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UNIVERSITY OF OXFORD

Summer School on Multidimensional Poverty

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Population Subgroup Decomposition and Policy Implications

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&

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OPHI Oxford Poverty & Human Development Initiative

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Focus of This Lecture

Discuss how the overall poverty can be decomposed across different population subgroups and create maps for visual policy analysis

Population Subgroups

Suppose the population size of achievement matrix x is denoted by n(x). Matrix x is divided into two population subgroups: x' with population size n(x') and x'' with population size n(x'') such that n(x) = n(x') + n(x'')

	Income	Education	Health	
$x =$	4	4	2	Person 1
	3	5	4	Person 2
	8	6	3	Person 3

Population Subgroups

Population Subgroup Decomposability: A poverty measure is additive decomposable if:

$$P(x) = \frac{n(x')}{n}P(x') + \frac{n(x'')}{n}P(x'')$$

Then, one can calculate the contribution of each group to overall poverty:

$$C(x') = \frac{n(x')P(x')}{nP(x)}$$

Population Subgroups

Reconsider the following example

	Income	Years of Education	Sanitation (Improved?)	Access to Electricity	
x =	700	14	Yes	Yes	**Person 1**
	300	13	Yes	**No**	**Person 2**
	400	**10**	**No**	**No**	**Person 3**
	800	**11**	Yes	Yes	**Person 4**
z =	**500**	**12**	**Yes**	**Yes**	

Population Subgroups

The deprivation matrix

	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**	

Population Subgroups

The weight vector is (1, 2, 0.5, 0.5), replace deprivation status by weight

$g^0 =$

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

Population Subgroups

Who is poor when k = 1.5?

$g^0 =$

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

Population Subgroups

Who is poor when k = 1.5?

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

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

Population Subgroups

What is the M_0 of the matrix?

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

Population Subgroups

What is the M_0 of the matrix? It is 15/32

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

Population Subgroups

Let us divide the population into two subgroups

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

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

Population Subgroups

Let us divide the population into two subgroups

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

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

- M_0 for pink group: 1.5/8 = 3/16
- M_0 for green group: 6/8 = 3/4
- Overall M_0 = **?**

Population Subgroups

Let us divide the population into two subgroups

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

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

- M_0 for pink group: 1.5/8 = 3/16
- M_0 for green group: 6/8 = 3/4
- Overall M_0 = (1/2)×(3/16) + (1/2)×(3/4) = 15/32

Contribution of Subgroup

Let us divide the population into two subgroups

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

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

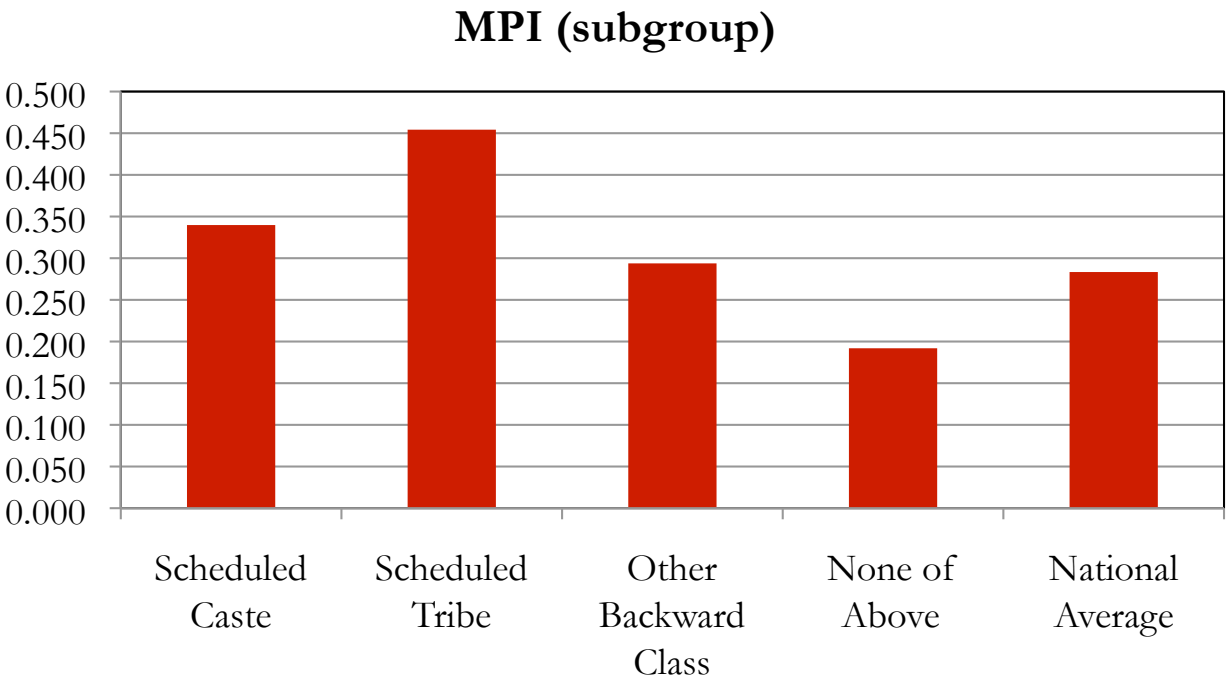
- The contribution of group 1 to M_0 is $(1/2)\times(3/16)/(15/32) = 1/5$
- The contribution of group 2 to M_0 is $(1/2)\times(3/4)/(15/32) = 4/5$
- The total contribution must sum up to 1

Applications and Case Studies

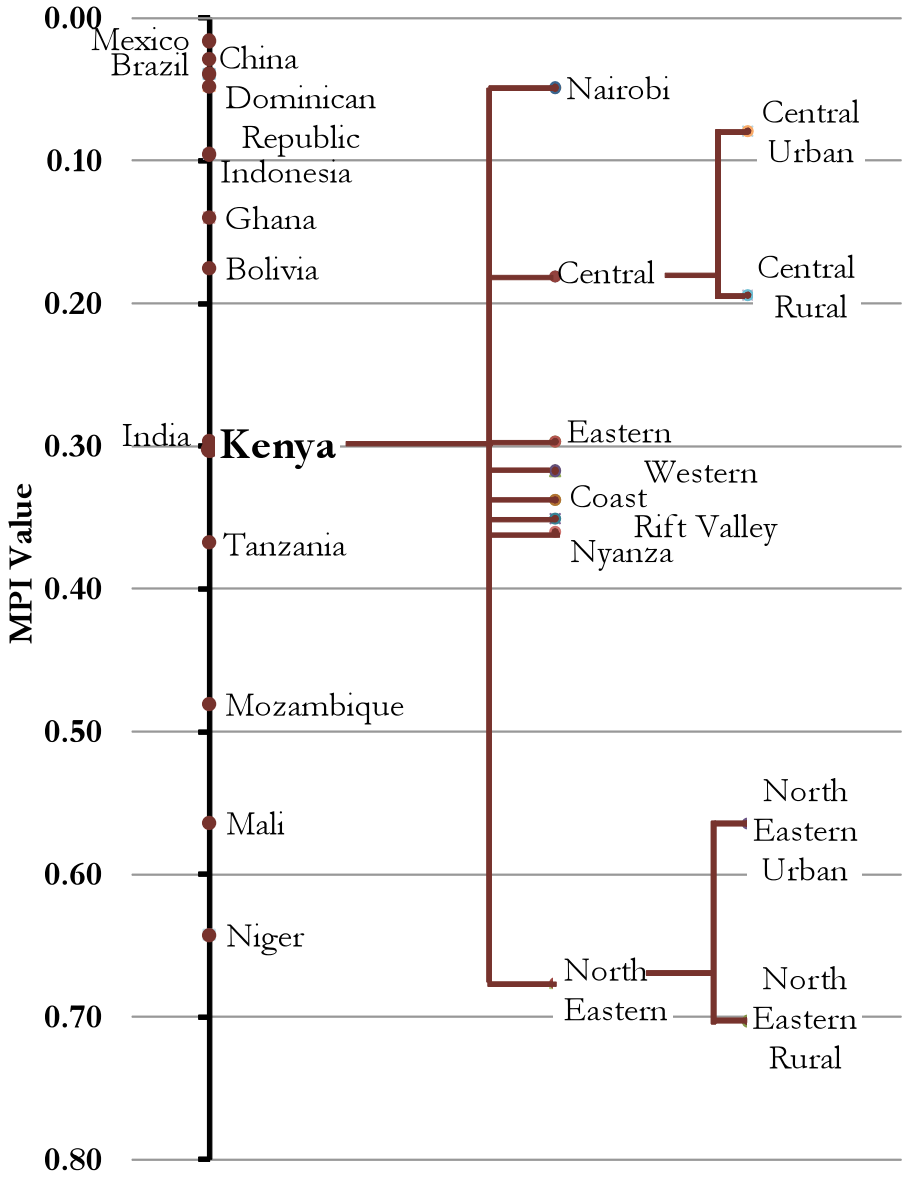
How do we present and analyze the results?

