

Trends in International Inequality: A Basic Needs Approach*

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The paper examines global inequality from a much broader perspective than is usually understood. Six composite indices of basic needs and an aggregate economic index are constructed for two years, 1970 and 1980, by using a relatively new data-analytic technique called 'Wroclaw taxonomic method.' It is observed that international inequality in terms of basic needs indices is conspicuously higher than that on overall economic index, and in many cases, the inequality worsened over the past decade. The economic inequality however improved slightly during the period.

I. Introduction

Perspectives on global inequality depend upon the manner in which the evidence is compiled and interpreted. Thus inter-country differences in basic needs provision may portray a more optimistic picture vis-à-vis inter-country per capita income differences. This is the essential point which was expounded in an insightful contribution by Ram (1982).¹ More specifically, Ram observed that:

"Two facts stand out quite clearly. First... inter-country inequality in meeting basic needs is much smaller than income inequality... Second,

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¹ This view has also been stressed by others — see for example, Leipziger and Lewis (1980), Hicks (1979), World Bank (1980). However, Ram's study represents the most comprehensive cross-country analysis of this topical issue.

while income inequality across countries has increased, inequality in the provision of basic needs has declined perceptibly in respect of literacy, life expectancy and physician supply... Thus, it seems fair to say that, during the last two decades, cross-country income inequality and inequality in the fulfillment of basic needs have changed significantly but in opposite directions, the former increasing while the latter declined."

The purpose of this note is to re-examine global inequality from a much broader perspective than used in Ram's study.²

Our empirical investigation suggests a mixed picture of trends in international inequality. To preview the conclusion: inter-country inequality in the provision of basic needs is higher than comparable inequality in economic indicators. More importantly, international inequality in the provision of basic needs has, with a few exceptions, worsened between 1970 and 1980, while global inequality in terms of economic indicators has improved slightly over the same period.

II. Method and Data

We use a relatively new data-analytic technique called 'Wroclaw taxonomic method'³ which is able to reduce a number of measures pertaining to a variable into a composite index. Thus, for example, if there are 'n' measures (where $n > 1$) which may be used to represent the nutritional status of a country, then the above technique can combine and aggregate them into an overall index. The advantage of this method lies in the need to avoid a multiplicity of measures and thus allows one to provide a parsimonious representation of the available evidence.⁴ This is particularly useful in the case of cross-country analysis. In the presence of

² Ram used the L-index to estimate inter-country differences in income and basic needs indicators. For the methodology used in this study, see text. Ram's sample size consisted of 100 countries using data drawn from the 1960-78 period. The current study uses data from 127 countries based on the 1970-80 period. We would like to emphasize that our study does not necessarily constitute a reconsideration of the Ram hypothesis because our results will invariably differ given that we use a different methodology, somewhat larger sample and different time period.

³ The method was originally developed by a group of Polish mathematicians in the early fifties and its first systematic application to development studies was made by Harbison et al. (1970). Applications were also made earlier for making international as well as inter-regional comparisons of development in a number of UNESCO studies. For a partial list of these, see UNESCO, "Social indicators: Problems of definition and of selection," Report No. 30, UNESCO press, Paris, 1974.

⁴ It has to be conceded that the results derived from the Wroclaw taxonomic method, like any other method entailing aggregation of several variables into a common index, are sen-

multiple indicators, a country may be high on one measure, and low on another, making it rather hazardous to engage in overall comparisons across countries.

In applying the technique, a given data set (which is often comprised of different measurement units such as percentages, numbers per 1,000 population, daily kilo-calories, and dollar values) is converted into commensurable units by applying the standardisation procedure⁵ (i.e. the rescaled data will have zero mean and unit variance). The adjusted data can then be used to rank the countries (or regions) according to their performance in any particular area of development.

