

Who are the World's Poor?
A New Profile of Global Multidimensional Poverty

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Abstract: This paper is concerned with the following question: Who are the world's multidimensionally poor? To answer this, we compare and contrast the original Alkire–Foster measure of multidimensional poverty with other multidimensional indices in order to show how they differ and the consequences for poverty headcount estimates. We assess the extent of the multidimensionality of poverty using the original Alkire–Foster measure of multidimensional poverty. We then make estimates of the global profile of multidimensional poverty in 2015 using the Alkire–Foster measure and two alternative indices. We conclude that the world's multidimensionally poor are largely young people, residing in rural areas though not necessarily working in agriculture. Overall, the contribution of the paper is to explain how multidimensional poverty indices differ; and to present a new set of estimates of the global multidimensional poverty profile for 2015.

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1 INTRODUCTION

In this paper, we compare and contrast the different existing multidimensional poverty indices; assess the extent of the multidimensionality of global poverty; and present estimates of the disaggregated characteristics of global multidimensional poverty for 2015. The contribution of this paper is to discuss how multidimensional poverty headcount indices differ and to present new estimates of the global multidimensional poverty profile for 2015.

The paper is structured as follows: Section 2 compares and contrasts the original Alkire–Foster measure of multidimensional poverty with other multidimensional indices in order to show how they differ, and the consequences for poverty headcount estimates. Section 3 then takes the original Alkire–Foster measure of multidimensional poverty and assesses the extent of the multidimensionality of poverty. Section 4 makes estimates of the global profile of multidimensional poverty for 2015, again using the original Alkire–Foster measure of multidimensional poverty and – in order to assess sensitivity – two alternative indices of multidimensional poverty. Section 5 concludes.

2 GLOBAL POVERTY PROFILES: ESTIMATING MULTIDIMENSIONAL POVERTY

2a. Existing indices of multidimensional poverty

In this section, we compare and contrast the original Alkire–Foster measure of multidimensional poverty with other multidimensional indices in order to show how they differ and what the consequences for poverty headcount estimates are.

Sen (1999) originally elucidated the importance of capabilities and functionings to reflect the actual experience of poverty, beyond the setting of a poverty threshold for welfare based on

consumption or income. A range of multidimensional poverty methodologies have been adopted to carry out aggregation of different dimensions of poverty (see for example the earlier discussion of Bourguignon & Chakravarty, 2003; Tsui, 2002). The choice of components themselves, the weighting, and the cutoffs have been subject to considerable debate, as well as the extent to which measures capture capabilities or functionings (see Alkire & Foster, 2011b; Ravallion, 2011). Sen (1999) argues that multidimensional poverty analysis shows what people can *do* and *be* rather than what they can buy or what they have bought, illustrating the strength of multidimensional poverty analysis vis-à-vis monetary poverty. In short, multidimensional poverty analysis is better at capturing the actual experience of those living in poverty rather than the potential experience that purely monetary poverty measures may capture.

Since 2010 the Multidimensional Poverty Index (MPI) of Alkire–Foster (2011a) (henceforth, MPI-1a) has been estimated annually by the Oxford Poverty and Human Development Initiative (OPHI) at the University of Oxford. The MPI-1a measure aggregates 10 poverty indicators in the dimensions of health (undernutrition and child mortality); education (years of schooling completed and school attendance); and ‘standards of living’ (which includes access to infrastructure such as electricity, sanitation, water, housing (flooring), and use of improved cooking fuel, as well as ownership of household assets).

A close, though slightly different MPI has been estimated annually by the United Nations Development Programme (UNDP) and published in the *Human Development Report* (2010–2016) (henceforth, MPI-1b). The MPI-1b measure differs slightly from the MPI-1a in that it includes school attainment at six years of education (instead of five years) and allows for the late enrollment of children aged one year at school. It also uses child stunting (rather than

underweight), and includes child mortality up to five years before the survey. It also includes ownership of arable lands and livestock as part of rural assets.

In late 2018, two further multidimensional poverty indices were proposed. First, a new joint OPHI–UNDP measure was developed (see OPHI, 2018) (henceforth, MPI-2). This included: a housing indicator developed from data on flooring, roof, and walls; computers and animal carts added to assets; and the age to determine undernutrition limited to 70 years old. Another measure was developed by the World Bank (2018) (henceforth MPI-3) using the Alkire–Foster method of aggregation, although the indicators, dimension weights, and cutoffs selected differ from MPI-1a (and MPI-1b and MPI-2) and the MPI-3 also includes monetary poverty at US\$1.90 per day which is not included in any other MPI. MPI-3 is different to the other MPIs in that it identifies one sole deprivation - monetary poverty - as sufficient to define a household as living in poverty.¹

Table 1 compares MPI-1a and MPI-1b with MPI-2 and MPI-3. The table outlines the dimensions, indicators, definitions, and weights of each index. There are some differences in labeling. For example, MPI-1a, MPI-1b, and MPI-2 refer to ‘standards of living’, while MPI-3 refers to ‘basic infrastructure’. MPI-1a, MPI-1b, and MPI-2 produce higher poverty headcounts principally because they include access to water and sanitation, while MPI-3 does not. As noted, there are also differences in the thresholds for years of schooling between MPI-1a, MPI-1b, MPI-2, and MPI-3. MPI-3 takes completion of primary school education as a threshold and thus because primary schooling may take five or more years in many countries, one would expect to see slightly larger estimates vis-à-vis MPI-1a, MPI-1b, and MPI-2. In terms of access to the full datasets, the original MPI-1a is the only dataset that is currently publicly available in full. Hence, we primarily focus on MPI-1a in this paper.

Table 1 MPI-1a, MPI-1b, MPI-2, and MPI-3: Components, measures, and weights (in parentheses)

	Shorthand	MPI-1a	MPI-1b	MPI-2	MPI-3
	Institutional basis	Original OPHI MPI	UNDP MPI	New MPI of OPHI/UNDP	New MPI of World Bank
	Source	Alkire & Foster (2011a); Alkire & Santos (2014)	UNDP (2010–2016)	OPHI (2018)	World Bank (2018)
Dimensions	Indicators				
Health	Nutrition	Any adult or child in the household with nutritional information is undernourished (1/6)	Any adult or child in the household (for whom there is nutrition information) is malnourished (1/6)	Any person under 70 years of age for whom there is nutritional information is undernourished (1/6)	
	Child mortality	Any child has died in the household (1/6)	Any child has died in the household within the five-year period preceding the survey (1/6)	Any child has died in the household within the five-year period preceding the survey (1/6)	
Education	Years of schooling	No household member (aged 10 or older) has completed five years of schooling (1/6)	No household member has completed six years of schooling (1/6)	No household member (aged 10 or older) has completed six years of schooling (1/6)	No household member (age of grade 9 or above) has completed primary education (1/6)
	School attendance	Any school-aged child in the household is not attending school up to class 8 (1/6)	Any school-aged child in the household is not attending school up to class 8 (1/6)	Any school-aged child in the household is not attending school up to the age at which he/she would complete class 8 (1/6)	At least one school-aged child up to the age of grade 8 is not enrolled in school (1/6)
Standard of living /basic infrastructure	Electricity	The household has no electricity (1/18)	The household has no electricity (1/18)	The household has no electricity (1/18)	The household has no electricity (1/9)
	Sanitation	The household's sanitation facility is not improved, or it is shared with other households (1/18)	The household's sanitation facility is not improved, or it is shared with other households (1/18)	The household's sanitation facility is not improved, or it is shared with other households (1/18)	The household lacks access to 'limited-standard' sanitation (1/9)
	Water	The household does not have access to safe drinking water, or safe water is	The household does not have access to clean drinking water, or safe water is	The household does not have access to improved drinking water,	The household lacks access to 'limited-standard' drinking water (1/9)

		more than a 30-minute walk, round trip (1/18)	further than a 30-minute walk, round trip (1/18)	or safe water is at least a 30-minute walk, round trip (1/18)	
	Floor	The household has a dirt, sand, or dung floor (1/18)	The household has a dirt, sand, or dung floor (1/18)		
	Cooking fuel	The household cooks with dung, wood, or charcoal (1/18)	The household cooks with dung, wood or charcoal (1/18)	The household cooks with dung, agricultural crops, shrubs, wood, charcoal, or coal (1/18)	
	Assets	The household does not own more than one of the following: radio, TV, telephone, bike, motorbike, or refrigerator, and does not own a car or truck (1/18)	The household does not have at least one information-related asset (radio, TV, telephone) and does not have at least one mobility-related asset (bike, motorbike, car, truck, animal cart, motorboat) or at least one livelihood-related asset (refrigerator, arable land, livestock)	The household does not own more than one of the following: radio, TV, telephone, computer, bike, motorbike, or refrigerator, and does not own a car or truck (1/18)	
	Housing			The floor is of natural materials or the roof or walls are of rudimentary materials (1/18)	
Monetary poverty	Income / Consumption				Daily consumption or income is less than US\$1.90 per person (1/3)
Definition of poverty		Households are defined as poor if they are deprived in indicators whose weight adds up to 1/3 or more.	Households are defined as poor if they are deprived in indicators whose weight adds up to 1/3 or more.	Households are defined as poor if they are deprived in indicators whose weight adds up to 1/3 or more	Households are defined as poor if they are deprived in indicators whose weight adds up to 1/3 or more
Poverty headcount in 2015		1.50 billion	1.51 billion	1.45 billion	0.60 billion

Sources: Alkire and Foster (2011a); Alkire and Santos (2014), OPHI (2018), UNDP (2015), and World Bank (2018). Note: There was no MPI published in 2017 by UNDP.

