Measurement of Multi-Dimensional Poverty in India: A state level analysis

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Measurement of Multi-Dimensional Poverty in India: A state level analysis

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Abstract:
The paper measures the multidimensional poverty index (MPI) in India by considering National Sample Survey (NSS) data on 'Consumption Expenditure' for the period of 2004-05 and 2011-12 by using Alkire and Foster's (2011) methodology and by considering three main indicators i.e., standard of living, education and income at the household or persons level. The results show that multidimensional poverty head count has declined from 62.2 percent in 2004-05 to 38.4 percent in 2011-12. However, rural/ urban separate analysis clearly indicates a sharp decline in rural poverty compared to urban poverty reduction. Lack of education of the household members made the highest contribution to poverty, followed by income and standard of living in India. State level analysis show that Jharkhand, Uttar Pradesh, Rajasthan, Orissa, Bihar, Chhattisgarh, and Arunachal Pradesh, have a higher poverty head count ratio while Kerala, Mizoram, Nagaland, Punjab, Himachal Pradesh, and Haryana have lower poverty rate. Promoting local resource and tourism based industries through urbanization, higher and job oriented education, and long term saving for creating funding are required to reduce poverty in India.

Key Words: Consumption expenditure, multidimensional poverty, poverty Indices, India
JEL classification: I30, I32, R10

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1. Introduction

Impact of reforms on inequality and poverty is an intensely debated issue in India. Due to paucity of data mostly income data in different time periods, one could not get a clear explanation or find an end to the debate. Economic growth cannot be the main objective of economic policy; it is also important to ensure that the benefits of growth reached to all sections of society. To examine whether growth has been beneficial to all section of society, we need to measure poverty in all its manifestations. Also, poverty measurement is essential to assess how an economy is performing in terms of providing a certain minimum standard of living to all its citizens. The measurement of poverty and the perception of poverty certainly vary across countries and states over time. Therefore, the measurement of poverty has very significant policy implications.

Dr. C. Rangarajan suggested that poverty is easy to perceive but difficult to be precise about.[1] India has had a long history of studies on the measurement of poverty. The latest poverty measurement by the expert group headed by Dr. C. Rangarajan has taken a new look at the methodology for the measurement of poverty. The new poverty line not only considers calorie intake but also proteins and fats consumption. Also, it has introduced new norms for the measurement of non-food expenditures in the construction of poverty line. However, it considers only consumption expenditure to measure the poverty in India. It is important to note here that due to unavailability of income data in India, consumption is considered as proxy of income.

The uni-dimensional poverty measurement has been criticized by many economists. For example, Sen (1980) argued that income may not be translated into basic needs. Therefore, deprivations such as in education, health, social and political status are very important to measure poverty as they are also harder to quantify through price. Therefore, measurement of multidimensional aspects of poverty is very important as it considers two approaches i.e., poverty as capability deprivation (Sen, 1993) and poverty as counting measure of deprivation (Atkinson, 2003). Recent studies (e.g., Tsui, 2002; Bourguinon and Chakravarty, 2003) have emphasized on multidimensional aspect of poverty. Multidimensional Poverty Index (MPI) considers both incidence and intensity of deprivation which is superior over measuring poverty

[1]More details are available from the following website; http://www.thehindu.com/opinion/op-ed/the-need-to-measure-poverty/article6288450.ece (Accessed on 26th July,2017)

only on the basis of income and consumption level. The MPI has also advantages over the HDI as HDI measures wellbeing at country level; on the other hand, MPI uses household-level data.

The Oxford Poverty & Human Development Initiative (OPHI) jointly with United Nations Development Programme developed the Multidimensional Poverty Index (MPI) in 2010. The MPI uses different factors to determine poverty beyond income. Alkire and Santos' (2010) method for calculating MPI has been used by OPHI to analyze poverty status for 104 countries. However, Alkire and Foster's (2011) methodology is used to measure multidimensional poverty index in more widely as it summarizes a plurality of not-perfectly overlapping deprivation domains into a consistent parametric class of multidimensional poverty indices (Pacifico and Poege, forthcoming). The method gained popularity as it was based on Foster-Greer-Thorbecke (FGT) indices, and it can also be used for decomposition not only for population subgroups but also by deprivation domains.

With this backdrop, the main objective of this paper is to measure the Multi-dimensional poverty index for India. For this purpose Alkire and Foster (2011) method has been used. National sample survey household or unit level data on consumption expenditure for the period of 2004-05 and 2011-12 have been used to calculate the MPI. Used for analysis in this paper are three major categories of indicators i.e., standard of living, education, and income to measure MPI in India. Novelty of this paper is the use of NSS data to calculate MPI. It is important to note here that government of India makes many important decisions based on NSS data; for example NSS data on consumption expenditure is used to arrive at poverty lines in the country. Therefore, the use of NSS data to measure MPI stands can be taken as a new contribution to poverty literature in India. As government of India calculates poverty line for rural and urban separately, we also calculate MPI separately for rural and urban areas as it provides completely different pictures and helps to prescribe appropriate policy to reduce multi-dimensional poverty in India, by formulating rural and urban policies separately. In addition, state level Multidimensional Poverty indices are calculated separately in this paper for rural and urban for easy formulation of state level policies.

Rest of paper is organized as follows. Section 2 provides the brief review of literature. Methodology and data used are explained in sections 3 and 4. Results of analysis are presented in section 5. Finally, main conclusions and discussions are discussed in sections 6 and 7.

2. Review of literature

There are very few studies in India which measure Multi-dimensional Poverty. The studies could be grouped in terms of different data use for measuring MPI.

Using secondary data, collected from different issues of periodic reports produced by OPHI and various other research reports, Kumar et.al (2015) calculated the state wise Multi-dimensional Poverty Index (MPI) for India. The authors used health (measured by child mortality and nutrition), education (years of school and child enrolled), and household-status (cooking fuel, toilet, water, electricity, floor and assets) to measure the MPI for India. As revealed by their exercise among the 28 states Goa, Punjab, Himachal Pradesh, Tamil Nadu are in a vulnerable stage; Kerala is in very good position in Multidimensional poverty index while remaining states are in very bad position. It was also revealed that 81.4 percent of the Scheduled Tribes are poor, compared with 33.3 percent of the general population in India.

