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The Income Component of the Human Development Index

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Issues and research strategies

Human beings as ends and means

The over-arching understanding that has motivated the Human Development Reports (United Nations Development Programme, several years) since their inception in 1990 is the elementary recognition that human beings are the primary ends as well as the principal means of development. These two aspects of the 'human' side of development are related but quite distinct, and recognizing the special demands of each is important for analytical clarity in this difficult subject.

As it happens, both these roles were typically neglected in the analyses of growth and development that came into fashion in the years following the Second World War. Both needed correction, but they called for rather different types of rectification. The rhetoric on 'the importance of human elements' in the process of development often confounds the disparate demands of the two emendations, each important in their own right, but quite dissimilar in their implications for the concepts, measures and priorities of development. As it happens, focusing on human beings as the principal means of development has been reasonably well addressed by the placing of 'human capital' at the centre of the stage. But this, on its own, is quite inadequate for the appreciation of human beings as the 'primary ends' of development. The Human Development Reports attempt to take on the task of incorporating the view of human beings as ends in the accounting and assessment of development.

Human capital and beyond

The importance of human efforts, skills and talents needs adequate acknowledgement. When these were systematically neglected (as was the case, with some notable exceptions, in the post-World War emergence of development economics as a subject), there were excellent grounds for drawing attention to the role of people as the promoters of development and progress. The

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need to emphasize 'human capital' as opposed to 'physical capital' was strongly felt by many who saw the overwhelming concentration on the accumulation of physical capital to be very inadequate for a proper understanding of the process of economic growth as well as of social change.¹

By now, the needed evolution in the understanding of development with appropriate acceptance of the pervasive role of 'human capital' — has largely occurred. Even some early sources of resistance have basically moved on to recognize the central part that the productive roles of human beings play in the promotion of economic and social development.² It is as unfashionable today to be sceptical of 'human capital' as it was to doubt the power and reach of physical capital some decades earlier.

However, this much-needed change addresses only one of the two major tasks related to the neglect of the human aspects of economic and social development. The view of human beings as the 'primary ends' of the process of development calls for emphasis to be placed on what people get from development, not only what they put into it. To see the importance of human qualities in the promotion and sustaining of economic growth, momentous as it is, tells us nothing about the reasons for seeking economic growth in the first place, nor about the fact that the quality of life can vary greatly between different countries with much the same level of per-capita Gross National Product (GNP) and real income. If the expansion of educational facilities or of health care has the effect of increasing productivity and thus the income level, the approach of 'human capital' would give it an immediate and elevated status. But, if these changes in educational and health facilities directly make our lives longer and more fulfilled, and add to our ability to avoid preventable diseases and miseries, without necessarily changing labour productivity or increasing commodity production, then that achievement would simply not get the recognition it deserves in the accounting of 'human capital'.

Something serious is thus missed even in the broadened perspective of development that emphasizes 'human capital'. To rectify what is missed in the perspective of 'human capital', we need a broader conception of development that concentrates on the enhancement of human lives and freedoms, no matter whether that enhancement is — or is not — intermediated through an expansion of commodity production.

Human development, capabilities and the quality of life

The object of the particular focus chosen by the *Human Development Reports* was to examine the progress of the conditions of human living the ability of people to lead the kind of life they have reason to value. It is the enhancement of the capability to live better and richer lives, through more freedom and opportunity, that became the central concern of these Reports (see Haq, 1995).

This motivation is not, in fact, different from that expressed in Adam Smith's (1790) resentment of seeing people merely as instruments of usefulness. Even Smith's friend David Hume, with his interest in the 'utility'

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ressed in Adam instruments of it in the 'utility' of people, received some criticism from Smith on this ground (although this was perhaps a little undeserved, since Hume was inclined to take a rather broad view of 'utility' itself). Adam Smith complained about the tendency to judge a person by his 'usefulness' or, as he put it, for "that for which we commend a chest of drawers".³

Adam Smith's concern with the ability of people to choose a reasonable life relates closely to the approach of human development, which concentrates on people's capabilities in some fields that are crucial for the quality of life. The approach also has clear Aristotelian connections — indeed, Aristotle was a major influence on Adam Smith's thinking. In the Aristotelian view, there is much focus on 'functionings' that people need for 'fourishing' as human beings.

The Human Development Reports have tended to focus on a variety of central functionings. While the coverage is necessarily restricted by data limitations, the ultimate object is to include all the crucial functionings that are central for quality of life, varying from such elementary ones as avoiding escapable morbidity and preventable mortality to being educated, having comfortable lives, achieving self-respect and respect from others, being socially integrated, and so on. In line with the significance of freedom in judging the advantages enjoyed by adult people, it is important, in this context, to esteem not just people's actual functionings, but their capability to achieve the functionings they have reason to choose (see Sen, 1980, 1987; Nussbaum and Sen, 1993).

Human development index and broader concerns

The domain of the *Human Development Reports* is much wider than what can be captured by one index, useful though such an index may be. The role of any overall 'development index' is thus rather complex, and calls for some scrutiny of research strategy. There are limits to the different values that can be reflected in one real number. Insofar as more variables are added (to make the measure more 'inclusive'), the already-included ones decline in significance and emphasis. There is thus a real dilemma in choosing what to include in the list.

The *Human Development Reports* have chosen a two-tiered approach to address this issue:

- (i) presenting a variety of relevant information in detail (with investigation of their respective roles, analyzed in different Reports, varying from year to year); and
- (ii) providing a summary picture of some of the major components of human development through a Human Development Index (HDI) to serve as an alternative focal point to the traditional concentration on the GNP, Gross Domestic Product (GDP), and other standard measures of economic development.

The scope of the latter was necessarily much more limited than that of the former, but its easy communicability and salience has made it, nevertheless,

a much used and appreciated indicator of parts of the complex process of human development.

