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Identifying the 'Poor' Using Binary Classifiers in Rural Bangladesh

by

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I. INTRODUCTION

Discussion on poverty very often refers to various dimensions of income and non-income approach of measurement. Even the simplistic explanation of raw or extreme poverty involves much about different indicators ranging from commodities or characteristics to well-being, material deprivation to low achievement and capabilities. Problems of poverty assessment have been extended from setting a poverty line to identifying the poor and the intensity of poverty. Amartya Sen (1976) in his pioneering work on *Poverty and Famine* has noted that the concept of poverty must involve the issue of identification of poor and the issue of aggregation of the set of poverty characteristics. Before reaching an aggregate measure of poverty, Sen (1976) emphasised on identification of the poor. He argued that due to variation in the physical features, climatic condition and work habits, the method of nutrition intake commonly used to identify the poor would involve shortcomings. The debate also goes to whether quantitative or qualitative techniques give more realistic view of poverty. Perhaps the most critical point in measurement of poverty is the use of appropriate metric of household characteristics in both quantitative and qualitative perspectives. In spite of spectacular methodological advances in poverty analysis, a number of conceptual and measurement issues are found to be addressed.

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Deprivation in well-being (World Bank 2000) or unfreedom from quality of life or living long and well (Sen 2000) are all related to define poverty and its extent. Capability to earn income and having food, getting treatment and nutrition, sending child for education, and living with less anxiety and vulnerability are the signs of quality of life. All aspects have its respective weight, and the development programmes should, therefore, bring more opportunities, as opposite to the idea that economic growth alone is enough for poverty reduction. Investigating human poverty is more pertinent in this perspective and demands much analytical rigour.

As Bangladesh is a resource-poor developing country, concern about poverty is quite obvious. The weight of poverty burden on the rural poor is to be enormous as much as has the policy implications and implementation of development programmes to alleviate the extent of poverty. Incidence of extreme poverty and rising inequality are a concern. Efforts have been made to alleviate the sufferings of the distressed people both at the macro and micro levels. To make the poverty alleviation programme a success, academic research is going on for understanding the nature and dimensionality of poverty. To get meaningful results in the outcomes of poverty alleviations efforts, we need stronger assertion of poverty that can help appropriate targeting. Some scholarly works (Khan 1977, Alamgir 1978, Ahmed and Hossain 1984, Sen *et al.* 1990) were done in the past to examine rural poverty and inequality. Many of these works tried to explain absolute and extreme level of poverty. Important, as it is argued here, that income or consumption expenditure based poverty description may lack identification of the poor by real deprivation in capabilities. Household poverty contains other significant features. Low social and human capital (housing, education, clothing), and food insecurity are the most cited poverty burden in Bangladesh.

What makes constituent of poverty can be argued in different ways. Measurement of income poverty cannot alone address all dimension of deprivation. The arguments of expansion of capabilities by the poor, as Sen (2000) put forward in *Development of Freedom*, have reason to value. The rise in per capita income does not always result in increased overall quality of life. As poverty is about income, food security, asset base, quality of life, constructing a common profile of classifiers of poverty is much important in development ideas. This paper is based on this idea and gives emphasis on knowing the surrogate for true identifiers of poverty in Bangladesh. A forward step wise procedure is then employed to get a simple composite classifier, a subset of variables which have multiple agreements with the surrogate identifier. A household is classified as "the poor" if the composite classifiers or attributes are present. Classifiers related to housing, education, food security, health and nutrition, and clothing are used to

examine rural poverty. Developing a composite index using the surrogate binary classifiers is beyond the scope of the study.

In this paper a statistical approach much used in psychological and education studies was applied to identify the most representative classifiers of poverty in rural Bangladesh. The approach involves proposing a set of fallible binary classifiers[1] and finding surrogate[2] classifiers that will indicate presence or absence of poverty in particular households. A step wise selection procedure was used to identify the surrogate identifiers of "poor" households observing Guttman score[3] -- an index used psychological and educational statistics. The study examined poverty by looking at the presence or absence of some fallible indicators that are very likelihood to indicate real economic condition. A survey was conducted over 100 households in some villages of Manikganj district.

The paper is structured into seven sections beginning with introduction. In section II description is given on the background of the study, existing literature on poverty, and research ideas on identifying the classifiers of the "poor." Methodologies and methods used in the study are discussed in the section III. It is pertinent to understand the variables and nature of the data used in the study which are presented in section IV. The subsequent sections cover results and discussion, and limitations of the study. The study draws on the policy implications of the findings revealed in the analysis in section VI. The concluding section briefly discusses the summary of the findings.

