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Author(s): Amartya Sen

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ISSUES IN THE MEASUREMENT OF POVERTY*

Amartya Sen

Nuffield College, Oxford, England

Abstract

The paper is concerned with discussing some of the basic issues in the measurement of poverty. The measurement of poverty can be split into two distinct operations, viz. *identification* (who are the poor?) and *aggregation* (how are the poverty characteristics of different people to be combined into an aggregate measure?). The nature of the exercise of poverty measurement is examined in Section I. Section II is devoted to the identification issue, including the fixation of a "poverty line". Section III goes into the aggregation problem. Some concluding remarks are made in the last section.

I. The Nature of Poverty Measurement

I.1. *A Value Judgment?*

The view that "poverty is a value judgment" has been presented forcefully by many authors. It seems natural to think of poverty as something that is disapproved of, the elimination of which is regarded as morally good. A consequence of this approach is to argue with Mollie Orshansky, an outstanding authority in the field, that "poverty, like beauty, lies in the eye of the beholder".¹ The exercise would, then, seem to be primarily a subjective one, unleashing one's morals on the statistics of deprivation.

I would like to argue against this approach. There is a difference between saying that the exercise is itself a prescriptive one from saying that the exercise must *take note of* the prescriptions made by members of the community. To describe a prevailing prescription is an act of description, not prescription. It may be the case that poverty, as Eric Hobsbawm (1968) puts it, "is always defined according to the conventions of the society in which it occurs" (p. 398). But this does not make the exercise of poverty assessment in a given society a value judgment, or even a subjective exercise of some other kind. For the person studying and measuring poverty, the conventions of society are matters of *fact* (what *are* the contemporary standards?) and not issues of *morality* or

* The paper draws partly on the analysis to be presented in a forthcoming book, *Poverty and Famines*, prepared for the ILO World Employment Programme. While that book is chiefly concerned with the causation of starvation and famines, it begins by analysing the more general concept of poverty.

¹ Orshansky (1969, p. 37). For a critique of this position, see Townsend (1974).

of *subjective search* (what *should be* the contemporary standards? what *should be* may values? how do I *feel* about all this?).¹

The point was brought out very clearly by Adam Smith more than two hundred years ago:

By necessities I understand not only the commodities which are indispensably necessary for the support of life, but what ever the custom of the country renders it indecent for creditable people, even of the lowest order, to be without. A linen shirt, for example, is, strictly speaking, not a necessary of life. The Greeks and Romans lived, I suppose, very comfortably though they had no linen. But in the present times, through the greater part of Europe, a creditable day-labourer would be ashamed to appear in public without a linen shirt, the want of which would be supposed to denote that disgraceful degree of poverty which, it is presumed, nobody can well fall into without extreme bad conduct.²

In a similar vein Karl Marx (1887) argued that while “a historical and moral element” enters the concept of subsistence, “nevertheless, in a given country, at a given period, the average quantity of the means of subsistence necessary for the labourer is practically known” (p. 150).

It is possible that Smith or Marx may have overestimated the extent of uniformity of views that tends to exist in a community on the content of “subsistence” or “poverty”. Description of “necessities” may be very far from ambiguous. But the presence of ambiguity in a description does not make it a prescriptive act—only one of ambiguous description. One may be forced to be arbitrary in eliminating the ambiguity, and if so, that arbitrariness would be worth recording. Similarly, one may be forced to use more than one criteria because of non-uniformity of accepted standards, and look at the *partial* ordering generated by the criteria taken together (reflecting “dominance” in terms of all the criteria).³ But the partial ordering would still reflect a descriptive statement rather than a prescriptive one.

I.2. *A Policy Definition?*

A related issue is worth exploring in this context. The measurement of poverty may be based on certain given standards, but what kind of statements do these standards themselves make? Are these standards of public policy, reflecting either the objectives of actual policy, *or* views on what the policy should be? There is little doubt that the standards must have a good deal to do with some broad notions of acceptability, but that is not the same thing as reflecting precise policy objectives—actual *or* recommended. On this subject too a certain amount of confusion seems to exist. For example, the United

¹ This does not, of course, in any way deny that one's values may implicitly affect one's assessment of facts, as indeed they very often do. The statement is about the nature of the exercise, viz., that it *is* concerned with assessment of facts, and not about the way it is typically performed and the psychology that lies behind that performance.

² Smith (1776, pp. 351–2).

³ Sen (1973, Chapters 2 and 3).

States' President's Commission on Income Maintenance (1969) argued thus for such a "policy definition" in its well-known report *Poverty amid Plenty*:

If society believes that people should not be permitted to die of starvation or exposure, then it will define poverty as the lack of minimum food and shelter necessary to maintain life. If society feels some responsibility for providing to all persons an established measure of well-being beyond mere existence, for example, good physical health, then it will add to its list of necessities the resources required to prevent or cure sickness. At any given time a policy definition reflects a balancing of community capabilities and desires. In low income societies the community finds it impossible to worry much beyond physical survival. Other societies, more able to support their dependent citizens, begin to consider the effects that pauperism will have on the poor and non-poor alike.¹

There are at least two difficulties with this "policy definition". First, the actual making of public policy depends on a number of influences of which the prevalent notions of what should be done is only one. Policy is a function of political organisation, and depends on a variety of factors including the nature of the government, the sources of its power, and the forces exerted by other organisations. Second, even if "policy" is taken to stand not for actual public policy, but for policy recommendations widely held in the society in question, there are problems. There is clearly a difference between the notion of "deprivation" and the idea of what should be eliminated by "policy". For one thing, policy recommendations must depend on an assessment of feasibilities ("ought implies can"²), but to concede that some deprivations cannot be immediately eliminated is not the same thing as conceding that they must not currently be seen as deprivations.

