Analytical Studies of Karnataka's Economy : 1

CONSTRUCTING THE POVERTY LINE

A New Approach with Applications to Karnataka

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ABSTRACT

The paper presents a new approach to the construction of the poverty line which examines more directly the existence of malnutrition in households. Jettisoning the assumption of a monotonic relationship between per capita expenditure and the consumption of nutrients, the paper proposes a new definition of the poverty line. This is generalised to the notion of a poverty band, which assists in examining certain relationships between nutrition and per capita expenditure. Whereas earlier poverty line studies of the Indian economy have defined nutritional norms solely in terms of minimal calorie intake, this paper is sensitive also to the need for a minimal protein intake. The complication this causes on account of the manner in which protein is either retained or oxidised in the human body at low levels of nutrition, is allowed for, and an algorithm is designed to solve for the poverty line.

This approach is applied to 1983 NSS data for Karnataka. The poverty line is computed at Rs.114 for rural areas and Rs.177 for urban areas. The proportion of the poor is 67% in rural areas, 82% in urban areas and 73% in all Karnataka. The possibility of estimational biases in the analytical procedure adopted is discussed, particularly in view of the high proportion of the urban poor.

1. Introduction and Summary

The construction of a poverty line and a suitable index for measuring poverty are familiar issues raised in existing economic approaches to poverty. Recent work in the Welfare Economics of Poverty, motivated particularly by the work of Sen(1976), has proposed various indices for the measurement of poverty, and central to this approach is the prior specification of the poverty line. Despite the considerable effort put in by nutrition experts in developing subsistence norms of individual nutrition intake and by economists in translating these norms into expenditure equivalents, the conceptualisation of the poverty line itself, however, appears to have received insufficient attention and does not rest on adequate welfare-theoretic foundations. In the absence of such underpinnings, the comparison of poverty levels either over time or between regions becomes hazardous, and the periodic generation of estimates of the size of the poor is surely suspect.

Although existing studies of poverty line computations in India pivot strongly round nutritional considerations, the correspondence between individual consumption expenditures and nutritional intake is a tenuous one, given the widespread ignorance about the nutritional content of different food items aswell as the pervasiveness of traditional dietary habits. People generally do not optimise on nutrient intake within their budget constraints. In this paper we recognise the absence of such a straightforward correspondence and use it to propose a new definition of the poverty line. We also investigate, within a generalised framework, how precisely one may characterise malnourishment in a household, and use this to identify malnourished households in Karnataka using 1983 NSS data. The empirical work is carried out within a more specialised framework wherein we allow for two nutritional determinants, proteins and calories. Such a specialised framework is, nevertheless, more general than the nutritional models which underpin most existing Indian studies of the poverty line, and spawn two complications which we are sensitive to : the problem of the dual role of protein, and the differing ways in which individual malnourishment can be aggregated to household malnourishment.We then devise an algorithm to solve for the poverty line, using 1983 NSS data for Karnataka.

The poverty line is computed at Rs. 114 for rural areas and Rs.177 for urban areas. The proportion of the poor is 67% in rural areas, 82% in urban areas and 73% in all Karnataka.

The paper is organised as follows: In Section 2 we define our framework of analysis and provide a definition of the poverty line. This definition is generalised to the notion of a poverty band, which assists in providing further intuitive support to the usefulness of our definition of the poverty line. The manner in which protein is either retained or oxidised in the human body at low levels of nutrition is also grafted onto our framework. In Section 3 we discuss earlier approaches to the problem and suggest that these can be subsumed under 3 broad groups. Section 4 discusses the problem of aggregating individual malnourishment into household malnourishment, and offers a solution algorithm. Section 5 presents applications to Karnataka while Section 6 offers certain concluding caveats.

2.The Construction of a Poverty Line

Although there are differing conceptions of what constitutes a condition of poverty, and although in some societies poverty may be more appropriately viewed as a relative phenomenon – as an aspect ofa skewedincome distribution – nevertheless for a developing economy the most useful approach to poverty does appear to lie in characterising it as an absolute condition arising from a lack of desirable minimal subsistence. The usefulness of viewing poverty as an essentially physical phenomenon arises as much from the need to focus policy attention where physical deprivation and consequent human agony is most severe, as from noting the stark consequences that emerge from the lack of subsistence nutrition to the physical growth of the human body. Economic approaches to the construction of the poverty line in India have therefore necessarily begun with minimal nutritional norms for subsistence as suggested by nutritional experts (such as those generated by the Indian Council of Medical Research (1968).) It must be recognised, of course, that subsistence is not an unambiguous concept and refers to a condition where a state of reasonable health can be maintained. Subjective interpretations of these terms are inevitable and nutritional studies have differred on adequate norms of minimal subsistence nutrition. Nevertheless, "Economists can do no better than respect their judgements, imperfect though admittedly they are. What they should guard against, however, is the mistake of employing a particular norm in every situation, regardless of its specific context. It is obvious that minimum nutritional requirements may vary from country to country depending on the ethnic and climatic factors" (Osmani (1982)).