Three rounds of National Family and Health Survey (NFHS) data, i.e. for the years 1992-93, 1998-99 and 2005-06 were considered in the study by Chaudhuri et al. (2014) to calculate MPI in India. The study considered different variables of Standard of Living, Health and Education to measure the state level MPI. The study also highlighted the existence of intra urban imbalances and female multi-dimensional deprivation in India. The study found that development has been imbalanced in the country with poorer states continuing to be poor. For example Bihar has remained as the most deprived state over the three rounds of NFHS data. Contrary to the results of income poverty that shows a systematic decrease in poverty in all states in India, the MPI calculations show an increase in poverty in few states like Arunachal Pradesh, Tripura and Manipur by 4.7%, 5% and 0.7 % respectively during 1992-93 and 2005-06. The study by Alkire and Suman (2008) uses Below the Poverty Line (BPL) 2002 methodology and NFHS to calculate MPI for India. The study found that up to 12 per cent of the poor sample population and 33 per cent of the extreme poor could be misclassified as non-poor by the pseudo-BPL method. Mohanty (2011) using unit data from the National Family and Health Survey 3, measured poverty in multidimensional space and examined the linkages of multidimensional poverty with child survival. The study found that child survival is significantly lower among abject poor compared to moderate poor and non-poor.

Mishra and Ray (2013), using National Sample Survey (NSS) and National Family Health Survey (NFHS) datasets considered a wider range of deprivation dimensions and provided a comprehensive and wide ranging assessment of changes to living standards in India for the period, 1992/93-2004/5, i.e. the period of Economic Reforms and the immediate post reforms period. The analysis is done both at regionally disaggregated levels and by socio economic groups.

Using NSSO data, Sarkar (2012) drew up a Multi-dimensional poverty index taking into consideration eight indicators such as the highest educational attainment of household members, mean per capita expenditure, protein, calorie, employment, land, electricity and cooking fuel. Considering all the indicators the author drew up the Multidimensional Poverty Index and analyzed the poverty status in rural India comparing rural NSSO quinquennial rounds. There were two methods of defining poverty line as proposed by the Task Force. One corresponds to minimum calorie requirements and the other was obtained using the Consumer Price Index for Agricultural Labour of Rural India. Sarkar merged these two methods by considering recent (for 61st round) Tendulkar Committee report poverty line and Consumer Price Index for agricultural labour. These methods of poverty measurement by Indian Government have been criticized by many. It is clear that Indian government laid more emphasize on growth over poverty removal. The slackening of Tendulkar Committee poverty line norms by the Planning Commissions has resulted in presenting accelerated reduction in poverty figures but there was indeed no reduction in poverty.

Most recently, Dehury and Mohanty (2015) using unit data from the Indian Human Development Survey (IHDS), 2004-05, estimated and decomposed the multidimensional poverty dynamics in 84 natural regions of India. Multidimensional poverty is measured in terms of indices of health, knowledge, income, employment and household environment. Results indicate that about 50% of India's population is multidimensional poor though with large regional variations. More than 70% of the population is multidimensional poor in the Mahanadi Basin, the southern region of Chhattisgarh and the Vindhya region of Madhya Pradesh, while it is less than 10% in the coastal regions of Maharashtra, Delhi, Goa, the mountainous region of Jammu and Kashmir, the Hills region and Plains region of Manipur, Puducherry and Sikkim.

Vijaya et al. (2014) using Karnataka Household Asset Survey (KHAS) data constructed an individual level multidimensional poverty measure for Karnataka, India. Results showed that an individual level measure can identify substantial gender differences in poverty that are masked at the household level. The authors also find large potential for misclassification of poor individuals as non-poor when poverty is not assessed at the individual level.

Review of results clearly shows that the number of studies that measure MPI in India is very limited. Use of NSS data has also been very limited. Therefore, this study seeks to fill this gap by using the latest NSS data.

3. METHODOLOGY

Alkire and Santos (2008) method has been used to measure MPI by different countries focusing on different contexts. However, this study uses Alkire and Foster (2011) method to measure multidimensional poverty for India. .

Before presenting the study results, it is necessary to explain the method in a nutshell. The method is explained by taking data for n individuals with $d \geq 2$ dimensions. $[y_{ij}]$ is the matrix of achievements in this model . Each element y_{ij} denotes the achievement of individual $i = (1(1)n$ in j_{th}dimension where $j = 1(1)d$. Let z_j be the cutoff point (or criteria) for each dimension j .

Define an identification function $I_{yi,z}$: $y_i \times z \rightarrow \{0,1\}$. In particular

$$I_{yi,z} = 1 \; if \; i \in S_j$$
$$= 0 \; if \; i \in (S \backslash S_j)$$

Where $S = S_j \cup \left(\frac{S}{S_j}\right) \forall \, j \in d$ and $card(S) = n.$ So we need to first identify the set of individual S_j who are deprived in dimension j.

Three case scenarios can be considered here.

First, All y_{ij}s are cardinal (categorical). Let dimension j has K_j order (or category) and let $k_j \subset k_j$ is the subset which denote deprivation set. In that case

$$I_{yi,z} = 1 \; if \; i \in k_j$$

$$= 0 \; if \; i \in (K \backslash k_j)$$

Second, All y_{ij}s are cardinal. We defined z_j is the cut-off point of jth dimension where $j \in d$. In that case

$$I_{yi,z} = 1 \; if \; y_{ij} < z_j \; \forall \; j \in d$$
$$= 0 \; if \; y_{ij} \geq z_j \; \forall \; j \in d$$

Third, most importantly, some y_{ij}s are cardinal and some ordinal, which is more commonly observed in survey data. We will use both to identify the poverty. Once the dimensional poverty is defined we will have a matrix $\left[I_{ij}\right]_{n\times d}$, such that

$I_{ij} = 1 \; if \; y_{ij} < z_j \forall \; j \in k_j$ when j is ordinal and

= 0 otherwise.

The next step is to aggregate those information in order to derive a single value which distinguish a person as poor or non-poor. It is worthwhile to mention two very popular processes here: a) union approach b) intersection approach. According to union approach a person is said to be poor if (s)he is deprived at least one dimension i.e.

$I_{i\blacksquare} = \sum_{j=1}^{d} I_{ij} > 1$

where I_{ij} is the row vector of the matrix $\left[I_{ij}\right]_{n\times d}$. On the other hand a person is said to be poor, according to intersection approach id (s) if he is deprived in all dimensions i.e

$$I_{i\blacksquare} = \sum_{j=1}^{d} I_{ij} = d$$

Poor could also be defined as the intermediate situation, i.e.:

$I_{i\blacksquare} = \sum_{j=1}^{d} I_{ij} = d : m \in (1, d)$

In practice a weighted mean is used where weight w_j is attached for dimension . Then if

$I_{i\blacksquare}^{w} = \sum_{j=1}^{d}(I_{ij} * w_j) \geq \frac{\sum w_j}{j}$ for union approach

$= \sum w_j$ for intersection approach

$= \overline{w} \in (\frac{\sum w_j}{j}, \sum w_j)$ for intermediate case.

When dimensions are equally important, then $w_j = {}^{1}/_{j}$ is a plausible choice. For the purpose of this study equal importance stance will be adhered to.

