

The Counting Approach to Multidimensional Poverty: Evidence from South Asia

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This study is about the inspection of the multidimensional poverty level and changes with time. Three sample countries (Pakistan, Bangladesh, and India) are taken from the South Asian Region to measure the depth of multidimensional poverty and inequality among the deprived individuals by using Alkire and Foster (2011) “Dimension Adjusted” or headcount ratio measure, Rippin (2010) Class of Ordinal Poverty measures, and Chakravarty and D’Ambrosio (2006) Class of Poverty measures. These all three approaches are counting-based approaches that are used on ordinal variables. The data of three main dimensions (Education, Health and Standard of Living) which is further divided into ten indicators is used for this study. The secondary data is used, which is extracted from Demographic Health Surveys (DHS). The last three surveys of DHS is used in this study, which was conducted in different period. Results of all three countries are compared and showed that India is having more poverty followed by Bangladesh and Pakistan. Change in inequality component among deprived individuals is recorded almost similar in all three sample countries. The finding of this study shows that all three techniques are providing insightful information about the depth and component inequality among deprived individuals.

Keywords: sustainable development goals (SDGs), multidimensional poverty index (MPI), demographic health surveys (DHS), oxford poverty and human development initiative (OPHDI)

Multidimensional poverty is a global phenomenon that brings the whole world together at the platform of the United Nations to handle this problem which is the root cause of so many issues of the developing nations. The developing world is facing deprivations in multiple dimensions which includes education, health and living standards, these all aspects are taken under the head of multidimensional poverty as per the latest studies. According to the latest report of the Oxford Poverty and Human Development Initiative (OPHDI) (2018), it is explored that in 105 developing countries 1.3 billion population is facing multidimensional poverty. The global MPI is estimated for these which shows that 23% (nearly a quarter) population of these countries are left behind in multiple means. The people are facing deprivation in one-third of overlying deprivations in living standards, health and education, which includes lack of clean water for drinking, facilities of sanitation, acceptable nutrition and minimum education level which is primary. The multidimensional poverty profiled scale and detail suggests that

there is a need to complement the income and consumption figures with multidimensional measurement which provides a precise picture (OPHDI, 2018).

The main aim of this paper is to use three main counting based measures of poverty found in the literature. In this paper, the decomposability properties of these three counting based measures will be used. This research shows that how to use all the measures in a manner that complements the evidence given by the MPI for insightful information by examining the elements of multidimensional poverty which tell us about the breadth and inequality in the South Asian Region. In addition, this study aims to find the most appropriate measurement for multidimensional poverty in the region, and take suitable actions to attain the sustainable development goal of UN, to” ending poverty in all its forms everywhere”.

In this research, the first section will focus on the theoretical background of the study where the literature gap is identified after the detailed literature review, which parts the second section of this research study. The third section details the methodology adopted to conduct this research followed by the data analysis and findings from the results obtained.

Theoretical Background

Sen’s ‘capabilities and functioning theoretical framework is the most inclusive and thus logical starting point to cover the idea of poverty. This framework states that the freedom of a person to decide his functioning is finally mattered. An individual need the bottom level of well-being taken by a set of elements. Income is the typical way of assessment that whether a person is below or above the poverty threshold. The approach which is known as money-metric is based on the principle that a person who exceeds the line of monetary poverty is supposed to have the possible power of purchasing to get the bundle of traits that are sufficient to get the level of well-being (Thorbecke, 2007).

Amartya Sen in his paper “Poverty: An ordinal approach to measurement” (1976) defined two main aspects that measurement of poverty must tackle;

1. Identifying the poor among the total population &
2. Constructing a numerical measure of poverty
- 3.

This twofold steps process of identification and aggregation has become the main conceptual framework for the measurement of poverty. Unidimensional methods apply when we have well-defined variables which is a single-dimensional resource, like income, as a base of the poverty evaluation. This type of variable is assumed typically to be a cardinal, however, variables have ordinal significance in some cases. For example, the direction of change is noticeable but its magnitude is not apparent. A poverty line is set for identification in the unidimensional environment which conforms to a minimum level below which an individual is put under the head of the poor. A numerical poverty measure is used for aggregation which establishes the total intensity of poverty in a poverty line distribution that is given. Sen’s procedure of two-step, which identifies and aggregate has been considering as a typical conceptual framework for poverty measurement, and the researcher follows this methodology in multidimensional and unidimensional methods (Alkire, & Foster, 2011).

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Sen illustrated the three basics that need to be included in a poverty index. Incidence of poverty tells us about the relative number of poor; income shortfall on average which indicates deprivation on average; and the income distribution among the poor, indicates relative deprivation among them (Sen, 1976). This study will open another dimension of research which is about the measurement of multidimensional poverty, as already MPI is the only measurement for the South Asian region and hardly any other measures are taken under consideration before. This research will provide the guideline for new studies in this area which helps the researcher to discuss more the true measure of multidimensional poverty of the South Asian region and then this region will be able to combat the core issue of poverty by taking suitable remedial measures by using scared resources.

Literature Gap

Candelario and Cortez (2019) studied that by using CIP and HDI index the researchers have shown consistently low scores of South Asia in these indexes for the last fifteen years. They forecast by their model that incidence rate of poverty is increasing for the region. After an extensive literature review it is disclosed that these three techniques are used in different regions of the world to explore the level of poverty in the region but it is hard to find collective implementation of these techniques in South Asian region so in our research we are going to use these three techniques to find the true measure of poverty measurement for the region (Berenger, 2019).