Direct and indirect measures

The first Report, *Human Development Report 1990*, identified three key aspects of the quality of life of people, to be enhanced by the process of development: longevity, education and "command over resources to enjoy a decent standard of living" (*Human Development Report 1990*, p. 1). There is a clear asymmetry here. Both longevity and education are clearly valuable as aspects of a good life, and also valued as constituents of the capability to do other things.⁴ In contrast, 'command over resources' is only an instrument for other ends — indeed, income is just one way of seeing this command. The purpose of including this in the HDI was to note the fact that there are many important capabilities which are critically dependent on one's economic circumstances. The income level enjoyed, especially close to poverty lines, can be very crucial information on the causal antecedents of basic human capabilities.

The use of 'command over resources' in the HDI is strictly as a residual catch-all, to reflect something of other basic capabilities not already incorporated in the measures of longevity and education. The concentration on 'command over resources' would have taken the HDI away from the basic approach of measuring 'human development' had it been the sole component of this index. Indeed, there is much evidence that a country's GNP per capita is often not a very good indicator of its achievements in health and survival. Much depends on how the national resources are used; for example, how much public health care is provided, and how the total income is distributed between the poor and non-poor (see Anand and Ravallion, 1993). Also, some countries do very much better than others both in using the fruits of economic growth and in making use of low-cost health care in combatting preventable illness and morbidity (see Drèze and Sen, 1989; and the literature cited therein). Thus, the command over material resources could not have served as a 'proxy' for health and longevity. The same applies to education.

On the other hand, after taking note of longevity and education, there still remain some basic concerns that have to be captured in any accounting of elementary capabilities. For example, going hungry is a deprivation that is serious not just for its tendency to reduce longevity, but also for the suffering it directly causes. Similarly, resources needed for shelter and for being able to travel may be quite important in generating the corresponding capabilities.

It is, in this sense, that the income component of the HDI has been used — as an *indirect* indicator of some capabilities not well reflected, directly or indirectly, in the measures of longevity and education.⁵ The role of the income component of the HDI has to be assessed in this light. This is what we proceed to do now, including a re-examination of the way this 'component' h that have been

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'component' has been used in the series of Human Development Reports that have been produced.

Human Development Reports: 1990-1995

The initial move: 1990

The HDI was first proposed in the *Human Development Report (HDR)* 1990. As has already been mentioned, it had three components: longevity (reflected by life expectancy at birth), education (reflected by literacy), and command over resources. It is this third component that we now scrutinize. The *HDR* 1990 (p. 12) states:

The third key component of human development — command over resources needed for a decent living — is perhaps the most difficult to measure simply. It requires data on access to land, credit, income and other resources. But given the scarce data on many of these variables, we must for the time being make the best use of an income indicator. The most readily available income indicator — per capita income — has wide national coverage. But the presence of nontradable goods and services and the distortions from exchange rate anomalies, tariffs and taxes make per capita income data in nominal prices not very useful for international comparisons. Such data can, however, be improved by using purchasing-power-adjusted real GDP per capita figures, which provide better approximations of the relative power to buy commodities and to gain command over resources for a decent living standard.

A further consideration is that the indicator should reflect the diminishing returns to transforming income into human capabilities. In other words, people do not need excessive financial resources to ensure a decent living. This aspect was taken into account by using the logarithm of real GDP per capita for the income indicator.

The Human Development Index is constructed by specifying a minimum value for each indicator (maximum deprivation set equal to one) and a desirable or adequate value (no deprivation set equal to zero). For the 1990 *HDR*, the minimum values were chosen by taking the lowest 1987 national value for each indicator. For the purchasing-power-adjusted GDP per capita, the minimum value was \$220 (log value 2.34), in Zaire. The values of desirable or adequate achievement were Japan's 1987 life expectancy at birth of 78 years and adult literacy rate of 100%, and the average official 'poverty line' income in nine industrial countries, adjusted by purchasing power parities, of \$4,861. The nine countries were Australia, Canada, the Federal Republic of Germany, the Netherlands, Norway, Sweden, Switzerland, the UK and the US (*HDR 1990*, p. 13).

Follow-ups: Human Development Reports 1991-1995

The *HDR 1991* made a series of 'refinements' to the HDI. Thus, it stated that "... income beyond the poverty level is no longer considered to make no contribution and thus is given not a zero weight but a progressively diminishing weight" (p. 2). It went on to suggest that: "The idea of diminishing returns to income is now better captured by giving a progressively lower weight to income beyond the poverty cut-off point, rather than the zero weight previously given. That zero weight was found to be too drastic an adjustment, particularly for higher income societies" (p. 15).

In Technical Note 1 of *HDR 1991*, an explicit formulation is given of the treatment of income in the new HDI. Specifically, *HDR 1991* assigns 'different weights' for income above and below the poverty line (p. 89):

In the HDI, income up to the poverty line (y^*) has a full weight, and income above it has a zero weight. [In the variations above, all income has the same weight. To explore alternatives between these two extremes,] we tried using a full weight for income up to the poverty line and a fractional weight above it. The new variable (call it W) was:

$$W = y \qquad \qquad \text{for } y \leq y^* \qquad (1a)$$

$$W = y + 2(y - y^*)^{1/2}$$
 for $y > y^*$ (1b)

The fractional weight assigned to income above the poverty line comes from a general formula:

$$W(y) = \frac{1}{1-\varepsilon} y^{1-\varepsilon}$$

In this formula $\varepsilon = 0$ puts full weight on all income, with no diminishing returns. As ε gets close to 1, W(y) becomes log y. In equations (1a) and (1b), the assumption is that $\varepsilon = 0$ for $y < y^*$ and $\varepsilon = 1/2$ for $y > y^*$.

In Technical Note 2 of HDR 1991, the modification to the income variable is described as follows.

