# Multidimensional poverty and the factors influencing the multidimensional poverty status of Bodos': a case study of Udalguri district, Bodoland

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**Abstract:** The aim of this paper is to identify the multidimensional poverty situation and determination of the factors that influence the multidimensional poverty of Bodos in Udalguri district, Bodoland. We applied multiple correspondence analysis (MCA) on the household level primary data for 333 Bodo households for constructing household level multidimensional poverty index (MPI). The data was collected by multistage stratified random sampling covering twenty-two villages of eleven blocks. The MPI value for the study area predicts that the area is poor and health, literacy, employment opportunities and the monthly consumption expenditure of the family are the most important influencing factors.

**Keywords:** MPI; multidimensional poverty index; MCA; multiple correspondence analysis; Bodo households; Udalguri district; literacy; health.

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## 1 Introduction

The status of tribal's in India has changed significantly over the past millennia. The aim of this paper is to identify the multidimensional poverty situation of Bodos in Udalguri district of Bodoland, Assam and to identify the factors that influence the multidimensional poverty status of Bodos of the same area. Welfare economists have argued that poverty has to be considered as a state of multidimensional nature of deprivation (Sen, 1976, 1993; Kolm, 1977; Atkinson and Bourguignon, 1982; Duclos et al., 2001). Therefore, Ravallion (1996), proposed to use several indices of poverty measured on different dimensions rather than a single multidimensional index.

Since the work of Townsend (1993), other aspects of human life not necessarily related to income are increasingly recognised as the aspect of human development. These include access to public goods, health, education, housing conditions, satisfaction and so on.

The consequence of this conceptual revolution has broadened the notion of poverty by including vulnerability, exposure to risks, voicelessness and powerlessness (World Bank, 2001). The multidimensional perspective of deprivation includes both quantitative and qualitative measures, such as the joy of choices. Some of them are the most basic to human development and can result in a different conclusion about poverty situation (Alkire, 2002). As a result, more and more researchers are now contributing identifying poverty multidimensionally, like Makoka and Kaplan (2005), Alkire and Foster (2007, 2011a).

Recently, a new technique to index the multidimensional aspect of poverty is developed based on MCA. The research papers based on this approach are Batista-Foguet et al. (2004), Booysen et al. (2005), Asselin and Anh (2005), Njong and Ningaye (2008), Wardhana (2010), Ezzrari and Verme (2012) and Noglo (2014).

In this paper, we also applied MCA for identifying the multidimensional poverty aspect of the study area along with the identification of the factors that influence the multidimensional poverty status of Bodo households. The justification to carry out this research is discussed in the next section.

## *1.1 Rationale of the study*

The traditional poverty traps have been studied based on consumption and asset availability. The United Nations Development Programme multidimensional poverty index (MPI) states that poverty is multidimensional. Poverty is defined as the presence of multiple deprivations in basic assets, education and/or health components (Anand and Sen, 1997; Alkire and Foster, 2011b; UNDP, 2010). In the proposed dual cut-off method (UNDP, 2010), households are first evaluated on, each dimension of poverty to be considered deprived of that element. A sufficient number of deprivations on multiple dimension leads to the conclusion that a family is considered multidimensionally poor. It should be noted that severe and chronic deprivation in more than one dimension interacts and increases the difficulty of moving out of poverty. Thus, this study is complementary to the new research on multidimensional poverty and contributes to taking a step beyond measuring multidimensional poverty to examining its potential effects. In this paper, we will investigate the range of extreme poverty in terms of household assets, health, nutrition and education.

The study area Udalguri is a town, a town area committee and a district in the Indian state of Assam. Earlier, it was a civil sub-division under the erstwhile Darrang district prior to the formation of the Bodoland Territorial Council. After signing the Tripartite Peace Agreement on 10th February 2003, a Memorandum of Settlement between the Bodo Liberation Tigers, the Government of India and the Government of Assam created the Bodoland Territorial Council. As a part of the settlement, an Autonomous Council called Bodoland Territorial Autonomous District, (BTAD) was created and Udalguri is now one of Four Districts under BTAD. It was notified as a district, vide Govt Notification No. GAG (B)-137/2002/Pt/117 dated 30 October, 2003 and was formally inaugurated as a district on 14 June, 2004 (Udalguri Official Website, 2016). The district is bounded by Bhutan and Arunachal Pradesh in the north, Sonitpur district in the east, Darrang district in the south and Baksa district in the west (Figure 1).

