

The Human Development Index: Yet Another Redundant Composite Development Indicator?

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Summary. — In its *Human Development Report 1990*, the United Nations Development Program (UNDP) proposes yet another composite indicator of development levels: the “human development index” (HDI). The HDI assesses intercountry development levels on the basis of three so-called deprivation indicators: life expectancy, adult literacy and the logarithm of purchasing power adjusted per capita GDP. Using simple statistical analysis, this paper questions both the composition of the HDI and its usefulness as a new index of development. It concludes that the HDI is both flawed in its composition and, like a number of its predecessors, fails to provide insights into intercountry development level comparisons which preexisting indicators, including GNP per capita, alone cannot.

1. INTRODUCTION

Few issues have aroused the intensity and longevity of debate as that concerning the appropriateness of GNP per capita as a development indicator.¹ While GNP per capita remains the most widely used indicator of the level of development in terms of intertemporal and intercountry comparisons, critics have repeatedly and often fashionably argued that development levels ought not be assessed by income measures alone and that one must take into account social and human welfare criteria. Of course, the nucleus of concern is the very assumption on which the use of GNP per capita is premised: that there is a systematic positive relationship between GNP per capita and social and human welfare. It is not therefore surprising that we have witnessed numerous attempts to construct composite development level indices intended to either replace or complement GNP per capita.² Such indices include the Drewnowski and Scott (1966) “level of living index,” the McGranahan *et al.* (1972) “development index,” and the Morris (1979) “physical quality of life index” (PQLI). While generally held to be ideologically sound, these indices have proved to be largely redundant in the sense that their observed values have been shown to exhibit positive, and statistically significant, correlations with GNP per capita.³ Therefore, these indices have failed to reveal what GNP per capita alone cannot reveal.

With the release of its *Human Development*

Report 1990, the United Nations Development Program (UNDP) has also attempted, some would say naively, to divert attention away from the exclusive use of income measures to assess development levels. It proposes yet another composite indicator, the so-called human development index (HDI), which assesses achieved development levels based on life expectancy, adult literacy, and purchasing power adjusted GDP per capita. Indeed, after calculating HDI values for 152 countries, the UNDP claims, albeit on somewhat selective and superficial evidence, that the index “ranks countries very differently from the way GNP per capita ranks them” (UNDP, 1990, p. 14).

This paper examines both the composition and usefulness of the HDI as a composite development indicator using simple statistical analysis. The issue under consideration is whether the HDI offers insights into intercountry development levels which preexisting indicators cannot. The preexisting indicators chosen are the three HDI component variables and, perhaps more interestingly given the UNDP’s previously mentioned claim, GNP per capita. Results obtained from this paper’s statistical analysis, which are based on various country samples, suggest that

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the HDI generally reveals little more than any one of the preexisting development indicators alone reveals. Notwithstanding occasionally large differences between GNP per capita and HDI rankings among countries,⁴ the HDI's contribution to the assessment of intercountry development levels is therefore questioned and the above-mentioned UNDP claim not entirely supported. Above all, the HDI is largely judged as yet another redundant composite development indicator.

2. THE HUMAN DEVELOPMENT INDEX

It is first necessary to identify the workings of the HDI and its components. For some country j , HDI is formally defined as follows:

$$\text{HDI}_j = 1 - \left(\frac{\sum_{i=1}^k I_{ij}/k}{k} \right) \quad (1)$$

where I_{ij} is the i th indicator of human deprivation in country j , $i = 1, \dots, k$ and $j = 1, \dots, l$. Country j 's deprivation is assessed on the basis of the following variables: life expectancy, adult literacy, and the logarithm of purchasing power adjusted GDP per capita. The latter serves as a proxy for "income for a decent standard of living" (UNDP, 1990, p. 13). Deprivation is treated as a relative concept by scaling these variables within the range of zero to one using the equation:

$$I_{ij} = \left(\frac{(X_i^* - X_{ij})}{(X_i^* - X_i^m)} \right) \quad (2)$$

where X_i^* is a subjectively chosen desired value of the i th variable, X_{ij} is the actual value of the i th variable for country j and X_i^m is the actual minimum value among l countries. If some country attains the desired value of the i th variable, an absence of relative deprivation is said to exist and, in turn, a desired level of human development with respect to that variable is achieved. If this is the case, then it follows that X_i^* equals X_{ij} and I_{ij} equals zero. If the j th country achieves the desired values of each of the X_i 's, then the I_i 's average to zero and the value of the HDI takes its maximum value of one. It also follows that the greater the gap between the three X_i 's and the corresponding X_i 's of the j th country, the lower is the value of that country's HDI and the lower is its assessed level of human development. The index reaches its minimum value of zero if country j exhibits X_i^m for each of

the X_i 's, indicating maximum relative deprivation and minimum human development.

In calculating HDI values of 130 countries (those with populations of at least one million people) the UNDP's desired value for life expectancy is 78 years, which is that achieved by Japan in 1987, while that for adult literacy is a rate of 100%. For purchasing power adjusted per capita GDP, the corresponding value is \$4,861, which is the average official poverty line income in nine industrial countries.⁵ For actual life expectancy and GDP, 1987 data are used, while 1985 data are used for adult literacy.⁶

3. STATISTICAL ANALYSIS

We now turn to the question of the HDI's redundancy as a development indicator by investigating the intensity of association between the HDI and each of its component variables as measured by zero-order (or simple) and rank-order correlation coefficients. If a significant positive correlation exists between the HDI and any one of its components, then the former reveals few additional insights into intercountry development levels and, as such, can be viewed as redundant. The degree of redundancy is greater the closer a given coefficient is to one. Conversely, an absence of such a correlation deems the HDI a useful new indicator. Of course, this analysis also implicitly critiques the composition of the HDI itself. Intuitively, a necessary, although not sufficient, property of a "good" composite indicator is that its components are themselves insignificantly correlated. It is not sufficient in the sense that combining uncorrelated variables can still produce values which are correlated with any one of these variables individually.

Correlation coefficients were calculated using a sample comprising the 130 previously mentioned countries, together with subsamples separately comprising those countries classified by the UNDP as low, medium and high human development countries (LHD, MHD and HHD respectively) and those separately classified as developing and industrial countries.⁷ Each of the HDI's component (or input) variables was first scaled according to the procedure described by equation (2) and then subtracted from one. This is, of course, no more than decomposing the HDI by setting k equal to one and recalculating using each of the input variables individually. Exceptions to this were the GDPs per capita of industrial countries. All but five of these countries' GDPs per capita were in excess of the corresponding desired value and, given the UNDP's treatment of this (as discussed in note

Table 1. Zero-order correlation coefficients between HDI variables

Variables	Low Human Development Countries (n = 44)	Medium Human Development Countries (n = 40)	High Human Development Countries (n = 46)	Developing Countries (n = 99)	Industrial Countries (n = 31)	All Countries (n = 130)
HDI & Life Expectancy	0.739*	0.792*	0.780*	0.950*	0.767*	0.968*
HDI & Adult Literacy	0.695*	0.541*	0.780*	0.879*	0.726*	0.922*
HDI & GDP per capita	0.531*	0.534*	0.650*	0.891*	0.915*	0.925*
Life Expectancy & Adult Literacy	0.324†	0.212	0.350†	0.763*	0.288	0.846*
Life Expectancy & GDP per capita	0.394*	0.314†	0.317†	0.827*	0.779*	0.880*
Adult Literacy & GDP per capita	-0.135	-0.283	0.306†	0.609*	0.648*	0.736*

*Significant at the 99% level.

†Significant at the 95% level.

Two-tailed *t* test employed. All input variables are expressed as one minus their scaled values with the exception of GDPs per capita of industrial countries. GDPs per capita are purchasing power adjusted and were converted to logarithms. All data used in calculation of coefficients taken from UNDP (1990).

