OPHI

OXFORD POVERTY & HUMAN DEVELOPMENT INITIATIVE

www.ophi.org.uk

UNIVERSITY OF OXFORD

Summer School on Multidimensional Poverty

8–19 July 2013

Institute for International Economic Policy (IIEP)
George Washington University
Washington, DC

Composition of Multidimensional Poverty

José Manuel Roche

&

Suman Seth

OPHI Oxford Poverty & Human Development Initiative

UNIVERSITY OF OXFORD

Focus of This Brief Lecture

Discuss how poverty can be decomposed to understand the prevalence of deprivation among the poor

Questions

Q1: What is the difference between the raw headcount ratio and the censored headcount ratio?

Q2: Can raw headcount ratio of a dimension be lower than its censored headcount ratio?

Q3: Can censored headcount ratio of a dimension be higher than the multidimensional headcount ratio?

Q4: What is the relation between the censored headcount ratios and M0?

Q5: What kind of policy analysis can be conducted using the censored headcount ratio?

Example

An achievement matrix with 4 dimensions

	Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
x =	700	14	1	1	**Person 1**
	300	13	1	0	**Person 2**
	400	10	0	0	**Person 3**
	800	11	1	1	**Person 4**
z =	**500**	**12**	**1**	**1**	

z is the vector of poverty lines

Example

Replace entries: 1 if deprived, 0 if not deprived

	Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
$g^0 =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	1	0	0	Person 4
$z =$	500	12	Yes	Yes	

These entries fall below cutoffs

Example

What is the *Raw Headcount Ratio* of each of the four dimensions

$g^0 =$

Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
0	0	0	0	**Person 1**
1	0	0	**1**	**Person 2**
1	**1**	**1**	**1**	**Person 3**
0	**1**	0	0	**Person 4**

Income: 2/4 Education: 2/4 Sanitation: 1/4 Electricity: 2/4

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5)

	Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
$g^0 =$	0	0	0	0	**Person 1**
	1	0	0	1	**Person 2**
	1	1	1	1	**Person 3**
	0	1	0	0	**Person 4**

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5)

– Replace the deprivation status by the weights

$$g^0 = \begin{array}{|cccc|l} \multicolumn{4}{c}{\textbf{Income}\quad \textbf{Years of Education}\quad \textbf{Sanitation (Improved?)}\quad \textbf{Access to Electricity}} & \\ \hline 0 & 0 & 0 & 0 & \textbf{Person 1} \\ \hline 1 & 0 & 0 & 1 & \textbf{Person 2} \\ \hline 1 & 1 & 1 & 1 & \textbf{Person 3} \\ \hline 0 & 1 & 0 & 0 & \textbf{Person 4} \\ \hline \end{array}$$

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5)

– Replace the deprivation status by the weights

$$g^0 = \begin{array}{|cccc|l} \multicolumn{4}{c}{\textbf{Income}\quad \textbf{Years of Education}\quad \textbf{Sanitation (Improved?)}\quad \textbf{Access to Electricity}} & \\ \hline 0 & 0 & 0 & 0 & \textbf{Person 1} \\ \hline 1 & 0 & 0 & 0.5 & \textbf{Person 2} \\ \hline 1 & 2 & 0.5 & 0.5 & \textbf{Person 3} \\ \hline 0 & 2 & 0 & 0 & \textbf{Person 4} \\ \hline \end{array}$$

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5). Each weight is w_d

– Replace the deprivation status by the weights

$$g^0 = \begin{array}{|cccc|l} \multicolumn{4}{c}{\textbf{Income}\quad \textbf{Years of Education}\quad \textbf{Sanitation (Improved?)}\quad \textbf{Access to Electricity}} & \\ \hline 0 & 0 & 0 & 0 & \textbf{Person 1} \\ \hline \mathbf{1} & 0 & 0 & \mathbf{0.5} & \textbf{Person 2} \\ \hline \mathbf{1} & \mathbf{2} & \mathbf{0.5} & \mathbf{0.5} & \textbf{Person 3} \\ \hline 0 & \mathbf{2} & 0 & 0 & \textbf{Person 4} \\ \hline \end{array}$$

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5)

– Construct the deprivation score vector

$$g^0 = \begin{array}{|cccc|l} \multicolumn{4}{c}{\text{Income}\quad \text{Years of Education}\quad \text{Sanitation (Improved?)}\quad \text{Access to Electricity}} & \\ \hline 0 & 0 & 0 & 0 & \text{Person 1} \\ 1 & 0 & 0 & 0.5 & \text{Person 2} \\ 1 & 2 & 0.5 & 0.5 & \text{Person 3} \\ 0 & 2 & 0 & 0 & \text{Person 4} \\ \hline \end{array}$$

Example

Suppose, the weight vector is (1, 2, 0.5, 0.5).

– Construct the deprivation score vector

$$g^0 = \left|\begin{array}{cccc|c} \text{Income} & \text{Years of Education} & \text{Sanitation (Improved?)} & \text{Access to Electricity} & \mathbf{c} \\ 0 & 0 & 0 & 0 & \mathbf{0} \\ 1 & 0 & 0 & 0.5 & \mathbf{1.5} \\ 1 & 2 & 0.5 & 0.5 & \mathbf{4} \\ 0 & 2 & 0 & 0 & \mathbf{2} \end{array}\right|$$

Example

If the poverty cutoff is $k = 2$, who is poor?

– Construct the deprivation score vector

$g^0 =$

Income	Years of Education	Sanitation (Improved?)	Access to Electricity	c
0	0	0	0	**0**
1	0	0	**0.5**	**1.5**
1	**2**	**0.5**	**0.5**	**4**
0	**2**	0	0	**2**

Example

Let us now censor the deprivation matrix and vector

$$g^0 = \left|\begin{array}{cccc|c} \textbf{Income} & \textbf{Years of Education} & \textbf{Sanitation (Improved?)} & \textbf{Access to Electricity} & \textbf{c} \\ 0 & 0 & 0 & 0 & \mathbf{0} \\ \mathbf{1} & 0 & 0 & \mathbf{0.5} & \mathbf{1.5} \\ \mathbf{1} & \mathbf{2} & \mathbf{0.5} & \mathbf{0.5} & \mathbf{4} \\ 0 & \mathbf{2} & 0 & 0 & \mathbf{2} \end{array}\right|$$

Example

Let us now censor the deprivation matrix and vector

$\mathbf{g}^0(k) =$

Income	Years of Education	Sanitation (Improved?)	Access to Electricity	c
0	0	0	0	**0**
0	0	0	**0**	**0**
1	**2**	**0.5**	**0.5**	**4**
0	**2**	0	0	**2**

The M_0 is 6/16

Dimensional Composition

There are four dimensions – denoted $D = 4$

$$\mathbf{g}^0(k) = \begin{array}{|cccc|l} \multicolumn{4}{c}{\begin{array}{cccc}\text{Income} & \text{Years of Education} & \text{Sanitation (Improved?)} & \text{Access to Electricity}\end{array}} & \\ \hline 0 & 0 & 0 & 0 & \textbf{Person 1} \\ 0 & 0 & 0 & 0 & \textbf{Person 2} \\ 1 & 2 & 0.5 & 0.5 & \textbf{Person 3} \\ 0 & 2 & 0 & 0 & \textbf{Person 4} \\ \hline \end{array}$$

Dimensional Composition

What is the *censored* headcount Ratio of each dimension?

$\mathbf{g^0}(k) =$

Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
0	0	0	0	**Person 1**
0	0	0	0	**Person 2**
1	**2**	**0.5**	**0.5**	**Person 3**
0	**2**	0	0	**Person 4**

Dimensional Composition

What is the *censored* headcount Ratio of each dimension?

$\mathbf{g^0}(k) =$

Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
0	0	0	0	**Person 1**
0	0	0	0	**Person 2**
1	**2**	**0.5**	**0.5**	**Person 3**
0	**2**	0	0	**Person 4**

Income: 1/4

Education: 2/4

Sanitation: 1/4

Electricity: 1/4

Raw vs. Censored Headcount Ratio

The raw headcount (RH) ratio of a dimension denotes the proportion of population deprived in a dimension

The censored headcount (CH) ratio of a dimension denotes the proportion of the population multidimensionally poor and deprived in that dimension at the same time

M_0 and Censored Headcount Ratio

If the censored headcount ratio of indicator d is denoted by $\underline{H}_d$, then the M_0 measure can be expressed as

$$M_0(x) = \sum_d (w_d/D) \times \underline{H}_d$$

where w_d is the weight attached to dimension d

Contribution of dimension d to overall poverty is

$$(w_d/D) \times [\underline{H}_d/M_0(x)]$$

for all d

M_0 and RH Ratio in Union Approach

What is the relation between the M_0 and the raw headcount ratio when a union approach is used for identifying the poor?