2b. Comparing estimates of multidimensional poverty

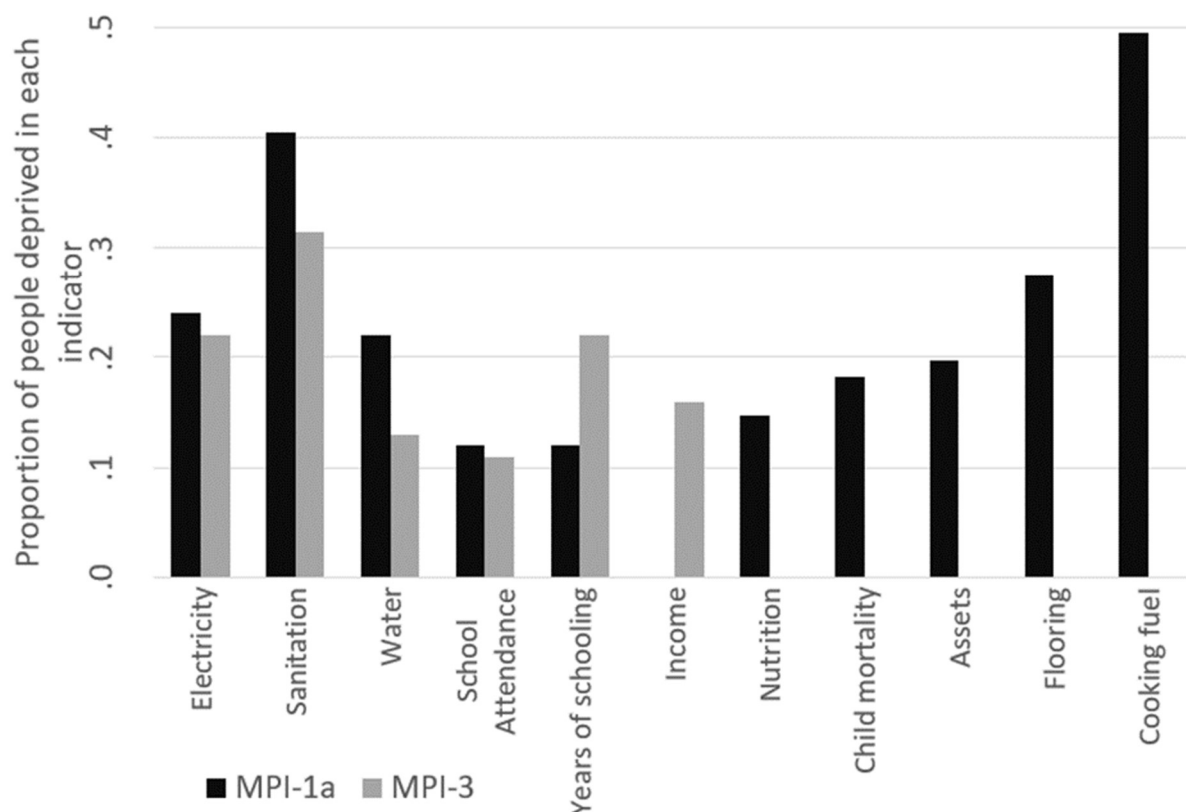
Comparisons between the measures above are fraught because MPI-1a, MPI-1b, MPI-2, and MPI-3 are based on different underlying datasets. The coverage of the world's population in the MPI-1a dataset is 78% and the window used for surveys is 2005–2016. One hundred and six countries are included or 92% per cent of the developing world's population. In contrast, MPI-3 is based on 2010–2016, and 119 countries or 42.6% per cent of the developing world's population.

In order to make meaningful comparisons, it is necessary to compare MPIs across as consistent a dataset as possible. For example, to compare the original MPI-1a and the MPI-3, we can compare across 73 countries or 45% of the world's population based on 2015 population figures (as MPI-3 is based on that set of countries, as noted above). We can only compare across the same set of five indicators that are included in both MPI-1a and MPI-3.

Even then, there is the limitation that estimates come from different household surveys conducted in different years in some instances. In fact, only nine of the surveys included in comparing MPI-1a and MPI-3 were conducted in the same year for a given country. The remainder that we make use of here have a time lag of one to six years between surveys.² Figure 1 shows the deprivation in each of the five common indicators across the consistent set of 73 countries. The MPI-1a indicators of deprivation are shown as black bars and the MPI-3 indicators are shown in gray. Not surprisingly, there are deprivations that are similar. For example, MPI-1a and MPI-3 identify similar levels of people deprived in access to electricity and school attendance. Even allowing for the same definition of deprivation, there is a slight difference in incidence due to the precise date of the surveys used.

The indicators that are exclusive to either MPI-1a or MPI-3 are also depicted in Figure 1. For example, MPI-3 estimates that 16% of people in the 73 countries live under the US\$1.90 monetary poverty line. The closest comparisons conceptually to the US\$1.90 poverty line within MPI-1a are arguably either asset ownership or undernutrition (given that the 15 national poverty lines from which the US\$1.90 monetary poverty line is derived from are largely based on calorie intake). MPI-1a generates an estimate that 15% of the population of the 73 countries was undernourished. However, 20% of the population of the 73 countries was deprived on the asset indicator.

In sum, the choice of MPI utilized – not surprisingly - has consequences for the total poverty headcount (and also the incidence rates of specific deprivations when different survey datasets are used). This raises a question of which indicators ought to be used in constructing a global multidimensional poverty profile. To answer this question an investigation of which deprivations overlap most frequently, in short, how ‘multidimensional’ global poverty is (meaning the experience of simultaneous deprivations) is useful (see also Battiston, Cruces, Lopez-Calva, Lugo, & Santos, 2013; Chakravarty & D’Ambrosio, 2006). To answer this question as fully as possible, we take the dataset of the MPI-1a as it is the largest and as noted publicly available in full.



Source: Authors' estimates and World Bank (2018, tables 4C.3 and 4C.4).

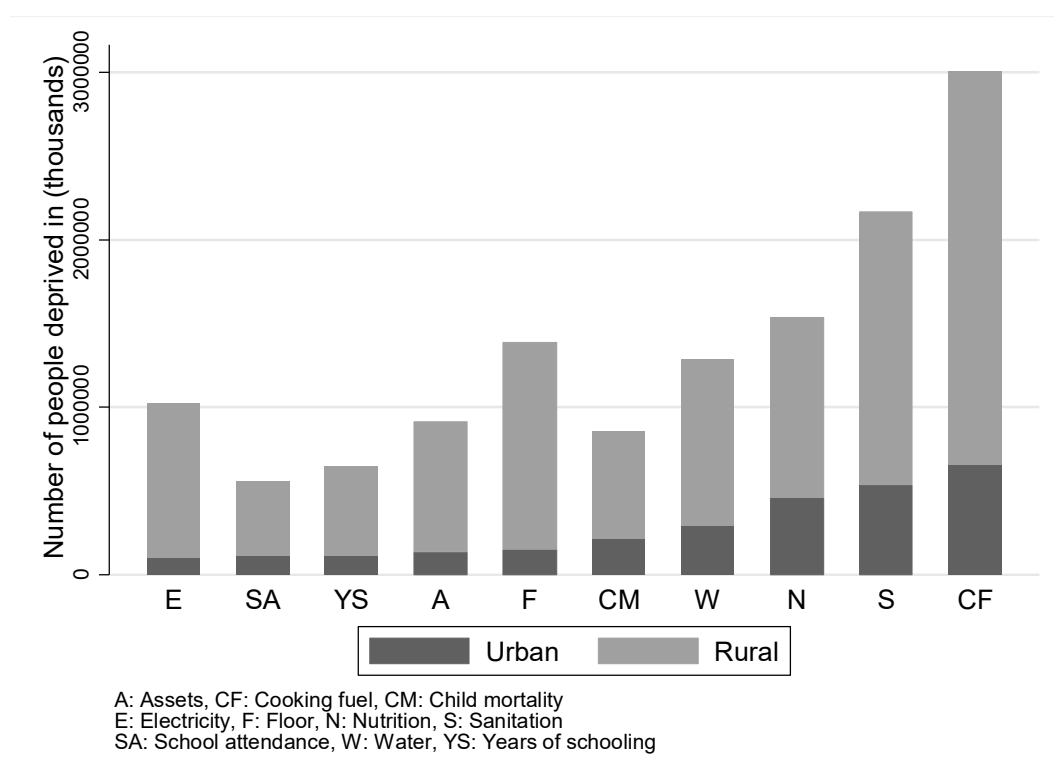
Figure 1 MPI-1a versus MPI-3: Estimates of poverty based on 73 countries using a consistent dataset

3 A GLOBAL POVERTY PROFILE: HOW MULTIDIMENSIONAL IS POVERTY?

In this section, we take the MPI-1a, the original Alkire–Foster measure of multidimensional poverty, to assess the extent of the multidimensionality of poverty as completely as possible, with some important caveats on data limitations to note at the outset. Specifically, survey data are taken from different years within a window (2005–2016).

We begin with an overview of global poverty based on MPI-1a. Figure 2 shows the most common deprivations by urban or rural residency. Bars are ordered from the least frequent deprivation in urban areas on the left to the most frequent deprivation on the right.³ We

estimate that the most frequent deprivation experienced of the 10 indicators in the MPI-1a is a lack of access to improved cooking fuel, which affects more than 3 billion people, of which 0.7 billion are located in urban areas, and more than 2.3 billion are located in rural areas. The second most frequent deprivation is access to sanitation, affecting over 2 billion people, of which 0.5 billion people live in urban areas and 1.6 billion live in rural areas. Nutrition is the third most frequent deprivation affecting 1.5 billion people, and it is more frequently observed in rural areas. Other living standards deprivations are also more frequently observed in rural areas, such as poor-quality housing (using flooring as proxy), access to water, electricity, or ownership of assets.

