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Multidimensional Poverty Reduction in India 2005/6–2015/16: Still a Long Way to Go but the Poorest Are Catching Up

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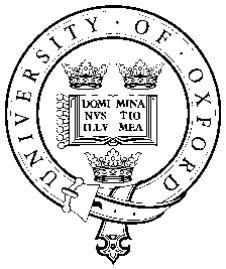

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Abstract
This paper assesses the change in multidimensional poverty in India from 2005/6 to 2015/16 using data from the NFHS-3 and NFHS-4 surveys. Estimates of changes are disaggregated by age cohort, state and by socio-economic group-level, and broken down by indicator; sampling errors are considered throughout. Multidimensional poverty is defined using the global Multidimensional Poverty Index 2018 (Alkire and Jahan 2018). The paper finds a very strong reduction, indeed a halving of the MPI during that decade. Furthermore, subnational patterns of poverty reduction are strongly pro-poor, whereas from 1998/9 to 2005/6 they had been regressive. The reductions of MPI are hardly correlated with state level growth in GDP, making this a rich terrain for future research. District level analyses in 2015/16 only document extensive ongoing intra and interstate variation. These explorations confirm that at the end of the decade under study, at least 271 million fewer persons were living in multidimensional poverty – a magnitude of change rivalling the numbers exiting monetary poverty in China.

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Introduction

This paper assesses the change in multidimensional poverty in India from 2005/6 to 2015/16 using data from the NFHS-3 and NFHS-4 surveys. Estimates of changes are disaggregated by age cohort, state and by socio-economic group-level, and always considered alongside sampling errors.[1] How change happened – in terms of the different patterns of reduction in deprivations across ten indicators measured for the same household – is explored for each case. Data tables accompany this paper. The definition of multidimensional poverty follows the global Multidimensional Poverty Index (2018 specifications) which was jointly designed by the United Nations Development Programme (UNDP) and the Oxford Poverty & Human Development Initiative (OPHI) in the University of Oxford. India's pattern of poverty reduction sub-nationally reflect a significant change in trajectory. In contrast to the period 1998/9–2005/6 during which the poorest groups had the slowest reduction of MPI according to the older MPI specifications, the poorest states and groups had the largest reductions in multidimensional poverty from 2005/6 to 2015/16 (Alkire and Seth 2015). To put these findings into perspective, they are overlaid with the annualized rate of reduction in monetary poverty across states, and also with state-level growth. As an interim methodological reflection, it is quite interesting that the patterns and magnitude of reduction of the MPI differs from that of the headcount ratio, and we empirically document the value-added of assessing changes in poverty using the MPI, which provides a sharply distinct and arguably more accurate account. District level analyses are also presented for 2015/16 only, and these show extensive intra and interstate variation in poverty levels. Given that the rate and magnitude of multidimensional poverty reduction was sizable, naturally, the question arises as to the extent to which this is driven by measurement specifications themselves: the indicator definitions, weights and poverty cutoff. To explore this, 20 alternative specifications of MPI are compared and alternative weighting structures and poverty cutoffs are implemented and assessed. The robustness of the findings is documented and seems overall quite strong. These explorations confirm that at the end of the decade under study, at least 271 million fewer persons were living in multidimensional poverty – a magnitude of change rivalling the numbers exiting monetary poverty in China.

The paper proceeds as follows: Section 1 presents the data, followed by methodology (Section 2). Section 3 presents results for changes in multidimensional poverty across states and socio-economic subgroups, In Section 4, we focus on the 2015/16 level and composition of MPI by the previously-mentioned groups as well as across each of 640 districts. The final section concludes.

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1 For state-level monetary poverty estimates, we rely on data from two "thick" rounds of the Consumer Expenditure Surveys (CES) of India's National Sample Survey Organisation (NSSO): 2004-5 (NSS 61st CES) and 2011-12 (NSS 68th CES).

1. Data

The Multidimensional Poverty Index, and its sub- and partial indices are estimated using the third and fourth rounds of the NFHS, 2005/06 and 2015/16, respectively.

1.1 Introducing the NFHS-3 and 4 Datasets

The NFHS has been conducted by the International Institute of Population Sciences, Mumbai and the major source for demographic and health indicators in India. With support from the ICF International, and the National AIDS Research Institute (NARI), Pune it is part of the Demographic Health Surveys (DHS) conducted globally. The NFHS questionnaire is comparable to those of other DHS surveys, making these findings suitable for international comparisons that are beyond the scope of this paper. While the DHS surveys are usually conducted every three to five years, the fourth round of the NFHS was conducted only after an interval of ten years. During that time, the absence of reliable microdata in the public domain stymied intertemporal analyses, particularly of nutrition, hence the intense research interest in the NFHS-4 data. Furthermore, the NFHS-4 is representative of 640 districts – a significant achievement requiring a manifold increase in sample size. The micro-data were made public in 2018, while district and state factsheets were available earlier.

Compared to NFHS-3, NFHS-4 is not only representative at the state level but also at the district level. For this purpose, the survey's sample size increased almost eightfold between NFHS-3 and 4. In NFHS-4, around 700, 000 women and about 100,000 men have been interviewed while in NFHS-3 interviewed about 124,000 women and 74,000 men. The sample designs of the two surveys are fairly similar, as both surveys use a two-stage stratified sampling strategy (IIPS 2007, 2017). This makes the two datasets comparable over time at the state level, albeit not at the district level. Several studies beyond IIPS's reports have already made great use of this, see for example a study by Coffey and Spears (2018) on sanitation in India (cf Sen 2017, NFHS-4, 2016, 2017). There are some cautionary notes regarding the usage of NFHS-4, as it is noted by IIPS that not all indicators can be estimated at the district-level in NFHS-4, but only those as published by IIPS (2017).

1.2 Data Quality

The Atkinson Commission Report *Monitoring Global Poverty* (World Bank 2017) stressed that, in the case of global poverty monitoring, it is necessary both to consider results using the confidence intervals not simply the point estimates. Going beyond this, *Monitoring Global Poverty* stressed the importance of considering 'total error' not merely sampling error. Given that the assessment of changes in India's MPI over time is part of an assessment of the global MPI across many countries, it is appropriate to discuss 'total error,' despite the fact that its magnitude is challenging to quantify. For example, both datasets

overlook, as most household surveys do, the persons living outside households – whether it is because they are in hospitals or military barracks, nursing homes, orphanages, dormitories, or as pavement dwellers and so on.[2] The sample size of NFHS-4, being representative at the district level across 640 districts, far exceeded the sample size of NFHS-3, which was representative at the state level: this implied that the task of guaranteeing data quality of NFHS-4 was unprecedented. Yet the NFHS-4 was very delayed in part due to interim innovations in fielding district level health surveys. The NFHS-4 benefited from lessons learned during the implementation of the District Level Health Surveys (DLHS) in intervening years.

1.3 Demographic Considerations

Assessing the change in MPI for disaggregated units over time using repeated cross-section data is challenging. First of all, population shares may have changed due to migration, differential fertility or other shocks. Second, both surveys are based on different censuses. Third, demographic changes in the size and composition of households may affect measured poverty. For example, the MPI indicators in health and education reflect the joint attainments or deprivations of household members. If the size or composition of households change considerably in a decade, this is likely to affect the apparent frequency and distribution of health and education deprivations.

This section gives an indication of the magnitude of these changes insofar as is possible from NFHS-3 and NFHS-4. Naturally, the precision of demographic assessments from repeated cross-section data are limited, and we do not include a detailed review of migration status of households within States. In addition to the survey data, a further point of reference is the India Census 2011 that was conducted midway between the two surveys of 2005/06 and 2015/06, and upon which the 2015/16 sample draws. Table 1 shows population shares as a percent of total population. For robust estimates of changes over time across sub-groups and sub-regions (states) it is important to understand whether major population and sampling changes took place. We report two population shares for each NFHS round: the retained sample employed to calculate the MPI, and the full NFHS sample. There are minor differences between the two due to the methodological choice to drop individuals for whom there are missing values in any of the 10 MPI-indicators. Evidently, the difference between the two is low in magnitude – always below one percentage point. We therefore restrict the following analysis of the samples and population shares to the retained MPI sample.

2 The 2011 census reports 1.77 million houseless persons.

Table 1: Population Shares in NFHS-3 and NFHS-4

State / Subgroup	Population Share (in %)				
	Census 2011	NFHS-3 (2005/6) Retained Sample	NFHS-4 (2015/16) Retained Sample	NFHS-3 (2005/6) Full Sample	NFHS-4 (2015/16) Full Sample
	1	2	3	4	5
Rural	68.86	69.30	67.32	68.94	66.91
Urban	31.14	30.70	32.68	31.06	33.09
Andhra Pradesh	6.99	7.14	6.84	7.04	7.10
Arunachal Pradesh	0.11	0.11	0.09	0.11	0.09
Assam	2.58	2.67	2.45	2.66	2.44
Bihar	8.60	7.97	8.86	7.90	8.75
Chhattisgarh	2.11	2.23	2.29	2.18	2.26
Delhi	1.39	1.08	1.31	1.19	1.49
Goa	0.12	0.13	0.12	0.14	0.12
Gujarat	4.99	4.85	4.74	4.84	4.79
Haryana	2.09	1.95	2.32	1.93	2.29
Himachal Pradesh	0.57	0.57	0.53	0.56	0.53
Jammu and Kashmir	1.04	0.94	0.97	0.95	0.96
Jharkhand	2.72	2.70	2.67	2.74	2.68
Karnataka	5.05	5.56	4.85	5.66	4.87
Kerala	2.76	2.54	2.92	2.54	2.88
Madhya Pradesh	6.00	6.26	6.54	6.25	6.48
Maharashtra	9.28	9.42	9.58	9.59	9.71
Manipur	0.24	0.21	0.18	0.20	0.18
Meghalaya	0.25	0.26	0.24	0.27	0.23
Mizoram	0.09	0.09	0.08	0.09	0.08
Nagaland	0.16	0.15	0.12	0.14	0.12
Orissa	3.47	3.66	3.44	3.64	3.42
Punjab	2.29	2.48	2.30	2.46	2.28
Rajasthan	5.66	5.82	5.53	5.76	5.47
Sikkim	0.05	0.06	0.04	0.06	0.04
Tamil Nadu	5.96	5.46	6.64	5.32	6.54
Tripura	0.30	0.34	0.29	0.33	0.29
Uttar Pradesh	16.50	16.64	15.67	16.88	15.54
Uttarakhand	0.83	0.80	0.82	0.82	0.82
West Bengal	7.54	7.91	7.56	7.76	7.53

Source: Authors' calculation.