In this paper we begin, therefore, by adopting a minimum subsistence nutrition basket which has emerged from nutritional studies. We regard an individual as being malnourished if his actual nutritional intake shows a deficiency in any one nutrient when compared to the subsistence nutrition basket. We then construct the poverty line such that (in an intuitive sense) the number of malnourished people equals the number of people whose individual consumption expenditure does not exceed the poverty line. We now formalise this definition.

Assume an economy with m individuals indexed by i ($i=1,\ldots,m$), k food items indexed by h ($h=1,\ldots,k$) and l nutrients indexed by j ($j=1,\ldots,l$). Let individual i have a personal consumption expenditure of e^i and consume a food vector $\mathbf{f}^i = (f_1{}^i,\ldots,f_k{}^i)$. Let **N** be an l x k matrix which we call the <u>food-nutrition transformation matrix</u>, the (j,h) component of which indicates the extent of nutrient j available in a unit of food item h. It is then clear that the matrix product $\mathbf{N}.\mathbf{f}^i$ represents the l-vector of nutrients actually consumed by individual i through his food vector f^i. Let M^i be the set of nutrition vectors in Euclidean l-space representing malnourishment for individual i. Clearly, the ith individual is malnourished if $\mathbf{N}.\mathbf{f}^i$ is an element of the set M^i.

Observe at this stage that the Malnourishment Set will not be identical for all individuals, and we assume later that variations will occur on account of the age and sex of individuals. We do not for the moment, however, offer a precise specification of the Malnourishment Sets M^i. Instead, let $S = \{i : N.f^i \in M^i\}$ be the set of malnourished individuals and let $S(e) = \{i : e^i \leq e\}$ refer to the set of individuals whose personal consumption expenditure does not exceed some non-negative number e. Let the notation $|S|$ and $|S(e)|$ refer to the number of elements in the sets S and S(e) respectively. We now propose a definition of the poverty line.

DEFINITION: The poverty line P is defined by

$$P = \text{minimum}\{e : |S(e)| \geq |S|\}$$

REMARK: The motivation behind this definition is straightforward: the number of people whose consumption expenditure does not exceed the poverty line should equal the number of malnourished people. However, equality may never exist as a number of individuals may have a per capita consumption expenditure equal to the poverty line. Thus P is the minimum expenditure level at which the number of people with a consumption expenditure no higher than P is no less than the number of malnourished people.

Observe that not everyone with a consumption expenditure not exceeding P is necessarily malnourished, just as some individuals with a consumption expenditure exceeding P may be malnourished. This in itself cannot constitute a critique of our definition of the poverty line, for such a scatter of malnourished and non-malnourished individuals on the "wrong" side of the poverty line is necessarily a feature of any nutrition-based definition of the poverty line, unless one presupposes a monotonically non-decreasing relationship between consumption expenditure and the quantity of every nutrient consumed (which we henceforth, refer to as the <u>monotonicity property</u>). Indeed, if we define:

$$P_{max} = \max\{e^i : i \in S\}$$
$$\text{and } P_{min} = \max\{e^i : i \in S \text{ and } e^i \leq e^{i'} \text{ for all } i' \notin S\}$$

then all individuals with a consumption expenditure ~~not exceeding~~ less than P_{min} are malnourished and no individual with a consumption expenditure exceeding P_{max} is malnourished. We referto the closed interval $[P_{min}, P_{max}]$ as the poverty band. The following proposition then holds:

LEMMA: The poverty line lies within the poverty band. Further, if the monotonicity property holds within the economy and if the minimal nutrition basket needed to avoid malnourishment is uniform for all individuals, then the poverty band is identical to the poverty line.

PROOF : As there is no malnourished individual with a consumption expenditure exceeding P_{max}, it follows that $|S(P_{max})| \geq |S|$. Hence $P \leq P_{max}$. Further, as every individual with a consumption expenditure less than P_{min} is malnourished, it follows that for any $e < P_{min}$ we have $|S(e)| < |S|$, implying that $P_{min} \leq P$. Hence the poverty line is contained within the povery band.