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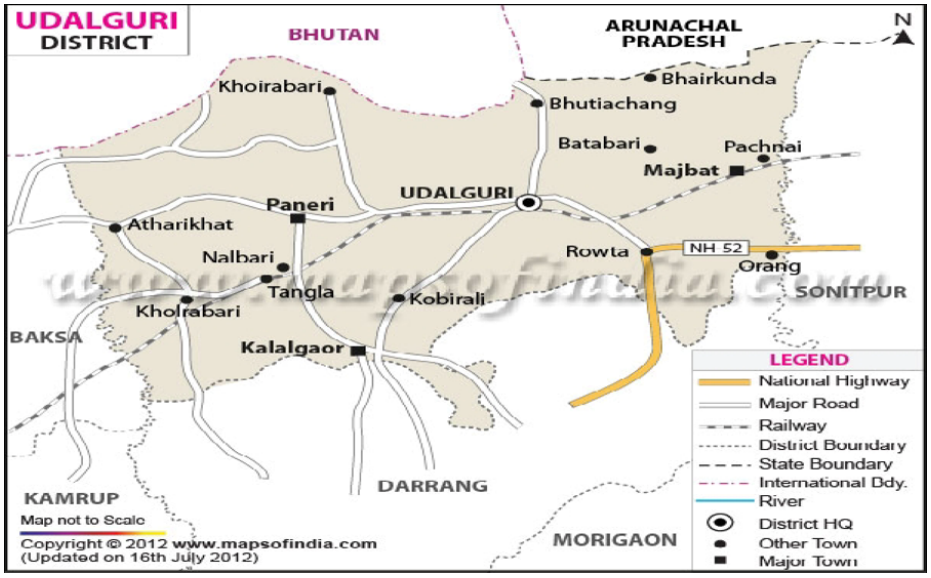
**Figure 1** Map of Udalguri District, Assam (India) (see online version for colours)



Among the Scheduled Tribe's population in the district, more than 80% population are Bodos. In spite of having an autonomous council in the study area, the Bodo are unable to improve their socioeconomic conditions. Bodos are generally depending on agriculture. However, 40% of the people are landless labourers. The educational status of Bodos is still below the state average. Due to poor economic conditions and illiteracy, the healthcare awareness is also very poor among the Bodos. Even under this tough socioeconomic condition, Bodo Liberation Tigers are still demanding for the Bodoland State. Under such circumstances, we have investigated the multidimensional poverty situation of the Bodo people by considering different indicators such as income, health, education and standard of living. At the same time, we assessed the influencing factor of this multidimensional poverty situation of Bodos to make policy recommendations to improve the situation of Bodos if required.

Moreover, it is worth to be mentioned here that this paper is the first attempt of this kind in the study area. In this respect, it is the pioneering attempt to measure multidimensional poverty status of Bodo households of Udalguri district, Assam.

The paper is organised as follows: after this introduction with the investigation of related literature and justification for this research study, in Section 2 we illustrate the data relating to 333 Bodo households. Section 3 deals with the methodology and econometric model. Section 4 shows the estimates of the MPI and the estimates of the parameters related to the regression equation and other empirical results. Finally, Section 5 concludes.

## 2 Literature

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### *2.1 Data*

The present study is based on both primary and secondary data. The secondary data are collected from different sources: the Economic Survey of Assam (2014–2015), the Statistical Handbook of Assam (2013–2014), the Census of India (2011), the Udalguri Official Website and the Assam Human Development Report (2014). The secondary data are used to make the profile of the study area and to identify the blocks and villages from which primary data are to be collected.

### *2.2 Sample design*

This paper is based primarily on a novel dataset that has been collected to examine the multidimensional poverty status of the study area. Bodo villages are the main sources and Bodo households in the entire Udalguri district are the main data unit of the present study. In order to collect related data, we have adopted the multistage random sampling with stratified and purposive sampling techniques. The profile of the study area is presented in Table 1.

From the table, it is clear that there are mainly two sub-divisions in the Udalguri district. Out of these two sub-divisions, we have selected one sub-division at first and then another sub-division by covering different development blocks and Village Council of Development Committees, also covering middle income, high-income and low-income groups. In the district of Udalguri, there are 802 revenue villages. The revenue village indicates the revenue collection area by the state government from the landlords. Among

the 802 revenue villages in the district, there are 750 Bodo villages. There are 11 development blocks in the district so the average number of villages per block is 72.82 (approx. 73). Thus, we selected 3% of the average number of villages per block resulting in 2.19 in each block became 2.19 (approx. 2) and in 22 villages in total. We have selected two villages from each block purposively, one nearby the main town and another far from the main town. Out of the total Bodo households of that village, the sample size specific to the concerned village was determined by Krejcie and Morgan (1970), formula. Using a random number table and information provided by the village head, we completed the random personal interview sampling procedure for 333 Bodo households (Table A1, appendices). Finally, from the selected households the relevant information was collected by using pre-tested questionnaire related to the literacy, health, standard of living status etc. (Table A2, appendices).

**Table 1** Profile of the Bodoland territorial area districts in Assam

| *S. No.* | *District* | *Sub-division* | *Block* | *Geographical area* (in Sq. Kilometres) | *Population* (in Lakhs) | *Revenue village* | *Towns* |
|---|---|---|---|---|---|---|---|
| 1 | Baksa | 03 | 10 | 2457.00 | 950,075 | 692 | 02 |
| 2 | Chirang | 02 | 05 | 1923.00 | 482,162 | 509 | 02 |
| 3 | Kokrajhar | 03 | 11 | 3296.00 | 887,142 | 1070 | 03 |
| 4 | Udalguri | 02 | 11 | 2012.00 | 831,668 | 801 | 03 |

*Source*: Based on 2011 Census India (2011)

## 3 Methodology

In this section, we will discuss the methodology to address the above-mentioned objectives of the study.

### *3.1 Multidimensional poverty index: multiple correspondence analysis*

When poverty is conceptualised as multidimensional, it should be measured through the aggregation of the different deprivation variables experienced by the individuals. The modalities utilised for the construction of the household level MPI is presented in appendices by Table A2. Given the fact that the indicators are categorical principal component analysis is not appropriate. Therefore, we used multiple correspondence analysis (MCA) for finding out the weights to construct MPI of the study area. In the next section, the MCA method is discussed.