1. Break down M_0 by subgroups

Decompositions uncover large variation in MPI across group

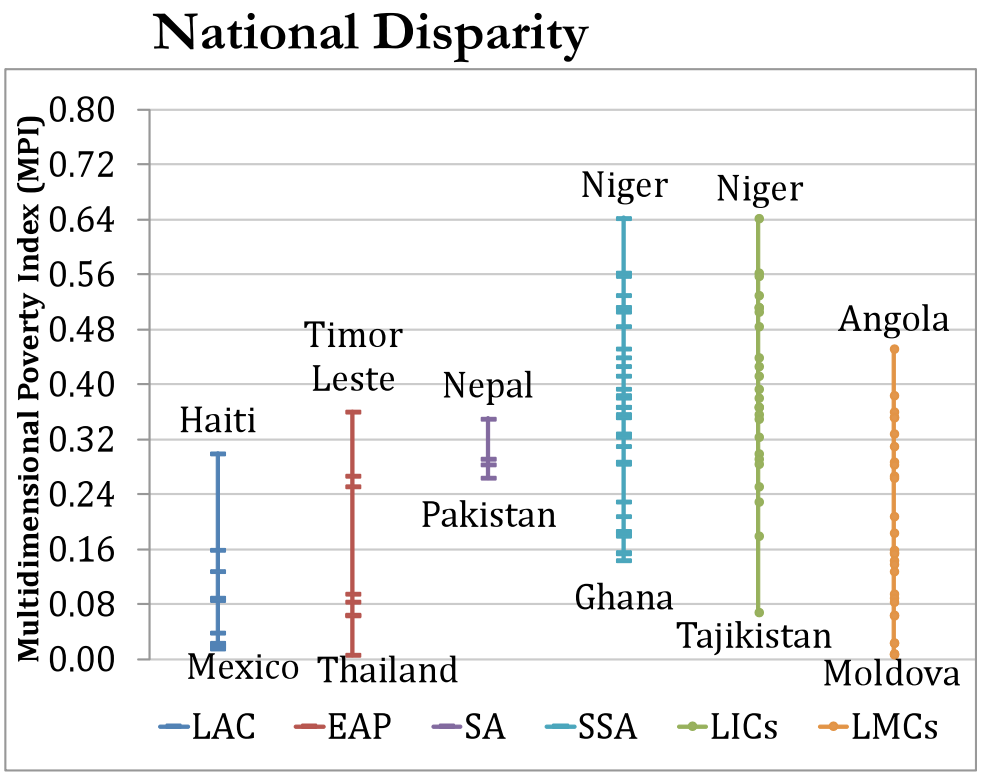


Decompositions uncover large variation in MPI.



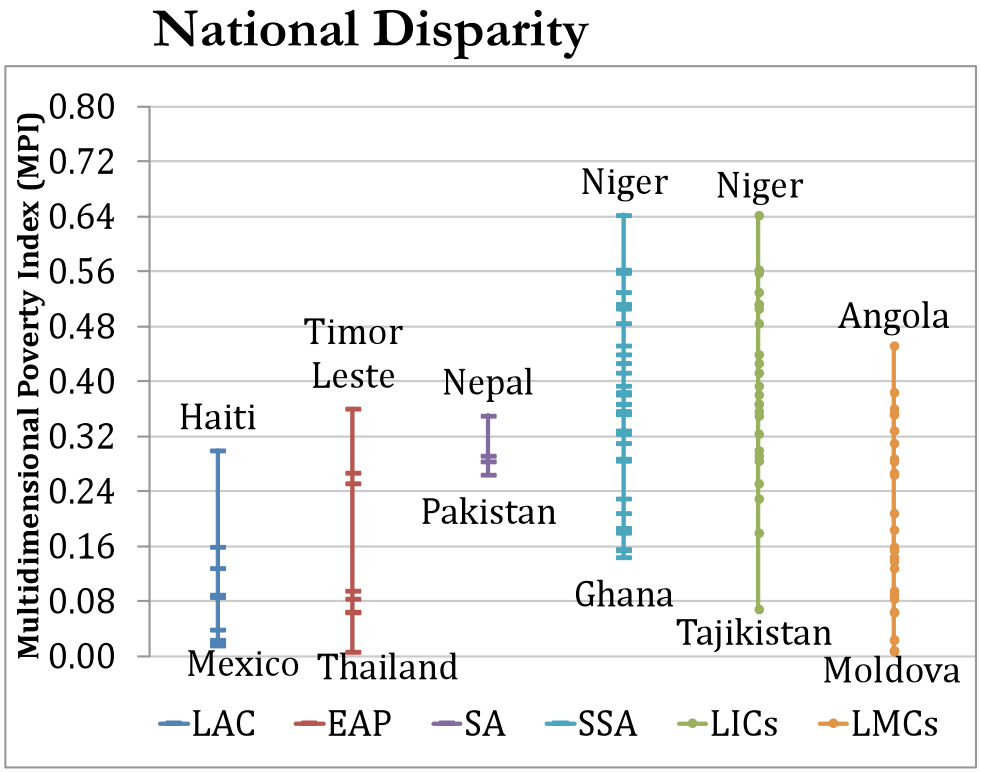
MPI 2011(Alkire & Santos 2010)

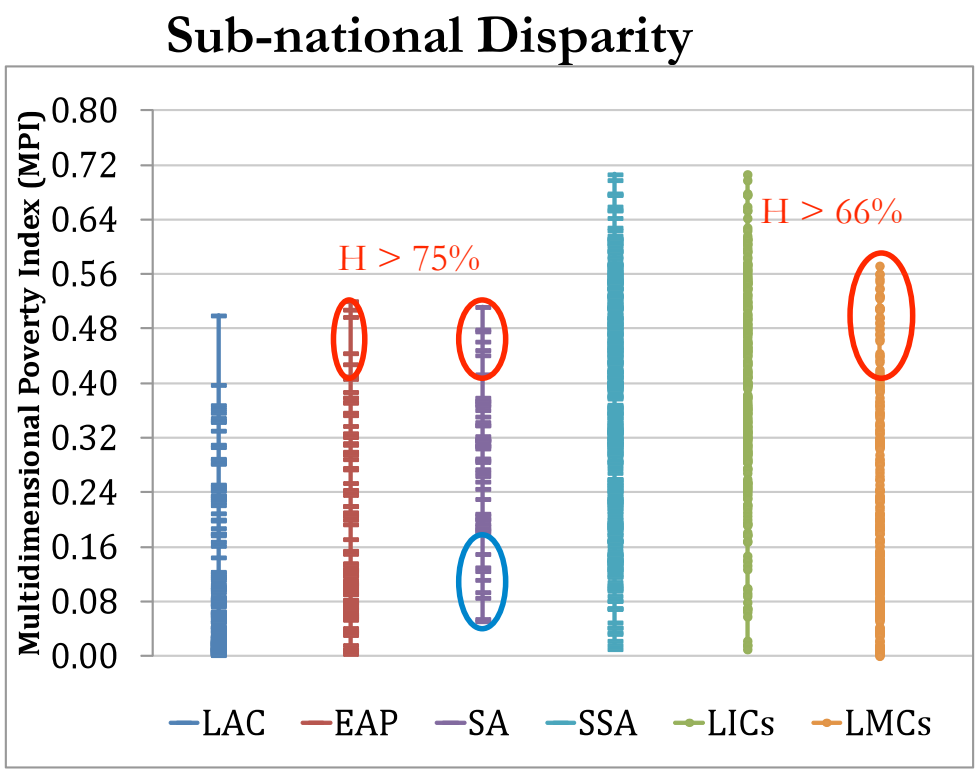
National Vs. Sub-national Disparity in MPI



	LAC	EAP	SA	SSA	LICs	LMICs
Standard Deviation of MPIs Across Countries	0.065	0.048	0.011	0.116	0.118	0.101