The original HDI was based on the premise of diminishing returns from income for human development (or human well-being). Last year, this fact was reflected by using the logarithm of income and giving a zero weight to income above the poverty line. A more systematic way is to use an explicit formulation for the diminishing return. A well-known, and frequently used, form is the Atkinson formulation for the utility of income: Here W() and the f It is the elincome. I: 1, the equ

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$$W(y) = \frac{1}{1-\varepsilon} y^{1-\varepsilon}$$

Here $W(\gamma)$ is the utility or well-being derived from income, and the parameter measures the extent of diminishing returns. It is the elasticity of the marginal utility of income with respect to income. If $\varepsilon = 0$ there are no diminishing returns. As ε approaches 1, the equation becomes:

$$W(y) = \log y.$$

The modification adopted in this HDI is to let the value of ε rise slowly as income rises. For this purpose, the full range of income was divided into multiples of the poverty line y^* . Thus, most countries are between 0 and y^* , some between y^* and $2y^*$, even fewer between $2y^*$ and $3y^*$ and so on. Now for all countries for which $y < y^*$, that is, the poor countries, ε is set equal to 0. There are no diminishing returns here. For income between y^* and $2y^*$, ε is set equal to 1/2. For income between $2y^*$ and $3y^*$, ε is set at 2/3. In general, if $ay^* \le y \le (a + 1)y^*$, then $\varepsilon = a/(a + 1)$. This gives:

 $\begin{aligned} W(y) &= y & \text{for } 0 < y \le y^* \\ &= y^* + 2(y - y^*)^{1/2} & \text{for } y^* \le y \le 2y^* \\ &= y^* + 2(y^*)^{1/2} + 3(y - 2y^*)^{1/3} & \text{for } 2y^* \le y \le 3y^* \\ &\text{and so on.} \end{aligned}$

So, the higher the income relative to the poverty level, the more sharply the diminishing returns affect the contribution of income to human development. Income above the poverty line thus has a marginal effect, but not a full dollar-for-dollar effect. This marginal effect is enough, however, to differentiate significantly among industrial countries. The original HDI formulation, by comparison, was:

> $W(y) = \log y \quad \text{for } 0 < y \le y^*$ $W(y) = \log y^* \quad \text{for } y > y^*.$

The revision thus does not take $\varepsilon = 1$, but allows it to vary between 0 and 1.

For example, the Bahamas has a real GDP per capita of \$10,590. With the poverty line set at \$4,829, there are three terms in the equation to determine the well-being of the Bahamas:

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= 4,829 + 2(4,829)^{1/2} + 3(10,590 - 9,658)^{1/3}
= 4,829 + 139 + 29 = \$4,997. (HDR 1991, p. 90)

Note that the well-being of the Bahamas is described in terms of a *dollar* figure. However, the income 'discounting' is done not by a rate of discount (pure number per time), but rather by raising dollar income to a power less than unity (to make the utility function strictly concave), which here is either 1/2 or 1/3. The number this calculation generates will be a utility or well-being number (utils or units of well-being), not a dollar figure.⁶

The treatment of income in the subsequent Human Development Reports from 1992 to 1995 is essentially similar to that in HDR 1991 (already described). Exactly the same W(y) function is used to transform or 'discount' real per-capita income in HDR 1991-1995. However, there is a change to the threshold income level y^* in HDR 1994 (p. 91):

It was always questionable, however, whether the poverty level of industrial countries was an appropriate income target for developing countries. So, for the 1994 HDI, the threshold value has been taken to be the current average global value of real GDP per capita in PPP\$. ... On the new basis of real GDP per capita, the threshold is $$5,120.^7$

In *HDR 1994*, there is also a change in the method of choosing the minimum and maximum values for the three components of HDI. In the case of the earlier *HDRs*, namely those of 1990–1993, the contribution of the 'discounted income' component W(y) to HDI is expressible as (see Anand and Sen, 1993):

 $\left(\frac{1}{3}\right)\frac{W(y) - \operatorname{Min}_{t}\{W(y_{i})\}}{\operatorname{Max}_{t}\{W(y_{i})\} - \operatorname{Min}_{t}\{W(y_{i})\}}$

where y_i is the real per-capita income (in PPP\$) of country *i*. The inter-country minimum and maximum values of y_i and $W(y_i)$ for each of the years 1990-1993 are shown in Table 1. However, this method of normalizing the components of HDI is not appropriate for measuring a given country's human development performance over time, because the HDI constructed in this way will be affected by the performance of the worst- and best-performing countries. Thus, Anand and Sen (1993) recommended fixing the 'goalposts' for each of the HDI components.

For the income component, *HDR 1994* chose to fix the real per-capita income levels (in 1990 PPP\$) at a minimum of \$200 and a maximum of \$40,000 (see *HDR 1994*, Table 5.1, p. 92). In terms of the W(y) function, this corresponded to a minimum of W(200) = 200 and a maximum of W(40,000) = 5,385 (see *HDR 1994*, p. 108). In *HDR 1995*, the minimum value of real per-capita income has been revised from PPP\$200 to PPP\$100:

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This revision was made because in the construction of the genderrelated 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. (HDR 1995, p. 134)

For this reason (and a change in the education component in 1995⁸), the HDI values in *HDR 1995* are not strictly comparable with those in *HDR 1994*.⁹

TABLE 1. Income bounds and threshold income for HDI 1990-1995

	Real per capita income (PPP\$)		Discounted real per capita income, W(y)		Threshold income v*
	Min	Max	Min	Max	(PPP\$) ^a
HDI 1990	220	4,861	2.34	3.69	4,861
HDI 1991	350	19,850	350	5,070	4,829
HDI 1992	380	20,998	380	5,079	4,829
HDI 1993	367	21,449	367	5,075	4,829
HDI 1994	200	40,000	200	5,385	5,120
HDI 1995	100	40,000	100	5,448	5,120

^aFor HDR 1990-1993, the threshold income y* was "derived from the poverty-level income of the industrial countries in the Luxembourg Income Study, with values updated and translated into purchasing power parity dollars (PPP\$)" (HDR 1994, p. 91). For HDR 1994-1995, the threshold value has been taken to be "the current [1992] average global value of real GDP per capita in PPP\$" (HDR 1994, p. 91).

Source: HDR 1990-1995.

