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UNIVERSITY OF
OXFORD

HDCA Summer School on Capability and Multidimensional Poverty

24 August – 3 September 2011

Delft University of Technology, Netherlands

**We are grateful to the World Bank, Anonymous Funders and OPHI for
funding this summer school**

Tabita, Kenya



Rabiya, India



Stéphanie, Madagascar



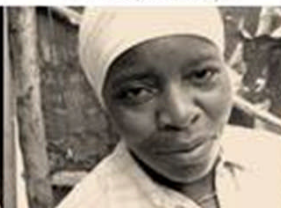
Agathe, Madagascar



Dalma, Kenya



Ann-Saphia, Kenya



Valérie, Madagascar



Decompositions by Dimension and Population Subgroups: Policy Implications

José Manuel Roche
&
Suman Seth

Focus of This Lecture

Discuss two ways of decomposing the poverty
using the AF measure

By population subgroup

By dimensional subgroup

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	Housing Index	Mal-nourished	
x =	700	14	4	No	Person 1
	300	13	5	Yes	Person 2
	400	10	1	Yes	Person 3
	800	11	3	No	Person 4
z =	500	12	3	No	

Population Subgroups

Reconsider the following example **Who is Poor?**

	Income	Years of Education	Housing Index	Mal-nourished	
x =	700	14	4	No	Person 1
	300	13	5	Yes	Person 2
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Population Subgroups

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$\mathbf{z} =$	500	12	3	No	

Population Subgroups

The deprivation matrix

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0 =$	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	3	No	
-------	-----	----	---	----	--

Population Subgroups

Who is poor when $k = 2$?

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0 =$	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	3	No	
-------	-----	----	---	----	--

Population Subgroups

Who is poor when $k = 2$?

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

$z =$	500	12	3	No	
-------	-----	----	---	----	--

Population Subgroups

What is the M_0 of the matrix?

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

Population Subgroups

What is the M_0 of the matrix? It is $6/16$ (equal weight)

	Income	Years of Education	Housing Index	Mal- nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

Population Subgroups

Let us divide the population into two subgroups

$$g^0(k) =$$

Income	Years of Education	Housing Index	Mal-nourished	
0	0	0	0	Person 1
1	0	0	1	Person 2
1	1	1	1	Person 3
0	0	0	0	Person 4

Population Subgroups

Let us divide the population into two subgroups

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0	0	0	0	Person 1
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1	1	1	1	Person 3
0	0	0	0	Person 4

- M_0 for pink group: $H_1 \times A_1 = 2/8 = 1/4$
- M_0 for green group: $H_2 \times A_2 = 4/8 = 1/2$
- Overall $M_0 = ?$

Population Subgroups

Let us divide the population into two subgroups

$g^0(k) =$

Income	Years of Education	Housing Index	Mal-nourished	
0	0	0	0	Person 1
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- M_0 for pink group: $H_1 \times A_1 = 2/8 = 1/4$
- M_0 for green group: $H_2 \times A_2 = 4/8 = 1/2$
- Overall $M_0 = (1/2) \times (1/2) + (1/2) \times (1/4) = 3/8 = 6/16$

Dimensional Subgroups

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

Decomposability Across Dimensions

It is a purely multidimensional concept, where the overall poverty can be expressed as an weighted average of dimensional deprivations (among poor only)

Dimensional Subgroups

Reconsider the censored deprivation matrix

	Income	Years of Education	Housing Index	Mal- nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

Dimensional Subgroups

There are four dimensions

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
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Dimensional Subgroups

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

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0(k) =$	0	0	0	0	Person 1
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Dimensional Subgroups

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	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

Income: 2/4

Education: 1/4

Housing: 1/4

Health: 2/4

Dimensional Subgroups

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

(What about M_1 and M_2)

Dimensional Subgroups

What is the contribution of income dimension to M_0 ?

	Income	Years of Education	Housing Index	Mal-nourished	
$g^0(k) =$	0	0	0	0	Person 1
	1	0	0	1	Person 2
	1	1	1	1	Person 3
	0	0	0	0	Person 4

Dimensional Subgroups

What is the contribution of income dimension to M_0 ?

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The contribution is $(1/4) \times [(2/4)/(6/16)] = 1/3$

Dimensional Subgroups

What is the contribution of income dimension to M_0 ?

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The contribution is $(1/4) \times [(2/4)/(6/16)] = 1/3$

Unequal weights?

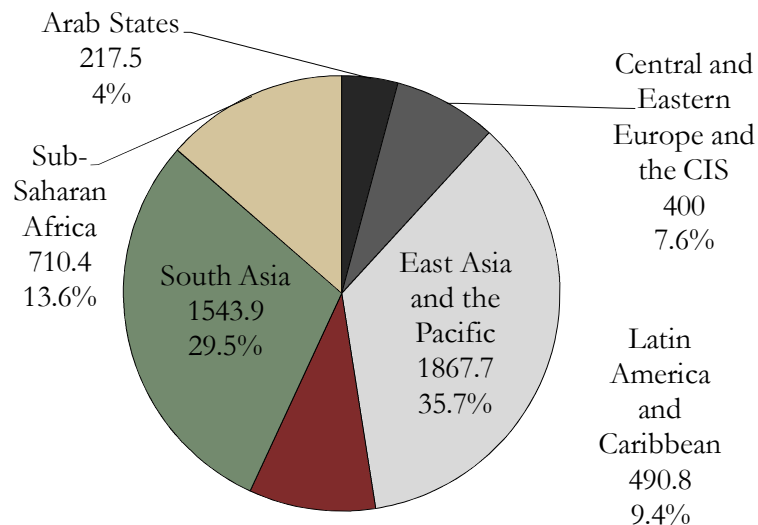
Policy Analysis:

Global MPI

and

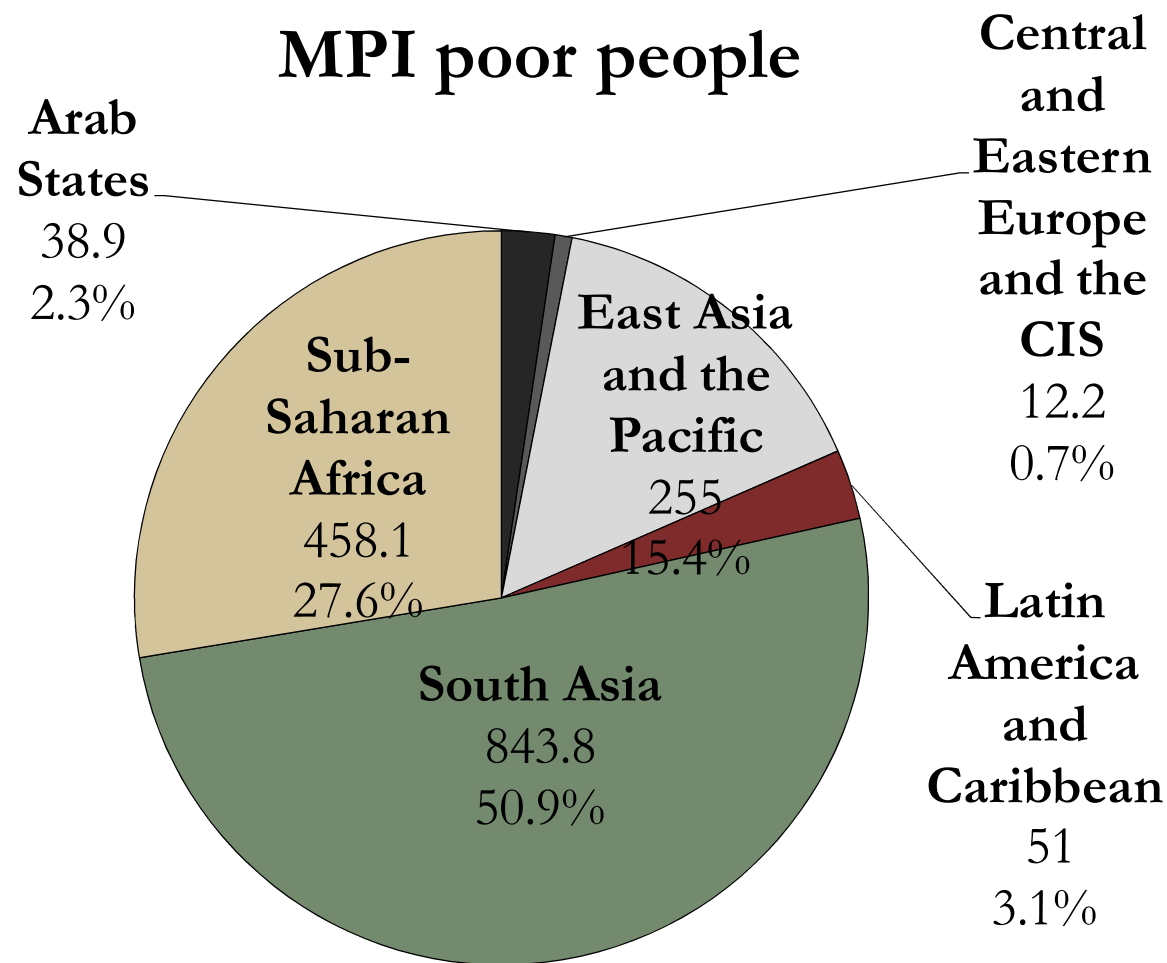
Child Poverty in Bangladesh

Population of 104 countries



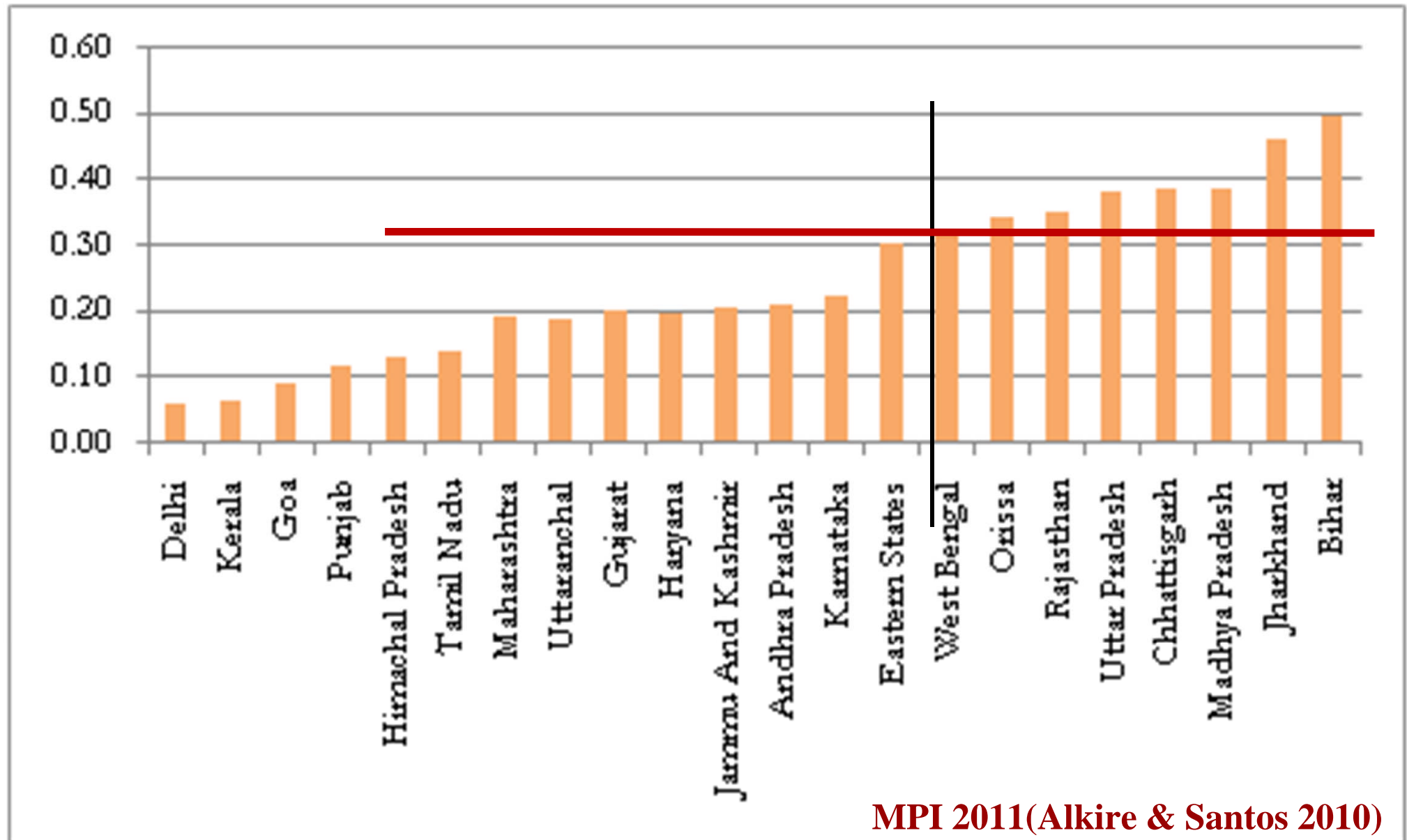
Most MPI poor people live in South Asia, followed by Sub-Saharan Africa