UN Agenda 2030

As it is known very well that agenda 2030 set by the United Nations (UN) known as “eradicating poverty in all its forms and dimensions is the greatest global challenge and an indispensable requirement for sustainable development.” As we are aware the third decade of the UN is specifically for the eradication of poverty. Poverty eradication measurement and reduction of multidimensional poverty are very important to achieve this goal. The whole world should be cover and no one is left behind then the UN will be able to make it possible to some extent (OPHDI, 2018). The Sustainable Development Goals are adequate to divert the concentration of the international community towards the issues which are faced by the developing world. The top priority is given to the “Poverty” in the Sustainable development goals (SDGs), as it is the number one goal which the whole world has to achieve by 2030, on their own and by partnerships. The precise multidimensional focus is “ending poverty in all its forms everywhere” (Berenger, 2019).

UN priorities in SDGs by showing in goal one that ending poverty in all its forms and dimensions is very important for achievement of other goals and targets. While normally defined by income, poverty can indeed be described in terms of the deprivation people have to bear in their everyday lives. Global Multidimensional Poverty Index of Deprivation (MPI) is a common instrument for evaluating improvement in contrast to SDG 1. Compares the severe multidimensional poverty in 5.7 billion people and more than 100 countries and evaluates change in time. The MPI which is computed globally scrutinizes the deprivation of an individual by 10 indicators for education, health and living standards as well as the offer High resolution lens to distinguish who are poor

people and how poor they are. It complements this worldwide poverty rate of \$1.90 a day which shows the nature and extent of overlap the deprivation of each person (Global MPI Report, 2019).

Oxford Poverty and Human Development Initiative (2018) report shows that Poverty in many dimensions exists in all territories of developing world but it found mainly severe in South Asia and Sub-Saharan Africa. Both localities have 83% of overall poor population in the whole world which is around 1.1 billion. The two-third population which is poor lives in the developing countries, who are experiencing deprivations in different dimensions, like schooling, nutrition and sanitation.

The Global MPI

Poverty structure improves worldwide by the global MPI. It was only make it possible by the assessment by MPI the interconnecting impact on choice of policy across several SDGs and it supports incorporated response to the complex development challenges, evidently it is proved. Though MPI contribution is recognized by the researchers but the in-depth and overall view of the poverty deprivations is not only covered by MPI. Researchers have to consider the other instruments as well. The one part of these instrument is, are indices which are related and they cover other fragments of the picture. There are sections of picture which are still obstinately dark, representing limitations in existing tools or a gap in data (OPHDI, 2018).

Below mentioned table shows the linkages between ten different indicators of poverty and sustainable development goals.

Table 3 *List of Poverty dimensions and indicators according to the Sustainable Development Goals*

Poverty Dimensions	Indicators	Area of SDG	Individual consider deprived if	Weightage
Health - dimension	Nutrition	SDG 2	Any person under 70 years of age for whom there is nutritional information is undernourished.	1/6
	Child Mortality	SDG 3	Any child has died in the family in the five-year period preceding the survey	1/6
Education – dimension	Years of schooling	SDG 4	No household member aged 10 years or older has completed six years of schooling.	1/6
	School attendance	SDG 4	Any school-aged child+ is not attending school up to the age at which he/she would complete class 8.	1/6
Standard of Living - dimension	Cooking fuel	SDG 7	A household cooks with dung, agricultural crop, shrubs, wood, charcoal or coal.	1/18
	Sanitation	SDG 11	The household’s sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households.	1/18

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Drinking water	SDG 6	The household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, roundtrip.	1/18
Electricity	SDG 7	Household has no electricity	1/18
Housing	SDG 11	The household has inadequate housing: the floor is of natural materials or the roof or walls are of rudimentary materials.	1/18
Assets	SDG 1	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	1/18

Table 1.3 Source: Global MPI 2018 by Oxford Poverty and Human Development Initiative (2018)

SDGs Interlinkages

It is represented by the global MPI that the poverty of everyone in different areas of SDG, like housing, sanitation, water, health and education etc. linking to the seven different SDGs. The MPI combines a number of concerns under measure which is significant and if persons are deprived of one third weighted measures, it means they are weak MPIs. The MPI concentrate on those people who are facing deprivation in number of SDGs simultaneously.

Subsaharan Africa (42%) and South Asia (41%) have most poor people of the world

Although deprived people are anywhere but maximum poor of the world (more than 1.1 billion) are living in South Asia and Subsaharan Africa. The people face severe poverty in Subsaharan Africa. A smaller portion of global multidimensionally poor is recorded in East Asia, even though the region have major population of the world.

Literature review

There are many studies which are conducted on the issue of poverty and multidimensionality of the poverty of the South Asian region but it is hard to find a study which shows that by using these three techniques the multidimensional poverty of the South Asian region is measured and compared collectively. Literature is showing that these techniques are used in the other regions to find out the better technique for poverty measurement which helps to take suitable remedial measures for the region. Literature also highlight that Asian region is affected more by multidimensional poverty and several methods are used to measure it and try to counter it by different recommended policies but more techniques are needed to find out the suitable measure.

Aaberge and Peluso, (2012) studied that there are several studies which examine the problem of ranking and quantification of the extent of deprivation shown by multidimensional distributions, where the multiple traits in which an individual can be

underprivileged are represented by dichotomized variables. The researcher's aggregate deprived individuals into a deprivation count. Under the head of deprivation count they discuss the dimensions an individual is deprived. Sen (1974) and Yaari (1988) originate the rank dependent social evaluation framework which helps the researchers to aggregate that individual deprivation to summaries in the measures of deprivation. Multiple deprivations distribution's decomposition dispersion and mean is proving to admit.

