Chapter - 3

REVIEW OF LITERATURE

3.1 Deprivation When Income Is The Only Indicator

In the opinion of Amrtya Sen, in the measurement of poverty two distinct problems must be faced, viz, 1) identifying the poor among the total population, and 2) constructing an index of poverty using the available information on the poor. This dissertation is more concerned with the second problem. The most common procedure for handling problem – 2 seems to be simply to count the number of poor and check the percentage of the total population belonging to this category. This ratio, which we shall call the Head-Count-Ratio H, is obviously a very crude index. To explain income shortfall and poverty Sen has considered a community S of n people. The set of q people with income no higher than x is called S (x). If Z is the 'poverty line', S (z) is the set of "the poor". S (∞) is, of course, the set of all, i.e., S. The income gap g_i of any individual 'i' is the difference betweeen the poverty line Z and his income Y_i.

$$g_i = Z - Y_i.$$

Obviously, g_i is non-negative for the poor negative for others.

This, however, all about the measurement of poverty by income shortfall method. But poverty will be better understood if we examine the real indicators. That's why we have dealt with weight poverty, calorie poverty and poverty on the point of education and sanitation.

Sen (1976) has noted that poverty measurement may be broken down into two steps : First, an identification step to determine who the poor are ; and second, an aggreation step which brings together the data on the poor into an overall measure of poverty. The fact that Sen considers the second step to be as important as the first is where he departs from the previous literature, and indeed thus ranks as one of his major contributions to the area.Sen beigns with a collection N of individuals i=1,2..............,n, each receiving a respective quantity Y_i of income. Implicitly, all problems with defining income are presumed to be solved, and a common poverty line π for all individuals is assumed to be given. The poor are indentified as all persons whose incomes don't exceed the poverty - line. Where $Y=(y_1, y_2, \ldots, y_n)$ is the income distribution and π is the poverty - line, we denote the set of poor by

$$T(Y;\pi)=\{i \in N | Y_i \ngtr \pi\},$$

Or simply T where there is no ambiguity. The number of persons in T is denoted by q (Y : π) or simply q.

At the heart of the Sen measure lies the notion of 'ranking' (r) of the poor. Given Y and π, we define a ranking of the poor to be one-to-one function, $r : T \rightarrow (1,2, \ldots, q)$, which satisfies r (i) > r (j) whenever

$$g_i(Y;\pi) > g_j(Y;\pi).$$

Note that r depends on the income distribution and the poverty line, and so we shall denote r (i) by $r_i(Y;\pi)$ or simply r_i. And T is the set of poor. Hence, the poorest person has a rank of q, while the poor person nearest the poverty line has a rank of 1.

The Sen poverty measure is defined by

$$S(Y;\pi) = 2/(q+1)n\pi \sum g_i\, r_i(Y;\pi), i \in T$$

Where $r_i(Y;\pi)$ is a ranking of the poor associated with Y and π. Aggregate poverty is a normalized weighted sum of individual poverty gaps, where the weights are given by ranking among the poor.

The aggregation step entails combining this basic data to obtain a number which indicates the overall level of poverty. When the poverty-line and all incomes are non-negative, this may be denoted by

$$P : R_+^{n+1} \rightarrow R$$

For Sen, the agregation step is tantamount to choosing an appropriate poverty measure.

For relative deprivation Sen introduced interpersonal comparison. If person i is accepted to be worse - off than person j in a given income configuration Y, then the weight V_i for the income shortfall g_i of the worse - off person i should be greater than the weight V_j for the income shortfall g_j. Let $W_i(Y)$ and $W_j(Y)$ be the welfare levels of i and j under configuration Y. Then for relative equity :

AXIOM-E (Relative Equity) [Sen (1976)]

For any Pair i, j : if $W_i(Y) < W_j(Y)$,

then $V_i(Z, Y) > V_j(Z, Y)$

Individual welfare is taken to be ordinally measurable and level comparable. There is agreement on who is worse off than whom, e.g., 'poor i is whorse off than wealthy j', but no agreement on the alues of the welfare differences is required. This axiom also states that if i is worse off than j, then the weight on i's income gap should be greater than on j's income gap. Alternatively, the lower a person is in the welfare scale, the greater is his sense of poverty, and his welfare rank among others may be taken to indicate the weight to be placed on his income gap.

This axiom gives expression to a very mild requirement of equity. Another Axiom is proposed which incorporates Axiom - E, but is substantially more demanding.

AXIOM - R (Ordinal Rank Weights) [Sen (1976)]

The weight $V_i(Z, Y)$ on the income gap of person i equals the rank order of i in the interpersonal welfare ordering of the poor.