For union approach, the censored headcount ratio for a dimension is its raw headcount ratio

Thus, the M_0 for the union approach is weighted average of the raw headcount ratios

Dimensional Contribution

What is the contribution of the education dimension to M_0?

$$g^0(k) = \begin{array}{|cccc|l} \multicolumn{4}{c}{\text{Income}\quad \text{Years of Education}\quad \text{Sanitation (Improved?)}\quad \text{Access to Electricity}} & \\ 0 & 0 & 0 & 0 & \textbf{Person 1} \\ 0 & 0 & 0 & 0 & \textbf{Person 2} \\ 1 & 2 & 0.5 & 0.5 & \textbf{Person 3} \\ 0 & 2 & 0 & 0 & \textbf{Person 4} \end{array}$$

Dimensional Contribution

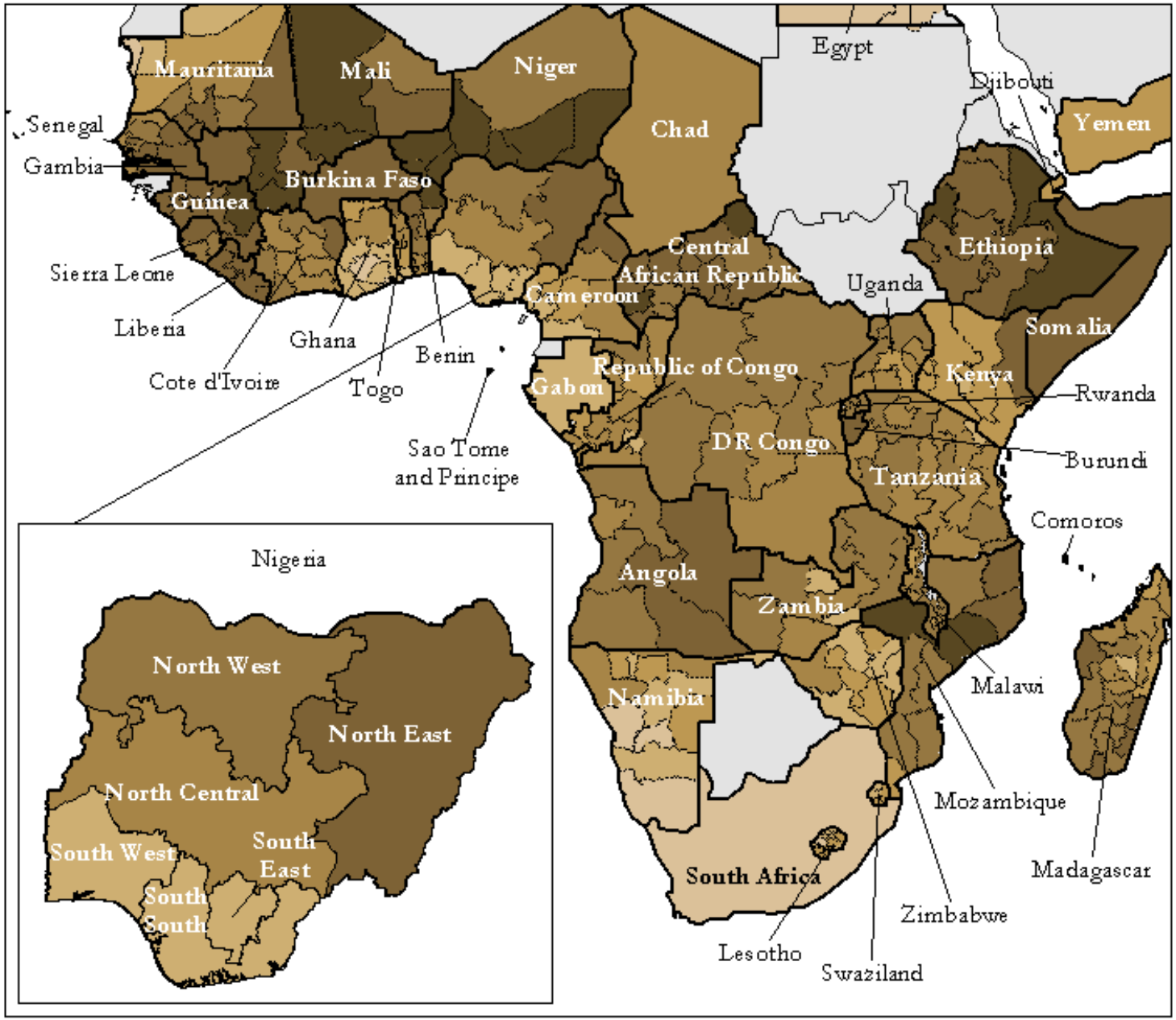
What is the contribution of the education dimension to M_0?

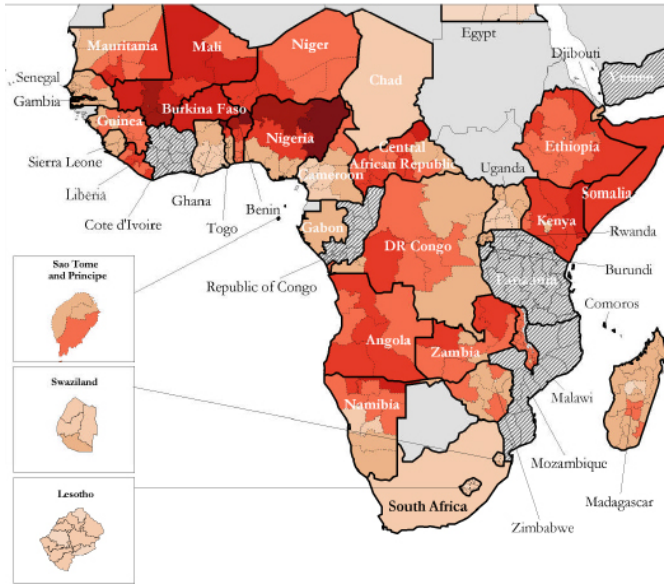
$$g^0(k) = \begin{array}{|cccc|l} \text{Income} & \text{Years of Education} & \text{Sanitation (Improved?)} & \text{Access to Electricity} & \\ 0 & 0 & 0 & 0 & \textbf{Person 1} \\ 0 & 0 & 0 & 0 & \textbf{Person 2} \\ \mathbf{1} & \mathbf{2} & \mathbf{0.5} & \mathbf{0.5} & \textbf{Person 3} \\ 0 & \mathbf{2} & 0 & 0 & \textbf{Person 4} \end{array}$$

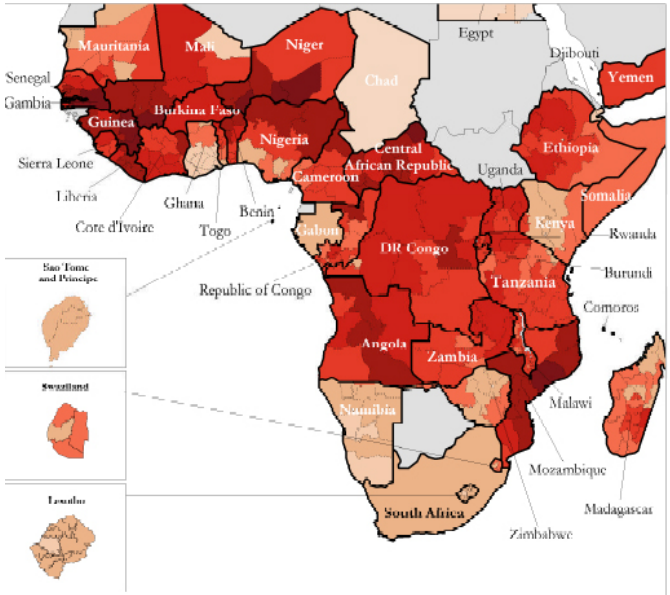
The contribution is $(2/4) \times [(2/4)/(6/16)] = 2/3$