Edem et al., (2020) emphasized the importance of the poverty with the help of a micro level study conducted for the region of Obudu, Nigeria. The author took a sample of 417 respondents and examined 84.75 percent people in the sample could not afford to give proper diet to their family twice a day while 96 percent could not afford to give square meal to their family thrice a day.

Agba et al., (2020) examined the role of local government in eliminating the poverty among the region and results concluded that large population of the area still suffers with the poverty and its harming effects. In this study researchers also accomplished that there are some social and macro factors caused for poverty.

Pasha (2017) examined the repercussions of a scheme which provides alternative weighting for the multidimensional poverty index (MPI) by using a data driven approach, as alluded to the equal weighting scheme which currently used. This scheme of weighting has been under serious inspection as the MPI's inception, provided the sensitive nature of country ranking to many indicator and weights preferences. The recent study therefore uses the Multiple Correspondence Analysis (MCA) for the indicators weighting and scrutinizes its effect on the relative ranking and scores of 28 countries. The outcome shows that three dimensions equal weighting is statistically not justified. Furthermore, it is noticed that statistical weights systematically vary along through countries, stating disparities in deprivation all over areas, even though poverty of household standings are correlated highly for both statistical and normative weights. Despite the strong similarity among all metrics used within the MPI, there is a significant statistics overlap, suggesting that there may be not really be so much multidimensionality even within MPI dimensions.

Alkire and Santos (2010) studied that the multidimensional poverty index (MPI) of 104 developing countries estimate by taking micro datasets which includes household surveys for those developing countries which covers the world's 78% population. The one of the Alkire and Fosters' mathematical structure of multidimensional measure is used to estimate the multidimensional poverty index (MPI). The MPI derive by the three different dimensions of living standards, education and health as the Human Development Index covers. Under these three heads tend indicators are the main composition of the MPI. A set of direct deprivations also covered by the MPI which batter an individual simultaneously. Alkire and Housseini (2014) discussed the Oxford Poverty and Human Development Initiative (OPHI) developed the Global Multidimensional Poverty Index (MPI) launched in 2010 and UNDP's Human Development Reports (HDR) reported.

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Rippin (2010) Studied the Multidimensional Poverty Measures axiomatic foundation. Rippin presented a family of poverty measures whose specific, axiomatically implied weighting arrangement gives the solution of exaggeration problem for ordinal and cardinal data. Simultaneously independent relationship is allowing between attributes. MPI is the special case of this family.

Chakravarty and D'Ambrosio (2006) shape up an approach which is an axiomatic and for the social exclusion measurement. It is observed at the individual level as in deprivation terms of an individual with regard to the various societal functioning. They see social exclusion as an individual exclusion function at the aggregate level. An independent axioms set is identified as the subgroup decomposable class of social exclusion measures. By the exclusion dominance principle they study the problem of ranking exclusion profiles within certain limitations. Application of non-decomposable measures and decomposable measures advised by using data of European Union and Italian data.

Berenger (2017) studied and examine the significance of latest methodological enhancements of the 'Counting Approach' to measurements of multidimensional poverty. An experiential design is provided by the Demographic and Health Surveys. The comparison between MPI and other measurements which counts deprivation among persons and sensitive to its distribution. When it computes by the measures of Rippin (2010) and Chakravarty and D'Ambrosio (2006) and other measurements of Multidimensional Poverty. It shows that consideration of numerous poverty measures are useful when national poverty trends are analyzing and when distinction is built.

Methods and Materials

This study comprises three measures for assessment of multidimensional poverty in South Asian region by taking three countries (Pakistan, India and Bangladesh) as a sample of the study. Three measures which are used in this research are; "Dimensions Adjusted" Poverty Measures by Alkire and Foster (2011), Class of Ordinal Poverty Measures by The Rippin (2010) and Class of Poverty Measure by The Chakravarty and D'Ambrosio (2006). The results of these three techniques will be compare to find out the better measurement indices of multidimensional poverty for the South Asian region.

Dimensions, Indicators, Weights and Cutoffs

Under this head we are taking three dimensions (living standards, education and health) in global MPI and further divided into 10 indicators. Each dimension is equally weighted, so every indicator of a dimension is equally distributed. A person is considered as poor multidimensionally if he or she is destitute of at least one third of the weighted indicators (Global MPI, 2018).

Method

Model

The main base of all three techniques which we are going to use in this study is the counting based approach which use for the poverty measurement.

The Counting Based Approach to Poverty Measurement

Two steps are involved in devis step is about the identification of poor (Berenger, 2019).

$$C_i(x_i, z, w) = \sum_{j=1}^m \xi(x_{ij}, z_j) w_j \dots \dots \dots (1)$$

“Dimensions Adjusted” Poverty Measures by Alkire and Foster (2011)

When poverty attributes are dichotomized variables then the function of the poverty is:

$$M_0 = \frac{1}{n} \sum_{i=1}^n \Psi^{AF}(x_i; z; k) c_i \dots \dots \dots (2)$$

Where c_i is given by (1). It satisfie includes dimensional monotonicity and which used for the MPI and known as adjusted headcount ratio. It is entitled as M_0 by Alkire and Foster (2011) which is possible to state M_0 as $M_0 = HA$, that is the product of the multidimensionally poor person s percentage (H) times the average deprivations share across poor persons (A). Though, M_0 is indifferent to the deprivations distribution among the poor (Berenger, 2019).

