Agricultural Economics Research Review 2021, 34 (Conference Number), 51-57
DOI: 10.5958/0974-0279.2021.00014.8

Correlates of multidimensional poverty in rural Bihar

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Abstract Reducing poverty has been the cornerstone of several development policies. Yet, reducing it on income level has not yielded much result, as income-based poverty fails to capture other dimensions of deprivations. This study, using data from the 7th DHS survey, constructs a Multidimensional Poverty Index (MPI) for 38 districts of rural Bihar and its correlates. The extent of multidimensional poverty is very high, varying from 0.19 in Rohtas to 0.39 in Araria. Further analysis shows that MPI is affected by the access to clean cooking fuel, improved sanitation facilities and education.

Keywords Multidimensional poverty, regression tree analysis, Bihar, India

JEL Codes C43, C38, I32, I38

Reducing poverty has been the cornerstone of India's development plans since independence. Despite this, poverty and its effects remain a persistent problem. The link between poverty reduction and realized welfare has also been debated. Although income, poverty and welfare seem to be related, the literature (Alkire 2005, Laderchi 1997, Sharma 1995) advocates that income alone should not be considered as the sole indicator for estimating poverty because of its non-linear relationship with other indicators of welfare. Therefore, a need arises to examine poverty through a multidimensional lens. Evidence suggests that the extent of poverty in India is highest in rural Bihar (Alkire 2015, Alkire et al. 2014, Panagariya and Mukim 2014). Chapoto et al. (2011) enumerated agricultural (including livestock) asset accumulation and commercialization, investment in secondary and post-secondary education, health shocks, lower access to markets as key factors in influencing poverty in developing countries. He suggested investment in these areas could help people escape poverty. Dhamija (2011) using panel data found that village-level infrastructure, rural-urban linkages, size of the village, and ownership of land and livestock play a significant role in reducing poverty in India. Krishna (1993) identified ill-health, high health care costs, high interest on private debts, droughts, and social and customary expenses as major contributing factors to poverty. Diversification of income sources, investment in health care facilities, education, industrial growth, land improvement were suggested for reducing poverty. Sharma (1995) estimated poverty using National Sample Survey (NSS) expenditure data and found that land, poor employment opportunities, the primitive form of agriculture and industries, faulty delivery systems, poor infrastructures and low assets and literacy were major causes of higher poverty in Bihar. Land reforms, rural industrialization, investment in irrigation, flood control, rural power supply, and education were suggested for reducing the poverty. He also supported inclusion of other indicators for measuring poverty. According to Singh et al. (2011), deprivation in education, caste, ownership of productive assets (like land and livestock), and lack in access to communication and information technology and institutional credit as major factors underlying the poverty in Bihar. This study aims to analyze the indicators that influence the present poverty status.

Our study contributes to the existing literature in several ways. First, it uses a large representative dataset. Second, it also uses deprivation in indicators other than

income for analyzing poverty. Since 76% of the population of Bihar is involved in agriculture, it includes several indicators related to agriculture and livestock.

Methodology

Data

Multidimensional Poverty Index (MPI) was calculated using data from the 7th Demographic and Health Survey (DHS) 2015-16. We followed Alkire and Foster (2011) to estimate multidimensional poverty. MPI mainly gives information about the extent of poverty as well as the average number of dimensions in which the poor are deprived. It can be estimated as:

$$M_0 = H \times A$$

Where, H is the poverty headcount ratio, $H = \frac{q}{n}$, and A represents the intensity of poverty i.e., the average number of deprivations faced by the poor, $A = \frac{\sum_{i=1}^{n} C_i(k)}{q}$.

The construction of H and A involves the selection of a set of indicators under each dimension. Then using the dual cut-off approach, the poor in each district are identified and aggregated. The indicators and dimensions and their respective cut-off considered in analyzing MPI are given in Table 1. The indicators used are the necessary factors for increasing the productive capacity of individuals, which in turn increases the efficiency of human capital and thereby promote economic growth. Thus, analyzing the domains responsible for multidimensional poverty can help in reducing poverty and increasing the welfare of the masses. Since a majority of the independent variables are categorical, a regression tree analysis was performed for analyzing the factors influencing the level of poverty. Regression tree analysis is a data mining technique that uses a variance minimizing approach to identify variables among a vector of factors. It is a non-parametric approach that explains the effects of independent continuous or categorical variables on the dependent variable. The tree is built on the algorithm of recursively splitting the data into different child nodes to attain homogeneity based on the given partition criteria or the dependent variable (Ramadas et al. 2021). Therefore, the root node (data set) is divided into other nodes (sub-samples) and this process continues till the decisive criteria are met. Finally, the process ends at the terminal node. The fundamental functional form used is: $Y_i = f(x_1, x_2 \ldots x_n)$

