An Analysis of Causal Flow Between Social Development and Economic Growth:

The Social Development Index

By KRISHNA MAZUMDAR*

ABSTRACT This is an attempt to examine whether there is any causal relation between *social development* and *economic growth*. Social development in this context is measured by a *social development index*, which is a weighted composite index formed with eight *social indicators* of life representing various spheres of *social life*. Economic growth is indicated by Per Capita *Real Gross Domestic Product* (PCRGDP). The *causality* test offered by *Granger* has been performed for the entire sample as well as for three income groups: high, middle and low. The study also tests causality between PCRGDP and the eight social indicators of life.

1

The Literature on Causality

MOST OF THE DEVELOPING COUNTRIES emphasize social well-being of the masses nowadays. Consequently, the problem faced by their policy makers is to increase the social benefit of the masses without hindering the economic growth of the country. This raises the question whether a country should try to improve social development, as it is measured by social indicators, or concentrate solely on economic growth and leave the question of basic needs of the public to take care of themselves.

The literature on development economics evidences that the research on the relationship between social development and economic growth has taken at least four different strands: (i) that social development is a product of economic growth; (ii) that economic growth and social development are two unrelated events; (iii) that neither social development nor economic growth is a primary cause of the other, but they are inter dependent; (iv) that social development precedes economic growth.

The first view, that social development is a product of economic growth has been adopted generally in the development policy. These policies tend to place a heavy emphasis on economic programs and assume that economic growth

* [Krishna Mazumdar, PhD., is a member of The Economic research Unit of the Indian Statistical Institute, 203 B. T. Road, Calcutta 700035, India.]

would tend to produce social development. This "trickle-down" was adopted by the United States towards third world development in the early post-war period. This approach is based implicitly on the Rostovian model, where economic growth is the impetus for passage through the various stages of development to a fully modernized society (Rostow, 1960). Okun and Richardson (1962) defined economic growth as "a sustained, secular improvement in material well-being . . . as reflected in an increasing flow of goods and services." This view regarding economic growth was not changed until the early 1970s when MacNamara (1971) asserted that "Development has for too long been expressed simply in terms of growth of output. There is now emerging the awareness that the availability of work, the distribution of income, and the quality of life are equally important measures of development."

Although this trickle down approach has been criticized since 1970 for being ineffective for meeting basic needs, studies still appear which follow this approach. For example, Hagen (1980) in his 'the Economics of Development' opines that economic growth, which he defines as the increase in production per capita or income per capita, will improve the distribution of material welfare.

More recent researches in this respect has been performed by Ram (1985) and Goldstein (1985). Ram suggests that increase in average per capita income should, in turn, improve the level of basic needs fulfillment. Goldstein posits a causal model based on the assumption that economic factors will strongly affect at least one component of basic needs, infant mortality rates, and that this basic needs indicator will only weakly affect the economic indicator, if at all.

The second view that social development and economic growth are unrelated is illustrated by Zuvekas (1979). He is of the opinion that economic growth can occur without social welfare development and expresses the views that the countries could limit the distribution of domestic benefits of growth to a privileged elite at the expense of widespread social welfare development. He states that without specifically targeting the poorer sections of the population for assistance in meeting basic needs, economic growth could produce an ever widening gap between the wealthy and the poor.

Grants' (1973) analysis of the empirical evidence also lends support to these contentions. Finally, London and Williams' (1988) correlational analysis suggests that basic needs measures are both analytically and empirically distinct from economic growth measures.

There are some studies in economic development which express the third view, that economic growth and social development are highly interdependent. For example, Srinivasan (1977) is of the opinion that the policies for economic growth and the policies towards basic needs development are interwoven. He

suggests that too much emphasis on basic needs would, at least in the short run, hurt economic growth which, in turn, would damage future improvement in the basic needs fulfillment.

Streeten (1977, 1981) has expressed the fourth possibility that economic growth is the result of social development. He has been a strong proponent of the basic needs approach. He provides a critique of the income approach to poverty alleviation by noting that the extra income would not always be spent on items basic to the individual's welfare. In addition, he notes that some basic needs may be satisfied more effectively through public services (including access to clean drinking water, schools and health services), and therefore, are not directly linked to individual income. In fact, Streeten suggests a "trickle-up" effects when he states "basic needs is not primarily a welfare concept; improved education and health can make a major contribution to increased productivity." (1981).

Hicks (1979, 1980) explores the relation between economic growth and basic needs and concludes that "the development of critical minimum level of basic human capital may be an important prerequisite for accelerating the growth of (economic) output" (1979). In fact, his findings indicate that improvements in basic needs satisfaction do not substantially decrease GNP growth rates but, such improvements tend to be associated with increased future economic growth.