Class of Ordinal Poverty Measures by the Rippin (2010)

$$P_\gamma^{RI} = \frac{1}{n} \sum_{i=1}^n c_i^{\gamma+1} \dots \dots \dots (3)$$

At this point γ is an avers consideration the association within attributes. This poverty measures class is sensitive to the deprivation focus for $\gamma \geq 0$. In addition, it not only satisfies subgroup decomposability, but also factor decomposability, as (3) may be expressed as:

$$P_\gamma^{RI} = \frac{1}{n} \sum_{j=1}^m w_j \sum_{i=1}^n \xi(x_{ij}; z_j) c_i^\gamma \dots \dots \dots (4)$$

Not like the Alkire and Foster (2011) measures, c_i^γ perform like a weight function, the input of a specified dimension to total poverty is more sensitive when an individual is facing deprivation in that dimension cumulate deprivations in other dimensions. By using the multiplicative decomposition of the FGT index which is developed by Aristondo et al., (2010), (4) is able to decomposed into the three ‘I’s of poverty (Jenkins & Lambert, 1997):

$$P_\gamma^{RI} = HA^{\gamma+1} \{1 + [(\gamma + 1)^2 - (\gamma + 1)]GE_{\gamma+1}(c)\} \dots \dots \dots (5)$$

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Using H the ratio of multidimensional headcount, A the deprivation intensity among the poor and $GE_{y+1}(c)$ is the generalized entropy inequality index within poor. Specific contributions are highlighted by this decomposition of a change in one of these factors to the overall change in the index of poverty. It represent that whether the decline in poverty reaches to the poorest of the poor.

Class of Poverty Measure by the Chakravarty and D’Ambrosio (2006)

$$P_{\alpha}^{CD} = \frac{1}{n} \sum_{i=1}^n c_i^{\alpha} \dots \dots \dots (6)$$

Through an implicit union approach, this measures class complies by an axiom which is similar to the Pigou-Dalton transfer ⁴ if $\alpha > 1$ and even for more general identification approaches. For

$\alpha = 2$, P_{α}^{CD} can be written again as taking the sum of M_0^2 and the variance of deprivation of the society scores σ^2 :

$$P_2^{CD} = M_0^2 + \sigma^2 \dots \dots \dots (7)$$

Even though, expressions (3) for PRI and (6) for PCD are equivalent and could be presented as a measures of single family, they are established on a different approach to inequality between dimensions. The Rippin measures class incorporates both efficiency considerations and distributive justice. Rippin (2010) introduces considerations of distributive fairness at the identification step by considering all deprivations (following the union approach) and assumptions on the degree of association among dimensions through the parameter γ . Not like Rippin measures class P_{α}^{CD} does not allow for factor decomposability. However, since P_{α}^{CD} can be view as a formulation of FGT measure, when $\alpha = 2$, it can be also expressed as:

$$P_2^{CD} = HA^2 \left[1 + \left(\frac{\sigma_p^2}{A^2} \right) \right] \dots \dots \dots (8)$$

With σ_p^2 the variance of deprivation scores within poor. We note that ratio $\frac{\sigma_p^2}{A^2}$ is somehow analogous to the square of the coefficient of variation of weighted deprivations among the poor.

Data Description

Secondary data is taken in this research to evaluate the different dimensions of poverty in South Asian region. UNDP drive the MPI by using the DHS in several countries so in this study we are going to use the data from DHS for MPI and other measurements. Table 1. Presents the list of indicators which used in MPI. The dimensions of MPI are similar to the Human Development Index (HDI). DHS surveys are taking place usually almost in every 5 years and using sample size between 5000 to 30000 households in different regions of the world.

Table 4

Variables and Dimensions selected to measure the poverty by using different Measurement approaches

Dimension	Indicators	Cut-off	Relative weight
Education	Child Enrollment	School aged child (6-15) not attending school	1/6
	Years of Schooling	No Household member completed 5 years of schooling, aged 10 year or older.	1/6
Health	Nutrition	One or more adults are underweight (in terms of BMI) or a child is undernourished (in terms of height or age)	1/6
	Mortality	Any child who has died from a household	1/6
Standard of Living	Water	No access to safe drinking water source within 30 minutes one-way distance from the residence	1/18
	Electricity	Household has no electricity	1/18
	Sanitation	Household sanitation facility is not improved or shared	1/18
	Floor	Household has rudimentary floor	1/18
	Cooking fuel	Household cooks with dung, wood, charcoal and other solid fuels	1/18
	Assets	Household does not own more than one radio, TV, telephone, bicycle, motorcycle or refrigerator and does not own a car	1/18

The proposed methodology which adopted is nested weight structure. In this methodology each indicator has the similar weightage for each given dimension and each dimension also has the same weight (Berenger, 2019).

Sample selection (with full justifications)

Sample of three Asian countries selected by proportionate method of sampling, using trifold sample selection criteria.

Table 5

Names of the selected Sample Countries

S. No	Country
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1	Pakistan
2	Bangladesh
3	India

Below mentioned points are taken under consideration during sample selection.

1. These three countries covers more than 90% population of the region
2. Latest data of these countries is available, for example we don't have latest data of Sri Lanka on DHS.
3. Based on the different UNDP and other agencies reports the most poverty affected countries are taken. As recent studies describe that 364 million poor people are living in India, the second largest number of poor people which is around 97 million are living in Nigeria, 86 million are in Ethiopia, 85 million are living in Pakistan and 67 million poor people's home is Bangladesh. Pakistan. National income measures took \$1.90 per day as the line of poverty (OPHDI, 2018).