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[1] Classifier is a decision procedure that categorises data into two or more predefined groups. Classifiers are also called predictors. Classifiers usually emit a score that can be interpreted as the likelihood that the data fall into a certain category, rather than just a binary yes/no answer. In many applications it is necessary to convert this likelihood into a yes/no answer, or perhaps a yes/no/may be answer, typically through a simple thresholding scheme.

[2] A surrogate classifier is a unique identifier to assert presence of certain attribute of poverty in a household.

[3] Guttman scaling, also sometimes known as cumulative scaling, establishes a one-dimensional continuum for a concept to measure. Essentially, a set of items can be put in survey on which a respondent who agrees with any specific question in the list will also agree with all previous questions. We would like to be able to predict item responses perfectly knowing only the total score for the respondent. For example, in a ten-item cumulative scale, if the respondent scores a four, it should mean that he/she agreed with the first four statements. If the respondent scores an eight, it should mean they agreed with the first eight. The object is to find a set of items that perfectly matches this pattern.

II. LITERATURE REVIEW AND USE OF QUALITATIVE AND QUANTITATIVE DATA IN POVERTY ANALYSIS

A concern for poverty arguably always has been at the heart of development studies. Analysis of poverty is clearly an essential step in understanding the causes of, and effects on other dimensions of well-being. There are different ways in which poverty can be defined and measured and how these different approaches can be used to obtain a "snap-shot" of the nature of poverty in a country at one point in time. Notably, despite the conceptual advances most poverty estimates are still largely based on income definitions derived from a basket of goods approach. Measuring poverty by nutritional intake method is the most familiar one (the other two methods are cost of basic needs (CBN) and food and energy intake (FEI)). In the first step, poverty line is constructed by estimating the cost of a minimum diet of essential food and non-food items. From popularity point of view, the head count measurement is the most cited index to explain incidence of poverty. Quantitative stream of poverty analysis goes extensively for measuring absolute poverty, its depth and severity. Among the various methods of quantifying poverty, the FGT formula (Foster, Greer, and Thorbecke 1984) is used most widely for quantitative description of poverty spread, the depth, and severity of income poverty in populations. It is observed that the data collection and analysis capacity of most developing countries is not at the stage of supporting the more sophisticated analytical approaches. Moreover, the concept of absolute poverty has been widely criticised for the general assumption of universal applicability.

While absolute standards of poverty are "absolute" in the sense of denoting a specific standard of living, they are not absolute in the sense of being fixed in time, or space. The use of relative standard is, therefore, appropriate for avoiding problems in absolute measurement. Moreover, deprivation and inequality cannot be reflected through only analysing absolute poverty, and thus inequality measures (e.g. Gini Coefficient, FGT index, percentile distribution of income, etc.) come into the discussion of poverty. Sociologists discuss three forms of deprivation objective, normative, and subjective. Atkinson (1978) has rightly pointed out that the degree of inequality can only be measured being conscious of the influence of normative aspect involved in social judgment. Sen (1976) argued that both absolute and relative measures have merits–neither concept subsumes the other. Moving from this idea Sen (1976) discussed two distinct measures of poverty assessment: first, identification of the poor, and then aggregation of their poverty characteristics into an overall measure. He suggested for identification of the poor that needs to be done prior to measuring extent of poverty.

Apart from the broad stream of poverty analysis (mainly quantitative method and analysis tools), there exist some qualitative methods and analysis techniques

that have very sound understanding and power in capturing poverty. The World Bank did an extensive study on poverty using qualitative methodologies such as Participatory Poverty Assessment Tools, Wealth Ranking Exercises, and published a volume titled "Voices of the Poor" in 2000. The study has come under criticism for lack of rigour in sampling and presentation of analysis. To overcome the drawback of qualitative survey approach and analysis methods, some authors suggest for combining quantitative methods with qualitative as developed by Kanbur and Shaffer (2007) (Q-squared Methodology). Kanbur and Shaffer (2007) investigated dimension of poverty and interpersonal comparison of well-being through numerical transformation of data, and selection of validity criteria. In this mix we find authors' use both sequential and simultaneous mixing of qualitative and quantitative data and methods. Some authors suggest for using a subjective definition of poverty and opting to undertake perception based survey and evaluation methods (Goedhart *et al.* 1977). Such definition focuses on the monetary amounts which people consider necessary to make ends meet for their households as provided in response to the Minimum Income Question (MIQ). Factors significantly related to reported minimum income include household income, household composition, age, education, sex, region, fixed expenditures, and whether the household experienced recent income changes. Construction of poverty mapping and profiles are two important examples of how poverty can be better captured and addressed through coherent and results based development programmes. Although qualitative data can be used to supplement the work of poverty measurement, they are not being focused area of poverty analysis for many reasons (Kanbur and Shaffer 2007).