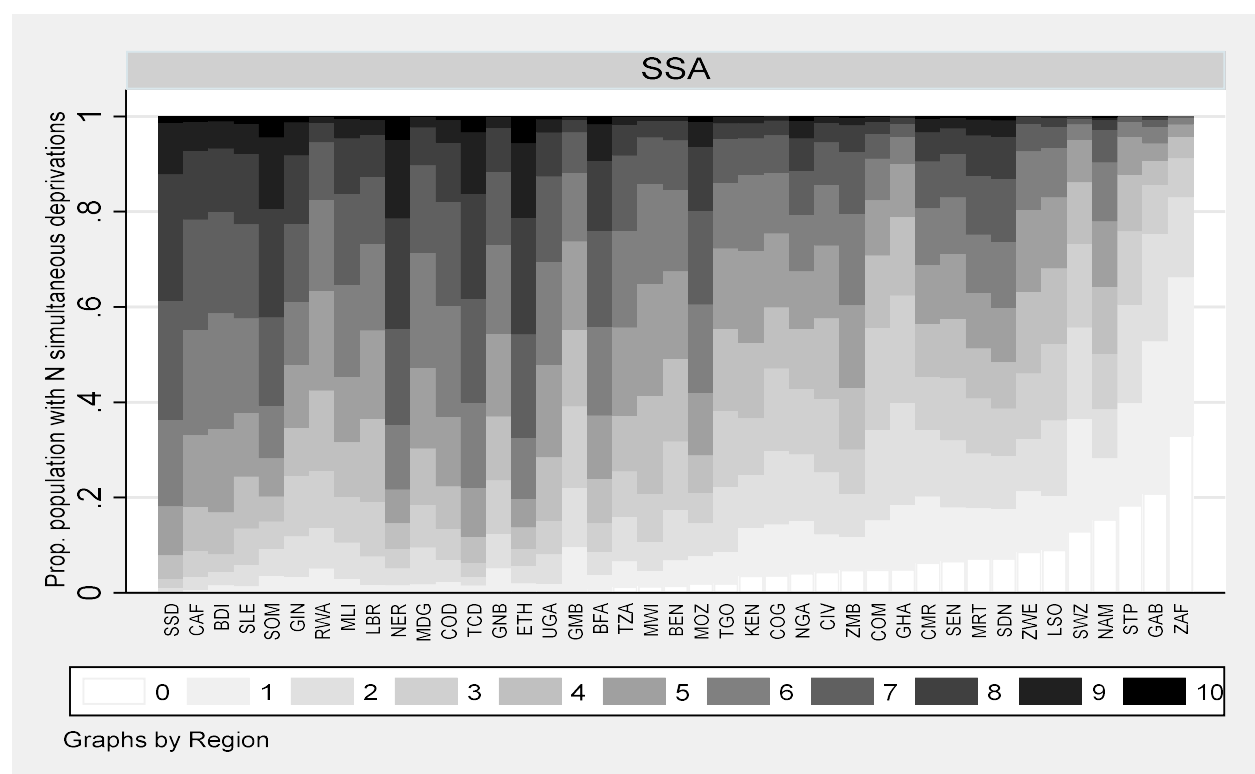
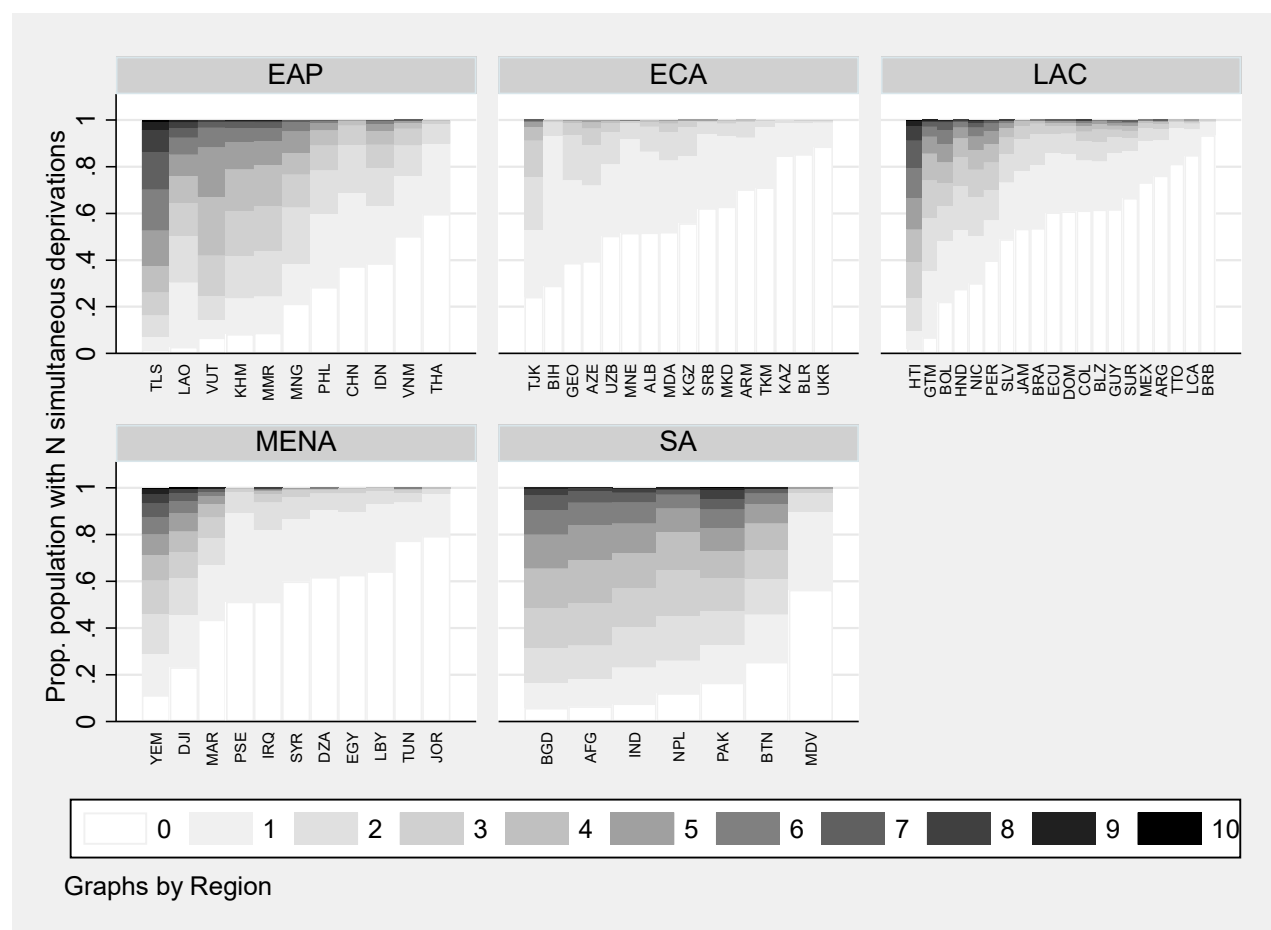


Note: Urban figures include the totals for Argentina and Libya which cannot be disaggregated by rural/urban area. *Source:* Authors' estimates.

Figure 2 MPI-1a: Number of people experiencing a given deprivation, urban and rural areas, 2015

Next, we present a regional overview of poverty based on MPI-1a. A comparison of the pattern of simultaneous deprivations across MPI-1a for countries grouped by regions of the world is presented in Figure 3. Each segment indicates the proportion of the population experiencing N overlapping deprivations, starting with zero deprivations in white at the bottom of each bar, and adding up segments of concurrent deprivations to reach 100% of the population. As segments become progressively darker, any additional deprivation is considered, until reaching 10 overlapping deprivations at the top (black) segment of the bar. Figure 3 shows that regions such as Europe and Central Asia (ECA), Latin America and the Caribbean (LAC), and the Middle East and North Africa (MENA) have 20% or more of the population without any deprivation (except for Haiti and Yemen). In ECA, we hardly see any gray segments, and in LAC and MENA, gray segments are visible only for a handful of countries, indicating that the proportion of population with five or more deprivations is minimal.

However, in East Asia and the Pacific (EAP), South Asia (SA), and sub-Saharan Africa (SSA), the overlap of deprivations is more common and shows more variation across countries in the same region. In EAP and SA, more than half of the population in each country experience at least one deprivation (except for Thailand, Vietnam, and the Maldives), and in SA, the proportion of people experiencing two or more deprivations is larger than 50% in every country except for the Maldives. In SSA, we observe a large variation of overlapping deprivations, from 5% of people deprived in five or more indicators in South Africa to 92% in South Sudan.



Source: Authors' estimates.

Figure 3 MPI-1a: Proportion of population with overlapping deprivations, 2015

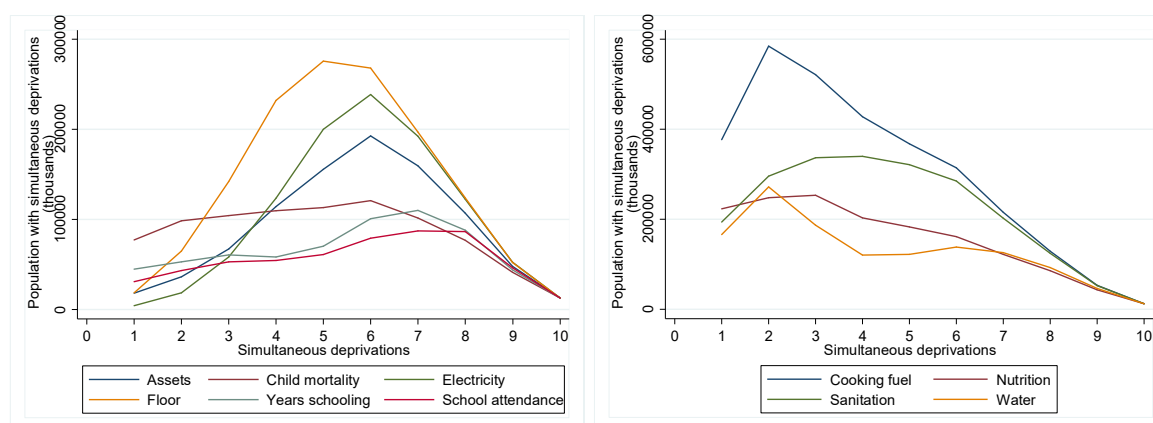
The fact that populations across different countries and regions of the world experience different patterns of concurrent deprivations raises the question: Which of the deprivations most frequently overlap? Figure 4 depicts each indicator with a line which shows the number of people who are deprived in that particular indicator (on the vertical axis) among people who simultaneously experience N deprivations, where N can take values from zero to 10 deprivations of MPI-1a (on the horizontal axis). It is divided into two panels to facilitate the visualization of indicators, and the vertical scale is different for each panel. In figure 4, there is the most frequently observed deprivations and there are rapidly increasing lines that reach a maximum value between two and three simultaneous deprivations, to decline steadily afterward. The rate of decline is less sharp for the nutrition deprivation and water access indicators. Looking at this global picture, it is possible to differentiate between the regions.

As a general conclusion, ECA, EAP, LAC, and MENA follow the global pattern. However, this is not the case in SSA and SA, where any of these indicators tend to overlap with three to six deprivations, and further discerning criteria may leave some of those with multiple deprivations behind. In ECA and MENA, the overlap of three or more deprivations is seldom identified by any indicator. In LAC, most indicators tend to identify households experiencing between two and three deprivations, while households that lack electricity and assets would tend to also experience four or more simultaneous deprivations; this also occurs in the MENA region. In SSA, almost every single indicator identifies people in households experiencing between six and eight concurrent deprivations. In SA, all indicators identify large amounts of people deprived in four or more simultaneous deprivations, while assets, electricity, and school attendance identify the population experiencing six or more

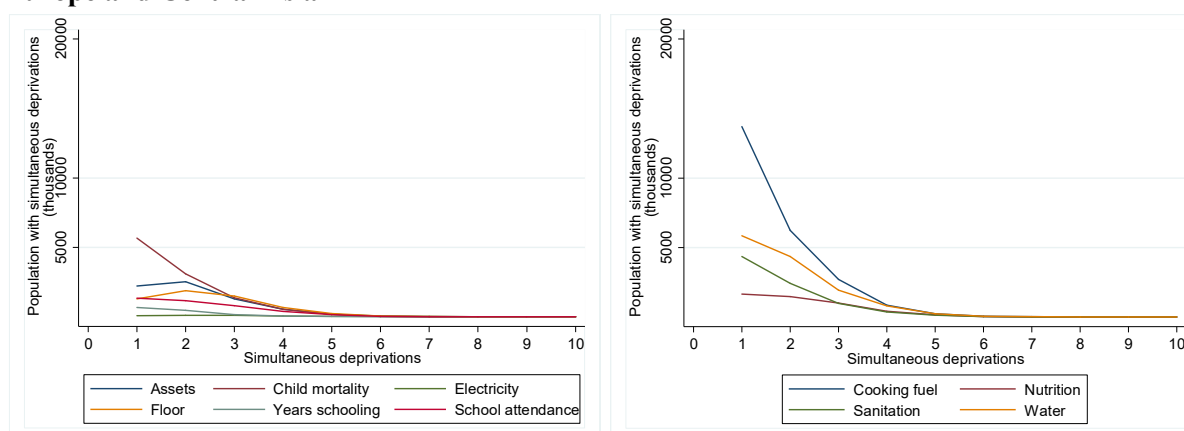
deprivations simultaneously. In EAP, the average number of simultaneous deprivations decreases for all indicators to between two and four.

In short, there are some deprivations which tend to overlap more frequently with other deprivations. For example, in SA, households deprived in any of the 10 indicators also tend to have three or more concurrent deprivations, but in SSA, all indicators tend to identify six or more concurrent deprivations.