To show that the poverty line is identical to the poverty band (ie. that $P_{max} = P_{min}$) when the monotonicity property holds and all individuals have a uniform minimal nutrition requirement, assume otherwise. Let $m = (m_1 \ldots . m_l)$ be the minimal nutrition basket indicating the minimal quantity of each nutrient required to avoid malnourishment. By hypothesis this is identical for all individuals. Let the malnourished individual with consumption expenditure P_{max} be deficient in his net consumption of some nutrient j. If his consumption of this nutrient is n'_j, we have $n'_j < m_j$. Further, if the nonmalnourished individual with consumption expenditure $< P_{max}$ has a net consumption n''_j, of nutrient j, we have $n''_j \geq m_j$. Finally, as the monotonicity property holds and as $P_{max} > P_{min}$, we have $n'_j \geq n''_j$. These inequalities imply a contradiction. Hence $P_{max} = P = P_{min}$

REMARK: The assumptions that the minimal nutrition basket needed to avoid malnourishment is uniform across individuals and that monotonicity is satisfied are stringent assumptions and will not be imposed later in this paper when we examine NSS data from Karnataka. In the absence of these 2 assumptions, however, the poverty band is in general non-degenerate (i.e. does not necessarily collapse to a point). As there is no ambiguity about the nutritional status of those either above or below the poverty band, and as it is therefore desirable that the poverty line lie within this band (which is assured by the LEMMA above), this reinforces intuitive support for the definition adopted in this paper of the poverty line.

We now introduce a simplification to our framework by assuming that our nutritional baskets consist of just <u>two</u> nutrients which we call energy (measured by the consumption of calories) and proteins. To be precise, energy is a nutritional characteristic rather than a nutrient, and the label "nutrient" is used figuratively. Observe that there are other nutrients (particularly vitamins) which are essential in minimal amounts for subsistence. Most studies on poverty line computations, however, have typically considered just one nutrient (energy through calories) and our inclusion of proteins provides greater generality. Whether the exclusion of other nutrients is a limitation of our exercise will be considered later.

With just 2 nutrients entering into the nutrition basket, the food-nutrition transformation matrix N is clearly a 2 x k matrix. At this stage, however, it is necessary to discriminate between the <u>gross</u> and <u>net</u> intake of energy and proteins, in view of the special way in which the human body absorbs these nutrients. Although the principal source of energy in the human body is fats and carbohydrates, proteins can also generate energy, as all these organic matters are converted into heat energy (measured through calories). The role of protein as a source of energy through oxidisation competes, however, with its more fundamental role of being the principal building block of blood cells and tissue, which enables the human body to grow. It is crucial, therefore, to comprehend the manner in which these competing uses of protein are resolved.

In practice fats and carbohydrates are much more readily oxidised than are proteins. As long as these readier sources of energy are available in sufficient amounts to provide adequate energy, protein's prime role of facilitating the building of blood cells and tissue is fully retained. If, however, fats and carbohydrates fail to provide adequate energy, protein is available for oxidisation for filling the gap, resulting in a dimunition of protein's central role. It is thus crucial (particularly at subsistence levels of nutrition) to be conscious of the extent to which protein is being oxidised to provide energy. Thus, although the food-nutrition transformation matrix N refers to the <u>gross</u> consumption of energy and proteins (the nutritional content of food items), the body's actual retention must be measured by their <u>net</u> consumption, and these may well be different in malnourished people.

This discussion above immediately introduces a caveat into the specification of the set M^i of malnourishment vectors for individual i. If $\mathbf{n}^i = (n_1^i, \ldots, n_l^i)$ represents the minimal nutrition vector needed to avoid malnourishment, then it may appear reasonable at first blush to define M^i as $\{\mathbf{n} = (n_1, \ldots, n_l): n_j < n_j^i, \text{for some } j\}$. However, this will be inadmissible as the vector $\mathbf{n}^i$ represents <u>net</u> consumption, while M^1 as defined in this paper is a set of <u>gross</u> consumption vectors. The existence of these biochemical relationships which induces the need to discriminate between gross and net consumption of nutrients was first recognised by Osmani (1982), though in his work he continues to define the malnourishment set in the above inadmissible manner.

That this distinction between gross and net consumption of nutrients necessarily alters the boundary of the Malnourishment Set is apparent from FIGURE 1, where all nutrients are measured in gross terms. We assume that all individuals fall into one of several age-sex groups in the population, each of which is characterised by a different minimal protein and energy norm. If n_e^G and n_p^G are the minimal net consumption of energy and protein required to avoid malnourishment for an individual who belongs to some age-sex group G , then the Malnourishment Set for that individual is the shaded part in the diagram. If the gross consumption of energy is less than n_e^G, then gross protein consumed (measured in grams) is initially converted into energy (measured in kilo calories) at the rate of 1:4 upto the point where the aggregate availability of energy reaches n_e^G. Thus the line AB has a negative slope of 4.