MPI poor people

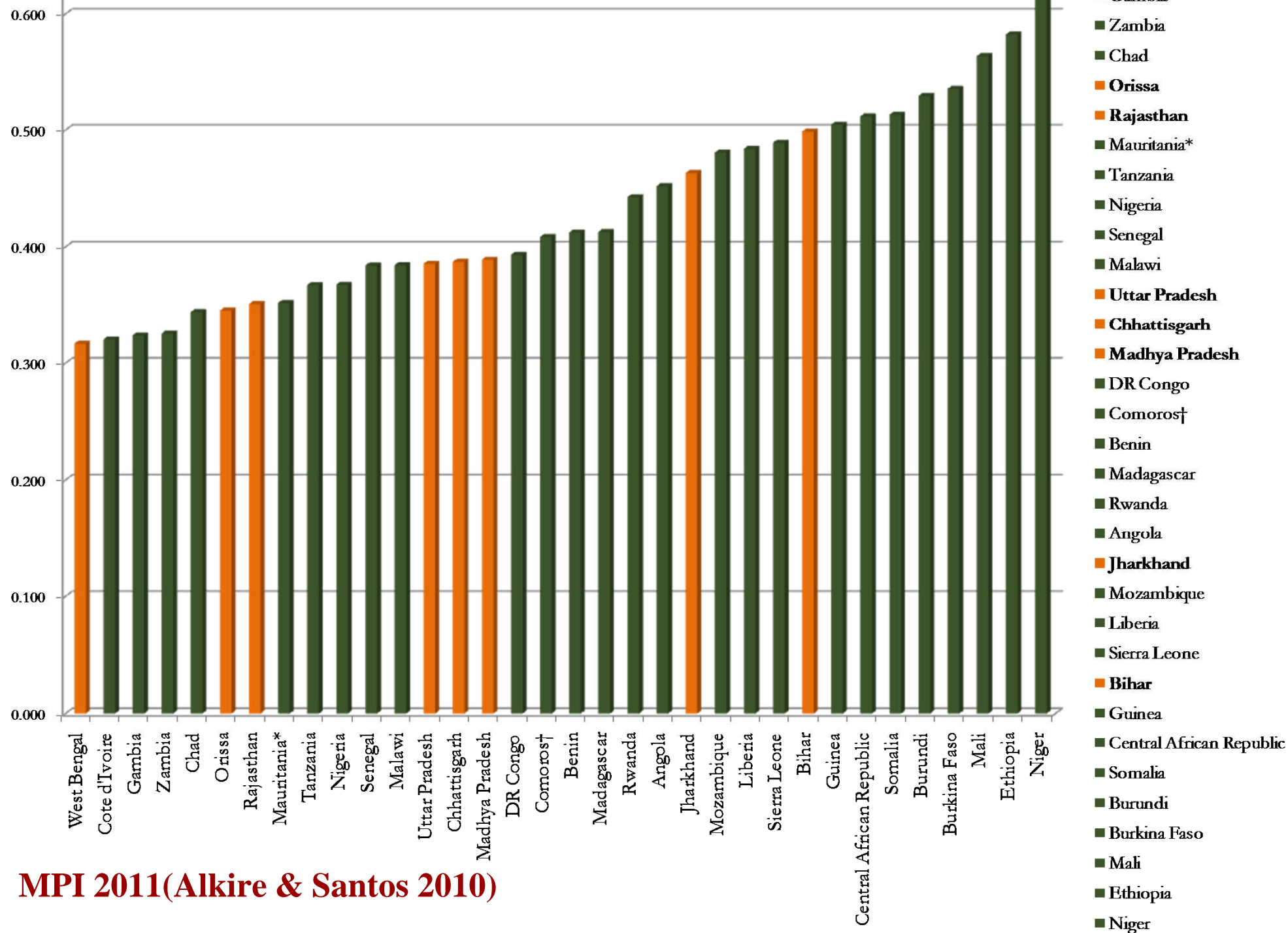


MPI 2011(Alkire & Santos 2010)

What Indian States' MPI ≥ 0.32 ?

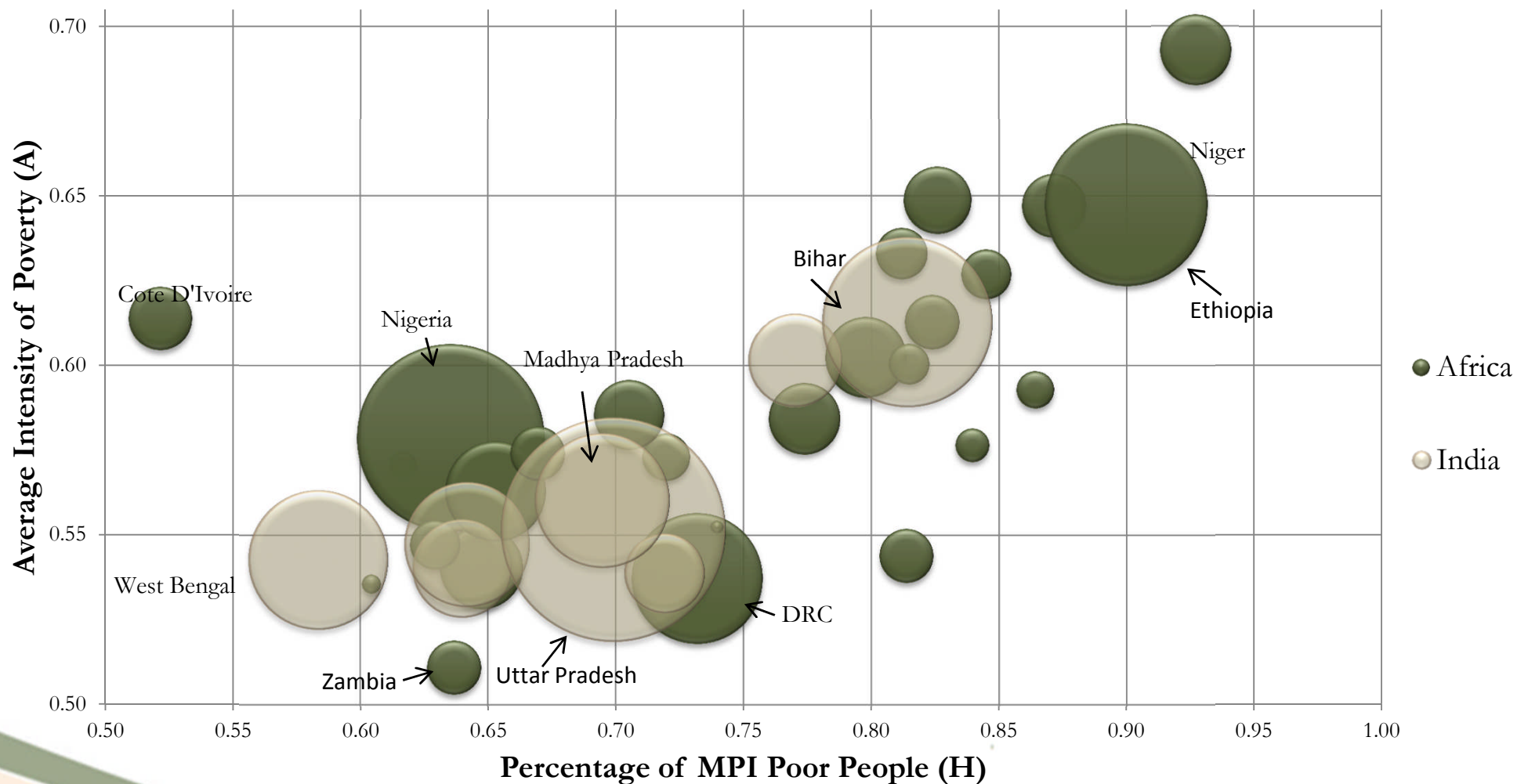


MPI 2011(Alkire & Santos 2010)

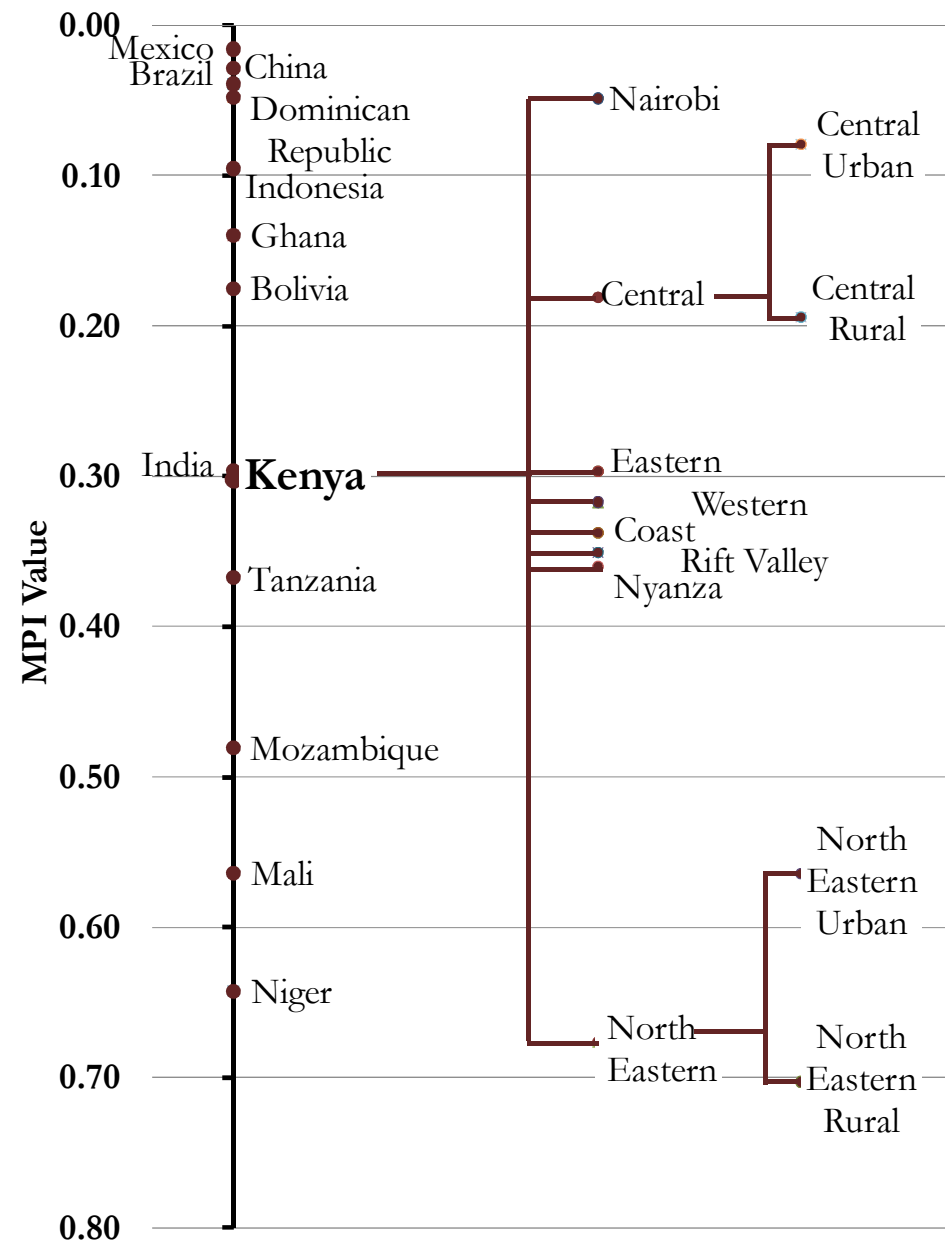


MPI 2011(Alkire & Santos 2010)