Where, Y is the dependent variable i.e., MPI for 38 districts in Bihar, and the explanatory variables include years of schooling, child school enrollment, nutritional status, child mortality, access to drinking water, sanitation, cooking fuel, electricity, housing conditions and life-sustaining assets.

Results and discussion

Table 2 presents the summary of the population deprived in different indicators in rural Bihar. A majority of the population is deprived of clean cooking fuel facilities, followed by asset ownership, improved sanitation facilities, better housing conditions, nutrition, access to electricity, education, and child attendance in school. The variation is the highest in the case of access to electricity and the lowest in the child mortality rate. Sharma (1995) reported that 50 to 70% of the wage earners in Bihar were deprived of nutritious food (both qualitatively and quantitatively), pucca houses, and agricultural assets. Only 15% of them owned a bicycle and a majority of the children were deprived of school education. Hence, to get a complete picture of the extent of poverty, a multidimensional poverty index was constructed for each of the districts and then the districts were categorized as low, moderate and high based on the magnitude of multidimensional poverty index (Sinha et al. 2021).

Figure 1 shows the intra-state variation in multidimensional poverty. The extent of poverty varies from 0.19 in Rohtas to 0.39 in Araria. A majority of the districts in the high multidimensional poverty zones are in north Bihar, which is highly vulnerable to climatic events (floods). The districts in moderate and low MPI zones lie in the central and southern parts of the state. This indicates that a higher extent of deprivation and climatic events make people fall back into poverty traps. To decipher the factors that are likely to increase the extent of multidimensional poverty, a regression tree analysis has been carried out. The results are presented in Figures 2 and 3.

Table 1 Dimensions and indicators included for constructing the MPI

Dimensions	Indicators (explanatory variables)	Deprivation cut-off	Weights
Education	Years of schooling	If household members aged 10 years orolder has completed 6 years of schooling	1/6
	Child school enrollment	Any school-aged child is not attending school up to class 8	1/6
Health	Nutrition	Individual or child in the household is malnourished*	1/6
	Child mortality	Any child died in the household in the last five years preceding the survey.	1/6
Standard of living	Drinking water	The household has no access to safe drinking water (according to SDG guidelines)** or if it takes more than 30 minutes to reach the clean water sources.	1/18
	Sanitation	Household's sanitation facility was not improved (according to SDG guidelines)***, or if improved but shared with other households.	1/18
	Housing conditions	Materials used for constructing the roof, walls and floor are inadequate****	1/18
	Cooking fuel	Lack of improved cooking fuel.#	1/18
	Electricity	Lack of electricity.	1/18
	Assets	The household doesn't have access to more than 2 assets, agricultural assets or tractor)	1/18
	Access to information and communication (Radio, Television, Telephone/ mobile-telephone)		
	Supporting the mobility (Bike, bicycle, animal cart, tractor)		
	Support livelihood (own agricultural land, livestock and other agricultural equipment)		

*The adult (20 to 70 years old) is considered malnourished if the BMI is less than 18.5 kg/m^2. Those between 5 to 20 years of age are malnourished if the age-specific BMI is below minus two standard deviations. Children under 5 years are categorized as malnourished if their z-score for either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the reference population.

**Clean drinking water sources: Piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within 30 minutes walk (round trip).

***Adequate sanitation facilities: some type of flush toilet or latrine, or ventilated improved pit or composting toilet and are not shared with other households.

****Inadequate flooring: If the floor is made of mud/clay/earth, sand or dung or if a dwelling has no roof or walls or if either the roof or walls are made of natural materials such as cane, palm/trunks, sod/mud, dirt, grass/reeds, thatch, bamboo, sticks or rudimentary materials such as carton, plastic/ polythene sheeting, bamboo with mud/stone with mud, loosely packed stones, uncovered adobe, raw/reused wood, plywood, cardboard, un-burnt brick or canvas/tent.