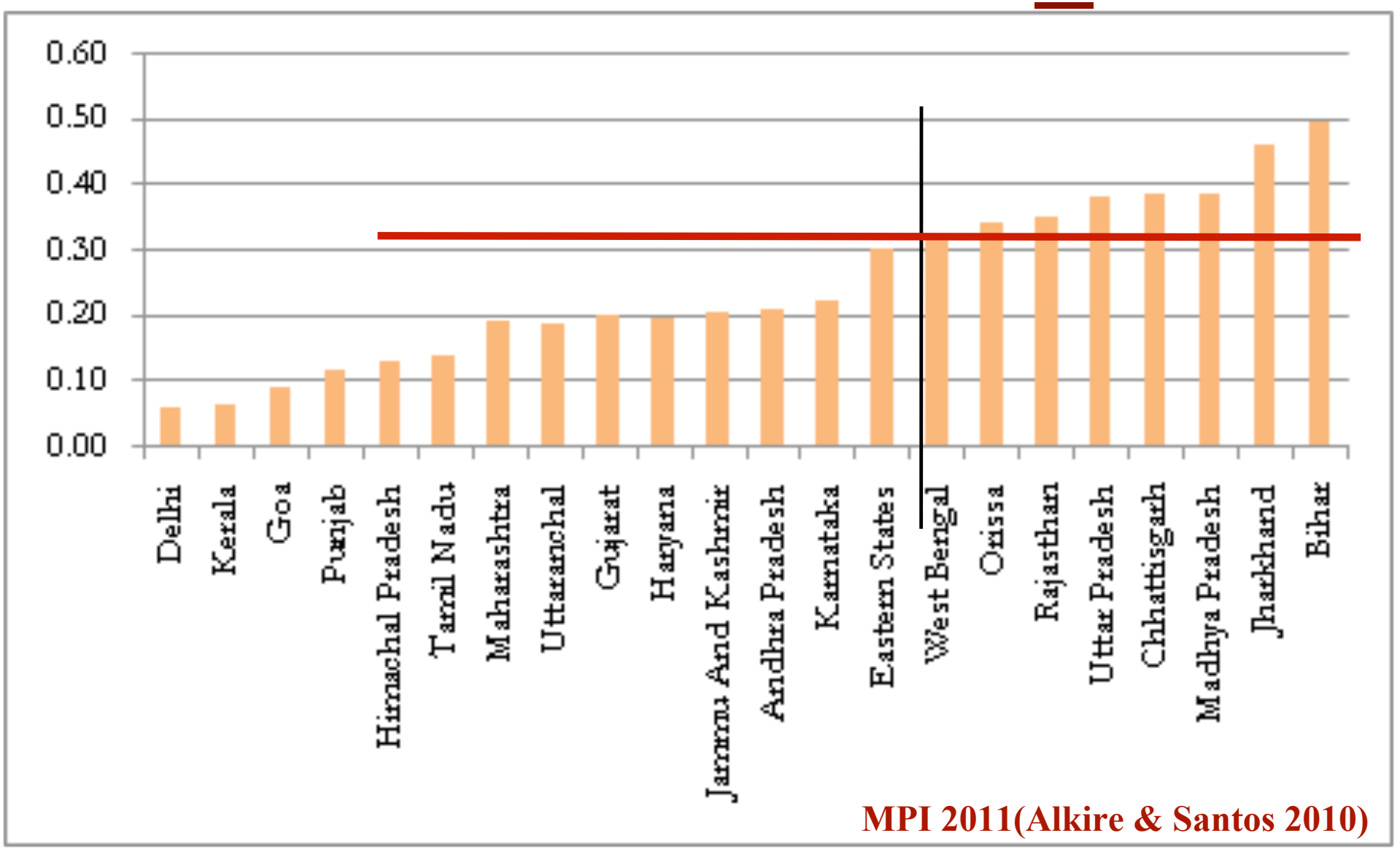
National Vs. Sub-national Disparity in MPI

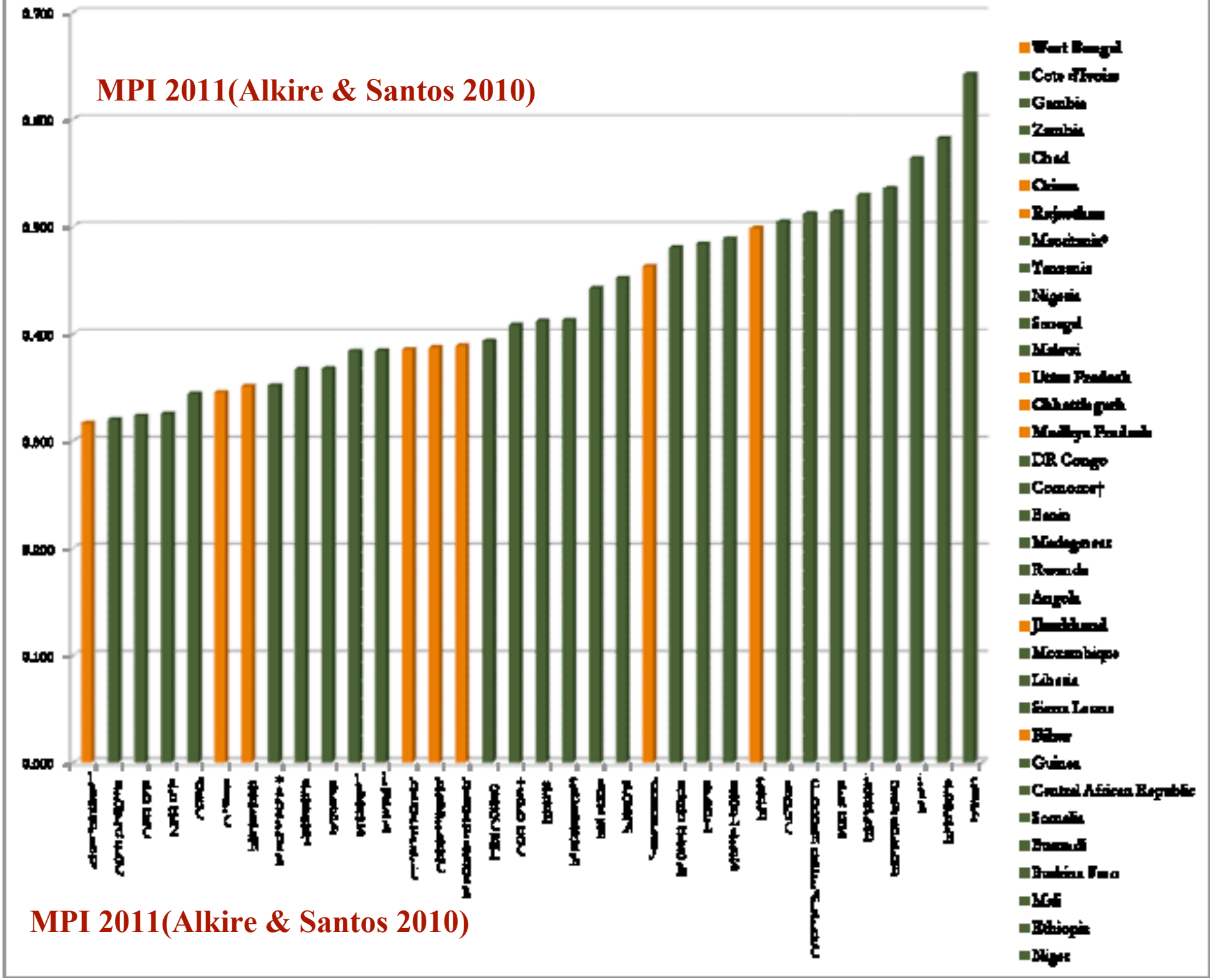




	LAC	EAP	SA	SSA	LICs	LMICs
Standard Deviation of MPIs						
Across Countries	0.065	0.048	0.011	0.116	0.118	0.101
Across Sub-National Regions	0.081	0.059	0.102	0.172	0.147	0.142

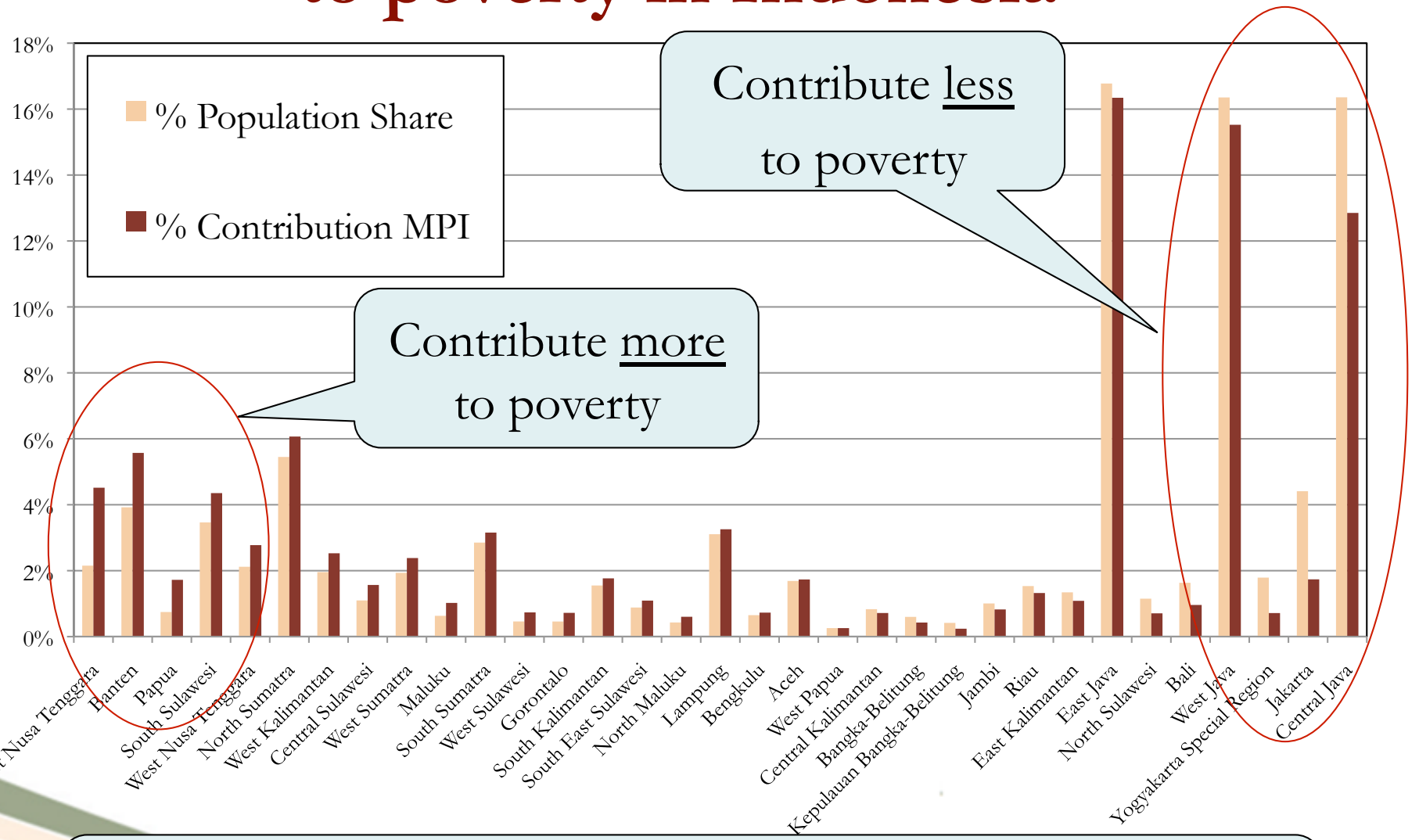
What Indian States' MPI ≥ 0.32?