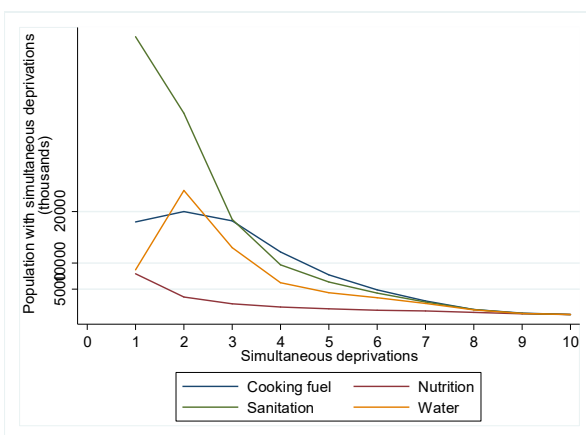
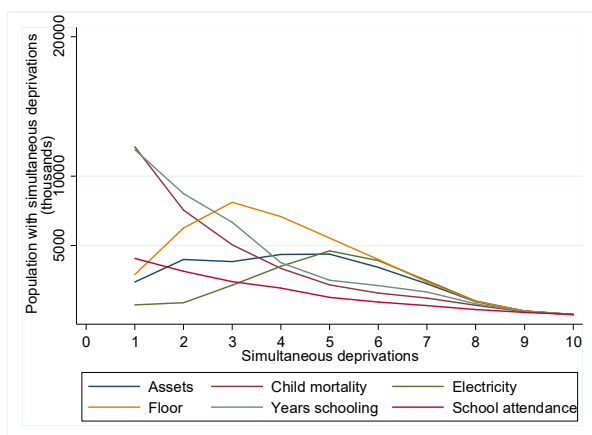
All regions



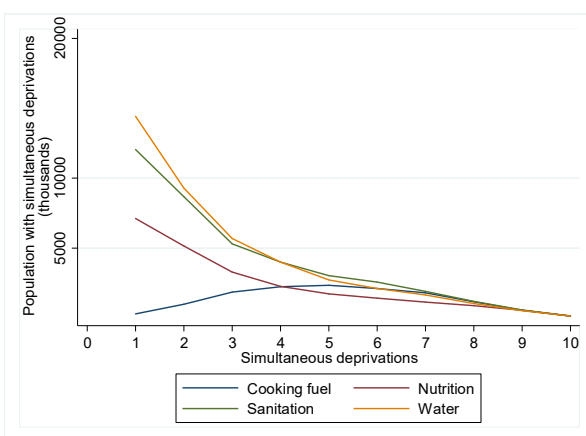
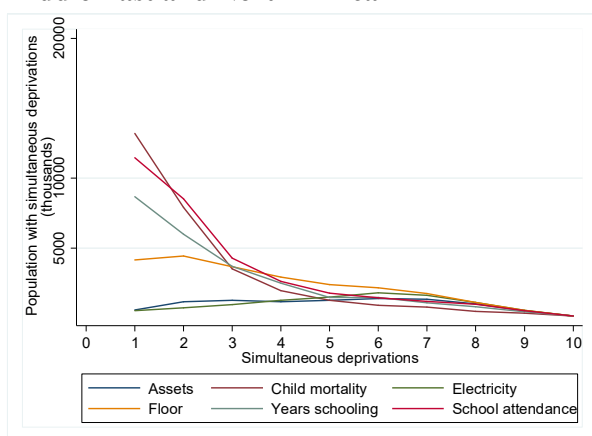
Europe and Central Asia



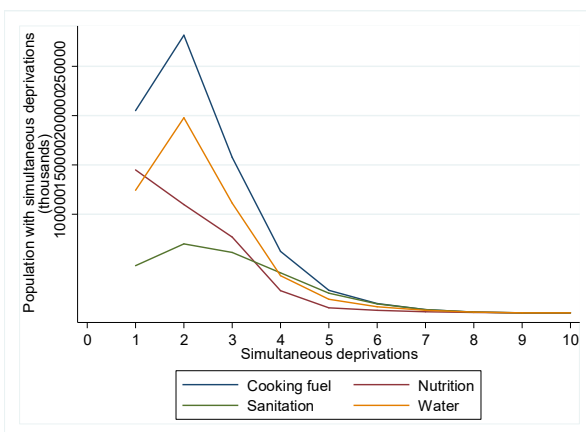
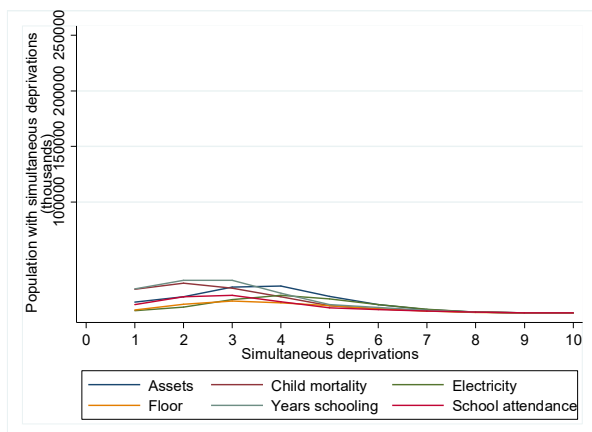
Latin America and the Caribbean



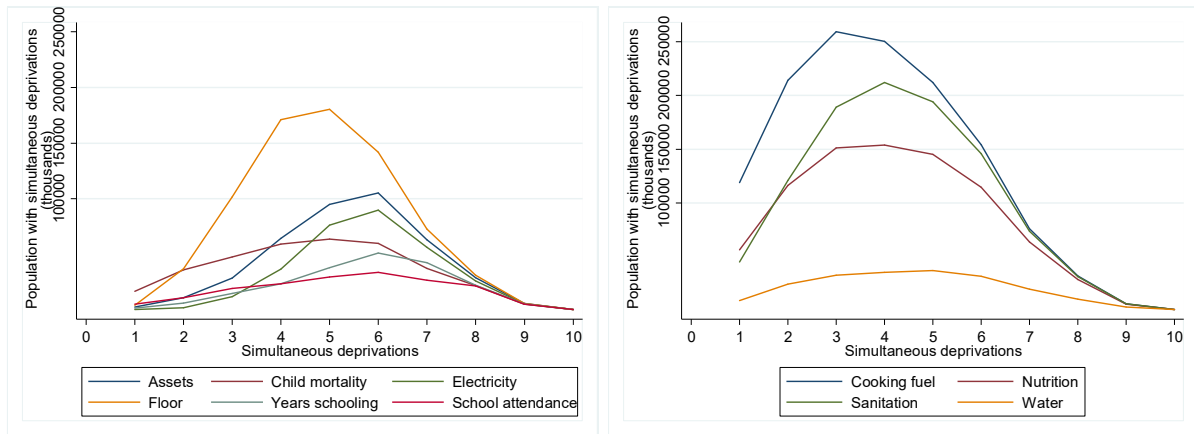
Middle East and North Africa



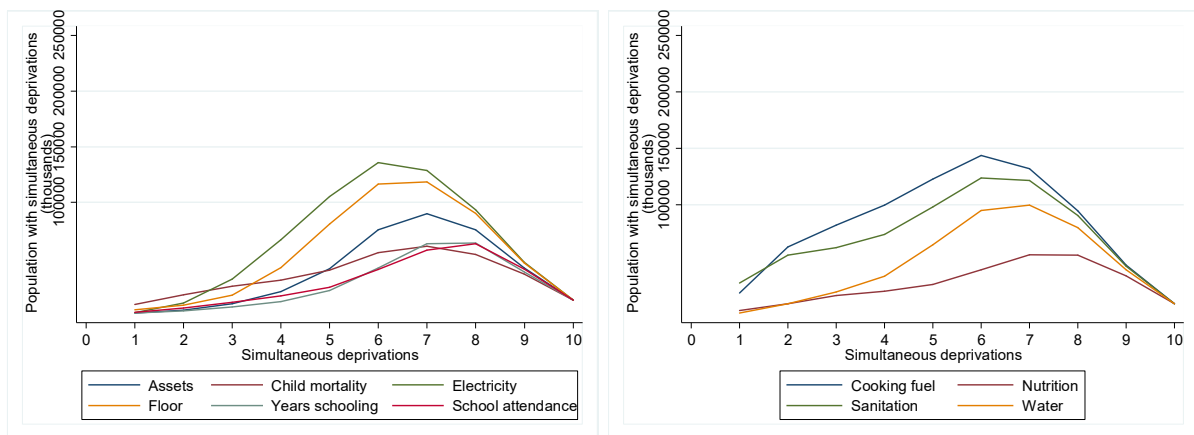
East Asia and Pacific



South Asia



Sub-Saharan Africa



Source: Authors' estimates.

Figure 4 MPI-1a: Number of people deprived in each indicator and N simultaneous deprivations by selected regions, 2015

It is also possible to assess the underlying empirical association between the indicators. To do this, Cramer V is a useful coefficient to measure association between two nominal variables. It is based on Pearson's chi-squared statistic but ranges from 0, implying a lack of association, to 1, implying perfect association. It can be interpreted as the percentage of the maximum possible association between two variables. Table 2 shows the mean value of Cramer's V coefficient presented for each pair of indicators. We observe the largest correlation coefficients across living standards. These are: electricity, housing (flooring), and

assets, which have Cramer's V coefficients of 0.28 to 0.37. This can be interpreted as having 28–37% of the maximum possible association between each pair of variables.

Table 2 Cramer V correlation coefficient for each pair of indicators across population in 106 countries

	Electricity	Floor	Assets	Cooking fuel	Sanitation	Water	Years of schooling	School attendance	Child mortality	Nutrition
Electricity		0.35	0.37	0.27	0.22	0.25	0.21	0.13	0.08	0.07
Floor	0.35		0.28	0.26	0.20	0.20	0.18	0.12	0.08	0.07
Assets	0.37	0.28		0.20	0.19	0.17	0.25	0.10	0.04	0.05
Cooking fuel	0.27	0.26	0.20		0.17	0.16	0.12	0.09	0.08	0.06
Sanitation	0.22	0.20	0.19	0.17		0.17	0.15	0.08	0.05	0.05
Water	0.25	0.20	0.17	0.16	0.17		0.13	0.10	0.06	0.05
Years of schooling	0.21	0.18	0.25	0.12	0.15	0.13		0.12	0.03	0.05
School attendance	0.13	0.12	0.10	0.09	0.08	0.10	0.12		0.09	0.07
Child mortality	0.08	0.08	0.04	0.08	0.05	0.06	0.03	0.09		0.07
Nutrition	0.07	0.07	0.05	0.06	0.05	0.05	0.05	0.07	0.07	

Source: Authors' estimates. Excludes Argentina.

Electricity, flooring, and asset ownership also have large association coefficient with the remaining living standards, namely improved cooking fuel and access to water and sanitation, but also have comparatively strong correlation coefficients with indicators of education and health. We also observe that the correlation coefficients between deprivations in health and education tend to be below 0.2, except for the association of years of education with assets and electricity, which is just above 0.2.

There is a caveat to flag: as noted at the outset of this section and in the methodological annex, although almost 90% of the survey data are in the 2010–2016 period, some are from the 2005–2010 period, in order to extend geographical coverage and to maintain

comparability with the most recent data available. We are thus making an important assumption that population characteristics have remained constant across households in different country–year estimates between the survey date and 2015. There is no systematic way to account for these changes in the absence of more recent survey data; these are issues also inherent in monetary poverty measurement (unless a method of extrapolation is used) even if one shortens the time window to five years rather than the 2005–2016 window we use.⁴

4 WHO ARE THE POOR? A NEW GLOBAL PROFILE OF MULTIDIMENSIONAL POVERTY

4a. GLOBAL POVERTY PROFILES

In this section, we ask: ‘Who are the world’s poor?’ Castañeda et. al (2018) summarizes the global monetary poor in 2013 using the US\$1.90 per day poverty line, thus: 80.1% of the total US\$1.90 poor are rural, compared to 44% of the ‘non-poor’ (defined as those above the ‘moderate’ monetary poverty line of US\$3.10 per day); 44.2% of the poor are 0–14 years of age and 61.2% are under 24 years, compared to 21.6% and 38.8% respectively of the non-poor; 64.6% of the total poor are working in agriculture, compared to 20.2% of the non-poor; and 60.9% of the poor have no education or incomplete primary education, compared to 27.7% of the non-poor.

