

ANNOTATIONS

STOCKWELL'S INFANT MORTALITY INDEX FOR MEASURING ECONOMIC DEVELOPMENT: A COMMENT¹

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EDWARD G. STOCKWELL constructed an index for measuring economic development based on infant mortality rates.³ Using 1949 data on thirty selected countries, the infant mortality index was chosen from among the seven indices he derived because it has "the highest negative correlation with annual per capita income."⁴

We have some reservations against single variable indices⁵ in general, and infant mortality in particular, as means of measuring economic development. In this brief comment, Mr. Stockwell's index will be discussed on three grounds:

- I. Empirical grounds:
 1. Reliability of data
 2. The sample
- II. Logical grounds: Validity of the index.
- III. Comparability with other indices.

¹ Edward G. Stockwell, *The Measurement of Economic Development*, *Economic Development and Cultural Change*, XIII, 4 (July, 1960), Part 1, pp. 419-432.

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³ Stockwell, *The measurement of Economic Development*, *op. cit.*

⁴ These seven indices are based on three variables and all possible combinations of them. The variables are: 1) crude birth rates, 2) crude death rates, 3) infant mortality rates, *ibid.*, pp. 424-425.

⁵ This is the term we are going to use for the indices constructed from one variable only. The other alternative is the multi-variate indices constructed on the basis of more than one variable which will be mentioned later in the discussion.

I. EMPIRICAL GROUNDS

1.1 *Reliability of Data*: Stockwell chose to use infant mortality rates in measuring economic development because

Table 1. Distribution of countries by continent.

CONTINENT	NUMBER OF COUNTRIES
Europe	16
Asia	4
South America	4
North America	3
Oceania	2
Africa	1
TOTAL	30

... although statistics relating to national income, industrial and agricultural production, employment, transportation and communication facilities, etc., are generally available in the economically advanced countries of the world, such information is

usually quite deficient or even entirely absent in the less developed nations.⁶

In other words, he assumed that the data available on infant mortality in "the less developed nations" are more reliable and easy to obtain than data on other economic variables. Actually, our knowledge and experience with underdeveloped countries indicates that vital statistics are still among the least reliable data in those areas.

Under-reporting in health statistics is one of the major problems in underdeveloped countries, particularly in the rural areas. Birth registration and death reporting are sometimes avoided, the first to escape the compulsory military service and the latter to avoid the inspection of the health department on cause of death. Infant mortality frequently is not reported, especially when the birth has not been registered. Moreover, the local health authorities sometimes contribute deliberately to the inaccuracy of vital statistics, particularly infant mortality rates.⁷

⁶ Stockwell, p. 419.

⁷ This I discovered from a health officer in an underdeveloped country during a discussion about under-reporting of infant deaths. Apart from being low, infant mortality rates were also stable over time. He said that they intentionally try to stabilize infant mortality rates from month to month, and from one year to another. Infant deaths are not recorded by the date they occur; instead, they are shifted from one

1.2. *The Sample:* The thirty countries Stockwell used in constructing the index do not represent the major areas of the world. The distribution of these countries by continent is shown in Table 1.

It can be seen that the countries included from Europe constitute 53 per cent of the total number of countries in the sample. In fact, the sample failed to include those countries in Africa and Asia with which the index should be mainly concerned. Thus an index built on such a limited, non-representative sample could not be relied on to measure economic development of all the countries.

II. LOGICAL GROUNDS

The Validity of the Index

If we now turn to Mr. Stockwell's argument and examine his logic in establishing the validity of his index, we find that he fell into the error of circular reasoning. His rationale in validating the index goes as follows:

- 1) He assumed the existence of a general historical inverse relationship between the seven demographic indices and a nation's level of economic development.⁸
- 2) The index based on infant mortality rates was chosen on the grounds that it has the highest negative correlation with annual per capita income.⁹
- 3) The index thus chosen was used to classify the thirty countries into three broad economic status groups.
- 4) The validity of the index was then established by showing "a marked inverse relationship between the three economic

month to another in order to get stable rates over a period of time. The reason is that if the health department reported a high rate in one month, the health authorities will be concerned with that and suspect the existence of an epidemic. They will start wide investigations in the area, which the health officer tries to avoid. This is only one example of many which contribute to the inaccuracy of health statistics in underdeveloped areas and, in fact, some of these countries simply try to estimate the amount of under-reporting.

⁸ "The general historical tendency has been for these measures to be inversely related to [a] nation's economic level of development." Stockwell, p. 424. This statement in itself needs support.

⁹ Correlation coefficient = $-.85$.

status groups and the average per capita income of all the countries within each group."¹⁰

We might go along with Stockwell and accept the assumption in (1), and consequently the result mentioned in (2). Turning to the criteria of validity in (4), we find that it follows directly from the result in (2). An index which is chosen because it has the highest negative correlation with annual per capita income is bound to classify countries inversely to their average annual per capita income or any variant of it. In other words, the criteria adopted for validation follows directly from his assumptions. It is not "deducible from the perceptions of the normal human being," as specified by Karl Pearson's definition of validity.¹¹

The circularity in Mr. Stockwell's reasoning could be seen more clearly by breaking down his argument and getting the relationship between the validity of his deductive argument and the truth-values of its statement-units. E. A. Adams defines validity as follows: "a *valid* deductive argument is one that is (not merely purports to be) such that it *is* logically impossible for the premises to be true and the conclusions false; that is, *the conclusion is necessarily true in relation to the truth of premises.*"¹² Following this definition we restate Mr. Stockwell's argument as follows:

First premise: demographic indices tend, in general, to be inversely related to a nation's level of economic development.

