

Research Paper

Multidimensional Deprivation: Cross-District Insights in West Bengal

Papita Dutta*¹ and Supravat Bagli²

¹Gushkara Mahavidyalaya, Gushkara, Purba Bardhaman, West Bengal, India

²Presidency University, Kolkata, India

*Corresponding author: pdutta.economics@gmail.com (ORCID ID: 0000-0002-3068-5843)

Received: 23-08-2022

Revised: 24-11-2022

Accepted: 05-12-2022

ABSTRACT

This study explores the intensity and inequality of multidimensional deprivation (MD) across the districts of West Bengal, a north-eastern state in India. The measure of MD covers the dimensions of Knowledge, Health and Living condition with the respective indicators. We have clustered the districts in accordance with the selected indicators. An attempt has also been taken to gauge the inequality for deprivation indicators and for multidimensional deprivation index (MDI) applying the class of Atkinson measures. This study has used the data published by Directorate of Population Census of India 2011. It is reported that value of MDI ranges from 0.013 to 0.675 across the districts in West Bengal. Purulia is the most deprived district followed by Jalpaiguri, Maldah. On the other hand, Kolkata is the least deprived among the districts preceded by North 24 Parganas, Purba Medinipur. The cluster analysis reveals that Kolkata is the distinct from the other districts of West Bengal. It is found that Darjeeling district and Jalpaiguri district form two separate clusters. The districts of Dakshin Dinajpur, Murshidabad, Uttar Dinajpur, Maldah, Birbhum, Bankura and Purulia are similar in terms of the indicators of multidimensional deprivation. The districts of West Bengal are, of course, not highly diverse in terms of multidimensional deprivation. However, inequality for MDI is higher than that for HDI of the districts.

HIGHLIGHTS

- ① Average value of multidimensional deprivation index for the districts in West Bengal is 0.42 with range 0.013 to 0.675. Purulia is the most deprived district in West Bengal followed by Jalpaiguri, Maldah, Uttar Dinajpur
- ② Geographical closeness of the districts in West Bengal does not ensure the closeness of the districts in respect of the socio-economic deprivation indicators.
- ③ The districts of West Bengal are not highly diverse in terms of multidimensional deprivation.

Keywords: Cluster Analysis, multidimensional deprivation index, normalized inverse euclidian distance, population census

The well-being of a person is best seen as an index of the person's functionings (Sen, 1987). Deprivation may be viewed as the failure to achieve the socially desirable functionings of the person. Personal achievement of functionings depends on many factors. Thus, deprivation of an individual or a community or a region is associated with the multiple aspects like health, education and access to decent living condition. India has some flagship programs like Pradhan Mantri Jan Dhan Yojana (PMJDY),

Swarnajayanti Gram Swarojgar Yojana (SGSY), National Rural Employment Guarantee Scheme (NREGS), Public Distribution System, Universal Health programmes to smooth the achievement of functionings of the common people. Despite

How to cite this article: Dutta, P. and Bagli, S. (2022). Multidimensional Deprivation: Cross-District Insights in West Bengal. *Econ. Aff.*, 67(05): 745-751.

Source of Support: None; **Conflict of Interest:** None



of all the governmental and non-governmental initiatives more than half of the Indians were multi-dimensionally poor (UNDP, 2011) while one fifth of the Indian were income poor for 2011-12 in our country. In West Bengal one fifth of the total population fails to earn poverty line income, (Planning Commission, 2014). It is disappointing that 44 per cent households in West Bengal have no electricity or solar energy for lighting and 80 per cent households use dirty fuel for cooking (Census, 2011). Further, there is wide disparity across the districts in terms of the monetary and non-monetary dimensions of deprivation. In order to quantify the multiple deprivations in a single figure the first attempt was in measuring Human Development Index (HDI) in 1990. Subsequently several indices like Human Poverty Index, Gender Development Index and Multidimensional Poverty Index appear. In recent times UNDP has emphasised on non-income indicators of deprivations for avoiding the fundamental flaws concentrating upon income or consumption data. Against this backdrop, we have been motivated to examine the intensity and inequality of non-monetary deprivations in the districts of West Bengal.