The difference between the two rounds of NFHS-3 and NFHS-4 can be substantial at times, and analysis of intertemporal trends must consider this. For instance, the demographic shift from rural to urban areas is visible, as the difference for rural and urban areas between the two years is about 2 percentage points in the retained sample. Comparing the NFHS figures with the Census 2011 (column 1), we see that this shift has been gradual, as the Census 2011 figure lies between the two survey years. We see a similar pattern of demographic shifts for age-groups (bottom rows). While the share of younger age-groups of 0-6 years and 7- 14 has reduced over time, the share of older age groups has increased equivalently – with

the NFHS-3 figure of 2005/06 being the lowest, followed by the Census 2011 estimate and the NFHS-4 figure of 2015/16. The population shares of religious groups have been stable over time and across surveys, whereas within caste groups, the share of Other Backward Classes has increased over time according to the NFHS figures (the Census 2011 does not report on this group). With regards to population shares by state, more complex and less gradual shifts are visible. While ideally the Census 2011 should lie in between the two years of the NFHS rounds, this is not always the case. For instance, in the case of Delhi, according to the NFHS the population share has been rising from 1.08 percent to 1.31 percent between 2005/06 and 2015/16, whereas the Census 2011 reports a figure of 1.4 percent. For Chhattisgarh, the pattern is reverse with the Census 2011 being the lowest and the NFHS figures rising over the years. In the case of Delhi, the difference in population shares is relatively large, as the relative difference between NFHS-3 2005/06 and Census 2011 is about 20 percent. Differences of a similar magnitude affect some other smaller states. Also, the state of Karnataka witnesses a decreasing trend in its population share, although the Census 2011 reassuringly lies in between the two NFHS estimates. Naturally, the NFHS-3 sampling frame was based on the Census 2001, and this also will affect results.

In terms changes in household size and age distribution which could affect the MPI, Table 2 shows rural and urban distributions of household size for 2006 and 2016. In both years, rural households tend to have more household members, but we see a decline in the average size for both rural and urban areas with a concentration toward 4-member/5-member households. In terms of age-groups, rural areas have higher shares of children (0-17) than urban areas in both years (Table 3). At the same time, we notice a demographic shift towards an aging population in both rural and urban areas. The share of children (below 18 years of age) decreases from 42.4 percent in 2006 to 37 percent in 2016 in rural areas, and from 35.3 percent to 30.1 percent in urban areas.

Table 2: Distribution of Household Size by Rural and Urban Areas in 2005/6 and 2015/16

Household size								
2006								
	1 Member–HH	**2 Member–HH**	**3 Member–HH**	**4 Member–HH %**	**5 Member–HH**	**6 Member–HH**	**7 Member–HH**	**8+ Member–HH**
Rural	1.0 %	4.5 %	8.0 %	15.4 %	18.4 %	16.3 %	11.7 %	24.6 %
Urbam	1.2 %	4.6 %	10.6 %	20.6 %	19.9 %	14.6 %	9.1 %	19.2 %
2016								
	1 Member–HH	**2 Member–HH**	**3 Member–HH**	**4 Member–HH**	**5 Member–HH**	**6 Member–HH**	**7 Member–HH**	**8 Member–HH**
Rural	0.8 %	4.8 %	9.3 %	18.6 %	19.9 %	16.7 %	10.9 %	19.0 %
Urban	1.0 %	5.5 %	12.4 %	24.0 %	20.1 %	14.4 %	7.8 %	14.8 %

Source: Authors' calculations

Table 3: Age Group Distribution by Rural and Urban Areas in 2005/6 and 2015/16

Age distribution									
2006									
	0–10 years	**11–17 years**	**18–24 years**	**25–30 years**	**31–39 years**	**40–49 years**	**50–59 years**	**60–69 years**	**70+ years**
Rural	24.4%	18.0%	11.7%	10.7%	9.8%	9.4%	6.9%	5.6%	3.4%
Urban	18.7%	16.5%	14.1%	12.0%	12.1%	11.0%	7.9%	4.7%	2.9%
2016									
	0–10 years	**11–17 years**	**18–24 years**	**25–30 years**	**31–39 years**	**40–49 years**	**50–59 years**	**60–69 years**	**70+ years**
Rural	19.5%	16.5%	12.5%	10.4%	10.8%	10.8%	8.7%	6.8%	4.0%
Urban	15.8%	14.3%	13.2%	11.8%	13.0%	12.7%	9.8%	6.1%	3.3%

Source: Authors' calculations

1.4 Survey Representativeness

Following the guidelines of the global MPI (Alkire Kanagaratnam and Suppa 2018), the NFHS3 and 4 datasets are disaggregated by the variables for which the surveys are representative, or by which indicators are disaggregated in the survey report. In particular, these are: states and union territories, districts (2015/16 only), rural/urban areas, caste groups nationally, caste groups by state (2015/16 only), religious groups, and religious groups by state (2015/16 only). In 2006, the disaggregation is by states and union territories, rural/urban, caste groups nationally, and religious groups nationally.

2. Methodology

2.1 Global MPI: Composition, Level, Change

The global MPI is a counting-based measure, that reflects the overlapping deprivations that strike members of the same household. It tracks ten deprivations related to three dimensions: health, education, and living standards. In 2018, the United Nations Development Programme (UNDP) and the Oxford Poverty & Human Development Initiative (OPHI) at the University of Oxford jointly revised five of the ten original indicators comprising the global Multidimensional Poverty Index which has been published since 2010 by both institutions. The conceptual justification for the revisions is given in Alkire and Jahan (2018), while the technical and methodological specifications can be found in Alkire Kanagaratnam and Suppa (2018). The dimensions, weights, and methodology remain unchanged.

An intuitive introduction to the methodology follows:[3] a **deprivation profile** is created for each person, showing the indicators in which each person is deprived. The deprivation profile shows, for example, if

[3] Many technical introductions are available: see Alkire and Foster 2011, Alkire Foster Seth Santos Roche and Ballon 2015 for example.

they lack any of the six aspects of living standards: safe water, adequate sanitation, electricity, clean cooking fuel, adequate housing materials, or even a few small assets. It also assesses whether anyone in the household is malnourished, or suffered the death of a child in the last five years. And if no household member has completed six years of schooling, or if a child is not attending school up to the age at which they would complete class eight, they are deprived in those indicators. The three dimensions are equally weighted; the indicators of health and education thus are each weighted one-sixth each, and the six indicators of living standard are weighted one-eighteenth. A person's deprivation profile is summarized in a **deprivation score** that adds up the weights on each indicator, and shows what percentage of weighted deprivations that person experiences. Next, following Sen 1976, comes **identification** of who is poor. If they experience one-third of the weighted deprivations or more, they are identified as MPI poor. If it is half or more they are identified as severely poor. If it is 20% to just under one-third, they are vulnerable of falling into poverty. Finally, this information is **aggregated** into the MPI, which is the product of the poverty rate (or incidence of multidimensional poverty) and the average deprivation score among the poor (or intensity). The MPI can be broken down to show the indicators that comprise it. And the MPI and its sub- and partial indices are used with confidence intervals reflecting sampling errors, to assess the significance of apparent differences in the level or change of poverty.[4]

The detailed formulation of measurement methodology, of assessment of changes over time, including analytical standard errors and their use for statistical inference, and the correct treatment of the sub-and partial indicators, is outlined in Alkire Foster Seth Santos Roche and Ballon 2015 and demonstrated in previous papers (Alkire and Seth 2015, Alkire Roche and Vaz 2017, Alkire Jindra Robles and Vaz 2017).

Table 4 provides specific details regarding the structure of the global MPI 2018.

[4] Methodological details are readily available in Alkire Kanagaratnam and Suppa 2018, and Alkire Foster Seth Santos Roche and Ballon 2015.

Table 4: The Dimensions, Indicators, Deprivation Cutoffs, and Weights of the Global MPI 2018

Dimensions of poverty	Indicator and SDG Area	Deprived if…	Weight	SDG Indicator
Health	Nutrition	Any person under 70 years of age for whom there is nutritional information is undernourished[+].	1/6	SDG 2
	Child mortality	Any child has died in the family in the five-year period preceding the survey.	1/6	SDG 3
Education	Years of schooling	No household member aged 10 years or older has completed six years of schooling.	1/6	SDG 4
	School attendance	Any school-aged child[++] is not attending school up to the age at which he/she would complete class 8.	1/6	SDG 4
Living standards	Cooking fuel	The household cooks with dung, wood, or charcoal.	1/18	SDG 7
	Sanitation	The household's sanitation facility is not improved (according to SDG guidelines) or it is improved but shared with other households[*].	1/18	SDG 11
	Drinking water	The household does not have access to improved drinking water (according to SDG guidelines) or safe drinking water is at least a 30-minute walk from home, roundtrip[**].	1/18	SDG 6
	Electricity	The household has no electricity.	1/18	SDG 7
	Housing	The household has inadequate housing: the floor is of natural materials or the roof or wall are of rudimentary materials[***].	1/18	SDG 11
	Assets	The household does not own more than one of these assets: radio, TV, telephone, computer, animal cart, bicycle, motorbike, or refrigerator, and does not own a car or truck.	1/18	SDG 1

Source: Alkire and Jahan 2018.

Notes

[+] Adults 20 to 70 years are considered malnourished if their Body Mass Index (BMI) is below 18.5 m/kg^2. Those 15 to 20 are identified as malnourished if their age-specific BMI cut-off is below minus two standard deviations. Children under 5 years are considered malnourished if their z-score of either height-for-age (stunting) or weight-for-age (underweight) is below minus two standard deviations from the median of the WHO 2006 reference population. In a majority of the countries, BMI-for-age covered people aged 15 to19 years, as anthropometric data was only available for this age group; if other data were available, BMI-for-age was applied for all individuals above 5 years and under 20 years.

[++] Data source for age children start primary school: United Nations Educational, Scientific and Cultural Organization, Institute for Statistics database, Table 1. Education systems [UIS, http://stats.uis.unesco.org/unesco/TableViewer/tableView.aspx?ReportId=163].

[*] A household is considered to have access to improved sanitation if it has some type of flush toilet or latrine, or ventilated improved pit or composting toilet, provided that they are not shared. If survey report uses other definitions of "adequate" sanitation, we follow the survey report.