Hopkins and Van der Hoevan (1982) use measures of basic needs and economic growth in a simulation test of interrelationship between economic and social change from 1980 to 2000. Their findings suggest that the best economic results by the year 2000 would be achieved through either an economic growth approach that gives only superficial attention to basic needs, or an approach that limits exports to the developed nations towards the provision of basic needs. Hopkins and Van der Hoevan argue for the implementation of the second of these two contradictory approaches because (a) the poor would receive their basic needs earlier under this approach, and (b) the developing nations would be less vulnerable to changing international circumstances if they concentrate less on the world market and more on the domestic markets (1982). As the authors warn, however, simulation findings should be evaluated with care due to the many problematic assumptions upon which simulations are based.

The survey indicates that the literature has not provided a consistent and clear answer to the question of causal priority between economic growth and social development. In fact, the lag-lead relationship between social development and economic growth varies with the choice of country group and choice of indicators representing social development and economic growth. The present study is an attempt to throw light on this.

II

Choice of Suitable Indicators

Appropriate indicators for social development and economic growth must be selected. The standard measure of economic growth is per capita Gross Domestic product (PCGDP). No doubt it is an acceptable indicator for measuring a specific country's economic performance, but its usefulness in cross country study is not beyond question. The major problem associated with it as an indicator for comparing the level of economic development of a number of countries is the conversion of each country's PCGDP to a common currency. The most widely used method is to convert the PCGDP of each country to U.S. dollars using exchange rates between the country's currency and the U.S. dollar. This method implicitly assumes that the purchasing power parity of U.S. $1 is the same in all the countries being compared. Since this assumption may not be correct, for the purpose of comparison, the indicator used to measure economic growth should be adjusted for purchasing power parity. Therefore the growth indicator chosen in the present study is the Per Capita Real Gross Domestic Product (PCRGDP) which is adjusted to accomodate purchasing power parity.

The selection of appropriate indicators to represent social development requires attention to comprehensiveness and comparability. The basic requirements of a particular society may not tally with the basic requirements of another society. However, a wider breadth of agreement is possible if indicators of social life which are directly related to the provision of *long life, health* and *education* are used.

It is generally believed that quality of life or welfare should be measured on the basis of as large a number of attributes as is relevant and feasible (See Slottje, 1991; Hirschberg, Maasoumi and Slottje, 1991; Sen, 1985, 1987; Maasoumi, 1986; Atkinson and Bourguignon, 1982; and Kolm, 1977). Therefore, the study widens the scope of physical quality of life measure by incorporating variables from various social aspects of human well being. The proposed index, constituted and used in this paper henceforth, will be called the *Social Development Index* (SDI).

III

The Social Development Index

The choice of component variables for forming the composite Social Development Index is governed by two apparently conflicting principles, wide coverage of various aspects of social development, and parsimony regarding the number of variables. The variables chosen are: Urban population as percentage of total population (UPOP), Life expectancy at birth (LIFE), Caloric supply per capita as a percentage

of requirement (CALO), Infant survival rate as per 1000 of live births (INFS), Physician per 1000 of population (PHYS), Adult literacy rate as a percentage of total population over age 15 years (ADLI), Teacher/pupil ratio in primary schooling (TPRP), Passenger cars per 1000 of population (PCAR).

All the variables chosen here are related to the outcomes of a development process. The rationale behind the choice of each variable bears discussion.

UPOP. The percentage of total population residing in the urban areas is incorporated with a view that this indicates the percentage of total population with urban facilities such as better sanitation, medical and educational facilities, better communications, access to safe water etc. There is a close association between urbanization and industrialization. Moreover, "urbanization promotes values favorable to participation, entrepreneurship, and industrial growth; in particular, cities typically tend to innovate and accept change, since in the relatively impersonal and fragmented setting of urban life the all embracing bonds of traditional community systems are difficult to maintain."

LIFE. Life expectancy at birth directly reflects the levels of health, nutrition and income and thus, indirectly, links employment and shelter. A low figure usually shows there is a sizeable percentage of the population facing poor living conditions and there is a lack of proper health facilities in the country.

CALO. Calorie intake per capita as percentage of requirement is the third variable chosen in this study. For countries, where available calorie per person are below the level of requirement, there exists almost certainly a significant problem of malnutrition. The problem of malnutrition is closely associated with the problem of low productivity and ultimately low national income.

