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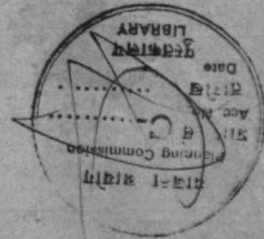
REPORT
OF
THE STUDY GROUP ON THE
CONCEPTS AND ESTIMATION
OF POVERTY LINE



PERSPECTIVE PLANNING DIVISION
PLANNING COMMISSION
GOVERNMENT OF INDIA
NEW DELHI



November, 1984.



FOREWORD

The existing definition of poverty line being used by Planning Commission is based on the recommendation of the report of the Task Force on Projections of Minimum Needs and Effective Consumption Demand set up by Planning Commission in 1977. The present Study Group was set up to recommend necessary revision in the existing definition of poverty line for use in the Seventh Five Year Plan, which was considered necessary in the light of the Sixth Plan experience in the implementation of poverty alleviation programmes and issues raised by many Economists, Statisticians and Nutritionists in the measurement of poverty.

The Study Group expresses its gratitude to the officers and the staff of the Perspective Planning Division of Planning Commission who have contributed to the preparation of this report. Special mention must be made of Dr. (Mrs.) Savita Sharma, SRO who supervised the tabulation work and Shri T.G.Srinivasan, SRO, who gave many valuable suggestions.

Also, we express our high appreciation for the help given by Dr. S.N. Ray, Executive Director, Computer Centre, Deptt. of Statistics, R.K. Puram in providing the basic tables from the data of NSSO's household consumption expenditure survey of 32nd Round (1977-78). We also acknowledge the help given by Sarvashri P.C. Agarwal and Karan Singh, Programmers, Computer Services Division, Planning Commission in reprocessing the data received from Computer Centre, Deptt. of Statistics.

Padam Singh
(Dr. Padam Singh) 22-11-84
Joint Adviser (FP)

&
Member-Secretary, Study Group

PLANNING COMMISSION
(P.P. Division)

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Report of the Study Group on Concepts and
Estimation of Poverty Line.

A Study Group on 'Concepts and Measurement of Poverty Line' was constituted by the Planning Commission in 1983 with the terms of reference as follows:

- i) to examine the conceptual problems of defining poverty line in the light of recent views of Prof. Sukhatma, Prof. Dandekar, Prof. Gopalan and others;
- ii) to decide on the cut-off point for calorie intake/consumer expenditure for defining poverty for the purpose of macro-economic analysis in the Seventh Five Year Plan formulation.

The following is the composition of the Study Group:

1. Dr. S.P. Gupta, Adviser (PP), Chairman
Planning Commission
2. Prof. P.V. Sukhatma, Member
Hon'y. Professor of Biometry and
Head of the Department of Biometry,
Maharashtra Association for Culti-
vation of Science,
Pune-410004
3. Dr. K.C. Seal, Member
Director General,
Central Statistical Organisation,
Department of Statistics,
Ministry of Planning,
New Delhi-110 001.
4. Prof. N.S. Iyengar, Member
Head Economic Analysis Unit,
Indian Statistical Institute,
31, Church Street,
Bangalore-560 001.
5. Prof. R. Radhakrishna, Member
Central University of Hyderabad,
Hyderabad.

6. Shri K.L. Datta, Member
Senior Research Officer,
Perspective Planning Division,
Planning Commission
7. Dr. N. Rath,* Member
Director,
Gokhale Institute of
Politics & Economics,
Pune.
8. Dr. Padam Singh Member-Secretary
Joint Adviser,
Perspective Planning Division,
Planning Commission,
New Delhi.

* Dr. N.Rath, Director, Gokhale Institute of Politics and Economics, Pune did not attend any of the meetings. But he has been kind enough to send his comments on the draft which have been considered by the Study Group.

Summary of recommendations of the Study Group
on Concepts & Estimation of Poverty Line.

Following are the main recommendations as coming out of the report of the Study Group:

1. Both the concepts of average norm and minimum norm should be used in identification of poors and estimation of poverty in the country. Given our resources constraints and the plans very high priority for helping the poorest of the poor, identification of the beneficiary group for poverty alleviation programmes should be initially on the basis of minimum calorie requirement and subsequently the programmes could be extended to cover beneficiaries upto the average calorie requirement.
2. The average calorie norm should be worked out on the basis of the age, sex, occupation structure of the population and the associated calorie norms of ICMR.
3. The method of bi-variate log normal distribution should be used for calculating the expenditure cut-off corresponding to the desired calorie norms.
4. The average per capita daily calorie requirement should be taken as 2400 in rural areas and 2100 in urban areas. The minimum calorie norms are 25% lower than the average calorie norms.

5. The poverty line corresponding to the average calorie norm is per capita monthly income/expenditure of Rs.59.15 in rural areas and Rs.73.51 in urban areas both at 1977-78 prices. The alternative poverty line or the severe poverty line corresponding to the minimum calorie norm is Rs.45.91 per capita per month for rural areas and Rs.61.20 per capita per month in urban areas both again at 1977-78 prices.
6. The poverty line should be up-dated for calorie norm and also for the expenditure cut-off for the years for which the private consumption surveys of NSS have been conducted. Since such surveys are conducted only once in five years, since 1973-74 the poverty line should be up-dated for inter-survey years with the help of following in the order of priority:
 - (a) Consumption basket of the persons near the poverty line together with the change in the prices.
 - (b) The price increase in the food items and non-food items together with the weights of food and non-food in the consumption basket of the persons near the poverty line.
 - (c) (i) Price index of agricultural labourers for rural areas;
(ii) Consumer price index of Industrial workers in urban areas.

Regarding (a) and (b) special tabulation has been

recommended from C.S.O. Regarding (c) the base of the indices needs updating for which also the recommendation has been given to C.S.O.

7. The existing practice of adjusting NSSO private consumption and its distribution by the ratio of the total private consumption of CSO and NSSO should be continued till further information is available.
8. The Study Group recommends the following studies:
 - i) Impact of Govt. aided programmes on the nutrition of poor,
 - ii) Adequacy of clothing, shelter, education and housing requirements from the consumption basket of the people near poverty line.
 - iii) Analysis of differences in the total private consumption as estimated by CSO and NSSO.
 - iv) Estimation of area specific and population specific poverty line.

CHAPTER I

BACKGROUND

1.1 Although there are differences of opinion among the experts on the measurement of poverty in the country, its importance in the context of planning has been well recognised because of greater emphasis on many anti-poverty programmes in the Indian Planning to combat the problem of poverty in the country. Precisely for this reason, a quantitative index of poverty is necessary.