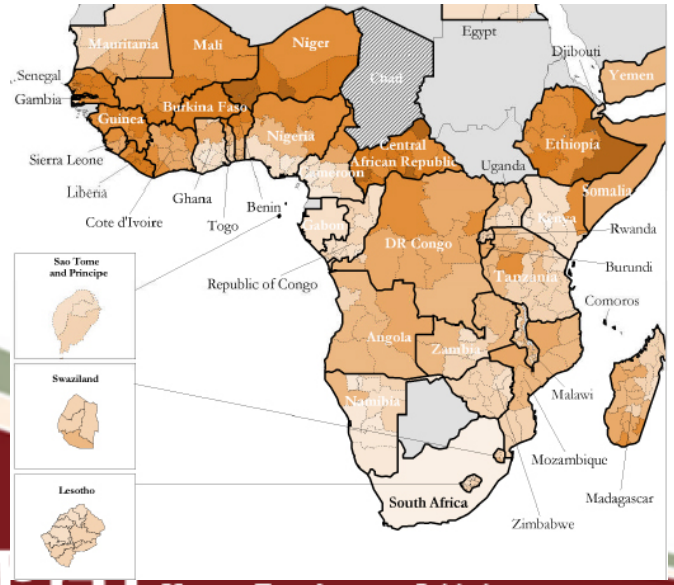
w_E CH_E M_0

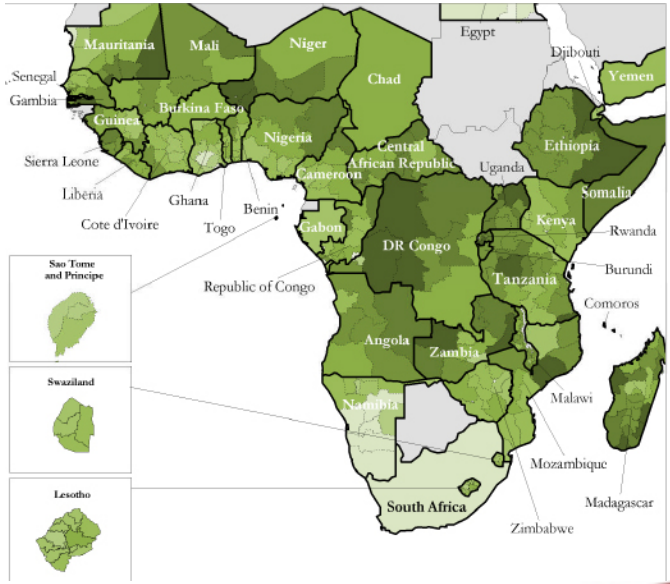
Applications and Case Studies

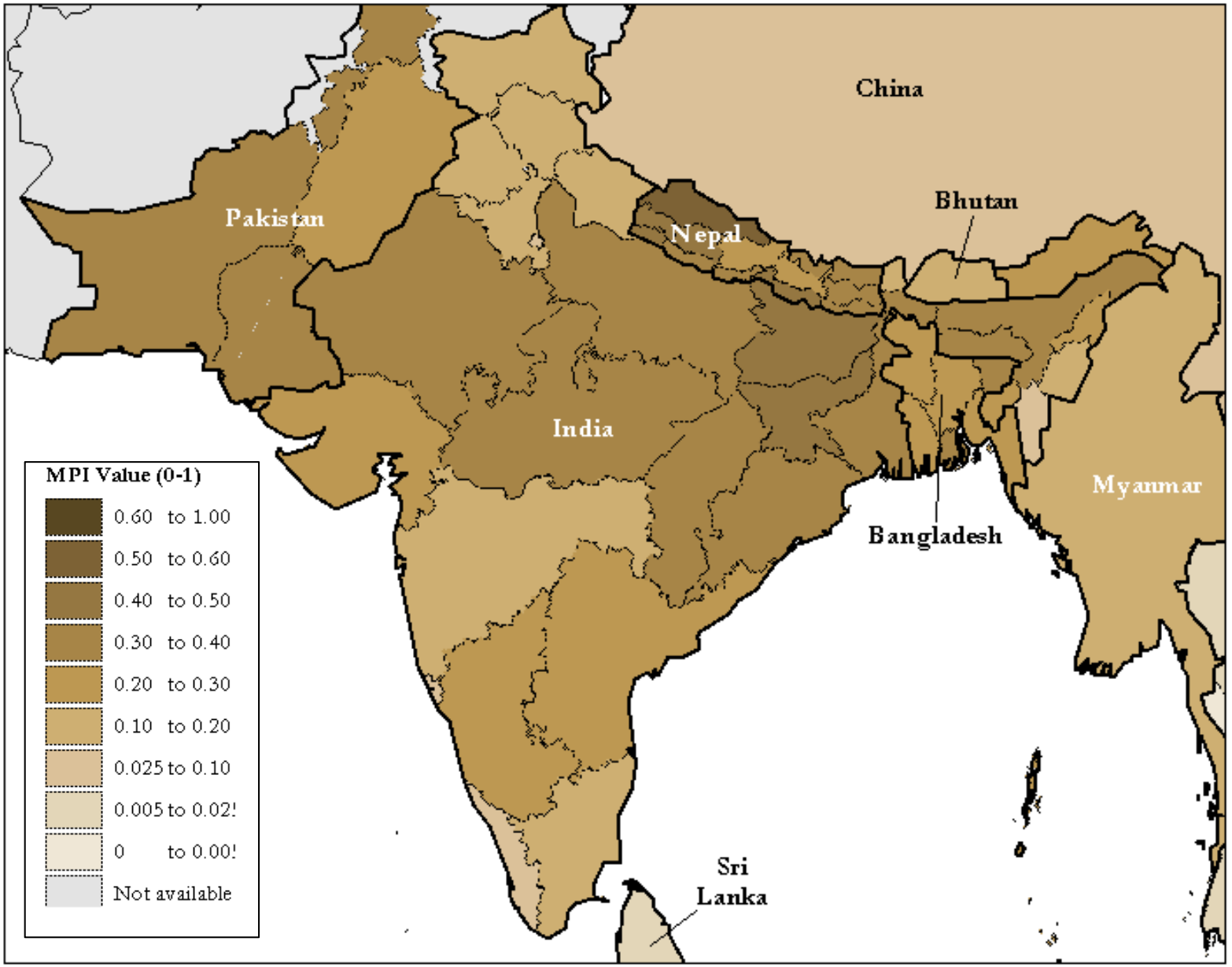

Mauritania
Mali
Niger
Egypt
Djibouti
Yemen
Senegal
Gambia
Chad
Burkina Faso
Guinea
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Somalia
Liberia
Ghana
Benin
Republic of Congo
Kenya
Cote d'Ivoire
Togo
Gabon
Rwanda
Sao Tome and Principe
DR Congo
Burundi
Tanzania
Comoros
Nigeria
Angola
Zambia
North West
Malawi
Namibia
North East
North Central
Mozambique
South West
South East
South South
Madagascar
South Africa
Zimbabwe
Lesotho
Swaziland


Mauritania
Mali
Niger
Egypt
Djibouti
Senegal
Gambia
Chad
Yemen
Burkina Faso
Guinea
Nigeria
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Liberia
Ghana
Benin
Somalia
Cote d'Ivoire
Togo
Gabon
Kenya
Rwanda
DR Congo
Sao Tome and Principe
Burundi
Republic of Congo
Tanzania
Comoros
Angola
Zambia
Swaziland
Namibia
Malawi
Mozambique
Lesotho
South Africa
Madagascar
Zimbabwe

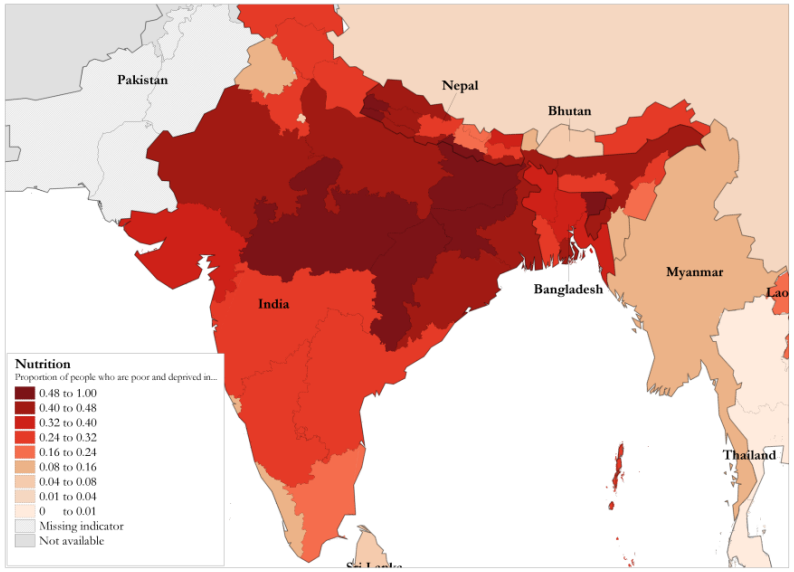

Mauritania
Mali
Niger
Egypt
Djibouti
Senegal
Gambia
Chad
Yemen
Guinea
Burkina Faso
Nigeria
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Liberia
Ghana
Benin
Somalia
Cote d'Ivoire
Togo
Gabon
Kenya
Rwanda
DR Congo
Sao Tome and Principe
Burundi
Republic of Congo
Tanzania
Comoros
Angola
Zambia
Swaziland
Namibia
Malawi
Mozambique
Lesotho
South Africa
Madagascar
Zimbabwe