The Household Malnourishment Set is then given by the aggregation of individual Malnourishment Sets and we discuss the method of aggregation later. FIGURE 2 illustrates such a Household Malnourishment Set. Its boundary is piecewise linear with 4 linear segments, indicating that the household consists of individuals who fall into 3 different minimal nutrient groups.

To determine whether the household is malnourished, it suffices to ascertain whether the actual household intake of gross protein and gross energy (P,E) is within the Household Malnourishment Set. We assume that all individuals in a household are malnourished if and only if the household is malnourished. Although this abstracts from certain important issues of intra-household feeding practices, the assumption is inevitable if individual consumption details are unavailable. We discuss later whether this is likely to bias our results.

The method outlined above enables us to identify all malnourished individuals and to thereby compute the poverty line in accordance with the definition given earlier. We propose later an algorithm for determining which households are malnourished; meanwhile, in the next Section, we compare our methodology with other approaches towards the construction of the poverty line.

3. Earlier Approaches

Earlier approaches to the construction of the poverty line fall conveniently into 3 conceptual categories. The first, and most widely used approach in the context of Indian data, is to postulate a minimum individual calorie norm for avoiding malnourishment, identify the expenditure class (from grouped NSS data) within which such a calorie norm falls, and estimate the poverty line as falling within such an expenditure class (e.g. mid-point of the expenditure class). Although there have been variations in the estimational procedures used (which have become increasingly sophisticated over the years), they conform to a uniform logical prototype. The studies of Sukhatme (1965), Dandekar and Rath (1969), Bardhan (1974), Minhas (1971) and the Planning Commission (1979) follow such a logic, as do all official documents in India which have attempted poverty line computations. These efforts must now be seen as based on a tentative conceptualisation, assuming as they do that:
(a) calorie consumption is a sufficient indicator of malnutrition;
(b) no distinction is made between the gross and net consumption of calories, despite the biochemical relationship that exists between protein and calorie consumption which ought not to be ignored at low levels of nutrition; and
(c) there is a monotonic relationship between average calorie consumption and average per capita expenditure within each expenditure class.

All the 3 assumptions are relaxed in our present paper.

A second approach, associated particularly with Pannikar (1972) and Rajaraman (1974) is to postulate a minimum calorie norm as before and, given a vector of food commodity prices, to estimate a least-cost diet which can be consumed at these prices. Given data on the proportion of total consumption expenditure spent on food, this provides the rationale for an alternative concept of the poverty line. Although such an approach dispenses with the monotonicity assumption (though it retains the other 2 assumptions of the first approach discussed above), this conceptualisation must be seen as being strongly normative. An individual may not necessarily purchase such a least-cost bundle of food commodities, either because of ignorance or on account of ingrained food habits, and the conceptualisation is largely insensitive to this. To argue that people should change their food habits in order to consume a higher quantity of nutrients and thereby escape being labelled poor is not very helpful in an estimation of poverty today. Although Pannikar and Rajaraman's exercises do recognise this through their introduction of 'palatability constraints' in their least-cost linear programming exercises, these constraints are entered in the most rudimentary fashion, and their exercises are undoubtedly normative. No such prescriptiveness exists in our present paper.

A third approach, initiated by Osmani (1982), pioneers the notion of the distinction between the gross and net consumption of nutrients (which we have adopted in this paper) but does not dispense with the monotonicity assumption which is used to generate a convergent algorithm for estimating the poverty line (monotonicity being crucial for ensuring convergence). Our present paper dispenses with this assumption.

One of the first attempts at computing the poverty line for India, which falls into none of the above 3 categories, emerged from the recommendations in 1962 of a Study Group set up by the Planning Commission which suggested that a per capita annual consumption of Rs.240 at 1960-61 prices (excluding expenditure on health and education which should be provided free by the State) be treated as the nationally desirable minimum level of consumption expenditure. However, there is no rigorous derivation of such a poverty line from nutritional norms and the formal logic employed by this Study Group in making their computations continues to be a little unclear.

4. A Solution Algorithm

Determining whether a household is malnourished or not necessitates (in FIGURE 2) an identification of which side of the boundary of the Malnourishment Set a particular (E,C) household consumption is located. In this Section we construct a solution algorithm for this purpose which precludes the need for information about the entire boundary of the Household Malnourishment Set. Observe first, however, that we have still not given a precise definition of the Household Malnourishment Set, beyond stating that it is an aggregated derivative of the Malnourishment Sets of the individuals contained in the household. There can be several ways of deriving such a Household Malnourishment Set. Consider the following two methods:

(a) The Household Malnourishment Set is the vector sum of elements of the individual Malnourishment Sets

i.e. $M_1 = \{(\sum_{i=1}^{n} x^i, \sum_{i=1}^{n} y^i) : (x^i, y^i) \in M^i, \text{ for all } i\}$

where we assume that the household consists of n individuals, and M^i is the Malnourishment Set of individual i.