1.1.2 The question of defining poverty line was first mooted by the Indian Labour Conference in 1957. A Working Group was set up by the Planning Commission in 1962 to deliberate on the question of what should be regarded as the nationally desirable minimum level of consumer expenditure. The Working Group after taking into account the recommendations made by the Nutrition Advisory Committee of the Indian Council of Medical Research(ICMR) in 1958 regarding the needs of a balanced diet came to the view that a minimum consumption expenditure of Rs.100 at 1960-61 prices of a family of 5 persons will be needed in order to provide minimum nutritional diet in terms of calorie as presented by ICMR. The group also suggested that for urban areas the minimum should be raised to Rs.25 per capita in view of the higher cost of living there. By implication this

meant that the corresponding amount in the rural areas would work out to Rs.18.9. Dandekar and Rath (1971) in their study recommended average calorie norm of 2250 per capita per day. The corresponding monthly per capita expenditure cut-off's in rural and urban areas were Rs.14.2 and 22.6 respectively at 1960-61 prices. Planning Commission constituted Task Force on Projections of Minimum Needs and Effective Consumption demand in 1977 to recommend a poverty line for use in Sixth Plan.

1.2 Procedure as adopted in the Sixth Plan (1980-85)

1.2.1 Basic Concepts

The existing definition of poverty line and the estimation of persons below the poverty line have its base from the report of the Task Force on Projection of Minimum Needs and Effective Consumption Demand set up by the Planning Commission. Accordingly the Poverty line is defined as monthly per capita expenditure of Rs.65/- in rural areas and Rs.75/-in urban areas (both at 1977-78 prices) corresponding to per capita daily calorie requirement of 2400 in rural areas and 2100 in urban areas respectively.

1.2.2. Calorie Norm

The calorie norms separately for rural and urban areas were obtained on the basis of age, sex, occupation

structure of the population and the associated calorie norms/requirements recommended by the Nutrition Expert Group (1968) of ICMR. The calorie requirements for 1982-83 which was the terminal year of the Draft Janata Plan (1978-83) were obtained as 2435 per capita per day in rural areas and 2095 in urban areas which were rounded off to 2400 and 2100 respectively. It was also mentioned in the Task Force report that the above mentioned norms were average and not the minimum required for biological existence.

1.2.3. Expenditure Cut-off

In working out the monetary equivalent defined as the poverty line corresponding to above mentioned calorie norms the data for 28th Round (1973-74) of NSSO relating to private consumption expenditure were utilised. The method of interpolation was used utilising the information on value of expenditure and calorie consumed derived from the food items in the consumption basket. It was estimated that an expenditure of Rs.49.09 per capita per month in rural areas and Rs.56.64 in urban areas (at 1973-74 prices) correspond to the calorie requirement of 2400 in rural areas and 2100 in urban areas respectively. Thus the estimated poverty line ensures that having this amount, an individual prefers to distribute his expenditure

between food and non-food in such a way that the calorie content of his food consumption satisfies the desired calorie norm.

1.3. Updating of Poverty Line:

The poverty line worked out this way needs updating over time for

- (i) change in the calorie norm resulting from change in population structure and
- (ii) change in the tastes over time and price structure.

It is important to mention here that the consumption expenditure surveys are conducted once in 5 years/only by National Sample Survey Organisation (NSSO) since 1973-74 and therefore such updating can be done only for those years where such surveys have been conducted. In estimating the poverty ratio for inter-survey years, therefore a separate method of updating is adopted. The present method adopted by the Planning Commission is using wholesale price index as deflator.

1.4. Adjustment of NSSO total private consumption to CSO total private consumption

In planning exercises the total private consumption is estimated using national income accounts of Central Statistical Organisation (CSO). It is observed that total private consumption as estimated from NSSO from its surveys differs from that derived using national income statistics of CSO. To maintain consistency in plan exercises at macro level, the Planning Commission adjusts the NSSO distribution pro-rata by the ratio of total private consumption of the CSO and the total private consumption of the NSSO.

CHAPTER 2

RECOMMENDATIONS OF THE STUDY GROUP

The present study group has been set up to examine and recommend any necessary revision in the existing definition of poverty line for use in Seventh Plan in the light of the Sixth Plan experience in the implementation of the major poverty alleviation programmes and issues raised by many Economists, Statisticians and Nutritionists. The views and recommendations of the Study Group on various issues relating to the terms of reference are discussed in this Chapter.

Determination of a Calorie Norm

2.1 The Calorie requirement of a person varies according to the age, sex, occupation/or activity category to which he belongs. Nutrition Expert Group (1981) considered 14 relatively homogeneous categories comprising (1) five for children on the basis of their age (2) three for adolescents in terms of their sex and age and (3) five for men/women of 19 years or over with three each for men and women engaged in heavy moderate and sedentary work respectively. To these another two, one each for non-working men and women were added to account for the whole of the population.

The weighting diagram of the population according to these categories is presented in Table-1. The age, sex, occupation category/specific caloric norms as per recommended Dietary Intakes for Indians, ICMR (1981) together with the weighting diagram of the population have been made use of in calculating the average caloric requirement at the aggregate level. This has been done separately for rural and urban areas. The average caloric norms by above method for the years 1984-85 and 1989-90 areas under:-

Table - A

Average Calorie Norm Per Capita per day

<u>Year</u>	<u>Rural</u>	<u>Urban</u>
1984-85	2414	2117
1989-90	2442	2132

These have been rounded to 2400 in rural areas and 2100 in urban areas.

2.2 Prof. Sukhatme, one of the members of this Study Group, prepared a detailed note on the issues relating to the determination of caloric norm. He also drew the attention of the Study Group on the "Guide-lines for the practical use of energy allowance" - ICMR recommended Dietary Intakes for Indians (1961), which are as under:

2.3 "Recommended energy allowance values must be used with

caution for estimating the extent of energy deficiency among population groups. The energy requirement is based on measurements of intakes in healthy active individuals and is defined separately for each of the various age and sex groups and for each specified level of activity. These figures are estimates of the average needs for the recommended allowances for individuals.

2.4 It is therefore to be expected that in any healthy active population of a specified category, half the individuals will be able to meet their requirements with intake less than the average, and the other half with more than the average. The coefficient of intake is estimated to be 15 per cent and this includes both intra-and-inter-individual variation. It has been observed that intra-individual variation accounts for almost the whole of the total variance observed within the same age, sex-group and category. Even on a conservative basis therefore, an individual in a specified category will be able to meet his requirement of intake ranging from mean-minus 25 per cent to mean-plus 25 per cent. In the light of these considerations, an individual eating less than the average requirement cannot be regarded as under-nourished or one eating above the average requirement as over-nourished, unless

such intakes result either in a decrease or an increase in body weight over prolonged periods. While estimating the incidence of energy deficiency among populations based on their intakes, the point of reference should not ~~therefore~~ be the average requirement, but the lower limit arising from intra-individual variation, viz. mean-minus 2 times the standard deviation or 25 per cent below the average requirements".

2.5 Taking into account the above view the Study Group recommends using both the concepts (i) an average norm and (ii) a minimum norm for the estimation of poverty in the country. The minimum norm ~~has~~ been taken as 25% lower than the average norm. It is further suggested that given our resources constraints and the Plan's very high priority for helping the poorest of the poor the identification of the beneficiary group for poverty alleviation programme could be initially on the basis of minimum calorie requirement. Subsequently, the programme could be extended to cover all beneficiary who are below the average calorie requirement.