Literature Review and Objectives

Although the level of multidimensional deprivation for India as a whole and for its states have been reporting (Mehta, and Shah, 2003; Alkire and Seth, 2013; Bagli, 2015) but regarding the intensity and inequality of multidimensional deprivation of the districts, and blocks in India information are rare. The Govt. of West Bengal reported HDI for each district for the last time in 2004. During the last two decades a few districts have published their Human Development report in different years, but no one report systematically addresses the issue of multifaceted deprivation of the districts. Therefore, the cross district study of multidimensional deprivation in West Bengal is pertinent for regional development and planning. With this end in view, this study sets the following objectives.

First, this study reports the positions of the districts of West Bengal computing a Multidimensional Deprivation Index (MDI) for each district and examines the association of MDI with the HDI of the districts.

Second, the pattern of relative similarity or

dissimilarity of the districts in terms of the observed indicators of multifaceted deprivation has been explained.

Third, we examine the nature of inequality of MDI and its indicators across the districts in West Bengal.

Methodology and Data

District level Multidimensional Deprivation Index (MDI) covers three dimensions – Knowledge, Health and Living condition. Illiteracy rate and financial illiteracy rate have been included as deprivation indicators under the knowledge dimension. Illiteracy rate refers to the percentage of population aged above six years, who are unable to read and write. The percentage of households having no access to any banking services has been taken as the indicator of financial illiteracy. The indicators of health dimension of multifaceted deprivation are the percentage of households use unsafe source of drinking water and percentage of households having no access to improved sanitation as indicator. The dimension of living condition is comprised of four indicators viz. households having dilapidated residence, no census assets, no access to electricity or solar energy for lighting and no access to improved fuel for cooking. The definition of the indicators are extracted from the Census report 2011. This study has divided the weight equally among the dimensions and the weight of each dimension has been distributed equally among the indicators as shown in table 1.

Initially, each indicator has been placed in scale 0 to w_i which indicates the deprivation index for the particular indicator. The weighted deprivation index (d_i) for i^{th} indicator is measured following the formula—

$$d_i = w_i \frac{A_i - m_i}{M_i - m_i} \quad \dots(1)$$

where, $i = 1, 2, 3, \dots, 8$, w_i = weight attached to indicator i , $0 \leq w_i \leq 1$, d_i = weighted deprivation index of i^{th} indicator, A_i = actual value of i^{th} indicator, M_i = maximum value of i^{th} indicator and m_i = minimum value of i^{th} indicator.

The minimum and maximum values of the indicators are observed among the districts as applicable, in West Bengal.

Table 1: Dimensions and Indicators of Multidimensional Deprivation

Dimension	Indicators (per cent)	Goalposts		Weight (w_i)
		Minimum Value (%)	Maximum Value (%)	
Knowledge	1. Illiterate population	12.98 (Purba Medinipur)	40.98 (Uttar Dinajpur)	1/6
	2. Households having no financial literacy	16.20 (Kolkata)	73.5 (Uttar Dinajpur)	1/6
Health	1. Households uses unsafe source of drinking water	2.60 (South 24-Parganas)	60.10 (Dajeeling)	1/6
	2. Households having no access to improved sanitation	5.1 (Kolkata)	88.2 (Purulia)	1/6
Living Standard	1. Households having dilapidated residence	2.6 (Kolkata)	16.6 (Purba Medinipur)	1/12
	2. Households having no census assets	3.6 (Kolkata)	36.3 (Maldah)	1/12
	3. Households uses dirty cooking fuel	33.8 (Kolkata)	94.3 (Purba Medinipur)	1/12
	4. Households having no access to electricity	2.2 (Kolkata)	71.7 (Koch Bihar)	1/12

Source: Authors' own justification.