I would submit that the "policy definition" is based on a fundamental confusion. It is certainly true that with economic development there are changes in the notion of what counts as deprivation and poverty, and there are changes also in the ideas as to what should be done. But while these two types of changes are interdependent and also intertemporally correlated with each other, neither can be *defined* entirely in terms of the other. Oil-rich Kuwait may be "more able to support their dependent citizens" with its new prosperity, but the notion of what is poverty may not go up immediately to the corresponding level. Similarly, war-devastated Netherlands may keep up its standard of what counts as poverty and not scale it down to the level commensurate with its predicament.³

If this approach is accepted, then the measurement of poverty must be seen as an exercise of description assessing the predicament of people in terms of the prevailing standards of necessities. It is primarily a *factual* rather than an ethical exercise, and the facts relate to what is regarded as deprivation, and not *directly* to what policies are recommended.

¹ U.S. President's Commission on Income Maintenance (1969, p. 8).

² Cf. Hare (1963, Chapter 4).

³ Cf. Stein, Susser, Saenger & Marolla (1975).

I.3. *Standards and Aggregation*

This still leaves two issues quite untouched. First, in comparing the poverty of two societies, how can a common standard of necessities be found, since such standards would vary from society to society? There are actually two quite distinct types of exercises in such inter-community comparisons. One is aimed at comparing the extent of deprivation in each community in relation to their respective standards of minimum necessities, and the other is concerned with comparing the predicament of the two communities in terms of some given minimum standard, e.g., that prevalent in either community. There is, indeed, nothing contradictory in asserting both of the following pair of statements:

- (i) there is *less* deprivation in community A than in community B in terms of some *common* standard, e.g., the notions of minimum needs prevailing in community A (or in B);
- (ii) there is *more* deprivation in community A than in community B in terms of their *respective* standards of minimum needs, which are a good deal higher in A than in B.

It is rather pointless to dispute which of these two senses is the “correct” one, since it is quite clear that both types of questions are of interest. The important thing to note is that the two questions are quite distinct from each other.

Second, while the exercise of “identification” of the poor can be based on a standard of minimum needs, that of “aggregation” requires some method of combining deprivations of different people into some over-all indicator. In the latter exercise some relative scaling of deprivations is necessary. The scope for arbitrariness in this is much greater since conventions on this are less firmly established and the constraints of acceptability would tend to leave one with a good deal of freedom.

In this context of arbitrariness of “aggregate description”, it becomes particularly tempting to redefine the problem as an “ethical” exercise, as has indeed been done in the measurement of economic inequality.¹ But the ethical exercises involve exactly similar ambiguities, and furthermore end up answering a different question from the descriptive one that was originally asked.² There is very little alternative to accepting the element of arbitrariness in the description of poverty, and making that element as explicit as possible. Since the notion of the poverty of a nation has some inherent ambiguities, one should not have expected anything else.

II. Minimum Needs and the Poverty Line

II.1. *Deprivation: Absolute and Relative*

Since “necessities” include “things which established rules of decency have rendered necessary”, the notion of “minimum needs” must, in an obvious

¹ See Dalton (1920) and Atkinson (1970), two of the outstanding contributions in this tradition.

² See Bentzel (1970), Hansson (1977), and Sen (1978b).

sense, be relative rather than absolute. The concept of "relative deprivation", much used in the sociological literature,¹ has thus an immediate relevance to the economic measurement of poverty. Deprivation has to be judged in comparison with the experience of others in the society.

Relative deprivation cannot, however, be the only basis of judging poverty. A famine, for example, will be readily accepted as a case of acute poverty no matter what the relative standards are. Indeed, there is an irreducible core of "absolute deprivation" in the notion of poverty which translates reports of starvation, severe malnutrition and visible hardship into a diagnosis of poverty without waiting to ascertain first the relative picture.² Thus the approach of relative deprivation supplements rather than supplants the analysis of poverty in terms of absolute dispossession.

This is particularly worth emphasizing in view of the recent tendency among some sociologists to view the problem of poverty as essentially indistinguishable from that of inequality. As Miller & Roby (1971) argue:

Casting the issues of poverty in terms of stratification leads to regarding poverty as an issue of inequality. In this approach we move away from efforts to measure poverty lines with pseudo-scientific accuracy. Instead, we look at the nature and size of the differences between the bottom 20 or 10 per cent and the rest of the society.³

Studies of the difference between the bottom decile (or the bottom two deciles) and the rest do throw light on the nature of inequality in the economy in question,⁴ but to identify that picture as one of poverty amounts to an exclusive concentration on relative as opposed to absolute deprivation (as well as quantifying relative deprivation in a very specific way). If an economic crisis leads to a general reduction of incomes with the relative pattern unchanged, then this approach of "poverty as inequality" may not diagnose any increase in the extent of poverty despite possibly dramatic rise in starvation and hunger. To ignore such information as hunger and hardship is not just an abstinence from "pseudo-scientific accuracy", but blindness to important parameters of the common understanding of poverty. There is, of course, a good deal of common ground between inequality and poverty, but the two cannot be treated as identical without impoverishing at least one of these two primitive notions.⁵

¹ See, for example, Runciman (1966) and Townsend (1971, 1974).

² Cf. Engels (1892). On related issues, see also Weisbrod (1965), Jackson (1972), Stewart & Streeten (1976), Drewnowski (1977), and Beckerman (1977).

³ Miller & Roby (1971, p. 143).

⁴ See, for example, Wiles (1974).

⁵ It is also worth noting that there are many measures of inequality, of which the gap between the bottom 10 % and the rest is only one (and rather a blunt one at that, completely insensitive to many types of changes). Also the question of economic inequality is not merely a matter of examining the size distribution of income but of investigating contrasts between different sections of the community from many different perspectives (e.g., in terms of relations of production, as done by Marx (1887)). Finally, for the concept of relative deprivation, the choice of "reference group" is important and a contrast with the average level may not be adequate.

II.2. *The Direct Method vs. the Income Method*

Even with a given set of minimum needs in terms of which poverty is to be measured, there are complex issues of methodology to be resolved. In the exercise of identifying the poor *vis-à-vis* that set of minimum needs, it is possible to use at least two alternative methods. One is simply to check the set of people whose actual consumption baskets happen to leave some minimum need unsatisfied. This we may call the “direct method”, and it does not involve the use of any income notion, in particular not that of a poverty-line income. In contrast, in what may be called the “income method”, the first step is to calculate the minimum income π at which all the specified minimum needs are satisfied. The next step is to identify those whose actual incomes fall below that poverty line π .¹

In an obvious sense the direct method is superior to the income method, since the former is not based on particular assumptions of consumption behaviour which may or may not be accurate. Indeed, it could be argued that *only* in the absence of direct information regarding the satisfaction of the specified needs can there be a case for bringing in the intermediary of income, so that the income method is at most a second best.