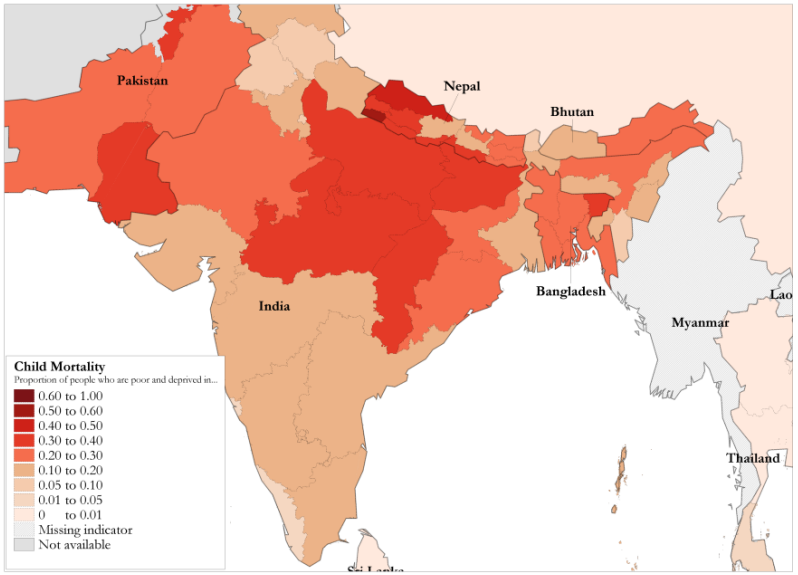

Mauritania
Mali
Niger
Egypt
Djibouti
Senegal
Gambia
Chad
Yemen
Burkina Faso
Guinea
Nigeria
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Liberia
Ghana
Benin
Somalia
Cote d'Ivoire
Togo
Gabon
Kenya
Rwanda
DR Congo
Sao Tome and Principe
Burundi
Republic of Congo
Tanzania
Comoros
Angola
Zambia
Swaziland
Namibia
Malawi
Mozambique
Lesotho
South Africa
Madagascar
Zimbabwe


Mauritania
Mali
Niger
Egypt
Djibouti
Senegal
Gambia
Chad
Yemen
Burkina Faso
Guinea
Nigeria
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Liberia
Ghana
Benin
Somalia
Cote d'Ivoire
Togo
Gabon
Kenya
Rwanda
DR Congo
Sao Tome and Principe
Burundi
Republic of Congo
Tanzania
Comoros
Angola
Zambia
Swaziland
Namibia
Malawi
Mozambique
Lesotho
South Africa
Madagascar
Zimbabwe

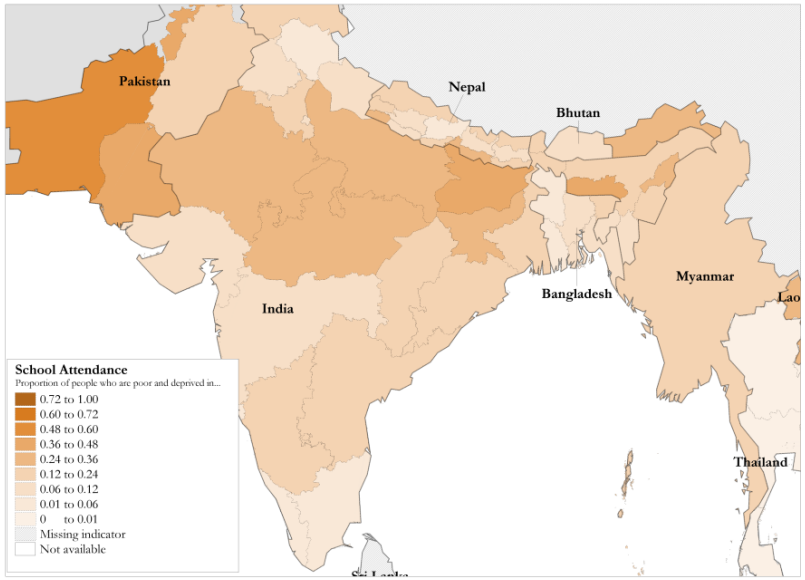

China
Pakistan
Nepal
Bhutan
India
Myanmar
Bangladesh
Sri Lanka
MPI Value (0-1)
0.60 to 1.00
0.50 to 0.60
0.40 to 0.50
0.30 to 0.40
0.20 to 0.30
0.10 to 0.20
0.025 to 0.10
0.005 to 0.02!
0 to 0.00!
Not available

Child Mortality (CH)