Visual comparison: Size = Number of Poor

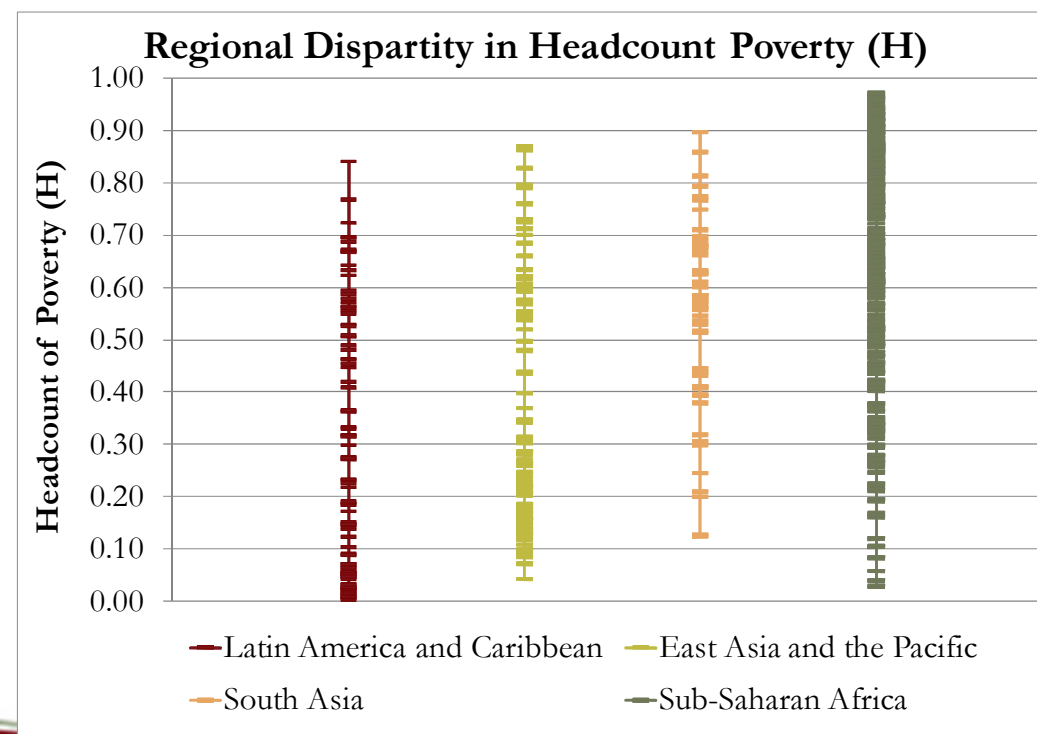
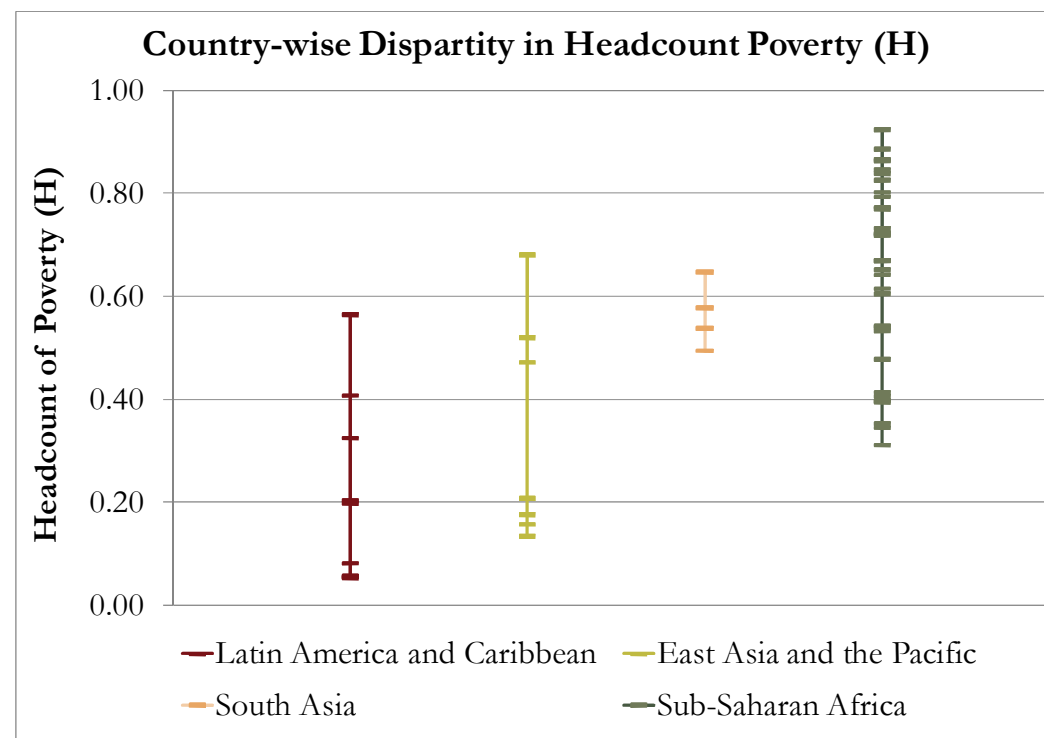


Decompositions uncover large variation in MPI.



MPI 2011(Alkire & Santos 2010)

Sub-regional MPI values for 57 countries (figure above) and 598 sub-regions (figure below) for which the decomposition at a sub-national level is statistically feasible.