With respect to the indicator deprivation indices the position of j^{th} district in the eight dimensional 'Cartesian Space' can be identified. In this Cartesian Space zero vector indicates the best situation where multifaceted deprivation is absent. The acute multifaceted deprivation is represented by the vector of the weights attached with the indicators. Finally, MDI for each district has been measured computing the weighted normalized inverse Euclidian distance of the vector of actual situation from the acute situation of deprivation. Finally, we can write the formula for MDI as follows.

$$MDI = 1 - \sqrt{\frac{\sum_{i=1}^8 (w_i - d_i)^2}{\sum_{i=1}^8 (w_i)^2}} \quad \dots(2)$$

The normalization of weighted Euclidian distance confirms the range of MDI from zero to one. Finally, the higher value of MDI represents higher intensity of multidimensional deprivation. Value '0' for MDI indicates zero deprivation and '1' indicates extreme intensity of deprivation. MDI formula satisfies the properties of normalisation, symmetry, monotonicity, proximity, uniformity and signalling. In order to investigate the similarities of the districts based on the selected indicators of multidimensional deprivation we have employed the tool of cluster

analysis. Cluster analysis classifies the objects into groups that are relatively homogeneous within the group and heterogeneous between the groups, on the basis of a defined set of uncorrelated variables. These groups are called cluster. Clusters have been identified maximizing the homogeneity of the objects within the clusters and the heterogeneity of the objects between the clusters. This study displays the Dendrograms showing the possible clusters of the districts estimating the Euclidean Distance Matrix and using the average linkage method.

As the Gini measure of inequality is not suitable for non-monetary values of the deprivation this study has applied Atkinson measures. Atkinson (1970) measure looks inequality from welfare point of view taking the normative judgement about social welfare. Considering the additivity and homotheticity assumption in welfare function Atkinson family of inequality measure can be written as follows.

$$A_\epsilon(x) = 1 - \left[\frac{1}{n} \sum_{i=1}^n \left(\frac{x_i}{\mu} \right)^\epsilon \right]^{1/\epsilon} \quad \text{for } \epsilon \leq 1 \text{ and } \epsilon \neq 0 \quad \dots(3)$$

$$= 1 - \prod_{i=1}^n \left(\frac{x_i}{\mu} \right)^{1/n} \quad \text{for } \epsilon = 0$$

where ϵ denotes the inequality aversion parameter, n stands for number of districts (19), x_i stands for the i^{th} indicator or index of deprivation. μ denotes the mean of x_i . The value of ϵ ranges from 1 indicating no preference for equality to minus infinite indicating extreme preference for equality. In this study the values of $\epsilon = 0.5, 0$ and -1 have been considered for measuring inequality of the indicators and indices under consideration.

The data for the indicators of multidimensional deprivation for the districts in West Bengal have been collected from Population Census Report 2011, Government of India. Data for HDI of the district have been collected from West Bengal Human Development report, 2004, the Government of West Bengal. We have considered all the districts in West Bengal during the census year 2011 and census data for studying the intensity and inequality in multidimensional deprivation.

RESULTS AND DISCUSSION

Table 2 displays the descriptive statistics of the indicators and indices of MDI. Average illiteracy rate of the districts in West Bengal is 25.14 per cent in 2011 which varies from 12.98 per cent to 49.93 per cent across the districts. In West Bengal 52.9 per cent households have no access to banking facilities. Median value of this indicator tells us that in half of the districts, 57 per cent or more households are deprived of banking facilities. Thus financial illiteracy is a serious deprivation among the districts of West Bengal. Although, intensity of financial illiteracy is higher than that of academic

illiteracy, relative dispersion of financial illiteracy is lower than that of illiterate populations across the districts. We observe that in average 41.46 per cent households of the districts in West Bengal collect drinking water from unsafe source. Percentage of households having access to unsafe source of drinking water is highest in Darjeeling followed by Jalpaiguri and Purulia and it is lowest in South 24 Parganas district. There is a wide variation across the districts in terms of access to safe source of drinking water. Average percentage of households without improved sanitation facility in the districts of West Bengal is 46.22 per cent. We have observed that 88 per cent of households in Purulia district, which is highest among the districts in West Bengal, do not have access to improved sanitation. Access to improved sanitation is the highest in the district of Kolkata. In average 11.16 per cent households of the districts in West Bengal live in dilapidated house. It varies from 2.6 per cent to 16.6 per cent across the districts. In majority of the districts more than half of the households have no electricity or solar energy for lighting.