[**] A household has access to clean drinking water if the water source is any of the following types: piped water, public tap, borehole or pump, protected well, protected spring or rainwater, and it is within 30 minutes' walk (round trip). If survey report uses other definitions of "safe" drinking water, we follow the survey report.

[***] Deprived if floor is made of mud/clay/earth, sand, or dung; or if dwelling has no roof or walls or if either the roof or walls are constructed using 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, adobe not covered, raw/reused wood, plywood, cardboard, unburnt brick, or canvas/tent.

2.2 Specific Indicator Treatment

In estimating the global MPI using NFHS-4 data, anthropometric data was collected for all eligible children under 5 years, all women aged 15 to 49 years, and a subsample of men aged 15 to 59 years. These men, who lived in one third of the sampled households, were selected for the state module questionnaire (IIPS 2017, p.4). The weight and height of children under five were measured regardless of whether their mothers were interviewed in the survey (IIPS 2017, p.290). The anthropometric data from women age 15-49 excluded pregnant women and those who had given birth in last two months of the survey (IIPS 2017, p.298). In the India DHS 2015-16 survey report, open defecation is identified neither as improved or unimproved sanitation facilities. However, following the MDG guidelines, open defecation is a clear standard of deprivation and was treated as such in this MPI estimation. According to the country report, because the quality of bottled water is not known, households using bottled water are classified as using unimproved source in accordance with the practice of the WHO-UNICEF Joint Monitoring Programme for Water Supply and Sanitation (IIPS 2017, p. 24). The category 'community RO plant' as source of drinking water is listed as improved source in the country report. This MPI estimation follows the report. Furthermore, the category 'other water sources' is neither listed as improved nor non-improved in the country report (IIPS 2017, Table 2.1, p.24). As such, this estimation followed the MDG standard where 'other drinking sources' are listed as unimproved. Survey estimates are disaggregated by rural and urban areas, as well as 29 states and union territories and by 640 districts. Some 3 percent of individuals (or close to 93,000 observations) were dropped from the dataset because they were identified as non-usual residents. The global MPI estimates are based on usual or permanent residents of a household. The final analytical sample for India 2015-16 covered 2.8 million individuals.

Comparisons over time are made using the 2005/6 NFHS 3 survey. In this survey, anthropometric data was collected for all eligible children under 5 years, all women aged 15 to 49 years, and a subsample of men aged 15 to 59 years. We identified households as using unimproved source of water hence deprived if they use bottled water. The decision departed from the country report, but was compatible to the decision made in India DHS 2015-16, allowing for comparable estimates between both survey periods. Survey estimates are disaggregated by rural and urban areas, and 29 states and union territories. Again, some 3 percent of individuals (or close to 18, 000 observations) were dropped from the dataset because they were identified as non-usual residents. The global MPI estimates are based on usual or permanent residents of a household. The final analytical sample for India 2005-06 covered slightly more than half a million individuals.

3. Changes in Multidimensional Poverty between 2005/6 and 2015/16

In this section, we report and discuss results for MPI, H, and A for states and socio-economic subgroups of age, religion and caste, for the two survey years of 2005/6 and 2015/16. We calculate standard errors and confidence intervals for all results. Due to the large sample sizes in both years, these are rather small in magnitude hence not reported in tables but are available online.

India has halved the MPI within ten years between 2005/6 and 2015/16 and reduced the incidence of multidimensional poverty – the headcount ratio (H) - strongly. While in 2005/6, 54.7 percent of India's population was deprived in at least one-third of the ten weighted indicators, H reduced to 27.5 percent in 2015/16. The intensity of multidimensional poverty (A) reduced from 51.07 percent to 43.9 percent which means that multidimensionally poor people face less deprivations on average. Therefore, the MPI halved due to deeper progress among the poorest. This results in a reduction of the number of poor people by more than 271 million.

Table 5: Multidimensional Poverty in India in 2005/6 and 2015/16

	MPI	H	A
2006	0.279	54.7%	51.1%
2016	0.121	27.5%	43.9%
Absolute change	–0.158	–27.2%	–7.2%

Source: Authors' calculation.

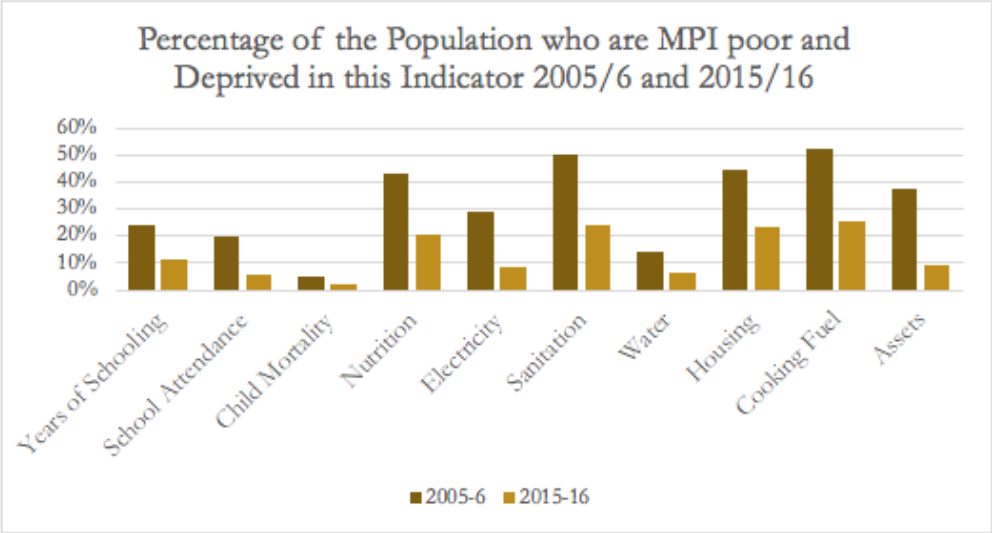
India's scale of multidimensional poverty reduction over the decade 2005/6 to 2015/16 brings to mind the pace of China's reduction of a different kind: consumption poverty reduction, which likewise had global implications. As is by now well-known, according to China's 2010 poverty line, the number of income poor in China reduced by 196 million 1990-2000, then by 268 million 1995-2005 (at which point there were still 287 million people in poverty). Reduction then hastened, so moving out five years, poverty 2000-2010 fell by a dramatic 297 million, and from 2005-2015 by 231 million, leaving only 56 million in poverty in 2015. Chen and Ravallion (2010) study China's reduction in poverty rates and number of poor using instead the $1.25/day poverty line. They suggest that 267 million people came out of $1.25/day consumption poverty 1990-2002.[5]

How did India's poverty change? Figure 1 below provides the censored headcount ratios: that is, the percentage of the population who are MPI poor and deprived in each indicator, in each of the years. Each of the ten indicators was reduced, and the reduction was statistically significant to the 1% level. As

5 Ravallion and Chen report the number of people who were poor in 1990, 1999 and 2002. If one does a linear extrapolation forward from 1999 or back from 2002, in either case one finds that roughly 267 million people came out of poverty between 1990-2000.

can be seen visually, the highest reduction in terms of percentage points were found in deprivations in nutrition, sanitation, cooking fuel, and assets. Housing and electricity also had large reductions affecting more than one in five people in India. But the change in nutrition is visible, and important.

Figure 1: Censored Headcount Ratios in 2005/6 and 2015/16 for India



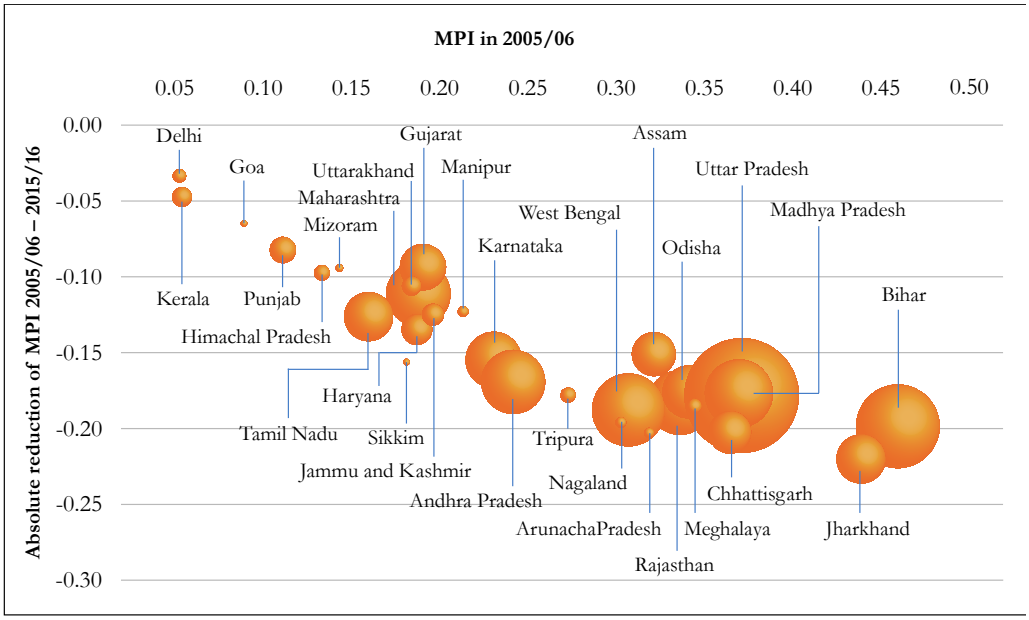
Source: Authors' calculations.

As Figure 2 shows, the huge progress in reducing multidimensional poverty can be attributed to all ten indicators. All censored headcount ratios decreased by at least 50 percent – except for housing (48 percent) – and have in some cases even dropped by more than 70 percent. Living standards have improved across the board. In 2006, about half of the population that was multidimensionally poor and deprived in housing suffer from this poor housing conditions in 2016 (45 percent versus 23 percent). The same is true for censored headcount ratios of adequate drinking water (14 percent to 6 percent), and for cooking fuel. The percentage of people using inadequate cooking fuel reduced by half, (52 percent to 26 percent). Censored headcount ratios in electricity and asset ownership reduced more than 70 percent. Malnutrition has been traditionally high in India. While this is still the case comparatively speaking, the censored headcount ratio of nutrition more than halved as well. In 2006, 43 percent of India's population was multidimensionally poor and had at least one malnourished child or adult within the household, while in 2016 this proportion has reduced to 21 percent. Furthermore, in the space of health, low levels of the censored headcount ratio of child mortality (5 percent in 2006) fell to 2 percent. Improvements in education were clearly visible as censored headcount ratios for both Years of schooling and School attendance more than halved. We return to locate this finding within the total distribution of deprivations and their change, in section 3.6.