2.6 Percentage of persons below the calorie norm

2.6.1 The computations have been done based on data collected by NSSO in their Household Consumer Expenditure Surveys. The year 1977-78 (32nd round) which is the latest

year for which detailed results were obtained from NSSO for the use of the Study Group, has been chosen for this purpose. The percentage of persons below 2400 calories in rural areas were estimated as 57.79 and those below 2100 calories in urban areas as 49.28.

2.7. Determination of Expenditure Cut-Off

2.7.1 The method being used at present for determining the expenditure cut-off corresponding to the desired calories norm utilises the distribution presented in Table 2.

The expenditure cut-off corresponding to desired calorie norm when calculated using the method of linear interpolation has the following limitations:

- i) This method ignores the percentage distribution of persons in different expenditure classes.
- ii) It assumes monotonic relationship between expenditure and calorie intake.
- iii) This does not satisfy the basic test of calibration as the percentage of persons below the expenditure cut-off are very much different than the percentage of calorie deficient persons (Table-B).

Table-B

Percentage of persons below expenditure cut-off and below calorie norm

	<u>Expenditure cut-off (at 1977-78 prices) per capita per month</u>	<u>%persons below expenditure cut-off</u>	<u>% calorie deficient persons</u>
Rural	55.77	51.45	57.79
Urban	56.79	29.74	49.28

2.8 The method of determining expenditure cut off for calorie norm being used at present depends on the assumption that there is a monotonic functional relationship between the per capita calorie consumption and per capita expenditure of individuals. If this assumption fails the expenditure cut off derived will mean including non-poor^s among poor^s and poor^s among non-poor^s. The assumption does not hold true from the fact that the percentage of persons below the calorie norm and below the expenditure cut off are seen to be totally different. In fact under such situation there will not be one choice but several choices and one has to prefer that which minimises inclusion of non-poor^s among poor^s.

2.9 It may be mentioned that similar to the distribution of persons by monthly per capita expenditure (and associated calorie intake) there is another distribution of persons by per capita calorie consumption (and associated monthly per capita expenditure) giving thereby a bi-variate distribution of persons by monthly per capita expenditure and per capita calorie intake.

An analysis of variance (separately for per capita calorie intake and per capita monthly expenditure)

from the bi-variate distribution of calorie intake and expenditure revealed the following:-

- (i) The within class (expenditure or calorie) variability was higher than the between class variability.
- (ii) The variability in the expenditure for given calorie intake was higher than the variability in calorie intake for given expenditure.

2.10 The distribution presented in table 2 and 3 conceal the within class variability and therefore we get two different sets of expenditure cut-off corresponding to the same calorie norm. Further, the monotonicity assumption between expenditure and calorie intake does not hold good. This assumption will be violated more if we examine at the un-grouped level.

Thus, it is observed that the method of linear interpolation used for determining the expenditure cut off corresponding to the calorie norm as being used in the Planning Commission is one of the several possible solutions and therefore requires indepth examination.

2.11 Fitting of bi-variate log normal distribution for use in determining the expenditure cut off

2.11.1 A bi-variate log normal distribution was fitted to the data presented in table 6. The expenditure cut-offs corresponding to the desired calorie norm were calculated from the fitted distribution. The results are presented in the table C below:-

Table C

Expenditure cut off corresponding to the desired calorie norms calculated by fitting of bi-variate log normal distribution - All India

	<u>Expenditure cut off (1977-78 prices) per capita per month</u>	<u>% of persons below the expenditure cut off</u>
Rural	59.15	57.63 (57.79)
Urban	73.51	49.99 (49.28)

The figures in the bracket in above table correspond to the percentage of calorie deficient persons. It can be seen that the expenditure cut off derived using method of fitting the bi-variate log normal distribution satisfies the calibration test. Having established that the method of fitting of bi-variate log normal distribution satisfies the calibration test, Having established that the method of fitting of bi-variate log normal distribution satisfies the calibration test, it is important to examine that of

the persons below the poverty line what percentage is below the desired calorie norm. With this in view an analysis has been attempted and the results are presented below:

Table D
Percentage of persons below poverty line and calorie norm

	Rural			Urban		
	Below poverty line	Above poverty line	Total	Below poverty line	Above poverty line	Total
Below Calorie Norm	47.32	12.47	57.79	37.33	11.95	49.28
Above Calorie Norm	12.31	29.90	42.21	12.66	38.06	50.72
	57.63	42.37	100.00	49.99	50.01	100.00

2.13 It can be seen from the above table that the percentage of persons which are calorie deficient as well as expenditure deficient are 47 % in rural areas and 37% in urban areas. These when expressed as percentage of poors (i.e. below the expenditure cut off) are more than 80 % in rural and about 75% in urban areas. Thus, the poverty line defined in this way also satisfies the desirable property that the extent of inclusion of non-poors among poors should ^{be} small.

In fact, by taking the expenditure cut off corresponding to the minimum calorie norm, the inclusion of non-poor among poor will be further less. Also, as the percent of poor among non-poor are seen to be almost the same as the percent of non-poor among poor, the estimation of percentage of population below poverty line by taking the average calorie norm is justified.

2.14 Study Group recommends the use of fitting of bivariate log normal distribution in determining the expenditure cut off. The finally recommended expenditure cut off's corresponding to average calorie norm (i.e. Poverty Line) and Minimum Calorie norm (i.e. Severe Poverty Line) are as under:

	<u>Poverty Line</u> (Corresponding to average calorie norm)	<u>Alternate Poverty Line</u> (Corresponding to Minimum calorie norm)
Rural	59.15	45.91
Urban	73.51	61.20

2.15 This poverty line estimates as above is on an average basis for the country as a whole. For any region it will differ depending upon the taste of the people and relative price structure for region only.

2.15.1 The measurement of poverty cut off point along the line suggested includes all items of consumption which are purchased against the household expenditure. There are items of consumption which are obtained in the form of social consumptions and even some times it is in the form of transfers in kind. These items of consumption also add to the quality of life of the people and sometimes even to their nutrition standards. If these types of benefits accrue to the poor people significantly then their omission may overstate the extent of poverty according to the present measurement. However, it is not easy to make an evaluation of all items of consumption in this category and also to locate their beneficiaries.

2.16 The present Study Group feels that this is an important area where future investigations should be made. But they have decided not to enter into detailed investigations in this field as it was outside the terms of reference of this Group.

2.17 Updating of Poverty Line

The Study Group recommends that the relevant price deflator should be worked out on the basis of an appropriate consumption basket selected by taking

a representative pattern of expenditure of persons near the poverty line and the prices relevant to the items of consumption of this Group. The changes in the calorie norm has also to be kept in mind while updating the poverty line. The CSO has been recommended to provide at the earliest the information on the relevant consumption basket and the appropriate prices.

2.17.1 Until the above information is available the Study Group recommends the use of the following with the latest base.