Castañeda et al. also find that 50.0% of poor people are women, compared to 50.8% of non-poor people. The use of the US\$3.10 per day poverty line ‘urbanizes’ the profile of global poverty by 4.4 percentage points; reduces the proportion of poor people under 14 years of age by almost ten percentage points; and dramatically reduces the proportion of the global poor working in agriculture by 13 percentage points (from 64.6% to 51.5%). There would also be

a fall of almost 12 percentage points in the proportion of global poor with no or little formal education. The sample for these estimates is based on household surveys from 2009–2014 covering 89 developing countries, of which 30 have income data and the remaining 59 are consumption based. We ask next: How does the global monetary poverty profile compare to global multidimensional poverty?

4b. MULTIDIMENSIONAL POVERTY INDICES UTILIZED

In this section, we update, expand, and extend the global multidimensional poverty profile estimated previously for 2010 by Alkire and Santos (2014) and make comparisons between the global multidimensional poverty profile in 2015 and the global monetary poverty profile in 2013 estimated by Castañeda et al. (2018). It is important to note that one difference between our underlying dataset and that of Castañeda et al. (2018) is that Castañeda et al. have a larger coverage of regions such as EAP and ECA, but smaller coverage of the MENA, SA, and SSA regions. That said, the populations in our estimates are similar in age and gender composition to those in Castañeda et al. (2018), but less rural and less frequently employed in agriculture.

In order to estimate the global multidimensional poverty profile using MPI-1a, we need to develop a means to assess the sensitivity to changes in the index in terms of both the weighting of indicators and missing indicators. In this section, we make estimates of the global profile of multidimensional poverty in 2015 using the MPI-1a, the original Alkire–Foster measure of multidimensional poverty and – in order to assess sensitivity – two alternative indices of multidimensional poverty.

MPI-1a is a nested-weights index that defines poverty at 33% of weighted indicators and identifies a headcount of 1.5 billion poor people in 2015. We also estimate an equally weighted Multidimensional Poverty Index which we call MPI-4. This is based on the same 10 indicators as the MPI-1a but it defines the poor as those living with five *or more* of the 10 deprivations, on the basis that these people are poor in the *majority* of indicators measured. MPI-4 estimates the global poverty headcount at 1.1 billion people in 2015.

MPI-4 builds from MPI-1a, but we have chosen an equal weighting. This is because with the MPI-4 we aim to identify how much the poverty profile changes if we think in terms of concurrent deprivations thus the MPI-4 assigns equal weights to each of the 10 deprivations, namely a 1/10 weight to each indicator. This effectively gives a larger preponderance in the index to the six indicators of living standards, as they will jointly aggregate 60% of the overall weighting structure, compared to 33% in the MPI-1a. Individuals in households identified as poor would have five concurrent deprivations, which could all be in the realm of living standards, but we are then focused on overlapping deprivations rather than dimensional underachievement. The remaining four indicators for health and education account for 40%.

There are a number of countries that lack health data in particular, so we also estimate a non-health Multidimensional Poverty Index which we call MPI-5. Health indicators are the most frequently missing indicators in the surveys used to calculate any MPI (see methodological annex for further details). The World Bank's MPI-3 does not include health indicators and thus our MPI-5 is somewhat comparable. Our MPI-5 is an equally weighted index based on eight education and living standards indicators of the MPI-1a above but excluding the health indicators, in order to understand the impact, it has to exclude health indicators from a measure of multidimensional poverty. We consider those people living with more than half,

so five *or more* of the eight deprivations, as being poor, identifying 0.8bn people in 2015, on the basis that these people are poor in the majority of indicators measured.

Table 3 describes each of the MPIs, and further details and robustness checks are provided in the methodological annex. In Table 3, the columns describe the nested structure of the MPI-1a, MPI-4, and MPI-5. This structure of weights gives equal importance to each of the three *dimensions*, but the importance of each indicator differs across MPIs.

Table 3 MPI-1a, MPI-4, and MPI-5 components, measures, and weights (in parentheses)

	Shorthand	MPI-1a	MPI-4	MPI-5
	Logic	Original OPHI MPI	Equal weighting of dimensions	Non-health MPI
Dimensions	Indicators			
Health	Nutrition	Any adult or child in the household with nutritional information is undernourished (1/6)	Any adult or child in the household with nutritional information is undernourished (1/10)	
	Child mortality	Any child has died in the household (1/6)	Any child has died in the household (1/10)	
Education	Years of schooling	No household member (age 10 or older) has completed five years of schooling (1/6)	No household member (age 10 or older) has completed five years of schooling (1/10)	No household member (age 10 or older) has completed five years of schooling (1/8)
	School attendance	Any school-aged child in the household is not attending school up to class 8 (1/6)	Any school-aged child in the household is not attending school up to class 8 (1/10)	Any school-aged child in the household is not attending school up to class 8 (1/8)
Standard of living	Electricity	The household has no electricity (1/18)	The household has no electricity (1/10)	The household has no electricity (1/8)
	Sanitation	The household's sanitation facility is not improved, or it is shared with other households (1/18)	The household's sanitation facility is not improved, or it is shared with other households (1/10)	The household's sanitation facility is not improved, or it is shared with other households (1/8)
	Water	The household does not have access to safe drinking water, or safe water is more than a 30-minute walk, round trip (1/18)	The household does not have access to safe drinking water, or safe water is more than a 30-minute walk, round trip (1/10)	The household does not have access to safe drinking water, or safe water is more than a 30-minute walk, round trip (1/8)
	Floor	The household has a dirt, sand, or dung floor (1/18)	The household has a dirt, sand, or dung floor (1/18)	The household has a dirt, sand, or dung floor (1/18)

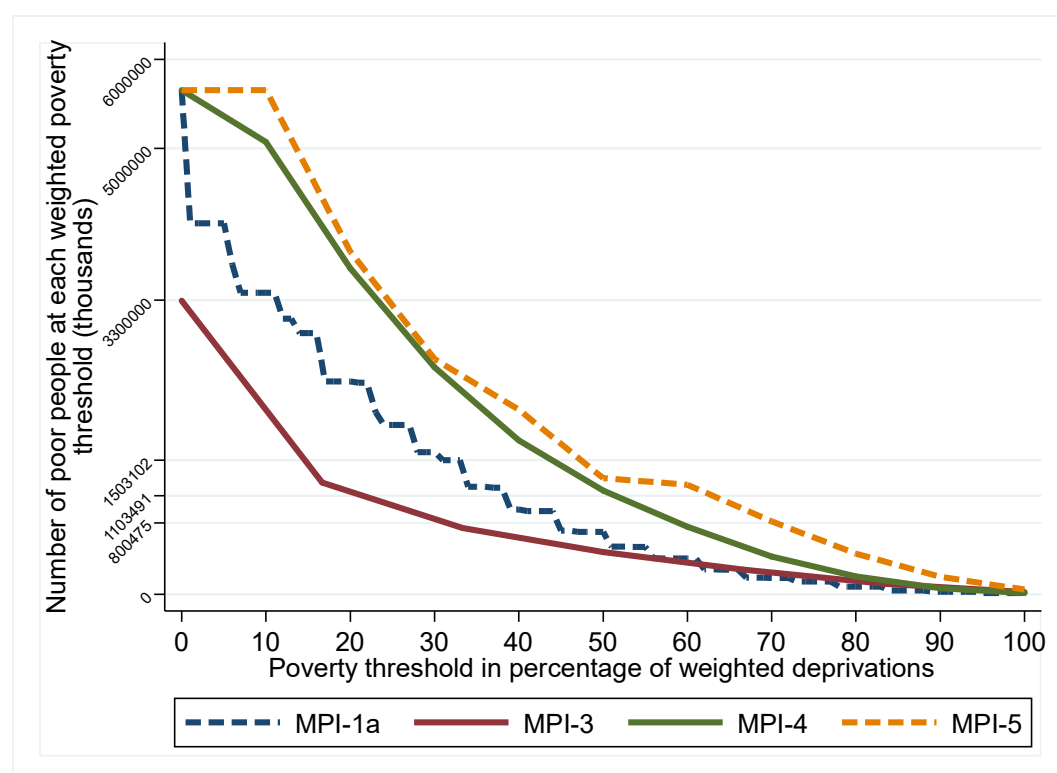
	Cooking fuel	The household cooks with dung, wood, or charcoal (1/18)	The household cooks with dung, wood, or charcoal (1/10)	The household cooks with dung, wood, or charcoal (1/8)
	Assets	The household does not own more than one of the following: radio, TV, telephone, bike, motorbike, or refrigerator, and does not own a car or truck (1/18)	The household does not own more than one of the following: radio, TV, telephone, bike, motorbike, or refrigerator, and does not own a car or truck (1/10)	The household does not own more than one of the following: radio, TV, telephone, bike, motorbike, or refrigerator, and does not own a car or truck (1/8)
Monetary poverty	Income / Consumption	n/a	n/a	n/a
Definition of poverty		33% of weighted indicators	50% of weighted indicators	62.5% of weighted indicators
Poverty headcount in 2015		1.50 billion	1.10 billion	0.80 billion

Sources: MPI-1a information from Alkire and Santos (2014); MPI-4 and MPI-5 from authors.

The total global poverty headcount differs notably across the MPI-1a, the MPI-4, and the MPI-5 (see Table 3). Figure 5 shows the number of people that accumulate simultaneous deprivations for MPI-1a, MPI-4, and MPI-5 and at each k poverty threshold of weighted indicators. The figure also includes for comparison here the MPI-3 of the World Bank (the solid line reproduced from Table 4.6 in World Bank, 2018). The gap between the solid line of the MPI-3 and the MPI-1a, MPI-4, and MPI-5 is large because the population included in the MPI-3 is much smaller (45% instead of 78% of the 2015 world population figures). Yet, the shape of the line confirms the overlap of deprivations and the underlying large correlation between indicators of education and living standards.

MPI-1a identifies fewer people as poor at every k threshold because the living standards indicators which tend to identify more people as deprived have been assigned a lower weight. MPI-4 is closely followed by MPI-5 as the difference in weights between those two measures is less pronounced. The removal of the health component in MPI-5 has the effect of reducing the number of people identified as poor by approximately 0.3 billion from the 10 equally weighted indicators measure (in MPI-4). The largest impact comes from the increased weight

of the living standards indicators between MPI-1a and MPI-4. This figure shows that poverty thresholds above 50% for MPI-4 and MPI-5 identify approximately 1 billion people living in poverty which is fewer than identified by the MPI-1a poverty threshold which has a lower threshold (of above 33%).



Source: Authors' estimates and World Bank (2018) Table 4.6.