Let us define an indicator vector whose element is defined by $H_i = 1$ if $I_{i\blacksquare}^{W} \geq \sum \frac{w_j}{j}$ and 0 otherwise. Then the column sum $\sum H_{i\blacksquare} = q$ is nothing but the headcount of the poor. And $H = \frac{q}{n}$ is the headcount ratio. Note that each entry of the vector $I_{i\blacksquare}$ denote the count of deprivation of ith individual. Hence average deprivation share across the poor is given by

$$A = \sum_{I=1}^{n} I_{i\blacksquare}/(qd)$$

Hence the adjusted headcount ratio using multidimensional is

$M = H * A$

4. DATA USED

To calculate multidimensional poverty index, this study uses two rounds of data sets of NSS data for the years 2004-05 and 2011-12. Due to non-availability of income data at the individual level, the urban monthly per capita consumer expenditure (MPCE) data from respectively the 61st and 68th Round of the National Sample Survey (NSS) are used as proxy for the years 2004-05 and 2011-12. Following the Expert Group's (Tendulkar committee) suggestion, the MRP (Mixed Reference Period) based consumption data is considered.[2] Table 1 presents the total sample households used for the estimation of multidimensional poverty index for India.

Table 1: Sample size and poverty line in different NSS years

Year	Rural	Urban	Rural	Urban
	Sample household size		Poverty line (Tendulkar methodology based) (Rs.)	
2004-05	79298	45346	447	579
2011-12	59695	41967	816	1000

Source: Authors' compilation

While computing index, 9 indicators are used to measure the index. The nine indicators are re-grouped into three major dimensions, i.e., education, income, and standard of living, and each

[2] MRP-based estimates capture the household consumption expenditure of the poor households on low frequency items of purchase more satisfactorily than the URP (Uniform Recall Period). However, NSS 68th Round in 2011-12 provides MMRP (Modified Mixed Recall Period) data. However, MMRP based MPCE data are not available for the year 2004-05. On the other hand, 66th Round of NNS in 2009-10 consumption expenditure data are not used here as 2009-10 was not a normal year because of severe drought (hence NSSO repeated the consumption expenditure survey in 2001-12). So a comparison among 2009-10 and other years may not give useful results.

indicator is given a weighted score following the rule that each dimension is equally weighted 1/3, and each indicator within a same dimension is equally weighted. As education and income have only one indicator each, this study assigns equal weight .i.e., 1/3 to them. However, as standard of living has seven indicators, the weighted score for this dimension is equal to 0.047 = (1/3*1/7).

The total number of weighted deprivations is aggregated for each household and individual with the identification of poor based on a poverty cut-off (i.e., k) of 30 per cent as per the methodology of the UNDP-MPI. Therefore, Vijaya et al. (2014) also use 30 per cent poverty cut-off to measure multidimensional poverty for the Indian state of Karnataka. Further, poverty analysis has been carried out for rural and urban areas separately in order to assess the existing rural urban differences in deprivation. The indicators taken are as follows-

Table 2: Details of Indicators used to measure

Dimensions	Indicators/Variables	Weights	Cutoffs
Standard of Living	Employment	Weight= 0.047 = (1/3)*(1/7)	Labourers
	Agriculture Land		1 acre
	Irrigated land		0.5 acre
	Source of lighting		No access of electricity
	Cooking fuels		Firewood and Chips, coke and coal, dung cake, charcoal.
	Dwelling unit		Not owned
	Ration card		Having ration card
Education	Highest education attainment in household	1/3 = 0.333	Primary schooling
Income	MPCE	1/3 =0.333	National Poverty line

Source: Authors' compilation

Table 2 presents the details of the Indicators used to measure the MPI. Based on available NSS household level data, this study relies on different indicators to measure MPI, and two rounds of NSS data are used to construct the MPI. In the context of employment, NSS 61st Round in 2004-05 provides information for rural areas on self-employed in agriculture, self-employed in non-agriculture, agricultural labour, other labour, and others. Further, for urban areas, information on self-employed, regular wage/salary earning, casual labour, and others are provided in different NSS rounds. Given this information, this study takes agriculture labour for rural areas and regular wage/salary earner for urban areas as cutoffs to measure state level MPI. However, to measure all India level MPI the study uses regular wage/salary earner as the cutoff.

On the other hand, NSS 68th Round provides information on self-employed worker in agriculture and non- agriculture, regular wage/salary earners, casual labourer in agriculture, non-agriclture, others. Therefore, agriculture labourer from self-employed and casual labour are taken as cut-offs to measure rural MPI at state level. On the other hand, for urban areas information on self-employed, regular wage/salary earning, casual labour, others are provided; therefore, regular wage/salary earning are taken as cut-offs to measure urban MPI at state level. To calculate all India level MPI we use wage/salary earner as cutoffs.

Two types of land holding information are provided by NSS, i.e., agriculture land and irrigated land. In this study, 1 acre agriculture land and 0.5 acre irrigated land respectively are taken as thresholds. For household lighting, NSS data provide information on consumption of kerosene, other oil, gas, candle, electricity, others, as also 'no lighting arrangement' at the household level. Electricity (availability-consumption) is taken as cutoff to measure state level MPI in India. In the context of household's cooking fuels, information on coke, coal, firewood and chips, LPG, gobar gas, dung cake, charcoal, kerosene, electricity, others, and 'no cooking arrangement' are given by NSS. Consumption of firewood and chips, coke and coal, dung cake, charcoal are taken as cut offs to measure MPI in India. NSS provides three types of information on dwelling units, i.e., hired, 'no dwelling units', and others; therefore, 'no dwelling unit' has been considered as the cutoff. Ration card is one of the indicators for identifying poor households in India, and households having ration card are treated as deprived. Therefore, households having ration card are treated as cutoffs to measure rural and urban MPI in India. In regard to household education, NSS data provide different information on education, i.e., literate without formal schooling, below primary, primary, middle, secondary, higher secondary, diploma/certificate course, graduate, and postgraduate and above, primary schooling is taken as cutoff in this study. Finally, as NSS data does not provide income data, Monthly Per-Capita Expenditure (MPCE) is considered as a proxy. While national poverty lines considered are as calculated and recommended by Tendulkar Committee, state level poverty lines with rural-urban distinction are used to calculate state level rural and urban MPI, separately.

Contribution of Indicator i to MPI = $= \frac{w_i CH_i}{MPI_{state}} * 100$

CH denotes Censored Headcount Ratio (CH has been calculated by adding up the number of poor households deprived in a particular indicator and then dividing by the total number of households surveyed) and W denotes weights given to each indicators.