(b) The complement of the Household Malnourishment Set is the vector sum of elements in the complement of individual Malnourishment Sets

i.e. $M_2 = \mathscr{C}\{(\sum_{i=1}^{n} x^i, \sum_{i=1}^{n} y^i) : (x^i, y^i) \in \mathscr{C} M^i, \text{for all } i\}$

where $\mathcal{C}$ refers to the complement of a set in the non-negative quadrant of the cartesian plane.

It is clear that the first definition M_1 offers a very liberal coverage under malnourishment: if a particular household consumption can be derived as the vector sum of individual malnourishment consumption (however unlikely in practice these individual arrays of consumption be) then that household consumption is malnourished. On the other hand, the second definition M_2 is more conservative in admitting malnourishment : if any household consumption can be derived as a vector sum of individual non-malnourished consumption (however improbable that such non-malnourished consumption will exist in practice), then that household consumption will not be regarded as malnourished.

FIGURE 3 refers to a household with 2 individuals, the boundaries of whose individual Malnourishment Sets are given by I_1 and I_2. The 2 kinds of Household Malnourishment Sets M_1 and M_2 are also shown. We now seek a notion of household malnourishment which is more liberal than M_2 yet less so than M_1. We use polar coordinates (r,θ) to define such a Household Malnourishment Set M.

DEFINITION: The Household Malnourishment Set M is defined by the use of polar coordinates as:

$$M = \{ (\sum_{i=1}^{n} r^i, \theta) : (r^i, \theta) \in M^i, \text{ for all } i \}.$$

REMARK: We recommend this definition in view of its intuitive simplicity. A point on the boundary of such a Household Malnutrition Set is then arrived at by moving up the line connecting the origin to that point in steps representing the intersection of each individual Malnourishment Set with this line. FIGURE 3 reveals that the boundary of M lies between the boundaries of M_1 and M_2. The definition also motivates our solution algorithm which, in FIGURE 2, seeks to compare the position of the point A (the intersection of the line joining (P,E) to the origin with the boundary of the Household Malnourishment Set) with the point (P,E). Again, the point A in our algorithm is arrived at by moving up the line connecting the origin to (P,E) in steps representing the intersection of each individual Malnourishment Set with this line. The point A is reached when all individuals in the household have been considered. A and the point (P,E) are then compared by noting their projections onto the protein axis. (Equally, of course, we may also project onto the energy axis).

We assume that all individuals fall into one of 10 age-sex groups in the population, each of which is characterised by a different minimal net requirement of proteins and energy for subsistence. For any such group G, let (n_p^G, n_e^G) represent the minimal net nutrition required by an individual contained in this group to avoid malnourishment. FIGURE 1 then indicates that the line with slope $Z = E/P$ from the origin intersects the boundary of the Malnourishment Set of that individual at some point (m_p^G, m_e^G), where:

$$m_p^G = \begin{cases} n_p^G, & \text{if } Z\,(n_p^G) \geq n_e^G \\ \dfrac{n_c^G + 4n_p^G}{Z+4}, & \text{if } Z\,(n_p^G) < n_e^G \end{cases}$$

This enables us to construct the following computer aided algorithm, as a sequence of instructions:

1. Consider the first individual in the household.

2. Identify the individual's age-sex group G and compute m_p^G.

3. Put $M_p = m_p^G$

* 4. If $M_p > P$, then we conclude <u>the household is not malnourished,</u> and move to the last instruction below.

5. If $M_p \leq P$, and all household individuals have been considered, we conclude <u>the household is malnourished</u> and move to the last instruction below

6. If $M_p \leq P$ and not all household individuals have been considered, then select the next individual in the household

7. Identify the individual's age-sex group G and compute m_p^G.

8. Increment M_p by m_p^G and let this be the new value of M_p.

9. Go to the instruction marked *

10. STOP

The algorithm enables us to identify all the malnourished households and to thereby compute the poverty line and the proportion of the poor. Clearly, the algorithm is fully decisive and can be separately applied on urban and rural data. We do so in the next Section.

5. Applications to Karnataka

We now use the ideas developed above to estimate, using 1983 NSS data, the poverty line for that year in Karnataka, as well as the proportion of people below the poverty line. The 38th Round of the NSS is the third quinquennial Survey on household consumer expenditure and employment and unemployment (the earlier surveys being in the 27th Round 1972-73 and the 32nd Round 1977-78). The State sample for Karnataka covers all 19 districts and has a two-stage stratified design : the first stage units being the villages and urban blocks, and the second stage being the households in them. A household is taken to be "a group of persons normally eating together and taking food from a common kitchen".