- a) For Rural, the Consumer Price Index of agriculture labourers in Rural areas; and
- b) For Urban, the Consumer Price Index for industrial workers in Urban areas.

2.17.2 It may be mentioned that the base of both these indices are extremely backdated. The base is 1956-57. It is, therefore, recommended that attempt should be made if the relevant price deflator can be weighted by the weights of the food and non-food items in the consumption basket of the relevant expenditure class for deriving the most appropriate deflator.

2.18 Adjustment of NSSO Private Consumption

The Study Group recommends the continuation of existing practice of adjusting NSSO private consumption and its distribution to the total private consumption of CSO and pro-rata adjustment of the distribution till further information is available. Though this is not the most efficient way yet in the absence of any detailed information, for maintaining consistency in the plan exercise, the above method has been recommended.

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Table 1

Weighting diagram for Working out Calorie requirements for the year 1984-85 and 1989-90 for rural and urban areas separately.

Age Group	1984-85		1989-90		Average Calorie Norm
	Rural	Urban	Rural	Urban	
0	2.97	2.56	2.77	2.39	760
1-3	8.67	7.44	8.25	6.89	1200
4-6	8.31	7.19	7.74	6.68	1500
7-9	7.91	7.09	7.48	6.70	1800
10-12 boys	3.89	3.70	3.77	3.46	2100
girls	3.57	3.58	3.45	3.38	2100
13-15 boys	2.41	2.35	2.38	2.41	2500
girls	2.22	2.25	2.19	2.31	2200
15 + Males					
Heavy workers	22.03	4.27	22.78	4.38	3900
Moderate "	2.51	3.11	2.59	9.35	2800
Sedentary	2.74	15.02	2.83	15.41	2400
Non-workers	3.29	6.25	3.41	6.39	2400
15 + Females	10.51	1.64	10.88	1.70	3000
Heavy workers					
Moderate	.92	1.77	.95	1.83	2200
Sedentary	.50	3.23	.51	3.34	1900
Non-workers	17.55	22.55	18.22	23.38	1900
Total					
Average	2414	2117	2442	2132	
Per capita per day					

Table 2

Distribution of persons, per capita monthly expenditure and per capita per day calorie intake by expenditure class - All India

Expendi- ture (Rs. per month)	Rural			Urban		
	% of persons	Monthly Expen- diture	Per capita per day cal.intake	% of persons	Monthly Expen- diture	Per capita per day cal. intake
1.	2.	3.	4.	5.	6.	7.
0-10	0.20	4.63	221	0.22	3.30	319
10-15	0.50	14.16	736	0.12	12.65	659
15-20	1.20	17.81	1026	0.34	17.93	1028
20-30	8.20	25.88	1444	2.60	26.06	1275
30-35	7.20	32.57	1719	3.01	32.67	1451
35-40	8.30	37.56	1888	4.24	37.58	1684
40-50	17.20	44.93	2114	10.85	45.17	1878
50-60	14.00	54.80	2378	12.33	54.90	2052
60-70	11.50	64.70	2602	11.36	64.89	2306
70-80	8.10	74.78	2857	9.95	74.78	2529
80-100	9.80	88.83	3163	14.57	89.12	2716
100-150	8.80	118.63	3691	17.42	120.56	3369
150-200	2.30	170.26	4561	6.62	170.96	4119
200+	1.80	489.23	5815	6.37	328.12	6551
Aggregate	<u>100.00</u>	<u>68.92</u>	<u>2507</u>	<u>100.00</u>	<u>96.04</u>	<u>2796</u>

Table :3

Distribution of persons, per capita monthly expenditure & per capita per day Calorie intake by calorie class.

Calorie Class (Per capita per day)	Rural			Urban		
	% of persons	Monthly Expenditure Rs. per capita	Calorie intake per capita per day	% persons	Monthly per capita expenditure	Per capita per day calorie intake.
1.	2.	3.	4.	5.	6.	7.
Upto 1475	13.57	33.34	1164	14.82	48.40	1188
1475-1885	1.91	40.53	1571	2.25	57.21	1570
1525-1875	2.07	41.73	1551	2.56	61.96	1551
1575-1625	2.19	43.84	1600	2.30	63.49	1671
1625-1675	2.27	46.40	1650	3.01	70.06	1651
1675-1725	2.27	47.39	1700	2.99	67.70	1700
1725-1775	2.44	52.96	1750	3.08	71.96	1750
1775-1825	2.41	48.32	1870	3.09	73.95	1800
1825-1875	2.69	51.49	1851	3.00	75.52	1850
1875-1925	2.69	51.04	1900	2.98	79.63	1900
1925-1975	2.69	53.81	1950	3.10	81.86	1950
1975-2025	2.63	54.65	2000	2.84	83.76	1999
2025-2075	2.69	55.06	2050	2.85	84.60	2050
2075-2125	2.66	55.70	2100	2.86	88.79	2100
2125-2175	2.68	59.98	2150	2.73	92.44	2150
2175-2225	2.62	59.66	2300	2.44	89.56	2190
2225-2275	2.41	62.06	2250	2.32	93.40	2250
2275-2325	2.56	62.79	2300	2.33	100.39	2300
2325-2375	2.33	64.38	2350	2.27	106.17	2350
2375-2425	2.18	65.85	2399	1.99	104.45	2400
2425-2475	2.18	72.16	2450	1.84	109.85	2450
2475-2525	2.02	68.43	2500	1.83	109.50	2500
2525-2575	2.05	70.49	2551	1.63	111.91	2550
2675-2625	1.96	69.91	2600	1.57	123.22	2599
2625-2675	1.68	73.73	2649	1.40	118.20	2630
2675-2725	1.68	74.26	2700	1.39	115.98	2700
2725-2775	1.57	75.66	2750	1.15	146.31	2750
2775-2825	1.53	86.21	2800	1.09	123.34	2800
2825-2875	1.48	79.65	2850	1.10	128.93	2848
2875-2925	1.33	88.88	2900	1.00	128.45	2900
2925-2975	1.20	84.32	2950	0.93	145.88	2949
2975-3025	1.19	82.95	2999	0.83	130.82	2999
3025 + above	20.07	120.47	4491	18.03	156.22	6679
	100.00	68.92	2507	100.00	96.04	2796

Table - 4

Distribution of persons with the same calorie intake according to different expenditure class.