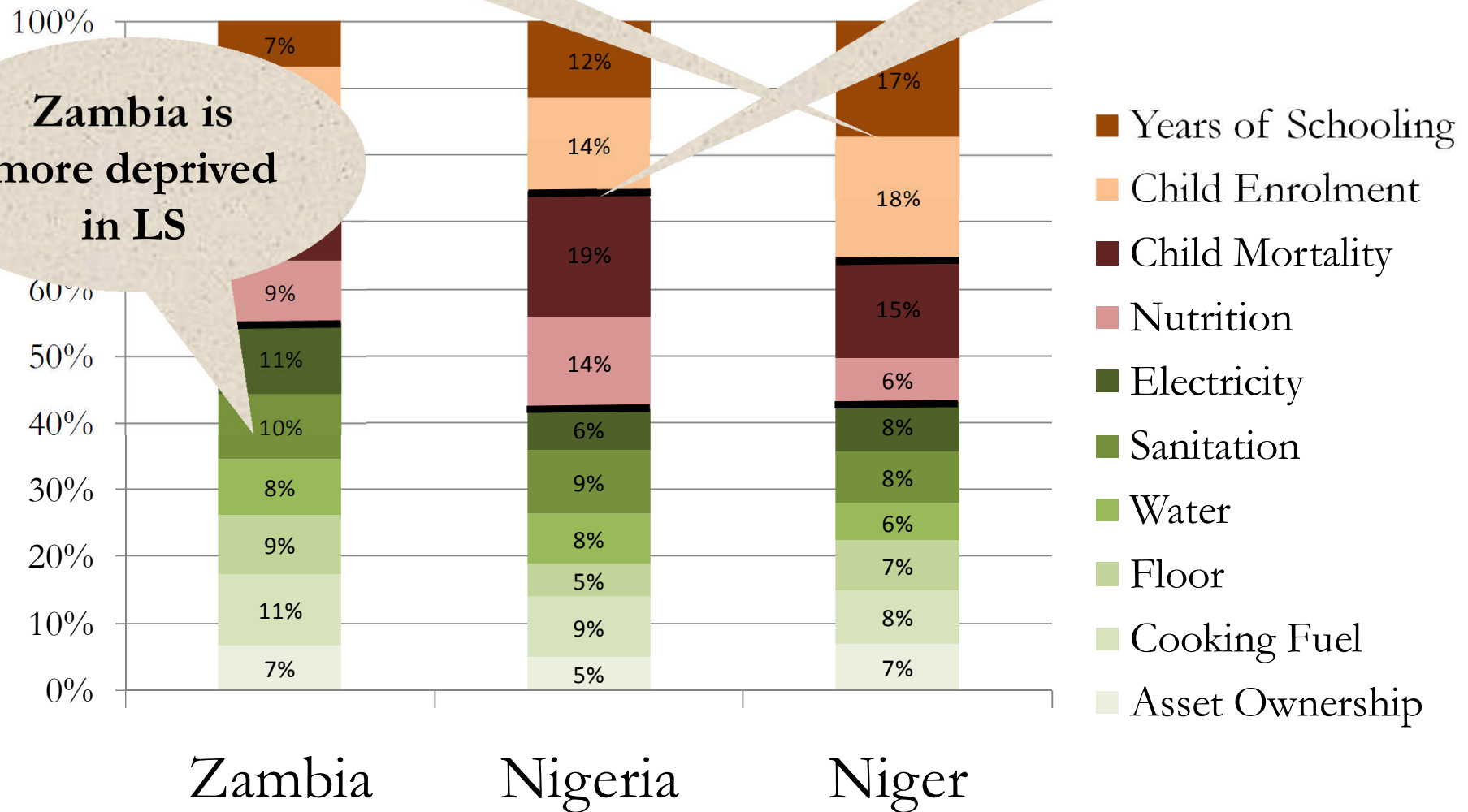
MPI2011 (Alkire, Roche, Santos and Seth 2011)

**Niger is most
deprived in
Education**

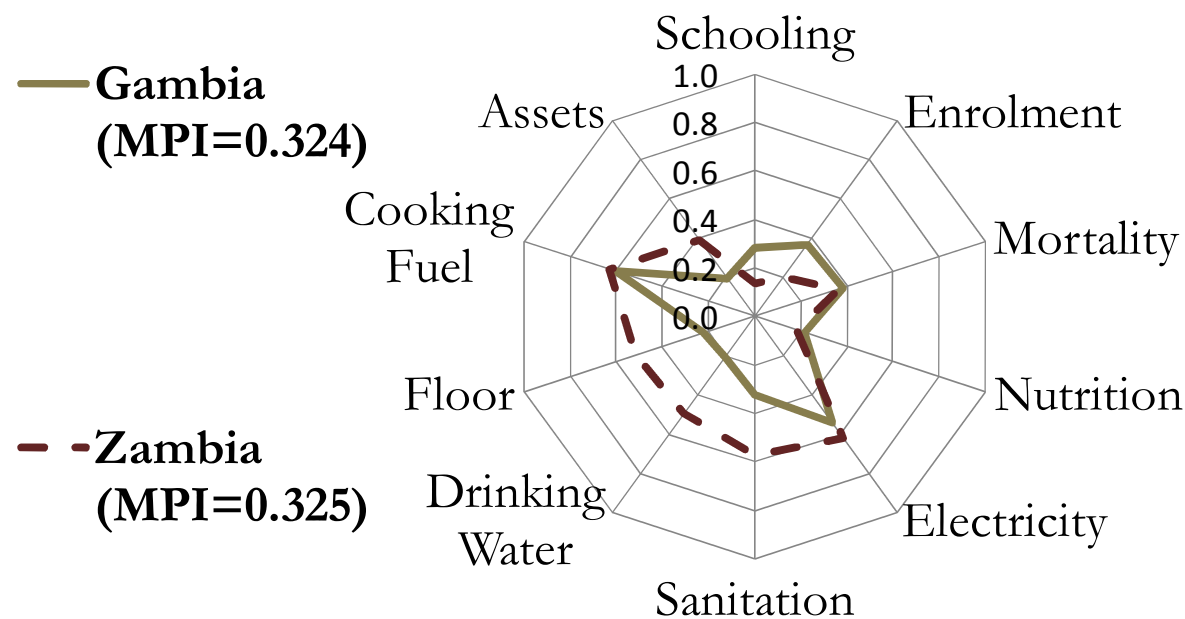
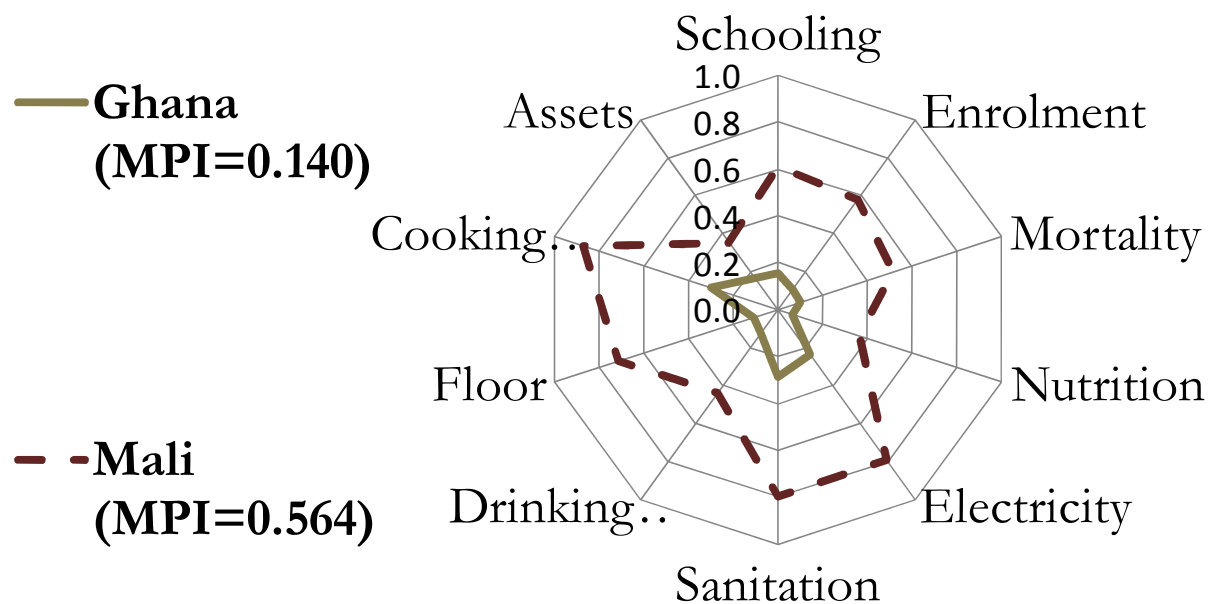
Composition by Ind