Poverty Analysis in Bangladesh

Many scholarly studies were carried out to analysis rural poverty situation in Bangladesh. Some of these are extensive in data collection and analysis and used mainly income and consumption expenditure data to derive poverty line. Some of these (Osmani 1982, Rahman 1994) also applied nutritional intake method and estimated poverty incidence. Khan (1977) provided a study on the estimate of the proportion of households who were in absolute and extreme poverty condition for 1963-64, 1968-69 and 1975 (first quarter). In a later study, Khan (1990) made an indirect estimate of threshold income for rural areas on the basis of 2112 k. calorie and 58 gm protein per day per person. Alamgir (1978) conducted a study on measuring the income inequality and poverty indices for several years using HIES data of Bangladesh Bureau of Statistics. He proposed a new index through averaging Gini index and composite poverty index as developed by Sen (1976).

Ravallion (1990) examined the robustness of some official estimates (done by BBS), and showed a dramatic decline in poverty in rural Bangladesh. Ravallion provided "deeper" estimate of poverty using FGT index for $\alpha = 1$ as well as $\alpha = 2$. The former is simply the aggregate poverty divided by the total population, hence closely related to Sen's "income gap ratio" (1976), which the later is more distributionally sensitive with respect to income. Sen *et al*. (1990) tried to sketch the weakness in the conceptual and empirical understanding of rural poverty. Considering the poverty indicators that include per capita income, household's self-evaluation about its deficit status and housing condition, they showed that the per cent of rural household living in poverty were 60, 50 and 52 respectively, using data of 62 villages.

Osmani (1982) developed poverty line for Bangladesh on the basis of interpersonal distribution of expenditure, nutrition coefficient matrix, information on physical amount of different food items consumed at various levels of expenditure and the minimum nutritional requirement vector. Rahman (1994) conducted a study focusing on the measurement of poverty line based on minimum balanced food requirement per day for each household member of different ages and sex, and then estimated monthly income poverty line for each household.

Recently, a number of studies (Sen and Hulme 2004, Quisumbing 2007, Baulch and Davis 2008) went deeper into the dynamics of poverty and unfolded some important findings about chronic and extreme poverty in Bangladesh using both qualitative and quantitative methods. In these studies two particular groups of the poorest, the chronically poor and the extreme poor, and their deprivation came under discussion thoroughly. Chronically poor constitutes the group who are in long-duration poverty—often spanning over generations—experiencing greater stress and burden of poverty. All these studies used dynamic household panel data to define chronically poor and tried to integrate quantitative and qualitative data through using longitudinal survey, semi-structured interview, case studies. The studies broadened the horizon of looking into poverty, causes and effects, and movement over time. --

Various studies on analysing rural poverty in Bangladesh provide us valuable insight in this area of enquiry and explain its aggregate nature, causes and effects. Some of these lack information regarding identification of the status of household poverty ("poor" or "not poor"). Most of these studies went for extensive survey and rigorous calculations on income and consumption data. The efforts were centralised on income and human poverty and nutritional deprivation. While drawing aggregate deprivation of poor people, the studies might miss telling very common features of household poverty, which have every merit to be addressed in development intervention. Household poverty has certain other significant features,

e.g. access to and use of resources, possessing important household materials, safety against shocks and natural calamities. In simple terms, all these can be captured in simple questions measured in binary scales. In India Roy and Sastry (1998) developed a procedure to identify the "poor" household in rural areas where they collected binary response on a set of qualitative variables having only two responses – "yes" or "no", and sequentially identified optimum set of variables that by methodology itself are sufficient in denoting a household as "poor." The basic idea that the authors worked on was to draw the best identifier variables from a set of fallible variables that have superior power in indicating presence or absence of poverty (here poverty is an attribute) in a household. The study found that smaller room height, unprotected living place from rain and storms, lack of food throughout the year, and no special food before/after delivery were the important identifiers of household poverty in rural India.