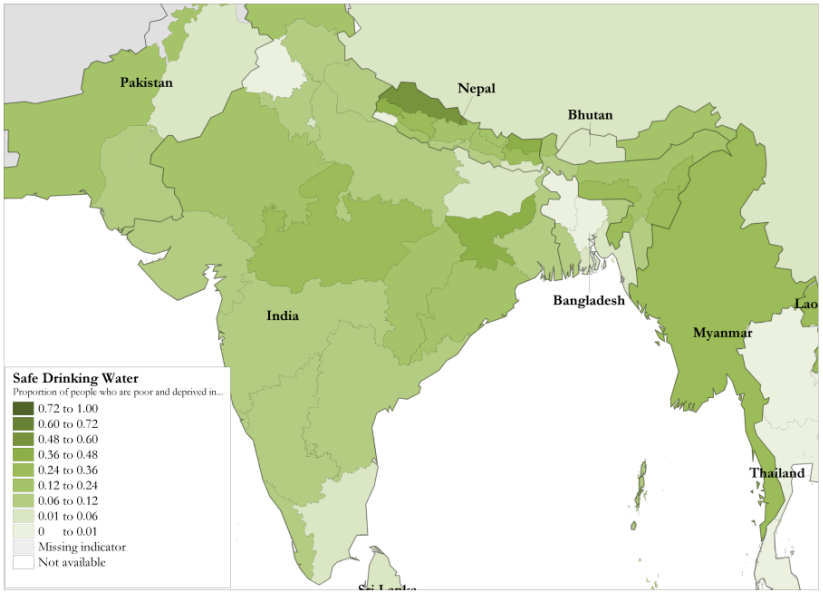




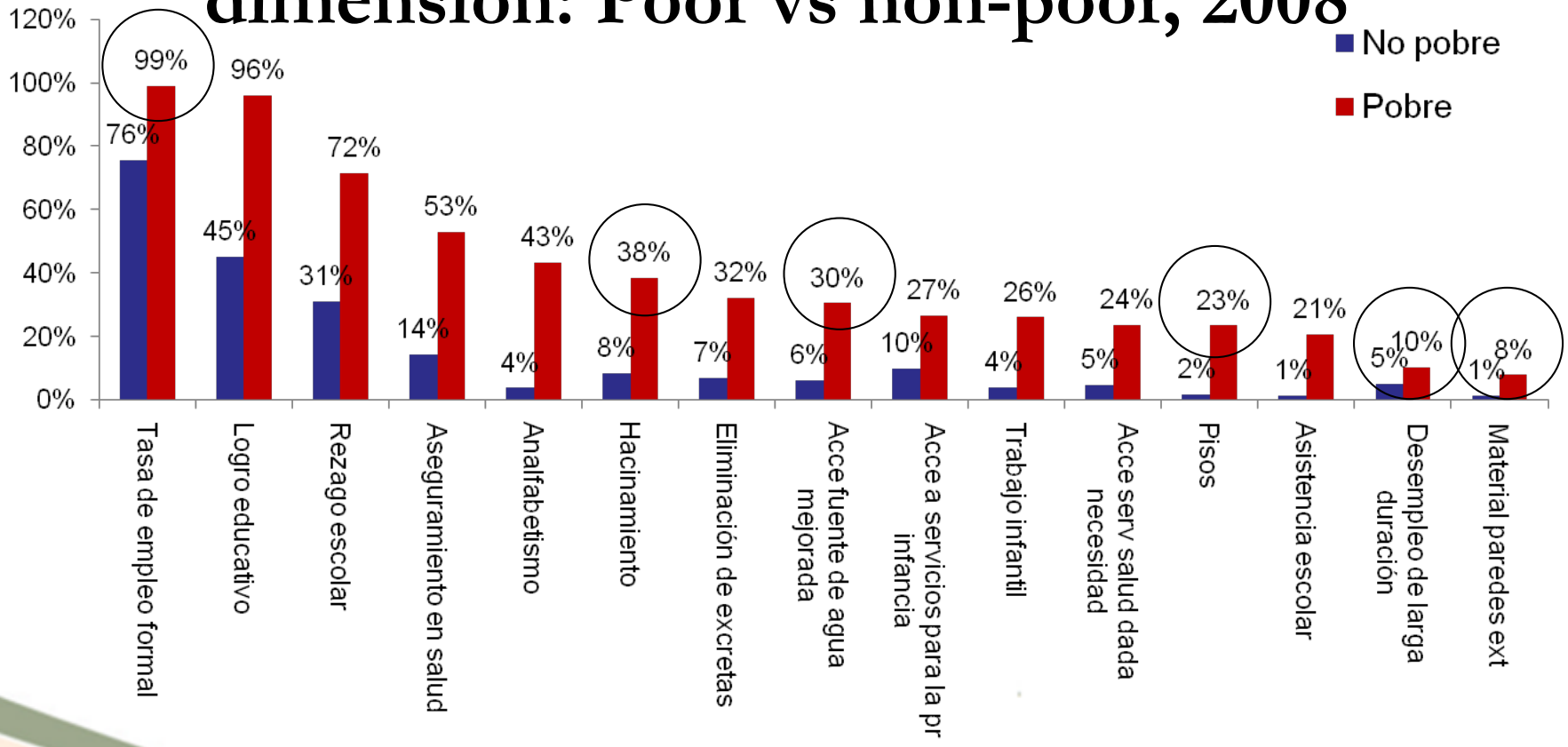
School Attendance (CH)



Safe Drinking Water (CH)

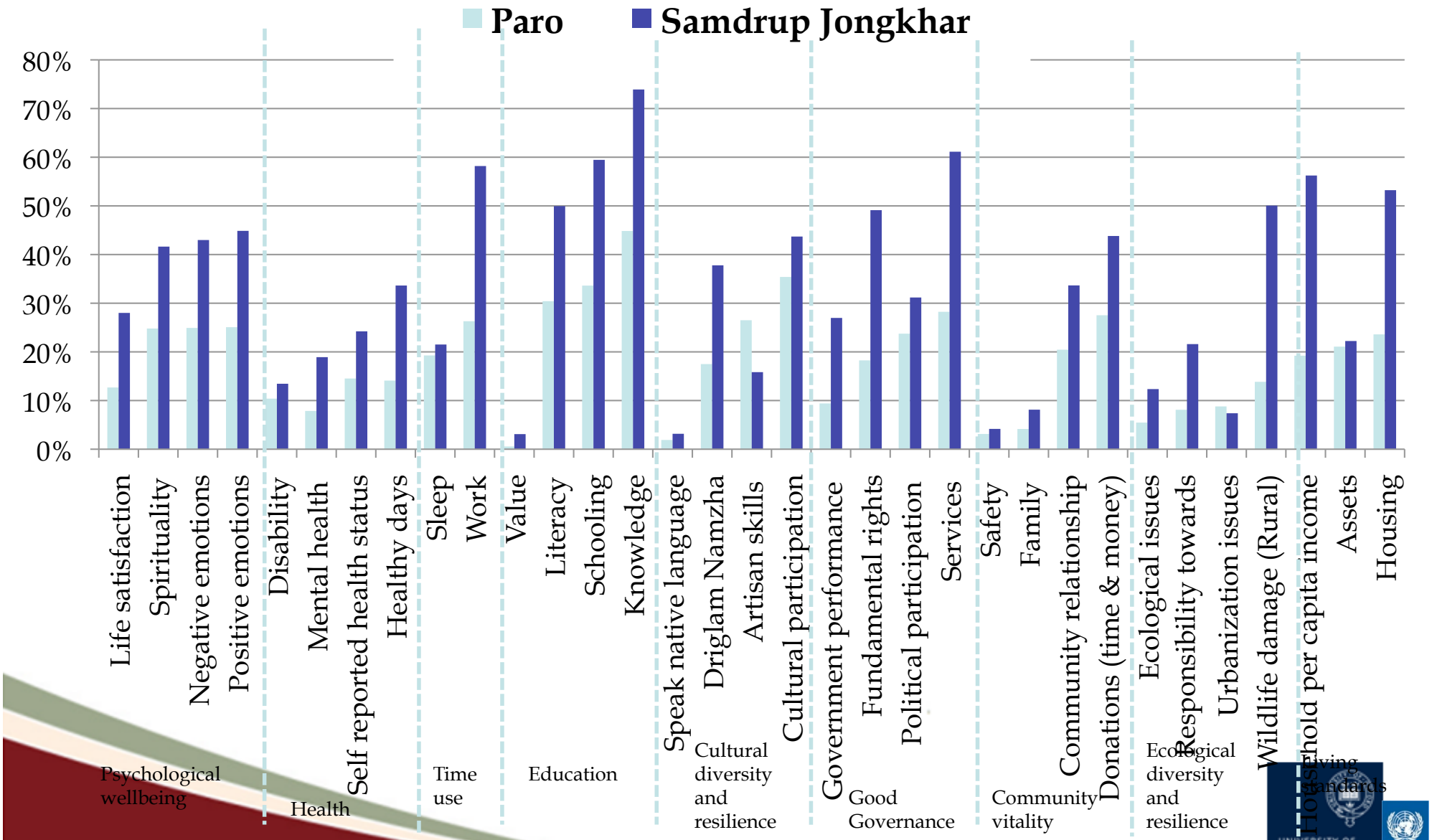


Percentage of hh with deprivations in each dimension: Poor vs non-poor, 2008



Fuente: DNP, DDS, SPSCV. 2010

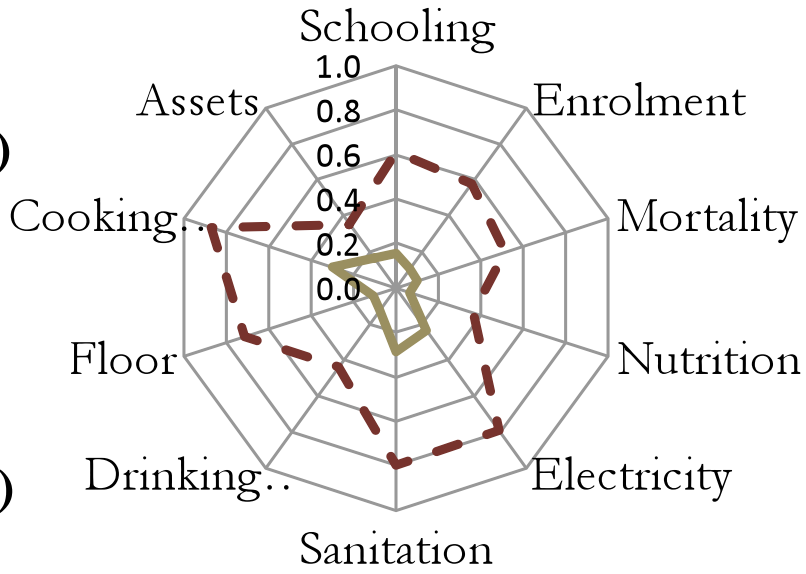
Percentage of Bhutanese who are not-yet-happy and lack sufficiency in indicators



Composition of Poverty

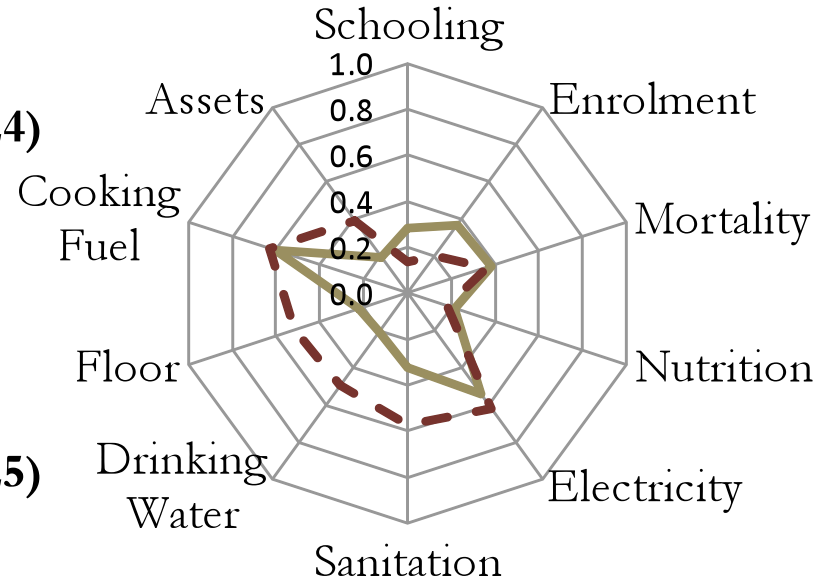
Ghana (MPI=0.140)