Liquefied Petroleum Gas (LPG) is taken as improved cooking fuel, other than LPG has been kept as unimproved cooking fuel category.

Table 2 Indicator wise summary statistics in rural Bihar (% of the deprived population)

Parameter	Years of education	Child attendance	Child mortality	Nutrition	Electricity	Sanitation facilities	Drinking water facilities	Housing conditions	Cooking fuel	Assets ownership
Maximum value	43.64	20.89	8.21	58.72	57.1	70.18	17.18	59.1	73.04	71.2
Minimum value	10.01	3.68	2.56	34.92	13.15	40.86	0	9.15	43.62	44.03
Range	33.63	17.21	5.65	23.8	43.95	29.32	17.18	49.95	29.42	27.17
Mean	27.08	12.21	4.65	46.36	31.26	54.16	1.68	29.24	57.66	57.39

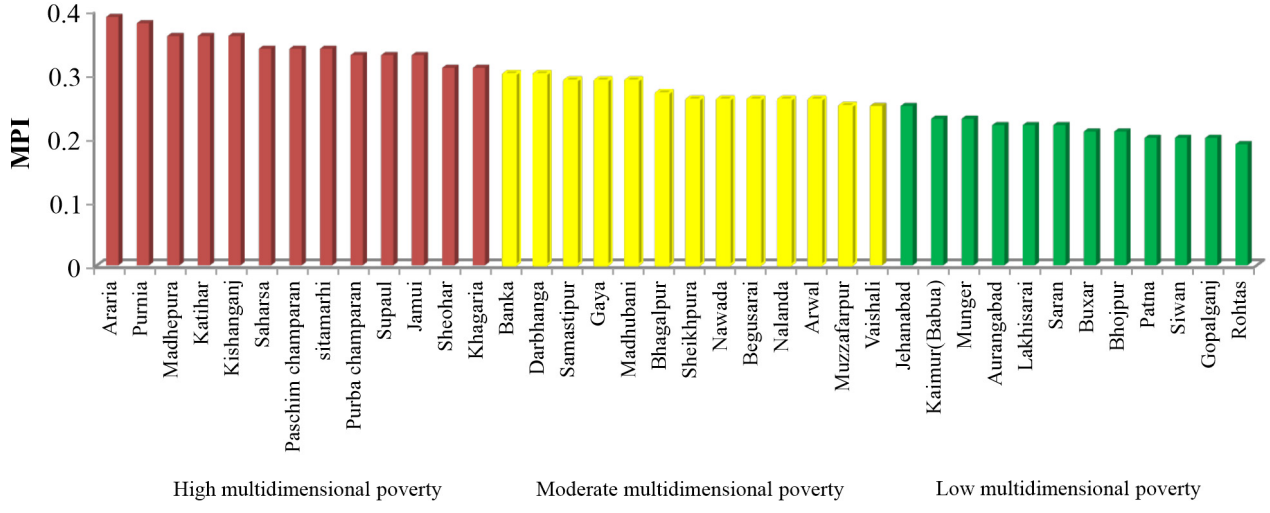

Figure 1 Extent of multidimensional poverty in districts of Bihar

Regression tree analysis helps to know the correlates of multidimensional poverty in each of the 38 districts, that are categorised into high, medium and low (Sinha et al. 2021). A perusal of the regression tree (Figure 2) indicates that the low and moderate MPI districts are grouped against the high MPI districts. The high multidimensional poverty zone gets further sub-divided depending on years of schooling. The districts with more than 39% of the households with members receiving schooling of fewer than 6 years cause an increase in MPI by 0.370. The low and moderate zones of MPI are further divided based on access to clean cooking fuel. The districts in which more than 52% of the households are deprived of clean cooking fuel have a higher MPI (0.271). The districts in which the deprivation to clean cooking fuel was more than 52%, are further subdivided based on access to improved sanitation facilities. Nodes 7 and 8 shows that a higher deprivation in improved sanitation facilities increases the extent of multidimensional poverty.