Expenditure Class	Rural	Urban
	<u>2400</u>	<u>2100</u>
0-20	0.07	0.11
20-30	1.56	0.02
30-36	2.83	0.30
35-40	5.69	1.30
40-50	20.01	4.27
50-60	22.04	7.96
60-70	16.08	13.22
70-80	12.94	13.79
80-100	10.77	22.07
100-150	6.19	22.92
150-200	1.33	7.05
200 +	0.49	6.98

Table - 5

Distribution of persons with the same expenditure according to different calorie classes

Calorie class	Rural Expenditure	Urban Expenditure
	50-60	60-70
Upto 1475	4.27	10.11
1475 - 1525	1.34	2.29
1525 - 1575	1.35	3.15
1575 - 1625	1.67	3.56
1625 - 1675	1.92	4.03
1675 - 1725	1.96	4.53
1725 - 1775	2.37	4.07
1775 - 1825	2.75	3.61
1825 - 1875	3.17	3.87
1875 - 1925	3.35	4.91
1925 - 1975	3.59	4.21
1975 - 2025	3.81	4.18
2025 - 2075	4.13	3.88
2075 - 2125	3.72	3.90
2125 - 2175	4.12	3.84
2175 - 2225	4.26	3.29
2225 - 2275	3.77	2.88
2275 - 2325	4.24	2.61
2325 - 2375	3.67	2.51
2375 - 2425	3.38	2.32
2425 - 2475	3.33	1.79
2475 - 2525	3.20	1.73
2525 - 2575	3.17	1.56

...../-

Calorie Class	Rural Expenditure 50-60	Urban Expenditure 60-70
2575 - 2625	2.59	1.47
2625 - 2675	2.25	1.17
2675 - 2725	2.19	1.18
2725 - 2775	2.00	0.90
2775 - 2825	1.93	0.91
2825 - 2875	1.86	0.87
2875 - 2925	1.50	0.61
2925 - 2975	1.10	0.68
2975 - 3025	1.17	0.45
3025 + above	10.86	8.91

NATIONAL SAMPLE SURVEY: INDIAN: JULY 1977-JUNE 1978
 TABLE D: DISTRIBUTION OF PERSONS FOR DIFFERENT PER CAPITA EXPENDITURE CLASSES
 BY MONTHLY PER CAPITA NET INTAKE OF CALORIE CLASSES

CALORIE CLASS	NUMBER OF PERSONS (00)										TOTAL	AGE			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)					
UP TO 1475	0	0	5443	24651	15284	9187	5311	3103	1382	785	333	532	717	513	57624
1475-1525	0	0	1503	13111	20894	1479	2993	975	521	237	1019	443	252	74	7512
1525-1575	0	94	965	20113	19327	19355	23855	10353	4115	1383	1744	933	51	51	103352
1575-1625	0	0	0	33	16444	2025	2623	12473	5834	1300	2551	830	77	393	113373
1625-1675	0	0	0	0	15193	19478	23315	14779	7443	3335	1773	1435	33	33	113373
1675-1725	0	0	0	0	15714	15374	15239	14557	3931	2824	2265	1534	133	133	113373
1725-1775	0	0	0	0	13445	21028	24119	17324	9138	3523	5439	204	155	155	113373
1775-1825	0	0	0	0	13174	19333	22543	20357	9133	4893	5439	204	155	155	113373
1825-1875	0	0	0	0	15113	15723	18273	23352	13744	5042	5052	2342	303	303	153373
1875-1925	0	0	0	0	13051	20333	23352	23877	12959	5079	3735	3020	203	113	184745
1925-1975	0	0	0	0	12314	13475	15133	25913	15317	6754	7415	292	235	235	113373
1975-2025	0	0	0	0	10003	15151	15712	23378	15112	3517	5400	358	315	315	113373
2025-2075	0	0	0	0	4221	13119	14422	30533	18030	710	5728	336	574	574	113373
2075-2125	0	0	0	0	3121	13703	15333	27353	17744	3087	9864	402	378	378	113373
2125-2175	0	0	0	0	2423	5177	10342	30342	20134	10217	3213	5339	329	329	153373
2175-2225	0	0	0	0	2359	3562	33358	51372	29511	11335	3335	4507	1555	1555	153373
2225-2275	0	0	0	0	1955	3709	4814	27377	18111	11334	11013	4987	609	609	119373
2275-2325	0	0	0	0	1335	4401	7004	23393	21339	13305	11521	5555	594	594	119373
2325-2375	0	0	0	0	123	3433	5057	24973	23143	13344	10971	6559	1045	1045	119373
2375-2425	0	0	0	0	1774	3223	5674	23134	13332	14753	12235	7033	1512	1512	119373
2425-2475	0	0	0	0	32	2757	5017	24757	19135	11522	12025	5093	351	351	119373
2475-2525	0	0	0	0	732	2255	4538	33560	16523	11522	13707	7513	1157	1157	119373
2525-2575	0	0	0	0	879	1512	4515	19332	13415	12580	12518	9027	1157	1157	119373
2575-2625	0	0	0	0	736	1925	611	19009	13453	13713	13713	3522	1210	1210	119373
2625-2675	0	0	0	0	509	775	3154	15241	16574	11335	12915	7324	1501	1501	119373
2675-2725	0	0	0	0	91	1142	2827	16359	14343	12215	13333	927	1125	1125	119373
2725-2775	0	0	0	0	1356	200	1304	14315	14315	11373	12582	3717	1125	1125	119373
2775-2825	0	0	0	0	217	831	1592	14354	14027	11097	13602	3717	1513	1513	119373
2825-2875	0	0	0	0	162	326	1333	13333	13333	12337	13600	3522	1758	1758	119373
2875-2925	0	0	0	0	341	330	583	1113	1201	11337	11337	9127	1643	1643	119373
2925-2975	0	0	0	0	109	549	556	3445	1143	1337	11337	10237	1101	1101	119373
2975-3025	0	0	0	0	207	452	311	3929	1741	10334	11603	3333	2145	2145	119373
3025 & ABOVE	90	70	215	1033	3710	1033	19552	30713	11351	12327	20953	25921	3513	3513	119373
ALL CLASSES	1234	21074	5027	41114	35384	11635	35317	74333	37101	40324	43971	44334	11619	3713	491314

ALL INDIA:

70311
 8216

TECHNICAL APPENDIX

The joint probability density function of $\log x_1$ and $\log x_2$, when x_1 and x_2 follow a bi-variate log normal distribution, is given by

$$f(\log x_1, \log x_2) = \frac{1}{2\pi R S_1 S_2}$$

$$\text{Exp. } -\frac{1}{2} \left\{ (\log x_1 - M_1)^2 + (\log x_2 - M_2)^2 - 2R (\log x_1 - M_1) (\log x_2 - M_2) \right\}$$

where M_1 , M_2 are the means of $\log x_1$, $\log x_2$ and R the correlation coefficient between them.

The conditional distribution of $\log x_2$ for given $\log x_1$ is known to be normal with parameters

$$\text{Mean} = M_2 + R \frac{S_2^2}{S_1^2} (\log \hat{x}_1 - M_1)$$

$$\text{Variance} = S^2 = (1 - R^2) S_2^2,$$

where S_1^2 and S_2^2 are the variance of $\log x_1$ and $\log x_2$ respectively and

$\log \hat{x}_1$ is the value of $\log x_1$ at the value of $x_1 = \hat{x}_1$

The conditional distribution of x_2 for given x_1 is known to be log normal.