The survey covered 336 villages and 240 blocks, involving 3320 rural households and 2390 urban households. 202 rural households and 236 urban households were deleted, largely because data pertaining to them was either incomplete or inconsistent, but also because individuals in some of these households ate partially or completely outside the household, and details of such external food consumed were unavailable. Thus a total of 3118 rural households involving 17,242 individuals, and 2154 urban households involving 12,295 individuals, were processed for this study.

From the exhaustive data schedules available, data on the consumption of 107 food items were culled out and grouped into 26 aggregated food items. The consumption of each household of these 26 food items includes data on quantities purchased as well as quantities consumed from home-grown stock.

The food-nutrition transformation matrix N defined in Section 2 is thus a (2 x 26) matrix whose coefficients emerge from the data contained in TABLE 1. Further, TABLE 2 contains the definitions of the 10 age-sex groups as well as the minimal net consumption necessary of protein and energy for avoiding malnourishment. The data in TABLE 1 is drawn from the Indian Council of Medical Research (1971), while the minimal protein and energy norms contained in TABLE 2 are from the Indian Council of Medical Research (1968).

The results emerging for Karnataka in 1983 are presented below:

RURAL KARNATAKA:	
No.of individuals covered	17,242
No.of individuals malnourished	11,508
Rural poverty line	Rs. 113.85
% of people below the poverty line	66.7
URBAN KARNATAKA	
No.of individuals covered	12,295
No.of individuals malnourished	10,112
Urban poverty line	Rs. 176.65
% of people below the poverty line	82.2
ALL KARNATAKA	
No.of individuals covered	29,537
No.of individuals malnourished	21,620
% of people below the poverty line	73.2

6. Conclusions and Caveats

This paper has suggested a critique and a reformulation of the notion of the poverty line and we would like to argue that its main contribution lies in the specific investigative logic proposed. Such a conceptualisation is also fully operationalisable if data on individual household consumption is available, as our application to 1983 NSS data from Karnataka reveals. The possibility of estimational bias in our results does require scrutiny, however, particularly in view of the very high proportion of the urban poor that our results provide. The Government of Karnataka's Draft Seventh Five Year Plan (which has also analysed 1983 NSS data) has computed the proportion of the poor as 61% in rural areas, 58% in urban areas and 60% in all Karnataka. The methodology used by that document conforms essentially to the first category of exercises discussed in Section 3 above, and relies on the Planning Commission's (1979) poverty line threshold of 2400 calories in rural areas and 2100 calories in urban areas. This is linked to monetary consumption expenditure and for 1979-80 the poverty line was computed at current prices as Rs.76 per capita per month in rural areas and Rs.88 in urban areas. Deflating these estimates by the Consumer Price Index for Agricultural Labourers (in rural areas) and for Industrial Workers (in urban areas) yields the 1983 Poverty Line in the Draft Seventh Plan document of Rs.108 (rural) and Rs.130 (urban).

A major reason why poverty levels as assessed in our present paper are higher than in the Draft Seventh Plan document of the Government of Karnataka must lie in our inclusion of protein adequacy as an indicator of nourishment; consequently, therefore, a major conclusion of our study must be that protein deficiency is more acute in urban rather than rural areas. Indeed, the wide divergence in the estimates of the urban poor in Karnataka as revealed in these 2 studies lends further justification to the incorporation of protein inadequacy as an indicator of malnourishment.

This necessarily also raises the issue of whether the exclusion of other crucial nutrients (particularly vitamins) leads to an underestimation of poverty. Clearly, a view on this must depend on an assessment of the categories of malnourishment which induce poverty through their impact on the capacity to earn. Thus, for instance, a plausible case can be argued that acute deficiency in vitamin A consumption can induce poverty through blindness, as can the prevalence of goitre which can lead to mental retardation in children. Our calculations of the size of the poor are in this respect probably biased downwards. Observe, however, that the general framework we set up in Section 2 does permit us in principle to take such a comprehensive view of malnourishment in its impact on poverty.

The aggregation of individual Malnourishment Sets into the Household Malnourishment Set may also, of course, lead to estimational bias. We argued earlier, in the context of FIGURE 3, that the set M_1 probably overestimates the extent of malnourishment, whereas the set M_2 underestimates it. We believe intuitively that the set M which we have constructed reduces such estimational bias. Given the information structure contained in NSS household schedules, which yield no information about the consumption patterns of individuals in the household, the boundary of the Household Malnourishment Set is inevitably blurred. Despite this, however, in obtaining information from household schedules rather than grouped NSS data, we have utilised a richer information structure than have most earlier studies of the poverty line in the Indian economy, and thereby reduced estimational bias.