The HDR 1991-1995 formula for 'Discounted Income' W(y): an evaluation

The motivation for using the already presented formula for W(y) was to incorporate the consideration that "the higher the income relative to the poverty level $[y^*]$, the more sharply the diminishing returns affect the contribution of income to human development". This was achieved by constructing a W(y) function that simply adds on the concave pieces

$$\frac{1}{1-\varepsilon}(y-jy^*)^{1-\varepsilon}$$

with different values of ε for different income intervals defined through successive integer multiples j of the poverty level y^* . For income interval $[jy^*, (j+1)y^*]$ the value of ε assumed is j/(j+1), for j = 0, 1, 2, 3, etc. We can thus write the *HDR 1991-1995* function W(y) in general form as:

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$$W(y) = \sum_{j=1}^{k} j(y^*)^{\frac{1}{j}} + (k+1)(y-ky^*)^{\frac{1}{(k+1)}} \quad \text{for } ky^* \le y \le (k+1)y^*$$

This form is valid for all integers $k \ge 1$. For k=0, i.e. for the income interval $0 \le y \le y^*$, the function is given by W(y) = y.

Note that although this function is *piecewise* concave, it is *not* concave throughout its range. Where each new piece gets added on, the right-hand derivative of the function has an infinite slope. The derivative of W(y) at any y in the income interval $[ky^*, (k+1)y^*]$ is given by

$$\frac{\partial W}{\partial y} = (y - ky^*)^{-\frac{k}{(k+1)}}$$
$$\to \infty \quad \text{as} \quad y \downarrow ky^*.$$

Hence, the right-hand derivative of W(y) is infinite at $y = ky^*$ for k = 1, 2, 3, etc. The left-hand derivative of the function W(y) at $y = ky^*$ is given by evaluating $\partial W/\partial y$ at the right end-point of the previous income interval, namely $[(k-1)y^*, ky^*]$. For any y in this interval, $\partial W/\partial y$ is given by

$$\frac{\partial W}{\partial y} = \left[y - (k-1)y^*\right]^{-\frac{(k-1)}{k}}.$$

Therefore, as $y \uparrow ky^*$, we have

$$\frac{\partial W}{\partial y} \rightarrow (y^*)^{-\frac{(k-1)}{k}}$$

which is a finite positive number for all integers $k \ge 1$.¹⁰ Thus the function W(y) is not concave in income y. In other words, it does not reflect "diminishing returns" in the "contribution of income to human development" (*HDR 1991*, p. 90, etc.).

The second problem with the formulation of the presented W(y) function is that the elasticity of the marginal valuation function W'(y) does not, in fact, lie between 0 and 1. Nor does the elasticity of W'(y) increase from 0 to 1 as income y increases. The elasticity of the W'(y) function is defined as

$$\eta(y) = -\frac{\partial \log W'(y)}{\partial \log y} = -y \frac{W''(y)}{W'(y)}$$

In the interval $[0, y^*]$, we do therefore have $\eta = 0$. However, in the intervals $[ky^*, (k+1)y^*]$ for $k \ge 1$, we have

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 $\eta(y) = -\frac{\partial \log W'(y)}{\partial \log y} = \frac{k}{(k+1)} \frac{y}{(y-ky^*)}.$

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$$\eta(y) = \frac{k}{(k+1)} \frac{(k+1)y^*}{(k+1)y^* - ky^*} = k \quad \text{as } y \to (k+1)y^*.$$

 $\eta(y) \to \infty$ as $y \to ky^*$

In other words, the elasticity of the marginal valuation function varies from ∞ to k between the left end-point and the right end-point of the income interval $[ky^*, (k+1)y^*]$. Therefore, the elasticity $\eta(y)$ neither lies between 0 and 1 nor increases with income y, both within and across income intervals corresponding to multiples of the poverty line y^* .

If the intention of the HDRs was to introduce a 'variable elasticity' valuation function that is both *concave* throughout the income range and for which the elasticity of marginal valuation *increases* with income ("the higher the income relative to the poverty level, the more sharply the diminishing returns affect the contribution of income to human development" (HDR 1991, p. 90, etc.)), there are alternative functions that satisfy these conditions. Take, for example, the class of constant absolute inequality aversion functions noted in Anand and Sen (1995, p. 27):

$$W(\gamma) = -e^{-\gamma \gamma}$$
 where $\gamma > 0$

up to a positive affine transformation. For this class, we have

$$W'(y) = \gamma e^{-\gamma y} > 0$$
$$W''(y) = -\gamma^2 e^{-\gamma y} < 0$$

the intervals

 $\eta(y) = -y \frac{W''(y)}{W'(y)} = \gamma y.$

Here, the elasticity $\eta(y)$ starts at 0 when y = 0 and *increases* linearly with income y.

A more general class of valuation function that combines the constant relative and constant absolute inequality aversion forms is given by

$$W(\gamma) = -\gamma^{-\alpha} \cdot e^{-\gamma \gamma}$$
 where $\alpha \ge 0, \ \gamma \ge 0$

up to a positive affine transformation. By differentiation and a certain amount of manipulation, it can be shown that for this class we have W'(y) > 0, W''(y) < 0 (i.e. W(y) is concave throughout), and that

$$\eta(y) = (\alpha + \gamma y) + \frac{\alpha}{(\alpha + \gamma y)}.$$

Note that when $\alpha = 0$, this reduces to the constant absolute inequality aversion class and $\eta(y) = \gamma y$ as above. When $\gamma = 0$, this reduces to the constant relative inequality aversion class (Anand and Sen, 1995, p. 25) and $\eta(y) = \alpha + 1$. In the general case, for y = 0 we have $\eta(y) = \alpha + 1$, and as $y \to \infty$, we have $\eta(y) \to \infty$.¹¹

Thus, if a 'variable elasticity' valuation function for discounted income is sought, there is considerable flexibility in providing one that satisfies the required properties. In this section, we have noted a number of problems and inconsistencies with the HDR 1991-1995 function for discounted income. However, by way of rectification, we have also suggested two classes of income function W(y) which are increasing, everywhere concave in the income range y, and have a 'variable and increasing' elasticity of marginal valuation $\eta(y)$.