Data Analysis

This study comprises three measures for assessment of multidimensional poverty in South Asian region by taking three countries (Pakistan, India and Bangladesh) as a sample of the study. Three measures which are used in this research are; "Dimensions Adjusted" Poverty Measures by Alkire and Foster (2011), Class of Ordinal Poverty Measures by The Rippin (2010) and Class of Poverty Measure by The Chakravarty and D'Ambrosio (2006). The results of these three techniques will be compare to find out the better measurement indices of multidimensional poverty for the South Asian region.

Data Processing

As large data sets were found for sample countries so we consider the 5000 observations of all three sample countries for our study, which is minimum benchmark sample size for demographic health surveys.

Data Recoding

The available data sets are in ordinal form but responses are not as per requirements of Alkire and Foster (2011) adjusted head count method. That was requirement of the analysis of the data to recode the data accordingly. For example, responses of households were recorded as yes or no, which were label 1 in case of yes and 0 as no or otherwise. According to our adopted three methods and specifically Alkire and Foster (2011) it is required that in case of a person is deprived in an indicator so it should be record as 1 which means that respondent is 100 percent deprived in this indicator and in opposite scenario it will be recorded as 0 (non-deprived). To fulfill this basic requirement we recoded the data accordingly as ignorance of this step could mislead the results of the analysis.

Composite Index of Variable (Assets)

As we are considering seven different items under the head of assets, like household does not own more than one radio, television, bicycle, telephone, refrigerator,

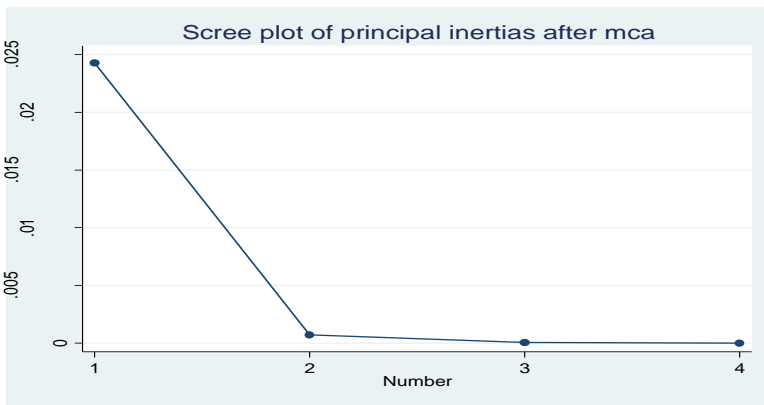
motorcycle and does not care. A variable asset is composition of all these seven items which required for the analysis of data.

Handling of Missing Values

As Alkire and Foster (2015) suggest two types of treatment of missing values, one is to drop the value which is useful for ordinal data and other is to create a rule to assign number to the missing value which is mostly used for cardinal data. In our study we drop the missing values of the data set to get most accurate results.

Multiple Correspondence Analysis (MCA)

Alkire et al., (2015) suggest Multiple Correspondence Analysis to analyze the ordinal data for multidimensional poverty measures. Implementation of Multiple Correspondence Analysis by using ten different indicators formed different number of dimensions. Scree plot of principal inertias help us to select the number of dimensions which are useful to summaries the data. Summarization is helpful for further analysis of data to get the ultimate result. Value of principal inertia is higher than 0 then we can take those dimension to summaries the results.



Aggregation of different Dimensions

To combine the selected dimensions by considering principal inertias value, by using the Multi Correspondence Analysis. We combined the selected dimensions as guided by Alkire et al., (2015). The process of aggregation is taken place by multiplying the dimension one values by dimension two after dividing by their variance just to give as a weight. As a result we find a new single dimension which has aggregated values of this whole procedure and we use this to count the number of deprived individuals (H) and average intensity of poverty (A).

Results and Discussion

Alkire and Foster (2011) Dimension Adjusted Approach Pakistan

By using Alkire and Foster (2011) approach the data of three sample countries is analyzed for three different years. First of all we would like to discuss the results of Pakistan, for which we use data of three different durations (2006-07, 2012-13, & 2017-18). The percentage of multidimensional poor person (H) in 2006-07 is 16 percent, for 2012-13 is 36 percent and for 2017-18 is 35 percent. The relative change between 2007 and 2013 is 20 percent, which means that 20 percent increment noted in number of

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individuals who are multidimensional poor. From 2013 to 2018 negative trend is noted as result shows that -1 percent decrease is recorded in number of people who are multidimensional poor (*H*).

The table of Alkire and Foster (2011) measurement also shows that average intensity of multidimensional poverty (*A*) in 2006-07 recorded as 42 percent which increased by 1 percent from 2007 to 2013 and no notable change recorded in 2018 results. These results shows that on average people are deprived in 42 percent dimensions in 2006-07 and 43 percent in remaining two years results.

As adjusted headcount ratio (M_0) or the MPI is the product of $M_0 = HA$, so we will see the similar changes in the value of M_0 . During the 2007 value of MPI is 7 percent and 15 percent recorded in 2013 and 2018 results. The relative change during 2007 and 2013 is noted as 8 percent and no notable change recorded during 2013 and 2018.

When we see the results, it is noted that a raise is recorded in MPI of Pakistan. The raise in multidimensional poverty could be due to terrorism activities which were on peak in 2007 to 2013 until the national action plan is implemented. Hyder et al., (2015) showed in their study that terrorism has severely affected the socio-economic structure of Pakistan. Lot of migration took place due to several operations by Pakistan Army in tribal areas to control the terrorism activities. These operations cause collapse of infrastructure which also damage all three main dimensions of multidimensional poverty (Education, Health and Living Standard).