Second premise: the infant mortality index (one of the seven demographic indices) has the highest negative correlation with annual per capita income.

Conclusion: thus infant mortality index is the "best" demographic indicator of economic development.

The first premise might be historically true—although this has to be established, and the second premise is also true (for

¹⁰ Stockwell, p. 426.

¹¹ "In order that a conception may have scientific validity, it must be self consistent, and deducible from the perceptions of the normal human being." *In THE GRAMMAR OF SCIENCE*, (New York: The Meridian Library, 1957), p. 53.

¹² *In THE FUNDAMENTALS OF GENERAL LOGIC*, (New York: Longmans, Green and Co., 1959), p. 31.

that particular sample of thirty countries), but the conclusion does not follow from the premises. It might be false in spite of the truth of the premises. It needs validation, and to do that by using the index chosen to classify the thirty countries into three broad economic status groups, and show the marked inverse relationship between this classification and the average per capita income of all the countries within each group is merely repeating the second premise. It does not establish the validity of that index.

III. COMPARABILITY WITH OTHER INDICES

As we pointed out before, Stockwell's infant mortality index belongs to the group of single-variable indices. This has been the dominant approach in the literature for a long time. Some economists used economic variables, others preferred indirect economic variables in constructing such indices. The two main criticisms that could be launched against this approach in general are:

- 1) lack of comprehensiveness, because the variable chosen may not express or reflect the many aspects of economic development;
- 2) unreal fluctuations, because the variable used is sometimes subject to short term fluctuations which may be due to external factors not pertaining to economic development.

Therefore there has been a recent tendency towards adopting the multi-variate approach. In this approach more than one variable is taken together to indicate the degree of economic development. However, some of the single-variable indices could be considered a first approximation. Their reliability depends on the degree to which the variables chosen are affected by economic development. We still believe that infant mortality does not belong to that category. To verify that, we are going to compare Stockwell's index with per capita income index (one which is considered a traditional single-variable index) for measuring economic development. Stockwell chose his index because it has the highest negative correlation with per capita income. Thus a classification of countries based on an infant mortality index would not be expected to differ a

great deal from a classification according to per capita income.

Eugene Staley¹³ provided a classification of 101 countries into three classes: highly developed, intermediate and under-

Table 2. Comparative classification of 30 countries.

	STOCKWELL'S INFANT MORTALITY INDEX	STALEY'S PER CAPITA INCOME INDEX
GROUP I DEVELOPED COUNTRIES	Australia Canada Denmark *Finland Netherlands New Zealand Norway Sweden Switzerland United Kingdom United States	Australia *Belgium Canada Denmark *France Netherlands New Zealand Norway Sweden Switzerland United Kingdom United States
GROUP II INTERMEDIATE COUNTRIES	Argentina Austria *Belgium Czechoslovakia *France Italy Japan	Argentina Austria *Chile Czechoslovakia *Finland *Hungary Italy Japan *Poland *Portugal *Venezuela
GROUP III UNDERDEVELOPED COUNTRIES	*Chile Ecuador *Hungary India Mexico Pakistan Philippines *Poland *Portugal U.A.R. (Egypt) *Venezuela Yugoslavia	Ecuador India Mexico Pakistan Philippines U.A.R. (Egypt) Yugoslavia

* Countries on the placement of which the two indices disagree.

¹³ Eugene Staley, *THE FUTURE OF UNDERDEVELOPED COUNTRIES*, (New York: Harper & Brothers, New York, 1954), pp. 14-18.

STALEY'S INDEX	STOCKWELL'S INDEX		
	Developed	Intermediate	Underdeveloped
Developed	10	2	0
Intermediate	1	5	5
Underdeveloped	0	0	7

Table 3. Matrix of agreement between the two indices.

developed.¹⁴ This classification is based mainly on per capita income of 1950 or there about. Table 2 shows Stockwell's classification according to infant mortality rates of the thirty countries he used in constructing his index as compared to Staley's classification of the same countries. There is marked difference in the grouping of countries. The two indices disagree on placing 27 per cent of the countries (eight countries), most of which fall outside the area of 'highly developed countries,' a large difference that cannot be ascribed to chance.

More can be seen from the matrix of agreement in Table 3. This matrix represents a cross-classification of the two indices by degree of development. All the countries should fall on the elements of the main diagonal if the two indices agree completely on the placing of the countries in the three groups. This is not the case as we can see from the matrix. The elements of the two diagonals next (above and below) to the main one represent a first difference. Such differences occur when a country is classified in a group by one index and in an adjacent one by another. All the differences that occur are of this type. No second differences¹⁵ occur between these two classifications. Naturally we didn't expect any first or second differences, because if infant mortality is a good indicator and "correlated highly with per capita income," no difference would have occurred.

From this comparison we can see that two single-variable

¹⁴ Estimated annual per capita income for highly developed countries is \$450 or more, from \$150 to \$450 for intermediate and less than \$150 for underdeveloped. *Ibid.*, p. 17.

¹⁵ This only occurs when a country is classified as developed by one index and underdeveloped by another or *vice versa*.

indices highly correlated do not provide the same classification of countries with respect to development. Thus it might be misleading sometimes to rely on a single variable in measuring economic development and it would be better to take more variables into consideration in constructing such indices.¹⁶

¹⁶ The author developed an index for measuring economic development using four variables: gross capital formation, share of agriculture in gross national product, degree of illiteracy and infant mortality rates. For a detailed discussion of that index, see, "On the Measurement of Economic Development Using Scalogram Analysis," unpublished study by the author, 1961.