Distributional adjustment to the income component

Practice: distribution adjustment procedures used

The 1990 HDR had foreshadowed a need to make distributional corrections for income, although no estimates for a distribution-adjusted HDI were presented until the 1991 HDR. According to HDR 1990 (p. 12), the rationale for making distributional corrections was that "[A]ll three measures of human development suffer from a common failing: they are averages that conceal wide disparities in the overall population".

The 1991 HDR was the first Human Development Report to adjust the income component of HDI for inequality. As well as formulating the 'diminishing returns' function W(y) (see previous section), the 1991 HDR introduced another refinement:

A second improvement in the HDI has been to make it more sensitive to the distribution of income within a country (technical note 4). Actual or interpolated Gini coefficients (measures of distribution) were obtained for 53 countries — and used to

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compute human development indices modified by income distribution (table 1.4) ... The compilation of this modified index once again drives home the point that a country's human development achievements are greatly modified if they are not shared by all its people. (HDR 1991, p. 17)

The precise method for making the HDI sensitive to income distribution is described in Technical Note 4 of HDR 1991.

Adjusted income [i.e. W(y)] was multiplied by (1 - G) — with G being the Gini coefficient — to modify income even further. Because this was done for the adjusted income, W(y), rather than for the actual income, the diminishing return effect could be incorporated before the distributional adjustment modifies incomes further. This modified income W(y)[1 - G] is then used as the third variable in addition to life expectancy and educational attainment to compute a distribution-adjusted HDI. (HDR 1991, p. 94)

Exactly the same method of modifying income was employed in HDR 1992 and HDR 1993. There appears to be some discrepancy between this method and what is stated to have been done in HDR 1994 (discussed later). Finally, no such distributional adjustment to the income component was undertaken in HDR 1995.

The method of interpolating distributional data for countries with no direct estimate of the Gini coefficient is also common to *HDR 1991-1993*. Thus, *HDR 1991* (p. 94) describes the estimation technique as follows.

Some 45 countries have data on the ratio of the income share of the highest 20% to the lowest 20%. Of these 45 countries, 17 have data on the Gini coefficient as well, and there was found to be a very strong association between the two — the logarithm of the ratio being a good predictor of the Gini coefficient. This regression result was used to interpolate the Gini coefficient for the remaining 28 countries. Some countries had data only on the Gini coefficient. In all, 53 countries with directly estimated or interpolated Gini coefficients were available.

A word of caution is in order. The Gini coefficients are registered for various years between 1967 and 1985, and the ratios of the top 20% to the lowest 20% for years between 1975 and 1986. This is not a serious problem, since these coefficients are unlikely to change quickly. But the Gini coefficient is not always truly representative of the entire country. It is sometimes only for a subsection, such as the urban population. (*HDR 1991*, p. 94)¹²

The results of this distributional adjustment are described in HDR 1991 (p. 94) as:

For all but two countries the HDI is reduced by making it sensitive to income distribution, and in over a third of them, it is reduced by 5% or more.¹³

The two countries for which the distribution-adjusted HDI value is higher than the HDI value are Republic of Korea and Indonesia (*HDR 1991*, Technical Note, Table 2, p. 95).

It is difficult to understand what meaning can attach to the reductions (and increases for Korea and Indonesia) in HDI values that result from making it sensitive to income distribution. A percentage reduction would be a meaningful calculation if the 'goalposts' (i.e. the minimum and maximum of the income component) are unaltered. This would require estimating the distribution-adjusted income component as

$$\left(\frac{1}{3}\right)\frac{W(y)[1-G] - \operatorname{Min}_{i}\{W(y_{i})\}}{\operatorname{Max}_{i}\{W(y_{i})\} - \operatorname{Min}_{i}\{W(y_{i})\}}$$

But then it is impossible for Korea and Indonesia to show rises, because $W(y)[1-G] \le W(y)$ for $G \ge 0$ (by definition of G).¹⁴

On the other hand, if the minimum and maximum levels of discounted income are altered to reflect the new inter-country range for distribution-adjusted (or modified) income W(y)[1-G], the contribution of the income component to HDI would be

$$\left(\frac{1}{3}\right) \frac{W(y)[1-G] - \operatorname{Min}_{i}\{W(y_{i})[1-G_{i}]\}}{\operatorname{Max}_{i}\{W(y_{i})[1-G_{i}]\} - \operatorname{Min}_{i}\{W(y_{i})[1-G_{i}]\}}$$

where G_i is the Gini coefficient for country *i*. In this case, it is possible for a country's distribution-adjusted HDI value to be higher than its HDI value. But then little sense can be made of percentage *reductions* (by 5 or 10%) in the HDI by making it sensitive to income distribution.¹⁵ The baseline value of HDI *without* distributional adjustment (obtained by putting G = 0) is not the same in the two cases. Therefore, any reduction that occurs for a country cannot be attributed to its own Gini coefficient G alone, but also to the Gini coefficients G_i and the $W(y_i)$ levels in the countries for which $\{W(y_i)[1 - G_i]\}$ is, respectively, minimized and maximized.

Statements of the following kind, then, do not seem to be altogether coherent:

Brazil has one of the most unequal distributions of income — the top 20% of the population receives 26 times the income of the bottom 20%. When the income component of its HDI is reduced by a factor to reflect *this* maldistribution, its overall HDI falls by 16%. The same correction also causes a major drop in the HDI of many other countries ... (HDR 1992, p. 22; emphasis added)

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HDR 1994 appears to use a somewhat different basis for an income-distribution-adjusted HDI. The Gini coefficient is no longer used as the measure of inequality of incomes. Rather, HDR 1994 (p. 97) states that:

For the income disparity factor, we have divided the share of the income of the bottom 20% of the population by the share of the top 20%. Multiplying this ratio by the country's overall HDI gives the income-distribution-adjusted HDI. This information is available for 55 countries.