However, this is not all there is to the contrast of the two methods. The income method can also be seen as a way of taking note of individual idiosyncrasies without upsetting the notion of poverty based on deprivation. The ascetic who fasts on his expensive bed of nails will be registered as poor under the direct method, but the income method will offer a different judgement in recognition of his level of income at which typical people in that community would have no difficulty in satisfying the basic nutritional requirements. The income of a person can be seen to be not merely a rough aid to predicting a person’s actual consumption, but also as capturing a person’s *ability* to meet his minimum needs (whether or not he, in fact, chooses to use that ability).

There is a difficult line to draw here. If one were to look merely for the ability to meet minimum needs without being bothered by tastes, then one would, of course, set up a cost-minimizing programming problem and simply check whether someone’s income falls short of that minimum cost solution. Such minimum cost diets are typically very inexpensive,² but exceedingly boring and quite unacceptable. (In Indira Rajaraman’s (1974) pioneering work on poverty in Punjab, in an initial round of optimization, unsuspecting Punjabis were subjected to a deluge of Bengal grams.) Taste factors can be introduced through constraints (as Rajaraman did, and others do), but it is difficult to decide how pervasive and severe these constraints should be. In the extreme case the constraints determine the consumption pattern entirely.

¹ The distinction relates to Seebom Rowntree’s (1901) contrast between “primary” and “secondary” poverty, but is not exactly the same.

² See, for example, Stigler’s (1945) astonishing estimates of the cost of subsistence.

But there is, I believe, a difference in principle between taste constraints that apply broadly to the entire community and those that essentially reflect individual idiosyncrasies. If the poverty-level income π can be derived from typical behaviour norms of society, a person with a higher income but choosing to fast on a bed of nails can be, with some legitimacy, declared to be non-poor.

The “direct method” and the “income method” are, in fact, not two alternative ways of measuring the same thing, but represent two alternative conceptions of poverty. The direct method identifies those whose actual consumption fails to meet the accepted conventions of minimum needs, while the income method is after spotting those who do not have the ability to meet these needs within the behavioural constraints typical in that community. Both concepts are of some interest on their own in diagnosing poverty in a community, and while the latter is a bit more remote in being dependent on the existence of some typical behaviour pattern in the community,¹ it is also a bit more refined in going beyond the observed choices into the notion of ability. A poor person, on this approach, is one whose income is not adequate to meet the specified minimum needs in conformity with the conventional behaviour pattern.

The income method has the advantage of providing a metric of *numerical* distances from the “poverty line”, in terms of income short-falls. This the “direct method” does not provide. On the other hand, the income method is more restrictive in terms of preconditions necessary for the “identification” exercise. First, if the pattern of consumption behaviour has no uniformity, there will be no specific level of income at which the “typical” consumer meets his or her minimum needs. Second, if prices facing different groups of people differ, e.g., between social classes or income groups or localities, then π will be group-specific, even when uniform norms and uniform consumption habits are considered.² These are real difficulties and cannot be wished away.

II.3. *Family Size and Equivalent Adults*

Another difficulty arises from the fact that the family rather than the individual is the natural unit as far as consumption behaviour is concerned. In calculating the income necessary for meeting the minimum needs of families of different size, some method of correspondence of family income with individual income is needed. While the simplest method of doing this is to divide the family income by the number of family members, this overlooks the economies of large scale that operate for many items of consumption, and also the fact that the children’s needs may be quite different from those of adults. To cope with these issues, the common practice both for poverty estimation as well as for social security operations is to convert each family into a certain number of “equivalent

¹ The income method is based on two different sets of conventions, viz., (i) those used to identify the minimum needs, and (ii) those used to specify behaviour and taste constraints.

² For evidence of sharp differences in income-group-specific price deflators in India, see Bardhan (1973), Vaidyanathan (1974), and Radhakrishna & Sharma (1975), among others.

adults" by the use of some "equivalence scale", or, alternatively, to convert the families into "equivalent households".¹

There tends to be a lot of arbitrariness in any such conversion. Much depends on the exact consumption patterns of the people involved, and their perception of their own relative position. Indeed, both the minimum needs of children as well as variations of consumption behaviour of families with variations of the number and age composition of children are complex fields for empirical investigation.

There are also different *bases* for deriving appropriate equivalence of needs.² One approach is to take the nutritional requirements for each age group separately and then to take the ratios of their costs given established patterns of consumer behaviour. A second approach is to examine how the people involved regard the equivalence question themselves, viz. how much extra income do they think is needed to make a larger family have the same standard of well-being as a smaller one. Empirical studies of these "views" have shown considerable regularities and consistency.³ A third way is to examine the actual consumption behaviour of families of different size and to treat some aspect of this behaviour as an indicator of welfare. For example, the fraction of income spent on food has been treated as an indicator of poverty: two families of different size are regarded as having "equivalent" incomes when they spend the same proportion of their incomes on food.⁴

No matter how these equivalent scales are drawn up, there remains the further issue of the weighting of families of different size. Three alternative approaches may be considered: (i) put the same weight on each household irrespective of size, (ii) put the same weight on each person irrespective of the size of the family to whom they belong, and (iii) put a weight on each family equal to the number of equivalent adults in it.

The first method is clearly unsatisfactory since the poverty and suffering of a large family is, in an obvious sense, greater than that of a small family at a *per capita* poverty level judged to be equivalent to that of the former. The third alternative might look like a nice compromise, but it is, I believe, based on a confusion. The scale of "equivalent adults" indicates conversion factors to be used to find out how well off members of that family are, but ultimately we are concerned with the sufferings of *everyone* in the family and not of a hypothetical equivalent number. If two can live as cheaply as $1\frac{1}{2}$ and three as cheaply as 2, these facts must be taken into account in comparing the relative well-beings of two-member and three-member families, but there is no reason why the suffer-

¹ See Orshansky (1965), Abel-Smith & Townsend (1965), and Atkinson (1969), among others.