5. Results analysis

Table 3 presents the calculated values of different MPI. According to poverty figures, 62.2 percent of people in India were poor in 2004-05, which has declined to 38.4 percent in 2011-12, i.e. a total decline of 23.8 percent in 7 years, and 3.4percent decline in each year. The adjusted headcount ratio shows that poverty in India declined from 38.3 percent in 2004-05 to 21 percent in 2011-12. The average multidimensional poverty intensity also declined from 61.6 percent in 2004-05 to 54.7 percent in 2011-12. Other measures of MPI such as, Adjusted Poverty Gap, Adjusted Foster-Greer-Thorbecke (FGT) Measure, average poverty gap, and Average Squared Poverty Gap also showed a decline in poverty in India in the years 2004-05 to 2011-12.[3] Rural urban analysis suggests that Multidimensional Deprivation poverty Headcount declined in the years 2004-05 to 2011-12 for both rural and urban areas.[4] In rural areas, it declined from 60.2 percent to 16.7 percent during the above years, which is about 43.5 percent decline. On the other hand, for urban areas it declined from 33.4 percent to 20 percent in the years from 2004-05 to 2011-12. Results show that rural areas have experienced a higher decline in MPI than urban areas. The calculated values of Adjusted Headcount Ratio show that rural (or urban) areas experienced a decline from 33.2 (or 19.2) percent in 2004-05 to 8.4 (or 9.8) percent in 2011-12. The calculated values of Average Multidimensional Poverty Intensity also declined for rural (or urban) areas from 55.1 (or 57.6) percent in 2004-05 to 50.4 (or 49.2) percent in 2011-12. Other MPI measurements also show similar results, as shown in Table 3.

[3] We are using many ordinal variables, therefore the results obtained from Adjusted Poverty Gap, Adjusted Foster-Greer-Thorbecke (FGT) Measure, average poverty gap, and Average Squared Poverty Gap are not highlighted as these measures depend on coding of the input variables. However, we try to solve this problem by adding a constant to an ordinal variable and adjusting the threshold accordingly.

[4] It is important to note that all India level, rural and urban level analysis directly cannot not be compared as the MPI measurement indicators are defined differently for these three measurements.

Table 3: Estimated results of the Multidimensional poverty index

Various MPI measurements		2004-05						2011-12					
		India (in %)	SE	Rural (in %)	SE	Urban (in %)	SE	India (in %)	SE	Rural (in %)	SE	Urban (in %)	SE
H	The Multidimensional Deprivation Headcount	62.2	0.003	60.2	0.003	33.4	0.007	38.4	0.003	16.7	0.003	20	0.003
M(0)	The Adjusted Headcount Ratio	38.3	0.002	33.2	0.002	19.2	0.004	21	0.002	8.4	0.001	9.8	0.002
M(1)	The Adjusted Poverty Gap	15.1	0.001	14.2	0.001	6.4	0.002	9.1	0.001	2.4	0.000	2.6	0.001
M(2)	The Adjusted Foster-Greer-Thorbecke (FGT) Measure	9.1	0.001	8.9	0.001	3.6	0.001	5.9	0.001	1.3	0.000	1.2	0.000
A	The Average Multidimensional Poverty Intensity	61.6	0.001	55.1	0.001	57.6	0.004	54.7	0.001	50.4	0.001	49.2	0.001
G	The Average Poverty Gap	39.3	0.001	42.9	0.001	33.2	0.004	43.3	0.002	28.2	0.003	26.1	0.003
S(2)	Average Squared Poverty Gap	23.8	0.001	26.7	0.001	18.5	0.004	28.1	0.001	15.4	0.003	11.7	0.002

Source: Authors' calculation using NSS data on consumption expenditure.

Notes:

SE stands for standard error.

H: The share of poor individuals in the population

M(0): Accounts for both the incidence of poor individuals and the intensity of their multiple deprivations.

M(1): Accounts for the incidence of poverty, the average range of deprivations and the average depth across deprivations. It is computed only with ordinal or real-valued indicators.

M(2): It is computed only with ordinal or real-valued indicators.

A: The average percentage of simultaneous deprivations suffered by the poor individuals.

G: Across all instances where poor individuals are deprived. It is computed only with ordinal or real-valued indicators.

S(2): Average Severity across all instances where individuals are deprived. It is computed only with ordinal or real-valued indicators.

Table 4: Contribution of different indicators in MPI measurement at all India aggregate level

Contribution of main and sub indicators (%)		2004-05			2011-12		
		M(0)	M(1)	M(2)	M(0)	M(1)	M(2)
Standard of Living	Employment	6.9	0.8	0.1	7.9	0.9	0.1
	Agriculture land (Cultivated)	0.7	1.7	2.8	0.3	0.7	1.1
	Irrigated land	1.2	2.9	4.9	0.5	1.2	1.9
	Cooking fuels	6.8	0.7	0.1	7.1	0.7	0
	Lighting	3.5	1	0.2	2.8	0.7	0.1
	Dwelling unit	0.2	0.1	0	0.2	0.1	0
	Ration card	7.9	6.7	3.7	9.2	7.1	3.6
Contribution of each domain (%)							
Standard of Living		27	14	11.6	27.9	11.4	6.8
Education		44.8	69.9	79.8	44	75.8	87.3
Income(MRP)		28.2	16.1	8.6	28.1	12.8	5.9

Source: Authors' calculation based NSS Consumption Expenditure data in 2004-05 and 2011-12.

Table 4 presents the contribution of each indicator to the overall measure of MPI. The results show that during the study period, the level of education of household members had made the highest contribution to Multidimensional Poverty Index of India, as measured by the adjusted head count ratio (M0), the adjusted poverty gap (M1) and the adjusted Foster-Greer-Thorbecke (FGT) measure (M2) in both the time periods. Most interestingly, the contribution from level of education was found increasing in the period 2004-05 to 2011-12. Except M(2), M(0) and M(1) measurements show that income and standard of living made the second and third highest contribution to Multidimensional Poverty Index of India. Sub indicators of standard of living show that ration card distribution made the highest contribution to multidimensional poverty index as measured by M(0) in 2004-05 and 2011-12. The measurement of the Adjusted Headcount Ratio shows that employment status, use of cooking fuels and lighting used by the household occupied second, third and fourth ranks in terms of higher contribution to poverty for the time period of 2004-05 to 2011-12. In fact, contribution from employment status and use of cooking fuels slightly increased in the years from 2004-05 to 2011-12, whereas the contribution to poverty index from lighting used by the household declined.