3.1 Poverty Changes by States: Fastest Movers and What Changed Most

The MPI is disaggregated into 29 States and Union Territories. It is noteworthy that each one had statistically significant reductions in MPI, H, and A. A factor that is of particular interest to pro-poor patterns of poverty reduction that 'leave no one behind' is the rate of poverty reduction among the poorest groups. An earlier work (Alkire & Seth 2015), found that progress had been slowest for the poorest states as well as the poorest caste and religious groups. In stark contrast, we find here that seven of the ten states that had the fastest reduction of MPI were among the ten poorest states in India. Jharkhand, which was second poorest in 2006, had the fastest reduction of all states, followed by Arunachal Pradesh, Chhattisgarh, Bihar, Nagaland, West Bengal, Meghalaya, Rajasthan, Uttar Pradesh, and Tripura. Figure 3 below illustrates this pattern. State-level absolute changes in MPI (y-axis) are plotted over MPI levels of 2005/06 (x-axis). The 11th and 12th fastest reductions were also among the poorest ten: Madhya Pradesh and Odisha. The poorest state in 2006 - Bihar - had the fourth fastest reduction in MPI. Nagaland West Bengal, and Tripura were not among the poorest 10 states, yet had extra strong reductions and also are ranked 11, 12 and 13 poorest, confirming this pro-poor trend. Only Assam had considerably slower progress in MPI reduction but still, being 16th fastest, was very respectable.

Figure 2: The Level of MPI in 2005/6 (Horizontal) vs. the Absolute Rate of Change to 2015/16



Note: size of bubble is proportional to the number of poor persons in 2005/06.
Source: Authors' calculations.

Table 6: Multidimensional Poverty across States

	2006				2016				Absolute Change		
State	Pop. Share	MPI	H	A	Pop. Share	MPI	H	A	MPI	H	A
Andhra Pradesh	7.1%	0.234	49.9%	47.0%	6.8%	0.065	15.8%	40.9%	-0.170	-34.1%	-6.1%
Arunachal	0.1%	0.309	59.7%	51.8%	0.1%	0.106	24.0%	44.1%	-0.203	-35.7%	-7.6%
Assam	2.7%	0.312	60.7%	51.4%	2.4%	0.160	35.8%	44.6%	-0.152	-24.8%	-6.7%
Bihar	8.0%	0.446	77.1%	57.8%	8.9%	0.246	52.2%	47.2%	-0.200	-25.0%	-10.6%
Chhattisgarh	2.2%	0.353	70.0%	50.5%	2.3%	0.151	36.3%	41.4%	-0.203	-33.7%	-9.0%
Delhi	1.1%	0.051	11.5%	44.4%	1.3%	0.016	3.8%	42.3%	-0.035	-7.7%	-2.1%
Goa	0.1%	0.087	20.4%	42.5%	0.1%	0.021	5.6%	37.2%	-0.066	-14.8%	-5.3%
Gujarat	4.9%	0.185	38.5%	48.0%	4.7%	0.090	21.4%	42.2%	-0.095	-17.1%	-5.8%
Haryana	2.0%	0.182	38.5%	47.2%	2.3%	0.046	11.0%	42.3%	-0.135	-27.5%	-4.9%
Himachal Pradesh	0.6%	0.129	31.1%	41.5%	0.5%	0.031	8.2%	37.4%	-0.098	-22.9%	-4.1%
Jammu And Kashmir	0.9%	0.189	40.8%	46.4%	1.0%	0.063	15.2%	41.7%	-0.126	-25.6%	-4.7%
Jharkhand	2.7%	0.425	74.7%	57.0%	2.7%	0.205	45.8%	44.7%	-0.221	-28.8%	-12.3%
Karnataka	5.6%	0.224	48.1%	46.5%	4.9%	0.068	17.1%	39.8%	-0.156	-31.0%	-6.7%
Kerala	2.5%	0.052	13.2%	39.6%	2.9%	0.004	1.1%	37.4%	-0.048	-12.2%	-2.3%
Madhya Pradesh	6.3%	0.358	67.7%	52.8%	6.5%	0.180	40.6%	44.2%	-0.178	-27.1%	-8.6%
Maharashtra	9.4%	0.182	39.4%	46.2%	9.6%	0.069	16.8%	41.3%	-0.113	-22.6%	-4.9%
Manipur	0.2%	0.207	45.1%	45.8%	0.2%	0.083	20.7%	40.3%	-0.123	-24.4%	-5.5%
Meghalaya	0.3%	0.334	60.5%	55.2%	0.2%	0.145	32.7%	44.5%	-0.188	-27.8%	-10.7%
Mizoram	0.1%	0.139	30.8%	45.0%	0.1%	0.044	9.7%	45.2%	-0.095	-21.2%	0.2%
Nagaland	0.1%	0.294	56.9%	51.6%	0.1%	0.097	23.3%	41.7%	-0.196	-33.6%	-9.9%
Odisha	3.7%	0.330	63.5%	52.0%	3.4%	0.154	35.5%	43.3%	-0.176	-28.0%	-8.7%
Punjab	2.5%	0.108	24.0%	45.0%	2.3%	0.025	6.0%	41.2%	-0.083	-18.0%	-3.8%
Rajasthan	5.8%	0.327	61.7%	52.9%	5.5%	0.143	31.6%	45.2%	-0.183	-30.0%	-7.7%
Sikkim	0.1%	0.176	37.6%	46.7%	0.0%	0.019	4.9%	38.1%	-0.157	-32.7%	-8.6%
Tamil Nadu	5.5%	0.155	37.0%	41.8%	6.6%	0.028	7.4%	37.5%	-0.127	-29.6%	-4.3%
Tripura	0.3%	0.265	54.4%	48.6%	0.3%	0.086	20.1%	42.7%	-0.179	-34.3%	-5.9%
Uttar Pradesh	16.6%	0.360	68.9%	52.2%	15.7%	0.180	40.4%	44.7%	-0.180	-28.5%	-7.5%
Uttarakhand	0.8%	0.179	38.7%	46.1%	0.8%	0.072	17.1%	41.8%	-0.107	-21.6%	-4.3%
West Bengal	7.9%	0.298	57.3%	52.0%	7.6%	0.109	26.0%	41.9%	-0.189	-31.4%	-10.0%

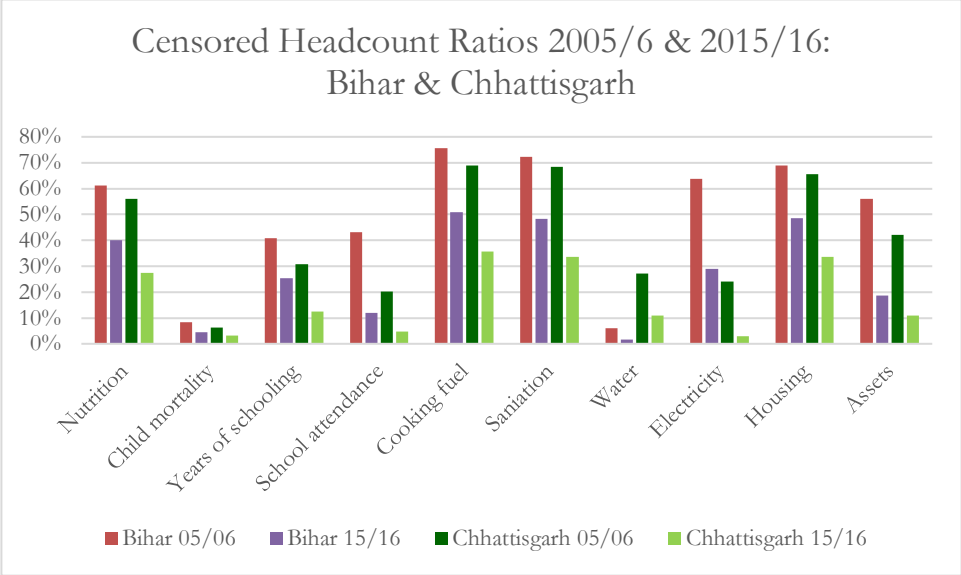
Source: Authors' calculations

Relative to their starting level of poverty, the fastest reductions were, in no cases, among the poorest states. However, six of the poorest ten states cut their starting level of MPI by more than 51 percent: Arunachal Pradesh, Chhattisgarh, Meghalaya, Rajasthan, Odisha, and Jharkhand. In terms of relative change, some of the least poor states improved MPI the most. Kerala, for example, reduced its MPI by around 92 percent to near zero with a headcount ratio of 1.1 percent. Similarly, Sikkim reduced the MPI by a massive 89 percent that lowered the MPI from 0.176 to 0.019, while the headcount ratio fell from 38 percent to 5 percent.

The pattern of MPI reduction was often rather similar but there were some interesting variations. Chhattisgarh and Bihar, for example, were among the ten poorest states. But what is clearly seen is that

while the magnitude of reduction in asset deprivations are similar, Chhattisgarh had larger reductions in housing, sanitation, cooking fuel, years of schooling, and nutrition; Bihar had larger reductions in electricity, school attendance. In absolute terms, people who were poor and deprived in electricity were negligible by 2015/16 in Chhattisgarh, whereas water deprivations were vanishingly small in Bihar.

Figure 3: Censored Headcount Ratios in Bihar and Chhattisgarh in 2005/6 and 2015/16



Source: Authors' calculations.

3.2 Overview of Poverty Changes by Areas and Groups

But is the pattern of reduction across states mirrored in other groups? Starting with the rural-urban divisions, the data show a convergence in absolute terms due to larger absolute changes in rural poverty. In both areas, the MPI was halved. In absolute terms, rural poverty decreased far faster than urban in absolute terms, whereas in relative terms, poverty (MPI) went down slightly faster. Rural poverty halved in terms of MPI but not the headcount ratio, although H went down from 68 percent to 36.5 percent while urban poverty in 2015/16 (9 percent) is almost a third of the 2005/06 rate (24.6 percent). Intensity (A) of multidimensionally has reduced more in rural than in urban areas, implying that the poorest are suffering from fewer deprivations on average in 2015/16. In the following, we focus at the progress made of each of the sub-groups of caste, religion and age at the national level.