**Nigeria is more
deprived in
Health and
Education**

**Zambia is
more deprived
in LS**



Composition of Poverty

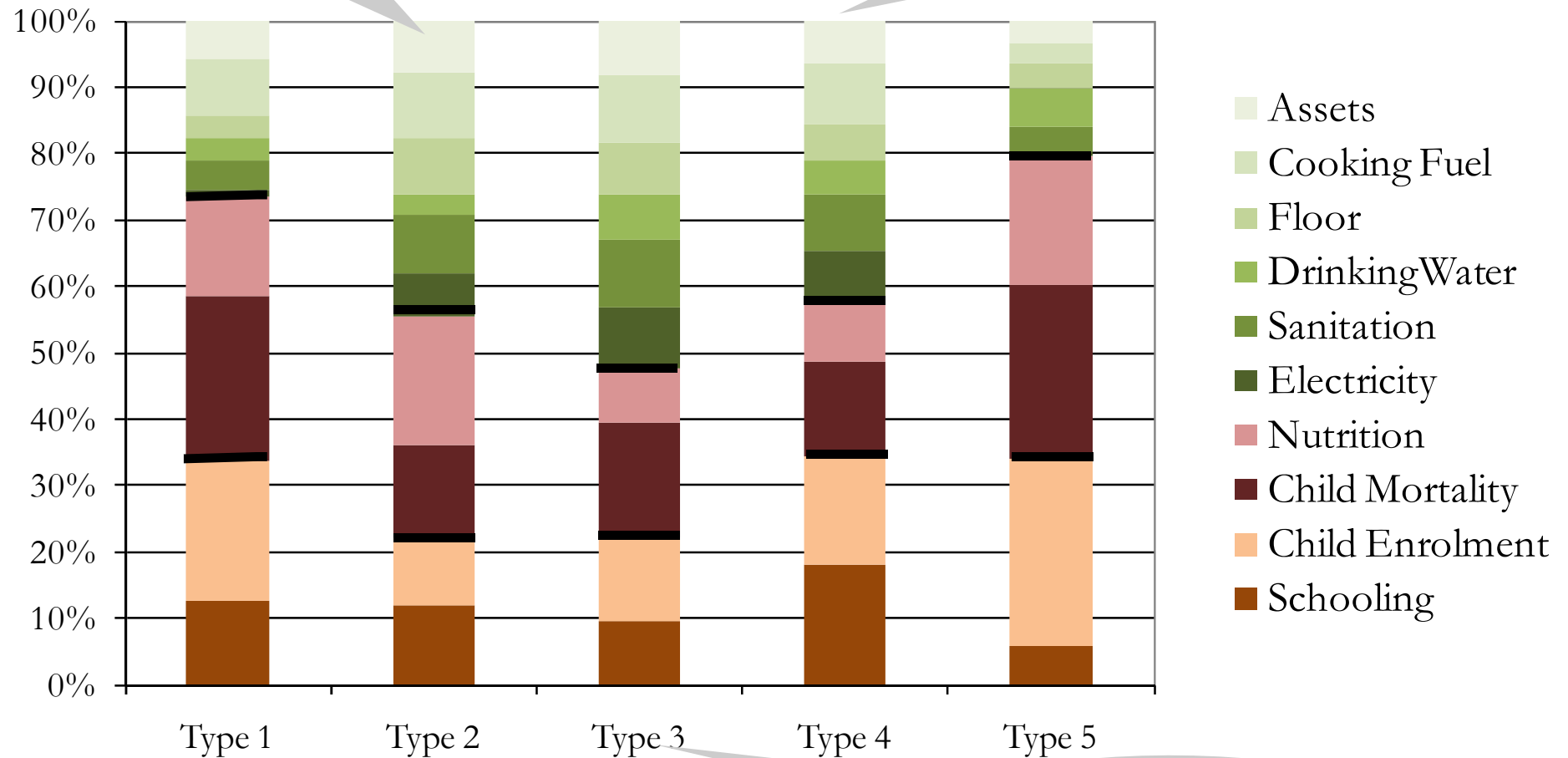


Poverty types
(Roche 2010 for MPI Analysis)

Typologies of Poverty

South Asia

SS Africa



SS Africa

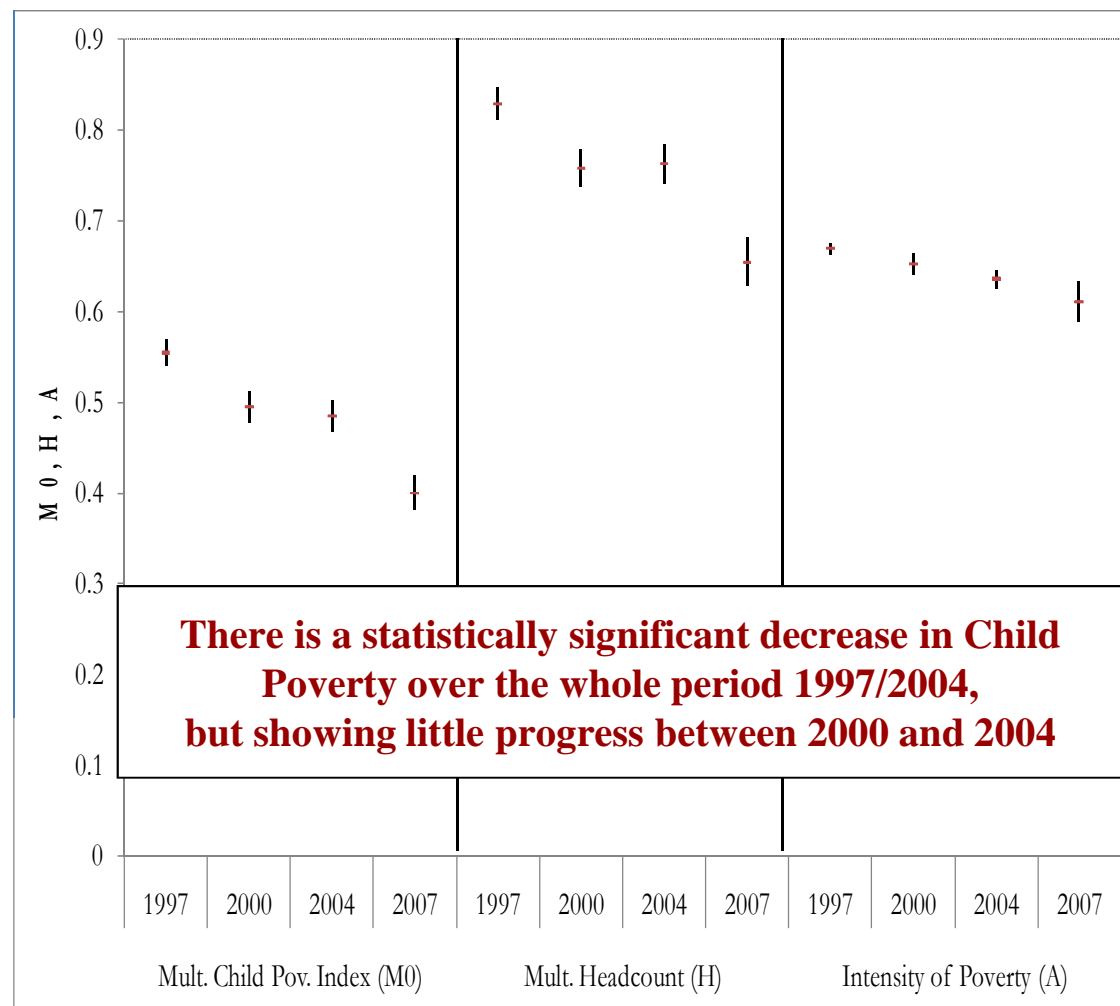
Poverty types

for MPI Analysis)

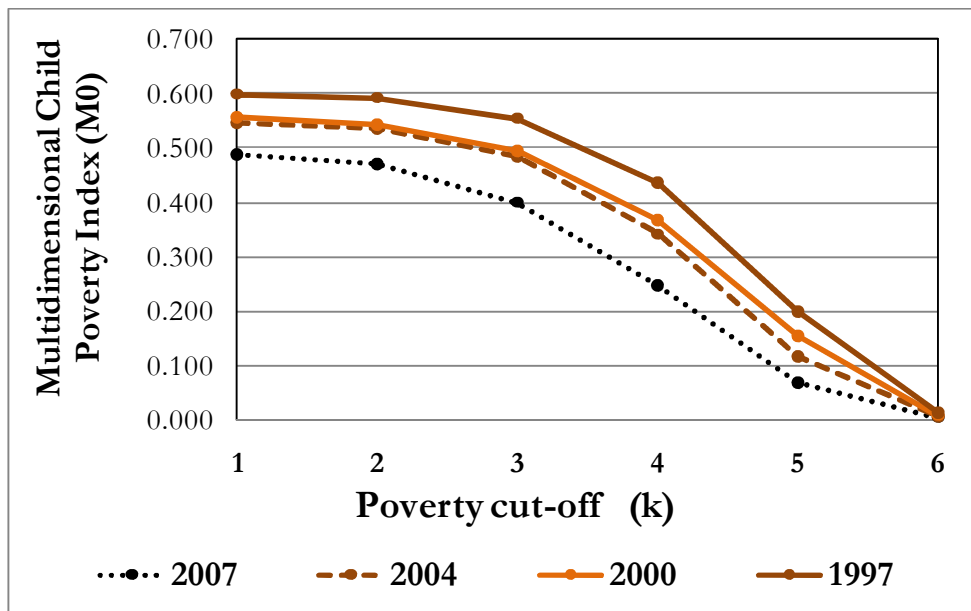
Second policy example: Child Poverty in Bangladesh (Alkire & Roche 2010)