Table 2. Spearman rank-order correlation coefficients between HDI variables

Variables	Low Human Development Countries (n = 44)	Medium Human Development Countries (n = 40)	High Human Development Countries (n = 46)	Developing Countries (n = 99)	Industrial Countries (n = 31)	All Countries (n = 130)
HDI & Life Expectancy	0.799*	0.774*	0.819*	0.951*	0.871*	0.971*
HDI & Adult Literacy	0.717*	0.572*	0.761*	0.880*	0.640*	0.938*
HDI & GDP per capita	0.518*	0.464*	0.368*	0.883*	0.846*	0.893*
Life Expectancy & Adult Literacy	0.397*	0.246	0.396*	0.767*	0.283	0.867*
Life Expectancy & GDP per capita	0.378*	0.299	0.355†	0.831*	0.735*	0.859*
Adult Literacy & GDP per capita	-0.086	-0.255	0.196	0.607*	0.517*	0.743*

*Significant at the 99% level.

†Significant at the 95% level.

Two-tailed *t* test employed. All input variables are expressed as one minus their scaled values with the exception of GDPs per capita of industrial countries. GDPs per capita are purchasing power adjusted and were converted to logarithms. All data used in calculation of coefficients taken from UNDP (1990).

6), were set equal to zero. For these countries, actual logarithmic rather than scaled logarithmic GDPs per capita were used.

The resulting zero- and rank-order correlation coefficients are shown respectively in Tables 1 and 2. The most striking feature of these coefficients is the indicated redundancy of the HDI *vis-à-vis* its individual components in terms of both values and rankings. Without exception and irrespective of the sample employed, the corresponding zero- and rank-order coefficients are both positive and statistically significant at the 99% or greater level of confidence and in many cases approach one. The zero-order coefficients range from 0.531 to 0.968 in the respective instances of GDP per capita for the LHD subsample and life expectancy for the full sample of 130 countries. The rank-order coefficients range from 0.368 to 0.971, which are those corresponding to GDP per capita for the HHD subsample and life expectancy for the full sample respectively. It ought, however, to be emphasized that these coefficients do not necessarily imply that the individual components themselves are similarly correlated and, therefore, redundant. As shown in Tables 1 and 2, correlation coefficients between these variables point to this, albeit in the minority of instances. This is especially the case with adult literacy and GDP per capita for the LHD and MHD subsamples and each of the

input variables for the MHD subsample as their zero- and rank-order coefficients are statistically insignificant. Notwithstanding these coefficients, taking the arithmetic mean of these variables yields results which provide few additional insights into intercountry development levels.

We now consider the issue of the HDI's redundancy *vis-à-vis* GNP per capita using the methodology outlined above. Together with calculating zero- and rank-order coefficients between the HDI and GNP per capita, coefficients between the latter and the HDI's component variables were also calculated. Both GNP per capita and its logarithm were employed. Although generally smaller due to the occasional unavailability of GNP data, the previous country samples were utilized together with separate subsamples consisting of countries classified as low, middle and high-income countries (LIC, MIC and HIC respectively).⁸ As is well-known, countries are assigned these classifications on the basis of their GNPs per capita. HDI input variables, except the GDPs per capita of the industrial and high-income countries (the latter all recorded GDP values greater than the desired value), were again expressed as one minus their scaled values. No attempt was made to scale GNP per capita data.