Table 7: Multidimensional Poverty in Rural and Urban India

	2006				2016				Absolute change		
State	**Pop. share**	**MPI**	**H**	**A**	**Pop. Share**	**MPI**	**H**	**A**	**MPI**	**H**	**A**
Rural	69.3%	0.352	68.0%	51.8%	67.3%	0.161	36.5%	44.1%	-0.191	-31.5%	-7.7%
Urban	30.7%	0.115	24.6%	46.6%	32.7%	0.039	9.0%	42.6%	-0.076	-15.5%	-4.0%

Source: Authors' calculations.

3.3 Poverty Changes by Caste Group: Nationally

In the NFHS-3 and NFHS-4, the many caste groups prevalent in India are clubbed into four major groups: Scheduled Castes (SC), Scheduled Tribes (ST), Other Backward Classes, and Other. While Schedule Castes include Dalit communities, Other include higher castes. Traditionally, the SC/ST communities have been the most disadvantaged sub-groups in India. In 2015/16, this is still the case, as 50 percent of people belonging to ST communities are multidimensionally poor. They were also the poorest in 2005/06 with a headcount ratio of 80 percent. Nevertheless, the progress made had been impressive as their overall MPI was almost halved within the decade. The Scheduled Castes communities also more than halved the MPI and reduced H by a larger magnitude: 32 percentage points. While we also observe large relative changes for the two groups of OBC and Other, in absolute terms SC and ST communities account for the highest reduction of poverty – a scenario very different and opposite to findings of Alkire and Seth (2014) for the period of 1998/99 to 2005/6. During that period India's poorest caste groups witnessed the slowest progress.

Table 8: Multidimensional Poverty across Caste Groups

	2006				2016				Absolute change		
State	**Pop. share**	**MPI**	**H**	**A**	**Pop. Share**	**MPI**	**H**	**A**	**MPI**	**H**	**A**
Scheduled castes	19.1%	0.338	65.0%	51.9%	20.7%	0.145	32.9%	44.1%	-0.193	-32.2%	-7.9%
Scheduled tribes	8.4%	0.447	79.8%	56.0%	9.4%	0.229	50.0%	45.8%	-0.218	-29.8%	-10.2%
Other backward class	40.2%	0.291	57.9%	50.2%	42.9%	0.117	26.9%	43.5%	-0.174	-31.0%	-6.7%
Other castes	29.3%	0.176	36.1%	48.9%	22.7%	0.065	15.3%	42.5%	-0.111	-20.8%	-6.3%

Source: Authors' calculations.

3.4 Poverty Changes by Religion: Nationally

The pro-poor poverty reduction is also prevalent when we look at absolute changes across religions groups. Muslims were the poorest religious group of 2005/06 with an MPI of 0.331 and H of 60.3 percent, followed by Hindu (MPI 0.277, H 54.9 percent) and Christian (MPI 0.191, H 38.8 percent). In absolute terms, both the MPI and H reduced the faster for Muslims than for other religious groups as the MPI dropped to 0.144 and H to 31.1 percent. Despite the huge progress, in 2015/16, Muslims are still the poorest religious sub-group with almost every third Muslim multidimensionally poor, compared to every sixth Christian.

Table 9: Multidimensional Poverty Across Religious Subgroups

	2006				2016				Absolute change		
State	**Pop. share**	**MPI**	**H**	**A**	**Pop. Share**	**MPI**	**H**	**A**	**MPI**	**H**	**A**
Hindu	80.3%	0.277	54.9%	50.4%	80.2%	0.120	27.7%	43.5%	-0.156	-27.2%	-7.0%
Muslim	14.1%	0.331	60.3%	54.9%	14.1%	0.144	31.1%	46.4%	-0.187	-29.3%	-8.5%
Christian	2.3%	0.191	38.8%	49.2%	2.4%	0.069	16.1%	42.9%	-0.122	-22.7%	-6.2%
Other religion	3.3%	0/172	35.2%	48.9%	3.3%	0.067	15.5%	43.0%	-0.105	-19.7%	-5.8%

Source: Authors' calculations.

3.5 Poverty Change by Age Groups

We disaggregate the MPI by four age-groups: households with children between 0 and 9 years, 10 and 17 years, adults between 18 to 60 years, and above 60 years. In 2005/6, children aged 0 to 9 and 10 to 17 were most likely to be living in multidimensionally poor households. While this is still the case in 2015/16, the headcount ratios for both have changed faster than for the two older sub-groups. The poorest sub-group of 2005/6 (0-9 years) saw its headcount ratio decline by 27.2 percentage points while the H for the second poorest (10-17 years) declined by 28.8 percentage points, both outpacing the older sub-groups. Similarly, in terms of absolute reductions of the MPI, the sub-groups for children saw higher reductions (0.182 and 0.168, respectively) than the adult sub-groups. In summary, while we notice the divergence to less poverty across all age-groups with the highest reductions for households with children, we observe that households with children aged 0 to 9 years are the most vulnerable sub-groups in 2015/16.

Table 10: Multidimensional Poverty across Age Groups

	2006				2016				Absolute change		
State	**Pop. Share**	**MPI**	**H**	**A**	**Pop. Share**	**MPI**	**H**	**A**	**MPI**	**H**	**A**
0–9 years	22.3%	0.371	68.1%	54.5%	18.2%	0.189	40.9%	46.3%	-0.182	-27.3%	-8.2%
10–17 years	17.7%	0.289	56.1%	51.6%	15.8%	0.121	27.3%	44.1%	-0.169	-28.7%	-7.5%
18–60 years	53.6%	0.244	49.2%	49.5%	57.5%	0.102	23.6%	43.0%	-0.142	-25.6%	-6.5%
60+ years	6.3%	0.228	49.2%	46.2%	8.5%	0.105	25.4%	41.3%	-0.122	-23.8%	-4.9%

Source: Authors' calculations.

3.7 Poverty Change: Distributional Shift

A natural question, at this point, is whether the change in poverty is unduly affected by the poverty cutoff. In this section, we go step by step through the reduction of poverty. We start by examining reduction among the poor, and then we consider the deprivations of persons whose are non-poor because their

deprivation score lies below the poverty cutoff. We conclude by depicting the entire distribution shift across the population of India.

First, recall the national picture of all deprivations for the total population mentioned in 3.1. If we consider deprivations across the population and how they changed 2005/6-2015/16, we observe strong and statistically significant changes in each indicator (as depicted in Table 11).

Table 11: Reduction of Total Deprivations Across India 2005/6 – 2015/16

Percent of Indian Population Deprived in:	2005/6	2015/16	Absolute Change	t-value	P-value	Reduction relative to 2005/6
Years of Schooling	24.9%	13.8%	-11.1%	27.95	0.00	-44.6%
School Attendance	21.2%	6.4%	-14.8%	42.26	0.00	-69.9%
Child Mortality	5.1%	2.9%	-2.1%	16.13	0.00	-42.3%
Nutrition	56.8%	36.4%	-20.4%	63.05	0.00	-35.9%
Electricity	32.7%	12.1%	-20.6%	40.34	0.00	-63.0%
Sanitation	70.6%	51.8%	-18.8%	38.52	0.00	-26.6%
Water	18.4%	14.6%	-3.7%	8.29	0.00	-20.3%
Housing	55.5%	45.4%	-10.1%	20.30	0.00	-18.2%
Cooking Fuel	73.8%	58.1%	-15.7%	32.98	0.00	-21.3%
Assets	46.6%	13.9%	-32.7%	79.21	0.00	-70.1%

Source: Authors' calculations.

For example, in Table 11, whereas 21.2% of Indians lived in a household in which at least one child was not attending school in 2005/6, it was 6.4% in 2015/16 - a 14.8 percentage point drop. Decreases in nutrition were even stronger: 56.8% of people lived in a household in which at least one person was undernourished in 2005/6 this it had dropped to 36.4% in 2015/16. Similarly, lack of access to electricity affected 32.8% of people in 2005/6 but only 12.1% in 2015/16. The biggest improvement – perhaps reflecting economic growth – was in asset ownership. Whereas 46.6% of Indians did not have more than one of the following assets: telephone, radio, television, computer, refrigerator, bicycle, motorcycle, or animal cart (and did not have a car/truck), in 2015/16 that had plummeted 32.7 percentage points; in 2015/16 only 13.9% did not own more than one of these assets. So, if we think of how deprivations declined relative to their starting levels (last column), we find that 18-70% of all deprivations in 2005/6 had been eradicated by 2015/16. Relative to the starting rates of deprivation, the largest share of deprivations (70%) were wiped out for school attendance and assets, and electricity (63%) - followed by strong gains for years of schooling (45%), child mortality (42%), and nutrition (36%).

Now we turn to how reductions occurred, according to those same 10 indicators, among MPI poor people. Recall that the MPI identifies as poor, people who are deprived in at least one-third of the weighted indicators. It is useful to remember at this point that the MPI is the weighted sum of the

'censored headcount ratios' for each indicator – which are the proportion of people who are identified as poor and are deprived in that indicator.

So how did the censored headcount ratios change? This is a very important question, which cannot be answered simply by looking at the national figures because it requires detailed knowledge of the joint distribution of indicators. To be more precise, we are wondering: did most of the reductions of deprivations occur among people who were deprived in at least one-third of weighted indicators at the same time? Or did most occur among people who face only a few deprivations? For example, consider two persons, A and B, who have the following deprivation profiles:

Table 12: Example of Counting Weighted Deprivations

	N	CM	YS	SA	E	W	S	F	H	A
A	**1/6**	ND	ND	ND	ND	ND	ND	ND	ND	ND
B	**1/6**	ND	**1/6**	ND	ND	ND	**1/18**	**1/18**	**1/18**	ND
C	**1/6**	ND	**1/6**	ND	ND	ND	ND	ND	ND	ND

Source: Authors' calculations.

Person A is deprived in nutrition only, whereas Person B is deprived in nutrition, years of schooling, sanitation, cooking fuel and housing. Moreover, person A is non-poor, because their deprivations sum to 1/6 which is less than 1/3, whereas Person B is multidimensionally poor because the deprivations sum to 1/2 . If Person A becomes non-deprived in nutrition, then the deprivations in the total population change, but the censored headcount ratio does not register any change. In contrast, if person B becomes non-deprived in nutrition, then both the total deprivation level and the censored headcount ratio register the same change. Naturally, we do not have panel data, so this example is illustrative. But we can compare the magnitude of changes in the censored and uncensored headcount ratios in two time periods, to observe whether it appears that reductions in deprivations took place among the MPI poor – or not.