To reduce the extent of deprivation in education, both supply and demand-side factors need to be improved. On the supply side, access to schools can be increased by providing incentives to students (Muralidharan and Prakash 2017, Das and Sarkhel 2019), teacher performance (Karthik and Venkatesh 2011), and collective incentive of the locals (Banerjee et al. 2017). Lack of proper infrastructure, low pupil-teacher ratio, low household income, poor functioning of Mid- day Meal scheme are the major lacunae that need to be addressed for improving access to education (Ghosh and Rana 2011, Ranjan and Prakash 2012). The demand for education can be improved by increasing the employment status. Lack of access to clean cooking fuel and improved sanitation can lead to several water-borne and respiratory diseases (Lai et al. 2012) and ultimately lowers the income of people. Increasing access to improved sanitation requires changing the attitude of the people, modifying it according to social norms and making it affordable (Sinha et al. 2017,

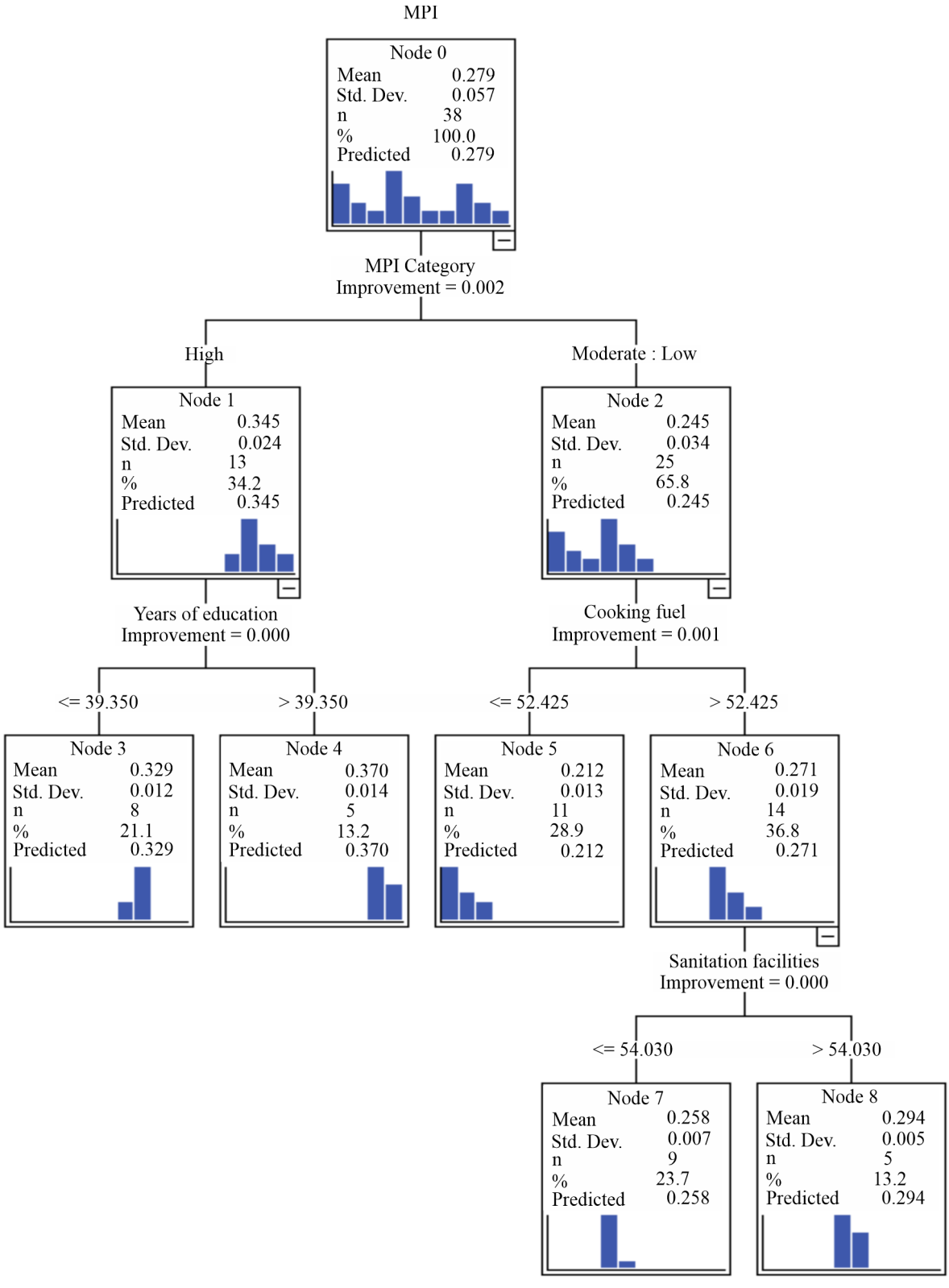

Figure 2 Determinants of multidimensional poverty in different poverty zones

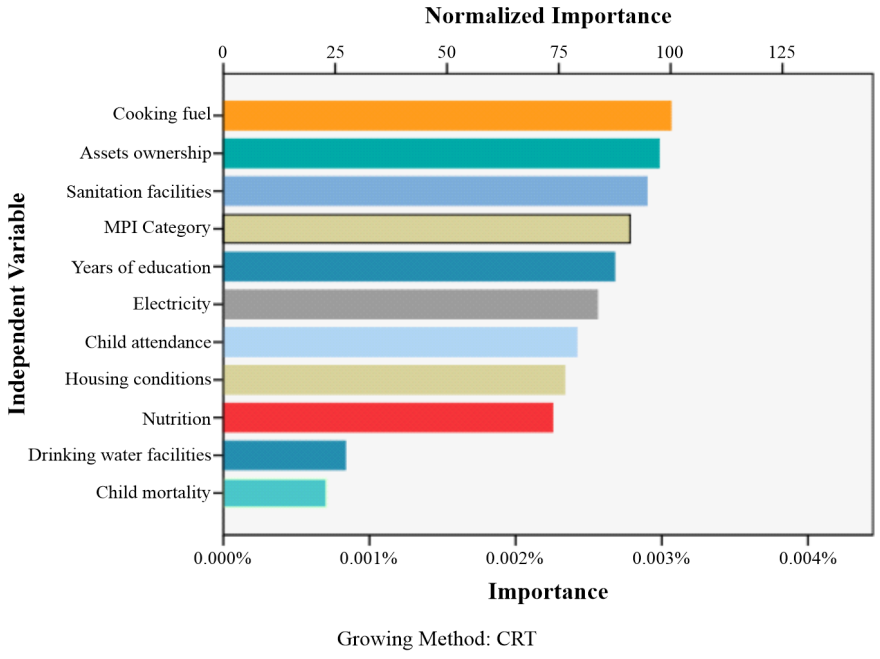

Figure 3 Explanatory variables influencing MPI

Novotný et al. 2018). Easy accessibility of other fuels makes it difficult to switch to using clean cooking fuels (Gould and Urpelainen 2018). Therefore, increasing the availability and affordability can help increase the adoption of clean cooking fuels.