² For an illuminating account of these methods and their underlying logic, see Muellbauer (1978).

³ See, for example, Goedhart, Halberstadt, Kapteyn & Van Praag (1977).

⁴ See Muellbauer (1977b). The method goes back to Engel (1895). See also Friedman (1952), Brown (1954), Prais & Houthakker (1955), Barten (1964), Nicholson (1976), Muellbauer (1977a), Kakwani (1977), among others.

ing of two three-member families should receive any less weight than that of three two-member families at the same level of illfare. There is, thus, a good case for using procedure (ii) after the personal level of well-being or poverty has been ascertained by the use of equivalent scales taking note of the size of the families to which they belong.

III. Aggregate Poverty

III.1. *Poverty Gaps and Relative Deprivation*

The income short-fall of a person whose income y_i is less than the poverty line π can be called his "income gap" ($\pi - y_i$). In the aggregate assessment of poverty, these income gaps must be taken into account. But does it make a difference as to whether or not a person's shortfall is unusually large compared with those of others? It seems reasonable to argue that any person's poverty cannot really be independent of how poor the others are.¹ Even with exactly the same absolute shortfall ($\pi - y_i$), a person may be thought to be "poorer" if the other poor have shortfalls smaller than his, in contrast with the case in which his shortfall is less than that of others. Quantification of poverty would, thus, seem to need the marrying of considerations of absolute and relative deprivation even *after* a set of minimum needs and a poverty line have been fixed.

The question of relative deprivation can be viewed also in the context of a possible transfer of a unit of income from a poor person—call him 1—to another—christened 2—who is richer but still below the poverty line and remains so even after the transfer. Such a transfer will increase the absolute shortfall of the first person by exactly the same amount by which the absolute shortfall of person 2 will be reduced. Can one then argue that the overall poverty is unaffected by the transfer? One can dispute this, of course, by bringing in some notion of diminishing marginal utility of income, so that the utility loss of the first may be argued to be greater than the utility gain of the second. But such cardinal utility comparisons for different persons involves the use of a rather demanding informational structure with well-known difficulties. In the absence of cardinal comparisons of marginal utility gains and losses, is it then impossible to hold that the over-all poverty of the community has increased? I would argue that this is not the case.

Person 1 is relatively deprived compared with 2 (and there may be others in between the two who are more deprived than 2 but less so than 1). When a unit of income is transferred from 1 to 2, it *increases* the absolute shortfall of a more deprived person and *reduces* that of someone *less* deprived, so that in a straightforward sense the over-all relative deprivation is increased.² And this is the

¹ Cf. Scitovsky (1976) and Hirsch (1976).

² A complex problem arises when the transfer makes person 2 cross the poverty line—a possibility that has been deliberately excluded in the postulated case. This case involves a reduction in one of the main parameters of poverty, viz., the identification of the poor,

case quite irrespective to whether absolute deprivation is measured by income shortfalls, or (taking utility to be an increasing function of income) by utility shortfalls, from the break-even poverty line. One does not, therefore, have to introduce an interpersonally comparable *cardinal* welfare scale to be able to say that the transfer specified will increase the extent of relative deprivation.

In the “aggregation” exercise the magnitudes of absolute deprivation may have to be supplemented by considerations of relative deprivation. Before this exercise is studied, it will be useful to review the standard measures of poverty used in the literature and to examine their shortcomings.

III.2. Critique of Standard Measures

The commonest measure of over-all poverty is what may be called the head-count measure H given by the proportion of the total population that happens to fall below the specified poverty line π . If q is the number of people who are identified as being poor and n the total number of people in the community, then the head-count measure H is simply:

$$H = q/n \quad (1)$$

This index has been widely used—explicitly or by implication—ever since quantitative study and measurement of poverty began (see Booth (1889), Rowntree (1901)). It seems to be still the mainstay of poverty statistics on which poverty programmes are based (see Orshansky (1965, 1966), Abel-Smith & Townsend (1965)). It has been extensively utilised recently both for intertemporal comparisons as well as for international contrasts.¹

Another measure that has had a fair amount of currency is the so-called “poverty gap”, which is the aggregate shortfall of income of all the poor from the specified poverty line π .² The index can be normalized by being expressed as the percentage shortfall of the average income of the poor from the poverty line. This measure—denoted I —will be called the “income-gap ratio”. With the poverty line income π and income of person i being y_i , the income-gap of person i is: $g_i = \pi - y_i$. The “income-gap ratio” I is given by the following when $S(\pi)$ stands for the set of people with income no higher than π :

$$I = \sum_{i \in S(\pi)} g_i / q\pi \quad (2)$$

and while there is an arbitrariness in attaching a lot of importance to whether a person actually crosses the poverty line, this is an arbitrariness that is implicit in the concept of poverty itself based on the use of a breakeven line. The question is investigated further in section 3.4.

¹ See, for example, the lively debate on the time trend of Indian poverty: Ojha (1970), Dandekar & Rath (1971), Minhas (1970, 1971), Bardhan (1970, 1971, 1973), Mukherjee, Bhattacharya & Chatterjee (1972), Vaidyanathan (1974), and Lal (1976). For international comparisons, see Chenery, Ahluwalia, Bell, Duloy & Jolly (1974).

² The poverty gap has been used by the U.S. Social Security Administration. For a discussion of the poverty-gap approach, see Batchelder (1971). See also Kakwani (1977) and Beckerman (1977).

The income-gap ratio I is completely insensitive to transfers of income among the poor so long as nobody crosses the poverty line by such transfers. It also pays no attention whatever to the number or proportion of poor people below the poverty line, concentrating only on the aggregate shortfall, no matter how it is distributed and among how many. These are damaging limitations.

The head-count measure H is, of course, not insensitive to the number below the poverty line; indeed for a given society it is the only thing to which H is sensitive. But H pays no attention whatever to the extent of income shortfall of those who lie below the poverty line: it matters not at all whether someone is just below the line, or very far from it in acute misery and hunger.