MCA allows one to analyse the pattern of relationships of several categorical dependent variables (Asselin, 2002). The principle of the MCA is to extract a first factor which retains maximum information contained in this matrix. The ultimate aim of MCA (in addition to data reduction) is to generate a composite indicator for each household.

For the construction of the MPI from K ordinal categorical indicators, the monotonicity axiom must be respected (Asselin, 2002). The axiom just means that if a household $i$ improves its situation for a given variable, then its index value ($MPI_i$) increases, meaning that the respondent's position improves. When all the variable modalities have been transformed into a dichotomous variable coded 0/1, giving a total of P binary indicators, the MPI for a given household $i$ can be written as (see Asselin, 2002):

$$\mathrm{MPI}_i = \frac{1}{K}\left(W_1 I_{i1} + W_2 I_{i2} + \cdots + W_p I_{ip}\right), \tag{1}$$

where

$W_p$: the weight (score of the first standardised axis, (score or $\sqrt{\lambda_1}$) of category *p*.

$I_p$: binary indicator (0 or 1), which takes the value 1 when the household has the modality, and 0 otherwise.

The MPI constructed using MCA has a tendency of being negative in its lowest part. This would make interpretation difficult. However, it can be made positive by a translation using the absolute value of the average $C_{\min}$ of the minimal categorical weight $W_{\min}^k$ of each indicator. Asselin (2002) expresses this average minimal weight as:

$$C_{\min} = \frac{\sum_{k=1}^{K} W_{\min}^k}{K}. \tag{2}$$

The absolute value of $C_{\min}$ can then is added to the general multidimensional poverty index (GMPI) of each individual to obtain the new positive MPI scores.

By using MCA we have constructed the literacy index (LI) (by using seven modalities), the health index (HI) (by using five modalities), the living standard index (LSI) (by using nine modalities) and the utilities and durable index (UDI) (by using fifteen modalities) separately. Then by giving equal weight to all indices we compute the household MPI by taking the weighted arithmetic mean of four indices, where weights in all cases are $\frac{1}{4}$. The formula for calculating HMPI is mentioned below:

$$\mathrm{HMPI}_i = \frac{w_l \times LI_i + w_h HI_i + w_{ls} + LSI_i + w_{ud} \times \mathrm{UDI}_i}{w_l + w_h + w_{ls} + w_{ud}} \quad \forall i = 1, 2, ...., 333, \tag{3}$$

where $w_i = w_h = w_{ls} = w_{ud} = \frac{1}{4} \forall i = 1, 2, ...., 333.$

This constructed HMPI also lies between (0, 1)

At the level of a village the village wise multidimensional poverty index (VMPI) is calculated by considering the simple arithmetic mean of the HMPI as follows:

$$\mathrm{VMPI}_j = \frac{\sum_{i=1}^{n} \mathrm{HMPI}_i}{n} \quad \forall j = 1 \ldots 22 \text{ and } n = \text{sample size}. \tag{4}$$

The block wise multidimensional poverty index (BMPI) is the weighted arithmetic mean of the VMPI, where weights are the number of a sampled household considered from the sampled village of that block:

$$\mathrm{BMPI}_k = \frac{n_1 \times \mathrm{VMPI}_1 + n_2 \times \mathrm{VMPI}_2}{n_1 + n_2}. \tag{5}$$

The MPI of the study area is the mean of the BMPIs:

$$\mathrm{MPI} = \frac{\sum_{k=1}^{11} \mathrm{BMPI}_k}{11}. \tag{6}$$

For the purpose of comparison of the relative poverty position of the sampled Bodo household, we consider the UNDP prescribed three levels. If $MPI_i$ falls below 0.5 it is a case of poor. If $MPI_i$ takes values from 0.5 to 0.799 it indicates the self-sufficient and $MPI_i$ value of 0.8 and above suggests a surplus income of the concerned Bodo household. We further group households into three categories namely, 'very poor' (with an $MPI_i$ value 0.14 or less), 'poor' (with an $MPI_i$ value 0.15–0.30), 'moderately poor or borderline' (with an $MPI_i$ value 0.31–0.49). It is to be noted here that both self-sufficient and surplus fall in the category of non-poor. The same benchmark is used for the purpose of comparison of all cases.

Next, we consider the discussion of the econometric model for identifying the factors influencing the socioeconomic status of Bodo household.

### *3.2 Econometric model*

We use an econometric model to determine the factors influencing the multidimensional poverty status of Bodo household of the Udalguri district of Bodoland. Seven social, demographic and economic variables are used for this purpose as the regressors. These are literacy levels of the households, health status of the households, and the distance of the village from the main town (three social variables), family size (demographic variable), number of employed in the age-group 15–59 for each household, operational land holding, consumption expenditures in rupees (three economic variables). The details descriptions of the variables are presented in Table 2.