Figure 5 MPI 1a, MPI-3, MPI-4, and MPI-5: Global poverty headcount at different poverty thresholds, 2015

4c THE GLOBAL MULTIDIMENSIONAL POVERTY PROFILE

i. Estimates by urban–rural profile

The global multidimensional poverty profile is largely rural. Table 4 presents estimates of the urban–rural and age characteristics of the whole sample, MPI-1a, MPI-4, MPI-5 as well as the MPI-3 and the US\$1.90 per day poverty line (data from Castañeda et al., 2018; World Bank, 2018). The overall sample has similar urban/rural, gender, and age composition to the

population estimates of UNDESA (2015) (see methodological annex). The overall sample is 56.3% rural. However, the proportion of global poverty accounted for by rural areas is much higher, ranging from 75.7% (US\$1.90 per day measure) to 92.3% (MPI-5 measure).

The structure of the population is predominantly rural in SSA and SA, and hence we would expect to identify more rural poverty in those regions. However, the high rural composition of global poverty holds across regions in general, although in LAC, almost 40% of poverty by MPI-1a is urban (see Table 5). MPI-1a identifies a more urbanized poverty globally and in LA than MPI-4 and MPI-5, due to the fact that MPI-1 assigns a larger weight to undernutrition which is more frequently experienced in urban areas.

As Figure 2 showed earlier, the set of 10 indicators tends to identify deprivations that are predominantly located in rural areas, and from Table 4 we see that the use of the US\$1.90 per day poverty line leads to a slightly smaller proportion of rural poverty in estimates. Castañeda et al. (2018, p. 255) explore biases in assessing monetary poverty in rural areas. Moreover, Lucci et al. (2018) also argued that indicators such as access to water do not consider the density of population that makes use of such resources, and that the quality of sanitation and housing is not considered when measuring urban poverty. This implies that the list of indicators within these multidimensional poverty indices may be better suited to estimating rural poverty rather than urban poverty. Here we assess poverty in rural and urban areas using the same indicators to make comparisons between regions.

Table 4 Overview of characteristics by different poverty measures, 2015

	Rural	Urban	Age					Gender		
			0–4	5–17	18–39	40+	Missing	Female	Male	Missing
All population in sample	56.3%	43.7%	10.1%	23.9%	33.5%	32.4%	0.0%	49.2%	50.8%	0.0%
MPI-1a	84.4%	15.6%	14.1%	33.6%	28.4%	23.8%	0.0%	48.7%	51.2%	0.0%
MPI-4	90.9%	9.1%	15.4%	35.3%	27.4%	21.8%	0.0%	48.6%	51.4%	0.0%
MPI-5	92.3%	7.7%	16.3%	35.8%	26.4%	21.4%	0.0%	48.4%	51.6%	0.0%
			0–14	15–24	25–34	35–44	45+			
US\$1.90/day	80.1%	19.9%	44.2%	17%	13.4	10.3	15.1	50%	50%	-
MPI-3	83.5%	16.5%	Poor households that are home to one or more children: 94%					-	-	-

Source: Authors' estimates, Castañeda et al. (2018), and World Bank (2018).

Table 5 Rural–urban disaggregation for sample, MPI-1a, MPI-4, and MPI-5, 2015

	Rural/urban (%)		Age groups (years, % of total)				
	Rural	Urban	0–4	5–17	18–39	40+	Missing
All population in sample							
East Asia & Pacific	48.4%	51.4%	7.8%	15.4%	34.4%	42.3%	0.0%
Europe & Central Asia	48.2%	51.8%	7.8%	19.8%	31.8%	40.6%	0.0%
Latin America & Caribbean	30.5%	69.5%	9.5%	24.1%	33.9%	32.4%	0.0%
Middle East & North Africa	49.6%	50.2%	12.3%	28.0%	35.1%	24.7%	0.0%
South Asia	69.2%	30.8%	9.3%	27.0%	34.3%	29.4%	0.0%
Sub-Saharan Africa	67.1%	32.9%	16.6%	35.1%	29.7%	18.6%	0.0%
MPI-1a							
East Asia & Pacific	75.2%	24.8%	9.0%	24.1%	28.2%	38.7%	0.0%
Europe & Central Asia	76.6%	23.4%	13.3%	29.5%	31.7%	25.5%	0.0%
Latin America & Caribbean	61.7%	38.1%	12.2%	32.2%	26.6%	29.0%	0.0%
Middle East & North Africa	79.1%	20.5%	15.7%	38.2%	28.1%	18.0%	0.0%
South Asia	88.0%	12.0%	11.5%	31.6%	30.8%	26.1%	0.0%
Sub-Saharan Africa	83.7%	16.3%	18.6%	38.3%	25.6%	17.5%	0.0%
MPI-4							
East Asia & Pacific	92.8%	7.2%	12.5%	30.6%	26.5%	30.3%	0.1%
Europe & Central Asia	95.0%	5.0%	15.1%	32.0%	29.1%	23.7%	0.0%
Latin America & Caribbean	86.9%	13.2%	14.4%	33.7%	25.4%	26.5%	0.0%
Middle East & North Africa	96.1%	3.8%	15.6%	38.3%	27.1%	19.0%	0.0%
South Asia	93.9%	6.1%	12.0%	32.6%	29.5%	26.0%	0.0%
Sub-Saharan Africa	88.2%	11.8%	18.7%	38.1%	25.7%	17.5%	0.0%
MPI-5							
East Asia & Pacific	93.2%	6.8%	13.1%	30.6%	26.0%	30.2%	0.1%
Europe & Central Asia	95.0%	5.0%	11.4%	30.4%	26.0%	32.2%	0.0%
Latin America & Caribbean	88.9%	11.0%	14.0%	32.8%	24.9%	28.3%	0.0%
Middle East & North Africa	96.7%	3.3%	15.2%	38.1%	26.5%	20.1%	0.0%
South Asia	95.1%	4.9%	12.6%	32.4%	28.0%	26.9%	0.0%
Sub-Saharan Africa	90.7%	9.3%	18.6%	38.1%	25.6%	17.7%	0.0%

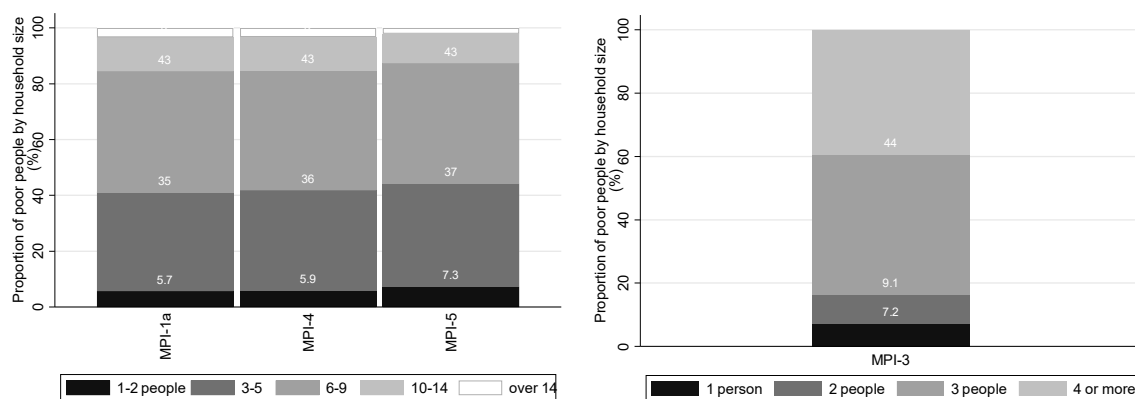
Source: Authors' estimates.

ii. Estimates by age

The global multidimensional poverty profile is largely composed of children and young adults. Table 4 shows that the age structure of the overall sample population is predominantly adult.⁵ Children under 18 years old account for a third of the overall sample population (34%). However, at least half of the poor are children (under 18 years). MPI-1a, MPI-3, and MPI-5 identify larger proportions of the young population than non-young populations among the poor. The MPI-1a identifies a slightly older population across the poor, especially in EAP and LAC. This is due to the fact that nutrition and child mortality deprivations have a higher weight in the measure. The equally weighted MPI-4 and MPI-5 show a similar age structure, indicating that infrastructure and education deprivations identify similar people.

iii. Estimates by household-size characteristics

The global multidimensional poverty profile is largely composed of bigger households. Figure 6 disaggregates the poor population in five household-size groups. We estimate that while only 40% of the population live in households of six or more members, MPI-1a, MPI-4, and MPI-5 identify more than 55% of the poor population as concentrated in those households of six to nine members. This is beyond the share of that household size in the whole population. When we disaggregate by regions, we see that both poor and non-poor households in SSA tend to be larger than in other regions. In EAP, poorer households tend to have three to five members. For SA and LAC, the average household size across the poor population fluctuates between three to five and six to ten members.



Source: Authors' estimates and World Bank (2018, Table 4C.2).

Figure 6 Proportion of people identified as poor according to household size, 2015

iv. Estimates by occupation

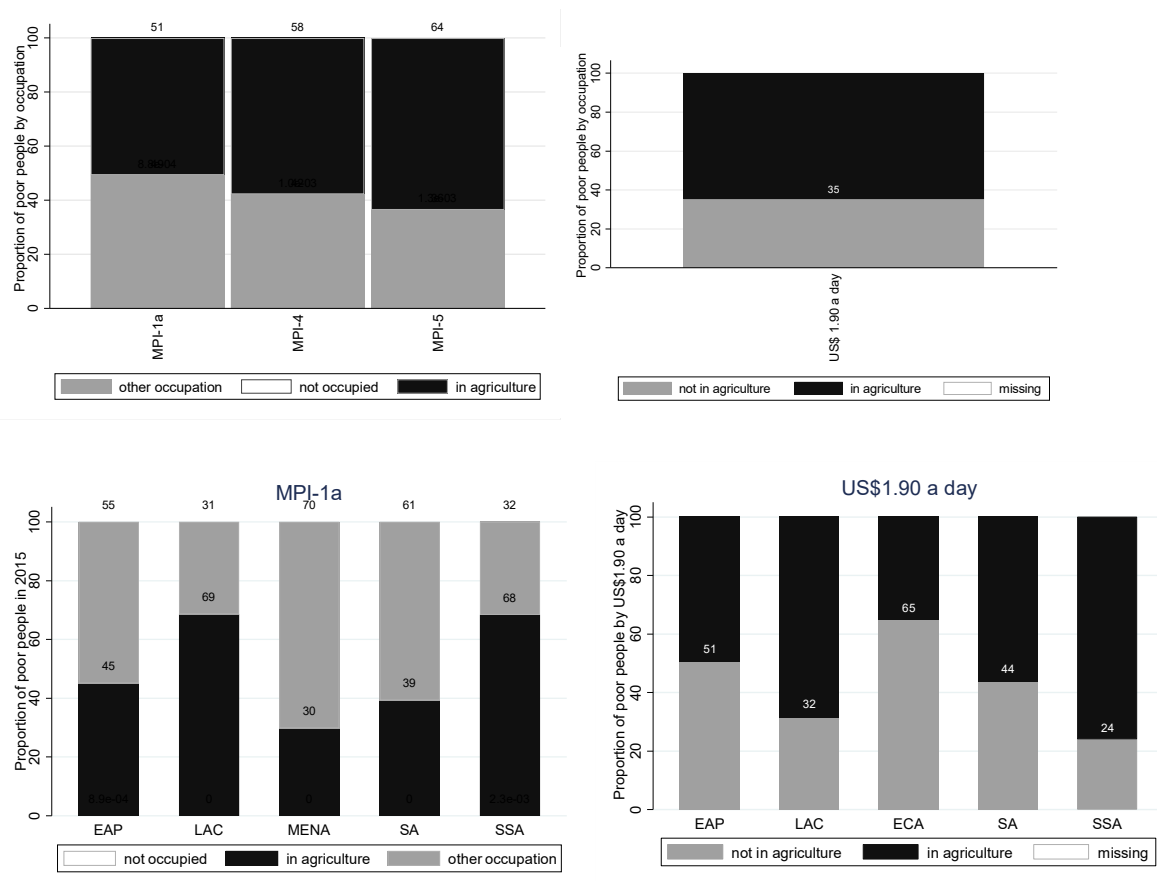
We make some tentative estimates of the occupation structure of the global multidimensional poverty profile. We find that agricultural employment, with caveats for data limitations, is less important than might be expected for those living in multidimensional poverty. It is possible to make estimates that account for 42% of the population of developing countries (35 countries or 2.5 billion people in 2015), using DHS questionnaires which ask interviewees whether they are employed or not and their type of occupation: this is for eligible women interviewed (aged 15 to 49 years) and for their husbands.⁶ Where the DHS implements a questionnaire for males, this information is also available for eligible men (aged 15 to 59) in the household.⁷

We make estimates of the proportion of households which have a 'usual resident' who is eligible to answer questions on being employed in agriculture. If no usual resident is eligible, then we consider this to mean that the household does not engage in agricultural activities as we have no information to infer the contrary; information is only considered missing if all eligible residents have missing information on occupation, which represents approximately

1% of the sample. Across the overall sample, approximately one in every three households has an eligible member engaged in agriculture, but this average can be as low as 14% across MENA or as high as 52% in SSA.