In the case of censored headcount ratio reductions, there is also a third scenario, reflected in person C. Let's say that person C becomes non deprived in years of schooling (note, not their nutrition deprivation, but some other deprivation that means they are identified as non-poor). So their deprivation score falls from 1/3 to 1/6. So they become non-deprived in years of schooling. But – and this is what is new – they also become identified as non-poor by the MPI. From the perspective of the censored headcount ratios – deprivations among the poor – actually two deprivations are reduced because they leave poverty: nutrition and schooling. They are still deprived in nutrition, so their nutrition deprivation is captured in Table 1. But it is no longer captured in the censored headcount ratios. Our question is, what proportion of the reductions in censored headcount ratios are also visible in uncensored headcount ratios – so suggest real reductions among the poor, and what proportion seem instead, like person C, to reflect a

graduation to being recorded only as deprivations among the non-poor, but not a real reduction? This is explored in Table 2 below.

Table 13: Changes of Censored and Uncensored Headcount Ratios

	2006	2016	Absolute Change in Censored H	t-value	P-value	Absolute Change in Uncensored H	Difference: Column 4-6
Years of Schooling	23.93%	11.59%	-12.3%	31.16	0.00	-11.1%	1.2%
School Attendance	19.71%	5.50%	-14.2%	40.63	0.00	-14.8%	-0.6%
Child Mortality	4.76%	2.39%	-2.4%	18.02	0.00	-2.1%	0.2%
Nutrition	43.46%	20.53%	-22.9%	59.08	0.00	-20.4%	2.6%
Electricity	28.85%	8.52%	-20.3%	42.86	0.00	-20.6%	-0.3%
Sanitation	50.00%	24.25%	-25.8%	55.42	0.00	-18.8%	**7.0%**
Water	13.84%	6.14%	-7.7%	20.92	0.00	-3.7%	**4.0%**
Housing	44.53%	23.27%	-21.3%	45.30	0.00	-10.1%	**11.2%**
Cooking Fuel	52.40%	25.75%	-26.6%	57.99	0.00	-15.7%	**10.9%**
Assets	37.28%	9.42%	-27.9%	67.82	0.00	-32.7%	-4.8%

Source: Authors' calculations.

If we compare total deprivation changes to the changes in censored headcount ratios – we find that the percentage changes are quite similar for years of schooling, school attendance, child mortality and electricity. In this case, it seems that *nearly all* of the reductions in deprivations occurred among persons who were MPI poor. For nutrition the reduction of censored headcount ratios was 2.5 percentage points more than the population level reductions. This means that, while 20.4 percentage points of the reduction in nutrition deprivations seem to have really occurred – and this among the poor – effectively 2.5% of the population appear to have graduated to non-poor status, while being still deprived in nutrition. For four indicators, the differences are larger: In the case of water, there is a four percentage point difference, for sanitation and cooking fuel it is 7 percentage points and for cooking fuel and housing, there is an eleven percentage point difference. In the case of these indicators, while most of the reduction still did appear to occur among the poor, what also happened was a reduction in the density or share of overlapping deprivations - effectively, a graduation from poverty to a state of vulnerability. Assets, on the other hand, had higher reductions in the overall population than among the poor. So effectively it could be imagined that 27.9% of poor people became non-deprived in assets and furthermore, 4.8% of the population who were not poor, reduced their deprivation in assets.

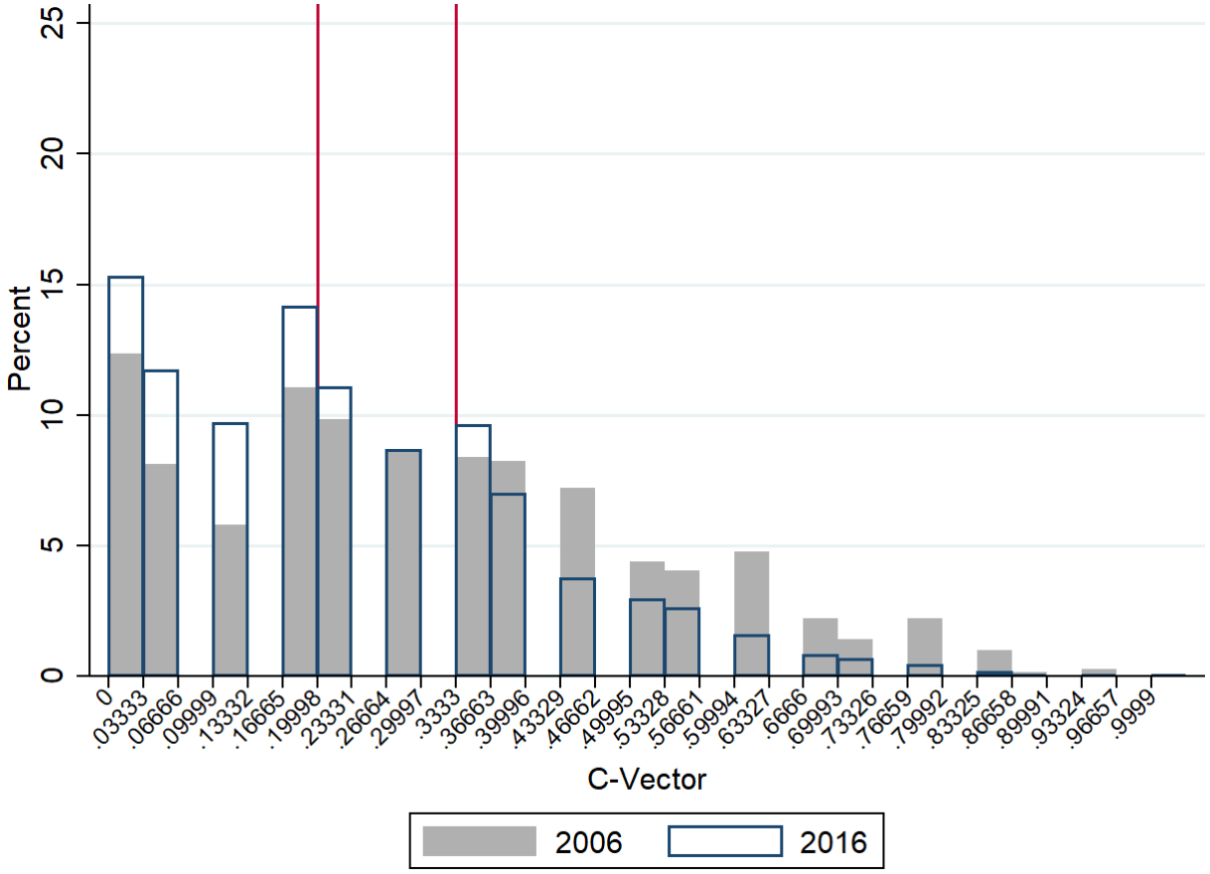
Naturally, using repeated cross-section data it is impossible to track these transitions precisely. But the interpretation of India's changes suggest that the reduction of poverty mainly reflected the reduction of real deprivations among persons who were poor, but that in some cases – particularly with cooking fuel and sanitation – it reflected a graduation to vulnerability status.

Even without panel data, we keep this graduation in view, albeit imperfectly, on the MPI dashboard, because we track the percentage of the population who are vulnerable. And the percentage of the population who are vulnerable – having deprivation scores of 20-33.32% – increased two percentage points: from 17.1% to 19.1%. In stark terms, the number of people who were vulnerable in 2005/6 was about 199 million whereas in 2015/16 it's 253 million. So 54 million more people in India are in precarious conditions of vulnerability in 2015/16 than in 2005/6.

Broadening out one final moment, let us consider all the deprivations of India. In 2005/6, 91.4% of Indians were deprived in at least one of the ten MPI indicators, the average intensity was 37.8%, and the MPI of all persons having any deprivation was 0.345. In 2015/16, 82.4% of Indians were deprived in at least one of the 10 indicators in the MPI, the average intensity of was 25.25% and the average MPI was 0.208. So, at the 'top' end of the distribution of deprivations, the change reflects the same pattern: it is more pervasive in terms of A than of H, and MPI has reduced among those who are non-poor, but slower than among those identified as MPI poor.

This analysis summarized a societal-wide picture of the shift in deprivation scores experienced by individual people in India in the two periods. In Figure 4 we examine the entire distribution of deprivations in each year. The histogram plots the percentage of people being deprived in intervals of .03 percent of the weighted counting vector (C-Vector). Red lines indicate cut-offs for 33 percent and 20 percent. Overall, there is a clear shift towards less deprivations. In 2005/06, many more people experienced deprivations of 36.7 percent or more than in 2015/16. Within a decade this has been reversed as there are now (2015/16) more people being deprived in less than 36.7 percent of the indicators than in 2005/06. In terms of identification of the multidimensionally poor by using a single cut-off of one third in each year, the entire distributional shift may be overlooked. In fact, many people that face just marginally less deprivations than one third, are no longer identified as poor. This may skew the success in poverty reduction to some extent. Policy makers may overlook that there in 2015/16, about 20 percent of the population faces between 20 and 30 percent of the weighted deprivations.

Figure 4: Percent of Population in 2005/6 and 2015/16 by Counting Vector of Weighted Deprivations



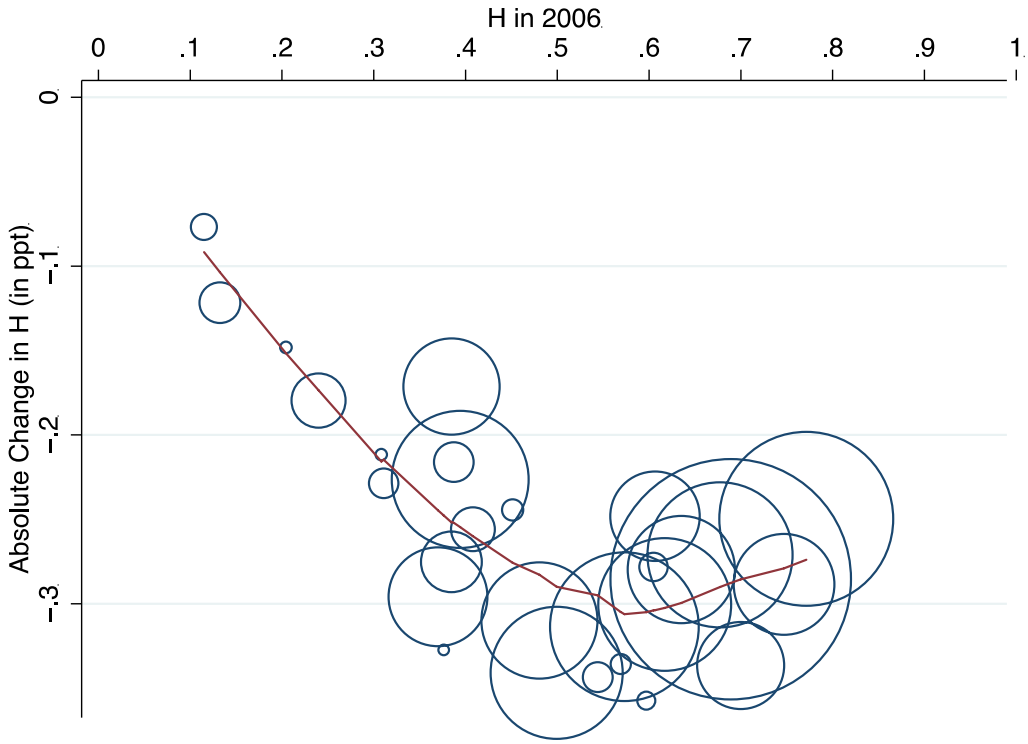
Source: Authors' calculations.