Table 5: Contribution of different indicators in MPI measurement at all India level for rural urban separately

Contribution of main and sub indicators (%)		2004-05						2011-12					
		Rural			Urban			Rural			Urban		
		M(0)	M(1)	M(2)	M(0)	M(1)	M(2)	M(0)	M(1)	M(2)	M(0)	M(1)	M(2)
Contribution of each indicator (%)													
Standard of Living	Employment	0.9	0.7	0.4	7	3.5	1	5.2	0.9	0.1	8.4	5.4	2
	Agriculture land (Cultivated)	0.5	1.2	1.9	3.4	10.1	18.1	0.3	1.1	2.1	1.2	4.6	10.2
	Irrigated land	1.1	2.5	4	3.8	11.5	20.6	0.6	2.2	4.1	1.5	5.6	12.4
	Cooking fuels	7.7	0.8	0.1	6.3	0.8	0.1	9.1	1.7	0.2	7	1.2	0.1
	Lighting	4.1	1.1	0.2	2.8	0.9	0.2	4.6	1.8	0.4	2.4	1	0.3
	Dwelling unit	0.1	0.1	0	1.1	0.6	0.2	0.1	0.1	0	0.5	0.4	0.2
	Ration card	8.9	6.9	3.7	7.1	7.1	4.2	9.9	11.5	7	9.7	12.3	9.2
Contribution of each domain (%)													
Standard of Living		23.4	13.3	10.3	31.4	34.7	44.5	30.8	19.2	13.8	30.6	30.4	34.3
Education		53.3	76.1	84.7	18.2	28.6	32.7	17.3	47.3	69	6	17.8	31.5
Income(MRP)		23.3	10.6	5	50.4	36.7	22.8	52.8	33.4	17.1	63.4	51.8	34.3

Source: Authors' calculation based NSS Consumption Expenditure data in 2004-05 and 2011-12.

Table 5 presents contribution of each of the indicators to the overall measure of MPI at rural urban levels, separately. The results show that education level of the household member contributed the highest (i.e., 53.3 percent) to the multidimensional rural poverty, as measured by adjusted headcount ratio, Adjusted Poverty Gap and Adjusted Foster-Greer-Thorbecke (FGT) Measure in 2004-05, followed by standard of living index and income. However in 2011-12, the highest contribution came from income (i.e., 52.8 percent) of the household, followed by standard of living (i.e., 30.8 percent) and education (17.3 percent) to the adjusted headcount ratio. However, education remains the highest contributor to MPI when it is measured by Adjusted Poverty Gap and Adjusted Foster-Greer-Thorbecke (FGT) Measure. In the context of urban areas, income contributed higher (i.e., 50.4 percent) than standard of living (31.4 percent) and education (18.2 percent) to adjusted headcount ratio in 2004-05. The highest contributor was again income (63.4 percent), followed by standard of living (30.6 percent) and education (6 percent) to the adjusted headcount ratio in 2011-12. Results show that similar for the adjusted poverty gap for both the time periods. Among the sub indicators of standard of living, the distribution of ration card contributed the highest to the rural and urban poverty in 2004-05 and 2011-12 as well. The contribution of ration card to adjusted headcount ratio increased for rural (or urban) areas from 8.9 (or 7.1) percent in 2004-05 to 9.9 (or 9.7) percent in 2011-12. . Cooking fuels, source of lighting and employability status for both rural and urban areas also contributed heavily to the adjusted headcount ratio in both periods.

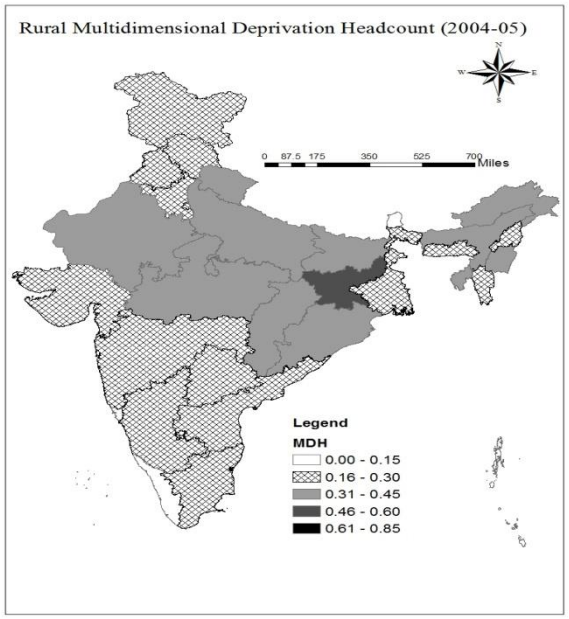
The study now moves on to state level analysis. The maps below show how poverty as measured by the multidimensional deprivation head count scenario has changed over the years in the different states of India.[5] The calculated values for rural show that Jharkhand ranked first among 26 states in India with 72 percent poverty head count in 2004-05 followed by Uttar Pradesh, Rajasthan, Orissa, and Bihar. On the other hand, Kerala ranked the lowest in rural headcount ratio (i.e., 28 percent) in 2004-05, followed by Mizoram, Nagaland, Punjab and Maharastra. The results also show that out of 26 states, 20 states had more than 50 percent of rural poverty headcount ratio in 2004-05. As per the results of 2011-12, Punjab tops the list in terms of lowest rural poverty headcount ratio followed by Kerala, Himachal Pradesh, Haryana and Jammu &

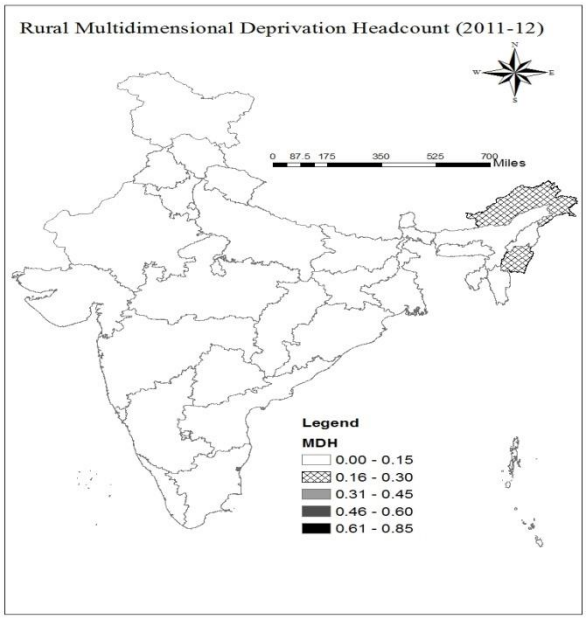
[5] All UTs, Goa and Sikkim are given 0 values, and Telangana is given the same value of Andhra Pradesh as there's no 2012 data for Telengana.