Axiom - R is taken as axiom here, though it can be easily made a theorem derived from more primitive axioms (see Sen [33 and 34]). There are essentially two ways of doing this. The first is to follow Borda's procedure (Borda [7, P. 659], translated by Black [6, P. 157]). Using Borda's procedure combined with appropriate normalization of the origin and the unit, we arrive at Axiom - R.

The second is to take a " relativist" view of poverty, viewing deprivation as an essentially relative concept (see Runciman [28]).

Since Axioms E and R are in terms of welfare rankings, where as the observed data are on income rankings, we have to turn to the relation between income and welfare. There are good reasons to think that sometimes a richer person may have lower welfare than a poorer person, e.g., if he is cripple. But Axiom - M proceeds on the crude assumptions that a richer person is also better off.

AXIOM - M (Monotonic welfare) [Sen (1976)]

The relation > (greater than) defined on the set of individual welfare numbers $\{W_i(Y)\}$ for any income configuration Y is a strict complete ordering, and the relation > defined on the corresponding set of individual incomes $\{Y_i\}$ is a sub relation of the former, i.e., for any

i, j : if $Y_i > Y_j$, then $W_i(Y) > W_j(Y)$.

AXIOM - N (Normalized poverty value) [Sen (1976)]

If the poor have the same income, then P = HI

where, H = q/n (i.e., Head-Count-Ration)

$I = \sum g_i / qz$ (i.e., Income-Gap- Ratio)

$i \in S(Z)$

In the special case in which all the poor have exactly the same income level $Y^* < Z$, it can be argued that H and I together should give us adequate information on the level of poverty, since in this special case the two together can tell us all about the proportion of people who are below the poverty line and the extent of the income short-fall of each. To obtain a simple normalization, we make P equal HI in this case.

The axioms stated determine one poverty index uniquely. It is easier to state that index if we number the persons in a non decreasing order of income, i.e., satisfying.

$$Y_1 \leq Y_2 \leq \ldots\ldots\ldots\ldots\ldots\ldots \leq Y_n$$

If, however, there is more than one person having the same income, it doesnot determine the numbering uniquely. The formula for poverty index is specified in the following theorem, given by Sen.

Theorom - 1 [Sen (1976)]

For large numbers of the poor, the only poverty index satisfying Axioms R, M, and N.

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

Where G is the Gini co-efficient of the income distribution of the poor. It is given by ;

$$* \; G = 1 / 2q2m \sum_{i=1}^{q} \sum_{j=1}^{q} |Y_i - Y_j|$$

(* For Gini co-effecient G of the Lorenz distribution of incomes of the poor see Gini [15] and Theil [38].)

Where m is the mean income of the poor.

The measure of poverty P presented here uses an ordinal approach to welfare comparisons. The need for placing a greater weight on the income of a poorer person is derived from equity considerations (Axiom - E) without necessarily using interpersonally comparable cardinal utility functions. Ordinal level comparability is used to obtain rank order weighting systems (Axion - R) given a monotonic relation between income and welfare (Axiom - M). It should be pointed out that any system of measurement that takes note only of ordinal welfare information must be recognized to be deficient by an observer who is convinced that he has access to cardinal interpersonally comparable welfare functions. If such cardinal information did obtain, the fact that P should throw away a part of it and use only the ordering information must be judged to be wasteful.

3.2 DEPRIVATION WHEN WE SEEK TO GO BEYOND INCOME

Traditionally, deprivation has been measured on the basis of money income of the individuals. However, over the last two decades or so, sen (1985, 1987) has advanced a number of powerful and persuasive reasons. Why it is important to go beyond money income and to consider various real indicators of the standard of living so as to get a more satisfactory measure of the level of deprivation in a society. when we consider real indicators, we nolonger have the convenience of a unidimensional measure. Rather we would have several direct indicators like education, health and nourishment. In this dissertation the exact measures to identify poverty is analysed in three heads : a) education, sanitaiton and housing ; b) health; and c) nourishment.

Very often we use the concepts well-being and deprivation synonymously. But those are two district concepts. Well-being reflects the standard of living, i.e. achieved attribute bundles of individuals, where as deprivation reflects the shortfall of what achieved by the individuals from that required. In this dissertation we have shown our interest in deprivation not in well being. So, obviously one question may arise, i.e., why the discussion of well-being ? In this context we are keen to clarify that well-being is the first step to measure shortfall. Unless we know the achieved (actual) attribute bundle of an individual, we can't find the difference between the actual and the ideal value. There is no need to define Well-Being Evaluation Function (WBEF) if we are concerned with diprivation over only one dimension. But if we are concerned with poverty over more than one dimension, we need to define a WBEF and state how poverty is identified in such cases.