Conclusions

This study analyzes the correlates of the multidimensional poverty in rural Bihar. The analysis revealed that enhanced investment in the provision of improved sanitation facilities, providing subsidies for the construction of improved toilets and refills in cooking fuel will help in reducing the extent of multidimensional poverty in low and moderate zones. Investment in education infrastructure, increasing the teacher-pupil ratio, providing a combination of information-incentive to parents, children and teachers can help in improving the educational attainment and thereby will reduce the extent of multidimensional poverty in high incidence regions. To conclude, a different combination of measures should be applied depending on the extent of deprivation across regions in addressing the issues of multidimensional poverty.

References

Alkire, S. 2005. Why the capability approach? *Journal of Human Development* 6 (1): 37–41. https://doi.org/10.1080/146498805200034275

Alkire, S. 2015. Global multidimensional poverty index. *Pakistan Development Review*. Vol. 54. https://doi.org/10.30541/v54i4i-iipp.287-299.

Alkire, S, and J Foster. 2011. Counting and multidimensional poverty measurement. *Journal of Public Economics* 95 (7–8): 476–87. https://doi.org/10.1016/j.jpubeco.2010.11.006.

Alkire, S, M Chatterjee, A Conconi, S Seth, and A Vaz. 2014. Poverty in Rural and Urban Areas Direct Comparisons Using the Global MPI 2014. *Oxford Poverty and Human Development Initiative*, 1–4.