We find that for MPI-1a, half of poor households will have an eligible resident occupied in agriculture (see Figure 7). The proportion of poor households with a resident occupied in agriculture is higher in MPI-4 and MPI-5. The figure is lower among those identified by the MPI-1a as MPI-1a assigns more weight to nutrition and child mortality deprivations. The data are consistent with a hypothesis that agricultural activities may protect households against nutrition poverty, which would prevent people from being identified as poor by MPI-1a. That said, MPI-1a poor households still have someone engaged in agriculture more frequently than non-poor households.

In SSA and LAC, approximately three of every four (74%) of MPI-4 and MPI-5 poor households have an eligible ‘usual resident’ occupied in agriculture. In contrast, less than one in every two MPI-4 or MPI-5 poor households are employed in agriculture in SA and EAP. It is not surprising that agriculture is a common occupation across a population which is predominantly rural. What is surprising is that agricultural occupations occur frequently, even in high urbanized regions such as LA or EAP. Castañeda et al. (2018) reach similar conclusions, despite the fact that they analyze survey data for 64 countries for which the population shows a smaller share of agricultural occupation. The conclusion in terms of agricultural occupation of the poor is similar for the EAP, LAC, and SSA regions despite larger shares of agricultural occupation across the poor and the population in SA.



Note: MPI-1, MPI-4, and MPI-5 estimates include MENA countries while US\$1.90 estimates do not. US\$1.90 a day estimates include ECA countries while MPI-1, MPI-4, and MPI-5 estimates do not. US\$1.90 estimates do not provide information on people not occupied. It is not possible to analyze lack of occupation in the data for India. *Source:* Authors' estimates and Castañeda et al. (2018).

Figure 7 Proportion of people identified as poor by MPI-1, MPI-4, MPI-5, and US\$1.90 per day by occupation and region

5 CONCLUSIONS

We sought to answer the following question: Who are the world's multidimensionally poor?

We find that the world's multidimensionally poor are largely children and young people, residing in rural areas though not necessarily working in agriculture. We draw three conclusions. First, on the extent and nature of multidimensionality, we find that the extent of the multidimensionality of poverty differs substantially by region and that some deprivations frequently overlap while others do not. For example, deprivations in electricity, housing, years of education, and school attendance overlap frequently between themselves and with

other deprivations in basic infrastructure. It is deprivations in health indicators which overlap least frequently with other indicators.

Second, at an aggregate level, the overall characteristics of global multidimensional poverty are somewhat similar to global monetary poverty at US\$1.90 per day, even though twice the level (when utilising MPI-1a), in that poor households tend to be larger-than-average rural households formed predominantly by young people who are not necessarily engaged in agriculture.

Third, at a disaggregated level, rural multidimensional poverty tends to be characterized by overlapping deprivations in education and in access to infrastructure (water, sanitation, electricity, and housing). In contrast, and counterintuitively, given proximity to better health care and economic opportunities, at least in principle, child mortality and malnutrition are more frequently observed within urban poverty.

Each of these conclusions has policy implications. First, if the infrastructure deprivations overlap more frequently, it implies that a policy focusing on packages of infrastructure rather than dealing with infrastructure sectorally will be more effective in multidimensional poverty reduction, with the caveat that people with access to the infrastructure may still be poor in other dimensions (e.g. nutrition). In other words, deprivations in infrastructure are a reflection of underlying poverty and providing, for example, access to sanitation would be a ‘cosmetic’ change if the person remained poor in other dimensions. Further, if the health dimensions of poverty overlap least frequently with other dimensions, this points toward the need for a direct prioritization of health poverty in policy rather than indirectly via other policies.

Second, although global multidimensional poverty has some similarities to the global profile of US\$1.90 per day poverty (specifically, the rural nature and household size), multidimensional poverty is substantially higher than US\$1.90 per day poverty using MPI-1a which generates a headcount estimate of twice the level of US\$1.90 per day demonstrating that global poverty using MPI-1a is more pervasive than monetary poverty estimates at US\$1.90 per day. Indeed, undernutrition alone affects 1.5bn people, in contrast to the estimated 0.7bn people living under the US\$1.90 per day threshold in 2015 based on the World Bank estimates. Over 2 billion people also lack access to water and sanitation. These estimates for global multidimensional poverty using MPI-1a are higher than global poverty estimates monetary US\$1.90 poverty which implies either that the US\$1.90 line is not sufficient to ‘buy’ basic capabilities, or that development strategies focused largely on economic growth rather than economic growth with substantial social policies and social spending will be insufficient to end multidimensional poverty.

Third, the finding that rural poverty is more about a lack of infrastructure and urban poverty is more about child mortality and a lack of nutrition points toward the need for quite differentiated poverty reduction strategies in rural and urban areas.

Finally, if many of the world’s urban multidimensional poor experience malnutrition and child mortality despite better economic opportunities in principle in urban areas, there is a need to further analyze when economic growth does or does not reduce multidimensional poverty.

METHODOLOGICAL ANNEX

A1. Poverty measurement

Alkire et al. (2015) identify eight steps in the process of designing a multidimensional measure. The five steps are: to define the purpose, space, unit, indicators, and dimensions of the measure. We have based our analysis on existing MPI measures, namely MPI-1a and the World Bank's MPI-3, their indicators and dimensions, and hence we do not describe the five steps for each. Instead, we describe the calibration we carried out (the three last steps) of key parameters: deprivation cutoffs, weights, and poverty cutoff. We replicated 10 indicators included in the MPI-1a, including their deprivation cutoffs.

The nested weighting structure of the MPI-1a and MPI-3 design overlooks the fact that some dimensions are conformed by only one indicator. This is why we explore a weighting structure that assigns equal weight to each indicator. We acknowledge that this weighting structure implies that living standards indicators, which are more numerous, would have a relatively larger importance if added together. We describe the empirical implications of such a weighting structure by defining the MPI-4 measure.

An additional characteristic is the poverty cutoff, defined as k or the second cutoff in the Alkire and Foster method, which indicates the share of weighted deprivations that identify whether a household is defined as poor or not. The MPI-1a and MPI-3 have a poverty cutoff of 0.333 or $1/3$ of the weighted deprivations, which can be the result of one heavily weighted deprivation. This paper describes the implications of selecting poverty cutoffs of $5/10$ (0.5) and $5/8$ (0.625) weighted indicators in MPI-4 and MPI-5 respectively.

Once these parameters are defined, the Alkire and Foster method is applied by assigning the weighting structure to the deprivations observed for each household. Then a deprivation score adds all the weighted deprivations observed in each household. Finally, people are identified

as poor if they live in a household that has a deprivation score equal to or larger than the poverty cutoff established. We report the headcount or proportion of households identified as poor across the population. The MPI is the product of the headcount and the average intensity of poverty, or average deprivation score, among the people identified as poor.

A2. Datasets

In order to construct the analysis, we use the indicators that form part of the Alkire–Foster measure of multidimensional poverty (see Alkire & Foster, 2011a; Alkire & Santos, 2014). These assess household living standards and an individual’s health and education wellbeing as described in Table 1 (in the text). As with monetary poverty at US\$1.90 per day, if conditions of deprivation are experienced by one household member, the status of deprivation is assigned to all members of the household. The assessment of some indicators is confined to specific demographic groups: school attendance is assessed only on school-aged household members, and nutrition and child mortality are assessed on eligible household members, commonly children and women of reproductive age.

The data sources are 106 surveys. Of these 106 surveys, 56 are DHS, 40 are Multiple Indicator Cluster Surveys (MICS), three are Pan-Arab Project on Family Health Surveys (PAPFAM), and seven are national surveys. The seven national surveys that are used are as follows: the Argentinean National Survey on Health and Nutrition, the Chinese Family Panel Survey, the Ecuadorian Quality of Life Survey, the Indian Human Development Survey, the Jamaican Survey of Living Conditions, the South African National Income Dynamics Study (NIDS), and the Brazilian National Household Survey.

The majority (89%) of the datasets were collected between 2010 and 2016. The remainder are from 2005–2010. Data sources older than 2005 are excluded to maintain comparability across estimates. The coverage of the 106 country surveys represents 78% of the population of the world in 2015 (UNDESA, 2015) and 92% of the developing world. The coverage per geographic region is as shown in Table A1.

Table A1 Population coverage by region, 2015

	% of population coverage
East Asia & Pacific	88.4
Europe & Central Asia	17.8
Latin America & Caribbean	87.3
Middle East & North Africa	65.5
North America	0
South Asia	98.8
Sub-Saharan Africa	96.5
Total: World	77.5
Total: Developing countries	91.7

Source: Authors' estimates.

Table A2 presents the missing values for each indicator. Of the 106 country datasets, 89 have information on 10 comparable indicators, 14 of the datasets have information on nine indicators, and three of the datasets have comparable information on eight indicators. Bosnia and Herzegovina, Macedonia, Barbados, Saint Lucia, and Suriname have no information on child mortality; Ukraine, Trinidad and Tobago, Indonesia, Afghanistan, Vietnam, and the Dominican Republic have no information on nutrition; China has no information on flooring; Egypt lacks an indicator for cooking fuel; and there is no indicator of electricity for Honduras. Three additional country survey datasets have information on eight indicators: Jamaica lacks information on child mortality and flooring; Brazil lacks information on nutrition and flooring; and the Philippines lacks information on school attendance and nutrition. Rural and urban residency is not available for Argentina and Libya, and the occupation of eligible household members is only available in 35 country datasets.