No country has a perfect income distribution, so adjusting the HDI for income distribution reduces the score for *all*. (*HDR* 1994, p. 97; emphasis added)

In Brazil itself, *HDR 1994* (p. 98) states that the ratio between the income share of the bottom 20% to the top 20% is 1 to 32 (and in Botswana it is 1 to 47). But, if the overall HDI is multiplied by 1/32 = 0.03, then the value for the distribution-adjusted HDI for Brazil would become $0.03 \times 0.756 = 0.02$, whereas the value given in Annex Table A5.5 (p. 107) is 0.436.

As a result perhaps of such problems coming to light, no distributionadjusted HDI was presented in *HDR 1995*. But 'income discounting' continued in that Report, in the form of using the same formula W(y) for the income component of the HDI as earlier *HDRs* (1991-1994) had done. If W(y) stands for achievements other than those of longevity and education, it may reasonably be asked why distributional adjustment is undertaken only for that component of HDI.¹⁶ Sensitivity to inequality in achievements requires that we adjust all three components of the HDI for inequality (discussed in the context of gender, for example, in Anand and Sen, 1995). Yet, as we show in the next section, even with no concern for inequality in achievement levels, diminishing returns to income is a sufficient reason for taking note of the distribution of incomes. Inequality in incomes reduces the *average* achievement level made possible by income.

Critique of distribution adjustment procedures used

As we have suggested earlier, the income component of HDI (justified in terms of 'command over resources needed for a decent living') is supposed to reflect elementary capabilities for which adequate quantitative indicators are not available, at any rate not on a comparable cross-country basis. Suppose that the income variable is indeed used as a proxy for achievements other than life expectancy and literacy. It may be posited that such achievements of an individual are represented through a concave function A(y) of her income y, say, by the isoelastic form

$$A(y) = \frac{1}{1-\varepsilon} y^{1-\varepsilon}$$

up to a positive affine transformation. The arithmetic average of people's *achievements* in a country of n persons is then given by

$$\bar{A} = \frac{1}{n} \sum_{i=1}^{n} A(y_i)$$

$$= \frac{1}{n} \sum_{i=1}^{n} \frac{1}{1-\varepsilon} y_i^{1-\varepsilon}$$

$$= \frac{1}{1-\varepsilon} y_{\text{ede}}^{1-\varepsilon} \quad \text{by definition of } y_{\text{ede}} \text{ (Atkinson, 1970)}$$

$$= A(y_{\text{ede}}).$$

Here y_{ede} , the equally distributed equivalent income, is defined as that level of income per head which, if distributed equally among the *n* persons, would generate the same (total and) *average achievement* \overline{A} (see Atkinson, 1970). For $\varepsilon > 0$, i.e. for a strictly diminishing returns to income function A(y), we will obtain

$A(y_{ede}) \neq A(\bar{y})$

where \bar{y} is the per-capita income. As shown in Anand and Sen (1995), for $\varepsilon > 0$, we in fact have $y_{ede} < \bar{y}$, and therefore $A(y_{ede}) < A(\bar{y})$ since A(.) is a monotonic increasing function. Like the first two components of HDI, the third component is supposed to represent the *average* achievement \bar{A} in the relevant dimension. For this purpose, therefore, as a measure of average achievement, one should use y_{ede} as the argument of the function A(.) rather than \bar{y} , as has been done in previous *HDR*s.

It should be emphasized that this adjustment for inequality (use of y_{ede} rather than \bar{y} in A(.) or W(.)) arises simply because inequality of incomes detracts from the (total and) *average* achievement

$$\vec{A} = \frac{1}{n} \sum_{i=1}^{n} A$$

where $A_i = A(y_i)$, not because we are concerned about *inequality* of the *achievement levels* A_i themselves. Also, using the average achievement level \bar{A} for the third component of HDI is consistent with what is done for the 98

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first two components, where average life expectancy and average literacy (or educational attainment) are the achievements measured.

If one were concerned with *inequality* of the A_i levels among people, then a different — and further — adjustment would be needed. A method for doing this is possible to devise, but we would then have to *fix* the affine transformation in the A(.) function, i.e. the constants α and β , because comparability of both the A_i levels *and* units would be required. The inequality correction, whether through the Gini coefficient or some other index, would then be in the space of the A_i (not the y_i) — and the adjustment to \overline{A} done through a measure of inequality of the A_i (not the y_i).

Hitherto, the *HDR* method of distributional adjustment has been to use $W(\bar{y})[1 - G]$ for the third component, where \bar{y} is per-capita real income, W(y) is the 'discounted income' function referred to earlier (piecewise concave with an infinite slope at the start of each new piece), and G is the Gini coefficient of incomes, not of the $W_i = W(y_i)$. Although it is possible to correct this formula by using a measure of inequality of the W_i or A_i themselves,¹⁷ such an adjustment alone in computing a 'distribution-adjusted' HDI would be partial and incomplete. An intrinsic concern for inequality in human development requires adjustment of average achievement in *each* of the three dimensions (by the extent of measured inequality in each) — as well as an accounting of the *covariances* in achievement along the different dimensions.

The income component of the HDI: purpose and functions

As was discussed earlier, the income component does play an important part in making the HDI a broad indicator. This purpose cannot be easily fulfilled by some other readily usable variable. In this final section, we come back to the motivational issues, and present some further scrutiny of the use of this third component.

We have shown how the precise uses of the income component in the previous *Human Development Reports* have sometimes been rather problematic, and it is clear that there has been ambiguity as well as occasional inconsistencies in the utilization of the income variable. But these problems, as already discussed, can be entirely remedied, and the purpose for which the income component was brought into the story can be fully served by a precisely structured and consistent use of incomerelated variables, along with making corrections for inequalities in income distribution (for example, through y_{ede}).

Longevity and education are, of course, important components of human development, and no attempt at constructing a human development index can be successful without giving a major place to information related to survival and learning. Yet it would be a mistake to confine attention *only* to these two components of HDI. The role of the income component is to serve as a proxy for some of the important aspects of the quality of life that are missed out in the exclusive concentration on life expectancy and basic education. The ability to command resources with which a person can lead

a positively freer life in a number of fields gives us an indirect account of many significant aspects of human development.