These variables have been identified based on field experience and from earlier literature (Rao and Rao, 2010). With the help of above-mentioned variables, we use the OLS regression model. We consider the $HMPI_i$ as the $p_i$ value and calculate the dependent variable value accordingly. The regression equation is specified as follows:

$$\ln\left(\frac{p}{1-p}\right) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + u_t, \qquad (7)$$

where

ln: natural logarithm

$p$: multidimensional poverty status of Bodo household

$\left(\frac{p}{1-p}\right)$: log odds ratio of multidimensional poverty status of Bodohousehold

$\alpha$ : a coefficient of the constant term

$X_1$: family size

$X_2$: literacy levels measured in terms of mean years of schooling of the selected household

$X_3$: number of employed in the age-group 15–59 for each household

$X_4$: health status as binary (calorie intake below normal-1, otherwise-0) variable

$X_5$: consumption expenditure in rupees

$X_6$: operational land holding

$X_7$: village distance from the main town

$u$: error term.

Statistical package STATA-11 and other relevant statistical tools are used to analysis the collected data.

**Table 2** Description of variables used in Probit model for probability of participation

| *Variable name* | *Variable description* | *Variable type* |
|---|---|---|
| Household level multidimensional poverty index ($HMPI_i$) | Composite index calculated by using the modalities in Table A5 and using MCA technique | Dependent |
| Family size | Total number of members in the family | Demographic (independent) |
| Literacy levels | The mean of the total years of schooling of all members of the sampled household and this variable is expected to influence the self-sufficient or surplus status of the household in the multidimensional poverty scale | Social (independent) |
| Health status | Measured in terms of the calorie intake. The variable is binary in nature. If the amount of calorie intake is below normal we put '1', '0' otherwise | Social (independent) |
| Village distance | The distance of the village from the two main towns, viz., Udalguri and Tangla in kilometres | Social (independent) |
| Number of employed | The total number of employed in the age-group 15–59 for each household | Economic (independent) |
| Operational land holding | Size of the operational land in Bigha holds by the family | Economic (independent) |
| Consumption expenditure | The monthly consumption expenditures of the family measured in terms of rupees. It includes expenditures on food items, for schooling and for betterment of health status | Economic (independent) |

*Source*: Authors' own specification

## 4 Analysis of research results

This section discusses the results related to the objectives mentioned earlier and the results are calculated by the methodology discussed in the third section of this paper. Firstly, we will discuss the results related to the first objective.

### *4.1 Multidimensional poverty index*

The weights for each modality of the MPI are presented in Table A2 in the appendices. By using these weights we have constructed the household level MPI for 333 households for 22 different villages. One VMPI calculation for the sample village is presented in Table A3 in appendices. By using the above-mentioned methodology we constructed village and block level MPI. The village level MPI is presented in Table 3.

**Table 3** Village wise multidimensional poverty index values and corresponding ranking

| *Name of the village* | *Village multidimensional poverty index* | *Rank* | *Identification of the village* | *Percentage of poor* |
|---|---|---|---|---|
| Arrangpara | 0.482 | 4 | Moderately poor | 66.67 |
| Dildangpara | 0.459 | 13 | Moderately poor | 100.00 |
| Dhakhin Chewni | 0.485 | 3 | Moderately poor | 53.33 |
| Langlinga | 0.501 | 1 | Self-sufficient | 53.33 |
| Landangpara | 0.471 | 10 | Moderately poor | 100.00 |
| Arrabari | 0.491 | 2 | Moderately poor | 46.67 |
| No-1 Khajuabil | 0.443 | 17 | Moderately poor | 86.67 |
| Kapati Bagicha | 0.478 | 7 | Moderately poor | 73.33 |
| Kamarchuburi | 0.434 | 20 | Moderately poor | 100.00 |
| Kacharison | 0.456 | 15 | Moderately poor | 100.00 |
| Batamari | 0.468 | 11 | Moderately poor | 73.33 |
| Niz-Dalgaon | 0.442 | 19 | Moderately poor | 93.33 |
| Batabari | 0.479 | 6 | Moderately poor | 86.67 |
| Ekorabari | 0.445 | 16 | Moderately poor | 100.00 |
| Kasibari | 0.456 | 14 | Moderately poor | 66.67 |
| Chengapathar | 0.466 | 12 | Moderately poor | 53.33 |
| Chapai Punia | 0.475 | 8 | Moderately poor | 80.00 |
| Chandowlpara | 0.443 | 18 | Moderately poor | 100.00 |
| Lamabari | 0.403 | 22 | Moderately poor | 80.00 |
| No-1 Bahadurgaon | 0.471 | 9 | Moderately poor | 75.00 |
| No-2 Jhargaon | 0.417 | 21 | Moderately poor | 100.00 |
| Kacharipara | 0.482 | 5 | Moderately poor | 66.67 |

*Source*: Authors' own calculation based on primary data

All the sampled villages are categorised as moderately poor as the calculated VMPI values fall within the range 0.31–0.49. The lowest VMPI value 0.403 is obtained for Lamabari with 80% poor households. Lamabari is preceded by No-2 Jhargaon with rank 21st and Kamarchuburi with rank 20th in the list. The VMPI values for No-2 Jhargaon and Kamarchuburi are 0.417 and 0.434 with 100% poor households. Other than No-2 Jhargaon and Kamarchuburi there are five more villages, namely, Dildangpara, Landangpara, Kacharison, Ekorabari and Chandowlpara for which we get 100% poor household living there. The ranks for these villages are 13th, 10th, 15th, 16th and 18th respectively. The highest value for VMPI is 0.501 is obtained for Langlinga with 53.33% poor households. In fact, it is the only village which is identified as non-poor, specifically a self-sufficient village. This village is ranked first in the list. The second and the third villages in the list are Arrabari and Dhakhin Chewni villages with VMPI values are 0.491 and 0.485 respectively. The percentages of poor households in these two villages are 46.67 and 53.33%. It is to be noted that the lowest percentage of poor households 46.67% is obtained for Arrabari village which is ranked 2nd in the list and categorised as moderately poor. On the other hand, the last position is occupied by Lamabari but the

percentage of poor households in this village is 80%, even though there are other seven villages with 100% poor households. These results reflect the uneven distribution of wealth and resources means the concentration of wealth, resources and power.

