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ESTIMATION OF MULTIDIMENSIONAL POVERTY IN PAKISTAN

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SUMMARY

This study is the first attempt to quantify the extent of multidimensional poverty in the context of Pakistan. It involves developing multidimensional poverty indices (headcount, poverty gap, and poverty severity) and comparing them with the traditional income approach.

It has been estimated, using household data for 2004-05, that about 54 percent of the population is poor in terms of socio-economic dimensions (including income) used in constructing multidimensional poverty incidence, while the estimated income/consumption poverty for the same year was 30 percent. The results also show that rural multidimensional poverty indices are substantially high as compared to urban poverty indices. To check the consistency and inter-temporal sensitivity of methodology, multidimensional poverty indices were also estimated for 2000-01.

1.   PROLOGUE

The approach to measure poverty solely in terms of financial deprivation has been widely criticized in the literature of welfare and wellbeing. It is argued that to understand the complex phenomenon of poverty or to evaluate household or individual wellbeing, a multidimensional exercise is imperative. The multidimensional approach is derived from Amartya Sen's capability theory and extends the number of dimensions along which poverty is measured. According to Sen[1], economic and social arrangements should be evaluated in terms of capabilities enjoyed by those who live in them. In this way, Sen shifts the terms of the poverty debate away from a reliance on income and consumption poverty measures alone, to the consideration of multiple dimensions of people's lives. This conceptual shift is worthy even in instances where the income or consumption approaches prove most useful. For policy perspectives, it is worth highlighting that uni-dimensional measures only advocate the case for transfer policies that alleviate poverty in the short-term, whereas multidimensional measures permit the recommendation of structural socio-economic policies that could alleviate the intergenerational poverty in the long-term.

The traditional uni-dimensional approach, which considers only one variable such as income or consumption, is widely used due to its practicality. The methodology of measuring uni-dimensional poverty has developed considerably and according to Bourguignon (2003) "has reached today a high level of sophistication and operationality". There has also been progress in defining and measuring the multidimensional nature of poverty and ample literature is now available on the conceptual and measurement issues. However, "…challenges remain quite serious if the objective is to reach a degree of operationality (for multidimensional paradigm) comparable to that enjoyed by the income poverty paradigm" (Bourguignon, 2003).

Despite difficulties and arbitrariness in the measurement and aggregation of household multiple deprivations, a multidimensional approach to define poverty has been adopted in many developed and developing countries. The United Nations Development Programme has since 1990 challenged the primacy of GDP per capita as the measure of progress by proposing the Human Development Index (HDI), which combines income with life

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[1] A summary of Amartya Sen's views and the development of that literature over the last 20 years may be found in Sen (1997).

expectancy and educational achievement. Similarly, the Millennium Development Goals (MDGs), which now dominate the development agenda of almost all developing countries, also emphasize multidimensionality in measuring progress in alleviating poverty.

Various studies are available on measuring and quantifying the extent of monetary poverty in Pakistan. So far however, no attempt has been made to evaluate household welfare in terms of multiple deprivations[2]. This research is the first and preliminary attempt to assess the level of household multiple deprivations in Pakistan. Multidimensional poverty in terms of the popular FGT (headcount, poverty gap, poverty severity) indices is estimated for the year 2005. Besides household financial deprivation, human poverty, poor housing and deprivation in household physical assets are included in estimating poverty. For assessing the inter-temporal consistency in methodology, poverty indices were also developed for the year 2001.

The next section discusses measurement and aggregation issues and the methodology adopted for this study. The multiple dimensions of deprivation, considered in the estimation of multidimensional poverty are briefed in section 3. Section 4 presents the empirical estimates of multidimensional poverty in Pakistan. A comparative picture of uni-dimensional (consumption) poverty for the same year is also portrayed in this section. The last section is reserved for some concluding remarks.

2.   METHODOLOGY FOR MEASURING MULTIDIMENSIONAL POVERTY

The multidimensional nature of poverty refers to the situation when an individual or household experiences a number of cumulative deprivations. These multiple deprivations represent different dimensions (economic wellbeing, education, health, social exclusion etc.) of human life.