Table 6
Poverty measures by Alkire and Foster 2011

	<i>H</i>		<i>H</i> %		M_0		M_0 %		<i>A</i>		<i>A</i> %				
Pakistan	2006-07	2012-13	2007-08	2008-12	2012-13	2006-07	2012-13	2015-18	2006-07	2012-13	2017-18	2006-12	2012-13		
K=33%	0.16	0.36	0.13	20.00	-1.00	0.07	0.15	0.15	8.00	00	0.42	0.43	0.43	1.00	00
National															
Bangladesh	2007	2011	2014	2007-11	2011-14	2007	2011	2014	2007-11	2011-14	2007	2011	2014	2007-11	2011-14
K=33%	0.25	0.24	0.28	-1.00	5.00	0.12	0.12	0.14	00	2.00	0.48	0.52	0.48	4.00	-3.00
National															
India	1998-08	2007-06	2011-16	1998-08	2006-16	1998-06	2007-06	2015-18	1998-06	2006-16	1998-09	2011-08	2011-16	1998-08	2006-18
K=33%	0.23	0.31	0.23	8.00	-6.00	0.10	0.14	0.11	4.00	-3.00	0.43	0.44	0.43	1.00	-1.00
National															

Another reason to raise the MPI in the beginning could be that the urbanization of Pakistan in these years was on increasing trend which raised the MPI. DHS increased their survey area, that might be included those districts or areas which are more multidimensionally poor, like; districts of Balochistan and KPK which were not accessible during 2006-07 due to law and order situation of these provinces. Iqbal et al., (2018) described in their study that micro financing played a vital role to reduce poverty in rural areas of Pakistan during 2018.

Bangladesh

By using Alkir and Foster (2011) approach the second sample country to discuss is the Bangladesh, for which we use data of three different durations (2007, 2011, & 2014). The percentage of multidimensional poor (H) in 2007 is 25 percent, for 2011 is 24 percent and for 2014 is 29 percent. The relative change between 2007 and 2011 is 1 percent, which means that 1 percent decrease noted in number of individuals who are multidimensional poor. From 2011 to 2014 also positive trend is noted as result shows that 5 percent increase is recorded in number of people who are multidimensional poor (H).

The table of Alkire and Foster (2011) measurement shows that average intensity of multidimensional poverty (A) in 2007 is 48 percent which increased by 4 percent in 2011 and negative change recorded in 2014 results, which is -3 percent. These results shows that on average people are deprived in 48 percent dimensions during 2007 and 52 percent in 2011 and -3 percent decrease is recorded in 2014 results which is 49 percent.

As adjusted headcount ratio (M_0) or the MPI is the product of $M_0 = HA$, so we will see the similar changes in the value of M_0 . During 2007 value of MPI is 12 percent and same recorded in 2011, only 2 percent increase recorded in 2014 results. The relative change during 2007 and 2011 is 0 percent and 2 percent change recorded during 2014. Salahuddin et al., (2013) indicated in their study that long run relationship exist between financial development, economic growth and poverty reduction in Bangladesh.

The stability in MPI of Bangladesh could be, because the country like Bangladesh was not having law and order situation like Pakistan during this tenure. That did not disturb their education, health and living standards. The second thing which could be an important factor is industry flee from Pakistan and took place in Bangladesh. The intensity of poverty in Bangladesh is higher than Pakistan which shows that the poor of Bangladesh is more deprived in three dimensions as compare with deprived individual in Pakistan. In last year 2 percent increase is recorded only.

India

By using Alkir and Foster (2011) approach our third sample country is India. We use data of three different durations (1998-99, 2005-06, & 2015-16). The percentage of multidimensional poor person (H) in 1998-99 is 23 percent, for 2005-06 is 31 percent and for 2015-16 is 25 percent. The relative change between 1999 and 2006 is 8 percent, which means that 8 percent increment noted in number of individuals who are multidimensional poor. From 2006 to 2016 negative trend is noted as result shows that -6 percent decrease is recorded in number of people who are multidimensional poor (H).

The table of Alkire and Foster (2011) measurement also shows that average intensity of multidimensional poverty (A) in 1998-99 is 43 percent which increased by 1 percent during 2006 and -1 percent decrease recorded during 2016, which means that average intensity of poverty is declined by 1 percent from 2006 to 2016. These results shows that on average people are deprived in 43 percent dimensions in 1998-99, 44 percent in 2005-06 and 43 percent again in 2016 results.

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As adjusted headcount ratio (M_0) or the MPI is the product of $M_0 = HA$, so we will see the similar changes in the value of M_0 . During the 1999 value of MPI is 10 percent, 14 percent recorded in 2006 and 11 percent noted in 2016 results. The relative change during 1999 and 2006 is noted as 4 percent and -3 percent in 2016.

The results of our calculated MPI shows boost of 4 percent from 1999 to 2006, which could be due to several reasons. We may consider the urbanization issue like the whole region India is also facing this issue, which increase the multidimensional poverty. The second aspect is expansion of data collection population from urban area to rural areas, which could have impact on the results of MPI calculation. When we see the indicators of three dimensions India is highlighted internationally like, UNDP that India does not have basic sanitation facilities as majority of people facing deprivation in this indicator. Drinking water is also not easily accessible so these could be the reasons to increase the graph of MPI during 1999 to 2006. According to the Global MPI (2019) it is noted that a declining trend is recorded during 2006 to 2016 MPI. As our results shows that from 2006 to 2016 the MPI is declined 3 percent. This could be due to several programs which run by UNDP in India to help out the deprived individuals. The boost in the information and technology industry also has positive impact because the share of India in global IT industry is significant. Sehwat et al., (2016) described that in long run and short run, financial development and economic growth reduce poverty in India.