MPI 2011(Alkire & Santos 2010)
MPI 2011(Alkire & Santos 2010)

2. Analyzing Contribution

Regional contribution to poverty in Indonesia



Suppose you want to distribute budget across regions considering two criteria: population size and poverty level

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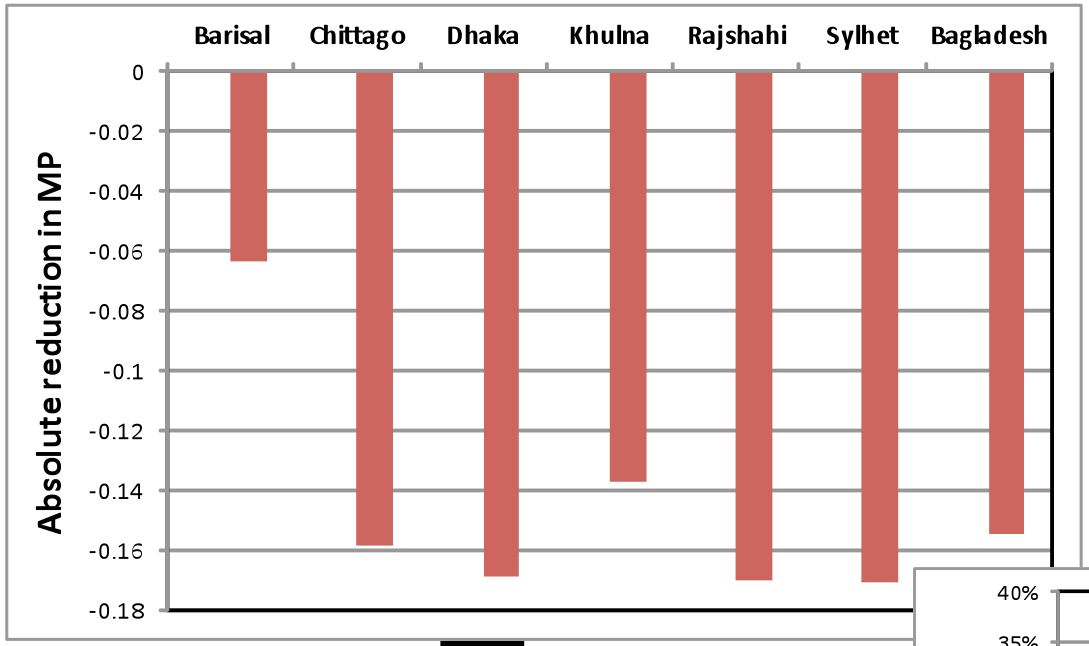
Regional contribution to poverty in Indonesia

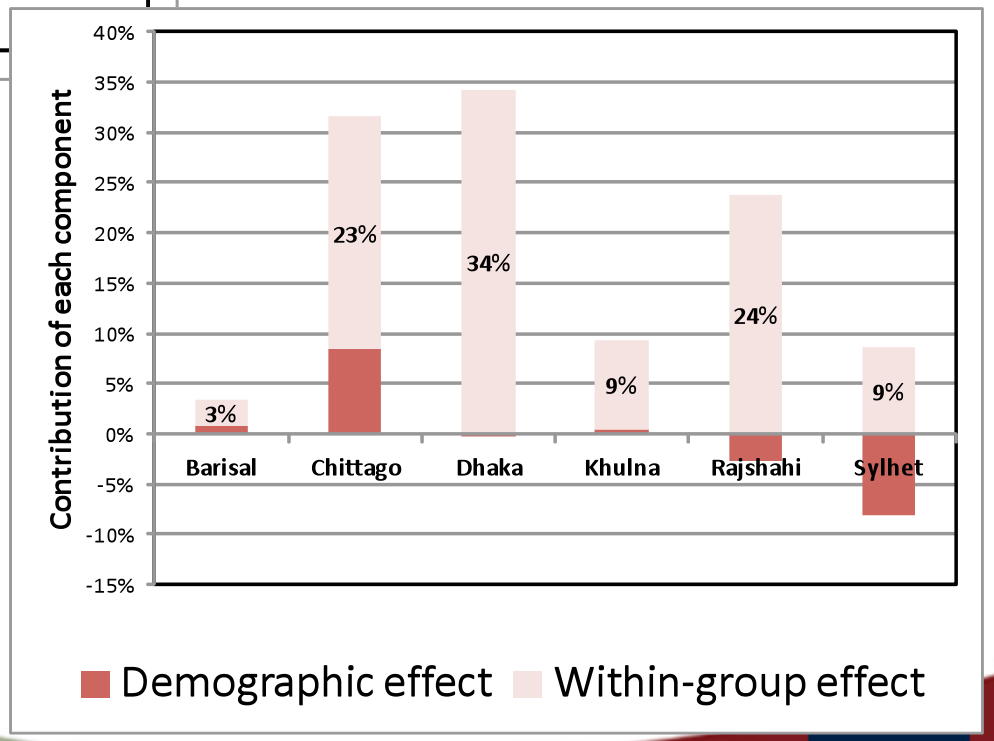
Region	East Nusa Tenggara	Banten	Papua	Yogyakarta Special Region	Jakarta	Central Java
Number of poor people (Thousand)	2,004	2,660	805	381	1,012	6,317
% Population Share	2%	4%	1%	2%	4%	16%
MPI	0.200	0.135	0.220	0.038	0.038	0.075
% Contribution MPI	5%	6%	2%	1%	2%	13%

Contribute more to poverty

Contribute less to poverty

Different path to poverty reduction (Roche 2013)