INFS. The infant survival rate, along with playing a significant role in interpreting life expectancy of a country, reflects nutrition and sanitary conditions of the country. This indicator also reflects the degree of existence of contagious disease in a country, as infants are more susceptible to these problems. This indicator shows very rapid response to many health policies. It is obvious that where the infant mortality rate is very high there are many people living in conditions under which basic health needs are not met.

PHYS. The health situation of a population depends mainly upon the health services available. The old industrialized countries have experienced slow but steady progress in regard to health services. In the newly independent poor countries, it is an enormous task to build up health services approaching the levels now existing in the rich countries. Education and various kinds of paramedical personnel on a large scale are required. It is expected that there are many more patients to share the service of one physician or nursing

person in the poor countries than in the rich ones. Physician per thousand of population, therefore, provides a general picture of the quantity of health care available in a country.

ADLI. Adult literacy rate is a direct measure of achievement of one basic right of the human beings, minimum education. This indicator is also well correlated with many other indices of quality of life such as measures of employment, income or health and therefore, adult literacy can be considered the most excellent overall quality of life indicator.

TPRP. Teacher/pupil ratio in the primary level of education is the seventh variable. This gives an indication of the quality of educational care available in the primary level of education. The higher the number of pupil per teacher, the lower are the quantity and quality of personal care available for each pupil.

PCAR. The last variable selected is passenger cars per thousand of population. This reflects the level of communication and transportation in the country. In fact, the better the transportation system is in a country, the more widespread are the medical and educational facilities.

IV

The Data

THE DATA FOR 1960, 1970, 1980 AND 1990 on all the social indicators considered in this study have been obtained from different issues of World Tables and World Development Reports. Figures not available for these 4 years have been imputed in some cases by figures from around these years. The data for actual calorie per capita for 1990 are not available. These figures are approximated using the ratio between percentage of requirement and actual supply for the year 1980.

A few variable had to be transformed to make all the variables move in the same direction along with the level of development. Data obtained from the official sources mentioned are infant mortality rate, population per physician, pupil-teacher ratio. These variables are negatively related with the level of development while other variables have positive correlations with the level of development. These variables are transformed as follows:

a) Infant survival rate (INFS) = 1000 − Infant mortality rate

b) Physician per 1000 of population = 1000/population per physician.

c) Teacher/pupil ratio = $\frac{1}{\text{pupil/teacher ratio}}$

The data for per capita real gross domestic product (PCRGDP) have been taken from Summers and Heston (1984, 1988).

The principle followed in choosing countries for the sample is wide representation from all income groups and all regions. But uniformity in number representing each income group or region cannot be maintained as the objective is to obtain uniform sample for four years under study and to have all the variables for all samples. Ultimately, the sample consists of 92 countries. These countries may be subdivided into three income groups high, middle and low following the World Bank classification of countries for 1990 per capita gross domestic product. The list of the sample countries is as follows:

High Income Group. Australia, Austria, Belgium, Canada, Denmark, Finland, France, Federal Republic of Germany, Hong Kong, Iceland, Italy, Japan, Netherlands, New Zealand, Norway, Singapore Spain, Sweden, United Kingdom, United States of America.

Middle Income Group. Algeria, Argentina, Barbados, Bolivia, Brazil, Cameroon, Chile, Colombia, Congo, Costa Rica, Cyprus, Dominican Republic, Ecuador, El Salvador, Greece, Guatemala, Guyana, Iran, Iraq, Ireland, Israel, Jordan, Korea Republic, Malaysia, Mauritius, Mexico, Morocco, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Portugal, Suriname, Syrian Arab Republic, Thailand, Trinidad and Tobago, Turkey, Uruguay, Venezuela.

Low Income Group. Bangladesh, Burundi, Central African Republic, Egypt, Ethiopia, Gambia, Ghana, Guinea, Haiti, Honduras, India, Kenya, Liberia, Malaysia, Malawi, Mozambique, Myanmar, Nicaragua, Niger, Nigeria, Pakistan, Rwanda, Sierra Leone, Sri Lanka, Sudan, Tanzania, Togo, Upper Volta, Zaire, Zambia, Zimbabwe.

V

The Construction of Composite Indices

THE CRUCIAL STAGE in spatial multivariate analysis is that of converting a large number of variables into a smaller number of indices such that the geographical units (here, countries) can be easily compared with each other. The construction of a composite index has two major problems: making the variables scalefree and the determination of weights. The variables chosen for the construction of the composite index are measured in different units and hence, in general, are not additive. Therefore, it is necessary to convert the variables into some standard units of measurement. There are different ways of standardization. A very simple one, represented below, is used.