We next consider the block-wise poverty status of the study area by considering blocks. The block MPI value is calculated by taking the simple average of VMPI values of two sampled villages from the same block (Table 4).

**Table 4** Block wise multidimensional poverty index values and corresponding ranking

| *Name of the block* | *Block multidimensional poverty index* | *Rank* | *Identification of the block* | *Percentage of poor* |
|---|---|---|---|---|
| Khoirabari | 0.471 | 3 | Moderately poor | 83.33 |
| Bhergaon | 0.489 | 1 | Moderately poor | 53.33 |
| Udalguri | 0.481 | 2 | Moderately poor | 73.33 |
| Dalgaon | 0.460 | 6 | Moderately poor | 80.00 |
| Borsola | 0.445 | 10 | Moderately poor | 100.00 |
| Bechimari | 0.455 | 8 | Moderately poor | 83.33 |
| Rowta | 0.462 | 4 | Moderately poor | 93.33 |
| Kalaigaon | 0.461 | 5 | Moderately poor | 60.00 |
| Paschim Mangaldoi | 0.459 | 7 | Moderately poor | 90.00 |
| Mazbat | 0.438 | 11 | Moderately poor | 77.42 |
| Pub Mangaldoi | 0.449 | 9 | Moderately poor | 83.87 |

*Source*: Authors' own calculation based on primary data

AQ3: Please cite check if the citation for Table 4 is ok.

From the calculated value of BMPI, we get all the sampled blocks are categorised as poor, more specifically, moderately poor. The highest value of BMPI is 0.489, obtained for Bhergaon with 53.33% poor households. Bhergaon is followed by Udalguri and Khoirabari blocks with BMPI values 0.481 and 0.471 respectively. The percentages of poor in these two blocks are 73.33 and 83.33% respectively. Borsola is that block for which we get 100% poor households and the corresponding BMPI value is 0.445. But it is not the lowest ranked block. The rank for this block is 10th in the list. The lowest position is occupied by Mazbat with BMPI value 0.438 and the percentage of poor is 77.42%. The important point is that for the blocks the percentages of poor are greater than 50%.

By using equation (6), the MPI for the study area is calculated as 0.461 and the study area is categorised as poor, specifically, moderately poor with 79.88% poor household. Thus from this study, we observe that out of twenty-two sampled villages all villages except one are identified as poor. In the case of this only one village, the VMPI value was 0.501 and the village is identified as self-sufficient. For seven villages we obtain 100% households are poor and on average more than 50% households in each village are identified as poor households. All eleven sampled blocks are identified as moderately poor blocks with more than 50% poor households. There is one block for which we obtain 100% poor households. For the study area as a whole 80% households are multidimensionally poor. However, in all cases, the sample unit is identified as moderately poor not extremely poor. Thus with the appropriate policy, the situation can be changed.

### *4.2 Factors influencing the multidimensional poverty status of the Bodos*

This section presents the regression results. The descriptive statistics for the regressors are presented in Table 5. The mean consumption expenditure for the sampled households is Rs. 5558.649 and the mean of years of schooling are two. On average, the sampled household holds five hectares of agricultural land. At least one member of each family is employed. The highest distance of the village from the main town is 42 km.

**Table 5** Descriptive statistics of the regressor

| *Variables* | *Mean* | *Standard Deviation* | *Min* | *Max* |
|---|---|---|---|---|
| Family size ($X_1$) | 4.625 | 1.469 | 1 | 11 |
| Literacy status ($X_2$) | 5.972 | 2.439 | 0 | 12.4 |
| No. of employed in the age group (15–59) ($X_3$) | 1.835 | 1.117 | 1 | 6 |
| Health status ($X_4$) | 0.949 | 0.220 | 0 | 1 |
| Consumption expenditure in rupees ($X_5$) | 5558.649 | 2696.435 | 1500 | 20000 |
| Operational land holding ($X_6$) | 5.164 | 5.961 | 0 | 70 |
| Distance from the main town ($X_7$) | 23.069 | 10.559 | 5 | 42 |

*Source*: Authors' own calculation based on primary data

In the regression, we used the HMPI value as $p$ in the following formula $\ln\left(\frac{p}{1-p}\right)$ to form the dependent variable. We then have applied the regression analysis for identifying the factors influencing the poverty situation of Bodo households of Udalguri district, Assam. We have used standardised coefficients to compare the impacts of different explanatory variables.

We have checked the multicollinearity among the explanatory variables and conclude that no multicollinearity (Tables A4–A6 in appendices). All results are obtained by using the statistical package STATA-11.