Results are reported in Tables 3 and 4. From the full sample of 119 countries, we observe

Table 3. Zero-order correlation coefficients between HDI variables and GNP per capita

Variables	Low Human Development Countries (n = 40)	Medium Human Development Countries (n = 34)	High Human Development Countries (n = 45)	Low Income Countries (n = 39)	Middle Income Countries (n = 54)	High Income Countries (n = 26)	Developing Countries (n = 79)	Industrial Countries (n = 27)	All Countries (n = 119)
HDI & GNP per capita	0.475*	0.203	0.676*	0.276	0.464*	0.216	0.551*	0.805*	0.646*
HDI & GNP per capita†	0.458*	0.309	0.748*	0.278	0.621*	0.242	0.746*	0.884*	0.859*
Life Expectancy & GNP per capita	0.235	0.204	0.730*	0.271	0.354*	0.354	0.457*	0.749*	0.669*
Life Expectancy & GNP per capita†	0.281	0.226	0.744*	0.294	0.502*	0.374	0.660*	0.787*	0.845*
Adult Literacy & GNP per capita	0.118	0.378‡	0.337‡	0.001	0.285‡	0.127	0.322*	0.506*	0.536*
Adult Literacy & GNP per capita†	0.035	0.435*	0.389*	0.012	0.431*	0.154	0.477*	0.589*	0.702*
GDP per capita & GNP per capita	0.658*	0.575*	0.470*	0.521*	0.662*	0.918*	0.703*	0.834*	0.623*
GDP per capita & GNP per capita†	0.692*	0.811*	0.596*	0.520*	0.790*	0.968*	0.875*	0.864*	0.888*

*Significant at the 99% level.

†Expressed as a logarithm.

‡Significant at the 95% level.

†Two-tailed t test employed. All HDI input variables are expressed as one minus their scaled values with the exception of GDPs per capita of industrial and high-income countries. GDPs per capita are purchasing power adjusted and were converted to logarithms. All data used in calculation of coefficients taken from UNDP (1990).

Table 4. Spearman rank-order correlation coefficients between HDI variables and GNP per capita

Variables	Low Human Development Countries (n = 40)	Medium Human Development Countries (n = 34)	High Human Development Countries (n = 45)	Low Income Countries (n = 39)	Middle Income Countries (n = 54)	High Income Countries (n = 26)	Developing Countries (n = 79)	Industrial Countries (n = 27)	All Countries (n = 119)
HDI &	0.451*	0.317	0.785*	0.301	0.647*	0.469*	0.770*	0.856*	0.889*
GNP per capita									
Life Expectancy &	0.265	0.161	0.757*	0.284	0.541*	0.353	0.688*	0.734*	0.862*
GNP per capita									
Adult Literacy &	0.062	0.337	0.594*	0.051	0.511*	0.076	0.506*	0.431*	0.754*
GNP per capita									
GDP per capita &	0.684*	0.833*	0.460*	0.518*	0.811*	0.804*	0.886*	0.965*	0.913*
GNP per capita									

*Significant at the 99% level.

Two-tailed *t* test employed. All HDI input variables are expressed as one minus their scaled values with the exception of GDPs per capita of industrial and high-income countries. GDPs per capita are purchasing power adjusted and were converted to logarithms. All data used in calculation of coefficients taken from UNDP (1990).

positive and often very large zero- and rank-order coefficients between the HDI and GNP per capita. Indeed, these coefficients, irrespective of whether actual or logarithmic values of GNP per capita are employed, are significant at the 99% confidence level or greater. Similar results were obtained from the industrial, developing, middle-income, HHD and LHD subsamples as all of the corresponding zero- and rank-order coefficients are both positive and significant at the 99% level of confidence. While positive, the zero-order coefficients between GNP per capita and the HDI obtained from the MHD, LIC and HIC subsamples are statistically insignificant. In contrast, however the corresponding rank-order coefficient obtained from the HIC sub-sample is both positive and significant. Indeed, of the nine rank-order coefficients between GNP per capita and the HDI reported in Table 4, seven are statistically significant. One can, therefore, justifiably suggest that the HDI generally ranks countries in a manner not dissimilar from the way GNP per capita ranks them.