Mali (MPI=0.564)



Gambia (MPI=0.324)

Zambia (MPI=0.325)



Poverty types (Roche 2010 for MPI Analysis)

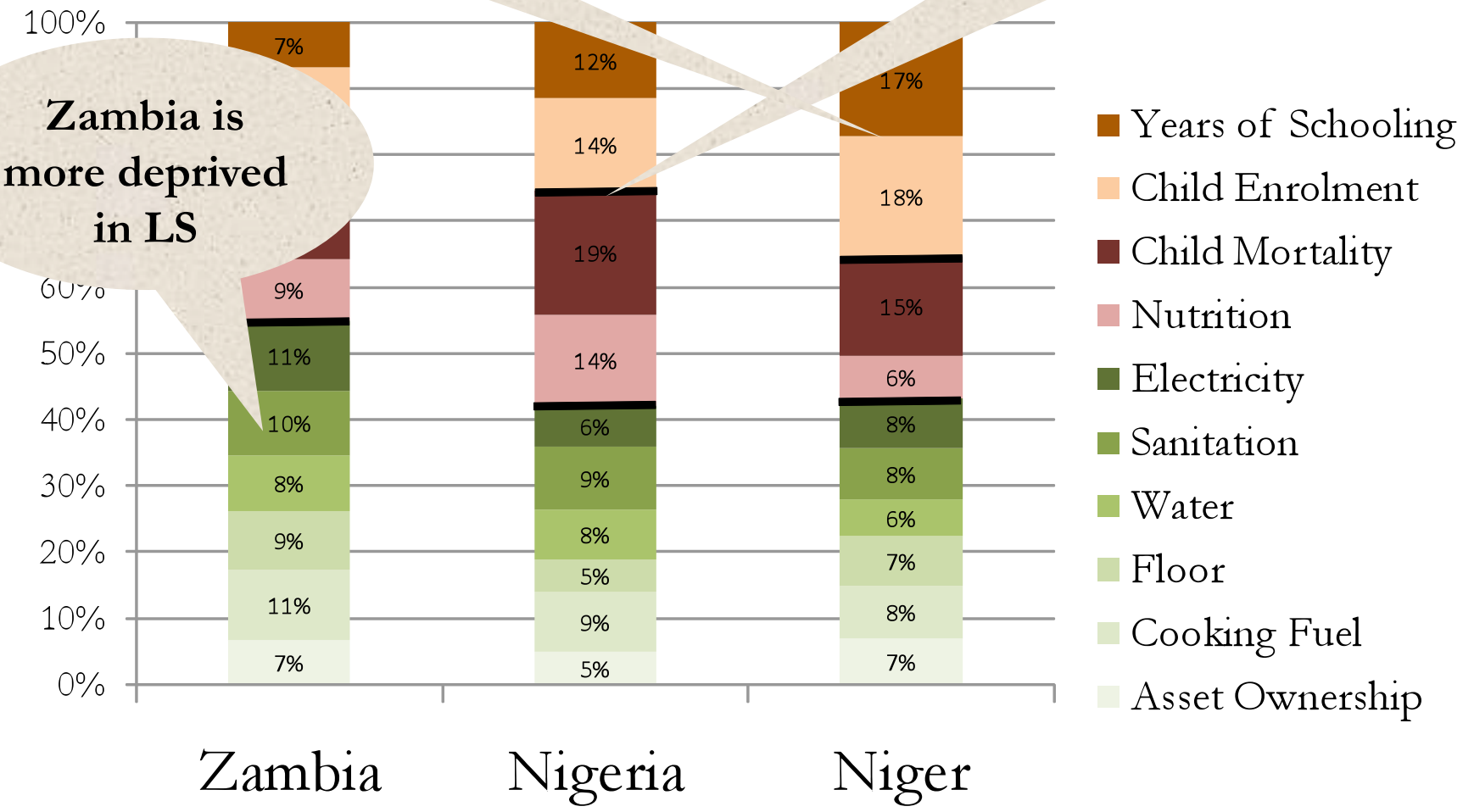
OPHI Oxford Poverty & Human Development Initiative

position by Ind

Niger is most deprived in Education

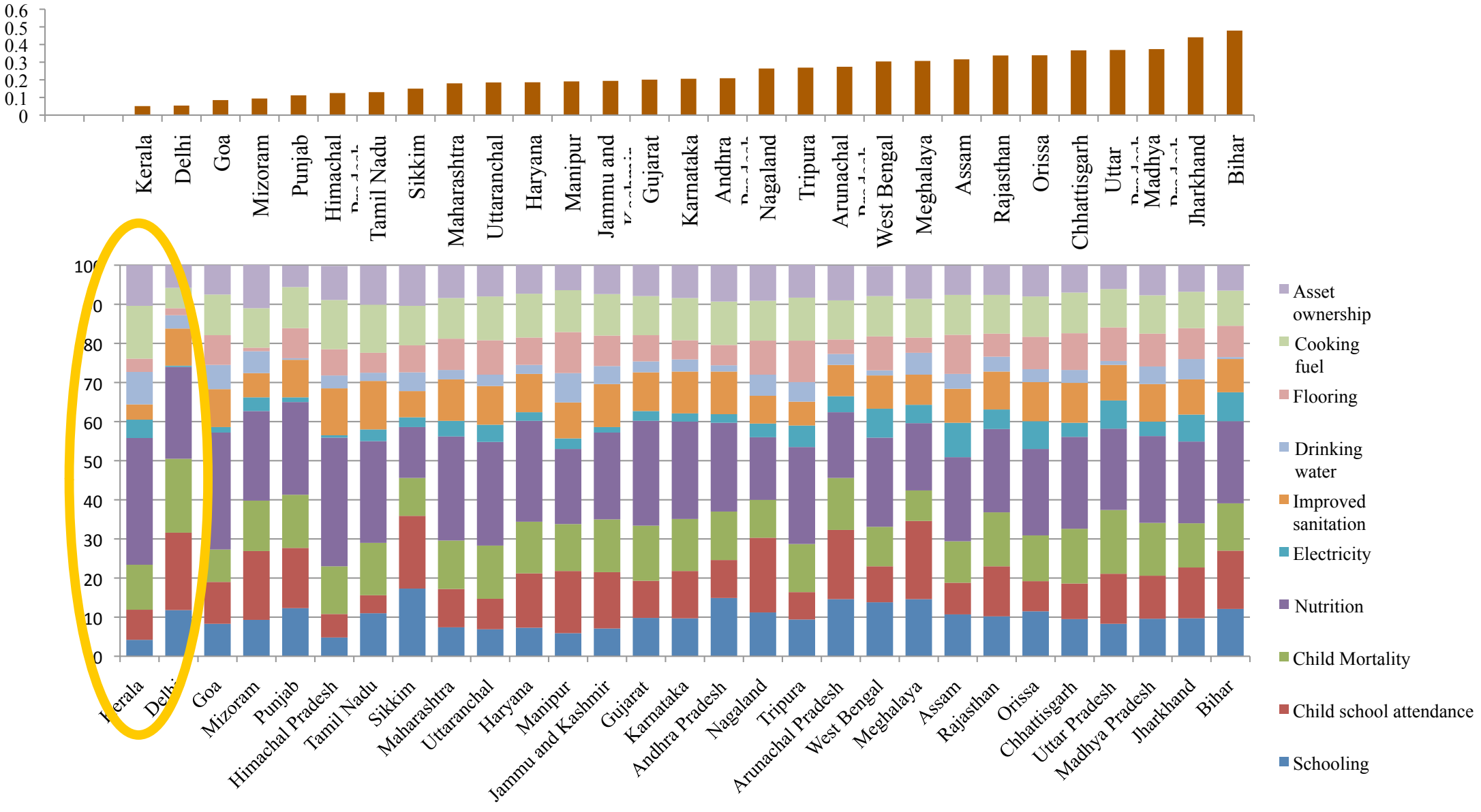
Nigeria is more deprived in Health and Education

