



Technical Notes

Human Development Index

The Human Development Index (HDI) is a composite index of human development in education, longevity or health, and in access to opportunities measured in per capita incomes, with the present status of districts in these parameters related with certain absolute achievement positions, or some desirable achievement positions. This index is a measure of how far a district has travelled, from a minimum level of achievement, and the path still left to travel.

The index is calculated by the following formula:

$$HDI_{ij} (\text{Index}) = \frac{\text{Target}_j - \text{Value}_{ij}}{\text{Target}_j - \text{Min}_j}$$

HDI_{ij} = Index of deprivation for the i^{th} district for the j^{th} criterion.

Target j = This is the maximum achievable target for the j^{th} criterion (for example, it is 100 percent for literacy).

Value ij = This is the value of the i^{th} district for the j^{th} criterion.

Min j = This is the minimum value for the j^{th} criterion (it is 0% for literacy)

Education

UNDP uses literacy rate as one of the two parameters. Recently it has changed the second indicator from mean years of schooling to school

enrolment. Both these are used as parameters for the education index.

Literacy denotes the most basic and essential criterion. Literacy levels are available for each district from the Census of India, 2001, and these figures were used for the index on literacy. Literacy rate for the population was calculated as percentage share of all literates in a district over the total population of people above 6 years in the district.

For the target maximum figure for the purpose of calculating the index of development in literacy, we use 100 percent. The minimum rate is taken as 0 percent.

The second component of education is the combined school level enrolment. Enrolment rates have been derived from data on enrolled children from the Directorate of Public Instruction (Schools) and estimated number of children in school going ages from population projections and age group based on Census of India 1991 and 2001.

The target maximum for this figure is difficult to assess, since the age group 6 – 14 includes ages at which many children would have passed out of the school after fully completing it, and would therefore not be counted. However, as we have no estimates to arrive at an acceptable figure for a target maximum for calculating the index of



deprivation in school enrolment, we use 100 percent as the target maximum, and 0 percent as the minimum.

The two indices of literacy and school level enrolment were combined to get the index of Deprivation for Education. The indices were combined in a weighted average, with 2/3 for literacy and 1/3 for all children in schools. A higher weight for literacy was taken to give importance to this most essential criterion and keeping in mind the problems of data in enrolment figures.

Health

Life expectancy is the single criteria used by the UNDP to assess health status. The Census of India has released fertility tables and estimates for infant mortality rates for 1991. The Census fertility tables for 1991 permit us to arrive at indirect estimates of life expectancy at birth for districts for 1991. The indirect estimates have been arrived at using the methodology applied by Census for calculating mortality tables for 1981.¹ These estimates are subject to corrections, after final fertility tables are released, and Census publishes estimates for life expectancy based on this data. Census has released estimates for child mortality, but is yet to publish estimates for expectancy of life at the time of the publication of this report.

The life expectancy at birth has been calculated using Census figures for fertility data on total number of children born and surviving of ever married women, given by the Census. Based on these data IMR is calculated using the methodology suggested by the Census of India. Mortpak Lite, a United Nation's programme for demography, was used for calculations. While the estimates for infant mortality match well with the 1991 Sample Registration Scheme (SRS) estimates, they are subject to modification, due

to a need to smoothen the population tables. Thus the estimates may become modified, but for the purpose of comparative analysis, and a fairly accurate picture of the status of longevity, the figures are very useful. Estimates are also provided for rural and urban and males and females. Estimates of male and female life expectancy were also calculated using widow techniques.

Estimates of life expectancy for districts from 1981 and 1991 were projected, and then sensitised to regional and state life expectancies projected by SRS to get estimates of life expectancy for 2001.

For the maximum target, a figure of 85 years was taken, and for the minimum value, a figure of 25 years was applied to calculate the Health Development Index.

Income

The UNDP HDI uses 'adjusted per capita income for countries' to calculate the index of income. For the Punjab income index the same criteria has been used. For district level incomes latest estimates have been calculated and provided by the Directorate of Economics and Statistics, Government of Punjab.

Adjusted Incomes

Estimates of per capita incomes alone do not give an idea of the distortions in distribution or the levels of poverty in the districts or the depth of deprivation of the poor. UNDP for their income component of the HDI, used Aitkinson's formula to adjust incomes, based upon marginal utility of incomes. This adjustment reduces the impact of very high incomes in some districts, and makes districts more comparable to each other to assess relative levels of achievement in incomes.

¹ The methodology has been taken from 'Indirect Estimates of Fertility and Mortality at the District Level', 1981, Occasional Paper No. 4 of 1994, Office of Registrar General of India.



However, the problem with this method is that it discounted incomes above a threshold level (minimum level) quite drastically. The UNDP HDI, now uses a different method of adjusting poverty. The same method has been used to discount incomes for district human development indices.

Income is discounted by using the following formula :

$$\text{Income Index} = \frac{\log y - \log y_{\min}}{\log y_{\max} - \log y_{\min}}$$

y : income of the district

y_{\min} : Minimum income

y_{\max} : Maximum target income

For a minimum income level, we took the minimum per capita income required to be above the poverty line.

The three indices of development for health, education and income are then combined in a simple average to get the Human Development Index.

Gender Development Index²

The Gender-related Development Index (GDI) uses the same variable as the HDI. The difference is that the GDI adjusts the average achievement of each district in life expectancy, education attainment and income in accordance with the degree of disparity in achievement between males and females. This is based on the GDI developed by UNDP, used first in the Human Development Report in 1995.