Finally, it is also pertinent to briefly note that GNP per capita is positively correlated with each of the HDI's component variables. In the majority of cases reported in Tables 3 and 4, especially the full sample and industrial, developing, middle-income and HHD country subsamples, the correlation coefficients are significant at either the 95 or 99% confidence levels. These correlations would seem to lie at the heart of the indicated redundancy, both in terms of rankings and values, of the HDI *vis-à-vis* GNP per capita.

4. CONCLUSION

This paper has questioned both the composition and usefulness of yet another composite development indicator, the UNDP's human de-

velopment index. On the basis of the results of a statistical analysis reported in this paper, the following conclusions have emerged: (a) the composition of the index is flawed as it is significantly and positively correlated with each of its component variables individually; (b) as a consequence, assessing intercountry development levels on any one of these variables yields similar results to those that the index itself yields, and more profoundly; (c) with the exception of a minority of country groups, the index largely provides us with little more information regarding intercountry development levels than the more traditional indicator, GNP per capita, alone provides. Conclusions (b) and (c) lead to the assessment that the UNDP's index is yet another redundant composite intercountry development indicator.

Finally, it ought to be emphasized that this paper does not imply that social or human conditions are irrelevant to the assessment of development levels. Nor does it imply a causal relationship between income per capita and these conditions. The issue of causality far exceeds the scope of the simple statistical tests employed in this paper. It does, however, imply that the human development index more effectively serves to provide an ideological statement rather than new insights into intercountry development levels. Moreover, it also somewhat paradoxically implies that a lesson learned from the human development index is that these insights might only be gained via the utilization of development indicators radically different from GNP per capita and those on which the UNDP's index is based. This, in turn, is contingent upon obtaining data on such indicators rather than finding new ways of expressing existing indicators. Presumably, only then will dissatisfaction with GNP per capita be truly put to rest. The motivation to seek such data may be the most effective contribution of the human development index.

NOTES

1. For the purposes of this paper, development refers to levels of, say, economic and social conditions rather than the rate of change in these conditions over time.
2. For an excellent, although now dated, survey of development indicators, see Hicks and Streeten (1979).
3. In the case of the PQLI, see Larson and Wilford (1979).
4. See UNDP (1990, p. 128, Table 1).
5. These countries are Australia, Canada, the Federal

Republic of Germany, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States.

6. While not central to the purpose of this paper, two comments concerning the mechanics of the index are in order. The first concerns the desired value of real GDP per capita of \$4,861. Of the countries for which the HDI is calculated, 43 recorded values in excess of this amount. Strictly speaking, given the formulation of equation (2), scaled values of the GDPs per capita of these countries would be less than zero. Given equation (1), it would consequently be theoretically possible for

a country's HDI to be greater than the "maximum" value of one. The UNDP recognizes this and its response is to set these countries' GDPs per capita to zero. Unless it can be shown that material living standards do not increase as GDP per capita exceeds \$4,861, the UNDP's response, given the formulation of equation (2), understates relative deprivation with respect to this variable and, in turn, overstates HDI values of all countries other than those with the highest and lowest GDPs per capita. This effect is greater the smaller the gap between any given country's GDP per capita and the highest GDP per capita of all countries. Since the index employs the average of three deprivation indicators, HDI rankings are distorted. The second comment also relates to equation (2) and concerns changes in HDI values over time. As the HDI measures relative development, by relating actual values of component variables to both desired and minimum values, a

country's index can change without any absolute improvement in these variables. This would occur if either the minimum or desired values change. For example, if the minimum value of life expectancy increased from one period to the next, this would decrease the value of the denominator of equation (2) and decrease the scaled values of other countries' life expectancies and thereby increasing their HDIs.

7. The UNDP respectively classifies LHD, MHD and HHD countries as those with HDI values of less than 0.500, within the range of 0.500-0.799 and equal to or greater than 0.800. For lists of countries belonging to these and the developing and industrial country classifications, see UNDP (1990, pp. 185 and 188).

8. For LIC, MIC and HIC definitions and country lists, see UNDP (1990, p. 187).

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