The expected value of x_2 for given x_1 is

$$E(x_2 | x_1) = g(S^2) \text{Exp.} \left(M_2 + R \frac{S_2^2}{S_1^2} (\log \hat{x}_1 - M_1) \right)$$

$$\text{where } g(S^2) = \left[1 - \frac{k}{n} \left\{ S^2 + (1-k)^2 S_2^4 \right\} \text{Exp.} (1-k) S^2 \right]$$

and $k = (\log x_1 - M_1)^2 / \sum_{j=1}^n (\log x_{1j} - M_1)^2$, x_{1j} being the value of the j th unit of variable x_1 .

In present case x_1 and x_2 represent per capita daily calorie intake and monthly per capita expenditure respectively.

The estimated parameters of the fitted distribution together with the expected expenditure for desired calorie norms are given in Table A - 1.

TABLE A - 1

Estimated parameters of the bi-variate log-normal
distribution

<u>Parameters</u>	<u>Rural</u>	<u>Urban</u>
M_1	7.7355	7.7650
M_2	4.0380	4.3681
S_1	0.4244	0.5475
S_2	0.5651	0.6078
P	0.6614	0.5512
$\frac{2}{S}$	0.1797	0.2571
Expected expenditure Corresponding to	...	
(1) Average Calorie norm	59.15	73.51
(2) Minimum calorie norm	45.91	61.20

No.4/7(1)/83-PP
GOVERNMENT OF INDIA
PLANNING COMMISSION

APPENDIX

....

Yojana Bhavan,
New Delhi-110001
May 10, 1983.

NOTIFICATION

It has been decided to constitute a Study Group on Concepts and Estimation of Poverty Line. The composition of the Study Group will be as follows:

- | | | |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| 1. | Dr. S.P. Gupta,
Adviser (PP),
Planning Commission | Chairman |
| 2. | Prof. P.V. Sukhatme,
Hony. Professor of Biometry &
Head, Department of Biometry,
Maharashtra Association for
Cultivation of Science,
Pune - 411004 | Member |
| 3. | Dr. K.C. Seal,
Director General,
Central Statistical Organisation
Department of Statistics,
Ministry of Planning,
New Delhi-110001 | Member |
| 4. | Dr. N. Rath,
Director,
Gokhale Institute of Politics
and Economics,
Pune - 411004 | Member |
| 5. | Prof. N.S. Iyengar,
Head, Economic Analysis Unit,
Indian Statistical Institute,
31, Church Street,
Bangalore -560001 | Member |
| 6. | Prof. Suresh Tendulkar,
Delhi School of Economics,
Delhi-110007 | Member |
| 7. | Prof. R. Radhakrishna,
Central University of Hyderabad,
Hyderabad. | Member |

.....2/-

8. Dr.(Mrs.) K.K. Sharma, Member
Executive Director,
Food & Nutrition Board,
Department of Food,
Ministry of Agriculture,
New Delhi.
9. Shri K.L. Datta, Member
Senior Research Officer,
Perspective Planning Division,
Planning Commission
10. Dr. Padam Singh, Member-Secretary
Joint Adviser,
Perspective Planning Division,
Planning Commission.

2- The terms of reference of the Study Group will be :

- (i) to examine the conceptual problems of defining 'Poverty Line' in the light of the recent views of Prof. Sukhatme, Prof. Damlekar, Prof. Goplan and others;
- (ii) to decide on the cut-off point for calorie intake/ consumer expenditure for defining poverty for the purposes of macro-economic analysis in the Seventh Five Year Plan formulation.

3- The Chairman of the Study Group may associate such official or non-official as members, if it is felt necessary.

4- The non-official members of the Study Group will be paid DA & TA at rates applicable to a Grade I officer of the Central Government for attending meetings of the Study Group.

5- The Study Group is requested to submit its report by the end of December, 1983.

Sd/-
(K.C. Agarwal)
Director (Administration)

To

All the Members of the Working Group.

Copy to:

P.S. to Deputy Chairman, Planning Commission
P.S. to Member (F)/(M)/(H)/(K)
P.S. to Secretary
Standard distribution in Planning Commission.

Sd/-
(K.C. Agarwal)
Director (Administration)

Tel.No.223387

THE DELHI SCHOOL OF ECONOMICS
UNIVERSITY OF DELHI
DELHI -7

Ref. No. Econ. 191

Date May 24, 1983

Shri K.C.Agarwal
Director (Administration),
Planning Commission
Yojana Bhavan
Parliament Street
New Delhi -110001.

Dear Shri Agarwal :

was This refers to your resolution No.4/6(1)/83-PP dated May 10 and notification no. 4/7(1)/83-PP dated May 10, 1983 which received after I sent my letter No. Econ./41 dated May 12 to Dr. S.P. Gupta indicating my inability to join the groups under consideration (copy attached). In view of my inability, my name may be removed from both the groups. The convener of the two groups may also be informed accordingly.

With regards,

Sincerely yours,

SD/-
(S.D. TENDULKAR)

APPENDIX

THE DELHI SCHOOL OF ECONOMICS
UNIVERSITY OF DELHI
DELHI-7

Date May, 12, 1983

Dr. S.P. Gupta
Adviser, Perspective Planning Division
Planning Commission
Yojana Bhavan
Parliament Street
New Delhi-110001

Dear Dr. Gupta:

I am grateful to you for asking me to join the PPD's Advisory Group on "PlanModelling" (D.O.No.4/6(1)/83-PP dated May 4, 1983) and a Study Group on "Concepts and Estimation of Poverty Line" (D.O.No.4/7(1)/83-PP dated May 5, 1983). My prior commitments over the next couple of years would not permit me to do justice to the work of the groups. I am, therefore, forced to regret my inability to formally associate myself with the work of the groups. You, however, known me long enough to draw on my time at an informal personal level whenever convenient and in case you choose to do so. I do hope you would not misunderstand.

With warm personal regards,

Sincerely yours,

sd/-
(S.D. Tendulkar)

D.O.No.SPA/ED/83

APPENDIX

Dr. (Mrs) KK Sharma,
Executive Director
Food & Nutrition Board.
T.No.389240

Department of Food
Government of India
Krishi Bhavan
New Delhi-110001

May 25, 1983

Dear Dr. Gupta,

This has reference to your DO No. 4/7(1)/83-PP dated 5th May, 1983, inviting me to be a Member of the Study Group on Concepts and Estimation of Poverty Line. I am indeed thankful to you for including me in the said Study Group. However, it would not be possible for me to participate in the deliberations of the Group. I would, therefore, suggest that either Dr. S.G.Srikantia or Dr. KT Achaya may be nominated on the Committee. Their addresses are as under :

1. Dr. S.G. Srikantia, Hony Prof. Foods & Nutrition, Department of Postgraduate Studies in Home Sc., Manasagangothri, Mysore-570012.
2. Dr. K.T. Achaya, Consultant, UNU, Central Food & Technological Research Instt., Mysore.

In case it is desired to have a Member from the Deptt. of Food then I would suggest that either Shri HD Bansa, Joint Secretary, Department of Food or Shri M Ramakrishna Rao, Deputy Director (Linear Programming), Diet and Nutrition Survey, Food and Nutrition Board, Jammagar House, New Delhi may be included in the Study Group.