Table A2 Availability of indicators across survey data

	No. datasets with information available	No. datasets with missing values	Mean percentage missing (unweighted)	Mean percentage missing (population weighted)
10 indicators across the full survey dataset				
Nutrition	98	95	2.3%	1.4%
Child mortality	100	88	1.9%	1.5%
Improved flooring	103	94	0.9%	1.0%
Cooking fuel	105	89	0.7%	0.7%
Electricity	105	88	0.7%	0.6%
School attendance	105	68	0.8%	0.6%
Assets	106	76	0.7%	0.5%
Years of schooling	106	94	1.5%	1.2%
Sanitation	106	93	0.7%	0.7%
Water	106	74	0.8%	0.6%
Characteristics across the sample population with no missing indicator				
Rural residency	104	4	0.1%	0.1%
Age	106	22	0.0%	0.0%
Gender	106	12	0.0%	0.0%
Occupation	35	28	1.1%	1.1%

Source: Authors' estimates.

A3. Robustness checks

Table A3 presents the population-weighted mean Cramer V coefficient of association between the deprivations experienced by each household. We see that the association between MPI-1a and MPI-4 is the closest to one, indicating the strongest association. Hence, having a similar list of indicators increases the chances of identifying the same people as poor, regardless of the changing weights. The association between the MPI-1a and the MPI-5 indicates that not including the health indicators does have implications on who is identified as poor. The association between the equally weighted 10 indicators (MPI-4) and eight indicators (MPI-5) is the weakest. This shows that although all indicators (education and living standards) have equal weights, the lack of health indicators and the heavier weight on living standards has a notable impact. These conclusions apply to the regions of SSA, SA, and EAP, three world regions with the largest numbers of people experiencing concurrent deprivations, and also to MENA. In the case of the two regions with fewer people

experiencing multiple deprivations, namely ECA and LAC, the association between the MPI-1a and the MPI-4 is still the strongest, but weaker if compared to other regions. The association between the two equally weighted indices is still the weakest one but including or excluding the health indicator does not change the correlation coefficient much. The health indicator is then identifying the same people as the rest of the indicators in ECA and LAC because MPI-4 and MPI-5 have larger associations. In SSA, SA, EAP, and MENA, a measure that includes health indicators identifies the same households more frequently than measures that exclude health indicators.

Table A3 Cramer V coefficients of associations for household deprivations, 106 countries

	World		SSA		SA		EAP		MENA		LAC		ECA	
	MPI-4	MPI-5	MPI-4	MPI-5	MPI-4	MPI-5	MPI-4	MPI-5	MPI-4	MPI-5	MPI-4	MPI-5	MPI-4	MPI-5
MPI-1a	0.94	0.78	0.93	0.75	0.93	0.73	0.97	0.84	0.94	0.77	0.89	0.78	0.88	0.77
MPI-4	.	0.69		0.68		0.66		0.69		0.71		0.80		0.82

Source: Authors' estimates.

The change of weight in the health indicators neither strengthens nor weakens the association in poor people identified by one index or the other, but a change in the list of indicators does have influence. We can think of a change in the list of indicators as a very large change in weight, from an N value to zero, and presumably this would be the largest change in weights of indicators. Therefore, it has a larger impact on both an absolute measure and the way in which it ranks countries. The changing weights of indicators do not tend to determine whether a household is identified as poor, as long as the list of indicators remains the same. Table A4 shows the overlapping deprivations across the 10 indicators of the MPI-1a.

Table A4 Simultaneous deprivations across 10 indicators of the MPI-1a measure for 106 countries as a proportion of population

	Population deprived in X simultaneous indicators									
	1	2	3	4	5	6	7	8	9	10
Population across 106 countries (thousands)	1,155,880	858,289	595,139	446,377	374,399	316,676	216,467	129,724	53,383	12,842
Years of schooling (proportion)	0.04	0.06	0.10	0.13	0.19	0.32	0.51	0.68	0.82	1
School attendance (proportion)	0.03	0.05	0.09	0.12	0.16	0.25	0.40	0.67	0.87	1
Child mortality (proportion)	0.07	0.11	0.18	0.25	0.30	0.38	0.47	0.59	0.78	1
Nutrition (proportion)	0.19	0.29	0.43	0.46	0.49	0.51	0.57	0.66	0.82	1
Electricity (proportion)	0.00	0.02	0.10	0.28	0.54	0.75	0.89	0.95	0.99	1
Sanitation (proportion)	0.17	0.35	0.57	0.76	0.86	0.90	0.94	0.96	0.98	1
Water (proportion)	0.14	0.32	0.31	0.27	0.33	0.44	0.58	0.72	0.87	1
Floor (proportion)	0.02	0.08	0.24	0.52	0.74	0.85	0.91	0.96	0.98	1
Cooking fuel (proportion)	0.33	0.68	0.88	0.96	0.98	0.99	1.00	1.00	1.00	1
Assets (proportion)	0.02	0.04	0.11	0.26	0.42	0.61	0.74	0.82	0.90	1

Source: Authors' estimates.

ENDNOTES

¹ According to the World Bank (2018, figures 4.1 and 4C.1), in SSA and SA less than 5% of those in multidimensional poverty would solely be deprived on income below the poverty line, but in regions such as ECA, EAP, LAC, and MENA sole monetary deprivation identifies between 10% and 27% of the households that are multidimensionally poor. Although the design of MPI-1a and other MPIs at first glance appears to avoid this issue of one sole deprivation as sufficient to define a household as living in poverty, in practice, in 14 of 106 country surveys the same feature is evident, namely one sole indicator per dimension, when there was no other information available in the dimensions of health and/or education (see for full details methodological annex).

² For Argentina, Belarus, and Georgia, the time lag is nine years between multidimensional surveys and income surveys. These three countries have been excluded from this comparison, so the time lapse between surveys varies from one to six years.

³ The analysis in this section includes Argentina and Libya entirely as urban population, as survey data for these two countries cannot be disaggregated into urban and rural areas.

⁴ The age and gender structure estimates from the survey data show a maximum difference of 2% of country age and gender groups, as published by UNDESA (2015). Although we validate age and gender groups in each country against the population projections published by UNDESA (2015), we do not adjust survey sampling weights to match population projections. Instead, we use survey estimates to characterize deprivation rates and household profiles of country population, and we simply re-scale these to reflect the UNDESA (2015) total country population figures in 2015. Further research should analyze the sensitivity of alternative approaches such as matching population projections or accounting for changes between survey years and the reference year in the analysis. However, some sensitivity analysis shows only minor differences to full alignment to reference year population estimates (Castañeda et al.,

2018). The survey data used contain missing information for the 10 indicators selected and the characteristics profiled in this analysis. These missing data are sometimes attributable to the fact that survey questionnaires do not cover specific demographic groups. This is a weakness. A compromise has been reached in including indicators for specific demographic groups, partly with the aim of enhancing the geographical coverage of this analysis. If the missing data that occur are attributable to non-response, households are excluded from the analysis and this is reported in the methodological annex.

⁵ The age structure of most geographic regions shows a difference of 1–2% relative to that which is published by UNDESA (2015), except for Europe and Central Asia. Twenty-two country datasets are missing the age of people interviewed, which represents 1,000–6,000 people in each country. However, the missing age of interviewees in South Africa and Indonesia represents 11,000 people. See methodological annex for more detail.

⁶ The country datasets analyzed are Afghanistan, Benin, Burkina Faso, Cambodia, Chad, Comoros, DR Congo, Egypt, Ethiopia, Gambia, Ghana, Guatemala, Guinea, Haiti, India, Jordan, Kenya, Liberia, Lesotho, Liberia, Malawi, Mali, Mozambique, Myanmar, Namibia, Nigeria, Pakistan, the Philippines, Rwanda, Senegal, Sierra Leone, Togo, Tanzania, Yemen, Zambia, and Zimbabwe.

⁷ The male questionnaire is not present in the surveys of Yemen, Egypt, Jordan, and the Philippines. In the case of India, the questionnaire asks eligible men and women (aged respectively 15–49 and 15–59 years) about the time devoted to income-generating activities in the past year, and it is assumed that interviewees have agriculture as their occupation if they devoted one hour or more to agriculture as an income-generating activity.

REFERENCES

- Alkire, S., & Foster, J. E. (2011a). Counting and Multidimensional Poverty Measurement. *Journal of Public Economics*, 95(7–8), 476–487.
<https://doi.org/10.1016/j.jpubeco.2010.11.006>
- Alkire, S., & Foster, J. E. (2011b). Understandings and Misunderstandings of Multidimensional Poverty Measurement. *Journal of Economic Inequality*, 9(2), 289–314.
<https://doi.org/10.1007/s10888-011-9181-4>
- Alkire, S., Foster, J. E., Seth, S., Santos, M. E., Roche, J. M. & Ballon, P. (2015). *Multidimensional poverty measurement and analysis*, Oxford: Oxford University Press.
- Alkire, S., & Santos, M. E. (2014). Measuring acute poverty in the developing world: Robustness and scope of the Multidimensional Poverty Index. *World Development*, 59: 251–274.
- Battiston, D., Cruces, G., Lopez-Calva, L. F., Lugo, M. A., & Santos, M. E. (2013). Income and Beyond: Multidimensional Poverty in Six Latin American Countries. *Social Indicators Research*, 112(2), 291–314. <https://doi.org/10.1007/s11205-013-0249-3>
- Bourguignon, F., & Chakravarty, S. R. (2003). The Measurement of Multidimensional Poverty. *Journal of Economic Inequality*, 1(1), 25–49. doi:10.1023/A:1023913831342
- Castañeda, A., Doan, D., Newhouse, D., Nguyen, M. C., Uematsu, H., Azevedo, J. P., & World Bank Data for Goals Group (2018). A New Profile of the Global Poor. *World*

Development, 101, 250–267. <https://doi.org/10.1016/j.worlddev.2017.08.002>

Chakravarty, S., & D'Ambrosio, C. (2006). The Measurement of Social Exclusion. *Review of Income and Wealth*, 52(3), 377–398. <https://doi.org/10.1111/j.1475-4991.2006.00195.x>

Lucci, P., Bhatkal, T., & Khan, A. (2018). Are We Underestimating Urban Poverty? *World Development*, 103, 297–310. <https://doi.org/10.1016/j.worlddev.2017.10.022>

OPHI (Oxford Poverty and Human Development Initiative) (2018). Global Multidimensional Poverty Index 2018. Retrieved from <https://ophi.org.uk/multidimensional-povertyindex/global-mpi-2018/#t1>

Ravallion, M. (2011). On Multidimensional Indices of Poverty. *The Journal of Economic Inequality*, 9(2), 235–248. <https://doi.org/10.1007/s10888-011-9173-4>

Sen, A. K. (1999). *Development as freedom*. Oxford: Oxford University Press.

Tsui, K. (2002). Multidimensional Poverty Indices. *Social Choice and Welfare*, 19(1), 69–93. doi:10.1007/s355-002-8326-3

UNDESA (2015). *World population prospects: The 2015 revision*. DVD Edition. New York, NY: United Nations, Department of Economic and Social Affairs, Population Division.

UNDP (2010). *Human development report 2010. The real wealth of nations: Pathways to human development*. New York, NY: United Nations Development Programme.

UNDP (2015). *Human development report 2015. Work for human development*. New York, NY: United Nations Development Programme.

UNDP (2016). *Human development report 2016. Human Development for Everyone*. New York, NY: United Nations Development Programme.

World Bank Group (2018). *Poverty and shared prosperity 2018: Piecing together the poverty puzzle*. Washington, DC: World Bank.