Banerjee, A, R Banerji, E Duflo, R Glennerster, and S Khemani. 2017. Pitfalls of participatory programs: Evidence from a randomized evaluation in education in India the deplorable. *American Economic Journal: Economic Policy* 2 (1): 1–30.

Chapoto, A, D Banda, S Haggblade, and P Hamukwala. 2011. Factors affecting poverty dynamics in Rural Zambia. FSRP Working Paper No. 55. Lusaka, Zambia.

Dhamija, N. 2011. Poverty in Rural India: Variations in factors influencing dynamics of chronic poverty. *Journal of International Development*. https://doi.org/10.1002/jid.1827.

Ghosh, P, and K Rana. 2011. Elementary education in Bihar progress and challenges. Centre for Economic Policy and Public Finance…….

Gould, C F, and J Urpelainen. 2018. LPG as a clean cooking fuel: Adoption , use , and impact in rural India. *Energy Policy* 122 (March): 395–408. https://doi.org/10.1016/j.enpol.2018.07.042.

Karthik, M, and S Venkatesh. 2011. Teacher performance pay: Experimental evidence from India. *Journal of Political Economy* 119 (1): 39–77. http://www.jstor.org/stable/10.1086/659655.

Krishna, A. 1993. Pathways out of and into poverty in 36 villages of Andhra Pradesh , India. *World Development* 34 (2): 271–88. https://doi.org/10.1016/j.worlddev.2005.08.003.

Laderchi, C R. 1997. Poverty and its many dimensions: The role of income as an indicator. *Oxford Development Studies* 25 (3): 345–60. https://doi.org/10.1080/13600819708424139.

Lai, A T, I Ching L, Y W Yang, and M F Wu. 2012. Climate change and human health. *Journal of Internal Medicine of Taiwan* 23 (5): 343–50. https://doi.org/10.6314/JIMT.2012.23(5).05.

Muralidharan, K, and N Prakash. 2017. Cycling to school: increasing secondary school enrollment for girls in India. *American Economic Journal: Applied Economics* 9 (3): 321–50. https://doi.org/10.1257/app.20160004.

Novotný, J, J K W Hill, and A Kumar. 2018. Social determinants of environmental health: A case of sanitation in rural Jharkhand. *Science of the Total Environment* 643: 762–74. https://doi.org/10.1016/j.scitotenv.2018.06.239.

Panagariya, A, and M Mukim. 2014. A comprehensive analysis of poverty in India. *Asian Development Review* 31 (1): 1–52. https://doi.org/10.1162/ADEV_a_00021.

Ramadas, S, R S Poswal, A Kumar, R Chand, J K Pandey, R Singh, R Singh, A S Kharub, and R P S Verma. 2021. Determinants of contract farming in barley production - Regression tree approach. *Indian Journal of Agricultural Sciences* 91 (3): 402–7. https://hdl.handle.net/20.500.11766/9700.

Ranjan, P, and N Prakash. 2012. Education policies and practices: What have we learnt and road ahead for Bihar. IZA Discussion Paper No. 6614. Institute of Labour Economics.

Sharma, A N. 1995. Political economy of poverty in Bihar. *Economic and Political Weekly* 30 (41): 2587–89.

Singh, K M, R K P Singh, M S Meena, and A Kumar. 2011. Dimensions of poverty in Bihar. In *Asian Society of Agricultural Economists 7* (conference number), 13-15 October. 10.22004/ag.econ.290427.

Sinha, A, C L Nagel, W P Schmidt, B Torondel, S Boisson, P Routray, and T F Clasen. 2017. Assessing patterns and determinants of latrine use in rural settings: A longitudinal study in Odisha , India. *International Journal of Hygiene and Environmental Health* 220 (5): 906–15. https://doi.org/10.1016/j.ijheh.2017.05.004.

Sinha, M, R Sendhil, B S Chandel, R Malhotra, A Singh, S K Jha, and G Sankhala. 2021. Are multidimensional poor more vulnerable to climate change? Evidence from rural Bihar, India. *Social Indicators Research*, no. 0123456789. https://doi.org/10.1007/s11205-021-02827-z.

Das, U, and P Sarkhel. 2019. Conditional cash transfer for secondary education: Impact assessment of the Kanyashree program in West Bengal. *SSRN*. http://dx.doi.org/10.2139/ssrn.3455215