Zambia is more deprived in LS



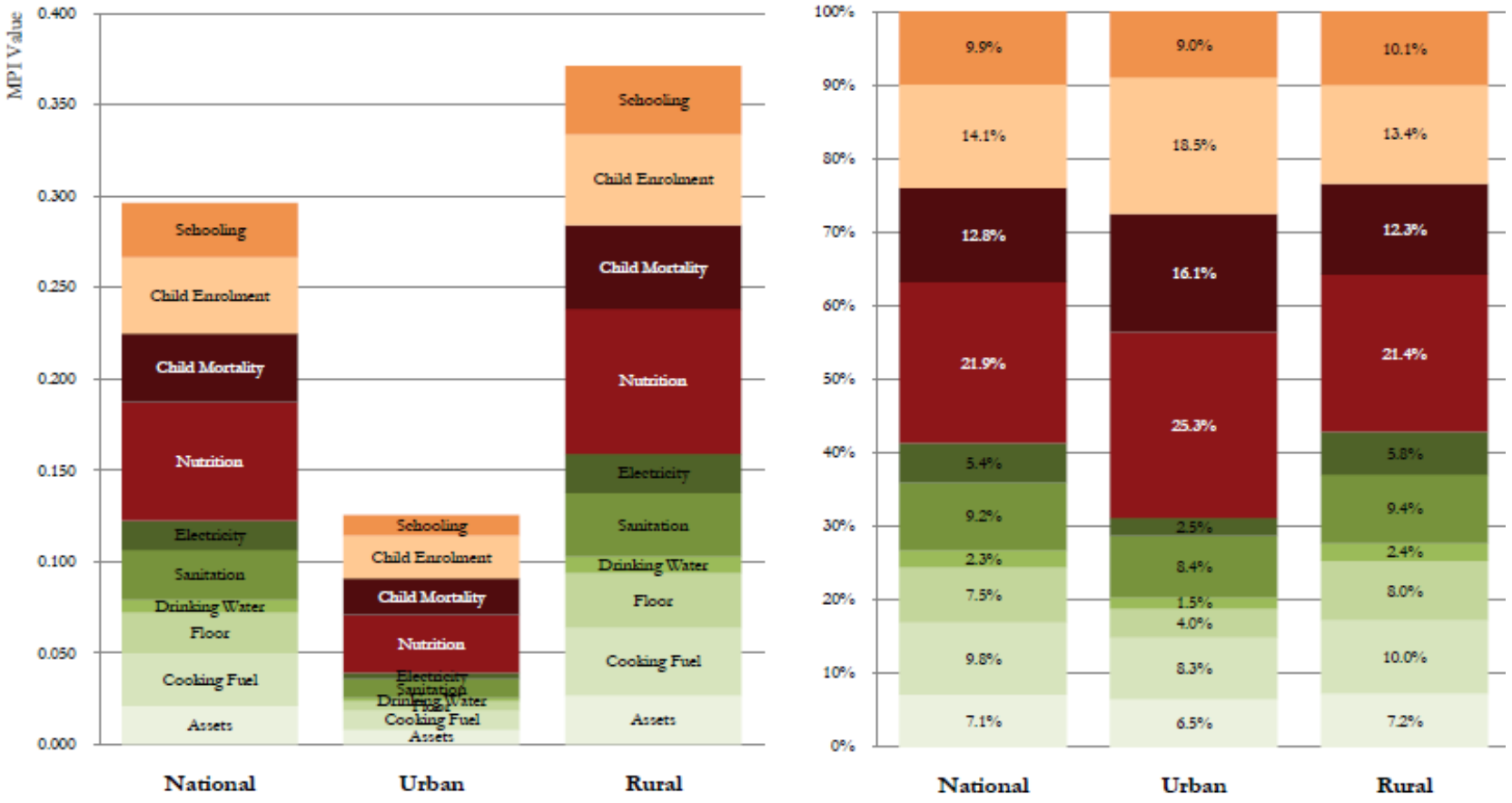
MPI 2011(Alkire & Santos 2010)

The composition of MPI can inform policy. It can change across countries and states.