There are two options available to decide when a household or individual is said to be poor in term of multiple deprivations. In the first option, each single indicator is assigned its own threshold value. For instance, Bourguignon and Chakravarty (2003) take as their fundamental and starting point in the development of multidimensional poverty measures that poverty

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[2] District Indices of Multiple Deprivations (excluding income) are developed by Jamal et al (2003). However these indices reflect a regional picture, while this research assesses household welfare in terms of multiple deprivations including income.

consists of a shortfall from a threshold on each dimension of an individual's well-being. They argue that "the issue of poverty arises because individuals, social observers or policy makers want to define a poverty limit on each individual attribute: income, health, education, etc….".

The concern here is whether a household should be considered poor if it falls short of the thresholds for all attributes, or only falls short of one[3]. In the two attribute case, if attribute 1 (x1) is less than its threshold (z1) and attribute 2 (x2) is also less than its threshold (z2), the status of the household is unambiguously 'poor'. Alternatively, the shortfall might be only in one dimension, in which case the determination would depend on the nature of the relationship between the two attributes. If the attributes are substitutes and an individual has a sufficiently high level of the first attribute above the threshold to more than compensate in terms of welfare for the shortfall in the second attribute, than the person cannot be classified as poor[4].

The second option refers to the case where to measure multidimensional poverty, a composite indicator incorporating the information from the selected deprivation dimensions or variables is constructed. The studies adopting this methodology combine the individual indicators into one index variable and assign a threshold. If the value of index variable is below this threshold, the household or individual is considered poor. The advantage of this approach is that it is compensatory: a low score on a certain indicator may be neutralized by a high score on another[5].

Here, two important decisions have to be made. The first decision concerns the weights of the indicators in the composite index, and the second concerns defining the threshold value of the

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[3] For instance, Bourguignon and Chakravarty (2003) suggest that an alternative way to take into account the multi-dimensionality of poverty is to specify a poverty line for *each* dimension of poverty and to consider that a person is poor if he/she falls below *at least one* of these various lines.

[4] In the literature of multidimensional poverty, the distinction between being poor in more than one and in only one dimension has been referred to as the *intersection* and *union* definitions of poverty. For instance, if well-being is measured in terms of x1 and x2 then a person could be considered poor if x1 falls below z1 *or* if x2 falls below z2. This case would be defined as a *union* definition of poverty. In contrast, an *intersection* definition would consider an individual as poor only if x1 and x2 both fall below their thresholds.

[5] A good example is the UNDP's Human Development Index (HDI), constructed from indicators of life expectancy, education and standard of living. HDI has received a great deal of attention in the development context.

composite indicator used to distinguish between poor and non-poor individuals or households. The weighting problem can be approached in a number of different ways. Besides equal weighting or subjective judgment of experts regarding the importance of each component, the weight structure may be empirically based on relative frequencies of components. However in most quantitative research on multidimensional poverty and multiple deprivations, the importance of each dimension is computed using different multivariate statistical techniques.

Use of Factor Analysis (FA) technique[6] for indexing multidimensional phenomena has been well-established. FA essentially consists of consolidating the data so as to structure it around the covariance structures of the variables. This technique reduces the number of relationships by grouping or clustering together all those variables which are highly correlated with each other into one factor or component. The FA model can be described as follows:

$$X_i = a_{i1}F_1 + a_{i2}F_2 + \ldots\ldots\ldots + a_{ij}F_j$$

where;

X_i = Attribute or dimension

a_{ij} = Proportion of the variation in X_i which is accounted for by the *jth* factor (factor loading)

Σa_{ij} = Multiple regression coefficient in regression analysis (communality)

F_j = *jth* factor or component

The Principal Component Analysis procedure in the FA method produces components in descending order of importance, that is, the first component explains the maximum amount of variation in the data, and the last component the minimum. Thus, the first few components (Principal Components) account for a sizeable part of the variation in the data and subsequent components contribute very little. It is also possible that a more interpretable solution can be achieved using a transformed model, obtained by a process known as factor rotation. Various methods for the rotation of factors are available and for this study, the Oblique Method was preferred. The Oblique Method in the Principal Component Analysis allows the factors to be

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[6] For detailed discussion, see Adelman and Morris (1972).

correlated rather than be independent. It is expected that in a multidimensional poverty phenomenon, several deprivations are likely to occur simultaneously.