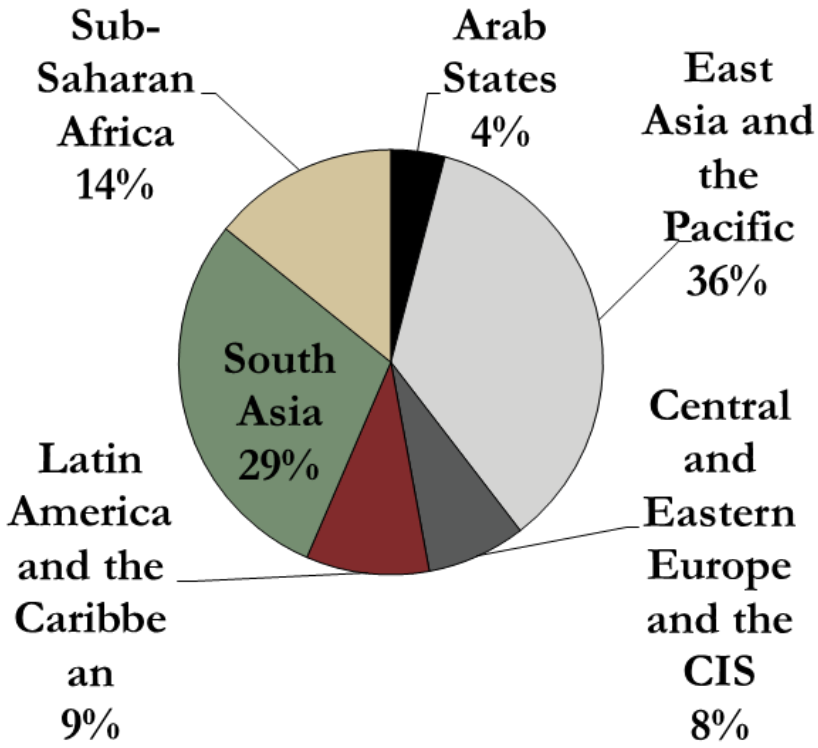
3. Aggregating results

Country Results: Across Geographic Regions and Income Categories

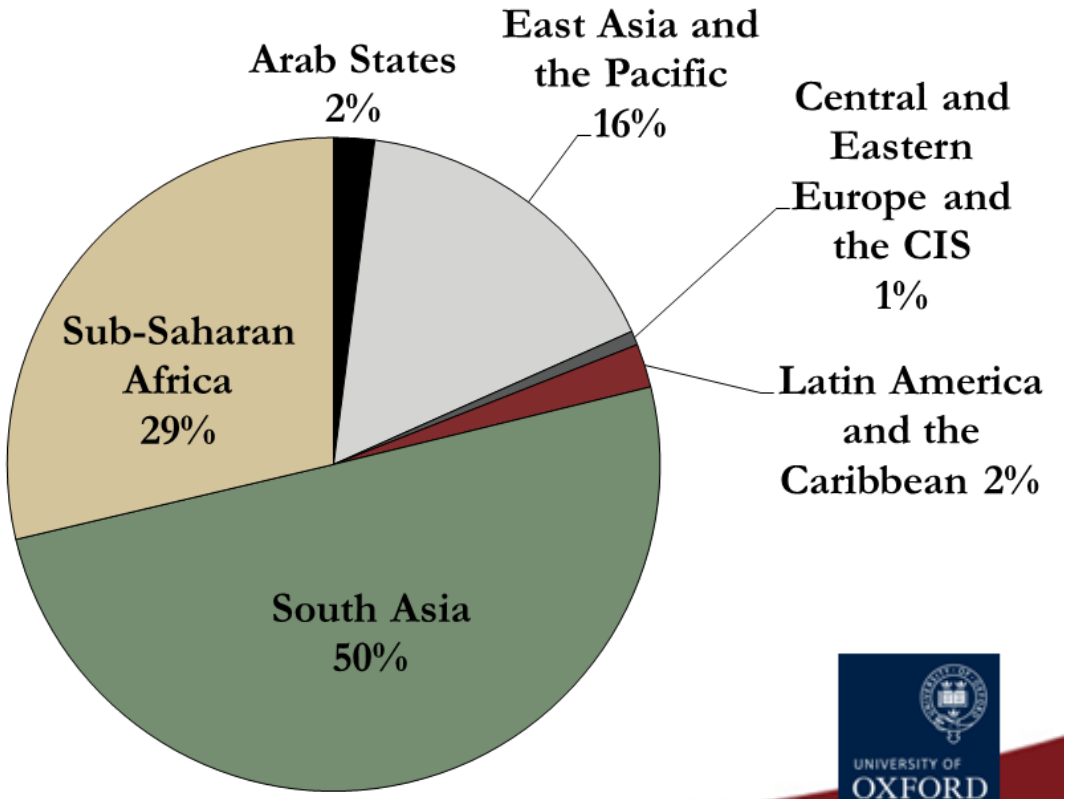
World Region	Number of Countries	2008 Pop (in Mils)	MPI	MPI Poor (%)	Severely Poor (%)
Total	**109**	**5,299.9**	**0.163**	**31.1%**	**16.4%**
Geographic Region					
Europe and Central Asia	24	399.5	0.011	2.9%	0.4%
Latin America and Caribbean	18	497.5	0.032	7.2%	2.2%
East Asia and Pacific	11	1,878.7	0.065	14.3%	5.2%
Arab States	11	217.7	0.077	15.3%	7.4%
South Asia	7	1,554.2	0.280	53.2%	28.0%
Sub-Saharan Africa	38	752.3	0.360	62.9%	41.2%
Income Category					
High Income	8	41.2	0.010	2.9%	0.0%
Upper Middle Income	28	2,179.0	0.041	9.3%	3.0%
Lower Middle Income	42	2,378.9	0.218	41.5%	21.9%
Low Income	31	700.9	0.367	65.6%	40.7%

Distribution of Population and MPI Poor across Geographic Regions

Total Population in 109 MPI countries



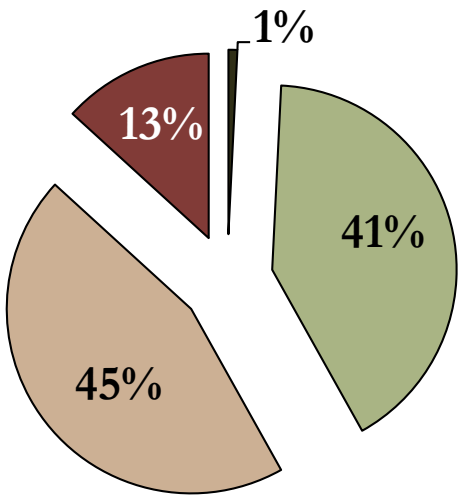
MPI poor people by region



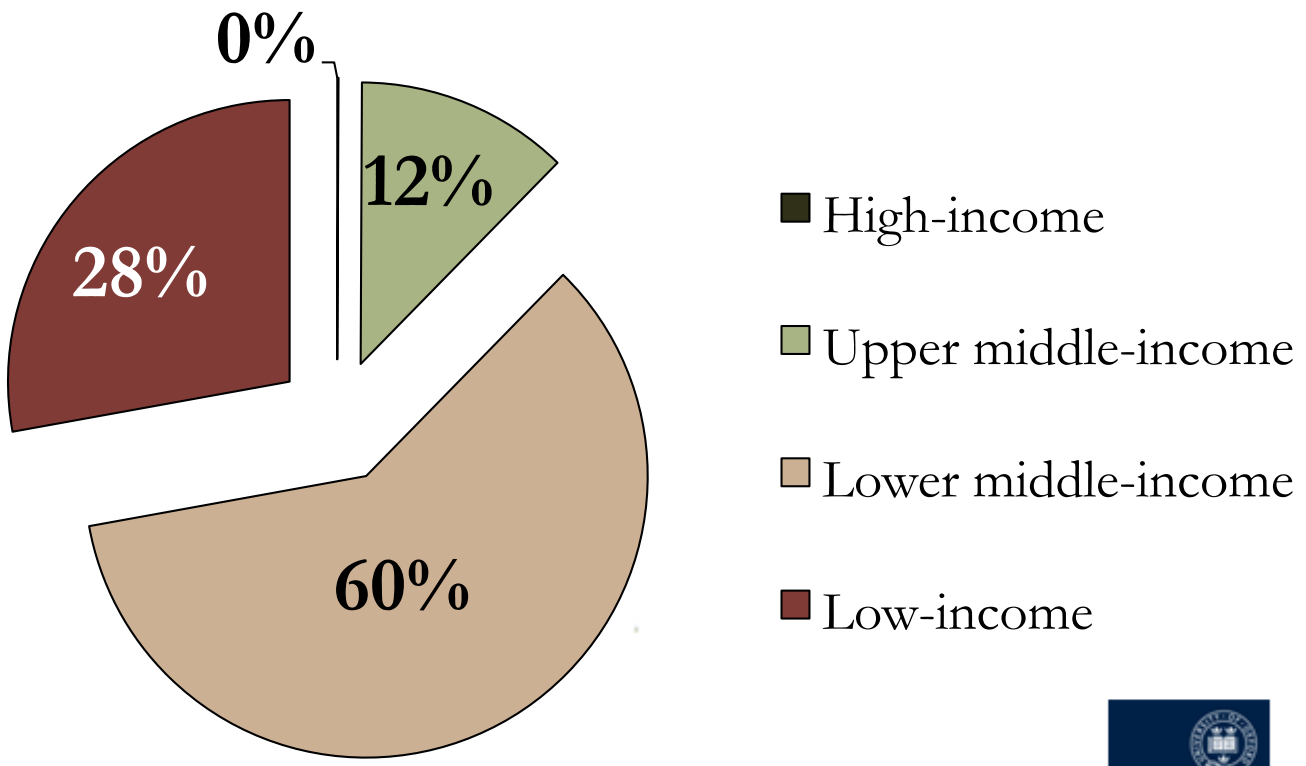
MPI in middle-income countries.

More than twice as many poor people live in middle-income countries (1,189 M) compared to low-income countries (459 M).