Even the elementary freedom from hunger, as was discussed earlier, is not just a matter of survival (nor of course of education), but includes, *inter alia*, not being forced to live on a half-empty stomach. Similarly, having adequate shelter can be important to leading a reasonable life, without this capability being reflected — directly or indirectly — by either longevity or education. Again, elementary pleasures of entertainment, or visiting and seeing friends, or taking part in the life of the community, may require resources that somehow must be considered in devising a human development index. It is these gaps that point to the need for something more than an exclusive concentration on life expectancy and schooling.

Having an income is not, of course, comparable with being educated or living long, which are valued for their own sake. Having an income-related control over purchasable commodities can scarcely be intrinsically valuable. Nevertheless, in an indirect way - both as a proxy and as a causal antecedent — the income of a person can tell us a good deal about her ability to do things that she has reason to value. As a crucial means to a number of important ends, income has, thus, much significance even in the accounting of human development. While something is lost in terms of 'purity', in not sticking only to variables such as life expectancy and being educated which are valuable in themselves, a major practical gain is made in indirectly extending the coverage to take note of various capabilities that people do value intensely and which cannot be adequately reflected in figures of life expectancy and literacy. The need to take a transformation to be exact, a strictly concave transformation — of the income variable relates to the fact that the valued object ultimately is not income itself, but the things we are able to do with the help of income, and it also gives recognition to the further fact that there is likely to be some diminishing returns in that conversion. We have already discussed these technical issues.

There is, however, a further — rather pragmatic — consideration connected with the need for the income component. The need to include any variable in addition to others depends a little on the extent to which these variables move with each other. If a variable x is already included, and another variable y, reflecting something important, is proposed for further inclusion, the case for that inclusion would be somewhat undermined if it were to turn out that x and y move very closely together, so that x itself serves as a proxy for y. It is, therefore, useful to see how per-capita income (a transformation of which is to be included in a three-component human development index) relates to life expectancy and basic education (the other variables already covered in the putative index).

There is, in fact, much evidence that life expectancy and GNP per head do move together to some extent. For example, in inter-country comparisons, there is typically a significantly positive correlation between GNP per capita and life expectancy at birth. While that relation is often invoked in the standard literature on economic development to make the claim that GNP itself can serve as a good development indicator (without supplementation by life try to turn tl expectancy ir longer be muc However, an the defence of development, for GNP per h

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NP per head try comparien GNP per ten invoked e claim that supplementation by life expectancy, since it is correlated with GNP), we could also try to turn the argument on its head to suggest that once we had life expectancy included in the human development index, there would no longer be much need to include *additionally* any GNP-based third variable. However, an empirical scrutiny does not provide much support either for the defence of the adequacy of GNP per head as a 'total' indicator of development, or for the proposed adequacy of life expectancy as a proxy for GNP per head.

The reasons for this empirical scepticism include the fact that there are many crucial divergences, even in inter-country comparisons, between rankings of GNP per head, and those of life expectancy achievements. Policy significance may be attached to the experience of 'outliers' in either direction - some countries (such as Costa Rica or Sri Lanka) doing much more to enhance life expectancy than their GNP per capita would suggest, while some other countries faring even worse than what their low GNP per head would lead us to expect (see Drèze and Sen, 1989). Underlying the disjointedness is the important fact that the connection between GNP per head and life expectancy, insofar as it is there, depends very much on the way income is used in developing countries. For example, more provision of public health care and reduction of poverty, both of which help to raise life expectancy, can go with a higher per-capita income, but that relationship is not very tight. Once the variations of health care and poverty are themselves taken directly into account, the need to include income per head as a separate variable would, to that extent, be reduced in explaining variations in *life expectancy*.¹⁸ Thus, in responding to the standard defence of the use of GNP per head alone, it can be argued that this is simply not adequate, since we can get much closer to life expectancy by concentrating instead on poverty removal and public health care.

This issue does not, of course, arise in that form in dealing with the putative formulae for human development, since life expectancy is *directly* included in every form of the proposed human development indicator. However, the same basis of scepticism operates to undermine the statistical adequacy of life expectancy to reflect indirectly the ranking of GNP per head. Life expectancy captures, in this view, the role of GNP per head mainly to the extent that it correlates with public health care and poverty removal. But that is just not adequate enough, if our focus, instead, is on those impacts of GNP per head that influence the quality of life in ways other than enhancing life expectancy. Income figures can still serve to indicate the basic resources that people have to achieve some other types of functionings (dependent on incomes), even though life expectancy cannot serve this purpose because its effectiveness depends on a different, and not very tight, intermediate connection with public policies.

For example, in dealing with the achievements of the Indian state of Kerala, it would be right to record its great success in raising life expectancy as well as basic education, but some of the deprivations connected with the low income levels of people in Kerala (such as inadequate housing, or even the prevalence of undernourishment) would also seem to need some

recognition, which cannot be obtained from its high life expectancy or literacy figures. The fact that good public health care can dramatically reduce mortality rates, even without eliminating undernourishment, is a tribute to the reach of public health care, but it *also* provides the basis of an argument for looking at undernourishment through some other direct or indirect indicator, rather than through mortality rates alone.¹⁹ Similar remarks can be made about some other aspects of quality of life that may remain significantly deficient even as longevity is radically expanded by good public policy. Life expectancy can soar and literacy come close to being total, and yet there could be major shortfalls in achievements which severely restrain the lives that people can lead.

Thus, the use of the income component in HDI is not dispensable, but it is important to know precisely why it is needed. It plays a part that the other two components of HDI cannot serve — either directly or as proxy variables through correlation. To keep track of human development, we need a broader picture than that provided by just education and health. It is because of this set of underlying concerns that we have focused, in this paper, specifically on 'the income component of the Human Development Index'.

In moving away from the traditional indicators of development, primarily GNP per head, the *Human Development Reports* have accomplished a major re-orientation of focal attention, by bringing into the limelight the neglected but crucial perspectives of survival and basic education as a part of development. But we have to avoid the opposite danger of taking survival and basic education to be *all*, in judging the progress of quality of life. There is a need for balance, and the rationale for having this third component of the Human Development Index relates to that reasoning. In this paper, we have discussed how this income component can be even more effectively used, particularly through corrections for inequalities, and what can be learned from the experiences and experiments in previous *Human Development Reports*. The third component is needed *and* it can be consistently and effectively used to serve the purpose for which it is needed.