Say these are m variables for n observations:

$$X = \begin{pmatrix} x_{11} & x_{12} & x_{1n} \\ x_{21} & & \\ x_{31} & & \\ x_{m1} & & x_{mn} \end{pmatrix}$$

where, x_{ij} represents value of the ith variable for the jth country. Let Y_{ij} represent the ith transformed variable for the jth country:

$$Y_{ij} = \frac{X_{ij} - -X_{imin}}{X_{imax} - -X_{imin}} \times 100 \qquad i = 1, 2, \ldots m$$

$$j = 1, 2, \ldots n$$

where,

X_{imin} = the minimum value for the ith variable
X_{imax} = the maximum value for the ith variable

This method is similar to the method used by Morris (1979) in estimation of Physical Quality of Life Index (PQLI)[3] and transforms the variables into a 0 to 100 scale (*i.e.* the worst value = 0 and the best value = 100).

The next stage in constructing a composite index is to assign appropriate weights to the constituent variables of the composite index. If one has sufficient insight into the nature and magnitude of the interrelations among the variables and their socio-economic implications, one might choose weights using one's individual judgement. This introduces a certain amount of subjectivity into the analysis, although, in some situations, it might help in computing the social reality much better than any statistical technique.

Another popular method is to assign equal weights to all the constituent variables. Giving equal importance to all the variables is considered to be an acceptable method when there is no reason to do otherwise. Kendal (1939) used equal weight in a study of crop productivity for regions of England. He aggregated the scalefree score (rank values) by giving them equal weights. But any answer is not always better than no answer. So here unequal weights are favored.

This study uses principal component technique to form its composite index, called Social Development Index (SDI), which is formed with the eight constituent variables already described. The multivariate method of computing principal components is a relatively straightforward device for parsimonious representation of multiplicity of relative variables for any given observation set. The method essentially consists of computing such linear combinations of the original variables that capture successively the largest proportion of the variance in the original variables. Thus, the first principal component is that linear combination which captures or 'explains' the highest fraction of the variance in the original variables. The second explains the largest part of the remaining variance, and so on.

The various principal component series are constructed by taking a weighted sum of the original variables, the weights being the elements of the characteristic vector of the correlation matrix (or covariance matrix) of the original variables, and the characteristic vectors being arranged in the descending order of the size of their associated characteristic roots. The principal components derived for this study are based on the correlation matrix of the relevant variables and are literally weighted

averages of the underlying variables. It is worthy to note that scaling of weights used for computing the components is arbitrary in the sense that the principal components are unique up to a scale factor. Often the weights are so scaled that their squared sum equals either 1 or the corresponding characteresic root. The weights have been scaled to make their sum equal to one.

The discussion in the preceding few lines indicates that principal components are a rather natural, straight forward and parsimonious mode of representation of observation sets with many variables. Whatever the number of original variables, they can be well represented by a much smaller number, possibly by just one number, in the form of principal components. These components can often capture a very large fraction of the variance in the original data set and can thus serve virtually the same function as the full set of original variables, but in a much more compact form. Moreover, the 'level of development' of a country may be treated as an unobservable or as a 'latent' variable. Several variables such as GNP per capita may be arranged as different proxies for that 'latent' variable. Therefore, the first principal component of these indicating variables may be viewed as this 'latent' variable, level of development.[2]

Since the objective of this study is to have a composite representation of all the important variables, only the first principal component is considered. The exact procedure followed for obtaining the first principal component is as follows: the characteristic vector corresponding to the largest characteristic root of the correlation matrix of the eight constituents is rescaled to make the sum of its elements equal to one, and the principal component is obtained as a weighted sum of the eight constituents with rescaled elements of the characteristic vector as the weights.

This study attempts to throw light on the causal relation between social development and economic development for the sample as a whole, representing the entire world as well as for three different income groups. Therefore each sample country is viewed from two points of view: as a member of a particular income-group and as a member of the world as a whole. Therefore, there are four sets of weights for each variable at each time as varying with sample: entire world, high income countries, middle income countries, and low income countries. As a result for each time, there are two social development indices for each country of the sample, one as a member of the world as a whole and as a member of the particular income group.

VI

Methodology

THE LAG-LEAD RELATION between social development and economic growth may be found by simple test of causality. In this respect the Granger (1969) causality

test is used. The concept of causality in the Granger sense is based on the basic assumptions: (i) Future cannot cause the past. It is the past and present which cause the future and (ii) Detection of causality is only possible between two stochastic variables.