After having a representation of the data in the component form, every household is ascribed a 'score' on each derived principal component using factor loading (variance in the individual attribute) as a weight and then multiplying this score with the standardized value of variables or dimensions. An overall score[7] (OS) for an individual or household is obtained as follows:

$$(OS)_i \quad = \quad \Sigma_n \left[\Sigma (a_{ij} * Z_j) \right]$$

Where; Σ_n =   Summation over n principal components

            a_{ij} =   Factor Loading of *ith* Factor and *jth* indicator (weights)

            Z_j =   Standardized value of *jth* variable or dimension

There has been some criticism on this multivariate statistical technique of data reduction[8]. However, much of the debate is on the inter-temporal or cross-section sensitivity of factors or components. It is argued that derived factors are not necessarily comparable over time or space. Since the main objective of this research is to get statistical weights for each dimension before aggregating in one single index, this criticism is not relevant to this study.

Once the composite indicator in terms of 'overall score' is obtained for each household, one still has to define a procedure to identify the poor. To determine threshold or poverty cut-off point, another multivariate statistical technique is used. Cluster Analysis allows the classification of similar objects into groups, or more precisely, the partitioning of an original

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[7] Since the oblique (not orthogonal) method of factor rotation is used, summation of weighted factor score is not preferred.

[8] Three problems are identified in the literature. First, composite indicators created using factor analysis – which are essentially weighted summations of individual variables – are sensitive to errors in measurement of the original variables. This gets amplified when the original variables are used to create the factor scores and is further compounded when the factor solutions are used across several years. Such measures cannot be meaningfully compared over time with the result that trends in the various dimensions of poverty cannot be securely established. Secondly, the factors often have to be rotated to allow a useful interpretation. That is, the original solution has to be operated on in such a way as to ease elucidation of the results or to fit with some theoretical framework. As a result of these rotations, factors are not necessarily comparable over time or space. Thirdly, factor analysis is essentially an exploratory technique. No strong theoretical justification is required in deciding which variables to include or exclude from the analysis and the researcher has little control over how the variables form the resulting factors.

population into subsets (clusters) according to some defined distance measure. On this basis, an overall score of two clusters representing household status (poor and non-poor) is developed. It is found that households are grouped around positive and negative values of an overall score. Therefore, mean value (zero in this case) of the distribution of the composite index is chosen as the cut-off point or as a poverty threshold. In other words, household i for which the composite index OS is smaller or equal than zero will be identified as poor.

After having a poverty threshold and the household status in terms of overall score with respect to multiple deprivations, the task then is how to aggregate this information into a single index to proxy the status of a group of individuals. Various poverty aggregates (indices) are used to proxy the status of a group of individuals. A class of functional forms, which has been suggested by Foster, Greer, and Thorbeke (FGT), uses various powers of the proportional gap between the observed and the required expenditure as the weights to indicate the extent of and level of intensity of poverty[9]. The higher the power the greater the weight assigned to a given level of poverty. Therefore, it combines both incidence and intensity.

The following formula is used for measuring various poverty aggregates.

$$P^{\alpha} = (1/N) \sum [(Z - EXP)/Z]^{\alpha}$$

where;

P^{α} = Aggregation measure

N = Total number of households

EXP = Observed household expenditure

Z = Poverty line or poverty threshold

$\sum$ = Summation for all individuals who are below the poverty line

Putting $\alpha = 0$, the formula shows the proportion of households whose consumption falls below the poverty line. The poverty incidence (headcount) is the most popular measure used. The formula assigns equal weights to all of the poor regardless of the extent of poverty. Putting $\alpha = 1$, the Proportionate Gap Index or Poverty Gap (PG) is calculated. The PG measures the

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[9] FGT indices are popular and widely used in the empirics on Pakistan poverty.

average distance from the poverty line. Although the PG shows the depth of poverty, it is insensitive to distribution among the poor. Putting $\alpha = 2$, FGT2 index is calculated. This index takes into account inequality amongst the poor and shows the poverty severity by assigning greater weights to those households who are far below the poverty line. Thus, these three aggregate indices (Headcount, Poverty Gap, and Poverty Severity) are computed to give a picture of the extent and severity of multidimensional poverty in Pakistan.