Furthermore, a transfer of income from a poor person to one who is richer can never increase the poverty measure H —surely a perverse feature. The poor person from whom the transfer takes place is, in any case, counted in the value of H , and no reduction of his income will make him count any more than he does already. On the other hand, the person who *receives* the income transfer cannot, of course, move below the poverty line as a consequence of this. Either he was rich and stays so, or was poor and stays so, in both cases the H measure remains unaffected; or he was below the line but is pulled above it by the transfer, and this makes the measure H fall rather than rise. So a transfer from a poor person to one who is richer can *never* increase poverty as represented by H .

There are, thus, good grounds for rejecting the standard poverty measures in terms of which most of the analyses and debates on poverty have traditionally taken place. The head-count measure in particular has commanded implicit support of a kind that is quite astonishing. Consider A. L. Bowley's (1923) famous assertion: "There is, perhaps, no better test of the progress of the nation than that which shows what proportion are in poverty" (p. 214). The spirit of the remark is acceptable enough but surely not the gratuitous identification of poverty with the head-count measure H .

What about a combination of these poverty measures? The head-count measure H ignores the extent of income shortfalls, while the income-gap ratio I ignores the numbers involved: why not a combination of the two? This is, alas, still inadequate. If a unit of income is transferred from a person below the poverty line to someone who is richer but who still is (and remains) below the poverty line, then both the measures H and I will remain completely unaffected. Hence any "combined" measure based only on these two must also show no response whatsoever to such a change, despite the obvious increase in aggregate poverty as a consequence of this transfer in terms of relative deprivation.

There is, however, a special case in which a combination of H and I might just about be adequate. Note that while individually H is insensitive to the extent of income shortfalls and I to the numbers involved, we could criticise the *combination* of the two only for their insensitivity to variations of distribu-

tion of income among the poor. If we were, then, to confine ourselves to cases in which all the poor have precisely the same income, it may be reasonable to expect that H and I together may do the job. Transfers of the kind that have been considered above to show the insensitivity of the combination of H and I will not then be in the domain of our discourse.

The interest of the special case in which all the poor have the same income does not arise from its being a very likely occurrence. Its value lies in clarifying the way absolute deprivation *vis-à-vis* the poverty line may be handled when there is not the additional feature of relative deprivation *among* the poor.¹ It helps us to formulate a condition that the required poverty measure P should satisfy when the problem of distribution among the poor is assumed away by postulating equality. It provides *one* regularity condition to be satisfied *among* others.

III.3. Axiomatic Derivation of a Poverty Measure

The absolute shortfall of income of a person i lying below the poverty line is given by g_i . We may begin by taking the poverty measure P to be a weighted sum of the shortfalls of all people who are judged to be poor, i.e., the set $S(\pi)$.² This is done in a very general way with provision for normalization in any way we like, and with weights that can be functions of other variables so that the superficially additive form is not a real constraint.

$$P = A(\pi, q, n) \sum_{i \in S(\pi)} g_i v_i \quad (3)$$

So far not much has been said, since both the weights v_i and the parameter A have been left unspecified, and not much exclusion has been achieved as yet.³ The interesting questions arise when we start characterizing the weights v_i and the parameter A .

If we wished to base the poverty measure on some quantification of the sum-total loss of utility arising from the penury of the poor, then v_i should be derived from the familiar utilitarian considerations. If, additionally, it is assumed that the utility of each person depends only on his own income, then v_i too will depend only on the income y_i of that person, and not also on the incomes of others. This will provide a "separable" structure, each person's component of

¹ As was discussed in Section II.1, the question of relative deprivation *vis-à-vis* the rest of the community is involved also in the fixing of minimum needs on which the choice of the poverty line is based, so that the estimation of "absolute" deprivation *vis-à-vis* the poverty line involves implicitly some considerations of *relative* deprivation as well. The reference in the text here is to issues of relative deprivation that remain *even after* the poverty line has been drawn, since there is the *further* question of how deprived one is compared with others who are also deprived.

² In fact, it is convenient to define the poor as those with income *no higher than* π . So, formally, $S(\pi) = \{i | y_i \leq \pi\}$.

³ To return to the head-count measure H , choose $v_i = 1/g_i$ and $A = 1/n$, where n is the total number of people in the community. For the income-gap ratio, use $v_i = 1$, and $A = 1/q\pi$, where q is the number of people who are poor, i.e., belong to $S(\pi)$.

the overall poverty being derived without reference to the conditions of the others. But this use of the traditional utilitarian model will miss the idea of relative deprivation, which—as we have already argued—is rather central to the notion of poverty. Furthermore, there are difficulties with such cardinal comparisons of utility gains and losses, and even if these were ignored, it is no easy matter to secure agreement on using one particular utility function among so many that can be postulated, all satisfying the usual regularity conditions such as concavity requirements.

Instead, the concentration here will be precisely on aspects of relative deprivation. Let $r(i)$ be the rank of person i in the ordering of all the poor in the decreasing order of income, e.g., $r(i) = 12$ if i is the 12th worst off among the poor. If more than one person has the same income, they can be ranked in any arbitrary order: the poverty measure must be such that it should not matter which particular arbitrary order is chosen among those with the same income. Clearly, the poorest poor has the largest rank value q , when there are q people altogether on this side of the poverty line, while the least poor has the rank value of 1. The greater the rank value the more is the person deprived in terms of relative deprivation with respect to others in the same category.¹ It is, thus, reasonable to argue that a poverty measure capturing this aspect of relative deprivation must make the weight v_i on a person's income shortfall increase with his rank value $r(i)$. As a functional relation this leads to:

$$v_i = f(r(i)), \text{ with } f \text{ an increasing function.} \quad (4)$$

A rather distinguished and simple case of such an increasing function f is the identity mapping which makes v_i equal the rank value $r(i)$. This makes the weights equi-distanced, and the procedure is in the same spirit as Borda's (1781) famous argument for the rank-order method of decisions, choosing equal distances in the absence of a convincing case for any alternative assumption. While this too is arbitrary, it captures the notion of relative deprivation in a simple way, and leads to a transparent procedure making it quite clear what precisely is being assumed.²

Axiom R (Ranked Relative Deprivation). The weight v_i on the income shortfall of person i is given by the income rank of person i among the poor, i.e.,

$$v_i = r(i) \quad (4.1)$$

This axiom, which focuses on the distribution of income among the poor, may be combined with the kind of information that is presented by the head-count measure H and the income-gap ratio I in the special case in which everyone below the poverty line has the same income (so that there is no distribution problem among the poor). H presents the proportion of people who are de-

¹ Cf. Runciman (1966), and Townsend (1971, 1974).