Granger proposed for a pair of linear covariance-stationary time series x and y: x causes y if the past values of x can be used to predict y more correctly than simply using the past values of y. Formally, x is said to cause y if and only if $\sigma_1^2(y_t|y_{t-j}) < \sigma_2^2(y_t|y_{t-j})$ where σ^2 represents the variance of forecast error and i and j = 1, 2, 3, . . . n.

To test causality and its direction between economic growth and social development in the Granger sense, the following equations are specified:

$$X_{1t} = A_1 + \sum_{i=1}^{n} B_i X_{1(t-i)} + \sum_{j=1}^{m} C_j X_{2(t-j)} + E_{1t} \quad [1]$$

$$X_{2t} = A_2 + \sum_{i=1}^{k} P_i X_{1(t-i)} + \sum_{j=1}^{l} Q_j X_{2(t-j)} + E_{2t} \quad [2]$$

where X_1 and X_2 are the variables across which causal ordering are to be investigated (here X_1 denotes Social Development Index and X_2 denotes Per Capita Real Gross Domestic Product, i and j are the time lags, B, C, P, Q are the coefficients and E_{1t} and E_{2t} are serially independent random vector with mean zero and finite covariance matrix. The causality tests to be performed can be represented simply in terms of the following hypotheses. The hypothesis that there is no causal flow from X_1 to X_2 and X_2 to X_1 is equivalent to postulate:

$$\sum_{j=1}^{n} C_j = 0 \quad \text{and} \quad \sum_{i=1}^{k} P_i = 0 \quad [3]$$

The alternative hypotheses in this respect are:

(a) There is unidirectional causality from X_2 to X_1 when:

$$\sum_{j=1}^{n} C_j \neq 0 \quad \text{and} \quad \sum_{i=1}^{k} P_i = 0 \quad [4]$$

(b) There is unidirectional causality from x_1 to x_2 when:

$$\sum_{j=1}^{n} C_j = 0 \quad \text{and} \quad \sum_{i=1}^{k} P_i \neq 0 \quad [5]$$

(c) There is mutual causality or feed back when:

$$\sum_{j=1}^{n} C_j \neq 0 \quad \text{and} \quad \sum_{i=1}^{k} \neq 0 \quad [6]$$

A brief discussion of the steps involved in performance of Granger causality tests is presented below:

(i) To determine whether the time series of changes in X_1 and changes in X_2 are stationary tests based on the Box Pierse "Q Statistic" are performed. For neither of the two series can the null hypothesis of stationarity be rejected.

(ii) The presence of serial correlation among residuals of estimated equations is checked by calculating Durbin "h-statistic". In all equations h-statistic are below the critical values, indicating that the residuals are not serially correlated.

(iii) Granger causality tests involve testing the significance of C's and P's conditional on the chosen lag lengths, n, m, k, l. There are many cases, for example, Jung and Marshall (1985), Chow (1987) and Hsiao (1987), such lag lengths are arbitrarily assigned. In this study a minimum of 10 year lag has been used, as in general it is only possible to obtain data on most of the variables representing social aspects of life for a 10 year lag.

VII

Causal Relations Between Social Development and Economic Growth

SOCIAL DEVELOPMENT IN THIS CONTEXT is identical with Social Development Index, the weighted composite index formed with eight social indicators of life and economic growth is indicated by Per Capita Real Gross Domestic Product. Test of causality has been performed for the entire sample as well as for three income groups: high, middle and low respectively. Similar test has been performed for the constituent indicators of the social development index. In this context again, the test has been conducted for the entire sample as well as for the three income groups.

Table 1 presents the results obtained from the Granger causality test between Social Development Index and Per Capita Real Gross Domestic Product for the world as well as three income groups. The first column of the table indicates the dependent variable. Column (2) and (3) represent the sum of standardized regression coefficients of X_1 and X_2 in each equation. Column (4) gives F-statistics. Column (5) and (6) represent R^2 and F-ratio respectively. As is evident from the table all the regression equations estimated for the Social Development Index and Per Capita Real Gross Domestic Product have high R^2 and all the F-ratios are significant. Test of significance for F-statistic and F-ratio have been worked out at the 5 percent level of significance. The final column provides a simple characterization of the test outcomes for each case.