This study tried to demonstrate the method applied by Roy and Sastry (1998) in India. In Bangladesh the relevance of the study lies in capturing very common features of rural poverty and revealing power of such analysis in policy context. The study identifies a set of optimum poverty variables that by the merit can tell the poverty status of any household in rural areas. Notably, the variables are drawn from typical understanding of poverty in rural areas in Bangladesh. From poverty targeting point of view, the study is quite relevant and timely to reveal the best identifiers of distress condition of household.

III. METHODOLOGICAL ISSUES INVOLVED

Like all other social phenomena poverty has multifaceted characteristics, and attempts towards measuring poverty using interval scale are rather tough and none the less controversial. The measurement problem can be more easily handled using binary classifiers. A procedure developed by Roy and Sastry (1998) was used in identifying the poverty characteristics dominant in rural Bangladesh. Inadequacy or achievement or behavioural pattern of an individual depends on a number of items, each of which can be considered as an indicator of the concerned attributes.[4] From each household a representative sample of household information on a set of fallible classifiers, developed considering all possible constituent indicators of a particular attribute, can be collected. A "yes" answer to a particular classifier

[4] Here "attribute" means the broad dimensions of empowerment being considered in the study. For example, economic freedom there might be several indicators that ultimately describe presence of this particular dimension. Therefore, economic freedom is one attribute identified in this article. Essentially, the attributes may include social, economic, demographic are psychological dimensions in the overall empowerment framework.

would either indicate the presence or absence of the attribute and can be coded either "0" or "1" whichever may be the case. If m such questions are used to get information on the considered fallible[5] classifiers, on each of a collection of n households, the responses to the j-th question can be represented as the binary variable-

X (j) ={x (j, 1), x (j, 2), ----------, x (j, n)}

Where, for i =1,2, ------,n and j=1,2, -----,m; x (j, i) = 1 (or, 0) according to the response of the i-th household to the j-th question is "yes" (or, "no"). This will be called the j-th fallible classifier of the concerned attribute. A single classifier does not determine the attribute definitely. A group of classifiers would be necessary, which may be identified from the set of fallible classifiers following a theoretically sound procedure.

Two basic assumptions are necessary for applying the method:

- There is not a priory reason to prefer any amongst the fallible classifiers to others: each is supposed to be equally valid and reliable.
- In the ideal situation when there is absolute agreement about the status of each household, the collection of households can be described by a binary statistical variable.

Y={y (1), y (2), --------, y (n)}

Where for i=1,2,----,n and y(i)=1 (or, 0) as the i-th household possesses or not possesses the attribute, and Y will be called the true identifier for the attribute, but it is seldom available.

The problem is to devise a "simple" procedure for deciding whether a particular household possess or not possess the attribute of interest, using as few as feasible of the fallible classifiers. The class of simple procedures to be considered is based on the Guttman score- the total number of "yes" answers obtained from a household to all the fallible classifiers used. A household is classified as "possessor of the attribute" if this score is not below a cut-off value. The specific problem is to determine an "optimum" subset of fallible classifiers and an "optimum" cut-off score for that subset.

[5] Here, "fallible" means likelihood of presence of any indicator variable under any attribute. The response coming out from individual household against any single indicator variable or classifier is referred as fallible classifier that may deviate from the households' true behaviour or actions.

Let J= (j_1, j_2, -----, j_k) be a given subset of the integers 1, 2, ----, m and S (J) = X (j_1) + X (j_2) + X (j_k). When J = (1, 2, -----, m), the notation S will be used for S (J). In general, the n components of S (J) will be denoted by {s (J, 1), s (J, 2), ----, S (J, n)} and those of S by {s (1), s (2), ----, s (n)}. For a given subset J and a given integer *l*, 0≤ *l* ≤ [J], our main interest will be in the use of binary vector U (J, *l*) – to be called a simple composite fallible classifier defined as:

U (J, *l*) = {u (J, *l*, 1), u (J, *l*, 2), ----u (J, *l*, n)}

Where u (J, *l*, i) = 1 (or, 0) as s (J, i) ≥ *l* (or, <*l*) for i=1, 2, ----, n). The vector (1, 1, -----, 1) will be denoted by E. A measure of agreement between two classifiers U and V will be defined as

r (U, V) = (UV′ + (E-U) (E-V)′)/n

This is analogous to the concept of correlation coefficient between two statistical variables. As a measure of agreement between a true identifier Y and a subset of fallible classifiers {X (j)}, for j in J, it is proposed to use R (J, Y) =max r (U (J, *l*)), where the maximum is with respect to *l* in the range 1, 2, ----, [J]. This will be called the coefficient of composite agreement and is analogous to the concept of multiple correlation in statistics.