A particular form of the WBEF is established in this section with the help of the following notations.

Let N be the set of individuals i,

i = 1,2,3,................, n

So N= {1,2, ..., n,}

M be the set of attributes or indicators, j

j = 1,2,........................,m

So M = {1,2,...............,m}

S_{ij} - i's achievement in terms of attribute j

S_i - The achieved attribute bundle of individual i.

$S_i = (S_{i1}, S_{i2}, ..., S_{im})$

Q_j - The benchmark interms of attribue j

$Q = (Q_1, Q_2,........................Q_m)$ denote vector of poverty benchmark, one poverty benchmark for each attribute.

The vector (S_i, Q) may be represented by $D(S_{i1},.............S_{im}; Q_1,..........., Q_m) \in [0,1]$

That means the deprivation of the individuals varies between 0 and 1. If it is 0, the individual is not deprived. That means his/her achieved value is just equal to the poverty benchmark. On the otherhand, if it is 1, the individual is mostly deprived. However, the vector (S_i, Q) constitutes the complete informational basis for our analysis. The WBEF for person i is defined as

$$W_i = W(S_i)$$

Definition - 3.1 : A person i is poor in terms of attribute j if and only if $S_{ij} < Q_j$.

In WBEF, poverty is identified in the following way.

Definition - 3.2 : A person i is deprived if and only if $W(S_i) < W(Q)$

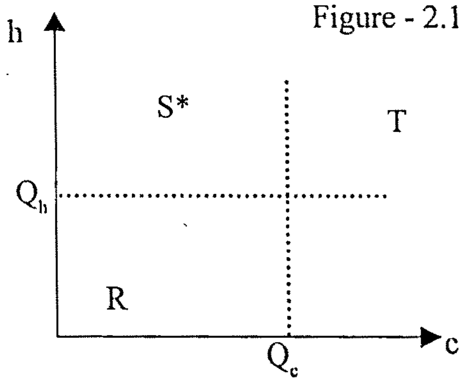
For simplicity suppose well-being is portrayed by two attributes - health (h) and nourishment or calorie (c). Further suppose that there is an agreed upon poverty line for each component denoted by Q_h and Q_c. For example, we could define a person as poor in terms of health if his weight falls below a certain level, i.e., the ideal weight. Given this agreement about poverty lines, we can then state whether a person is poor in terms of one component. Difficulties arise in deciding whether a person is poor when more than one component is considered.

In figure 2.1, the components h and c and the respective poverty lines, Q_h and Q_c, are shown. Two reasonable criteria for a poverty measure are :

A) If a person is below the poverty lines for both components he or she is poor and

B) If a person is above the poverty line of both components then he or she is not poor. These situations

Figure - 2.1

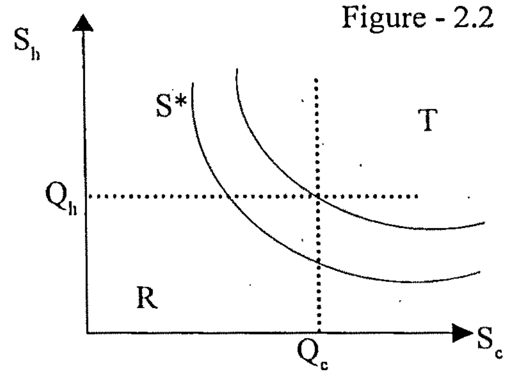


Correspond to areas R and T on the graph. While a poverty measure should meet these two criteria, the question remains as to whether persons with some components below the poverty lines and some above should be counted as poor.

For example, should a person with componet bundle S* be considered poor on health ? Well - Being Evaluation Function (WBEF) can answer this question. If we consider only one indicator to identify poverty then there will be no necessity to take the help of WBEF. But in this dissertation we have considered three indicators to identify poverty. As such we need to define a WBEF. While evaluating the well-being of an individual, Sen asks the question, "Is the relevant valuation function that of the person whose standard of living is being assessed, or is it some general valuation function reflecting accepted 'standards' (e.g. those widely shared in the society)" ?* [*Sen 1987 a]. Accordingly, Sen distinguishes between what he calls 'self evaluation' approach and the 'standard evaluation' approach, and argues that both have some relevance of their own. Furthermore, he notes that the use of accepted social standards has both subjective and objective features. When he refers to 'objective' features presumbaly he is holding some essentialist notion of human being. But when he is refering to the subjective features of the 'standard evaluation' approach, by the world subjective he means "the building blocks of judgements are the opinions held in a particular community".