Table 1

Test of Causality between SDI and PCRGDP

Dep. Var	Sum of Coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
SDI	1.32	-0.42	23.50*	0.95	311.76* (6.85)	SDI ← PCRGDP
PCRGDP	0.09	0.88	1.00	0.95	87.03* (6.85)	
High Income Group						
SDI	0.77	0.11	0.08	0.86	13.16* (6.13)	SDI $\not\rightarrow$ PCRGDP
PCRGDP	0.25	0.90	0.24	0.84	11.82* (6.13)	
Middle Income Group						
SDI	0.85	0.12	0.83*	0.93	70.72* (6.33)	SDI → PCRGDP
PCRGDP	0.32	0.52	3.30*	0.75	67.83* (6.33)	
Low Income Group						
SDI	0.93	0.03	0.13	0.89	34.50* (6.25)	SDI → PCRGDP
PCRGDP	0.69	0.21	14.15*	0.75	12.27* (6.25)	

Notes : * indicates significance at the 5% level.

Figures in parenthesis show degrees of freedom.

The results obtained from the F-statistic throw light to the fact that for the world Per Capita Real Gross Domestic Product precedes Social Development Index. In fact, increase in Per Capita Real Gross Domestic Product enables a country to invest more on social aspects of life. This bears evidence in favor of

the view of Ram (1985) and Goldstein (1985) that increase in per capita income should improve the level of basic needs fulfillment. This result does not hold when income groupwise situation is considered. It has been observed that for the high income group (HIG) Social Development Index (SDI) and Per Capita Gross Domestic Product (PCRGDP) are independent. But for the middle income group (MIG) and low income group (LIG), Social Development Index precedes Per Capita Real Gross Domestic Product. This sheds light to the fact that up to certain level of income there is a one way causal flow from Social Development Index to Per Capita Real Gross Domestic Product, but after attainment of certain minimum level of economic growth, a country's social development and economic growth may move independently. At the low level of economic growth, in general, the level of social development is also low. Low social development implies low literacy rate, low life expectancy, low infant survival rate, low number passenger car etc. These imply underdeveloped infrastructure and low labor productivity which in turn implies low Per Capita Real Gross Domestic Product, a typical vicious circle phenomenon.

Casual relations between Per Capita Real Gross Domestic Product and the constituent social indicators (Urban Population, life expectancy at birth, caloric supply per capita as percentage of requirement, infant survival rate per 1000 of live births, physician per 1000 of population, adult literacy rate, teacher pupil ratio in primary schooling and passenger car per 1000 of population) have been presented in Table 2. Column headings of Table 2 are same as those of Table 1. The table portrays that for the entire sample, urban population, life expectancy at birth and infant survival rate per 1000 of live births precedes Per Capita Real Gross Domestic Product while calorie supply per capita as percentage of requirement, adult literacy rate and teacher pupil ratio in primary schooling follows Per Capita Real Gross Domestic Product, physician per 1000 of population and Per Capita Real Gross Domestic Product have no causal relation but passenger car per 1000 of population and Per Capita Real Gross Domestic Product evidence bidirectional causal flow between themselves.

The table also picturies income groupwise variation of causal relations between each social indicator of life and Per Capita Real Gross Domestic Product. There is unidirectional causal flow from urban population to Per Capita Real Gross Domestic Product for the high income group and low income group but bidirectional causal flow between urban population and Per Capita Real Gross Domestic Product for middle income group.

Life expectancy at birth is followed by Per Capita Real Gross Domestic Product for high income group and middle income group while Per Capita Real Gross Domestic Product is followed by life expectancy at birth in case of low income group.

Calorie supply per capita as percentage of requirement is preceded by Per Capita Real Gross Domestic Product for high income group, on the contrary it is followed by Per Capita Real Gross Domestic Product for low income group and there is no causal relation between calorie supply per capita as percentage of requirement and Per Capita Real Gross Domestic Product for middle income group.

Table 2

Test of Causality between selected Social indicators and PCRGDP

Urban Population

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
UPOP	0.91	0.04	0.21	0.90	164.45* (6.85)	UPOP → PCRGDP
PCRGDP	0.05	0.93	1.86*	0.95	318.50* (6.85)	
High Income Group						
UPOP	0.82	-0.06	0.05	0.67	3.70* (6.13)	UPOP → PCRGDP
PCRGDP	0.90	0.05	1.52*	0.83	13.92* (6.13)	
Middle Income Group						
UPOP	0.74	0.21	3.26*	0.83	33.46* (6.33)	UPOP → PCRGDP
PCRGDP	0.50	1.25	1.41*	0.75	20.09* (6.33)	
Low Income Group						
UPOP	0.77	-0.06	0.35	0.81	17.56* (6.25)	UPOP → PCRGDP
PCRGDP	0.49	0.61	8.45*	0.67	8.56* (6.25)	