The regression results are presented in Table 6. The signs of the estimated coefficients are as expected. The demographic variable family size has a negative influence on the non-poverty status of the Bodo households at 5% level of significance. Economically it means that a larger family increases the probability to become poor. This is quite obvious as the same amount of resources will be more thinly distributed among the members of the family. The two most important social variables, namely, literacy status and health status positively influence the non-poverty status of the sampled household at 1% level of significance. This means that higher literacy status and good health condition for the household will increase their chance to avoid poverty and they will become multidimensionally self-sufficient or in some better cases surplus. The distance of the sampled village from the main town has as expected a negative influence on the non-poverty status of the sampled households at 1% level of significance. From the field survey, we observe that the means of transportation to the study area is very poor; this means that the farthest village from the town will not be able to get all the facilities that are enjoyed by the nearest village, in terms of hospitals, health centres, schools, colleges etc. Thus, those households who are living in the village which is farthest from the main town have greater chance to suffer from poverty in the multidimensional sense.

**Table 6** Factor influencing the socioeconomic status of Bodo people

| *Variables* | *Coefficients* | *Standard error* | *t* | *P* > \|*t*\| | *Standardised coefficient (Beta)* |
|---|---|---|---|---|---|
| Family size ($X_1$) | –0.0240** | 0.0103 | –2.33 | 0.021 | –0.134** |
| Literacy status ($X_2$) | 0.0193* | 0.0043 | 4.52 | 0.000 | 0.2348* |
| No. of employed in the age group (15–59) ($X_3$) | 0.0235* | 0.0082 | 2.87 | 0.004 | 0.1724* |
| Health status ($X_4$) | 0.3077* | 0.0457 | 6.73 | 0.000 | 0.3389* |
| Consumption expenditure in rupees ($X_5$) | 0.5771* | 0.0583 | 9.90 | 0.000 | 0.0481* |
| Land holding ($X_6$) | 0.0025 | 0.0019 | 1.31 | 0.192 | 0.0739 |
| Distance from the main town ($X_7$) | –0.0027* | 0.0009 | –2.82 | 0.005 | –0.1406* |
| Constant | 0.0004 | 0.0004 | 0.85 | 0.395 | |
| ANOVA | | | | | |
| Number of observations | | | 333 | | |
| $R^2$ | | | 0.4331 | | |
| $\overline{R}^2$ | | | 0.4166 | | |

*Significant at 1% level, **significant at 5% level, ***significant at 10% level.

*Source*: Authors' own calculation based on primary data

All three economic variables show a positive influence on the non-poverty status and the results are as expected. Higher consumption expenditures (including expenditures on food items, education, maintenance of health, proper cooking energy etc), large land operational holding, and the higher number of employed in the working-age group of the family obviously will improve the economic status of the household. Consumption expenditures and the number of employed members in the household within the working age group are significant at 1% level. But the third economic variable, the amount of operational land holdings becomes insignificant, although the sign of the estimated coefficient is economically meaningful.

In order to understand the relative influence of these variables, we consider the standardised coefficients of the regression which are also presented in the same table. For the policy purpose, the most important variable is the health status of the sampled Bodo households, measured in terms of the calorie intake with an estimated coefficient 0.3389, highest in absolute number. Thus, in order to improve the socioeconomic status or multidimensional poverty status, the family requires giving emphasis on healthy habits. The second most important policy variable is the literacy status with the estimated standardised coefficient 0.2348. Thus, to improve the socioeconomic status or the multidimensional poverty status the family should push themselves in acquiring more education, including girl children. Next in the row is the number of employed members of the family in the age working group with an estimated standardised coefficient 0.1724. All these variables have a positive influence on the socioeconomic status of sampled

Bodo households. The regression analysis suggests that for the purpose of policy recommendations we need to give more emphasis on health, literacy and employment opportunity.

## 5 Conclusion and policy recommendations

Our study concludes that the Udalguri district can be categorised as moderately poor, with the overall MPI value of 0.461 and almost 80% households are identified as poor. This means that the study area is multidimensionally poor and the area needs the specific policy for transformation from poor to at least self-sufficient. Bodoland Territorial Autonomous District, (BTAD) was created in 2004 and the leaders of the Bodo Liberation Tigers are still in demand for complete statehood, named as Bodoland. But from our result, it follows that Bodoland still needs to go a long way and the BTAD with the help of the state and central government can improve the present situation of Bodoland.

The regression results suggest that to improve the present status the BTAD needs to give emphasis on improving the literacy status, the health status and the employment opportunities. The independent variables, literacy status, health status, the number of employed in the working-age group, consumption expenditures of the family influence positively the transformation of the poor to non-poor status in multidimensional aspect. The other two regressors family size and the distance of the village from the main town negatively influence the non-poor status of Bodo households. The estimated coefficient for the former is statistically significant at 10% level while the latter is significant at 1% level. Hence we need to frame policy recommendations for this study on the basis of these observations to build up micro-macro linkages for this study.

With the estimated results we suggest the following policy recommendations:

- The health status becomes the most important determining factor for transforming Bodo households from poor to non-poor. In order to improve the health status of the study area more health centres with modern equipments, medicines and sufficient medical staffs even in the interior village are to be setup. 'Aganwari' workers should be given proper training to handle delivery cases at home. In case of emergency for quick transfer of the patient 'Ambulance' service should be made available to all villages. Modern equipped multispecialty hospitals in nearby main towns should be established.
- As literacy becomes the second important positively influenced factor to improve the non-poor status of the Bodo households we need to put emphasise on parents for sending their children to school including girl children. More schools within limited distance should be set-up so the children can reach to the school with convenience. Incentives like free books and learning materials, mead-day-meal etc., should to be implemented.
- Third most important determining factor for the transformation of poor to non-poor is the number of employed in the family in the working age group. Thus to improve the employment opportunity the BTAD needs to implement all the central government employment creation policy, like, JRY, Swarnjayanti Gram Swarozgar Yojana etc., as applicable to that area.