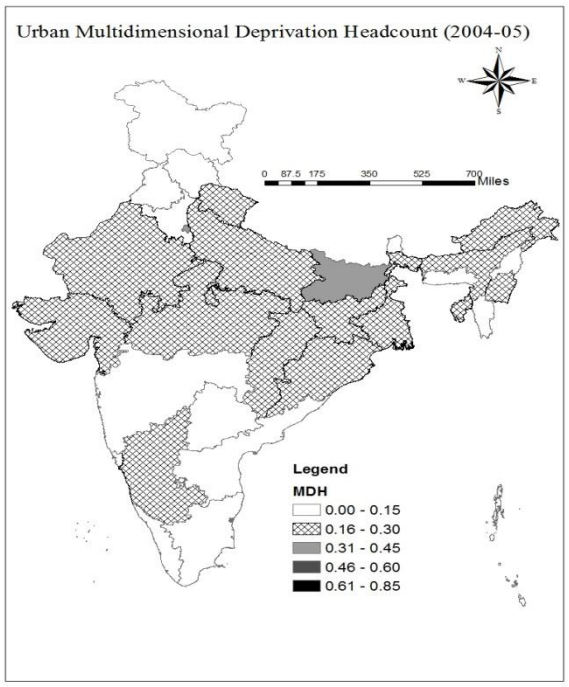
Kashmir. This indicates that Mizoram, Nagaland, and Maharastra declined in ranks from top five positions in the years from 2004-05 to 2011-12. Manipur ranked at the top with the highest level of poverty headcount ratio (i.e., 38 percent) followed by Arunachal Pradesh, Jharkhand, Orissa and Uttar Pradesh. This indicates that though Manipur and Arunachal Pradesh were not at the top five ranks in terms of higher poverty level in 2004-05, they could reach higher ranks by 2011-12. In contrast, Bihar and Rajasthan registered some improvement in reducing rural poverty ratio in the years from 2004-05 to 2011-12. As per study results, in 2011-12 none of the states had more than 50 percent rural poverty whereas in 2004-05 20 states had more than 50 percent rural poverty. In 2011-12, 17 states had more than 10 percent poverty head count whereas 9 states had less than of 10 percent poverty headcount ratio.

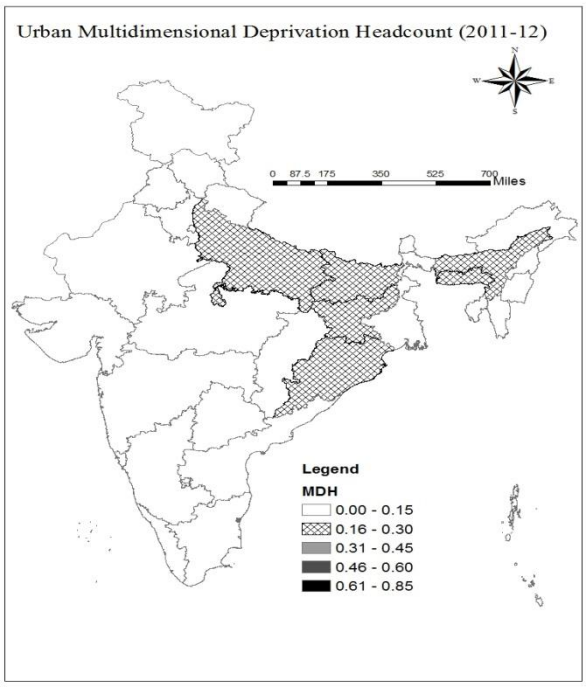
Coming to state-wise urban multidimensional deprivation head count ratio, Nagaland had the lowest (i.e., 7 per cent) urban poverty head count ratio followed by Mizoram, Himachal Pradesh, Jammu & Kashmir, and Kerala in 2004-05. In contrast, Chhattisgarh had the highest (i.e., 53 percent) poverty head count ratio followed by Arunachal Pradesh, Bihar, Manipur and Uttar Pradesh during the same time-period. The average state urban head headcount ratio was about 30 per cent in 2004-05. As per the results of 2011-12, Meghalaya, Orissa, Bihar, Jharkhand and Uttar Pradesh are at ranks one to five in terms of higher urban headcount poverty ratio. The result indicates that Meghalaya, Orissa, and Jharkhand were not listed as top five states in terms of state wise urban poverty measure in 2004-05, but entered the top-5 list in 2011-12. This indicates that these states experienced an increase in poverty rate over the period of time. On the other hand, Manipur, Arunachal Pradesh, and Chhattisgarh witnessed a decrease in poverty rate over a period of time.

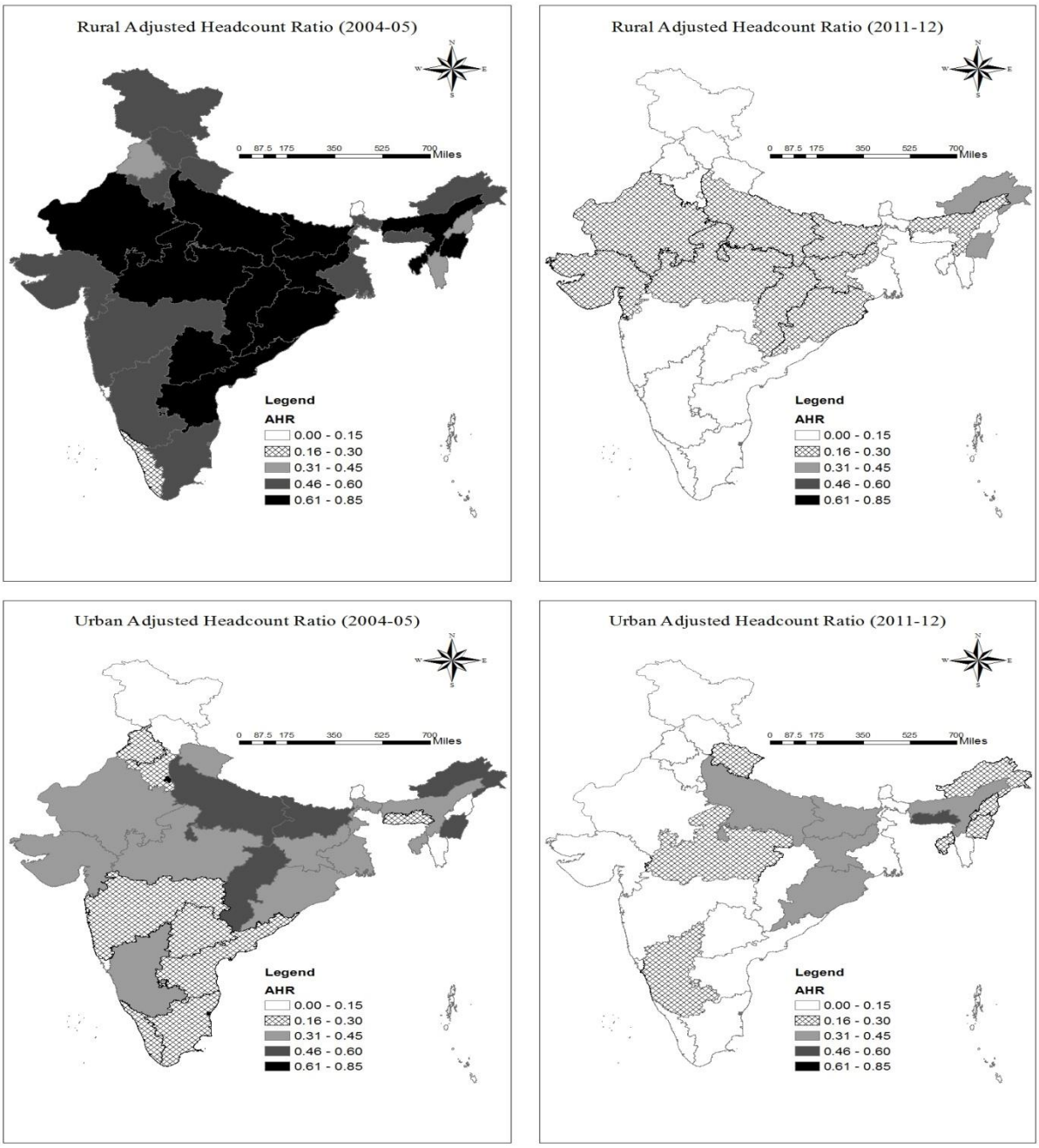
In contrast, Himachal Pradesh had the lowest (i.e., 3 per cent) urban head count ratio in 2011-12 followed by Haryana, Kerala, Punjab and Tamil Nadu. The results indicate that Jammu & Kashmir, Mizoram, and Nagaland lost their top five positions in terms of lowest urban poverty head count ratio in the years from 2004-05 to 2011-12.State-wise average urban poverty was about 19 percent in 2011-12 which is lower than 30 percent in 2011-12.