Aggregation from individual to household malnourishment can, however, introduce a different sort of bias. Given the considerable evidence that exists of sequential feeding within poor families ("male breadwinners eat first, male children eat next,...., adult females eat last whatever remains"), a malnourished household (as identified by our solution algorithm) does not necessarily imply that all individuals in the household are malnourished. In this sense our results do probably overestimate poverty, though the magnitude of this bias is difficult to quantify in the absence of data on intra-household food consumption.

As against this, an underestimation of rural poverty is also implicit in our minimal nutritional norms being dependent on just age and sex, and not on the worker's occupation. For adult males our norms refer to moderate physical activity at work, whereas more strenuous manual activity would necessitate a higher nutritional threshold for avoiding malnourishment. Poverty amongst agricultural labourers may, therefore, be higher than our approach allows for.

REFERENCES

BARDHAN, P.K. (1974) "On the Incidence of Poverty in Rural India in the Sixties" in Srinivasan and Bardhan (ed.)Poverty and Income Distribution in India, Calcutta.

DANDEKAR, V.M. AND RATH, N. (1969):Poverty in India, Indian School of Political Economy, Pune.

INDIAN COUNCIL OF MEDICAL RESEARCH (1968): Recommended Daily Allowances of Nutrients and Balanced Diets, Hyderabad.

INDIAN COUNCIL OF MEDICAL RESEARCH (1971): Nutritive Value of Indian Foods, Hyderabad.

MINHAS, B.S. (1971): "Rural Poverty and the Minimum Level of Living",Indian Economic Review, Vol.6

~~OSMANI, S.R. (1982): Economic Inequality and Group Welfare, Oxford~~

OSMANI, S.R. (1982): Economic Inequality and Group Welfare, Oxford University Press.

PANNIKAR, P.G.K.(1972): "Economics of Nutrition", Economic and Political Weekly, Annual Number.

PLANNING COMMISSION (1979): Report of the Task Force on Projections of Minimum Needs and Effective Consumption Demand, New Delhi.

RAJARAMAN, I (1974): "Constructing the Poverty Line: Rural Punjab,1960-61", Discussion Paper 43, Research Program in Economic Development, Princeton University (Mimeo)

SEN, A.K. (1976): "Poverty: An Ordinal Approach to Measurement", Econometrica, Vol.44

SUKHATME, V.V. (1965): Feeding India's Growing Millions, Asia Publishing House, Bombay

TABLE 1

COEFFICIENTS FOR THE FOOD-NUTRITION TRANSFORMATION MATRIX

Food Item	Unit of Measurement	Edible Portion where less than full (%)	Calorie/Unit (k.cal.)	Protein/Unit (gms.)
1. Rice	Kgs.		3178.0	68.0
2. Wheat	Kgs.		2988.0	118.0
3. Jowar	Kgs.		3074.0	104.0
4. Bajra	Kgs.	84	2642.6	97.4
5. Maize	Kgs.		2976.0	111.0
6. Barley	Kgs.		2900.0	115.0
7. Small Millets	Kgs.		2822.0	62.0
8. Ragi	Kgs.		2988.0	73.0
9. Gram	Kgs.		2648.0	205.5
10. Pulses	Kgs.		2322.0	282.0
11. Milk	Litres		656.0	34.8
12. Ghee	Kgs.		9000.0	0.0
13. Edible Oil	Kgs.		9000.0	0.0
14. Meat	Kgs.	85	1020.0	157.3
15. Poultry	Nos.	70	54.0	259.0
16. Eggs	Nos.		35.9	4.0
17. Fresh Fish	Kgs.	66	237.6	148.5
18. Dry Fish	Kgs.		766.0	681.0
19. Vegetables	Kgs.	95	953.0	39.0
20. Bananas	Nos.	71	79.0	0.9
21. Guavas	Nos.		48.9	0.1
22. Oranges/Mosambis	Nos.	79	33.0	0.7
23. Mangos	Kgs.	74	53.0	0.4
24. Grapes	Kgs.		690.0	5.0
25. Groundnut	Kgs.	73	3400.3	184.7
26. Sugar	Kgs.		3976.0	1.0

TABLE 2
AGE-SEX GROUPS AND SUBSISTENCE NORMS OF PROTEIN
AND ENERGY CONSUMPTION

PER MONTH

Group	Age-Range	Sex	Minimal Protein Consumption (Kgs.)	Minimal Energy Consumption (k.cals.)
1	>19	M	1650	84,000
2	>19	F	1350	66,000
3	16-18	M	1800	90,000
4	13-18	F	1500	66,000
5	13-15	M	1650	75,000
6	10-12	M,F	1230	63,000
7	7-9	M,F	990	54,000
8	4-6	M,F	660	45,000
9	1-3	M,F	540	36,000
10	<1	M,F	450	27,000