In order to make the comparisons more meaningful, it is necessary to specify clearly whether a particular indicator is 'stimulant' (positive factor) or 'retardant' (negative factor) to development. For example, a higher per capita GNP would enhance development but a higher infant mortality rate may act as a deterrent to development. After such specifications are made, the Wroclaw procedure relies upon the selection of indicator values (standardised earlier) which are "best" in the sense that they represent the highest values for all positive factors and the lowest values for all negative factors contained within the sample. The Euclidean distance from the "idea" (or best) values summed over all indicators, as shown in Equation 1, is referred to as 'pattern of development' (PD).

$$(1) \quad (PD)_i = \left\{ \sum_{j=1}^n (x_{ij} - x_{Bj})^2 \right\}^{\frac{1}{2}}$$

sitive to the aggregation procedure used. However, the Wroclaw taxonomic method has several advantages over other multivariate analytic techniques. For the main arguments, see text and for details, see Zerby and Khan (1984).

⁵ If there are 'N' countries and 'n' indicators the standardised value of each indicator is derived by using the following formula:

$$x_{ij} = \frac{X_{ij} - \bar{X}_j}{S_j}, \quad \begin{array}{l} i = 1, 2, \dots, N \\ j = 1, 2, \dots, n \end{array}$$

where

$$\bar{X}_j = \text{mean value of indicator } j = \frac{1}{N} \sum_{i=1}^N X_{ij}$$

$$S_j = \text{standard deviation of } j\text{th indicator values} = \left[\frac{1}{N} \sum_{i=1}^N (X_{ij} - \bar{X}_j)^2 \right]^{\frac{1}{2}}$$

Suppose, in a sample of 3 countries, a particular indicator (say, doctors per 1,000 population) assumes the values of 12, 15 and 11. Applying the above formula, the standardised values are: -0.392, 1.373 and -0.981. For details on the procedure, see Harbison F.H. et al. (1970).

where, $i = 1, 2, \dots, N$ (number of countries)
 $j = 1, 2, \dots, n$ (number of indicators)
 'B' denotes best standardised values.

Another way of ranking the countries by using the taxonomic technique, is to derive a composite index called 'measure of development' (MD). This new measure is computed by rescaling the PD values as shown below:

$$(2) \quad (MD)_i = \frac{(PD)_i}{C_B}$$

where, C_B = 'critical' distance from the ideal country

$$= \frac{1}{N} \sum_{i=1}^N (PD)_i + 2 \left[\frac{1}{N} \sum_{i=1}^N ((PD)_i - \frac{1}{N} \sum_{i=1}^N (PD)_i)^2 \right]^{\frac{1}{2}}$$

The rescaled values usually range between 0.0 (the most developed country) and 1.0 (the least developed country). A country will fall beyond the range of 1.0 only if its distance from the hypothetical ideal country (i.e. PD) exceeds the 'critical' distance (C_B).

Besides ranking, the Wroclaw technique can also be used to 'group' the countries on the basis of measures or similarities. It can also identify the closest neighbours (or 'model' countries) of a particular country or groups of countries. We argued elsewhere (Zerby and Khan 1984) that the method is more useful in development analysis than the other traditional techniques such as discriminant analysis or principal component analysis. It requires fewer *a priori* assumptions than other multivariate techniques. Perhaps the greatest merit of the technique lies in the fact that it provides a convenient way of evaluating inter-country (or inter-regional) inequality based on a wide range of social and economic indicators. One can easily estimate the extent of inequality by computing the coefficient of variation (or any another measure of dispersion) of MD or PD values derived for different sets of data. The present study uses the coefficient of variation (C.V.) of MD scores as the relevant measures.⁶

In estimating inter-country variation in basic needs provision, one has to encounter the fundamental complication of providing an unam-

⁶ It satisfies the Pigou-Dalton condition and the principle of zero-homogeneity (see Cowell, 1977 for details). The L-index, used by Ram, also possesses such properties.

biguous, a priori specification of what are 'basic needs.' Even if this problem is resolved, one has to contend with a multiplicity of indicators. Several practitioners have tried to resolve some of these difficulties. Streeten and others (Streeten et al. 1981, Hicks and Streeten, 1979) have suggested a set of core indicators along the following lines:

Health	: Life expectancy at birth;
Education	: Literacy Primary school enrolment
Food/Nutrition:	Calorie supply per head or calorie supply as a percent of requirements
Water supply	: Infant mortality : Percent population with access to portable water
Sanitation	: Infant mortality
Housing	: None

Based on such considerations, this paper has focussed on the following basic needs components:

- (1) Nutrition
- (2) Health
- (3) Sanitation
- (4) Education
- (5) Housing and related infrastructure.

A wide set of measures were utilised (see appendix for a complete list) to depict the afore-mentioned basic needs variables. The Wroclaw taxonomic method was then applied to the multiple measures to generate single-valued, generic indices to represent each of the above variables. For ease of reference, an all-encompassing basic needs index was also computed. Data for the present study are taken from a data bank, compiled by one of the authors⁷ earlier, which contains statistics on 132 development indicators (66 social plus 66 economic indicators) for almost all the countries of the world whose mid-year population in 1970 exceeded 500,000. These data are largely derived from various national and international sources. The missing data were estimated by calculating the appropriate group averages with the use of cluster analysis.

III. Evidence

Our main findings are presented in Table 1. As can be seen, the value

⁷ All data are presently stored in a microfiche under the title 'Socioeconomic data bank' (Khan, 1985), and can be made available for research purposes on application from the Reprographic services unit of the National University of Singapore Library.

Table 1
 INTER-COUNTRY INEQUALITY(COEFFICIENT OF VARIATION)
 IN TERMS OF BASIC NEEDS INDICATORS AND
 A COMPOSITE ECONOMIC INDEX, 1970-80

Index	1970	1980
Basic Needs: Overall	13.371	14.082
Nutrition	30.804	32.513
Health	16.236	18.911
Sanitation	26.014	25.988
Housing	8.425	8.117
Education	20.802	27.767
Economic: Overall	7.353	7.164

Note: The coefficient of variation for each index is derived by dividing the composite Wroclaw measures (MD values) by the corresponding standard deviations and the resulting scores are expressed in percentage terms for facilitating comparisons. These numbers can be interpreted in the same way as any other measure of inequality (i.e. the higher the values, the greater will be the extent of inequalities and vice versa).

of the C.V. of all the basic needs indices are conspicuously higher than the corresponding economic inequality index.⁸ Thus, for example, the C.V. of the overall basic needs index is approximately two times higher than the C.V. of the economic inequality index. Among the basic needs indices, inter-country disparities in nutritional standards seem to be the most extreme.⁹ The least international inequality appears to prevail in the case of housing.¹⁰

What is more important and germane to our study is the evidence that inter-country inequality in terms of a broad-based economic index has im-

⁸ This index is constructed by aggregating 66 economic indicators representing various components such as agriculture, industry, transport and communications, international trade, and so on. For a complete list of indicators, please refer to Khan (1986).

⁹ Ram's analysis showed that inter-country variations in nutritional standards were the lowest when compared to other basic needs indicators. This conclusion was based on only one measure: daily calorie intake as percentage of amount required. The use of a wider range of measures to depict nutritional standards apparently reverses this result.

¹⁰ It should be noted that in the case of housing there were several missing observations. Accordingly, data had to be estimated for such cases. This could have affected the results. The same reservation also applies to sanitation.

proved modestly. This has to be juxtaposed with the distressing trend of growing international inequality in terms of basic needs fulfillment. The exceptions are provided by sanitation and housing which show modest improvements.

IV. Concluding Remarks

It should be stressed that the inability to replicate Ram's findings do not necessarily constitute a refutation of the author's hypothesis. However, what our investigation demonstrates is that empirically-oriented propositions are invariably equivocal, sensitive to the nature of the data and perhaps even the methodology used. It only seems fair to maintain that the distressing evidence of growing international inequality in basic needs fulfillment needs to be verified by further investigations. Consistent sensitivity analysis utilising different data sets and a variety of methodologies are essential in allowing one to form firm perceptions on what is really happening to global inequality.

