefficient	Using Reduced Form Coefficients	Using Structural Coefficients
DR	-0.2446	—	-0.5822	-0.4878
F	0.0272	0.0383	-0.0263	-0.0368
GL	0.3208	0.2688	0.1239	—
LIT	0.0884	0.0737	0.0340	—
R_1	0.0176	—	0.0416	0.0374
R_2	-0.1804	—	-0.4300	-0.3860
GC	0.2097	—	0.4996	0.4187

*Note: Relevant elasticities are calculated using coefficients from Table 3.

Considering Table 3, we find that DR, F, GL and LIT have the expected signs for the total and direct effects on both savings and growth. From the model, it is clear that DR and income distribution variables do not have any direct effect on savings, while DR has negative effect on growth, other variables such as F, GL and LIT have positive direct and total effects, but in the case of F, direct effect overestimates the total effect and in the case of GL and LIT, direct effect underestimates the total effect. We also find that income distribution as measured by Gini coefficient has positive effect on growth but when income distribution is measured by the two ratios, we observe similar results as we obtained in the structural equations, that is, R_1 has positive and R_2 negative effects on growth.

Turning to the savings function, we find that the direct effect underestimates the adverse total effect of DR and overestimates the adverse total effect of F on savings.[8] In the case of income distribution, we find that Gini coefficient has positive effect on savings but in terms of the ratios, it is clear that R_1 has positive and R_2 has negative total effects which are consistent with the structural results. We also notice that direct effect significantly underestimates the total effect of income distribution on savings. Once again, the trade-off hypothesis is suspect.

It is not possible to compare relative importance of different exogenous variables on the basis of reduced form coefficients because they are not independent of the unit of measurement. The scale independent elasticity multipliers are claculated and reported in Table 4. In terms of the effect on growth, GL has the largest coefficient followed by DR and then by income distribution. This is not surprising because distribution has only indirect effect on growth. In terms of the effects on savings, income distribution variables rank second only to DR. Using the elasticity coefficient of R_1, we can infer that a percentage point increase in the income share of the bottom 40% relative to the top 20% of the population is likely to increase growth by about 0.01 percent and savings by 0.04 percent. In either case of R_2, a similar transfer from the rich to the middle income group is likely to reduce growth rate by 0.18 percent and the savings rate by about 0.43 percent.

The analysis so far did not show the impact of savings on

8 For more details and explanation, see Gupta (7) and Gupta-Islam (8).

growth and that of growth on savings because they are both determined within the model. To ascertain their impacts, we calculate the intercept multipliers suggested by Gregory et.al., (9). For example, to examine the effect of savings on growth, we construct an elasticity coefficient which measures the percentage change in the growth rates caused by a given percentage change in the intercept of the savings function. The calculated value of the savings intercept elasticity is 0.1833 which shows that a percentage point autonomous shift in the savings function will lead to 0.18 percent increase in the growth rate. The growth intercept elasticity is found to be 0.0826 which is much smaller than the savings intercept elasticity.[9] The results suggest that although savings and growth affect each other, the effect of savings on growth seems to be quantitatively stronger than that of growth on savings.

V. Conclusions and Policy Implications

In this paper, we set out to investigate the role of income distribution in the process of economic development. We formulated a simultaneous equations model to empirically test the hypothesis that there is a trade-off between income distribution and economic growth. The model was tested using international cross-country data. Given the usual limitations of cross-country data, our results indicate that the nature and magnitude of the trade-off has been overemphasized in the past. Although the use of Gini coefficient shows some degree of trade-off, the results derived from income share data are much more useful and provide more useful insights into the nature and the pattern of income distribution which will generate equity without reducing economic efficiency. Our empirical results indicate that a redistribution of income from the rich to the poor not only does not reduce savings but also increases economic growth through increased efficiency and productivity. In other words, the goal of income distribution and economic growth can be pursued as a complementary tool of

9 For comparison, it should be mentioned that the elasticities calculated from the structural equations directly are as follows:

(a) $\frac{\partial G}{\partial S} \cdot \frac{\overline{S}}{\overline{G}} = 0.4198$ compared to the savings intercept elasticity of 0.1833 and