Life expectancy

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
LIFE	0.88	0.09	0.11	0.94	275.72* (6.85)	LIFE → PCRGDP
PCRGDP	0.12	0.85	3.66*	0.94	288.39* (6.85)	
High Income Group						
LIFE	0.75	0.42	1.83*	0.63	3.66* (6.13)	LIFE ← PCRGDP
PCRGDP	0.23	1.02	0.06	0.83	10.74* (6.13)	
Middle Income Group						
LIFE	0.66	0.32	2.96*	0.85	37.55* (6.33)	LIFE ← PCRGDP
PCRGDP	0.26	0.63	3.66*	0.76	21.13* (6.33)	
Low Income Group						
LIFE	0.89	0.06	0.02	0.85	23.02* (6.25)	LIFE → PCRGDP
PCRGDP	0.46	0.48	11.46*	0.82	19.40* (6.25)	

Calorie intake Per Capita

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
CALO	0.53	0.34	1.81*	0.64	25.52* (6.85)	CALO ← PCRGDP
PCRGDP	0.03	0.93	0.60	0.94	225.86* (6.85)	

High Income Group						
CALO	0.68	0.53	5.30*	0.68	4.56* (6.13)	CALO ← PCRGDP
PCRGDP	-0.06	0.78	0.17	0.82	9.61* (6.13)	
Middle Income Group						
CALO	0.19	0.41	0.03	0.34	2.89* (6.33)	CALO ≠ PCRGDP
PCRGDP	0.10	0.96	0.56	0.73	14.91* (6.33)	
Low Income Group						
CALO	0.74	0.06	0.00	0.30	4.39* (6.25)	CALO → PCRGDP
PCRGDP	0.34	0.58	4.28*	0.52	4.65* (6.25)	

Infant survival Rate

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
INFS	0.87	0.07	0.73*	0.86	90.58* (6.85)	INFS ≠ PCRGDP
PCRGDP	-0.10	0.87	2.65*	0.94	243.17* (6.85)	
High Income Group						
INFS	0.50	0.27	0.27	0.59	1.16* (6.13)	INFS → PCRGDP
PCRGDP	0.05	0.81	1.45*	0.88	15.31* (6.13)	
Middle Income Group						
INFS	0.93	-0.03	0.01	0.85	31.82* (6.33)	INFS → PCRGDP
PCRGDP	-0.23	0.65	2.10*	0.75	16.92* (6.33)	

Low Income Group						
INFS	0.62	-0.17	1.95*	0.63	7.03* (6.25)	INFS ⇄ PCRGDP
PCRGDP	-0.40	0.44	6.80*	0.51	4.34* (6.25)	

Physician Per 1000 of population

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
PHYS	0.95	0.05	0.28*	0.77	47.93* (6.85)	PHYS ⇄ PCRGDP
PCRGDP	-0.02	0.95	0.03	0.94	225.53* (6.85)	
High Income Group						
PHYS	0.90	-0.03	0.62	0.95	38.97* (6.13)	PHYS → PCRGDP
PCRGDP	0.39	1.00	4.70	0.95	18.97* (6.13)	
Middle Income Group						
PHYS	0.65	-0.26	2.76*	0.74	15.88* (6.33)	PHYS ⇄ PCRGDP
PCRGDP	-0.20	0.68	1.43*	0.75	16.24* (6.33)	
Low Income Group						
PHYS	0.94	0.08	0.43	0.71	10.24* (6.25)	PHYS ⇄ PCRGDP
PCRGDP	-0.38	0.47	0.88	0.50	4.10* (6.25)	

Adult Literacy Rate

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
ADLI	0.96	-0.03	3.66*	0.90	123.14* (6.85)	ADLI ← PCRGDP
PCRGDP	0.00	0.91	0.12	0.94	231.01* (6.85)	
High Income Group						
ADLI	0.93	0.10	3.24*	0.98	113.87* (6.13)	ADLI ← PCRGDP
PCRGDP	-0.39	1.04	0.29	0.86	13.79* (6.13)	
Middle Income Group						
ADLI	0.89	0.09	0.94	0.87	35.70* (6.33)	ADLI → PCRGDP
PCRGDP	0.21	0.68	4.08*	0.75	16.94* (6.33)	
Low Income Group						
ADLI	0.87	-0.01	63.25*	0.75	12.66* (6.25)	ADLI ⇄ PCRGDP
PCRGDP	0.52	0.45	12.29*	0.58	5.90* (6.25)	