Rural Multidimensional Deprivation Headcount (2004-05)
0 87.5 175 350 525 700 Miles
Legend
MDH
0.00 - 0.15
0.16 - 0.30
0.31 - 0.45
0.46 - 0.60
0.61 - 0.85


Rural Multidimensional Deprivation Headcount (2011-12)
0 87.5 175 350 525 700 Miles
Legend
MDH
0.00 - 0.15
0.16 - 0.30
0.31 - 0.45
0.46 - 0.60
0.61 - 0.85


Urban Multidimensional Deprivation Headcount (2004-05)
0 87.5 175 350 525 700 Miles
Legend
MDH
0.00 - 0.15
0.16 - 0.30
0.31 - 0.45
0.46 - 0.60
0.61 - 0.85


Urban Multidimensional Deprivation Headcount (2011-12)
0 87.5 175 350 525 700 Miles
Legend
MDH
0.00 - 0.15
0.16 - 0.30
0.31 - 0.45
0.46 - 0.60
0.61 - 0.85



Most importantly, the results indicate an average 32 percent rural poverty decline in the years from 2004-05 to 2011-12. Rajasthan, Uttaranchal, Meghalaya and Jammu & Kashmir experienced the higher decline in rural poverty head count in the period 2004-05 to 2011-12 than others states. In contrast, Meghalaya, Nagaland, Orissa and Mizoran witnessed a higher increase in urban poverty head count ratio than other state. In contrast, Chhattisgarh, Arunachal Pradesh, Rajasthan, and Gujarat experienced a higher decline in urban poverty. Appendix Table 1 presents the complete rankings of the states as per the calculated multidimensional poverty headcount ratio. The ranking is

done in the ascending order, i.e., from the lowest to the highest poverty head count ratio. In other words, the state which has the lowest poverty headcount ratio gets the first rank.

The study now takes up a discussion on the multidimensional poverty index which is based on adjusted headcount ratio. The results do not show any change in rural adjusted headcount ratio for the years 2004-05 to 2011-12. According to the urban adjusted headcount ratio, Manipur was not listed among top five but it is listed among top five highest poverty ratios as per multidimensional poverty headcount ratio in 2004-05. On the other hand, Jammu & Kashmir (or Assam) was listed among top five states with the lowest (or highest) adjusted poverty ratio as of 2004-05 whereas it does not figure among top five state-list as per poverty headcount ratio of 2011-12. Overall, the study has not found any differences in the ranks calculated in terms of multidimensional headcount ratio and adjusted headcount ratio.

Table 6: Spearman's Rank Correlation Matrix for Different multidimensional deprivation headcount (H)

			2004-05		2011-12		2004-05		2011-12		2004-05		2011-12	
			K=4				K=5				K=6			
			Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
K=3	2004-05	Rural	0.95*				0.84*				0.86*			
		Urban		0.84*				0.67*				0.54*		
	2011-12	Rural			0.97*				0.80*				0.80*	
		Urban				0.97*				0.62*				0.39**

Note: * and ** indicate statistical significant at 1% and 5% levels, respectively.

It is time now to check how robust the poverty ranking is in terms of value of poverty cut-offs. It may be the case that the choice of cut-off is arbitrary and ranking of states may change drastically due to a change in the cut-off. To deal with this issue, the multidimensional deprivation headcount measures were calculated for all states with rural and urban distinction for different cut-offs for k =4,5, and 6, which was followed by estimation of Spearman's rank correlation coefficients as between each pair of rankings. From Table 6, it can be seen that the correlation coefficient is positive and highly statistically significant for the different ranking of the states based on k=3 with k=4, 5, and 6. Hence the conclusion that the rankings for varying poverty cut-offs are highly robust, i.e., not much different raking is obtained for different values of k. Rankings beyond $k = 6$ are not attempted in the study because the value of H is very low, and with so few observations the rankings could be biased.

6. Main conclusions

The present paper measures the multidimensional poverty index for India by considering two different rounds of National Sample Survey on consumption expenditure for the period of 2004-05 and 2011-12. Alkire and Foster's (2011) methodology is used to measure multidimensional poverty by considering three main indicators, i.e., standard of living, education and income at the household levels. Standard of living is measured by considering seven sub indicators, i.e., employment status, agricultural land possessed, integrated land possessed, source of lighting, cooking fuels, dwelling unit and ration card holding status of the households. Education is measured by the highest education attainment of the household members. Due to paucity of income, data monthly per capita consumption expenditure data are used as proxy of income data. A person is identified as poor if the household is deprived in 30 percent of all weighted indicators. Spearman's rank correlation coefficients between the ranking of states by considering different poverty cut-offs do not show any significant different.

Use of latest NSS data to measure MPI and consideration of different household level characteristics stands as new contribution of this paper.