It is saddening that 82 per cent households of the districts in West Bengal have no access to improved fuel for cooking which ranges from 33 to 94 per cent. However, only 23 per cent households in average of the districts have no census assets. Thus poverty in terms of asset holding is not so serious in the districts of West Bengal. Therefore, from the analysis of individual indicator is it not sufficient to determine the relative position of the districts. We need a comprehensive index which covers multiple

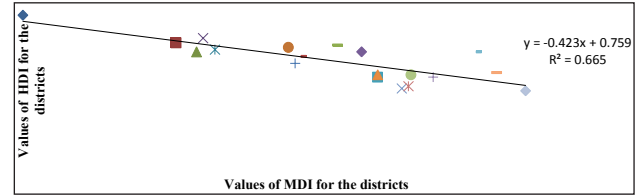
Table 2: Description of the indicators of Deprivations in the districts of West Bengal

Indicators(%) /Index	Mean	Median	S D	CV	Skew	Max	Min
Illiterate population	25.14	25.03	8.05	32.04	0.34	40.93	12.98
Households having no access to banking facility	52.90	57.00	13.56	25.63	-0.44	73.50	16.20
Households use unsafe source of drinking water	14.46	8.20	15.67	108.34	2.03	60.10	2.60
Households have no improved sanitation facility	46.22	44.30	24.60	53.23	0.02	88.20	5.10
Households live in dilapidated residence	11.16	11.40	3.45	30.95	-0.74	16.60	2.60
Households have no access to electricity or solar power for lighting	46.59	50.60	19.18	41.16	-0.74	71.70	2.20
Households use dirty fuel for cooking	82.52	90.30	15.79	19.13	-0.83	94.30	33.80
Households do not have census asset	23.41	23.40	8.39	35.82	-1.93	36.30	3.60
HDI	0.58	0.60	0.09	14.94	0.33	0.78	0.45
MDI	0.42	0.46	0.17	39.80	-0.68	0.68	0.013

Source: Authors' computation.

dimensions of deprivation. Following the above mentioned methodology we have computed MDI for 19 districts of West Bengal for 2011 as given in table 3. This study reveals that average value of MDI of the districts of West Bengal is 0.42 which ranges from 0.013 to 0.675. We have also computed average of the HDI values in 2004 of the districts which is found to be 0.58. As our MDI is a symmetric measure we can say that average achievement index of the districts is 0.58 which is same as the value of HDI in 2004. Nevertheless, the inequality of HDI in the district is lower than that of MDI. Further, skewness of MDI is negative. The lower tail of the distribution is towards the lower values of MDI. In accordance with the value of MDI Purulia is the most deprived district in West Bengal followed by Jalpaiguri, Maldah, Uttar Dinajpur, Bankura, Birbhumthen Murshidabad. On the other hand, Kolkata is the least deprived among the districts in West Bengal followed by North 24 Parganas, Purba Medinipur, Howrah, and Hooghly.

found to be -0.816. This association is statistically significant at 1 % level. In figure we observe that higher the deprivation lower is the HDI. Therefore, the MDI a non-income measure of multidimensional deprivation is an alternative measure of human development.



Source: Authors' estimation

Fig. 1: Association between HDI and MDI for the districts in West Bengal

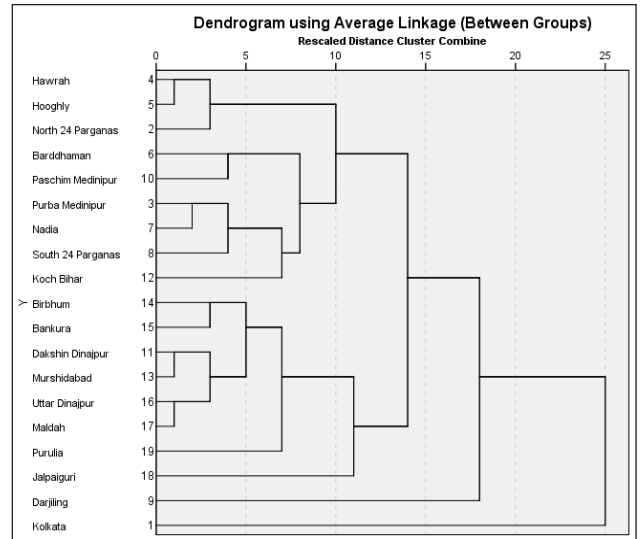
The values of MDI are not sufficient to identify the similarity among the districts in terms of the multiple indicators of deprivation. To this end we have done cluster analysis for the indicators of multidimensional deprivation. The result of cluster analysis has been presented by the Dendrogram shown in Fig. 2.