III.1 Surrogate for True Identifier

In the absence of the true classifier Y the following surrogate is proposed to form the class of binary vectors U (S, *l*); 0≤ *l* ≤N, by using the maximin principle. Let l^* be the value of *l* for *l* =1, 2, ---, m. Then $U^* = U^*$ (S, l^*) is the proposed surrogate for, whenever the true classifier[6] Y is not available, U^* obtained this way will be used in its place and when there is no possibility of confusion, denoted by Y itself. It should be noted that by definition, for the surrogate, R (S, U^*) =1 whereas for true identifier when it exists, this is smaller than unity generally.

III.2 Choosing a Simple Composite Classifier

Two different procedures are described below for choosing an appropriate subset of linked variables for the purpose of constructing a simple composite classifier—one based on the concept of multiple agreements and the other based on representatives of possibly overlapping identified clusters of a linked classifiers.

The first procedure is similar to the forward step-wise procedure in multiple regression. In what follows, the symbol Y is used for the true identifier when it

[6] True classifier represents what woman is likely to behave in true sense for certain empowerment indicator.

exists or, for the best surrogate identifier when the true does not exist. In the first step, one selects the single fallible classifier which has the highest coefficient agreement with Y. Let this fallible classifier be denoted by $X^{(1)}$. The coefficient of agreement of $X^{(1)}$ with Y is noted. In the next step, one more fallible classifier is selected, which along with $X^{(1)}$ has the highest measure of composite agreement with Y.

Let this fallible classifier be denoted by $X^{(2)}$. The coefficient of composite agreement of $X^{(1)}$ and $X^{(2)}$ with Y is then noted. One continues in this way and introduces an additional fallible classifier in each step until the coefficient of composite agreement ceases to increase, or, when it attains a pre-assigned high value.

The second procedure is heuristic, based on cluster analytic techniques. It does not use the coefficient of composite agreement of the chosen fallible classifiers with the true identifier or its surrogate. Instead, it groups the fallible classifiers into a number of "perfect" clusters or "cliques" and selects a representative from each clique. Given a lower limit L of the coefficient of agreement, a subset of fallible classifiers is to be a "clique" if the coefficient of agreement between any two fallible classifiers belonging to the subset is at least L and if no other fallible classifier can be included in the subset without breaking this condition. A representative of a cluster of fallible classifiers is the one whose minimum agreement with other fallible classifiers is the highest.

In this study the forward step wise procedure is used in developing a procedure for identifying the concerned attributes. The heavy computations were carried out using programme language Q-basic developed by C.H. Sastry (1998).

IV. SURVEY AND DATA

The data for the study was resulted from a primary survey conducted in November 2000. A group of 100 women participants in the Grameen Bank and BRAC programme in Manikganj district were interviewed. Selection of the study area and sample size was purposive as the study attempted to demonstrate the method identifying the poverty status of household. Moreover, both the organisations have relatively long been in operation in the district. The district is a low lying area and relatively more poverty prone as drawn from World Food Programme (WFP)' poverty mapping on Bangladesh. Nevertheless, BRAC and Grameen Bank generally lend their money according to certain criteria—household having land less than 50 decimals. The cut-off point of this size of land is used to demark income classes among the households. The households having land less than 50 decimals are considered falling under absolute poverty. Therefore, the households selected from the participants of BRAC and Grameen

Bank programme constitute the sample having higher probability of falling into poor class. The sampling framework (listing of survey population) was prepared based on pre-testing a brief questionnaire over all households in the villages considered for the study. The study has covered fourteen villages under two different areas of a Manikganj district using a simple random sampling design.

IV.1 Fallible Variables for Identifying the "Poor"

Developing of a set of fallible classifiers appropriate for identifying a household as poor is a difficult task. It should be based on household characteristics, their consumption behaviour, social and economic environment, cultural norm of the region under study. Instead of the measurement on interval scale in a household survey, simple binary questions are asked to develop a reliable set of fallible variables. These variables reveal whether the household had an adequate provision of basic needs, which are deemed to be indispensably necessary for the support of life. If the answer is in negative direction, it will indicate the experience of poverty. But by the "no" answer to a single question by itself would not be necessarily definitive. A "yes" answer is coded as "0" and a no answer is coded as "1."

