The Operational Analysis of Human Development Index (HDI)

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Introduction

The Human Development Index (HDI) is a summary composite index that measures a country's average achievements in three basic aspects of human development: health, knowledge, and income. It was first developed by the late Pakistani economist Mahbub ul Haq with the collaboration of the Nobel laureate Amartya Sen and other leading development thinkers for the first Human Development Report in 1990. It was introduced as an alternative to conventional measures of national development, such as level of income and the rate of economic growth.

The HDI was created to emphasize that people and their capabilities should be the ultimate criteria for assessing the development of a country, not economic growth alone. The HDI can also be used to question national policy choices, asking how two countries with the same level of GNI per capita can end up with such different human development outcomes. For example, the Bahamas and New Zealand have similar levels of income per person, but life expectancy and expected years of schooling differ greatly between the two countries, resulting in New Zealand having a much higher HDI value than the Bahamas. These striking contrasts can directly stimulate debate about government policy priorities.

Revision of the Methodology of HDI

The original HDI methodology has been revised somewhat for this 20th anniversary edition of the Human Development Report in 2010. As in past Human Development Reports, the HDI remains a composite index that measures progress in the three basic dimensions—health, knowledge and income. Under the previous HDI formula, health was measured by life expectancy at birth; education or "knowledge" by a combination of the adult literacy rate and school enrolment rates (for primary through university years); and income or standard of living by GDP per capita adjusted for purchasing-power parity (PPP US$). Health is still measured by life expectancy at birth. But the 2010 HDI measures achievement in knowledge by combining the expected years of schooling for a school-age child in a country today with the mean years of prior schooling for adults aged 25 and older. The income measurement, meanwhile, has changed from purchasing-power-adjusted per capita Gross Domestic Product (GDP) to purchasing-power-adjusted per capita Gross National Income (GNI); GNI includes remittances and foreign assistance income, for example, providing a more accurate economic picture of many developing countries.

In the 2010 HDI measures the indicators for measuring education and income were changed for several reasons. For example, adult literacy used in the old HDI (which is simply a binary variable – literate or illiterate, with no gradations) is an insufficient measure for getting a complete picture of knowledge achievements. By including average years of schooling and expected years of schooling, one can better capture the level of education and recent changes.

Gross Domestic Product (GDP) is the monetary value of goods and services produced in a country irrespective of how much is re-

tained in the country. Gross National Income (GNI) expresses the income accrued to residents of a country, including international flows such as remittances and aid, and excluding income generated in the country but repatriated abroad. Thus, GNI is a more accurate measure of a country's economic welfare. As shown in the Report, large differences could exist between the income of a country's residents, measured by GNI or GDP.

Previously, the HDI had a form of the arithmetic mean of dimension indices obtained from the corresponding indicators by normalization using the fixed minima and maxima. The normalisation refers to the transformation of indicators expressed in different units to the unit-less quantities taking values between 0 and 1. But the HDI compiled in 2010 has a form of geometric mean of dimension indices obtained from the indicators by normalization based on minima and maxima observed over the period for which the HDI has been computed and reported. Thus, the previous 'cap' on the income component has been replaced in the 2010 HDI by an 'observed maximum' per capita income level. Adopting the geometric mean produces lower index values, with the largest changes occurring in countries with uneven development across dimensions. The geometric mean has only a moderate impact on HDI rankings.

Unlike the old HDI, the new HDI based on the geometric mean takes into account differences in achievement across dimensions. Poor performance in any dimension is now directly reflected in the new HDI, which captures how well a country's performance is across the three dimensions. There is no longer perfect substitutability across the dimensions. That is to say, a low achievement in one dimension is not anymore linearly compensated for by high achievement in another dimension. The geometric mean reduces the level of substitutability between dimensions and at the same time ensures that a 1 percent decline in say life expectancy at birth has the same impact on the HDI as a 1 percent decline in education or income. Thus, as a basis for comparisons of achievements, this method is also more respectful of the intrinsic differences across the dimensions than a simple average.

The new HDI uses the natural logarithm instead of the previously used logarithm with the base of 10. This minor change has no effect on the value of the income index and is motivated by the fact that most of the economic literature uses the natural logarithm of income. The caps in each dimension are lifted so one can say that they are equal to the observed maxima over the period (1980-2010) for which HDI trends are presented.