(b) $\frac{\partial S}{\partial G} \cdot \frac{\overline{G}}{\overline{S}} = 0.3863$ compared to the growth intercept elasticity of 0.0826.

government economic policy. The results also indicate qualitative and quantitative differences in the nature of the trade-off between developed and developing countries. The policies which are useful in the developed countries may not provide us with appropriate methods to deal with the problems facing the developing world. The notion that the problem of growth and distribution is to be solved sequentially has also been questioned by Hirschman and Rothschild in their 1973 paper (12) who wrote, 'if because of existing social, political, or psychological structures, the tunnel effect[10] is weak or non-existent, then the two tasks will have to be solved simultaneously, a difficult enterprise and one that probably requires institutions wholly different from those appropriate to the sequential case.' Our analysis suggests that income distribution is not only a desirable goal in itself, but it can also be fruitfully used as a policy variable in influencing economic growth and that both growth and distribution can be pursued simultaneously.

References

1. Ahluwalia, M.S.: "Inequality, Poverty and Development," in *Journal of Development Economics* 3, 1976, pp. 307-42.

2. Chenery, H.B.: "Patterns of Industrial Growth," *American Economic Review* 50, September 1960, pp. 624-54.

3. Chenery, H.B. and A. Strout: "Foreign Assistance and Economic Development", *American Economic Review,* September 1966.

4. Chenery, H.B. and M. Syrquin: "*Patterns of Development 1950-1970,* Oxford University Press, London, 1975.

5. Chenery, H.B., et.al.: *Redistribution with Growth,* Oxford University Press, London, 1974.

6. Chow, G.C.: "Tests of Equality between Sets of Coefficients in Two Linear Regressions," *Econometrica,* 1960, pp. 591-605.

7. Gupta, K.L.: "Foreign Capital Inflows, Dependency Burden and Saving Rates in Developing Countries: A Simultaneous Equation Model", *Kyklos* 28, 1975, pp. 358-374.

8. Gupta, K.L. with Anisul Islam: *Foreign Capital, Savings and Growth: An International Cross-Section*

10 The tunnel effect can be described as the initial gratification of the people who think that their fortunes will soon begin to change because they find that the fortunes of some of the people around them have started to change. This initial gratification is called the tunnel effect which is conducive to increasing tolerance for inequality under certain conditions. For details, see Hirschman and Rothschild (12, p. 545).

Study, D. Riedel Publishing Company, Dordrecht, Netherlands, 1982, (forthcoming).

9. Gregory, P.R., J.M. Campbell and C. Benjamin: "A Cost-inclusive Simultaneous Model of Birth Rates," *Econometrica*, July 1972, pp. 681-688.

10. Haavelmo, T.: Comment on Leontief, Wassily, "The Rates of Long-Run Economic Growth and Capital Transfer from Development to Underdeveloped Areas" Study week on *The Economic Approach to Development Planning*, (Oct. 7-13, 1963), Amsterdam: North Holland Publishing Company, 1965.

11. Hicks, N.L.: "Growth vs. Basic Needs: Is there a Trade-Off?" *World Develpment* 7, No. 11/12, 1979, pp. 985-994.

12. Hirschman, A. and M. Rothschild:- "Changing Tolerance for Inequality in Development," *The Quarterly Journal of Economics*, No. 4, November 1973, pp. 544-566.

13. 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 and Company, 1965.

14. Kuznets, S.: "Economic Growth and Income Inequality," *American Economic Review*, March 1955.

15. Leff, N.H.: "Dependency Rates and Savings Rates," *American Economic Review* 59, December 1969, pp. 866-896.

16. Maddala, G.S.: *Econometrics*, McGraw Hill Company, New York, 1977.

17. 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.

18. Papanek, G.F.: "Aid, Foreign Private Investment, Savings and Growth in Less Developed Countries," *Journal of Political Economy* 81, Jan-Feb 1973, pp. 120-130.

19. Rahman, M.A.: "Foreign Capital and Domestic Savings: A Test of Haavelmo's Hypothesis with Cross-country Data," *Review of Economic and Statistics* 50, Feb., 1968, pp. 137-38.