The first fallible variable is considered here whether the household met protein and calories. For this reason we have taken the commodities such as fish, meat, egg, etc. The second fallible variable is about housing which includes number of rooms, height of the room, and protection from rain, storm, etc. The subsequent fallible variable is about clothing. The household is asked whether it had adequate clothes, required for the protection of weather related calamities such as cold wave, for each member of the family, particularly child and women. Right to education is fundamental and so a variable concerning whether the household could provide education for the children is an important variable. Health care for the family member, particularly for women who is in the state of pregnancy and also for children, is crucial in the sense that it has impact on the socio-economic condition of the family and for survival smoothly. The household is also asked whether it could provide adequate protein in terms of commodity such as milk for children aged between 0 and 4 years, since children with malnutrition is a common phenomenon in our country.

Based on these considerations, the response from a collection of households to the questions of these types can be represented as a binary statistical variable. For 19 such questions used here, on each of a collection of 100 households, the responses to the j-th question can be represented as the binary variable-

$X_1 (i) = \{x_1 (j, 1), x_1 (j, 2), \text{-------} x_1 (j, 100)\}$

Where for i = 1, 2, ---, 100 and j = 1, 2, ----, 19. x_1 (j, i) = 1 (or, 0) as the response of the i-th household to the j-th question is "no" (or "yes"). This will be termed as the j-th fallible classifier of poverty fallible because by itself it does not determine poverty definitely. For status of each household on "poor" or, "not poor," the collection of households can be classified by a binary statistical variable-

Y_1 (i) = {y_1 (1), y_1 (2), ----, y_1 (100)}

Where for i =1, 2, ----, 100 and y_1 (i) = 1 (or, 0) as the i-th household is (or, is not) poor. Y_1 will be called the true identifier of poverty, but it is seldom available.

The yes/no answers have been coded as either 0 or 1 in such a way that a response of 1 indicates poverty. The following table describes the procedure of data coding and its representation.

TABLE I
DESCRIPTION OF THE VARIABLES

Variable No.	Description	Response	
		Yes	No
1	Meat/fish/egg eaten last month	0	1
2	Bed room per family (≤ 1)	1	0
3	Room height (≤ 1.68 mtrs)	1	0
4	Living place protected from rain/storm	0	1
5	Possesses woolen clothing	0	1
6	Woolen cloth per person (≤ 1)	1	0
7	Lady saree per adult (≤ 2)	1	0
8	Bed lacked mattress	1	0
9	Household lacked blanket/quilts	1	0
10	Dining plates per adult (<1)	1	0
11	Household can not provide education for children due to low income	1	0
12	During last three years whether any female member in the family was given special food before and after delivery	0	1
13	Had food throughout the year	0	1
14	Children (1-4 years) didn't get milk daily	1	0
15	Begging as a profession	1	0
16	Food items borrowed/received as gift last month	1	0
17	Food items collected from nature/other sources	1	0
18	Going to a doctor or any health complex and getting health care facilities for any normal sickness	0	1
19	Can not provide food for three meals a day in the last month	1	0

V. RESULTS

Using data values of poverty indicators for each household, presented in Table I, results of the agreements of Guttman score for different cut-off values with individual classifiers, agreement of the individual classifier with surrogate, step wise selection of additional fallible variables and sequence of fallible variables and their corresponding maximum agreement have been presented respectively in Tables II through V.

Selection of Cut-off Point

The first step is to select the cut-off point, and the process is to find the agreement (score) that is minimum (lowest) against each cut-off point (0 to 19 here) at first step and then to find the maximum of all those minimum scores or agreement.

