

An improved model for defining “Below Poverty Line”

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ABSTRACT: *Defining “Poverty Line” is an important step in providing developmental assistance to the weaker sections of the society, especially in rural parts of a country. The methodologies of identifying “Below Poverty Line”(BPL) families have been evolving over the last few five year plans. The latest model is a professional effort at including, in addition to “Roti, Kapda aur Makaan”, such other factors which affect the quality of life and long term potential of the families for upliftment. It employs 13 such factors and defines “scores” at five levels of each factor, from 0 to 4. But in actual practice, the existing model has been found to be effective only at the two extremes and fails to do justice to “marginal” families. It is the suggestion of the author that the sensitivity of the model can be increased by: giving different “weights” to different factors similar to fuzzy set theory, and having different “margins” between different levels of each factor. Actual data - 3 lakh 64 thousand records – of rural areas of REWA district of Madhya Pradesh state in Central India are used. Correlations of different factors with food, dress and home are used to determine basic weights of each factor. The new proposed model is tested on actual data and shown to yield significantly better results.*

Keywords: BPL, criterion, fuzzy set theory, Methodology, statistical analysis.

I. INTRODUCTION

All developing countries aim at helping the poor raise the quality of life. For this purpose, various schemes for aid, assistance, employment, education, sanitation etc. are launched at different levels of a country. One important step in this direction is the identification of “the poor”. Earlier, poverty was estimated based on expenditure surveys. Such surveys were done in the beginning of each plan period. For example, the “Below Poverty Line (BPL)” census of 1992 identified 52.49% of the rural families as BPL whereas in 1997, by a different methodology, the figure of 41.05% was arrived at.

Reacting to criticism of the above two surveys the Government of India constituted an expert group of planners, academicians, administrators and representatives of the states. Based on their recommendations, a new methodology was adopted in BPL survey of 2002. In this model, thirteen factors were considered under the survey. Apart from the basic factors of food security, clothes, and housing (ROTI, KAPDA AUR MAKAAAN), other factors which contributed to the quality of life were also included. Literacy, children’s education, indebtedness, reasons for migration and ownership of simple consumer goods, were some of these. Each factor was rated on a five point uniform scale of 0 to 4 and the scores of all thirteen factors were added. The poverty line was drawn at a score of 14. The above rating has been used for subsequent government schemes including the Rojgar Guarantee Yojana.

However, analysis shows that while the BPL score index is good at distinguishing the bottom 10 percent from the top 20 percent of the population, it is unable to differentiate between the poor and non-poor in the vicinity of the poverty line⁵. First, the scoring method transforms the data for each indicator to a uniform cardinal scale – scored as 0, 1, 2, 3, or 4, with zero representing extreme deprivation – such that the difference between 0 and 1 (for example, the difference between being illiterate and having some primary education) is the same as between 3 and 4 (for example, the difference between having secondary education versus having a graduate degree). Second, each indicator enters the aggregate score with an equal weight, implicitly assuming that each indicator has the same impact on poverty status. Equal weights have the appeal of simplicity and apparent objectivity, but these qualities only mask the fact that the imposition of numeric equality is completely arbitrary. It can lead to absurd situations where having less than one square meal per day for much of the year can be treated the same as non-ownership of any of the listed consumer durables. It is to this anomaly that the present paper is targeted. It suggests an improved model which employs “weights” and tests field data by the two models to draw conclusions.

II. PRESENT MODEL

The following table shows the “criteria” included in the BPL and the point-system.