Notes

- 1 An early indication of the presence of a lacuna here was Robert Solow's (1956) identification of the immensely high proportion of the causation of per-capita economic growth that remained to be explained even after taking full note of the accumulation of capital, within the interpretative structure of neo-classical growth theory.
- 2 A good indication of the accepted status of this change can be seen in the plentiful recognition, in the World Bank's (1993) study of the 'East Asian Miracle', of the roles of education, training, health care, and related changes in bringing about economic transformation in the east Asian economies.
- 3 Smith (1790), section IV.2.4 (in the 1975 edition, p. 188). The connections between the different issues related to this question are discussed in Sen (1995).
- 4 Longevity is a crucial determinant of basic capabilities (one has to be alive to be able to pursue actively one's objectives), and being educated helps to advance other objectives (through knowledge and understanding as well as respect, status, and relative power).

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- 5 There is some evidence that conditions of health and morbidity are reasonably well reflected, despite some obvious imperfections, by measures of life expectancy. Indeed, direct questioning on the level of health and illnesses suffered seem often to produce misleading answers, reflecting the differences in the knowledge and understanding of ill-health. For example, Kerala, with the best care in India and the highest life expectancy at birth, produces also the highest reported levels of ill-health. Greater medical knowledge and the possibility of treatment generates more awareness of ill-health, just as it also leads to treatment for ill-health (see Sen, 1993). It appears that longevity may well be a better proxy for health conditions than the psychological perceptions of ill-health. There are also problems with going by medical reports of ill-health, since they depend on the availability of medical services again, better provided in states with greater health care, and little present in the more deprived states.
- 6 W(y) is the sum of (PPP\$), (PPP\$)^{1/2}, (PPP\$)^{1/3}, etc., and thus cannot be readily interpreted as a PPP\$ figure.
- 7 In HDR 1995 also, the world average income of PPP\$5,120 in 1992 is taken to be the threshold level y^* (p. 134).
- 8 This was the replacement of mean years of schooling with the combined enrolment ratio and the adoption of new series of data in constructing the 1995 HDI (HDR 1995, p. 19).
- 9 There is also an anomaly in the maximum value of W(y) assumed in HDR 1994 and in HDR 1995. Thus, in HDR 1994 (p. 108), the value used for W(40,000) is 5,385, while in HDR 1995 (p. 134), the value derived for W(40,000) is 'PPP\$5,448' for exactly the same W(y) function and poverty threshold y^* .
- 10 Hence, the left-hand derivative of the function W(y) at $y = ky^*$ decreases monotonically with k, from a value of 1 at k = 1 to $(1/y^*)$ as $k \to \infty$.
- 11 It can be shown that $\eta(y)$ is monotonic increasing for $y > (\alpha^{1/2} \alpha)/\gamma$. This certainly holds for $\alpha \ge 1$, if incomes are positive.
- 12 A virtually verbatim statement is found in HDR 1992 (pp. 94-95) with the following exceptions: (i) 41 instead of 45 countries (as in HDR 1991) are stated to have data on the ratio of the income share of the highest 20% to the lowest 20%; and (ii) the Gini coefficients are registered for various years between 1975 and 1988 (rather than between 1967 and 1985 as in HDR 1991), and the ratios of the top 20% to the lowest 20% are for years between 1980 and 1988 (rather than between 1975 and 1986 as in HDR 1991). HDR 1993 (pp. 101-102) also contains a similar statement, with data for 41 countries available on the ratio of the income share of the highest 20% to the lowest 20% (of which 17 also have data on the Gini coefficient), and the regression result being "used to interpolate the Gini coefficient for another 11 countries, for a total of 52 countries" (HDR 1993, Technical Note, Table 1.2).
- 13 A similar result is reported in *HDR 1992* (p. 95): "For all but two countries, the HDI is reduced by making it sensitive to income distribution, and in a half of them, it is reduced by 4% or more. This is particularly marked in the developing countries, where 24 of the 32 developing counties have a reduction of 4% or more and seven show a reduction in excess of 10%." The two countries for which the value of the distribution-adjusted HDI is higher than the HDI are Republic of Korea and Indonesia (*HDR 1992*, Technical Note, Table 1.2, p. 93).
- 14 The only way for W(y)[1-G] to be higher than W(y) is if G is negative (contra definition). Obviously, negative values of G should not be used even if interpolation of the Gini coefficient (through the regression equation) produced negative values for Korea and Indonesia.
- 15 See *HDR 1991* (Table 1.4, p. 18, or Technical Note, Table 2, p. 95) for estimates of the percentage difference between HDI and distribution-adjusted HDI.
- 16 By applying the Gini coefficient G of *income* inequality to inequality in 'discounted incomes' W(y), the HDRs 1991-1994 were not altogether consistent with an attempt to adjust for inequality in the *achievements* represented by income. A more consistent procedure would have been to adjust W(y) by an index of inequality of the W(y) themselves (rather than of incomes y).
- 17 In the case of a separable, constant elasticity formulation, this becomes tantamount to

computing y_{ede} for an elasticity of social marginal value of income greater than ε , the income elasticity of the individual marginal achievement function A'(y).

- 18 See Anand and Ravallion (1993), where it is shown that once public health expenditure and a measure of poverty are used as separate variables on their own, the use of GNP per head as a further explanatory variable does not add significantly to the explanation.
- 19 The need for additional concern with undernourishment was forcefully argued by Kumar (1987); on related matters, see also Panikar and Soman (1984), Kumar and Vaidyanathan (1988), Anand and Harris (1992), and Kumar and Stewart (1992).

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Introduction

The deep integrati many advantages a In particular,

important benefit: investment, which know-how and acc positive microeco credit-worthy firm complement dom this latter positive economies, but m East Asia.

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