With kind regards,

Yours sincerely,

Sd/-
(K.K.Sharma)

Dr. S.P. Gupta,
Adviser(PP) & Chairman, Study Group,
Planning Commission,
New Delhi.

A Note on the Draft Report of the Study Group
on Concepts and Estimation of Poverty Line

H. Rath

1. In the last sentence of paragraph 2.2 of the draft Report of the Study Group it is mentioned : "As far as Bandekar and Rath study is concerned, their basis to arrive at the adequacy of 2250 calories per person per day is not clearly spelt out." The essay, Poverty in India, says ("Poverty in India", Indian School of Political Economy, 1971, p.6) : "Nutritional experts regard this (i.e., 2250 calories per capita per day) as adequate under Indian conditions of climate, etc." However, the essay did not cite the specific reference to it. But the reference implied was to Prof. P.V. Sukhatme's work. The nutritionists' views at that time had been examined and summarised by P.V. Sukhatme in his book Feeding India's Growing Millions (Bombay: Asia Publishing House, 1965). Sukhatme examined the views of Nutrition Advisory Committee of India and of the FAO and came to the conclusion that the average daily calorie requirement of an average Indian - average of sex, age, climate, work, etc. - may be put at 2100 calories at physiological level. Then making allowances for wastages, etc., between retail and physiological level, which he estimated to be between 7 per cent and 10 per cent, he concluded: "... the average per caput requirement at the retail level for India would be of the order of 2250 to 2300

calories." (p.23). Dandekar and Rath have used the lower of ^{though} these two figures, ~~though~~ reference to Sukhatme's was not cited.

2. The first item in the Terms of Reference of the Study Group is : "to examine the conceptual problems of defining the poverty-line in the light of recent views of Prof. Sukhatme, Prof. Dandekar, Prof. Gopalan and others." Since Professor Sukhatme had been included as a member of the Study Group, I had in a letter to the Convener, suggested that in propriety Prof. Dandekar should also be made a member of the Study Group. This was not considered necessary. Now, from the draft Report ^{and no account taken} I find that no mention has been made ^{of} the studies and views of Prof. Dandekar on the subject. Prof. Dandekar's studies and views are contained in two publications - (1) "Measurement of Poverty" (R.R. Kale Memorial Lecture, 1981, Gokhale Institute of Politics and Economics, Pune, 1981), and "Measurement of Undernutrition" (Fifth Gopalan Oration, Nutrition Society of India, Proceedings, No. 27, 1982). Both these essays were published after the Task Force on Projection of Minimum Needs and Effective Consumption Demand, set up by the Planning Commission, reported in 1979. (That, I presume, is the reason why the very first term of reference of the present Working Group refers to the views of Prof. Sukhatme, Prof. Dandekar and Prof. Gopalan.) The points made by Prof. Dandekar ^{on} the subject should be taken into account in the Report of the Study Group.

As I understand it, Prof. Dandekar makes the following points :

(1) He maintains that while Poverty and Undernutrition are related, the two are not the same things. Commenting on Prof. Sukhatme's formulation on this question, Prof. Dandekar writes:

".....Dr. Sukhatme says that a person who cannot afford a diet which meets his minimum energy needs for a healthy active life is certainly both poor and malnourished. Note that Dr. Sukhatme says that the person is both poor and malnourished. It means that he recognises that poverty and under-nutrition are two different phenomena but he is unable to see the distinction clearly. Hence he says that when a person cannot afford the needed diet, he is both poor and under-nourished. This is the source of confusion. When we say that a household cannot afford the requisite diet, we mean that as judged by the average consumer behaviour and household management at that expenditure level. The household is therefore poor. But, as I have already explained, a poor household need not necessarily be under-nourished; by better priorities and better management of expenditure, it may in fact eat an adequate diet. Similarly, and for the opposite reason, a not-poor household may in fact suffer from under-nutrition. I wish to emphasise and plead with Dr. Sukhatme to understand that, all through our little study on Poverty in India, Professor Bath and myself have been discussing poverty and not under-nutrition. The two are related because as Dr. Sukhatme points out "as income increases, the energy intake increases, rapidly to start with and gradually thereafter indicating that an appreciable number of people remain under-nourished for want of adequate income." But the two are not identical; in fact, they are two different phenomena.

Consider again Dr. Sukhatme's statement : "When.... Dandekar and Bath find that 40 per cent of the rural population and 50 per cent of the urban India live on a level of total expenditure below the level corresponding to the average energy need for the country, it simply means that they find a situation which is in line with what one expects to find it in a healthy

active population of the 'reference' type." He argues this on the ground that, in a healthy active population, one expects to find that about half the individuals will have energy intakes less than the average and half more than the average; and he does not see the difference. Dr. Sukhatme does not see the difference between half the population having calorie intake less than the average and half the population living below the total expenditure level corresponding to the average energy need. In a healthy active population one would expect to find about half the population to live on calorie intake below the average. But, in such a population, should we also expect about half the population to live on total expenditure less than the expenditure corresponding to the average calorie intake? I ask, is this also an essential attribute of a healthy active population?"

(Measurement of Poverty, pp. 14-15)

(ii) Secondly, discussing the measurement of under-nutrition, which is what Prof. Sukhatme has tried to do, Professor Dandekar accepts the fact of intra as well as inter-individual variation in calorie requirements. Let me quote Prof. Sukhatme in this connection from the quotation of his note reproduced in p.6 of the draft Report. He says, "In the light of these considerations, an individual eating less than the average requirement cannot be regarded as undernourished or one eating above the average requirement as over-nourished, unless such intakes result either in decrease or an increase in body weight over prolonged periods." This suggests that under-nutrition may be observed at various levels of energy intake, both below the average required level and above it. Therefore, to take those below the average level of energy requirement as under-

nourished may give a very rough approximation to the figure of the undernourished. But, Prof. Sukhatme follows the above statement with the following : "While estimating the incidence of energy deficiency among populations based on their intakes, the point of reference should not therefore be the average requirement, but the lower limit arising from intra-individual variation, viz., mean minus 2 times the standard deviation or 25 per cent below the average requirement." Now, if undernutrition can exist at every possible level of energy intake, how can it be measured by fixing a "minimum" norm like this? Prof. Dandekar makes the same point, and I quote him below:

".....x when Dr. Sukhatme says that all those and only those whose energy intake is less than 2300 calories should be counted as under-nourished, does he realise that what he calls the 'minimum', howsoever defined, is considered the requirement for everybody? Once we recognise the existence of inter and intra individual variation in requirement, each individual on each occasion has a particular requirement and whether he is under-nourished must be determined by comparing his observed intake with his particular requirement. Like the individual intakes cannot be judged by the average, they cannot also be judged by any single figure called the 'minimum' howsoever defined. Dr. Sukhatme does not see this because, as I shall presently state, he is applying the logic of test of significance appropriate to one situation to another where it is not appropriate."
(Measurement of Poverty, p.20)

Applying the logic of test of significance to the distribution of consumers by energy intake, Prof. Dandekar suggests ^{by} (what he calls ~~by~~ a crude method) that the number

of undernourished individuals in every calorie level below the level of average requirement, should be the observed number in that class minus the number which may be normally expected to be having that level of energy intake (as per the normal distribution of the total number of individual consumers around the mean). Looked at this way, Prof. Dandekar argues, all individuals with less than a given "minimum" level of energy intake cannot be regarded as undernourished. The draft Report, however, follows the method of counting all those (and only those) below a certain "minimum" level of energy intake as undernourished. It does not make any reference to Prof. Dandekar's point in this connection, nor does it say why it has been set aside, if it has been.