20. Stoneman, C.: "Foreign Capital and Economic Growth," *World Development* 3, No. 1, January 1975, pp. 11-26.

21. Swamy, S.: "A Dynamic, Personal Savings Function and its Long Run Implications," *Review of Economics and Statistics*, February 1968, pp. 111-116.

22. Weisskopf, T.E.: "The Impact of Foreign Capital Inflow on Domestic Savings in Underdeveloped Countries," *Journal of International Economics* 2, No. 1, February 1972, pp. 25-38.

Data Appendix

I. The Sample:

The choice and the size of the sample is dictated by the data availability for the income distribution variable. Income share data were available for 58 countries and we have included those countries in our sample leading to 58 observations. Out of these 58 countries, 39 consist of developing countries across various income ranges, 13 developed capitalist countries and six socialist countries. The sample countries are list as follows:

A. Developing Countries (LDC's):

1. Argentina; 2. Botswana; 3. Brazil; 4. Chad; 5. Chile; 6. Columbia; 7. Costa Rica ; 8. Ecuador; 9. Egypt; 10. El Salvador; 11. Gabon; 12. Guyana; 13. Honduras; 14. India; 15. Iraq; 16. Ivory Coast; 17. Jamaica; 18. Kenya; 19. Korea (R); 20. Lebanon; 21. Malawi; 22. Malasyia; 23. Mexico; 24. Pakistan; 25. Panama; 26. Peru; 27. Philippines; 28. Senegal; 29. Spain; 30. Sri Lanka; 31. Taiwan; 32. Tanzania; 33. Thailand; 34. Tunisia; 35. Turkey; 36. Uganda; 37. Uruguay; 38. Venezuela; 39. Zambia.

B. Developed Capitalist Countries:

1. Australia; 2. Canada; 3. Denmark; 4. Finland; 5. France; 6. Germany (R); 7. Japan; 8. Netherlands; 9. New Zealand; 10. Norway; 11. Sweden; 12. United Kingdom; 13. United States.

C. Socialist Countries;

1. Bulgaria; 2. Czechoslovakia; 3. Germany (E); 4. Hungary; 5. Poland; 6. Yugoslavia.

II. Sources of Data:

(a) Data on income share of different population groups are taken from Ahluwalia

(b) Data on Gini coefficient are taken from M. Todaro: *Economic Development in the Third World,* Longman, 1977 and in some cases, estimated from income share data.

(c) Data on the other variables used in our analysis are taken from World Bank Publications such as World Tables 1976, World Tables 1980, and World Development Report, 1980.

III. Measurement of the Variables:

(a) G is measured as the compound annual rate of growth of GNP over the period 1965 to 1970.

(b) Y is the GNP per capita in 1970.

(c) s is the ratio of domestic savings over GNP (percent) for 1970.

(d) F is measured as the ratio of the current account balance over GNP for 1968.

(e) GL is measured as the annual rate of growth of the working age population over the period 1960 to 1970.

(f) LIT is the literacy rate of the population for 1970; it is used to reflect quality differences in the labour force.

(g) DR is the dependency rate measured as the percentage of population below age 14 and above age 65. This variable refers to 1970.

(h) The data on Gini coefficient, R_1 and R_2, range from early fifties to late sixties. R_1 is computed as the ratio of the income share of the bottom 40% as percentage of the income share of the top 20% of the population. Similarly, R_2 is measured as the ratio of the income share of the middle 40% as a percentage of the income share of the top 20% of the population.

(i) Two dummy variables D_1 and D_2 are used in the relevant regressions to capture the structural differences that exist between groups of countries. D_1 assumes a value of 1 if a country belongs to the group of developed capitalist countries and zero otherwise. D_2 assumes a value of 1 if the country is a socialist one and zero otherwise.

IV. Estimation:

Since the model is simultaneous in nature, application of OLS technique is not appropriate. So, we have used two stage least squares method to estimate the structural equations of the model. For comparison purposes, we have also reported a few OLS regressions. We have estimated the model for the total sample (with appropriate dummy variables) as well as two groups of the total sample, group I consisting of all developing countries and group II consisting of all the developed (capitalist and socialist) countries. The latter grouping allows us to understand the nature and magnitude of the trade-off between distribution and growth in more detail and greater insight which dummy variables failed to capture.