

3. Computing the human development index

The HDI is based on three indicators: longevity, as measured by life expectancy at birth; educational attainment, as measured by a combination of adult literacy (two-thirds weight) and combined primary, secondary and tertiary enrolment ratios (one-third weight); and standard of living, as measured by real GDP per capita (PPP\$).

For the construction of the index, fixed minimum and maximum values have been established for each of these indicators:

- Life expectancy at birth: 25 years and 85 years
- Adult literacy: 0% and 100%
- Combined enrolment ratio: 0% and 100%
- Real GDP per capita (PPP\$): PPP\$100 and PPP\$40,000.

Since *Human Development Report 1994*, two changes have been made in the construction of the HDI relating to variables and minimum and maximum values. First, the variable of mean years of schooling has been replaced by the combined primary, secondary and tertiary enrolment ratios, mainly because the formula for calculating mean years of schooling is complex and has enormous data requirements. Data on mean years of schooling are not provided by any UN agency or international organization. As a result, estimates must sometimes be used, which are not always acceptable. The combined enrolment ratio overcomes both these problems. It shows the stock of literacy quite easily for those under age 24. And it is based on the work of UNESCO.

Second, the minimum value of income has been revised from PPP\$200 to PPP\$100. This revision was made because in the construction of the gender-related development index (GDI) for different countries, the minimum observed value of female income of PPP\$100 is used as the lower goal post. It is necessary to use this fixed minimum for construction of the overall HDI to maintain consistency between the construction of the HDI and that of the GDI and to ensure comparability between the two indices. For the HDI, the revision is only marginal, and it had little effect on HDI values.

For any component of the HDI, individual indices can be computed according to the general formula:

$$\text{Index} = \frac{\text{Actual } x_i \text{ value} - \text{minimum } x_i \text{ value}}{\text{Maximum } x_i \text{ value} - \text{minimum } x_i \text{ value}}$$

If, for example, the life expectancy at birth in a country is 65 years, the index of life expectancy for this country would be:

$$\text{Life expectancy index} = \frac{65 - 25}{85 - 25} = \frac{40}{60} = 0.667$$

The construction of the income index is a little more complex. As explained in chapter 1, the world average income of PPP\$5,120 in 1992 is taken as the threshold level (y^*) and any income above this level is discounted using the following formula for the utility of income:

$$\begin{aligned} W(y) &= y^* \text{ for } 0 < y < y^* \\ &= y^* + 2[(y - y^*)^{1/2}] \text{ for } y^* \leq y \leq 2y^* \\ &= y^* + 2(y^{*1/2}) + 3[(y - 2y^*)^{1/3}] \text{ for } 2y^* \leq y \leq 3y^* \end{aligned}$$

To calculate the discounted value of the maximum income of PPP\$40,000, the following formula is used:

$$W(y) = y^* + 2(y^{*1/2}) + 3(y^{*1/3}) + 4(y^{*1/4}) + 5(y^{*1/5}) + 6(y^{*1/6}) + 7(y^{*1/7}) + 8[(40,000 - 7y^*)^{1/8}]$$

This is because PPP\$40,000 is between $7y^*$ and $8y^*$. With the above formulation, the discounted value of the maximum income of PPP\$40,000 is PPP\$5,448.

The actual construction of the HDI is illustrated with two examples—Greece, an industrial country, and Gabon, a developing country.

Country	Life expectancy (years)	Adult literacy (%)	Combined enrolment ratio (%)	Real GDP per capita (PPP\$)
Greece	77.6	93.8	78	8,310
Gabon	53.5	58.9	47	3,913

Life expectancy index

$$\text{Greece} = \frac{77.6 - 25}{85 - 25} = \frac{52.6}{60} = 0.876$$

$$\text{Gabon} = \frac{53.5 - 25}{85 - 25} = \frac{28.5}{60} = 0.475$$

Adult literacy index

$$\text{Greece} = \frac{93.8 - 0}{100 - 0} = \frac{93.8}{100} = 0.938$$

$$\text{Gabon} = \frac{58.9 - 0}{100 - 0} = \frac{58.9}{100} = 0.589$$

Combined primary, secondary and tertiary enrolment ratio index

$$\text{Greece} = \frac{78 - 0}{100 - 0} = 0.780$$

$$\text{Gabon} = \frac{47 - 0}{100 - 0} = 0.470$$

Educational attainment index

$$\text{Greece} = [2(0.938) + 1(0.780)] \div 3 = 0.885$$

$$\text{Gabon} = [2(0.589) + 1(0.470)] \div 3 = 0.549$$

Adjusted real GDP per capita (PPP\$) index

Greece's real GDP per capita, at PPP\$8,310, is above—but less than twice—the threshold. Thus, the adjusted

The method of income discounting used in technical note 3 is the same as that used in *Human Development Report 1992*. It draws on the work of Meghnad Desai.

real GDP per capita for Greece would be PPP\$5,233 because $5,233 = [5,120 + 2(8,310 - 5,120)1/2]$.

Gabon's real GDP per capita income, at PPP\$3,913, is less than the threshold, so it needs no adjustment.

The adjusted real GDP per capita (PPP\$) index for Greece and Gabon would be:

$$\text{Greece} = \frac{5,233 - 100}{5,448 - 100} = \frac{5,133}{5,348} = 0.960$$

$$\text{Gabon} = \frac{3,913 - 100}{5,449 - 100} = \frac{3,813}{5,348} = 0.713$$

Human development index

The HDI is a simple average of the life expectancy index, educational attainment index and the adjusted real GDP per capita (PPP\$) index. It is calculated by dividing the sum of these three indices by 3. The HDI of both Greece and Gabon are calculated using this formula:

Country	Life expectancy index	Educational attainment index	Adjusted real GDP per capita (PPP\$) index	Σ	HDI
Greece	0.876	0.885	0.960	2.721	0.907
Gabon	0.475	0.549	0.713	1.737	0.579