FIGURE 1

MALNOURISHMENT SET FOR INDIVIDUAL IN GROUP G

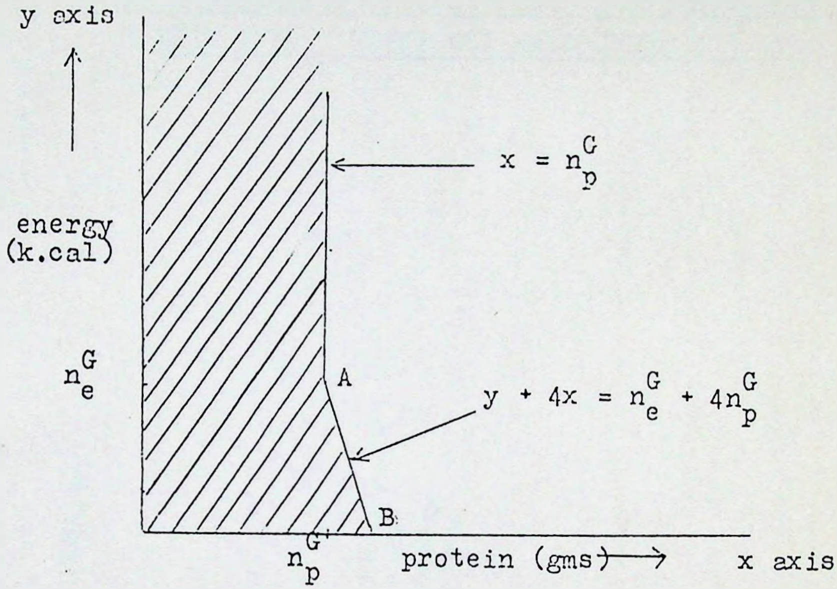

FIGURE 2

MALNOURISHMENT SET FOR A HOUSEHOLD

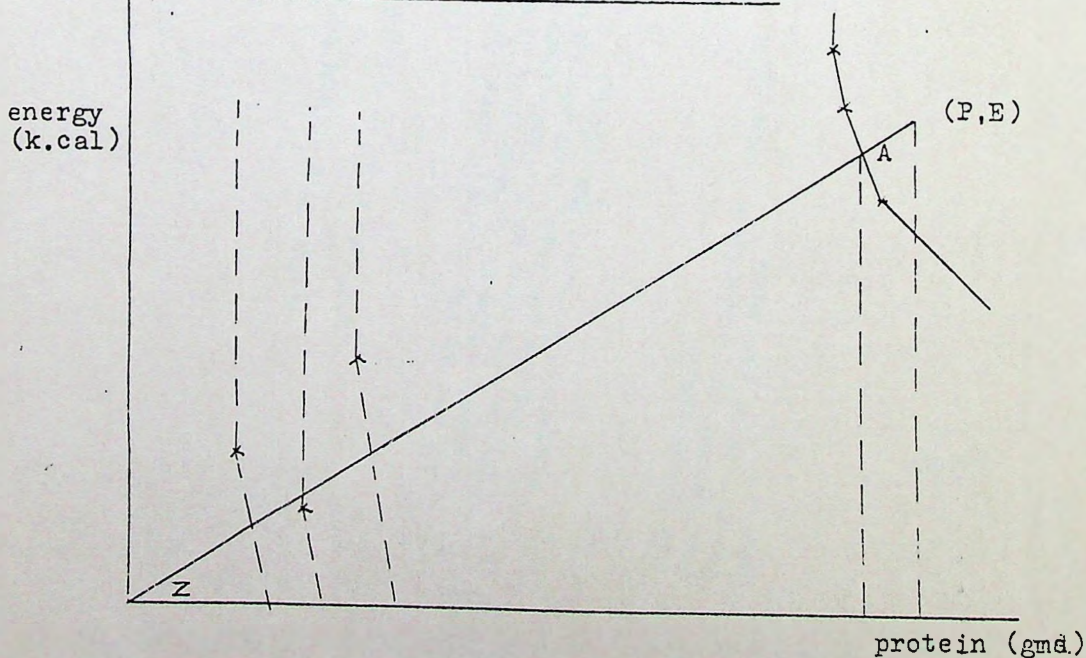

FIGURE 3

THE AGGREGATION OF INDIVIDUAL MALNOURISHMENT SETS INTO A HOUSEHOLD MALNOURISHMENT SET