(iii) The draft Report refers to the 'minimum' calorie intake as 25 per cent below the average, specified in the "Guidelines for practical use of energy allowances" by the ICMR (1981) as quoted by Prof. Sukhatme, and the Report further reduces it to 20 per cent. Professor Sukhatme has in his earlier writings put the "minimum" at mean minus 25 where s , the standard deviation of the mean has been put as 15 per cent of the mean. That means, the minimum was taken at 30 per cent below the mean. The "Guidelines" have reduced this to 25 per cent and the draft Report to 20 per cent, without any explanation or justification what-

soever. As Prof. Dandekar has pointed out, these different levels of the minimum imply different levels of significance in terms of the statistical test of significance, and no justification was provided by Prof. Sukhatme, nor has any been provided in the Guidelines or the draft Report for their chosen levels of significance. The draft Report merely refers to it as a more "conservative" figure. What is conservative about it?

Furthermore, as Prof. Dandekar points out, the N.S.S.O. data does not give consumption or energy intake of individuals, but of households. Therefore, if the standard deviation of individual requirement is s , then the standard deviation of the per individual requirement in a household will be s divided by the square root of the number of individuals in the household. Dr. Sukhatme also recognises this. But does the 25 per cent of the "Guidelines" or the 20 per cent of the draft Report refer to this standard deviation? For, the draft Report is using N.S.S. consumer expenditure data for the purpose. If it is so, then it would mean that the s (i.e., the standard deviation of the energy requirement of pure individuals) is 25 or 20 per cent. In the absence of any explanation and justification of these percentages, the whole question is left to speculation and doubt.

Finally, Prof. Dandekar draws attention to what he considers to be a serious statistical error in Dr. Sukhatme's

method of calculation. To calculate the "minimum" as mean - 2s, Prof. Sukhatme has used N.S.S.O.'s data where households are classified according to their per capita monthly expenditure and then the caloric availability of the average individual in each expenditure class is calculated. This average figure is not only the average of all individuals in a households but of all households in the group. The standard deviation in this case, therefore, would be smaller than that for individual households; the standard deviation for the individual in the household will have to be divided by the square root of the number of households in the group to give the proper standard deviation of the mean.

Referring to this Prof. Dandekar says, and I quote:

"As I have said, I readily admit the existence of inter and intra individual variation in energy requirement of individuals. I also accept the magnitude of this variation as Dr. Sukhatme has indicated it; namely, a standard deviation of 450 calories for energy requirement of individuals and 225 calories for energy requirement of households. But I ask, what is the standard deviation of the energy requirement of a group of households - because now we are concerned with groups of households in different expenditure classes. For identifying the cut-off expenditure level, we examine the actual average intake of the group of households in each expenditure class and we must compare it with the average energy requirement of a group of the same size. Because the energy requirement of individual households is variable, the average requirement of a group of households is also variable. This is agreed. But how variable it is? In other words, what is its standard deviation? Not the same as the standard deviation of energy requirement of individual households. Dr. Sukhatme has overlooked this and has continued to work with a standard deviation of 225

calories even when he is considering the average energy requirement of groups of households in different expenditure classes. That is the basis of his determining the cut-off expenditure level at the average intake of $(2750 - 2 \times 225) = 2300$ calories. The error is obvious.

Dr. Sukhatme should know that if the standard deviation of the energy requirement of a household is 225 calories, the standard deviation of the average requirement of a group of 1748 households is not 225 calories but $225/41.8 = 5.4$ calories, 41.8 being the square root of 1748. Hence, with the same level of significance as chosen by Dr. Sukhatme, the average energy need of the group of 1748 households in the expenditure class of Rs. 28-34, cannot be placed below $(2750 - 2 \times 5.4) = 2739.2$ calories and one cannot be far wrong by placing it at 2750 calories." (Measurement of Poverty, pp. 24-25)

No notice appears to have been taken in the draft Report of this point raised by Prof. Dandekar, or if after consideration it has been set aside, no reasons are given. The draft Report uses similar N.S.S. data and makes similar calculations (Refer to Table 2), and therefore it is necessary to take specific cognisance of the point.

3. The above points raised by Prof. Dandekar in the context of fixing a minimum calorie level (in terms of $m - 2s$) in order to define poverty (as different from undernutrition) suggest that this "minimum" calories - based measure bristles with conceptual fuzziness and statistical inaccuracies. Nevertheless, without carefully examining these propositions, the draft Report chooses to specify two limits for measurement of poverty - demarking expenditure level, one based on

the recommended average calorie requirement for an average India (average for age, sex, etc.), and another based on a "minimum" requirement in the sense in which Dr. Sukhatme has formulated it. The reason for the choice of such a "minimum" cut-off level is given in the draft Report in the following words:

"It is further suggested that given our constraints and Plan commitments to help the poorest of the poor, to begin with the beneficiary group for poverty alleviation programme should be identified on the basis of minimum calorie requirements. Subsequently, the programme could be extended to cover all beneficiaries who are below the average calorie requirements." (p.6)

Now, if the consideration is that in view of the resource constraints and Plan commitments, attention may not be possible to all the poor, and therefore only the poorest among them may be first attended to, then that is understandable. But for doing this and saying what this "poorest group" would be, it is unnecessary to take recourse to this highly questionable calculation of the "minimum" calorie needs. The straight and simple approach uncluttered by any questionable nutritional norms, would be to define a lower level of per capita expenditure than the one corresponding to the average recommended calorie level, and say that all those below this level of income or expenditure shall be first attended to, and, subsequently the programme can be extended to the others.

4. In Section 4, particularly paragraph 4.2 of the draft Report, the comments on the limitations of the linear (not linear) interpolation method are not clear. While it is not stated how the figures in cols. 2 and 3 of Table A were calculated, it appears that while col. 2 is based on the data in Table 2, col. 3 is based on the data in Table 3. Now, while Table 2 classifies the sample households by their monthly per capita expenditure, Table 3 classifies the same households by their average daily per capita energy intake. Therefore there is no reason why the estimated proportion of the under-nutrited by interpolation in one Table will be the same when applied to the other. The difference has nothing to do with linear (or non-linear) interpolation. I suggest that the statistical comments in this section be clarified and made accurate.

The draft Report fits a bi-variate log-normal distribution for use in determining the expenditure cut off. This method is given in Appendix B, which has, however, not been made available to me. I trust the method followed and the calculations made are correct.

D. Ratt 7.9.54