CRITERIA	POINT SYSTEM
Land owned by family	0 if nil, 1 if unirrigated land less than 1 hectare (irrigated land less than half hectare), 2 if unirrigated 1-2 hect (irrigated 1/2-1 hect), 3 if unirrigated 2-5 (irrigated 1-2.5), 4 if unirrigated more than 5 hect (irrigated more than 2.5 hect)
Type of house	0 if homeless, 1 if non-concrete, 2 if half concrete, 3 if concrete, 4 if like urban house
Availability of dresses per person	0 if 2 pairs, 1 if 2-4 pairs, 2 if 4-6 pairs, 3 if 6-10 pairs, 4 if more than 10 pairs
Food security	0 if less than one meal everyday for most of the days in a year, 1 if generally everyday one meal but sometimes less than one, 2 if one meal through out the year, 3 if generally two meals everyday in a year, 4 if sufficient food through out the year.
Sanitation	0 if in open, 1 if public toilets with irregular water supply, 2 if public toilets with regular water supply, 3 if public toilets with regular water supply & sweeper, 4 if private toilet.
Ownership of Consumer Goods	0 if nil, 1 if anyone, 2 if any two, 3 if any 3, 4 if all cooker, radio, fan, TV (list other items also if any like computer, telephone, refrigerator, color TV, 2/4 wheeler, tractor, thrasher, harvester, expensive furniture, electric kitchenware like micro wave oven, mixer)
Educational standard of the most educated person of the family	0 if illiterate, 1 if primary, 2 if 10th pass, 3 if graduate/technical diploma, 4 if post graduate/ technical graduate
Standard of family labour	0 if bonded labourer, 1 if female and child labourer, 2 if only adult female labourer, 3 if only adult male labourer, 4 if others
Means of livelihood	0 casual labor, 1 sustainable farming, 2 artisan, 3 salaried, 4 others
Standard of children (5-14 years)	0 if going to work and not school. 1 if going to school and work both, 4 if going to school and not to work.
Type of debts	0 if from casual resources for daily uses, 1 if from casual resources for production, 2 if from casual resources for other reasons, 3 if loans only from banks etc, 4 no loan owning property
Reason for migration	0 if casual work, 1 if seasonal employment, 2 if other means of livelihood, 3 if don't migrate, 4 if migrate for other reasons
Preference for aid	0 if labor employment/PDS, 1 if for self-employment, 2 if trained and skill improvement, 3 if for residence, 4 if grant > 1 lakh for loan or no need of any help

Based on the above system a family is considered BPL if it scores less than 14.

III. PROPOSED MODEL

A study was made of 3, 64,000 families of Rewa district. of M.P. by obtaining the data from district authorities. The scores were added up and it was found that 1,53,302 families crossed the criterion of BPL (approx. 42%). Applying the basic criteria of food, dresses and housing, analysis showed that 140,947 (approx. 39%) families who did not have “sufficient food throughout the year” were excluded from BPL. Similarly, 1,79,099 families (49%!) with no home or “kutchas” were excluded. We now work on the assumption that these results are because of the following two shortcomings in the present model :

- all the 13 factors have been given equal importance
- the margin between different levels within each factor is kept uniformly at 1.

We tackle (a) first. The existing model includes a number of factors apart from food, clothes and housing. This is a laudable addition for improving the quality of life. The intention obviously is that even those families, who have basic security of Roti, Kapda aur Makaan, but lack in other areas which improve the quality of life, should be included in BPL and helped to raise their standard. However, food, clothing and housing remains the basic factors determining poverty and we propose to give weightage to all factors based on their correlation to these three.

For this purpose the existing data of 364000 records were analysed using SPSS version 15. Pearson coefficient for all the factors was found. The Pearson coefficient of all factors with respect to these three, were added up, giving a weightage of 1 to housing, 2 to clothing and 4 to food. This sum ranged from 1.115 for sanitation to 4.693 for food. These “weights” were multiplied by 10 to bring them to proper “degree” and the following final weights were obtained:

FACTOR	WEIGHTS
own land	21
house type	27
clothes	34
food	47
sanitation	11
literacy	19
labour	16
livelihood	23
children	17
debts	21
migration	19
assistance	21
consumer durable	20

We now tackle (b).

For this purpose, we analyze the data of 364000 families at different levels within these factors. Before analyzing these new scores, we have to define the new poverty line. For this we take each factor and determine at what level a family can be considered to be “above” poverty. These criteria are shown below:

Ownland	own land	At least 1 to 2 hectare if unirrigated
house type		At least a non-concrete (“kutcha”) house
clothes		At least 2-4 pairs of dresses per person
food		At least “generally” two meals everyday in a year
sanitation		At least public toilet with regular cleaning
literacy		At least primary
labour		Only adult male labourer
livelihood		Anything except casual labourer
children		At least going to school even if working also
debts		Debts not for daily use
migration		Migration at least for seasonal employment
assistance		Aid asked for self-employment not PDS
consumer durable		At least one, say Fan

Using Visual Foxpro Software, a program was developed to find “population” of BPL families as per the above criterion (BPL at 462) at different levels. These are shown below:

own land	124632	88058	21708	4849	2500
house type	10273	225919	3171	1526	858
clothes	208085	29801	2690	857	314
food	21371	13880	33726	161102	11668
sanitation	238284	900	381	209	1973
literacy	94595	82205	55052	7905	1990
labour	26818	14167	16983	157710	26069
livelihood	165889	60037	6317	2424	7080
children	95900	90574	10821	3515	40937
debts	171165	53213	0	0	17369
migration	132724	34273	22019	48734	3997
assistance	124741	92225	5327	16891	2563
consumer durable	225657	8848	1921	4548	773