A WBEF ranks persons according to their components and reflects the analyst's conception of well - beings. In the present context we want to define a WBEF for all values of S_h and S_c denoted by W (S_h, S_c). To solve the problem of identification, let W(Q_h, Q_c) be the well-being corresponding to the pair of poverty levels defined in terms of the two components and let W (S^*_h and S^*_c) be the well-being of S*. These are depicted in figure - 2.2.

Figure - 2.2



A person is then poor if and only if $W(S_h, S_c) < W(Q_h, Q_c)$. This WBEF meets the criteria that a person in region R is poor in health and a person in region T is not poor in health. Under this WBEF, a perosn with the component bundle S* is poor. It is possible that under an alternative WBEF S* is not poor.

Identification of the extent of deprivation of an individual :

As we have discussed earlier in this chapter, an individual i will be deprived in terms of attribute j if

$S_{ij} < Q_j$

It we consider the case of an individual 1 interms of indicator 1, then he/ she will be treated as deprived if $S_{11} < Q_1$.

The absolute shortfall of individual 1 in terms of attribute 1 may be denoted as

$s_{11} = Q_1 - S_{11}$ The absolute shortfall of individual i interms of all attributes cab be represented through the set $s_i = \{Q_1 - S_{i1}, \ldots\ldots\ldots\ldots, Q_m - S_{im}$

To obtain the normalized shortfall, we have to express the absolute shortfall as a proportion of the poverty benchmark. Here the normalized deprivation or shortfall of individual i in terms of attribute j is $\frac{Q_j - S_{ij}}{Q_j}$

Which can be denoted as $\underline{s}_{ij}$.

where $i = 1, \ldots\ldots\ldots\ldots n$.

$j = 1, \ldots\ldots\ldots\ldots m$

So normalized shortfall of individual i in terms of all attributes will be

$$\left(\frac{Q_1 - S_{i1}}{Q_1}, \frac{Q_2 - S_{i2}}{Q_2}, \ldots\ldots\ldots\ldots, \frac{Q_m - S_{im}}{Q_m}\right)$$

This set of normalized shortfall of individual i can be denoed as $\underline{s}_i$ Where $(\underline{s}_i = \underline{s}_{i1}, \underline{s}_{i2}, \ldots\ldots\ldots, \underline{s}_{im})$. The over all deprivation d_i, of individual i will be assumed to be a function of $\underline{s}_i$; this function will be assumed to be the same for all individuals. Thus, we write

$$d(\underline{s}_i) = d_i,\ i = 1, \ldots\ldots\ldots, n.$$

The normalized overall shortfalls of all the individuals is given by the vector

$$(d_1, \ldots\ldots, d_n).$$

The level of deprivation D in the society is assumed to be a function of $d_1, \ldots\ldots d_n$.

Therefore, we write $D = F(d_1, \ldots\ldots\ldots, d_n)$

We know that

$$\underline{s}_{ij} = \frac{Q_j - S_{ij}}{Q_j} = 1 - \frac{S_{ij}}{Q_j}$$

As Q_j increases, $\underline{s}_{ij}$ increases. But to know the rate of increase of $\underline{s}_{ij}$ due to an increase of Q_j, we have to differentiate $\underline{s}_{ij}$ with respect to Q_j twice.

$$\frac{d(\underline{s}_{ij})}{dQ_j} = \frac{d\left(1 - \frac{S_{ij}}{Q_j}\right)}{dQ_j} = -S_{ij}(-1)[Q_j]^{-2}$$

$$= \frac{S_{ij}}{Q_j^2}$$

$$\frac{d^2(\underline{s}_{ij})}{dQ_j^2} = \frac{d\left(\frac{S_{ij}}{Q_j^2}\right)}{dQ_j} = -2\frac{S_{ij}}{Q_j^3}$$

As the second-order derivative of $(\underline{s}_{ij})$ with respect to Q_j is negative, $(\underline{s}_{ij})$ increases at a decreasing rate if Q_j increases.

Further, we know that $d_i = d(\underline{s}_{i1}, \ldots\ldots\ldots\ldots\ldots, \underline{s}_{im})$.

So, we know that d_i increases at an increasing rate if $\underline{s}_{ij}$ increases. As such d_i increases if Q_j increases. But it is rather difficult to express the rate of increase of d_i as Q_j increases.

Our disussion above indices that there can be alternative approaches to the issue of who counts as poor and what features characterize the poor.