² It is, in fact, possible to derive the characteristic of equi-distance from other—more primitive—axioms (see Sen (1973b, 1974)).

prived in relation to the poverty line π , and I reflects the proportionate amount of absolute income deprivation *vis-à-vis* π . It can be argued that H catches one aspect of overall deprivation, viz. how many (never mind how much), while I catches another aspect of it, viz. how much on the average (never mind suffered by how many). In the special case when all the poor have the same income, H and I together may give us a fairly good idea of the extent of poverty in terms of overall deprivation. Since the problem of relative distribution among the poor does not arise in this special case, we may settle for a measure that boils down to some function of only H and I under these circumstances. A simple representation of this, leading to a convenient normalization, is the product HI .

*Axiom A (Normalized Absolute Deprivation)*¹. If all the poor have the same income, then $P = HI$.

If these two axioms are accepted, then a precise measure of poverty emerges axiomatically (see Sen (1973b, 1976a)):

If the number of the poor is large, then the only poverty measure satisfying Axioms R and A is given by:

$$P = H[I + (1 - I)G], \quad (5)$$

where G is the Gini coefficient of the income distribution among the poor.

For formal proofs of results essentially equivalent to this one, the reader is referred to Sen (1973b, 1976a). Here I confine myself to giving a heuristic view of what P stands for.² When there is no inequality among the poor, clearly G is zero, and P will then stand for HI , consisting of the product of two indicators of "absolute" deprivation, viz. the proportion of people who are deprived (H) and the proportionate average deprivation of those who are deprived (I). With the same number of poor and the same average deprivation, if the income among the poor is redistributed with some becoming poorer and others richer (though still poor), it would clearly lead to more relative deprivation. The poorer a person is, the larger his income shortfall g_i , and under Axiom R this shortfall will receive a greater weight than the shortfall of a person who is relatively richer.³ Thus a transfer from a poorer person (call him 1) to a richer person (call him 2) will reduce the shortfall of 2, which has a lower weight, by

¹ It should be remembered that in fixing the poverty line considerations of relative deprivation have already played a part, so that absolute deprivation *vis-à-vis* the poverty line is non-relative only in the limited context of the "aggregation" exercise. As was discussed earlier, the concepts of absolute and relative deprivation are both relevant to *each* of the two exercises in the measurement of poverty, viz., identification and aggregation. Axioms A and R are each concerned exclusively with the aggregation exercise.

² For empirical applications of this measure of poverty to data of different countries and interesting discussions of related conceptual issues, see Ahluwalia (1978), Alamgir (1976), Anand (1977), Bhatta (1974), Dutta (1978), Kakwani (1977), Osmani (1978), Sastry (1978), Seastrand & Diwan (1975), among others.

³ This approach relates closely to the evaluation of real national income in terms of "named good vectors" presented in Sen (1976b). The relationship between the two types of exercises has been analysed in depth by Osmani (1978).

the same amount as the increase in the shortfall of 1, which has a higher weight. This will, of course, increase the overall measure of poverty with weights based on the notion of relative deprivation. In some ways, this increase in inequality among the poor with an unchanged average gap I is equivalent to an increase in that average gap with unchanged distribution. To the absolute deprivation I is, thus, to be added a bit from the rest, i.e., from $(1 - I)$, in proportion to the measure of inequality among the poor given by the Gini coefficient. This "equivalent" absolute shortfall is, thus, given by the actual shortfall I plus the additional equivalent bit reflecting the impact of the inequality among the poor $(1 - I)G$. If we now take the product of this aggregate "equivalent" shortfall $[I + (1 - I)G]$ with the other aspect of absolute deprivation given by the head-count measure H , then we indeed get the poverty measure P as expressed in (5).

III.4. Alternatives and Variations

Axioms A and R can be varied in certain ways that are not unreasonable. Ambiguities in the notion of poverty permit such plurality (see section 1 above). One idea is to modify the income-gap element I in the measure of deprivation by taking the *per capita* gap not as a percentage of the poverty level income π but as a percentage of the mean income of the community: where μ is the mean income of the entire community.

$$I^* = \sum_{i \in S(\pi)} g_i / q\mu \quad (2^*)$$

HI^* clearly equals the ratio of the aggregate poverty gap to total national income or GDP:¹

$$HI^* = \sum_{i \in S(\pi)} g_i / n\mu \quad (2^{**})$$

Axiom A (Alternative Normalized Absolute Deprivation).* If all the poor have the same income, then $P = HI^*$.

It is easily checked that Axioms A^* and R lead to a modified poverty measure P_1 , which has been proposed and extensively explored by Sunhir Anand², and which differs from P by a multiplicative constant reflecting normalization per unit of national mean income rather than the poverty line income:

$$P_1 = P\pi/\mu \quad (6)$$

P_1 has the feature of being sensitive to the income of the non-poor as well. A rise in the income of a non-poor person, given other things, will reduce I^* and obviously will also reduce the modified poverty measure P_1 . A rise in the

¹ Beckerman (1977) puts this measure to good use as an indicator of the relative burden of poverty, but also warns against reading too much into this ratio (p. 12).

² See Anand (1977).

income of anyone can be taken to be, in some ways, a reduction of the poverty of the nation; P_1 will show this directional response, while P will not budge if the income rise is of a person who is above the poverty line. Another way of defending the use of P_1 rather than P is to note that HI^* expresses the percentage of national income that would have to be devoted to transfers if poverty were to be wiped out by redistribution, and in some sense, HI^* does, therefore, reflect the *relative burden* of poverty on the nation compared with its aggregate income.