Morover in the new HDI the methodology for calculating the dimension sub-indices also changed. The dimension indicators are transformed using the maximum levels for all sub-components observed over the period for which HDI trends are presented (from 1980). The minimum levels for the dimension indicators are set as follows: life expectancy at 20 years; both education variables at 0; and GNI per capita at PPP $163, which is the observed minimum. The choice of minimum values is motivated by the principle of natural zeros below which there is no possibility for human development. As noted already, this way of normalizing has the effect of making the component sub-indices of these dimensions vary along the similar range. The rationale behind changing the minimum value for life expectancy at birth from 25 years to 20 is based on historical evidence (Maddison, 2010, and Riley, 2005)[1], which indicates 20 years as the minimum. If a society or a subgroup of society has a life expectancy below the typical age of reproduction, that society would die out. Lower values have occurred during some crises, such as the Rwandan genocide, but these were exceptional cases that were

not sustainable.

Generally, the minimum values are set to the values that a society needs to survive over time. For both education indicators, the minimum is set to 0 since societies can subsist without formal education. For income, it is set at $163 per capita GNI, which is the lowest value attained by any country in recent history (Zimbabwe in 2008) and corresponds to less than 45 cents a day (just over a third of the World Bank's $1.25 a day poverty line). The minimum values are essentially fixed. On the other hand the maximum values are observed over the period for which HDI trends are presented (from 1980), so while there might be year to year variation of the maximum values, the changes are not going to have any impact on ranks. This is because of the multiplicative form of the new HDI, which preserves the relative position of countries when maximum values change, although, the HDI values are affected by the choice of the normalizing parameters. Each year HDI trends are recalculated from 1980 based on consistent time series data and the new maximum values. In any case, the HDI is not meant to monitor progress in the short term—it takes time before policy interventions reflect on indicators such as mean years of schooling and life expectancy at birth. This is why HDI trends are provided in five-year intervals.

There are arguments for and against transforming the health and education variables to account for diminishing returns. It is true that health and education are not only of intrinsic value; they, like income, are instrumental to other dimensions of human development not included in the HDI (Sen 1999). Thus, their ability to be converted into other ends may likewise incur diminishing returns. The approach is to value each year of age or education equally, and therefore the principle has been applied only to the income indicator.

The new HDI assigns equal weight to all three dimension indices; the two education sub-indices are also weighted equally. This is different from the previous HDI, which weighted them differentially. The choice of weights is based on the normative judgement that all three dimensions are equally important. Research papers that provide a statistical justification for this approach include Noorkbakhsh (1998) and Decanq and Lugo (2009)[1]. The new HDI has more equal ranges of variation of dimension indices than the previous one, implying that the effective weighting is more equal than it was before.

Significance of Income in preparing HDI

Income is instrumental to human development, but the contribution diminishes as incomes rise. GDP in the previous HDI was capped at $40,000 and was logarithmically transformed. The original HDI placed this cap on income to reflect the view that beyond some upper set amount, additional income does not expand human development opportunities. A further consideration was that while literacy rates and school enrolment and life expectancy have 'natural' caps (100 percent, mortality limits, and so on forth), the highest incomes would continue rising, skewing the upper ranks of the HDI to increasingly income-driven values and rankings over time. There are other reasons why the cap on income is lifted. First, countries were increasingly bunched at the cap. This meant that we could not distinguish among an increasing number of countries at the top of the distribution. In 2007, the GDP of 13 countries exceeded the cap. Thus, the discriminatory power of capped income has been weakened, especially for discrimination between the very high developed countries. Second, it was not originally intended to be binding in the sense of totally disregarding additional income beyond a particular level. For example, the income cap of PPP$ 40,000 was not binding on countries when it was introduced in the mid-1990s but rather

was an upper bound used to normalize the income dimension index Third, the use of geometric mean intensifies the diminishing returns of the logarithmic transformation of GNI compared to the arithmetic mean. Fourth, and very importantly, the use of real maximum values instead of caps allows the resulting indices to vary in similar ranges so that their implicit weights are more similar than had been the case under the previous method.

Significance of the HDI

As a simple summary index, the HDI is designed to reflect average achievements in three basic aspects of human development – leading a long and healthy life, being knowledgeable and enjoying a decent standard of living. The policy of the Human Development Report Office has always been to construct additional complementary composite indices for covering some of the "missing" dimensions in the HDI. Gender disparity, inequality and human deprivation are measured by other indices (see Gender Inequality Index, Multidimensional Poverty Index and Inequality-adjusted HDI). Participation and other aspects of well-being are measured using a range of objective and subjective indicators and are discussed in the Report. Measurement issues related to these aspects of human development demonstrate the conceptual and methodological challenges that need to be further addressed.