3.8 Methodological Interlude: The Critical Importance of MPI vs. H

In examining changes over time in India, we notice that the changes in MPI and H vary in an interesting way. We observed, at the most general level, that whereas the MPI was more than halved 2005/6-2015/16, the headcount ratio did not quite fall by half. How do we interpret this finding?

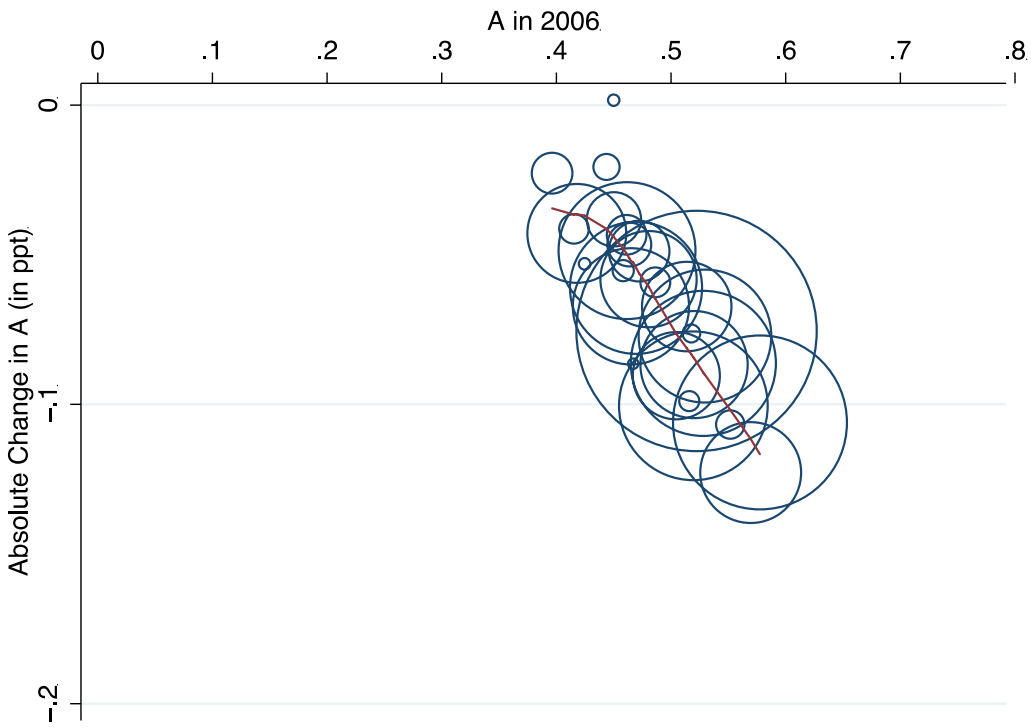
First, when we explore it sub-nationally we find the same pattern holds by state, caste group and religion. In Section 3.1, we plotted the change in MPI against the starting value of MPI in 2005/06. Doing so, we observed that the poorest states of 2005/06 reduced poverty the fastest which implied a pattern of pro-poor poverty reduction. We concluded that states with higher MPI values in 2005/6 reduced poverty faster. However, if we plot the headcount ratio of multidimensional poverty against its starting value, the same pattern of pro-poor poverty reduction holds only to some extent (see Figure 6). In particular, the right end of the tail that depicts the poorest states and the biggest states that house most of the poor people, the relationship does not exist. However, looking at the pattern of intensity reduction (see Figure 7), it is even more sharply evident among the poorest states.

Figure 5: Level of H in 2005/6 Compared to Absolute Rate of Change by 2015/16



Source: Authors' calculations.

Figure 6: Level of Intensity in 2005/6 Compared to Absolute Rate of Change between 2005/6 and 2015/16



Source: Authors' calculations.

What this means is that in the poorest states a major reduction of intensity drove changes, but in many cases, the persons remain poor – instead of being deprived in, for example, 77% of all dimensions now they are deprived 'only' in 45%. They still experience acute poverty – headcount ratio has not changed – but it is less intense.

Turning to the other groups, in absolute terms, the caste and religious groups had the largest absolute change in terms of MPI but not in terms of H. The ST communities reduced MPI by -0.218 whereas the SC communities reduced it by -0.193. But the SC communities had a 32.2 percentage point decrease in their multidimensional poverty rate (H) whereas for ST it was 29.8 percentage points. Similarly, Muslims reduced their MPI by -0.187 which was faster than the reduction of Hindu by -0.156. But Hindus reduced their MPI rate by 29.3 percentage points whereas Muslims reduced it by 27.2. Interestingly, in the case of children, both measures align - considering either MPI or headcount ratio, children 0-9 and 10-17 had a faster absolute reduction of poverty than the other age groups, making this a strongly significant finding. In relative terms, the less poor groups reduced MPI and H faster across these groups as they had across states.

The finding evident for states, caste, and religious groups was already corroborated in section 3.6, which established that there was a momentous shift across the entire distribution of deprivations, not just among the less poor strata, which lead to the sharpest reduction among populations having the highest deprivation scores. This significant achievement is absolutely invisible by using the headcount ratio only.

Actually, this pattern is positive in equity terms. One of the flaws of the poverty rate in terms of measurement that led to the generation of better poverty measures in the 1970s and 1980s by Amartya Sen (1979), Foster Greer and Thorbecke (1984), and others, was precisely its lack of monotonicity. The headcount ratio, being insensitive to the depth or breadth of poverty, does not provide any incentive to public actors to invest in reducing the disadvantages of the poorest, whose poverty status will be most expensive to change. To the contrary, the poverty rate gives public actors an incentive to address the needs of the barely poor and so they come out of poverty visibly, while the needs of the very poorest are left unaddressed. If such policies had driven change in multidimensional poverty 2005/6 to 2015/16, we would have seen a monotonic decrease of the headcount ratio, but not of intensity or MPI. Overall, this demonstrates the value-added of using MPI (which respects dimensional monotonicity) rather than just a headcount ratio: the pro-poor change in MPI is driven by the reduction of intensity among the poor as well as by a reduction in incidence.

3.9 Robustness of the Number of Poor Leaving Poverty

Because the global MPI 2018 is a new measure, in which half of the indicators of the original MPI saw some adjustments, a question naturally arises whether certain analyses such as the observation that 271 million fewer people are MPI poor in 2015/16 than 2005/6 is sensitive to these changes. If the previous MPI were used, or had other indicator specifications been used, how would this have affected the number? To scrutinise that question we ran the original MPI and 19 additional alternative MPIs on both datasets, to assess how results are affected. As reported in Table 14, if the original MPI specifications were used (Trial 0), then we would have found that 286 million fewer people were MPI poor in 2015/16. Across the other 19 specifications in all but one, the number of poor people who left poverty was higher than 271 million, but in the range of 275 million to 302 million. Only in one extreme trial in which all adult malnutrition data were deleted did the number exiting poverty drop below 271 million. And how would these figures have changed had we used population data from 2006-2015 instead of 2016 (because while 90% of the interviews in 2005/6 were taken in 2006, that was not the case for the 2015/16 survey)? They would have increased – by about 4 million for each trial MPI in fact. Thus we can say with rigour that the figure of 271 represents a lower bound of the plausible numbers exiting poverty.

Table 14: Trial Measures of the MPI

Trial	Old MPI and Modifications to Old MPI	People out of Poverty (2015 Population)	People out of Poverty (2016 Population)
Trial 0	Old MPI	290,601,679	286,240,322
Trial 1	6yr	284,448,521	279,845,250
Trial 2	6yr+cm5	297,043,937	292,923,290
Trial 3	6yr+stunt	291,640,909	287,205,279
Trial 4	6yr+cm5+stunt	303,301,075	299,343,424
Trial 5	6yr+combo	291,425,963	287,020,666
Trial 6	6yr+cm5+combo	303,021,983	299,096,837
Trial 7	6yr+union	286,456,031	281,903,549
Trial 8	6yr+cm5+union	298,694,713	294,622,861
Trial 9	6yr+stunt+H1+asset2	288,467,238	283,879,505
Trial 10	6yr+cm5+stunt+H1+asset2	300,577,153	296,471,205
Trial 11	6yr+stunt+H2+asset2	306,162,120	302,072,799
Trial 12	6yr+combo+H1+asset2	288,228,027	283,671,297
Trial 13	6yr+cm5+combo+H1+asset2	300,384,230	296,312,293
Trial 14	6yr+combo+H2+asset2	305,612,435	301,550,060
Trial 15	6yr+cm+union+H1+asset2	282,882,473	278,173,598
Trial 16	6yr+cm5WOM+stunt+H1+asset2	279,911,630	275,872,790
Trial 17	6yr+union+H2+asset2	301,290,556	297,089,818
Trial 18	6yr+cm5WOM+unionCHILD+H1+asset2	220,546,326	217,300,526
Trial 19	6yr+union+H1+asset3(land10ha)	284,230,634	279,537,761
Trial 20	6yr+cm5WOM+union+H1+asset2	275,132,813	270,974,646

Source: Authors' calculations.