On the other hand, it can be argued that assessing the relative burden of poverty is really a different exercise from the description of poverty in terms of prevailing notions of deprivation. More importantly, P_1 has the characteristic that some increase in the income shortfall of the poor may be compensated by a sufficiently high rise in the income of the non-poor. And this can be objected to on the ground that poverty is a characteristic of the poor, and a reduction of the incomes of the poor must increase the measure of poverty, no matter how much the incomes of the non-poor go up at the same time. P satisfies this condition, but not P_1 .

The choice of the index must, of course, depend on the purpose for which such a measure is sought. For descriptive exercises on "the state of the poor" (to quote the title of the famous treatise of F. M. Eden (1797)) P would have an obvious advantage over P_1 . But if, on the other hand, the intention is to check the country's potential ability to meet the challenge of poverty, P_1 has a clear advantage. The two versions, therefore, describe two rather different things.

Variants of Axiom R may also be considered. Nanak Kakwani (1977) has provided various measures closely related to the measure P . An especially interesting one—we may call it P_2 —makes the weight v_i on the income shortfall of person i depend not on the number of people among the poor *vis-à-vis* whom i is relatively deprived, but on the aggregate *income* of these people. P_2 has the merit of making i 's sense of deprivation take note of the actual incomes enjoyed by those who are richer than him, but lying below the poverty line. On the other hand, P_2 takes no note of how the aggregate income of these people is divided among them, and more importantly, no note even of the number of persons among whom this aggregate income is divided. The sense of relative deprivation is made to depend on the sum-total of income of those who—while poor—are better off than the person in question, and no other information is used regarding the disposition of that sum-total.

In another contribution, Kakwani (1978) modifies Axiom R in a different way to provide a more general structure than Axiom R would permit. Essentially, Kakwani's axiom makes the weight v_i the k th power of the income rank of person i among the poor.

Axiom R^ .* The weights v_i in (3) are given by:

$$v_i = r(i)^k \quad (4.2)$$

For the poverty measure—call it P_3 —derived from this, the sensitivity of between-poor income distribution will depend on the value of k . The poverty measure P obtained earlier corresponds to $k=1$, making it, as Kakwani (1978) puts it, “equally sensitive to a transfer of income at all income positions” (p. 7). The generalization involved in P_3 permits various alternative assumptions about transfer sensitivity, e.g., giving more weight to transfers of income at the lower end of the distribution of income.

A different generalization based on a reinterpretation of the poverty index P has been proposed by Blackorby & Donaldson (1978). They note that the measure P , as given by (5), can be seen as the product of the head count ratio H and the proportionate gap between the poverty line income π and the Atkinson-Kolm “equally distributed equivalent income”, e^q , of the incomes of the poor when the evaluation is done with the Gini social evaluation function.¹

$$P = H[(\pi - e^q)/\pi]. \quad (5.1)$$

If the social evaluation function is changed, a new poverty measure would emerge correspondingly, with e the equally distributed equivalent income according to that social evaluation function.²

$$P_4 = H[(\pi - e)/\pi]. \quad (5.2)$$

Blackorby & Donaldson choose an *ethical* interpretation of the poverty measures. The value of e reflects that level of income which if shared by all the poor would be judged by the social evaluation function to be exactly as good as the actual distribution of income among the poor. But it is easily seen that the format permits a *descriptive* interpretation as well, viz. e standing for that level of income which if shared by all the poor will be regarded as displaying as much overall poverty as the actual distribution of income among the poor. The issues involved in the choice between descriptive and ethical interpretations of poverty have been discussed elsewhere (Sections I.1 and I.2 above),³ and will not be pursued further. The poverty measures, not merely in the generalized form P_4 , but also in the original form P , can be mathematically interpreted in either way, and the real question is one of relevance of the exercise to the motivation that leads to the search for a measure of poverty.

A particular descriptive characteristic of the poverty measure P has been the subject of some detailed investigation. While it is clear that the measure P of poverty *must* record a rise when there is a transfer of income from a poorer

¹ For the concept of equally distributed equivalent income, see Kolm (1969) and Atkinson (1970). For the relation of the poverty measure P to the Gini evaluation function, see Sen (1976a), and related matters in Sen (1974, 1976b).

² Blackorby & Donaldson (1978) point out the need for some assumptions about the general characteristics of such a social evaluation function, especially its homotheticity, and strict separability of a kind that permits one to rank the distributions of income among the poor independently of the incomes of those who are richer.

³ See also Sen (1978b).

person to one who is richer provided this does not make the richer person cross the poverty line, exactly the opposite *can* happen—depending on the exact values—when such a crossing does take place (see Sen (1977a, p. 77)). It is arguable whether a poverty measure should not show *increased* poverty *when* ever some income is transferred from a poorer to a richer person *no matter* whether this makes the richer person cease to be regarded as poor because of his crossing the poverty line. Dominique Thon (1978) has analysed the analytical relations involved in such monotonic transfer sensitivity, and has proposed a variation of P that would ensure that the poverty measure records an increase whenever there is a transfer of income from a person who is poor to one who is richer. He modifies Axiom R to make the weight v_i on poor i 's income gap g_i equal his income rank $R(i)$ among *all* the people in the community and not merely among the poor (as under Axiom R).

*Axiom R^{**} .* The weights v_i in (3) are given by:

$$v_i = R(i) \quad (4.3)$$

Combined with the original structure with slight modifications, Axiom R^{**} precipitates Thon's variant—we may call it P_5 —of the poverty measure satisfying this monotonic transfer property.¹

There remains, of course, the substantial issue as to whether a poverty measure should always register an increase whenever there is such a transfer even when the transfer actually reduces the number of the poor.² In so far as the index of poverty is interpreted to represent the condition of the poor in the nation—their prevalence and their penury—a good case can perhaps be made for permitting the possibility that a reduction of the prevalence of poverty might under some circumstances compensate a rise in the extent of penury of those who remain below the poverty line. The old measure P admits this, while Thon's P_5 does not. If, however, the focus is on the general poverty of the nation and not merely of the predicament of people below the poverty line, then the monotonic transfer axiom would make a good deal of sense, since the poverty-alleviating role of crossing the poverty line would be then rendered less crucial. Again, the variation proposed has merits that are conditional on the purpose for which the poverty measure is being sought.