3. DIMENSIONS AND COMPONENTS OF MULTIDIMENSIONAL POVERTY

The technique presented in the above section is applied to data of Household Income and Expenditure Surveys (HIES) enumerated during 2000-01 and 2004-05. Therefore, the selection of dimensions or components to derive multidimensional poverty is purely based on the appropriate data available in these household surveys. The selected dimensions and components in constructing indices of multidimensional poverty are briefly described below, while a schematic view of variables[10] is furnished in Table 1.

Table – 1 Variables Used to Assess Multi-Dimensional Poverty	
Dimensions	*Variables*
Financial Poverty	
	Poor Households in terms of per capita household consumption poverty line
Human Poverty	
	Illiterate Head of Household
	Illiterate Spouse
	No child of primary age is in school
	No child of secondary age is in school
Poor Housing	
	Households with only one room
	Household with Inadequate Roof Structure**
	Household with Inadequate Wall Structure**
	Households with no electricity
	Households using inadequate water
	Households with no telephone connection (landline or mobile)
	Households using inadequate fuel for cooking (wood, coal, etc.)
	Households without latrine facility
Physical Household Assets Poverty	
	Households with no physical household assets
	Households with no home ownership
** The data on these variables are not available for the year 2000-01.	

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[10] All these variables are binary. A value of 0 is assigned to poor household and 1 to non-poor households.

Financial poverty or household status in terms of 'poor' and 'non-poor' is represented with reference to the absolute poverty line. To compute[11] poverty line, calorie norms[12] (cutoff points) and estimation of the Calorie-Consumption Function (CCF) are required. The CCFs are estimated separately for urban and rural areas and the estimated coefficients are used to calculate total household expenditure required to obtain the minimum required calories. Once a poverty line[13] is defined, the household poverty status is determined by relating the poverty line to household per capita consumption.

The extent of human poverty in the household is represented by current and future levels of education deprivations. Two measures, illiteracy (head of household and spouse) and children out of school (primary and secondary), are included in this dimension. Literacy is defined as the "ability of a person to read a newspaper or write a simple letter in any language." Children between the ages of 5 to 9 and 10 to 14, who are not attending school, are taken to compute out-of-school children at the primary and secondary levels respectively.

No information regarding individual health status in general or some indication of individual physical and mental health problems, illness or disability is available in the HIES data. The dimension of health deprivation is therefore missing from the multidimensional poverty analysis due to absence of required information.

The housing quality dimension identifies people living in unsatisfactory and inadequate housing structures. It is represented by a series of variables. The housing structure is treated as inadequate if un-baked bricks, earth bound materials, wood or bamboo are used in the construction of a wall or the roof. Housing congestion is represented by households with only one room. Access to basic utilities is an important aspect of everyday lives of people. Deprivation for this sector includes households with no electricity, households using wood or kerosene oil as cooking fuel, households with no inside water availability and households

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[11] For detail methodology and other issues related to absolute poverty lines, see Jamal (2002)

[12] The 2550 and 2230 calories per day per adult are used as calorie norms (minimum requirements) for estimating poverty line. For discussion and justification see Jamal (2002). Household food consumption is translated into calories using Food Consumption Tables for Pakistan (GoP 2001).

[13] The estimated poverty lines for 2004-05 are Rs. 990 and Rs. 778 per capita per month for urban and rural areas respectively. For the year 2000-01, poverty lines are estimated at Rs.761 and Rs. 605. For detail see Jamal (2005 and 2007).

with no landline or mobile telephone facility. Households which are lacking essential facilities such as kitchens, bathrooms and toilets are also seen as an important poverty dimension. Due to data constraints, only households lacking a toilet facility are included in the 'poor housing' dimension of f multidimensional poverty.

To capture the poverty in endowments, non-ownership of house and non-ownership of any household assets[14] – inquired about during the survey – are added to the list of variables used to assess the household multidimensional poverty[15].