Note on abbreviations: "6yr" - 6 years of schooling; "cm5" - child mortality within last 5 years; "stunt" - stunting of children; "combo" - the combination of children stunted and age-wise WHO standards for adolescents; "union" – union approach identifying children stunted or underweight; "cm5WOM" – 5-year-child mortality from woman questionnaire only; H1" - if any housing material of roof, floor, and walls is deprived; "H2" - if 2 out of the 3 housing materials are deprived"; "asset2" – household has a car or more than 1 small assets incl. computer & animal cart; "asset3" - household has a car or more than 1 small assets incl. computer, animal cart & land size >=10ha.

4. Poverty Levels and Composition in 2015/16: Informing Public Action

Section 3 presented the very positive account of India's reduction in MPI 2005/6 to 2015/16. However, in 2015/16, still 364 million people were in multidimensional poverty – a number far higher than those living in $1.90/day who are estimated at 73 million (World Bank 2018). This section provides an in-depth overview of the level and composition of poverty for different groups in India, with an aim to illuminate entries for public action to reduce the interlocking deprivations that continue to afflict so many.

4.1 National Poverty Levels in 2015/16 (briefly) – MPI, H, A, and Major Contribution

In 2015/16, 27.5 percent of India's population is multidimensionally poor and deprived in at least one third of the ten weighted indicators. That translates into more than 364 million people who cope with multiple deprivations at the same time. The magnitude of this number is enormous, as it is roughly equivalent in size to the combined and entire populations of the most populous Western European countries including Germany, France, Spain, Portugal, and Italy; or African countries including Nigeria, Ethiopia, and Egypt. On average, multidimensionally poor Indians are deprived in 44 percent of the 10 weighted indicators. In particular, three censored headcount ratios seem to be driving the high number of multidimensional poverty at the national level: every fifth Indian lives in a multidimensionally poor household that has at least one malnourished person (20 percent); while about every fourth Indian is multidimensionally poor and lives in household without improved cooking fuel according to SDG standards (24.8 percent). A quarter of India's population is multidimensionally poor and does not have adequate sanitation facilities (25.2 percent).

4.2 Indicator Composition and Priority Action Areas

Across nearly every state, poor nutrition is the largest contributor to multidimensional poverty, responsible for 28.3 percent of India's MPI. Not having a household member with at least six years of education is the second largest contributor, at 16 percent. Insufficient access to clean water and child mortality contribute least, at 2.8 percent and 3.3 percent, respectively. Relatively few poor people experience deprivations in school attendance.

4.3 The Poorest Groups and Regions

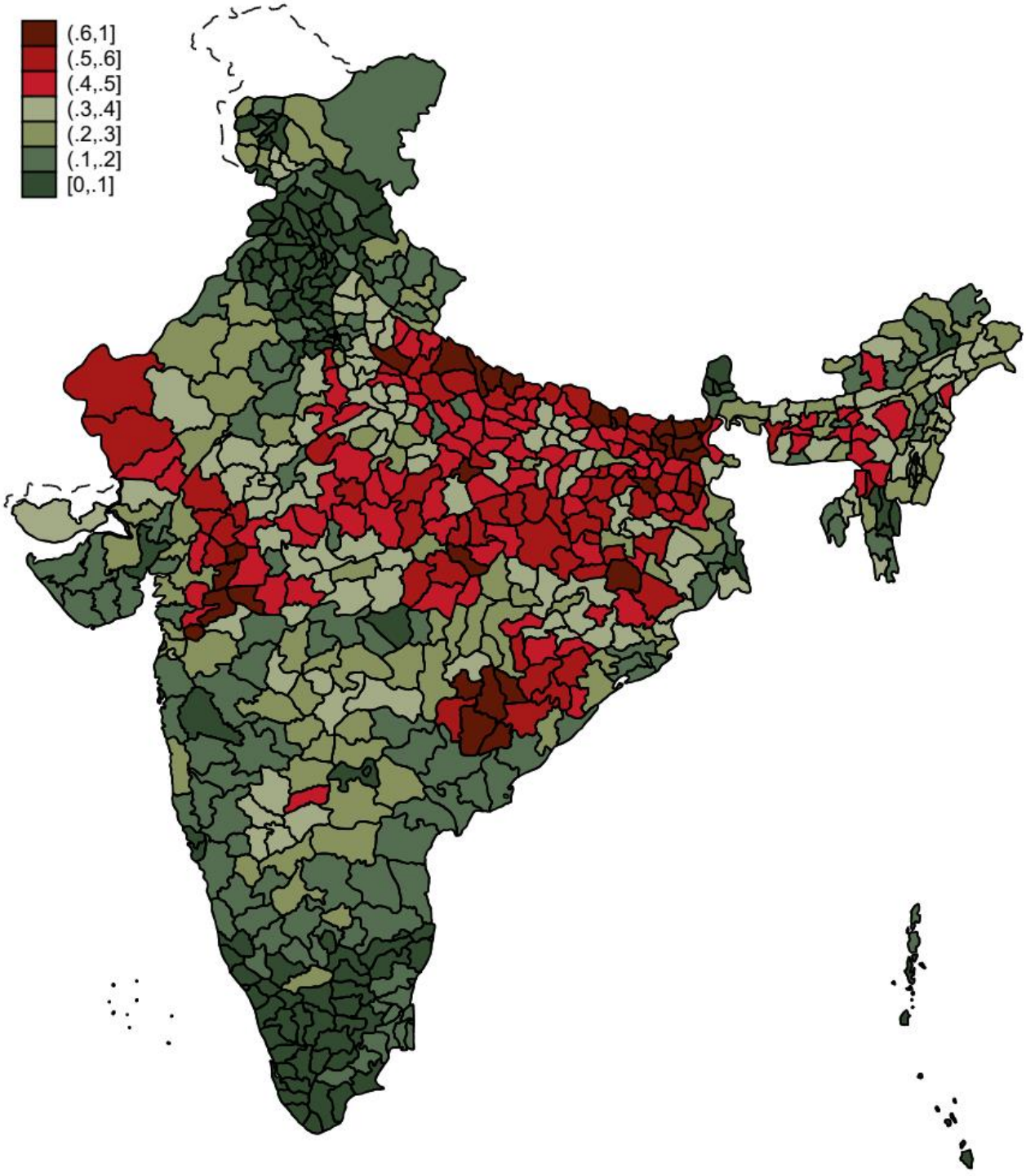
While there has been much progress in reducing poverty both in rural areas as well as in urban areas in absolute terms, the rural-urban divide remains a cause for concern. In 2015/16, residents in rural areas are very roughly four times more likely to be multidimensionally poor than their countrymen living in urban areas. To put the divide into perspective, one can compare the MPI 2015/16 for urban areas (0.039) to, for example, the overall MPI of the Philippines and Brazil. The MPI for rural areas (0.161) is, on the other hand and despite all progress more than four times higher and comparable to the MPI of much poorer countries. Despite the progress made for the poorest sub-groups of 2005/6, the traditionally disadvantaged subgroups such as lower castes and tribes, Muslims, and young children are still the poorest in 2015/16. In terms of states, Bihar is the poorest state in 2015/16, with more than half of its population in multidimensional poverty. In 2015/16, the four poorest states of Bihar, Jharkhand, Uttar Pradesh, and Madhya Pradesh host over half of all the MPI poor people in India. Furthermore, young children aged 0 to 9 years are most likely to be living in multidimensionally poor households, as 4 out of 10 children are multdimensionally poor in 2015/16.

4.4 District Level MPI

The 2015/16 district-level data for India reveal pockets of poverty and those regions that seem to be left behind despite the progress made at the state-level. Figure 8 shows a district map for India with district-level values of the multidimensional headcount ratio ranging from dark green (lowest H) to dark red (highest H). The poorest district is Alirajpur in Madhya Pradesh, where 76.5 percent of people are poor. In four districts more than 70 percent of people are poor; these are located in Uttar Pradesh and Madhya Pradesh. Twenty-seven districts have 60 to 70 percent of their people in poverty. At the other end of the scale, in 19 districts less than 1 percent of people are poor, and in 42 districts, poverty rates are 2 to 5 percent. The map depicts a clear divide between districts located in southern and north-central India. For example, in the 134 districts of Maharashtra, Telangana, Andhra Pradesh, Karnataka, Tamil Nadu, and Kerala, there are just two districts with poverty rates above 40 percent. These are Nandurbar in northern Maharashtra bordering Gujarat (60 percent) and Yadgir in north-eastern Karnataka, where almost every second person is multidimensionally poor. In Tamil Nadu and Kerala, most district-level headcount ratios hover around 10 percent or less. Interestingly, districts in the far northern states such as Punjab, Haryana, and Himachal Pradesh show a similar pattern. In major contrast are districts that spread all the way from north-western Uttar Pradesh to eastern Bihar along the Indo-Gangetic Plain, and from pockets in western Madhya Pradesh to Odisha via many isolated and neglected districts in Jharkhand and Chhattisgarh (note that NFHS-4 district level disaggregation groups together some of Chhattisgarh's districts). These states reduced multidimensional poverty at very high rates as discussed above, yet many districts still account

for some of the highest poverty rates in India and in South Asia. A case in point is Bihar. In 11 of its 38 districts more than six in ten people are poor, and in two districts almost 70 percent are multidimensionally poor (Madhepura, Araria).

Figure 7: Multidimensional Poverty Headcount Ratio (H) across Indian Districts in 2015/16



Source: Authors' calculations.

Concluding Remarks

This paper offers a descriptive investigation of the changes in multidimensional poverty 2005/6 to 2015/16 in India using data from the NFHS-3 and NFHS-4 surveys. We find a very strong reduction, indeed a halving of the MPI during that decade. Furthermore, subnational patterns of poverty reduction are strongly pro-poor, whereas from 1998/9 to 2005/6 they had been regressive. In particular, our findings demonstrate the value-added of using MPI (which respects dimensional monotonicity) rather than just a headcount ratio: the pro-poor change in MPI is driven by the reduction of intensity among the poor as well as by a reduction in incidence. In summary, this paper confirms that at the end of the decade under study, at least 271 million fewer persons were living in multidimensional poverty – a magnitude of change rivalling the numbers exiting monetary poverty in China. At the same time, the district level analyses for 2015/16 reveals the importance of acknowledging the extensive ongoing intra and interstate variation that may be hidden by the huge progress made across states.

In ongoing research, we show that the MPI reduction are hardly correlated with state level growth in GDP, making this a rich terrain for future research. There is a great deal more data available to be interpreted and analysed. This ranges from data on caste or religious groups and their trends within states, to data on the composition of poverty across districts.

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