¹ $P_5 = [2/\pi n(n+1)] \sum_{i=1}^q g_i R(i)$. This contrasts with the poverty measure P , which can be written as:

$$P = [2/\pi n(q+1)] \sum_{i=1}^q g_i r(i).$$

² The "transfer axiom" considered (but not used in the derivation of P) in Sen (1976a) demanded: "Given other things, a pure transfer of income from a person below the poverty line to anyone who is richer must increase the poverty measure" (p. 219). In Sen (1977a), this was modified to the less demanding requirement: "Given other things, a pure transfer of income from a person below the poverty line to anyone richer must strictly increase the poverty measure unless the number below the poverty line is strictly reduced by the transfer" (p. 77). This contrast is the central one between P and P_5 . It is worth noting that the traditional measures of poverty, such as H and I , which were shown to violate the original transfer axiom continue to violate this modified transfer axiom.

Another interesting variant of the poverty measures P has been proposed by Takayama (1978), and the approach used in that derivation has been extensively explored by Hamada & Takayama (1977). From the actual income distribution a "censored" income distribution is obtained by replacing the incomes that exceed the poverty line ($y > \pi$) by incomes exactly equalling the poverty line (π). Takayama (1977) then takes the Gini coefficient G_c of the censored income distribution as the measure of poverty—we may call it P_c —and other measures of inequality are applied to the censored distribution to derive corresponding measures of poverty in Hamada & Takayama (1977).

The approach has some clear merits. The Gini coefficient of the censored distribution is a much neater—and closer—translation of the Gini measure of inequality into a poverty measure. It doctors the income distribution itself by ignoring the information on the actual incomes of the people who are not poor, but counts them in with poverty line incomes. Takayama (1978) has also provided an interesting axiomatization of his measure of poverty G_c , and Hamada & Takayama (1977) have suggested derivations for similar poverty measures based on other inequality indexes applied to the censored distribution.

The main drawback of this approach lies in its robust violation of the requirement that a reduction of income of anyone below the poverty line—given everything else—must *increase* the poverty measure to be used (the "monotonicity axiom" in Sen (1976a)). A person below the poverty line may still be among the *relatively* richer in the censored distribution of income with an income above the mean and the median of that distribution. A reduction of his income will in an obvious sense reduce the extent of inequality in the censored distribution, but in an equally obvious sense the community must now be having *more*—not *less*—poverty. So the simplicity of the formulae used by Takayama (1978) and Hamada & Takayama (1977) is achieved at some real cost, viz. failing to establish a monotonic relation between the poverty measure and vector-dominance of deprivation of the poor.

IV. Concluding Remarks

There will be no attempt to summarise the arguments presented in the paper, but a few general remarks will be made to put the discussion in perspective.

(1) There is a good case for viewing the measurement of poverty not, as is often asserted, as an ethical exercise, but primarily as a descriptive one (Section I.1). Furthermore, it can be argued that the frequently-used "policy definition" of poverty is fundamentally flawed (Section I.2). The exercise of describing the predicament of the poor in terms of the prevailing standards of "necessities" does, of course, involve ambiguities, which are inherent in the concept of poverty, but ambiguous description is not the same thing as prescription. Instead, the arbitrariness that is inescapable in choosing between permissible precedures and possible interpretations of standards require recognition and

appropriate treatment, e.g., explicit pointers to arbitrary elements, and use of partial orderings reflecting the intersection of various criteria (Sections I.1 and I.3).

(2) Considerations of “absolute” and “relative” deprivation both enter the concept of poverty. While the so-called “biological approach” of Rowntree (1901) and others may have concentrated too much on absolute aspects and the approach of “relative deprivation” corrects this, still there is an irreducible core of absolute deprivation in the perception of poverty. Attempts at “regarding poverty as an issue in inequality”, appealing as it is, is crucially incomplete (Section II.1).

(3) The measurement of poverty can be split into two interrelated exercises, viz. the *identification* of the poor, and *aggregation* of the poverty characteristics of different people into one overall measure, or one ranking. The “direct method” and the “income method” are two different ways of resolving the *identification* exercise. They are not, however, two alternative ways of measuring the “same” thing, but reflect two different conceptions of poverty (Section II.2).

(4) Because of variations of family size, economies of large scale in family consumption, and age-specificity of needs, the problem of converting families into “equivalent adult” numbers involve serious difficulties. But alternative approaches can be considered, providing different *bases* for deriving equivalence of needs. There is the further problem of *weighting* of families of different size in the aggregation exercise. In this the practice of weighting families according to the number of “equivalent adults” rather than according to *actual* numbers reflects confusion, albeit a sophisticated one (Section II.3).

(5) The aggregation exercise is much too crudely performed by the standard measures of poverty such as the “head-count” of the poor and the “income gap” ratio. Some elementary characteristics that any measure of poverty can be expected to satisfy are robustly violated by these measures and by all joint functions of these variables (Section III.2).

(6) An axiomatization of the aggregation exercise using notions of absolute and relative deprivation leads to a poverty measure P , which can be shown to be a function of the “head-count ratio”, the “income-gap ratio” and the “Gini coefficient” of income distribution among the poor (eq. 5). While the proof of the theorem has been presented elsewhere (Sen, 1976a), its intuitive content is explored here (Section III.3). It can easily be empirically applied, and has indeed been used to measure and compare poverty in a number of countries, and different states within a country.

(7) The axioms used for deriving the measure P can be varied, yielding other poverty measures, e.g., P_1 to P_6 discussed in the text (Section III.4). An analysis of the rationale of these variants indicate what they are trying to capture *vis-à-vis* what is represented by the poverty measure P . The choice depends largely on the precise motivation underlying the measurement of poverty. Some of these variations, in fact, define *classes* of measures with the

measure P a member of each such class. While P has certain unique advantages, which its axiomatization brings out, several of the variants are certainly permissible interpretations of the common conception of poverty. There is nothing defeatist or astonishing in the acceptance of this "pluralism". Indeed, as argued earlier (Sections I.1 and I.3), such pluralism is inherent in the nature of the exercise.

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