The results of our study by using Alkire and Foster (2011) method are not consistent with the study of Berenger (2019) which is conducted in Africa by using this technique. Berenger (2019) study shows that only decline is recorded in the sample countries by using this method which was due to several poverty reduction programs in those sample countries. The concentration of the whole world (UN) is on the African countries, as severe poverty recorded in this region. In Asia UN also launched different programs to control the multidimensional poverty but in our sample countries the poverty reduction is not significant except India.

Rippin's (2010) Measurers

Table 7
Rippin's (2010) measures' variations and their components of $\gamma=1.5$

Pakistan	2007-2013				2013-2018			
K=33%	ΔP^{RI}	ΔH	$\Delta A^{2.5}$	$\Delta GE^{*2.5}$	ΔP^{RI}	ΔH	$\Delta A^{2.5}$	$\Delta GE^{*2.5}$
National	187.50	20.00	-02.50	-9.375	1.01	-01.00	02.00	-1.27
Bangladesh	2007-11				2011-14			
K=33%	05.28	-01.00	10.00	-1.32	-15.90	05.00	-07.50	1.06
National								
India	1999-06				2006-16			
K=33%	08.40	08.00	02.50	1.05	-01.06	-06.00	-02.50	-0.178
National								

Rippin's (2010) is the measure which allows the multiplicative decomposition among the intensity ($A^{2.5}$), incidence of poverty (H) and inequality of deprivations among

the deprived individuals. Above mentioned table shows the outcomes of the decomposition of poverty measures which is based on Rippin’s (2010) approach. The parameter value of the extent of severity of poverty γ is equal to 1.5. Value of Rippin’s (2010) measures which is denoted by P^{RI} increase by 187.50 percent during 2007-13 and increase by 1 percent from 2013-18 in case of Pakistan. $GE^{*2.5}$ shows that inequality in deprivations among the poor decrease by 9.38 percent and during 2013 and 2018 it is 1.27 percent. In case of our second sample country (Bangladesh) P^{RI} increase 5.28 percent from 2007 to 2011 and decrease 15.90 percent from 2011 to 2014. $GE^{*2.5}$ from 2007 to 2011 decrease by 1.32 percent and increase by 1.06 percent from 2011 to 2014. Which shows that inequality in deprivations among poor decrease in first tenure and increase in second tenure. Our third sample country (India) Rippin’s (2010) measures P^{RI} shows 8.4 increase from 1999 to 2006 and 1.06 percent decrease from 2006 to 2016, the comparison between two tenure shows decline of poverty on average. $GE^{*2.5}$ of India during 1999 in 2006 is 1 percent which shows increase in inequality in deprivations among poor and a nominal decrease from 2006 to 2016. Results of our sample by using Rippin’s (2010) are inconsistent with Berenger (2019) study. Study of Berenger (2019) conducted in African region and showed decline in head count ratio and intensity of the poverty in the region. Our study shows increase in deprived individuals and intensity of poverty in South Asian region.

Table 8
Chakravarty and D’Ambrosio Measures of Poverty (P^{CD} with $\alpha = 2$)

Pakistan K=33% National										
P^{CD}			RC (%)		α^2			RC (%)		
2007	2013	2018	2007-13	2013-18	2007	2013	2018	2007-13	2013-18	
0.28	0.36	0.56	08.00	20.00	0.017	0.019	0.032	0.20	1.30	
Bangladesh K=33% National										
P^{CD}			RC (%)		α^2			RC (%)		
2007	2011	2014	2007-11	2011-14	2007	2011	2014	2007-11	2011-14	
0.46	0.79	0.61	33.00	-18.00	0.018	0.033	0.021	1.50	-1.20	
India K=33% National										
P^{CD}			RC (%)		α^2			RC (%)		
1998-99	2005-06	2015-16	1999-06	2006-16	1998-99	2005-06	2015-16	1999-06	2006-16	
0.65	0.53	0.24	-12.00	-29.00	0.028	0.017	0.019	-1.10	0.20	

Source: Author’s illustration based on Calculations.

Chakravarty and D’Ambrosio (2006) measures is denoted with P^{CD} . We can express P^{CD} for $\alpha = 2$ as the sum of the average deprivation scores’ square and of their variance. In our first sample country (Pakistan) the poverty estimates increase from 28 percent in 2007, 36 percent in 2013 and 56 percent in 2018 respectively. In case of second sample country (Bangladesh) relative change of poverty estimates increase by 33 percent during 2007 and 2011. It is recorded that it is decreased by 18 percent in next

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tenure (2011-2014). Third sample country (India) shows 12 percent decrease in poverty estimates from 1999 to 2006 tenure and decreasing trend is continue in 2006 to 2016 duration. The contribution of inequality components in our first sample country (Pakistan) shows nominal increment in first duration (2006 – 2012) and 1.30 percent increase in second duration (2012 – 2018), which means that weightage of sever poverty within multidimensional deprived individuals increased by these numbers respectively. The second sample country (Bangladesh) shows 1.50 percent increase in contribution of inequality components during first tenure (2007 – 2011), and 1.20 percent decrease in second tenure (2011 – 2014). In case of third sample country (India) result shows that during first period (1999 – 2006) the contribution of inequality components decrease by 1.10 percent and increase by nominal percentage in second tenure (2006 – 2016). Result of our sample country India is consistent with the Berenger (2019) study as relative change shows decline in poverty. Results of other two sample countries (Pakistan, Bangladesh) are inconsistent with the Berenger (2019) by using Chakravarty and D’Ambrosio (2006) measure. Other international reports (OPHDI, 2018) also showed that decline of poverty in India is significant in the region.