4.   EMPIRICAL FINDINGS

Table 2 presents the estimates of multidimensional poverty. In the year 2004-05, about 54 percent of the people of Pakistan were in the state of multiple deprivations[16]. This is indicative of more than 70 million people living in desperate condition and eventually being socially excluded. The magnitudes of multidimensional poverty incidence, poverty gap and poverty severity are substantially high in rural areas. According to the table, rural incidence is about 69 percent against the urban incidence of 21 percent. Similarly, the magnitudes of equity-sensitive poverty indices (poverty gap and poverty severity) for rural areas are almost five times higher when compared to their urban counterparts. Rural multidimensional poverty gap and poverty severity are estimated as 27.51 and 15.5 percent respectively, while comparative figures for urban areas are 6.35 and 3.06 percent respectively.

Table – 2 Estimates Of Multi-Dimensional Poverty Measures, 2004-05 [Percent]			
	Head Count Index [Incidence]	Poverty Gap Index [Depth]	FGT2 Index [Severity]
Pakistan	**53.64**	**20.79**	**11.56**
Urban	21.42	6.35	3.06
Rural	68.61	27.51	15.50
Source: Estimates are based on PIHS-HIES (2004-05) unit record data			

[14] These assets are; refrigerator, freezer, air-conditioner, air cooler, geyser, washing machine, camera, cooking range, heater, car, motorcycle, TV, VCR, cassette player, compact disk player, vacuum cleaner and computer.

[15] Landlessness is also an important aspect of multidimensional poverty and a powerful determinant of social exclusion in rural areas. Since the analysis was done in a national framework, it was difficult to include a characteristic associated only with rural households.

[16] These deprivations are listed in Table 1.

Table – 3 Income v/s Multi-Dimensional Poverty Trends – Overall Pakistan [Percent]				
	2001	2005	Percent Change	Percentage Points Change
Multi-Dimensional Poverty				
Incidence	54.98	53.64	-2.44	-1.34
Depth	19.68	20.79	5.64	1.11
Severity	10.14	11.56	14.0	1.42
Income (Consumption) Poverty				
Incidence	33.37	29.85	-10.55	-3.52
Depth	7.16	6.51	-9.08	-0.65
Severity	2.27	2.13	-6.17	-0.14
Source: Estimated from Household Surveys, 2000-01 and 2004-05				

Table 3 and Figure 1 show inter-temporal (2000-01 vs. 2004-05) changes in the multidimensional and traditional income poverty indices. The period was characterized with macro-economic stability and relatively high GDP growth. The average annual growth rate of the economy during this period was nearly six percent. The estimates show a decline of about one percentage point in multidimensional poverty. On the contrary, decline in traditional income poverty is about 3 percentage points. This clearly reveals the sluggishness of non-income dimensions of poverty in responding growth. It is plausible to argue that the decline in multidimensional poverty is mainly due to a decrease in income or financial poverty. Non-income deprivations take a longer time to change.

Figure – 1
Income v/s Multi-dimensional Poverty Trends
[Headcount - Percent of Poor Population]
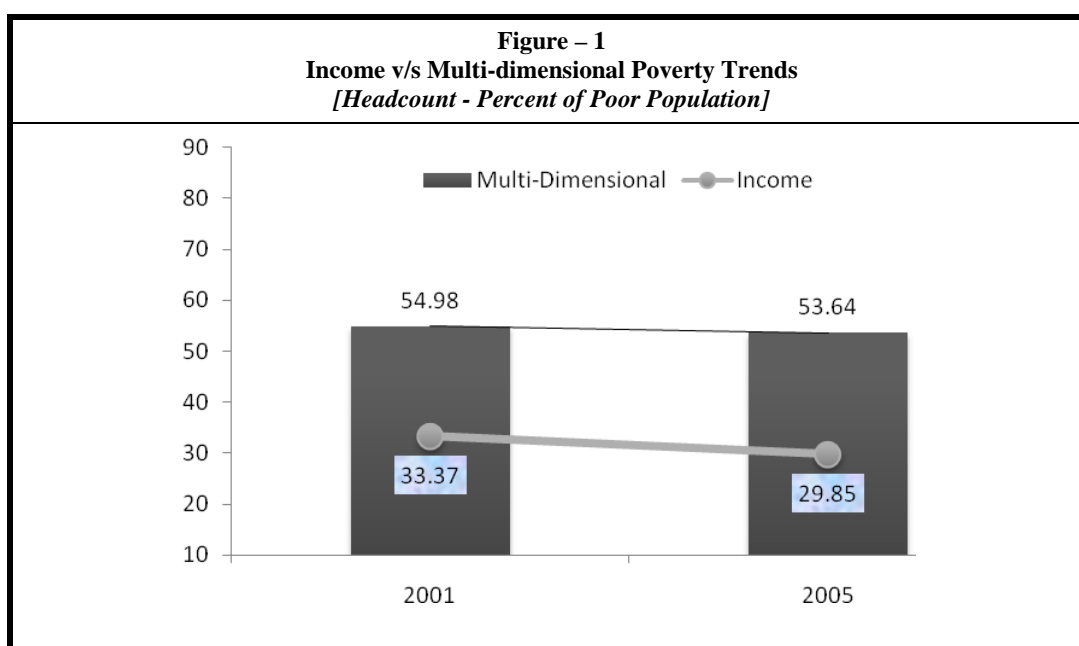
Two important observations also emerge from Table 3. First, the magnitudes of multidimensional depth and severity (equity sensitive poverty aggregates) indices are quite high as compared with traditional income indices. For instance, multidimensional poverty severity is about 12 percent for the year 2005, while in case of income poverty it is just 2 percent. Second, although the depth and severity of income poverty have declined during this period, multidimensional depth and severity indices have gone up.