- There is no doubt that the proper implementation of the 'Land Reform' policy, with full political cooperation, will definitely improve the poverty status of the Bodo households as most of the Bodo families are peasant families with agriculture as a sole occupation.
- The negative influence of the family size on poverty indicates that the Bodo families should be encouraged to adopt proper family planning.
- The distance variable indicates that improving the transportation system is important. Particularly the development of roadways, railways are recommended. These can only be done by state and central governments joint venture.

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## Appendix

**Table A1** Village wise population and sample size for Bodo households

| *Name of the block* | *Name of the village* | *Sample size (in whole numbers)* | *Category of village* |
|---|---|---|---|
| Khoirabari | Arrangpara | 15 | 1 (T) |
| Khoirabari | Dildangpara | 15 | 0 (T) |
| Bhergaon | Dhakhin Chewni | 15 | 1(U) |
| Bhergaon | Langlinga | 15 | 0(U) |
| Udalguri | Landangpara | 15 | 1(T) |
| Udalguri | Arrabari | 15 | 0 (T) |
| Dalgaon | No-1 Khajuabil | 15 | 0(U) |
| Dalgaon | Kapati Bagicha | 15 | 1(U) |
| Borsola | Kamarchuburi | 15 | 1(U) |
| Borsola | Kacharison | 16 | 0(U) |
| Bechimari | Batamari | 15 | 0(U) |
| Bechimari | Niz-Dalgaon | 15 | 1(U) |
| Rowta | Batabari | 15 | 1(U) |
| Rowta | Ekorabari | 15 | 0(U) |
| Kalaigaon | Kasibari | 15 | 0 (T) |
| Kalaigaon | Chengapathar | 15 | 1 (T) |
| Paschim Mangaldoi | Chapai Punia | 15 | 1 (T) |
| Paschim Mangaldoi | Chandowlpara | 15 | 0 (T) |
| Mazbat | Lamabari | 15 | 1 (U) |
| Mazbat | No-1 Bahadurgaon | 16 | 0 (U) |
| Pub Mangaldoi | No-2 Jhargaon | 16 | 1 (T) |
| Pub Mangaldoi | Kacharipara | 15 | 0 (T) |
| *Total* | *22* | *333* | |

0: Farthest village from the town, 1: nearest village from the town and U: Udalguri, T: Tangla.

*Source*: Researcher's own calculation based on primary data

**Table A2** Indicators used for primary data collection

| *Indicator* | *Modality* | *Weights* |
|---|---|---|
| Literacy status | Head of household alphabetised (if yes = 1, otherwise = 0) | 0.114 |
| | Household share with no education | |
| | Less than 1/3 | 0.078 |
| | Between 1/3 &1/2 | 0.054 |
| | Between 1/2 &3/4 | 0.007 |
| | More than 3/4 | 0.004 |
| | No member of the household has completed five years of schooling (if no = 1. Otherwise = 0) | 0.137 |
| | At least one school age children not enrolled in school (if no child and no = 1. Otherwise = 0) | 0.125 |
| Health status of the household | Antenatal child care (if yes = 1, otherwise = 0) | 0.124 |
| | Postnatal child care (if yes = 1, otherwise = 0) | 0.142 |
| | Polio affected household (if no = 1, otherwise = 0) | 0.165 |
| | Family planning adoption (if yes = 1, otherwise = 0) | 0.123 |
| | Child malnutrition (if no and no child = 1, otherwise = 0) | 0.165 |
| Living standard index | Roof materials | |
| | Thatches/mats | 0.016 |
| | Zinc sheets | 0.241 |
| | Cement/Tiles | 0.258 |
| | Floor materials | |
| | Mud/Wood/others | 0.002 |
| | Cement | 0.076 |
| | Titles | 0.256 |
| | Type of toilet facility | |
| | No toilet | 0.009 |
| | Unconstructed latrine | 0.060 |
| | Constructed latrine | 0.263 |
| Utilities and durable index | Source of water supply | |
| | Streams/others | 0.004 |
| | Spring/wells | 0.094 |
| | Public tap | 0.202 |
| | Source of lighting | |
| | Kerosene lamp | 0.112 |
| | Electricity | 0.385 |

**Table A2** Indicators used for primary data collection (continued)

| *Indicator* | *Modality* | *Weights* |
|---|---|---|
| Utilities and durable index | Energy for cooking | |
| | Firewood | 0.003 |
| | Charcoal/sawdust | 0.005 |
| | Kerosene | 0.075 |
| | Gas | 0.178 |
| | Durables with the household | |
| | Possession of mobile phone (if yes = 1, otherwise = 0) | 0.231 |
| | Possession of TV set (if yes = 1, otherwise = 0) | 0.129 |
| | Possession of Refrigerator (if yes = 1, otherwise = 0) | 0.003 |
| | Possession of Electricity (if yes = 1, otherwise = 0) | 0.192 |
| | Possession of cycle (if yes = 1, otherwise = 0) | 0.241 |
| | Possession of motored vehicles (Two wheelers) (if yes = 1, otherwise = 0) | 0.043 |