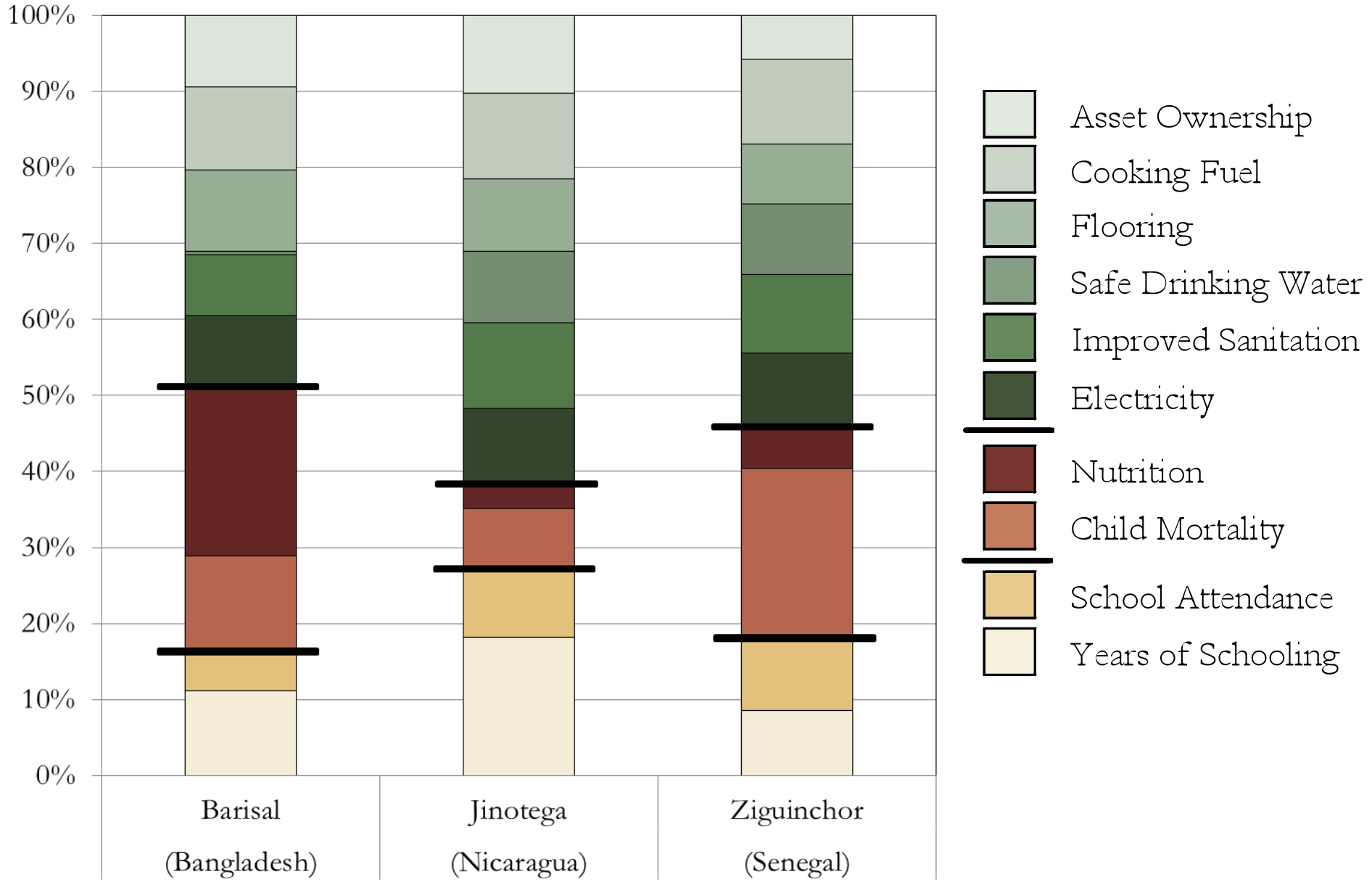


Dimensions breakdown - MPI for India

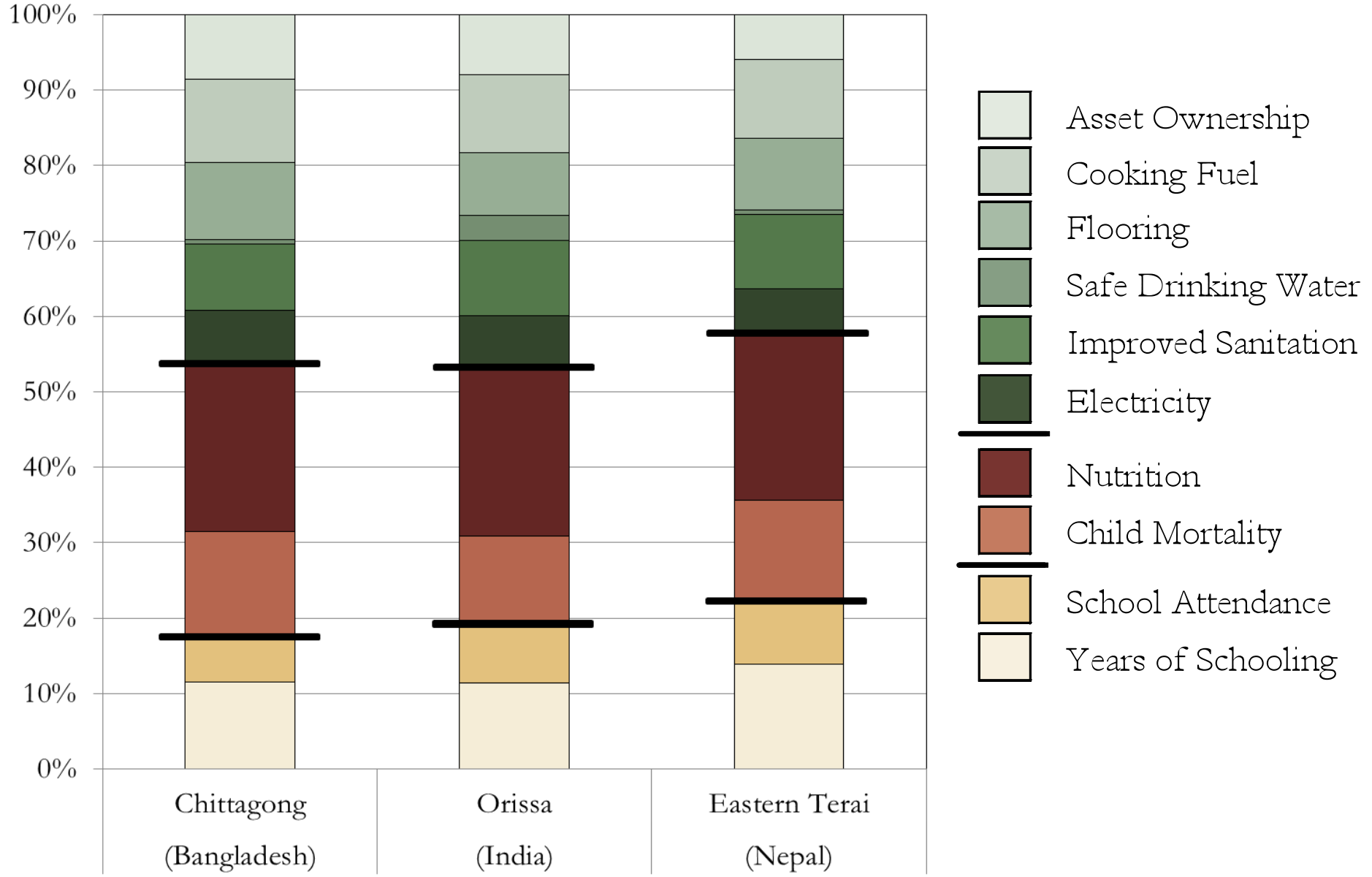
E. Contribution of Indicators to the MPI at the national level, for urban areas, and for rural areas



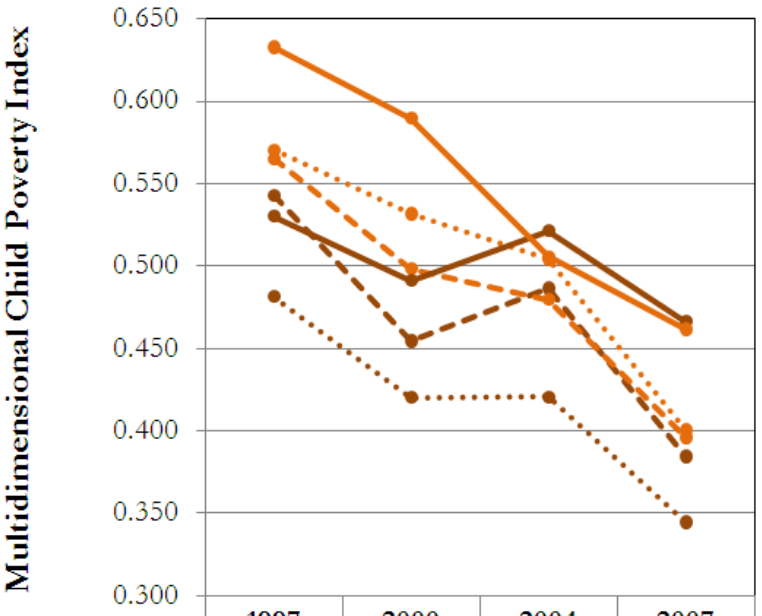
Similar MPI, but Different Composition



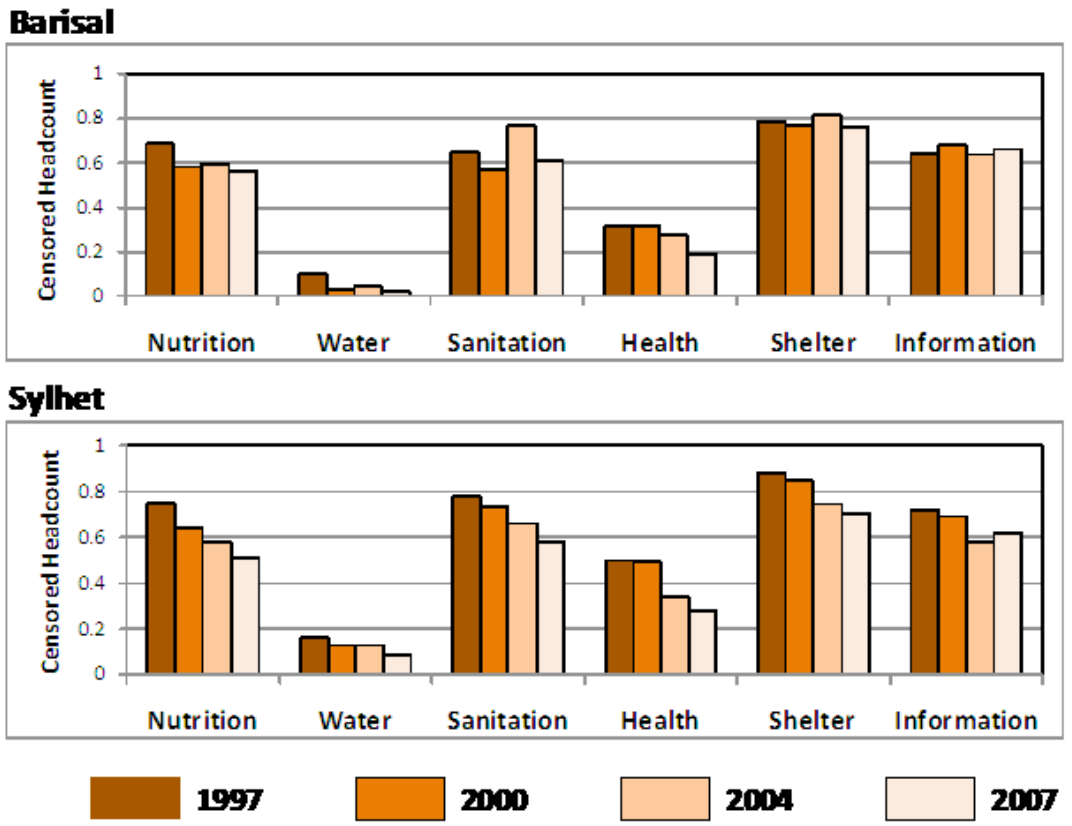
Different MPI, Similar Dimensional Composition



Child Poverty (Alkire & Roche 2010)



	1997	2000	2004	2007
Chittagon	0.543	0.455	0.486	0.384
Dhaka	0.565	0.498	0.480	0.396
Khulna	0.481	0.420	0.421	0.345
Rajshahi	0.571	0.532	0.504	0.401
Barisal	0.530	0.491	0.521	0.467
Sylhet	0.633	0.590	0.506	0.462



While under-five child poverty had been decreasing in the preceding decade, there was a resurgence of poverty in the low-lying coastal regions including Barisal and Chittagong between 2000-2004. Strikingly, the region of Barisal was not able to recover as fast as other regions.