Inter-provincial comparisons regarding the multidimensional poverty incidence is exhibited in Table 4. The lowest incidence (50.46 percent) is observed in the province of Sindh, mainly due to it having the lowest urban incidence[17]. However, the estimated multidimensional poverty incidence for rural Sindh is high as compared to the NWFP and province of Punjab. As expected, Balochistan has the highest multidimensional poverty incidences in both urban and rural areas. About 75 percent of the population of Balochistan is categorized as poor in terms of multiple deprivations.

Table – 4 Provincial Multi-Dimensional Poverty Incidences, 2004-05 *[Headcount - Percent of Poor Population]*			
	Overall	**Urban**	**Rural**
Punjab	52.10	25.27	64.36
Sindh	50.46	13.16	78.21
NWFP	59.08	27.85	65.31
Balochistan	74.54	29.23	86.28
Source: Estimates are based on PIHS-HIES (2004-05) unit record data			

5.   CONCLUDING REMARKS

It has long been argued that poverty is a multi-dimension phenomenon and 'not just about money'. The operational emphasis of poverty is understood in terms of deprivation of food and other 'basic' commodities, and therefore, on private income or private consumption shortfalls, mainly due to the advancement and the level of sophistication in measuring and assessing financial poverty. Vast literature is now available on conceptual and measurement issues of multidimensionality of poverty. Due to this advancement and technical

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[17] The share of urban population is more than 50 percent in the province of Sindh.

development, non-income indicators of well-being and the multidimensionality of poverty have recently received much attention, especially in developing countries.

This research for the first time quantifies the extent of multidimensional poverty in Pakistan in terms of the popular FGT indices (headcount, poverty gap and poverty severity). The choice of indicators describing deprivation is country-specific and depends on the level of development, the nature of poverty, type of social exclusion and available household data. For this study, indicators of financial poverty, human poverty, poor housing and lack of physical assets are combined to get a composite index of poverty across multiple deprivations. These income and non-income indicators are developed using Household Income and Expenditure Surveys for the years 2004-05 and 2000-01. Multivariate statistical tools (Factor Analysis and Cluster Analysis) are used to construct the composite index and to ascertain multidimensional poverty threshold.

The empirical findings reveal that about 54 percent of the people of Pakistan were in the state of multiple deprivations in the year 2004-05. Rural incidence was about 69 percent, while 21 percent of urban population faced extreme poverty in terms of indicators used in the construction of multidimensional poverty. An important finding of this study is that the magnitudes of equity-sensitive multidimensional poverty aggregates (poverty gap and poverty severity) are quite high as compared with income poverty. This situation indicates high inequality among the poor in terms of non-income poverty dimensions. Inter-temporal consistency of methodology facilitates future monitoring of multidimensional phenomenon of poverty.

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