Deprivation	Thresholds for deprivation
Shelter	Children living in a house with no flooring (i.e. a mud or dung floor) or inadequate roofing.
Sanitation	Children using unimproved sanitation facilities. Unimproved sanitation facilities include: pit latrine without slab, open pit latrine, bucket toilet and hanging toilet.
Water	Children using water from an unimproved source such as open wells, open springs or surface water.
Information	Children (aged 3-17 years) with no access to a radio or television (i.e. broadcast media).
Food	Children who are more than two standard deviations below the international reference population for stunting (height for age) or wasting (weight for height) or underweight (weight for age).
Health	Children who have not been immunised by 2 years of age. If the child has not received eight of the following vaccinations they are defined as deprived: bcg, dpt1, dpt2, dpt3, polio0, polio1, polio2, polio3, measles or did not receive treatment for a recent illness involving an acute respiratory infection or diarrhoea.

Confidence interval and changes over time



Child Poverty Measurement (Alkire & Roche 2010)



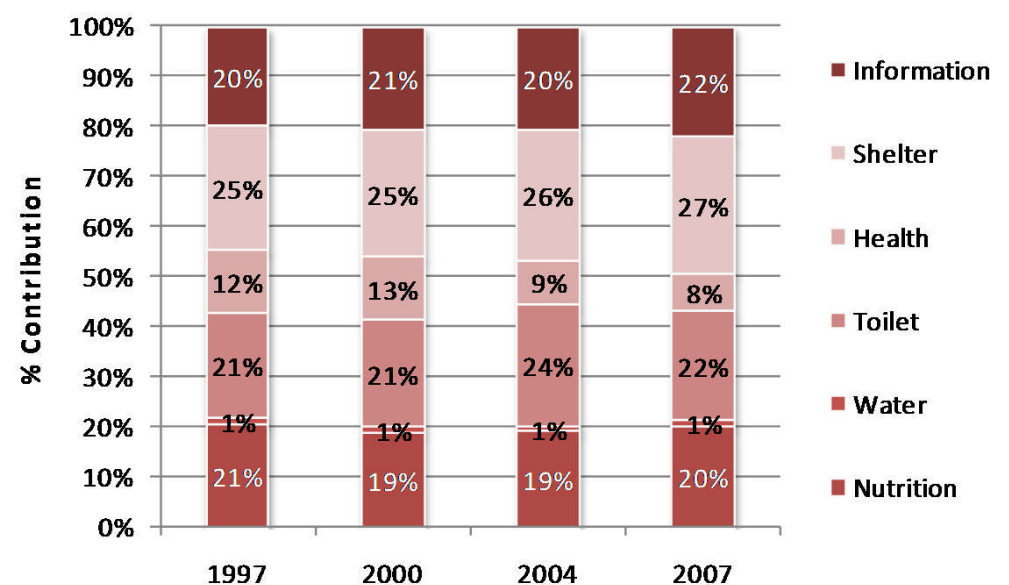
Are the results robust to the choice of k value?

While the difference between 2004 / 07 is not statistically representative, we observed a first order dominance between each year.

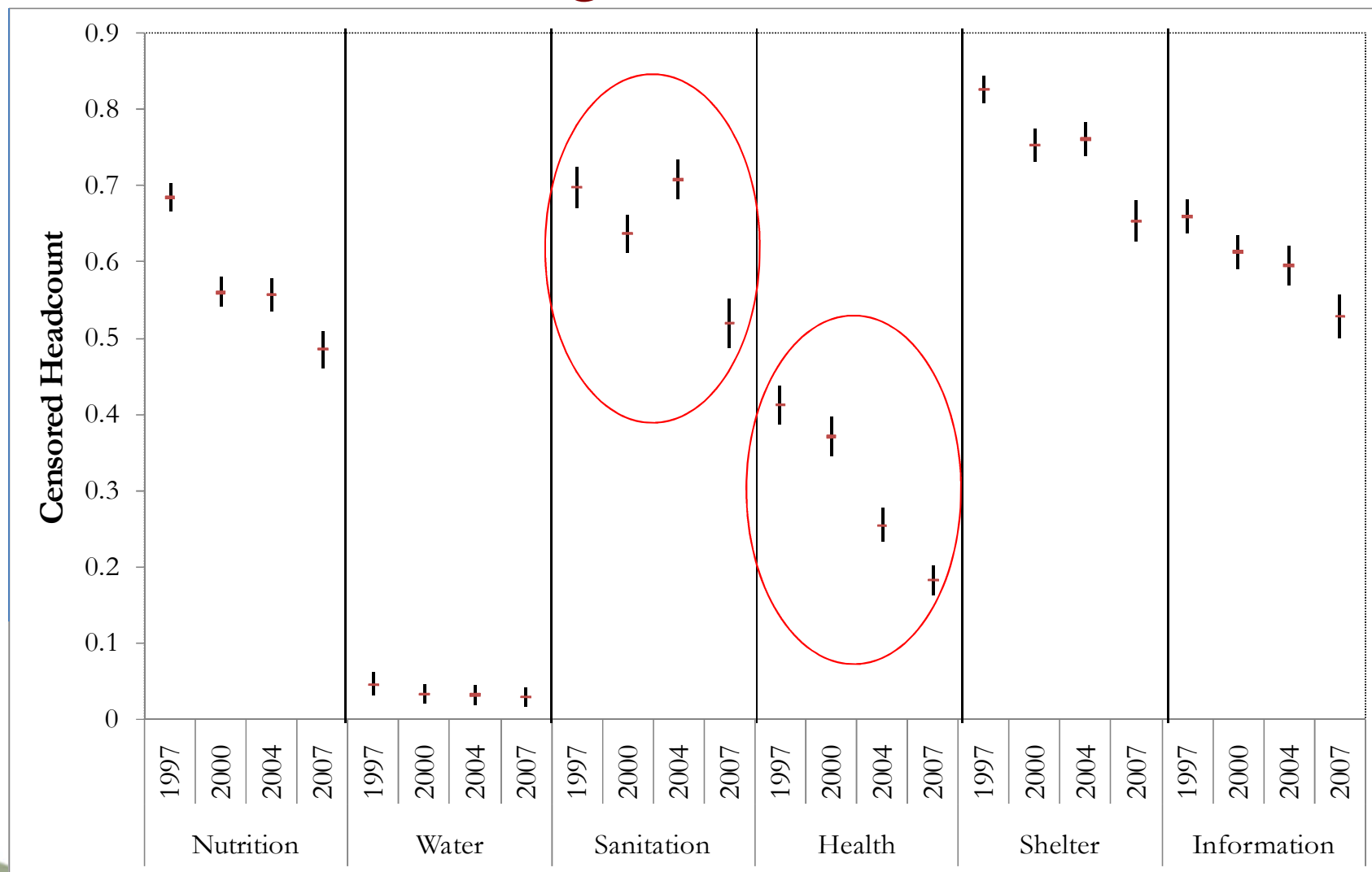
Decomposition by dimension What can we see?

Health show a clear decrease in % of contribution, while toilet increased and then decreased. Shelter increased its contribution.