The results show that 62.2 percent of people in India were poor as measured by multidimensional poverty head count in 2004-05, which declined to 38.4 percent in 2011-12. Also, the adjusted headcount ratio (or average multidimensional poverty) declined from 38.3 (or 61.6) percent in 2004-05 to 21 (or 54.7) percent in 2011-12. The Adjusted Poverty Gap, Adjusted Foster-Greer-Thorbecke (FGT) Measure, Average Poverty Gap, and Average Squared Poverty Gap also showed a decline in poverty in India in the years from 2004-05 to 2011-12.

Rural (or urban) Multidimensional Deprivation poverty Headcount at all India level declined from 60.2 (or 33.4) percent in 2004-05 to 16.7 (or 20) percent in 2011-12. This indicates that rural India has experienced a sharper decline in poverty than urban India.

The estimated results indicate that level of education of the household members has made the highest contribution to poverty in India, followed by income and standard of living. Sub- indicators of standard of living (ration card status, employment status, use of cooking fuels and source of lighting of the households) are the major determinants of poverty-level in India. At state level analysis suggests that Jharkhand, Uttar Pradesh, Rajasthan, Orissa, and Bihar had the higher multidimensional rural poverty, whereas Kerala, Mizoram, Nagaland, Punjab and Maharashtra had

the lower level of poverty as of 2004-05. As revealed by the study, in 2011-12, Punjab, Kerala, Himachal Pradesh, Haryana and Jammu & Kashmir had lower level of poverty whereas Manipur, Arunachal Pradesh, Jharkhand, Orissa and Uttar Pradesh had higher level of poverty. In regard to urban multidimensional poverty Nagaland, Mizoram, Himachal Pradesh, Jammu & Kashmir, and Kerala witnessed lower poverty headcount ratio whereas Chhattisgarh, Arunachal Pradesh, Bihar, Manipur and Uttar Pradesh witnessed higher poverty ratio in 2004-05. Further, as of 2011-12, Meghalaya, Orissa, Bihar, Jharkhand and Uttar Pradesh witnessed higher urban headcount poverty ratio while Himachal Pradesh, Haryana, Kerala, Punjab and Tamil Nadu witnessed lower poverty ratio. Among the other Indian states, Meghalaya, Nagaland, Orissa and Mizoran experienced an increase in urban poverty head count ratio in the years from 2004-05 to 2011-12.

7. Discussion

This paper argues that though poverty in India has declined due to economic reforms as evidenced by the higher economic growth, degree of poverty reduction varies across states and also across rural and urban regions. Effective distributive policies have to be formulated and implemented benefit the rural population of Jharkhand, Uttar Pradesh, Rajasthan, Orissa, and Bihar as these states suffers higher multidimensional rural poverty. Similar consideration is essential for the urban areas of Chhattisgarh, Arunachal Pradesh, Bihar, Manipur and Uttar Pradesh as they too suffer from higher multidimensional poverty head count ratio. Especially, Bihar and Orissa have to be given special consideration as both rural and urban areas of these states have higher multidimensional poverty head count ratio. It is to be noted that these states are mainly based on agrarian economy, i.e., agriculture, forestry and allied activities. Indian agriculture is characterized by lower productivity and growth rate. Therefore, it is important for the state to switch over from an agriculture-driven to an industry driven economy through rapid urbanization. These states also have experienced lower urbanization than other states in India. Therefore, there is an urgent need to promote urbanization so that the state can take advantage of higher productivity and higher economic growth that emanate from urbanization. This will help agriculture worker not to depend solely on agriculture but also on industry so that not only their income rises but they also feel more confident with assured and regular income. These states are also rich in natural resources such as coal, limestone, iron, nickel, cobalt, chromium, and marble. There is a paramount need to develop industries based on these local resources in order to ensure that local resources are utilized properly and the people get optimum benefits. Most of the states are also endowed with spots of scenic

beauty and therefore have high tourism potential. It is also suggested that tourism industries can be supported for the overall development of these states.

Lack of transport infrastructure is found to be one of the major drawbacks that come in the way of setting up industries in these states. Other problems haunting these states are shortage of electricity, capital, and telecommunication infrastructure and these issues can be solved only by providing adequate funds. Therefore, the real issue is the lack of funding. Given this scenario, it is imperative to the government to step in formulate a long term saving plan so that the money so collected can be invested in building the required transport, and communication infrastructure and provision of basic services for industries to come up.

Apart from this, these states need a boost in education through promoting institutions for basic to higher education. As of 2011, Bihar's illiteracy rate is whopping 36.2 percent, much higher than in other Indian states. Gross Enrolment Ratio (GER) in higher education in India is 20.4, which is calculated for 18-23 years of age group. Less than 0.5% of the total students are enrolled in doctoral programme (Ph.D. degree). This shows that urgent attention needs to pay to the education system of India. Also industry oriented technical and vocational education is required to be provided from school level, so that an industry-complaint labor force is created. Now two ways are open to the government to fund for higher education: Initially, government can fund to build higher educational institutions and later can collect income tax from the higher educated employees. Second, the government can offer fellowships for pursuing higher education, and recipients of such fellowships can later pay back their dues after getting employment.

Above mentioned policies are prescribed as guidelines for the Indian policy makers. Both poor and not-so-poor states will find these suggestions useful in improving their poverty situation. It is hoped that these policies will improve education, income and standard of living of the people so that they can escape from the clutches of multidimensional poverty and deprivation.

Appendix Table 1: Multi-dimensional Poverty headcount Rank (k=30%)

Sr. No.	State	2004-05		2011-12	
		Rural	Urban	Rural	Urban
1	Andhra Pardesh	17	8	14	8
2	Arunachal Pradesh	15	25	25	14
3	Assam	19	15	17	21
4	Bihar	22	24	20	24
5	Chhattisgarh	18	26	18	13
6	Gujarat	11	13	16	10
7	Haryana	8	9	4	2
8	Himachal Pradesh	6	3	3	1
9	Jammu & Kashmir	12	4	5	6
10	Jharkhand	26	20	24	23
11	Karnataka	9	14	11	16
12	Kerala	1	5	2	3
13	Madhya Pradesh	21	21	21	18
14	Maharastra	5	10	7	7
15	Manipur	20	23	26	19
16	Meghalaya	13	11	8	26
17	Mizoram	2	2	15	9
18	Nagaland	3	1	13	17
19	Orissa	23	17	23	25
20	Punjab	4	6	1	4
21	Rajasthan	24	19	19	12
22	Tamil Nadu	7	7	9	5
23	Tripura	16	16	12	15
24	Uttar Pradesh	25	22	22	22
25	Uttaranchal	14	18	6	20
26	West Bengal	10	12	10	11

Source: Authors' calculation

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