Table 3: Positions of the Districts of West Bengal in respect of the MDI

District Name	HDI	Rank for HDI	MDI	Rank for MDI
Purulia	0.45	19	0.675	1
Jalpaiguri	0.53	12	0.637	2
Maldah	0.62	7	0.61	3
Uttar Dinajpur	0.51	15	0.553	4
Bankura	0.52	13	0.524	5
Birbhum	0.47	17	0.521	6
Murshidabad	0.46	18	0.512	7
Koch Bihar	0.52	14	0.48	9
Dakshin Dinajpur	0.51	16	0.48	8
Paschim Medinipur	0.62	8	0.459	10
Darjiling	0.65	4	0.428	11
South 24 Parganas	0.6	10	0.38	12
Nadia	0.57	11	0.372	13
Barddhaman	0.64	5	0.363	14
Hooghly	0.63	6	0.266	15
Howrah	0.68	2	0.251	16
Purba Medinipur	0.62	9	0.242	17
North 24 Parganas	0.66	3	0.215	18
Kolkata	0.78	1	0.013	19

Source: Authors' estimation.

Scatter diagram presented in Fig. 1 shows the nature of association between HDI and MDI. The correlation coefficient between HDI and MDI is



Source: Authors' estimation.

Fig. 2: Dendrogram after Cluster Analysis using Average Linkage (between groups)

In the analysis we have identified six possible clusters. It explores that in terms of the indicators of multiple deprivations Kolkata is the distinct from the other districts of West Bengal. Darjeeling district and Jalpaiguri district form two separate clusters. The districts of Howrah, Hooghly and North 24 Parganas form a cluster if we allow up to 10 point

in the dissimilarity scale. The districts of Dakshin Dinajpur, Murshidabad, Uttar Dinajpur, Maldah, Birbhum, Bankura and Purulia are similar in terms of the indicators of multifaceted deprivation. It is interesting to note that Koch Bihar, Purba Medinipur, Paschim Medinipur and Burdwan come under the same cluster. It indicates that similarity of the districts in West Bengal in geographical location and similarity in deprivations are not closely connected.

Moreover, all the districts with high intensity of deprivation are not similar in respect of the indicators. We find that Jalpaiguri district is completely different from the other most deprived districts. Further, Purulia is some extent different from other remaining most deprived districts. But if the dissimilar scale is allowed up to 10 points, all the most deprived districts except Jalpaiguri fall in the same cluster. Among the least deprived districts Kolkata form a distinct cluster and Hooghly, Howrah and North 24 Paraganas belong to other cluster. The district of Purba Medinipur has low level of deprivation but it is different from other districts with low level deprivation. Therefore, we cannot say the districts of Jangalmahal are similar with respect to the indicators of deprivation under consideration. Further, districts of North Bengal are not belonging to the same cluster.

Table 4: Inequality of the MDI and its Indicators across the Districts in West Bengal

Indicator (%) / index	$A_{(0.5)}$	$A_{(0)}$	$A_{(-1)}$
Households live in dilapidated residence	0.0289	0.0644	0.1636
Households do not have access to improved power for lighting	0.0621	0.1614	0.5379
Households use dirty fuel for cooking	0.0110	0.0241	0.0820
Households do not have census asset	0.0392	0.0900	0.2465
Households having no access to banking facility	0.0194	0.0427	0.1060
Illiteracy rate	0.0248	0.0496	0.0989
Households use unsafe source of drinking water	0.1914	0.3373	0.5099
Households have no improved sanitation facility	0.0823	0.1807	0.4146
HDI	0.0034	0.0087	0.0190
MDI	0.0598	0.1665	0.6243

Source: Authors' estimation

In table 4 we see that as the preference for equality becomes stronger the value inequality measure (Atkinson measure) becomes stronger. In accordance with the all measures under consideration the inequality across the districts for MDI is higher than that for HDI of the districts. Among the indicators of deprivations the inequality of usage of unsafe source of drinking water across the districts is the highest for all measures except $A_{(-1)}$. The inequality for usage of dirty fuel for cooking is the least across the districts for each measure of inequality. However, the extents of inequalities are different across the indicators under consideration, but they are not of high valued. Thus, the districts of West Bengal are not highly diverse in terms of multifaceted deprivation.