Total Population by Income Category in MPI countries (2008)



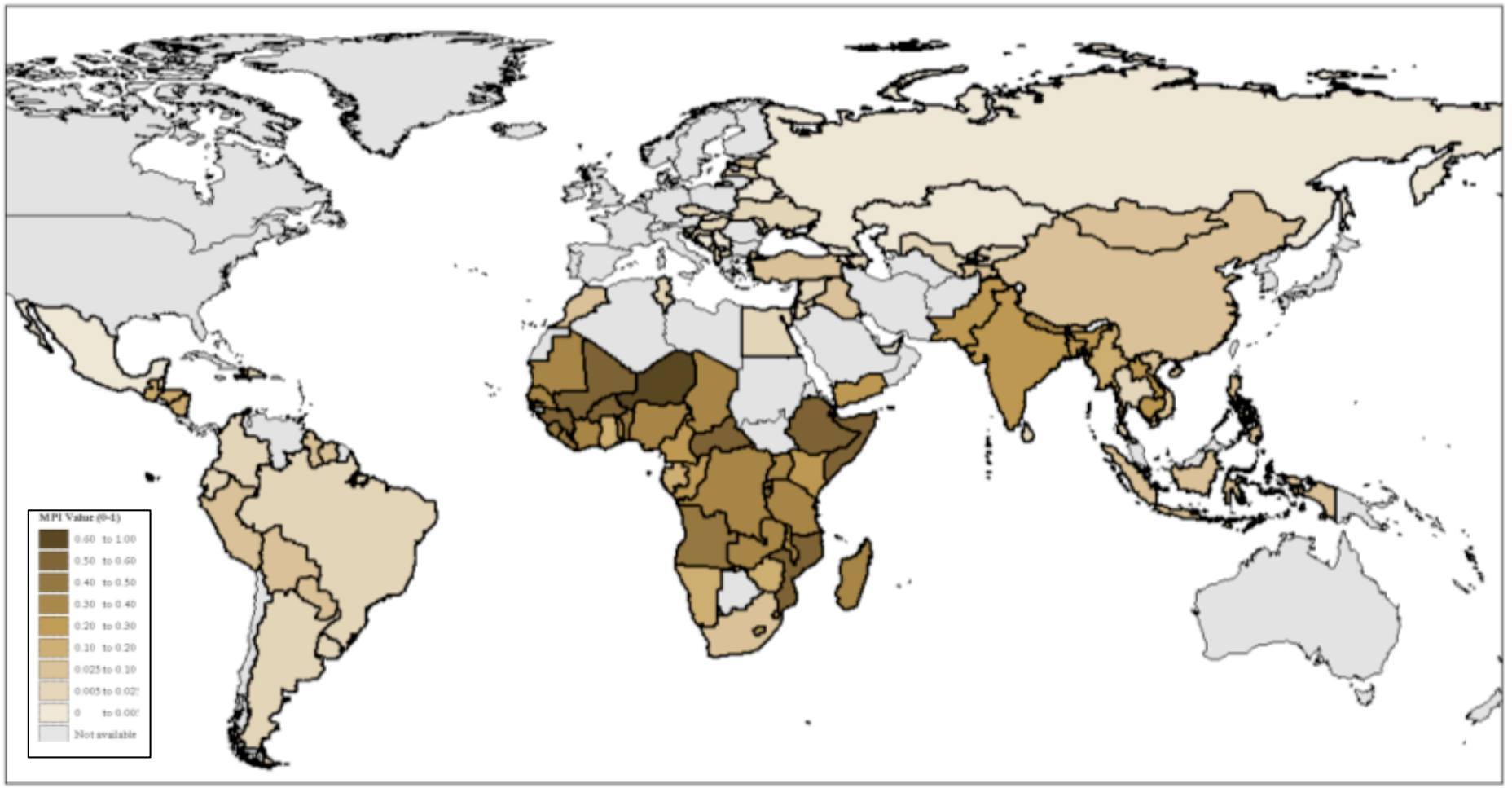
MPI Poor Population (2008)