TABLE II
AGREEMENT OF THE GUTTMAN SCORE FOR DIFFERENT CUT-OFF VALUES WITH INDIVIDUAL CLASSIFIERS

Cut-off value	Individual Classifiers																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	10	360	390	460	980	340	510	490	110	190	230	230	170	710	670	70	600	0	0
1	10	360	390	460	980	340	510	490	110	190	230	230	170	710	670	70	600	0	0
2	90	780	440	470	540	900	420	590	570	190	270	310	310	250	80	790	750	150	680
3	130	800	480	510	580	860	460	630	610	230	310	350	350	290	120	830	730	190	720
4	240	770	570	580	690	750	550	700	720	340	400	460	460	400	230	860	780	300	810
5	300	770	610	620	750	690	610	740	740	400	420	520	520	460	290	840	800	360	830
6	410	740	620	670	820	580	720	790	810	510	490	590	610	570	400	790	810	470	860
7	480	710	610	680	850	510	770	800	840	580	520	660	680	640	470	740	800	540	870
8	530	680	600	670	860	480	780	810	870	630	570	710	730	670	520	710	750	590	840
9	600	630	610	660	850	410	810	800	820	700	620	740	800	720	590	660	720	660	810
10	690	560	640	670	800	320	800	770	770	770	670	830	870	810	680	570	630	730	720
11	760	530	630	680	770	270	790	700	740	800	700	880	860	860	750	520	560	780	650
12	800	470	690	720	710	210	770	640	700	860	720	900	820	860	810	460	500	820	590
13	890	380	680	690	640	120	760	550	610	890	790	830	830	830	900	390	430	890	500
14	950	340	680	650	580	60	700	530	550	890	830	790	790	830	960	330	370	910	440
15	970	320	660	630	560	40	680	510	530	910	810	770	790	830	980	310	350	930	420
16	990	300	640	610	540	20	660	490	510	890	810	770	770	830	1000	290	330	930	400
17	990	300	640	610	540	20	660	490	510	890	810	770	770	830	1000	290	330	930	400
18	990	300	640	610	540	20	660	490	510	890	810	770	770	830	1000	290	330	930	400
19	990	300	640	610	540	20	660	490	510	890	810	770	770	830	1000	290	330	930	400

Maxmin agreement = 480; cut-off value = 8

From the above table we find that cut-off point selected is 8, which has score of 480 by maxmin principle. The following table is constructed selecting the entire row of the cut-off point (8). Now, the first variable that has maximum agreement or score among all is identified. Clearly, the variable number 9 has the maximum score and so selected as the first variable in the set of optimum variables to identify the status "poor."

TABLE III
AGREEMENT OF THE INDIVIDUAL CLASSIFIER WITH THE SURROGATE

Individual Classifiers																		
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
530	680	600	670	860	480	780	810	870	630	570	710	730	670	520	710	750	590	840

Maximum agreement attained: 870 with variable 9.

Step wise Selection of Additional Fallible Classifiers

At this stage the additional variables are selected applying the methodology. The procedure is forward step selection of additional variables. In each step the additional variable is selected where it has maximum agreement with the first variable (variable 9). Here it is found that variable 19 has the maximum agreement with the variable 9. Hence, it is selected in the composite set and step continues.

TABLE IV
ADDITIONAL VARIABLE(S)

Cut-off value	Individual Classifiers																	
	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
0	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480	480
1	690	800	810	880	480	870	850	870	880	810	870	890	870	870	700	740	880	790
2	860	670	730	850	870	780	830	530	620	630	710	710	670	520	880	880	580	920

Cut-off value = 2; maximum agreement = 920; chosen additional variable is 19.

Selection of Final or Optimum Set of Variables

Forward step procedure of selection of additional variables suggests for selecting the set of variable until the scores cease to increase at a point. The tabulated value of the sequence of fallible classifiers and their corresponding maximum agreements show that the contribution to the agreement rises from the score 870 and it stabilises at the score 980 and the stable condition continues from step 8 up to 15 and again gradually increases. The set also includes the variable where the score reaches stable position. All the variables up (the variable number 9, 19, 5, 7, 3, 10, 12, 1) to this point enter into the composite set of classifiers of poverty.

TABLE V
THE SEQUENCE OF FALLIBLE CLASSIFIERS AND THEIR CORRESPONDING MAXIMUM AGREEMENTS

Step No.	Individual Classifiers																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Variable	9	19	5	7	3	10	12	1	13	15	18	6	14	4	11	16	8	2	17
Cut-off value	8	2	2	2	3	3	3	3	3	3	3	4	4	5	5	6	6	7	8
Ag'ment	870	920	950	950	960	970	980	980	980	980	980	980	980	980	990	990	980	1000	1000

The methodology studied here suggests that six additional valuable classifiers should be justified to identify the "poor" in the rural areas. These optimum classifiers include:

- 9 (household lack blanket/quilt),
- 19 (cannot provide adequate food for three meals of a day in the last month due to economic constraint),
- 5 (do not possesses woolen clothes),
- 7 (less than two saree for women in the family),
- 3 (insufficient room height),
- 10 (household has no adequate dining plates per adult), and
- 12 (household can not provide special foods containing valuable protein and calories for the female member before and after delivery during last three years).