Conclusion

The main objective of this study was to compare the obtained results when using three different poverty measures which are proposed by Alkire and Foster (2011), like MPI by UNDP, and counting based poverty measures, which are sensitive to inequality measures. These are measures which are proposed by Rippin (2010) and Chakravarty and D’ Ambrosio (2006). The dual cut-off method used to identify poor individuals by setting value of $K=33$. This study showed that how the other measurement approaches complements the results obtained by MPI with regard to inequality.

The DHS surveys data of poverty measurement is used for three different years of Pakistan (2006-07, 2012-13 and 2017-18), Bangladesh (2007, 2011 and 2014) and India (1998-99, 2005-06 and 2015-16) by considering deprivation in three dimensions of poverty, which are education, health and standard of living.

The results of our study shows that the highest poverty level is found in India followed by Bangladesh and Pakistan by using Alkire and Foster (2011) method to measure multidimensional poverty. In case of Rippin’s (2010) method we found that highest reduction of inequality within deprived individuals is found in Pakistan, and increase in Bangladesh, and India. The third approach of Chakravarty and D’Ambrosio (2006) shows that highest poverty estimation is found in India followed by Bangladesh and Pakistan. In case of contribution of inequality components it is found that they are increased in all three countries approximately at similar level. The evolution of multidimensional poverty over time for each country examine by using three multidimensional poverty measures, which provided insightful information on the evolution of the inequality and breadth of multidimensional poverty.

Table 9

Number of People who are counted as deprived and MPI poor in South Asia

Indicators	MPI poor individual share in percentage (%)								
	Bangladesh			India			Pakistan		
	2007	2011	2014	1998-99	2005-06	2015-16	2006-07	2012-13	2017-18
Child Enrolment	32	4	27	84	51	26	65	69	73
Years of Schooling	72	73	65	73	29	19	72	62	68
Nutrition	55	63	64	80	74	76	48	48	43
Mortality	89	3	90	84	96	97	88	87	93
Water	-	96	4	9	1.33	1.23	7	1.64	5
Electricity	63	44	52	35	1.17	1	11	1.72	8
Sanitation	76	84	87	91	73	93	90	79	88
Floor	87	80	85	-	52	28	43	28	44
Cooking Fuel	98	97	97	-	36	37	66	60	57
Assets	94	99	96	99	98	99	96	99	99

Source: Author's illustration based on Calculations.

Above table is presenting the MPI poor individual share in different indicators in our three sample countries. Child enrolment share is alarming for Pakistan as it is showing increasing trend and country need to prioritize it and do strict actions against child labor and motivate their parents to enroll them in schools. Primary level years of non-completion percentage is high in Pakistan and Bangladesh, so both countries need to monitor the enrolled student that they must complete their education without any disturbance. Third indicator nutrition is showing more deprived people in India and Bangladesh as compare to Pakistan. Both countries should make sure that available food is hygienic and must fulfill the required nutrition. Fourth indicator mortality is higher in all three sample countries. All three countries need to concentrate on child vaccination and better facilities of maternity to control this deprivation. Water facility is better in all three countries. Proper sanitation is required in all three countries. Due to haphazardly developed new cities and expansion of towns creating problem for proper sanitation. Planned cities and proper implementation of rules and regulation of different development authorities will help to solve this issue. Illegal construction on drainage is also on major reason to create hurdle in proper sanitation. Bangladesh housing facilities like floor is not as per the standard. Cooking fuel is one of the basic necessity, Bangladesh and Pakistan is facing more deprivation in this indicator. Both countries need to provide the natural gas for cooking, it is economical and also environment friendly and it will also stop deforestation. The cutoff line for asset is that household does not own more than one radio, TV, telephone, bicycle, motorcycle or refrigerator and does not own a car. All three sample countries showing high deprivation in assets.

Regional Level Recommendations

As our study comprises on the sample of three countries, which are major countries of the Region and cover most of the population of the region, so we would like to give recommendations at regional level and national level also.

- As this study showed that all three approaches to measure multidimensional poverty, provided results which tell us about breadth and inequality of poverty, so it is recommended to implement these techniques at regional level to get the results which will be helpful for SAARC to make the policies accordingly for the region.

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- As results of India shows a significant decline in poverty from 2006 to 2016 and OPHDI (2018) report also described that India reduce poverty in all ten indicators and they target the rural areas extensively to reduce the poverty which shows the results. India also implemented several social protection programs which aim to improve living standard of their people. So the second recommendation is that SAARC countries should learn from India to let the multidimensional poverty down.
- UNDP programs are also looks fruitful in India so other countries of the region should also make sure that implementation of UNDP programs and other aid programs should be utilize efficiently and effectively with good monitoring and control system.

National Level Recommendations

- Results of our study showed that all three measurement to measure the depth and inequality of multidimensional poverty are effective, so these all three measurements are recommended at national level to measure the multidimensional poverty.
- These approaches could be implemented at district levels which help the policy makers to make the policies which will be effective to reduce the depth and inequality of multidimensional poverty at grass root level.
- It is also recommended at national level that we should make sure the data is collected properly from rural areas and those areas which are far behind in development.
- These techniques would be helpful to highlight the more deprived districts, which will be help for international donor agencies and national policy makers to concentrate on more deprived areas and indicators.
- The stakeholders who can play an important role are: Civil Society, Academia, Major faith groups and donors, Private sector and Government agencies for poverty alleviation.

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