Appendix

List of Basic Needs Indicators

Nutrition:

- Dietary energy supply per capita in relation to nutritional requirements;
- Total calorie consumption as percent of requirement;
- Grams protein consumed per capita per day;
- Percent contribution of animal protein to total intake of protein;
- * Consumption of calories derived from cereals and starchy roots as percent of total calories consumed;

Health:

- * Crude death rate per 1,000 population;
- * Infant mortality rate;
- Expectation of life at birth;
- Hospital beds per 10,000 population;
- Doctors per 10,000 population;
- Dentists per 10,000 population;
- Pharmacists per 10,000 population;
- Nurses per 10,000 population;
- Midwifery personnel per 10,000 population;
- Proportion of third level enrolment in medical courses:

Sanitation:

- * Death rate due to infectious and parasitic diseases per 10,000 population;
- Dwellings with toilet as percent of all dwellings;
- Dwellings with piped water as percent of all dwellings;

Housing and related infrastructure:

- Average size of dwelling (rooms per dwelling);
- * Average number of persons per room;
- Dwellings with electricity as percent of all dwellings;
- Dwellings constructed per 1,000 population;
- Index number of construction activity;
- Passenger railway kilometers per capita;

* Considered 'retardant' to development and ascribed negative signs in Wrocław program specification.

Total road network per 100 population;
Per capita electricity consumption in kwh;

Education:

- * Percentage of illiteracy of adult population;
- * Percentage of female illiteracy;
First level enrolment ratio;
Second level enrolment ratio;
- * Student/teacher ratio at the first level;
- * Student/teacher ratio at the second level;
- Public expenditure on education as percent of GNP;

Basic Needs: Overall

- * Annual rate of growth of population;
- * Infant mortality rate;
Expectation of life at birth;
Hospital beds per 10,000 population;
- * Death rate due to infectious and parasitic diseases per 10,000 population;
- Dietary energy supply per capita in relation to nutritional requirements;
- Total calorie consumption as percent of requirement;
- Grams protein consumed per capita per day;
- * Percentage of illiteracy of adult population;
First level enrolment ratio;
Second level enrolment ratio;
- Public expenditure on education as percent of GNP;
- Dwellings with toilet as percent of all dwellings;
- Dwellings with piped water as percent of all dwellings;
- Dwellings with electricity as percent of all dwellings;
- Dwellings constructed per 1,000 population;
- Circulation of daily general-interest newspapers per 1,000 population;
- Number of radio sets per 1,000 population;
- Number of telephones per 100 population;
- Per capita GDP;

References

- Cowell, F.A., *Measuring Inequality*, Philip Allan, Oxford, 1977.
- Harbison, F.H., et al., *Quantitative Analysis of Modernization and Development*, Princeton University, New Jersey, 1970.
- Hicks, H. and P. Streeten, "Indicators of Development: The Search for a Basic Needs Yardstick," *World Development*, 7, 1979, 567-580.
- Khan, M.H., *Socioeconomic Development of ASEAN: An International Perspective*, Chopmen, Singapore, 1986.
- Leipziger, L. and M.A. Lewis, "Social Indicators, Growth and Distribution," *World Development*, 8, 1980, 299-302.
- Ram, R., "International Inequality in the Basic Needs Indicators," *Journal of Development Economics*, 10, 1982, 113-117.
- Streeten, P., et al., *First Things First: Meeting Basic Needs in Developing Countries*, Oxford University Press, Oxford, 1981.
- World Bank, *World Development Report*, Oxford University Press for the World Bank, 1980.
- Zerby, J.A. and M.H. Khan, "A Comparison of Multivariate Methods for Indexing Socio-Economic Development," *Singapore Economic Review*, 29, 1984, 46-66.