Identifying the "Poor"

The above findings seem interesting and meaningful as it contains the elements which are perceived to be important for identifying a household as in state of poverty in rural Bangladesh. If we look at the first identifier, it signifies that the household is unprotected from natural calamities such as cold wave. The second most important variable is the ''household without three meals a day.'' This variable alone tells the story of hunger and poverty. The subsequent variables selected in the process are coming from non-food items that are deemed to be necessary for life. Among these, shortages of food supply during the whole day, not possessing woolen clothes, and insufficient room height and unable to provide nutritious food to the pregnant female are the representative elements of household poverty. All these have explanatory power in analysing poverty situation. Presence of these poverty classifiers, considered as optimum set resulting from the methodology, in a household is sufficient for reaching a decision about the status of household as "poor" or, "not poor."

Limitations of Analysis

Literature on poverty analysis suggests for aggregate measurement of income and non-income variables in a household. This study lacks analysis on aggregation of the results. Moreover, the study does not tell about relative measurement of poverty analysis and focuses only on absolute indicators.

VI. POLICY IMPLICATIONS

Developing a meaningful concept on poverty cannot be a matter of academic invention. Rather formulating a clear picture about the nature and behaviour of poverty is essential for a policymaking regarding development and welfare of the society. Analysis of causation and effects of poverty do have own merits in the development discourse and need to be focused on overall well-being of the poor. Viewing poverty in terms of capability is the strongest in the sense that it tells about freedom and quality of life and it also tells about political, social and economic opportunities and interaction. Normative measure of poverty as done by income or consumption method may overlook the important aspects of human well-being. This study goes in a simplistic but more powerful way in the identification of the poverty characteristics, mostly covering human poverty (e.g. housing, education, health, food security, etc.).

The international development goals (e.g. MDGs) have targeted achieving freedom from hunger by 2015. Food security for the poor is the centre point of this discussion. So, inability to provide three meals a day or nutritious food for pregnant women, as revealed from this study, can be termed the most important indicator of poverty and thus demand more action and opportunities for food security. Living in a poorly built house poses insecurity of the poor against disaster and accidents. Insufficient room height and lack of utensils are all indicators of poor living condition. Clothing is essential, for women and children, in the time of extreme weather. In the rural areas the poor most often can afford sufficient clothes after meeting the needs of foods. The results show that the poor has lack in having woolen clothes for all family members. Food intake, particularly nutritious foods, is the commodities that the poor cannot consume due to economic constraints. In the time of pregnancy the women need more nutritious foods that can help their health condition sound. In the above findings it is observed that the studied households could not provide sufficient foods to the women in before and after delivery period. By any means, this is the indication of the unfreedom of the poor in purchasing power for food. From targeting point of view, the method applied in this study is very powerful as it reveals some common and representative classifiers of poverty in specific geographic areas. This may allow the policymakers and the practitioners to undertake area specific development programme for achieving greater success.

Most of the development policies and strategies have been set for a common goal, a poverty-free and egalitarian society. Engagement in poverty classification and listing the priorities are the parts of the targeting success. Acceleration in poverty reduction will take place if only appropriately designed and implemented programmes are in place. It is much relevant that poverty needs to be described in

terms of local indicators or classifiers so that we can address the needs or problems of poverty. It is difficult convincingly to comment on the magnitude of the household characteristics of poverty. This paper has tried to find reliable and meaningful results for understanding the real status of each attribute admitting some limitations. More sophisticated and valid set of fallible classifiers can be developed to signify the poverty characteristics.

VII. CONCLUSION

Analysing poverty and its characteristics warrant policy discussions and helps setting social and economic development programmes for the poor. Some pioneering research works were carried out earlier in this area of interest bringing both quantitative and qualitative focus in the methodologies. This paper draws on the identifiers of poverty relevant in local context of Bangladesh and map out the most representative ones using Guttman score—highly used in education and psychological studies. The methodologies and methods used in the study are strong in producing robust results and involve less ambiguity in measurement scale.

A total of 19 fallible binary variables have been used, which are deemed likely to characterise rural poverty in Bangladesh. Among those, the surrogate classifiers came out from the study include inability to supply adequate food to family members, insufficient room height, less cloths, lack of protection against cold, etc. The methodology used in the study suggests that these are most matched characteristics of poor households, based on which we can identify a household as "poor." The study gives thought on how to identify most localised indicators of poverty in a particular geographic setting. This may help development practitioners address the outcomes of poverty with local solutions.

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