By similar methods we find the total population at these levels out of the entire 364000 families. These are:

factor	11	12	13	14	15
own land	144932	125087	52541	25597	15839
house type	11391	317981	14539	16497	3592
clothes	258962	79047	17419	4773	3799
food	21922	14103	35604	217087	75280
sanitation	353572	1375	1054	445	7554
literacy	105769	109755	108677	25674	14125
labour	29991	14927	19245	218264	81573
livelihood	175632	107747	8926	33173	38522
children	111647	105962	20934	9934	115523
debts	185025	44257	25880	17969	90869
migration	141873	40354	34727	108693	38353
assistance	134822	131562	13987	37210	46419
consumer durable	299273	24073	15138	14656	10860

We now find the weightage of being in BPL for each level in each factor by dividing the population of BPL by the total population. The resultant weightages shown as percentages are:

own land	85.99343	70.3974	41.31631	18.94363	15.78382
house type	90.18523	71.04796	21.8103	9.250167	23.88641
clothes	80.35349	37.70036	15.44291	17.95516	8.265333
food	97.48654	98.41878	94.72531	74.2108	15.49947
sanitation	67.39335	65.45455	36.14801	46.96629	26.11861
literacy	89.43547	74.89864	50.65653	30.7899	14.0885
labour	89.42016	94.90855	88.2463	72.25653	31.95788
livelihood	94.45261	55.72034	70.77078	7.307147	18.37911
children	85.89572	85.47781	51.69103	35.38353	35.43623
debts	92.50962	60.39588	#DIV/0!	#DIV/0!	19.11433
migration	93.55127	84.93086	63.406	44.83637	10.42161
assistance	92.52273	70.10003	38.08536	45.39371	5.521446
consumer durable	75.40172	36.75487	12.68992	31.03166	7.117864

These weightages shall form the basis of “relative weights” given at each level for each factor. We have to remember here that a higher score is against BPL. So the relative weights should be inversely proportional to the probability. To achieve this end, we divide the highest probability in each factor (which is obviously at lowest level, i.e. column 1) by individual level probabilities. Thus, the first level has a weightage of 1 for all factors and these weights go on increasing as we move to higher levels.

These are rounded and, along with the basic weight of the factor, are shown below:

own land	21	1	1	2	5	5
house type	27	1	1	4	10	4
clothes	34	1	2	5	4	10
food	47	1	1	1	1	6
sanitation	11	1	1	2	1	3
literacy	19	1	1	2	3	6
labour	16	1	1	1	1	3
livelihood	23	1	2	1	13	5
children	17	1	1	2	2	2
debts	21	1	2	3	4	5
migration	19	1	1	1	2	9
assistance	21	1	1	2	2	17
consumer durable	20	1	2	6	2	11

This new model was applied to the 3,64,000 families by using a software (Visual Foxpro) to calculate new scores. These were added up.

IV. ANALYSIS

Now with these additional weightages the new “poverty line” was calculated which came at 668. Now the BPL data was analysed and compared with the old score model.

The analysis shows significant improvement as shown by the table below:

FACTOR	OLD MODEL	NEW MODEL
Families below Poverty Line (/364000)	153032	241747
Families with food insecurity excluded from BPL	140947	30357
Families with home insecurity excluded from BPL	187190	71491
Families with clothes insecurity excluded from BPL	179099	64969

Thus the BPL families rise by about 25%. The food insecure families not making to BPL come down by 30%. Similar improvements are seen in families with home insecurity and clothes insecurity (all percentages of total families).

V. CONCLUSION

The concept of having 13 factors with 5 levels of scores is a brilliant idea. Initially, it was not possible, perhaps, to give “weights” to these factors or levels. Any “empirical” weights would have been suspect. But now that we HAVE so many data, these should be used periodically to modify the model to obtain a fairer BPL. The present model is one such attempt at suggesting weights based on statistical model of field data. It shows significant improvement in sensitivity of the criterion for BPL. It is the suggestion of the authors that as more data is available it should be analysed and the model go on evolving. The scores being on a bigger scale, the new model offers us the opportunity of having more classifications. For example, in the new score we can have a category “destitute” for very low scores (say below 300). Similarly, the factors can be divided into “immediate”, “mid-term” and “long term”. For example “food” and “clothes” are immediate factors. “Migration” and “assistance” may be “mid-term” and “education” and “children” may be “long term”.

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