For a gender sensitive adjustment, we use a weighting formula that expresses a moderate aversion to inequality, setting the weighting

parameter ϵ equal to 2. This is the harmonic mean of the male and the female values.

The harmonic mean is calculated by taking the reciprocal of the population weighted arithmetic mean of female and male achievement levels (which are themselves expressed in reciprocal form). Although this may sound complicated, the principle is fairly straightforward. The harmonic mean will be less than the arithmetic mean to the degree that there is disparity between male and female achievement.

Longevity

The first step in the calculation of GDI is to index the variable for life expectancy and education attainment. The estimates for life expectancy were calculated using Census of India 1991 fertility tables and projected to 2001, as explained earlier in this chapter. Although the range for life expectancy is the same for women and men (60 years), the maximum and the minimum values are different. The value (or “fixed goal post”) for male life expectancy is 82.5 years and the minimum value is 22.5 years. For female life expectancy the maximum value is 87.5 years and the minimum 22.5 years. The values for women and men are indexed accordingly.

Educational Attainment

The variable for educational attainment is a composite index. It includes adult literacy, with a 2/3 weight, and gross combined primary, secondary and tertiary enrolment with a 1/3 weight. Each of these sub-components is indexed separately. Both indices use a maximum value of 100 percent and a minimum value of 0 percent. The two indices are added together with the appropriate weights to form the composite index for educational attainment.

² This note has been taken from the Technical Notes describing the methodology for Gender Development Index from the Human Development Report – 1995, Technical notes 1. Computing gender-equity-sensitive indicators, UNDP

Incomes

The calculation of the index for income is more complicated. In calculating female and male shares of earned income, we used two pieces of information: the ratio of the average female wage to the average male wage and the female and male percentage shares of the economically active population aged 15 and above.

The ratio of the average female wage to the average male wage is not available for the state or the districts. The ratio is assumed to be the average ratio for the agricultural sector as well. The ratio of female to male was assumed to average at 67% based upon some recently conducted poverty assessment surveys.

The ratio is crude proxy for gender income differentials in paid work. These approximations for wages need to be improved and assessed for each district, but due to lack of proper information for all districts, the same ratio was applied across the state. Apart from a possible underestimation of the male-female wage differential, the figure of 67 percent also does not account for the fact that the numbers of women are greater as casual labour and as marginal workers, working for less than 183 days a year. Men on the other hand work primarily as main workers (gainfully employed for 183 days or more per year). The ratio of 67% also does not account for income disparities based on non-labour resources, such as land and physical capital. However, in the absence of better data we use this figure.

The next step in calculating gender disparity in income uses available information on the percentage share of men and women in the economically active population aged 15 and above. Because of the lack of data on employment of gender, this procedure makes the simplifying assumption that female employment and male employment are proportional to female and male participation in labour force. We have two choices

here : one is to consider the workforce participation ratio (WPR), which includes main and marginal workers, and the second is to consider only main workers, where the ratio of male to female main workers is very high. We choose to take main and marginal workers, for the sake of corresponding to the general WPR terms used to assess participation of people in the workforce. From the ratio of female to male wages we can derive two ratio: the ratio of the female wage to the overall average wage and the ratio of the male wage.

These total ratios are derived from the following definition of the total wage bill (WL):

$$WL = W_f L_f + W_m L_m$$

where W is the average wage and L is the total labour force, and the f subscript denote female, and m subscript denotes male.

Dividing the equation through by $W_m L$, we can solve for W/W_m

$$W/W_m = (W_f/W_m) (L_f/L) + (W_m/W_m) (L_m/L)$$

we take the reciprocal of this result to solve for W_m/W . We can now also solve for W_f/W

$$W_f/W = (W_f/W_m) / (W/W_m)$$

A rough estimate of the female share of income can then be derived by multiplying the ratio of the average female wage to the overall average wage of the female share of the economically active population. The male share of income can be calculated in the same way or by subtracting female share from 1.

The third step in estimating disparities in income is to calculate the female and the male share of the population. The adjusted per capita incomes are then discounted on the basis of the gender disparity in proportional income share. In using



adjusted per capita incomes, we are already taking into account the diminishing marginal importance for human development of the additional income above the average world per capita income. Up to this point, the methodology is the same as that used for the human development index.

The discounting for the gender disparity is calculated as follows. We form two proportional income shares by dividing the female and male shares of income by the female and male shares of the population. If there were gender equality, each proportional share would be equal to 1. We have to apply the gender-equity-sensitive indicators (GESI) methodology of (1- ϵ) averaging - with equal to 2 in this case - to the two proportional income shares to derive the "equally distributed proportional income share". The more gender inequality there is, the lower this ratio will be related to 1. We then multiply the adjusted per capita incomes by the equally distributed proportional income share to derive a measure of per capita income that, in effect, is now discounted for gender inequality. If there were no gender inequality, the ratio would be equal to 1 and per capita incomes would remain the same. As in the HDI, adjusted per capita income is proxy for

access to basic resource necessary for human development. Finally, we index the adjusted per capita incomes for men and women with respect to maximum and minimum similar to those used in the HDI.

$$\text{Income Index} = \frac{\log y - \log y_{\min}}{\log y_{\max} - \log y_{\min}}$$

y : income of the district

y_{\min} : Minimum income

y_{\max} : Maximum target income

The equally adjusted income index is given by :

[female population share X (adjusted female per capita)⁻¹ + male population share X (adjusted male per capita)⁻¹]⁻¹

The last step in calculating the GDI is to add index for the income that we have just derived to the indices for life expectancy and the educational attainment and divide by 3. That gives each index a one-third weight.