Coverage of countries by HDI

The Human Development Report Office strives to include as many UN member countries as possible in the HDI. To include a country in the HDI we need recent, reliable, and comparable data for all three dimensions of the Index. For a country to be included, data ideally should be available from the relevant international data agencies. However, in comparison to 2009 fewer countries are covered in the 2010 HDI. HDI for 2010 has been calculated for 169 countries and territories. Countries not included

because of missing data for one or more components are: Antigua and Barbuda, Bhutan, Cuba, Dominica, Eritrea, Grenada, Lebanon, the Occupied Palestinian Territories, Oman, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Samoa, Seychelles and Vanuatu. Micronesia has entered the HDI table for the first time this year, while Zimbabwe has re-entered after not being included in 2009 due to missing income values.

Determinants of Country Coverage in HDI

Data availability determines HDI country coverage. Where reliable data are unavailable and there is significant uncertainty about the validity of existing data estimates, countries are excluded to ensure the credibility of the Human Development Report and the family of human development indices. There are four countries that have information on the other three HDI components but not on GNI: Cuba, Iraq, the Marshall Islands and Palau. In the past, GDP per capita (PPP US$) was estimated by the Center for International Comparisons of Production, Income and Prices (CICPIP) at the University of Pennsylvania to calculate the HDI for Cuba. These estimates rely on data from the salaries of international civil servants converted using the official exchange rate. However, because the markets in which foreigners purchase goods and services tend to be separated from the rest of the economy, such data can be an insufficient guide to prices faced by people in practice. The CICPIP recognizes this limitation and has graded the estimate of Cuba's GDP as a "D" — the lowest grade. This is why Cuba is not in this year's HDI.

Sources of data for HDI

Life expectancy at birth is provided by the UN Department of Economic and Social Affairs; mean years of schooling by Barro and Lee (2010); expected years of schooling by the UNESCO Institute for Statistics; and GNI per capita by the World Bank and the International

Monetary Fund. For few countries, mean years of schooling are estimated from nationally representative household surveys. Many data gaps still exist in even some very basic areas of human development indicators. While actively advocating for the improvement of human development data, as a principle and for practical reasons, the Human Development Report Office does not collect data directly from countries or make estimates to fill these data gaps in the Report.

The 2010 HDI attempts to make an assessment of 169 diverse countries and areas, with very different price levels. To compare economic statistics across countries, the data must first be converted into a common currency. Unlike market exchange rates, PPP (Purchasing Power Parity) rates of exchange allow this conversion to take account of price differences between countries. In that way GNI per capita (PPP US$) better reflects people's living standards. In theory, 1 PPP dollar (or international dollar) has the same purchasing power in the domestic economy of a country as US$1 has in the United States economy. The new PPP values have been used since 2008. The latest International Comparison Survey ICP, from which the PPPs are calculated, was done in 2005; 146 countries took part in the survey, which were 26 more than in the previous one. For further discussion on the PPP, see Human Development Indices – A statistical update 2008 (Section 2).

Mean years of schooling (MYS) for Andorra and Liechtenstein were based on the MYS of neighbouring countries Spain and Switzerland, respectively. For 25 countries, the MYS was estimated from nationally representative household surveys – UNICEF's Multiple Indicator Cluster Surveys MICS) Demographic and Health Surveys (DHS, and the World Bank's Income International Distribution Database.

Expected years of schooling were estimated by cross-country regression in three countries – Montenegro, Singapore and Turkmenistan.

Comparable data are not available for many countries for all components of the HDI before 1980; so 1980 is the first year for which the HDI was calculated. Estimates for some indicators are available before this time, such as life expectancy, which is available since 1950.

Conclusion

The concept of human development is much broader than can be captured in the HDI, or any other of the composite indices in the Human Development Report (Inequality-adjusted HDI, Gender Inequality Index and Multidimensional Poverty Index). The HDI, for example, does not reflect political participation or gender inequalities. The HDI and the other composite indices can only offer a broad proxy on some of the key issues of human development, gender disparity and human poverty. A fuller picture of a country's level of human development requires analysis of other indicators and information presented in the statistical annex of the report.

References
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