4. Poverty Maps analysis

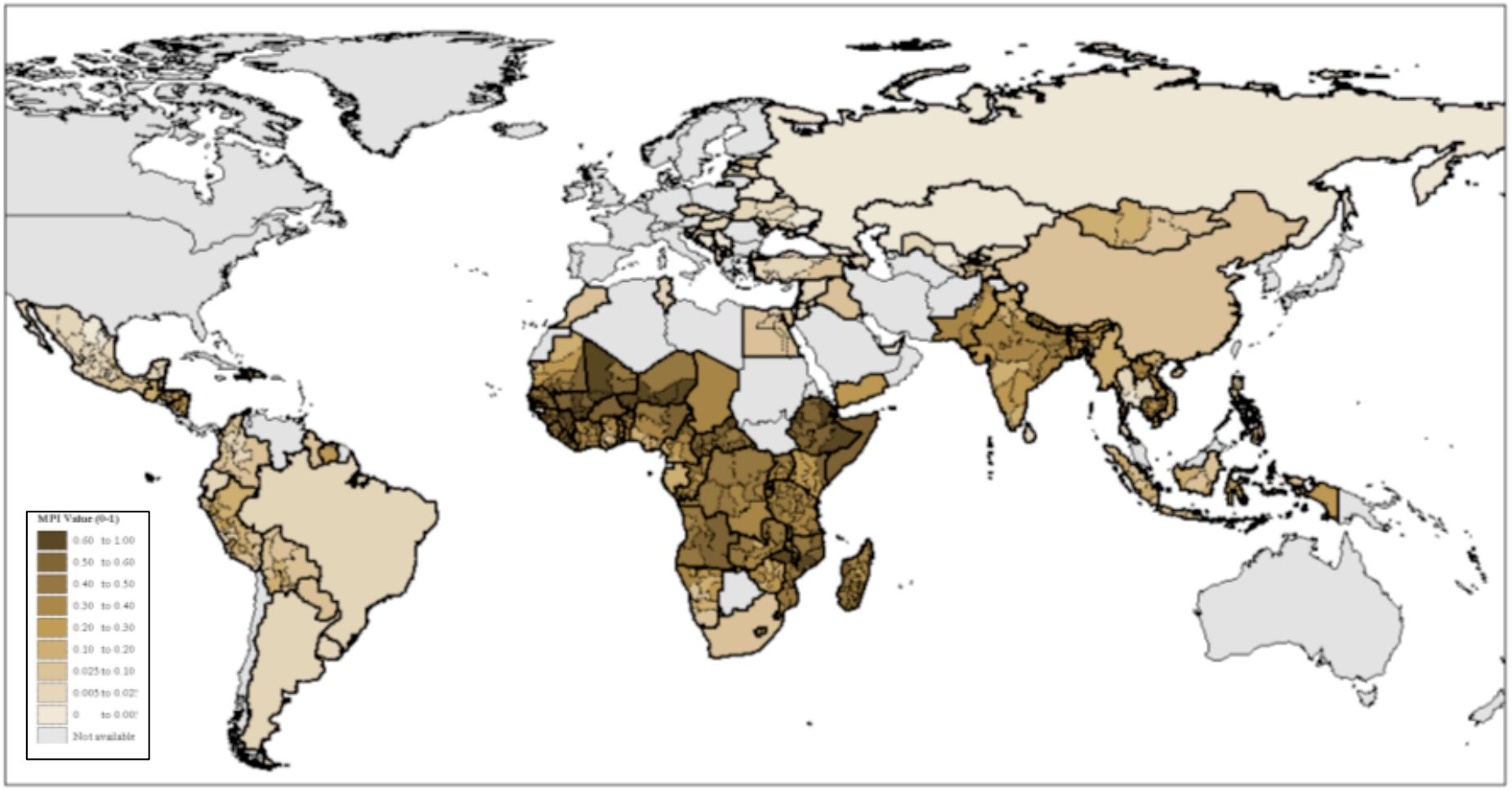
National MPI

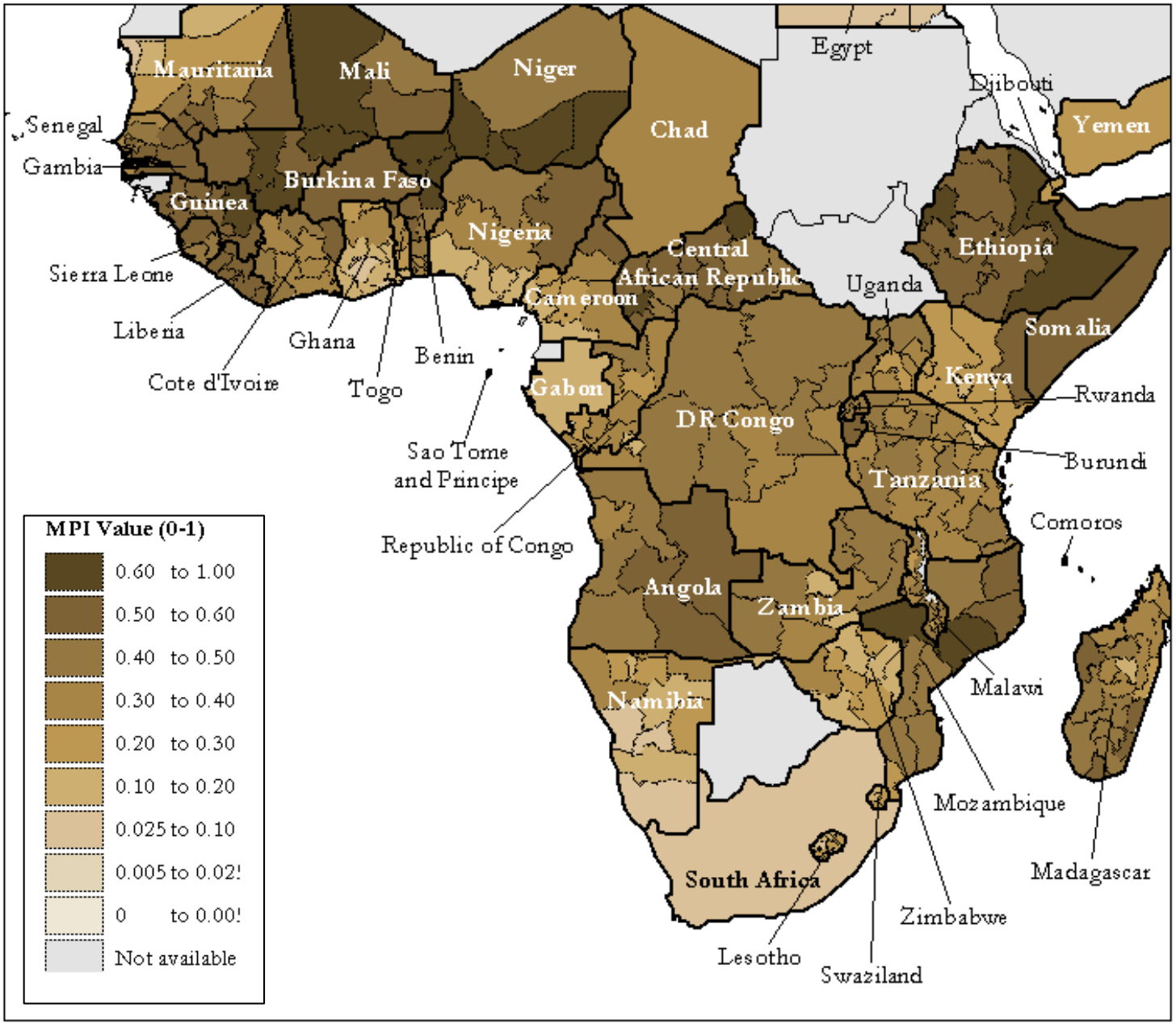
(109 Countries)



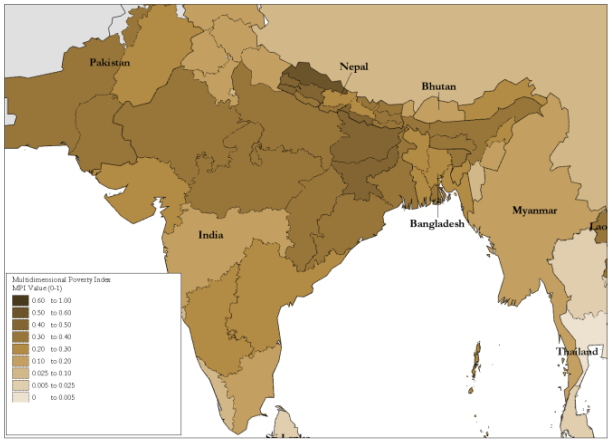
Sub-national disparities in MPI

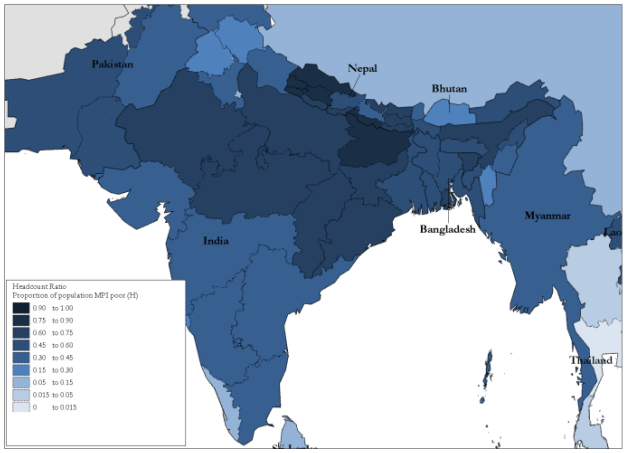
(Subnational disaggregation available for 66 countries)

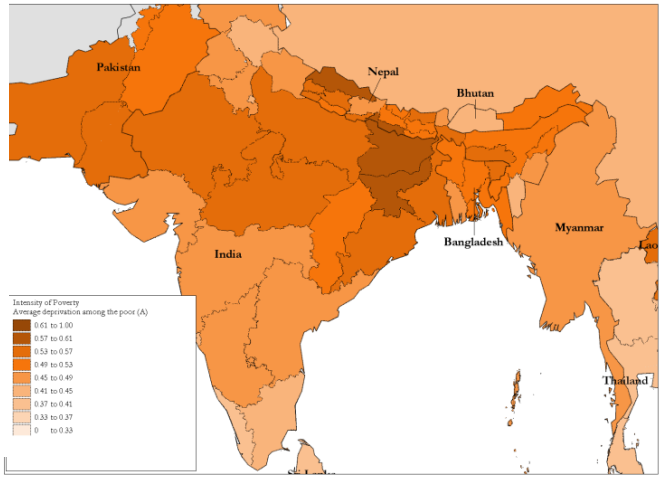


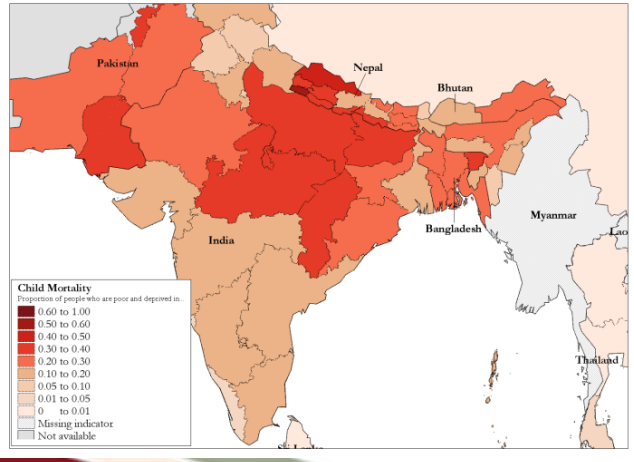

Mauritania
Mali
Niger
Egypt
Djibouti
Yemen
Senegal
Chad
Gambia
Burkina Faso
Guinea
Nigeria
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Somalia
Liberia
Ghana
Benin
Kenya
Cote d'Ivoire
Togo
Gabon
Rwanda
DR Congo
Sao Tome and Principe
Burundi
Tanzania
Comoros
Republic of Congo
Angola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