CONCLUSION

This study has elicited the intensity of multidimensional deprivation for all the districts in West Bengal. In accordance with the value of the multidimensional index of deprivation by and large the districts of Kolkata, North 24 Parganas, Purba Medinipur, Howrah, and Hooghly are comparatively better off, while districts like Purulia, Jalpaiguri, Maldah, Uttar Dinajpur, and Bankura are in worse off situation. However, all the districts with high intensity of deprivation do not fall in same cluster in respect of the indicators of deprivation. The district of Purulia is some extent different from other remaining most deprived districts. The district of Purba Medinipur has low level of deprivation but it is different from other districts with low level deprivation. Further, we have seen that the districts located in so called Paschimanchal are not similar. Again the districts of North Bengal are very much dissimilar in respect of the set of deprivation indicators. It concludes that geographical locations are not important to determine the closeness of the districts in respect of the socio-economic deprivation indicators. Therefore, for alleviating multifaceted deprivation we should formulate and implement regional programs based on the nature of deprivation of the districts not on the location of the districts. Finally, this study has explored the inequality in various indicators of deprivation across the districts. The results of inequality measurement of several deprivation indices are conclusive enough to clear the pattern of uneven

spatial distribution of the multifaceted deprivation indicators. The inequality in access to safe source of drinking water and access to improved sanitation are more prominent as compared to the other indicators under study. Therefore, we have to emphasize more on existing plan and policies for sanitation and drinking water supply or have to formulate some special plan for most deprived districts. It is observed that the inequality in access to electricity and solar energy for lighting is also prominent across the district. Thus, universal electrification is urgently felt. This study has analysed the intensity and inequality of deprivations at the district level. One may extend this study at the block or village level to understand the further extent of spatial intensities and inequalities of the deprivation indicators and indices. So far, often it is reported that the state of West Bengal fails to fulfil the target utilisation of the fund for development. After all, we need to utilise the flagship programs more effectively and more wisely for alleviating the intensity and inequality of multifaceted deprivation across the districts in West Bengal.

REFERENCES

- Alkire, S. and Seth, S. 2013. Multidimensional Poverty Reduction in India between 1999 and 2006: Where and How? OPHI Working Paper No. 60. <http://www.ophi.org.uk> (Last accessed on 25th July, 2018).
- Atkinson, A.B. 1970. On measurement of Inequality. *J. Econ. Theory*, **2**(3): 244-263.
- Bagli, S. 2015. Intensity and Inequality of Multifaceted Deprivation of the States in India. *The Asian Econ. Rev.*, **57**(4): 119-136.
- Bagli, S. and Tewari, G. 2019. Multidimensional Poverty: An Exploratory Study in Purulia District, West Bengal. *Econ. Aff.*, **64**(3): 517-527.
- Government of India. 2011. Population Census Report, 2011. Registrar General of India. <https://censusindia.gov.in>. (Last accessed on 12th August, 2021)
- Government of West Bengal. 2004. West Bengal Human Development report, 2004. <http://www.undp.org.in> (Last accessed on 12th August, 2021).
- Mehta, K.A. and Shah, A. 2003. Chronic poverty in India: Incidence, causes and policies. *World Dev.*, **31**(3): 491-511.
- Planning Commission. 2014. Government of India. Report of The Expert Group to Review The Methodology for Measurement of Poverty. <https://www.planningcommission.in> (Last accessed on 10th July 2015).
- Sen, A. 1987. *Commodities and Capabilities*. 89p. Oxford University Press, UK.
- UNDP. 2011. Human Development Report, 2011. 176 p. Palgrave Macmillan, New York.