*Source*: Authors' own specification for primary data collection

**Table A3** Multidimensional poverty index for Arrangpara of Khoirabari block

| *Village name* | *Name of the block* | *Distance from the main town* | *Household* | *Composite household MPI (HMPI)* | *Village MPI (VSEI)* | *Block MPI* | *MPI* |
|---|---|---|---|---|---|---|---|
| Arrangpara | Khoirabari | 15 km Tangla (Nearest) | hh-1 | 0.508 | 0.482033 | 0.4706 | 0.461 |
| | | | hh-2 | 0.462 | Poor | Poor | Poor |
| | | | hh-3 | 0.465 | (Moderately poor or borderline) | (Moderately poor or borderline) | (Moderately poor or borderline) |
| | | | hh-4 | 0.465 | | | |
| | | | hh-5 | 0.473 | | | |
| | | | hh-6 | 0.493 | | | |
| | | | hh-7 | 0.442 | | | |
| | | | hh-8 | 0.445 | | | |
| | | | hh-9 | 0.493 | | | |
| | | | hh-10 | 0.508 | | | |
| | | | hh-11 | 0.473 | | | |
| | | | hh-12 | 0.508 | | | |
| | | | hh-13 | 0.508 | | | |
| | | | hh-14 | 0.508 | | | |
| | | | hh-15 | 0.479 | | | |

*Source*: Authors' own calculation based on primary data

**Table A4** Collinearity diagnostics

| *Variable* | *VIF* | *SQRT VIF* | *Tolerance* | *Eigen value* | *Cond index* |
|---|---|---|---|---|---|
| Family size ($X_1$) | 1.53 | 1.24 | 0.654 | 6.4106 | 1.0000 |
| Literacy status ($X_2$) | 1.14 | 1.07 | 0.8766 | 0.5730 | 3.3447 |
| No. of employed in the age group (15–59) ($X_3$) | 1.4 | 1.19 | 0.7118 | 0.4156 | 3.9274 |
| Health status ($X_4$) | 1.08 | 1.04 | 0.93 | 0.2605 | 4.9609 |
| Consumption expenditure in rupees ($X_5$) | 1.35 | 1.16 | 0.7387 | 0.1538 | 6.4559 |
| Land holding ($X_6$) | 1.36 | 1.16 | 0.7373 | 0.0974 | 8.1125 |
| Distance from the main town ($X_7$) | 1.05 | 1.03 | 0.9518 | 0.0675 | 9.7442 |
| *Mean VIF* | | | 1.27 | | |
| *Condition number* | | | 9.7442 | | |

*Source*: Authors' own calculation based on primary data

**Table A5** Correlation diagnostics

| *Variable* | *Family size ($X_1$)* | *Literacy status ($X_2$)* | *No. of employed in the age group (15–59) ($X_3$)* | *Health status ($X_4$)* | *Consumption expenditure in rupees ($X_5$)* | *Land holding ($X_6$)* | *Distance from the main town ($X_7$)* |
|---|---|---|---|---|---|---|---|
| Family size ($X_1$) | 1 | | | | | | |
| Literacy status ($X_2$) | 0.0205 | 1 | | | | | |
| No. of employed in the age group (15–59) ($X_3$) | 0.5241 | 0.004 | 1 | | | | |
| Health status ($X_4$) | 0.0616 | 0.1487 | 0.0758 | 1 | | | |
| Consumption expenditure in rupees ($X_5$) | 0.1666 | 0.3171 | 0.0198 | 0.2029 | 1 | | |
| Land holding ($X_6$) | 0.291 | 0.1943 | 0.0697 | 0.1531 | 0.4218 | 1 | |
| Distance from the main town ($X_7$) | –0.0078 | –0.0862 | –0.0105 | 0.0895 | 0.0335 | –0.1341 | 1 |

*Source*: Authors' own calculation based on primary data

**Table A6** Variance inflation factor (VIF) for the regression

| *Variables* | *VIF* | *1/VIF* |
|---|---|---|
| Family size ($X_1$) | 1.53 | 0.653963 |
| Literacy status ($X_2$) | 1.4 | 0.711792 |
| No. of employed in the age group (15–59) ($X_3$) | 1.36 | 0.737299 |
| Health status ($X_4$) | 1.35 | 0.738734 |
| Consumption expenditure in rupees ($X_5$) | 1.14 | 0.876568 |
| Land holding ($X_6$) | 1.08 | 0.929997 |
| Distance from the main town ($X_7$) | 1.05 | 0.951801 |
| *Mean VIF* | *1.27* | |

The rule of thumb for the variance inflation factor is that a variable whose VIF values are greater than 10 may merit further investigation. Tolerance, defined as 1/VIF, is used by many researchers to check on the degree of collinearity. A tolerance value lower than 0.1 is comparable to a VIF of 10. It means that the variable could be considered as a linear combination of other independent variables. Let us now look at the regression we did. Here VIF and tolerance (1/VIF) values for all explanatory variables are much lower than 10 and much higher than 0.1 respectively. Thus we can say that our estimated equation is not suffering from multicollinearity problem.

*Source*: Authors' own calculation based on primary data