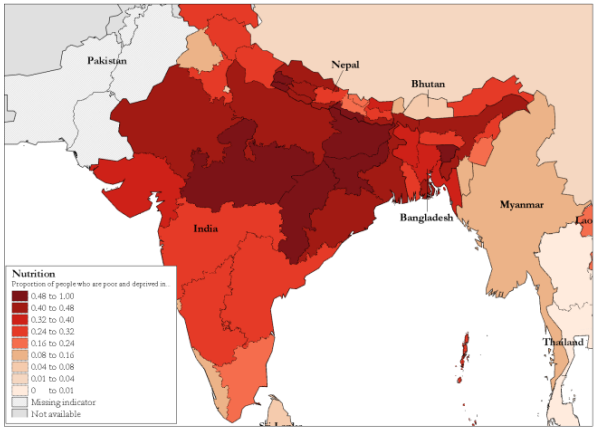
MPI: various levels of resolution

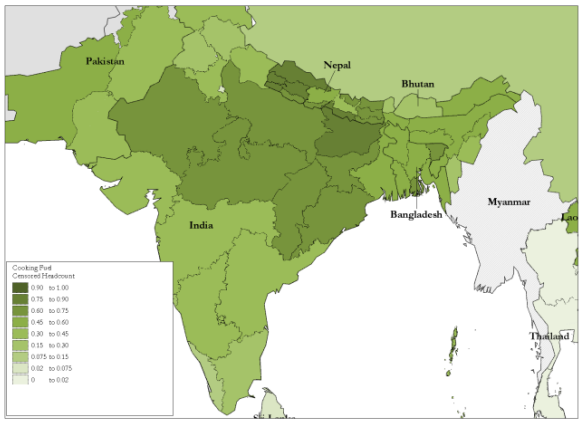


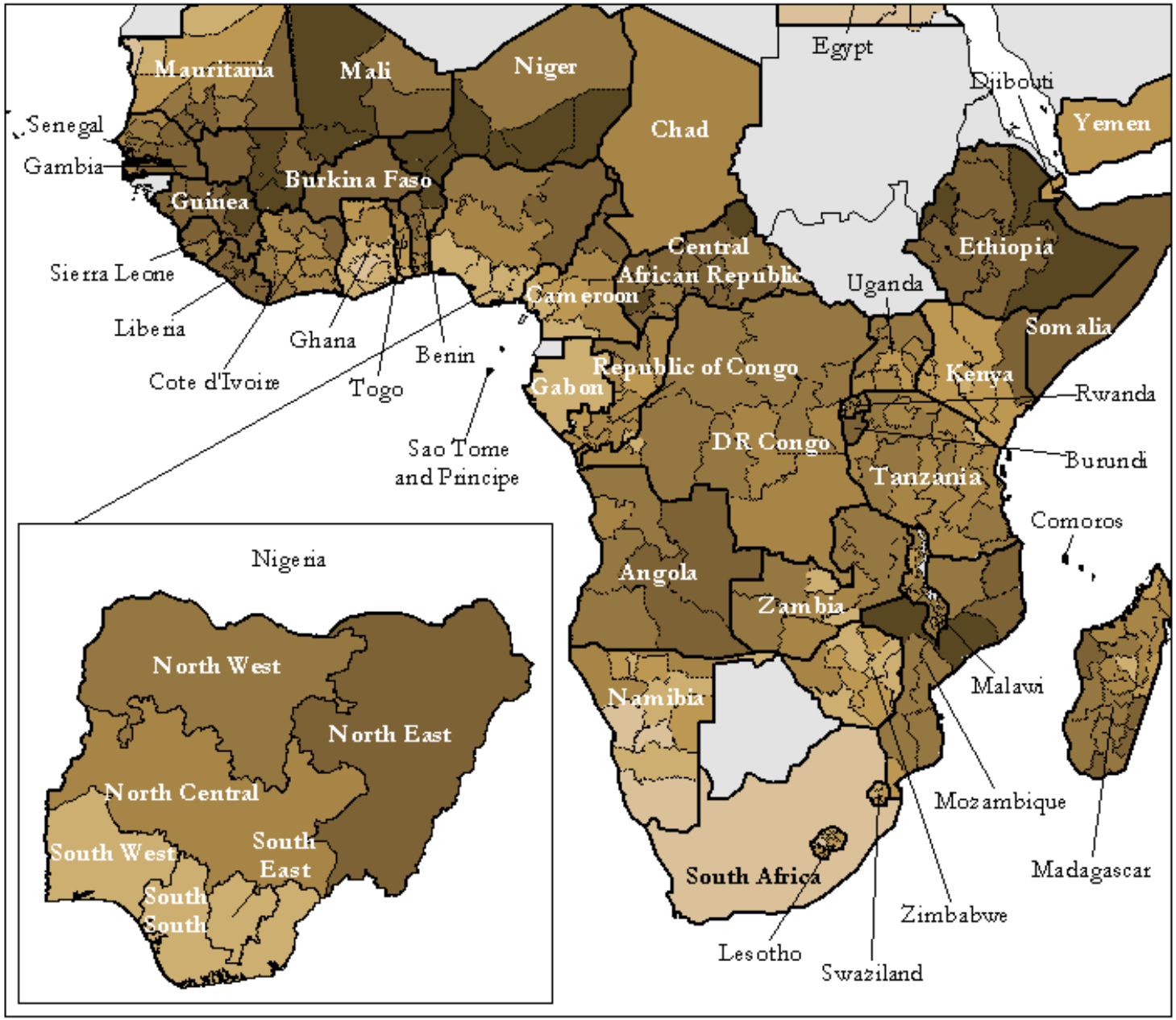











Mauritania
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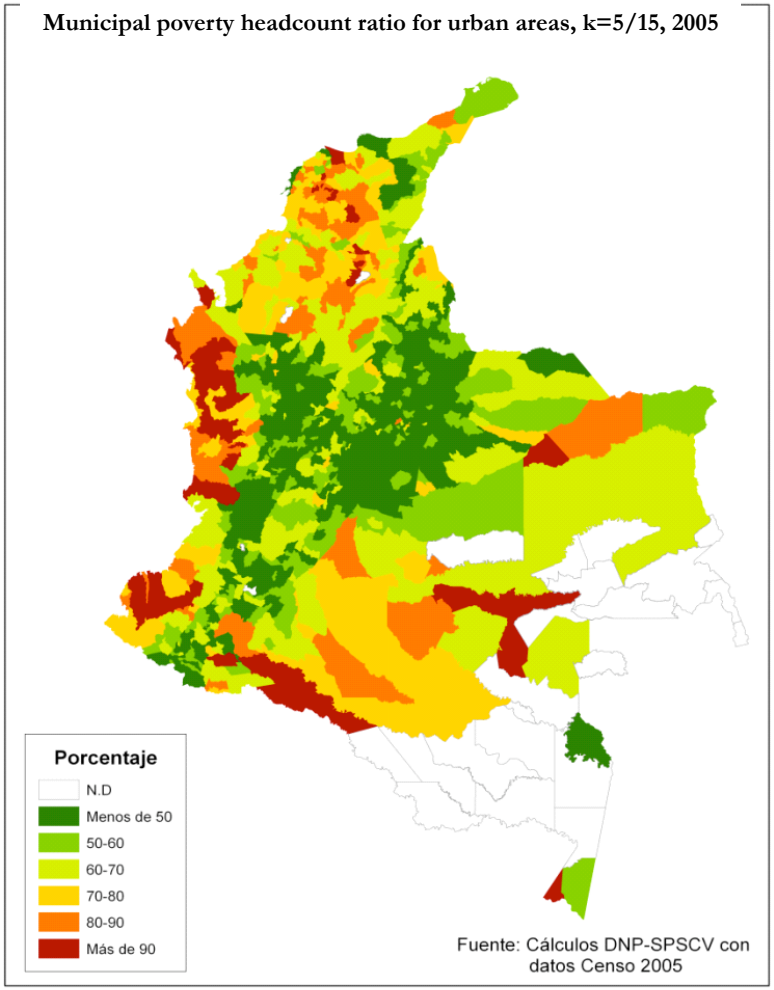
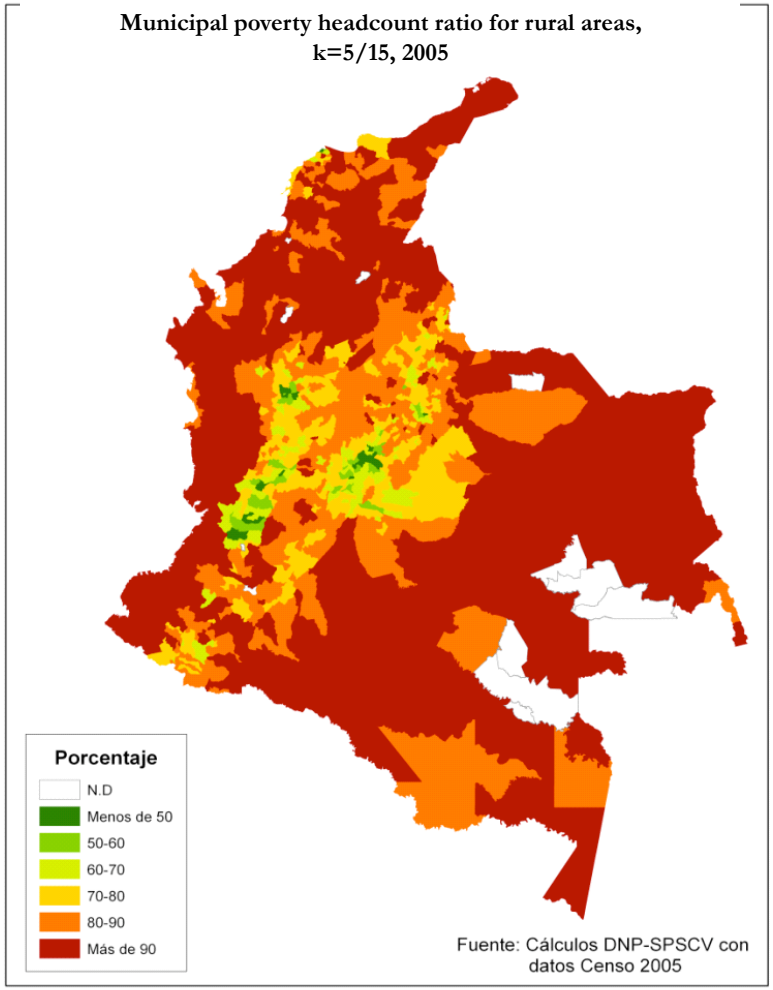
Guinea
Central African Republic
Ethiopia
Sierra Leone
Cameroon
Uganda
Somalia
Liberia
Ghana
Benin
Republic of Congo
Kenya
Cote d'Ivoire
Togo
Gabon
Rwanda
Sao Tome and Principe
DR Congo
Burundi
Tanzania
Comoros
Nigeria
Angola
Zambia
North West
Malawi
Namibia
North East
North Central
Mozambique
South West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

Municipal MPI Colombia
Headcount ratio, urban-rural areas, 2005

Municipal poverty headcount ratio for urban areas, k=5/15, 2005



Municipal poverty headcount ratio for rural areas, k=5/15, 2005



MPI proxy based on Census Data 2005