Teacher - pupil ratio in the primary level

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
World (entire sample)						
TPRP	0.59	-0.27	1.81*	0.73	38.16* (6.85)	TPRP ← PCRGDP
PCRGDP	0.01	0.96	0.00	0.94	225.07* (6.85)	

High Income Group						
TPRP	0.95	-0.13	0.91	0.83	10.47* (6.13)	TPRP ⇄ PCRGDP
PCRGDP	0.16	0.73	0.92	0.87	15.27* (6.13)	
Middle Income Group						
TPRP	0.99	-0.09	0.08	0.83	26.27* (6.33)	TPRP ⇄ PCRGDP
PCRGDP	-0.12	0.75	0.32	0.74	15.83* (6.33)	
Low Income Group						
TPRP	0.28	-0.21	1.48*	0.34	2.16* (6.25)	TPRP ← PCRGDP
PCRGDP	-0.06	0.59	0.92	0.44	3.30* (6.25)	

Passenger car per 1000 of population

Dep. Var	Sum of coefficients		F-Statistics	R^2	F-ratio	Inference on causality
	SDI	PCRGDP				
Passenger car per 1000 of World (entire sample)						
PCAR	0.62	-1.03	7.13*	0.23	4.21* (6.85)	PCAR ⇆ PCRGDP
PCRGDP	0.10	0.86	2.50*	0.94	240.80* (6.85)	
High Income Group						
PCAR	-0.29	-0.23	0.15	0.62	3.52* (6.13)	PCAR ⇆ PCRGDP
PCRGDP	0.00	0.75	0.34	0.89	18.09* (6.13)	

Middle Income Group						
PCAR	-0.38	-0.07	1.51*	0.25	1.83* (6.33)	PCAR ⇆ PCRGDP
PCRGDP	0.29	0.06	1.54*	0.76	17.24* (6.33)	
Low Income Group						
PCAR	-0.39	-0.08	0.49	0.39	2.72* (6.25)	PCAR → PCRGDP
PCRGDP	0.40	0.35	2.10*	0.59	4.16* (6.25)	

It has been evidenced one way causal flow from infant survival rate per 1000 of live births to Per Capita Real Gross Domestic Product for high income group and middle income group while two way causal flow between infant survival rate per 1000 of live births and Per Capita Real Gross Domestic Product for the low income group.

Physician per 1000 of population precedes Per Capita Real Gross Domestic Product for high income group, while for middle income group physician per 1000 of population and Per Capita Real Gross Domestic Product have bidirectional causal flow between themselves and for low income group there is no causal flow between physician per 1000 of population and Per Capita Real Gross Domestic Product.

There is one way causal flow from Per Capita Real Gross Domestic Product to adult literacy rate for the high income group and from adult literacy rate to Per Capita Real Gross Domestic Product for middle income group but two way causal flow for low income group.

Teacher pupil ratio in primary schooling and Per Capita Real Gross Domestic Product have no causal relation between themselves for high income group and middle income group but for low income group, teacher pupil ratio in primary schooling precedes Per Capita Real Gross Domestic Product.

Passenger car per 1000 of population and Per Capita Real Gross Domestic Product have no causal flow for high income group, two way causal flow for middle income group and passenger car per 1000 of population precedes Per Capita Real Gross Domestic Product for low income group.

VIII

Summary and Concluding Remarks

THIS PAPER REPRESENTS an attempt to examine the causal relationship between social development and economic growth. Apart from the entire sample of countries, this study attempts to observe such relationships for three different income groups: high, middle and low. It also performs test of causality between each selected social indicator and per capita real gross domestic product for the entire sample of countries and each income group separately.

The observation has been drawn that there is no uniform causal relation between economic growth and social development. This relationship varies with change of income group and change of variables. Consequently, it may be concluded that none of the hypotheses mentioned in section one of the present paper is universally supported by the data: each of them is supported in different context for different income groups and for different variables.

Notes

1. Morris D. Morris (1979) introduced Physical Quality of Life Index (PQLI) to measure the level of development of a country on the basis of quality of life indicators. He uses three simple indicators life expectancy at age one, infant mortality rate and adult literacy. PQLI was produced by the unweighted average of these three indicators. For each indicator the performance of individual countries is rated on a scale of 1 to 100, where 1 represents the worst performance by any country and 100 represents the best performance.

2. Discussion in this section is largely based on Rati Ram (1982): "Composite Indices of Physical Quality of Life, Basic Needs Fulfillment and Income: A 'Principal Component' Representation," *Journal of Development Economics*, Vol. 11, 227–47.

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