To understand it better we need to see the censored headcounts

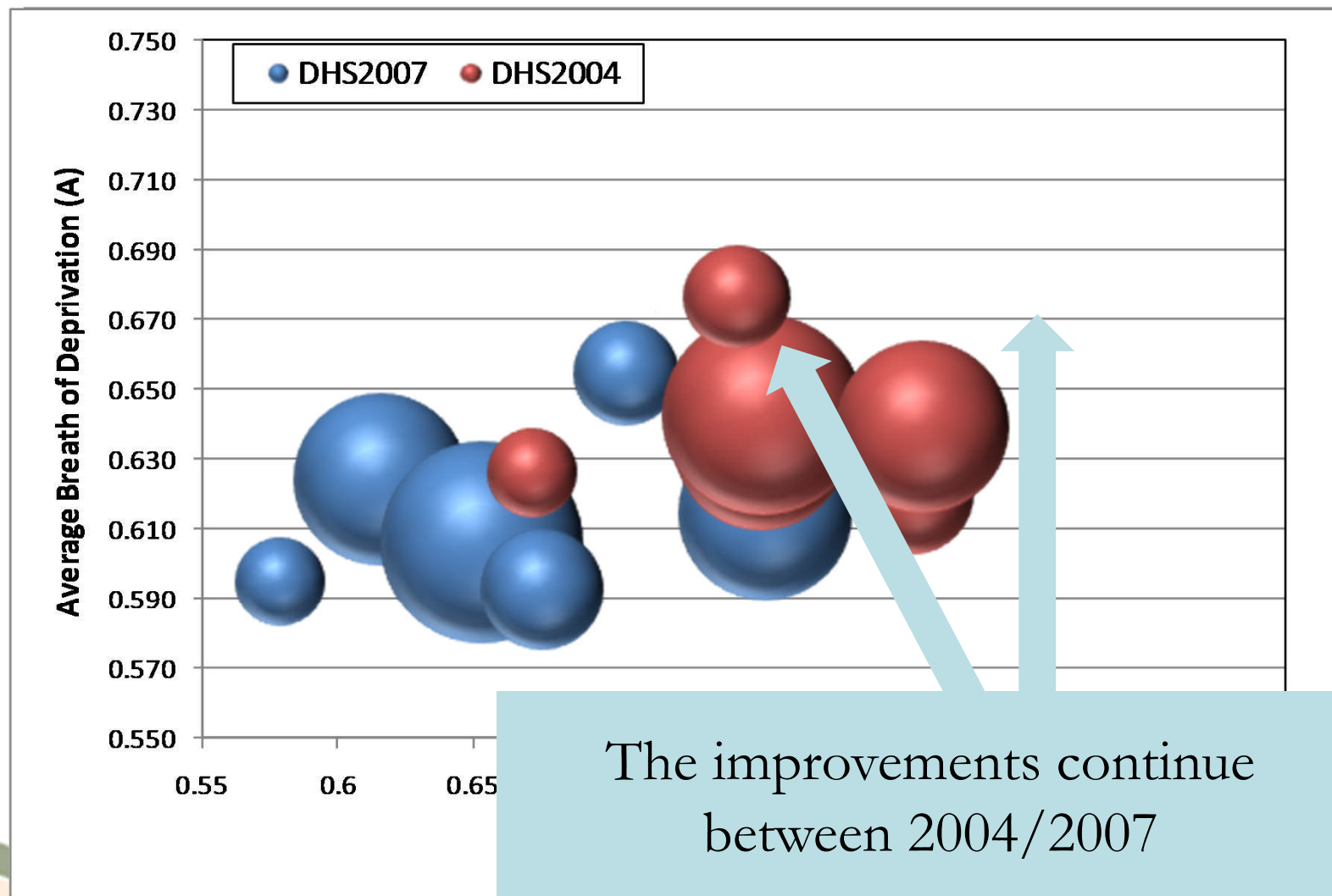


Confidence Intervals for the censored headcount, Bangladesh (k=3)

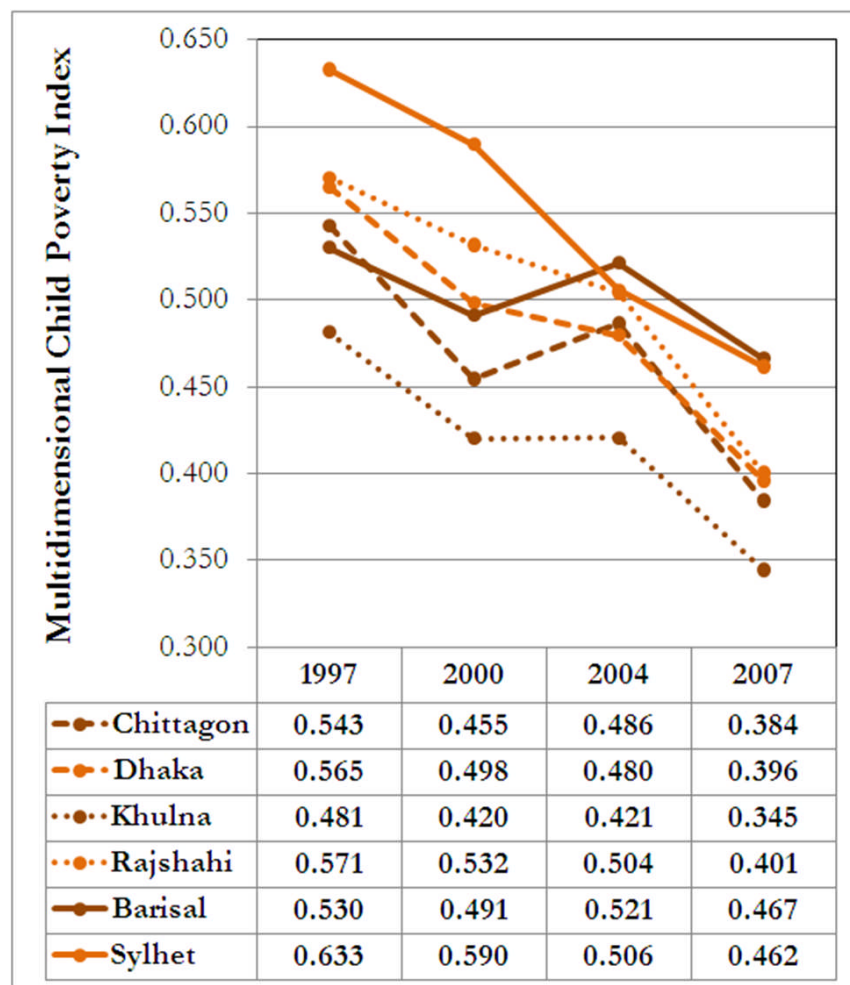


Child Poverty (Alkire & Roche 2010)

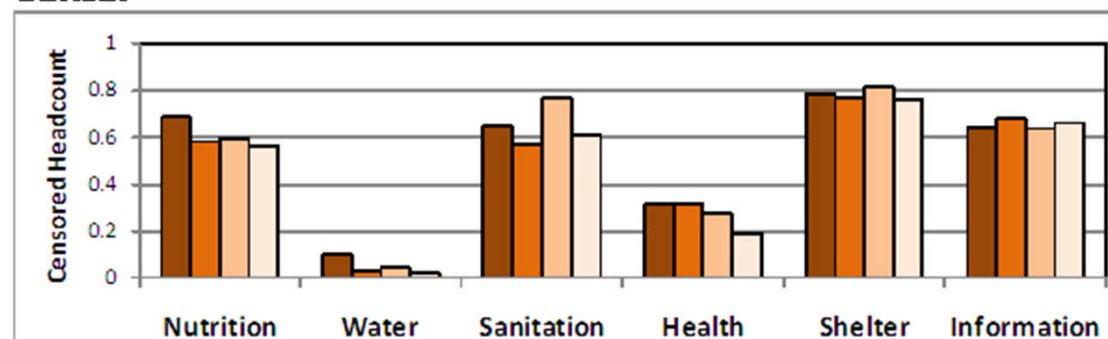
Regional Decomposition and Changes over time ($k = 3$)



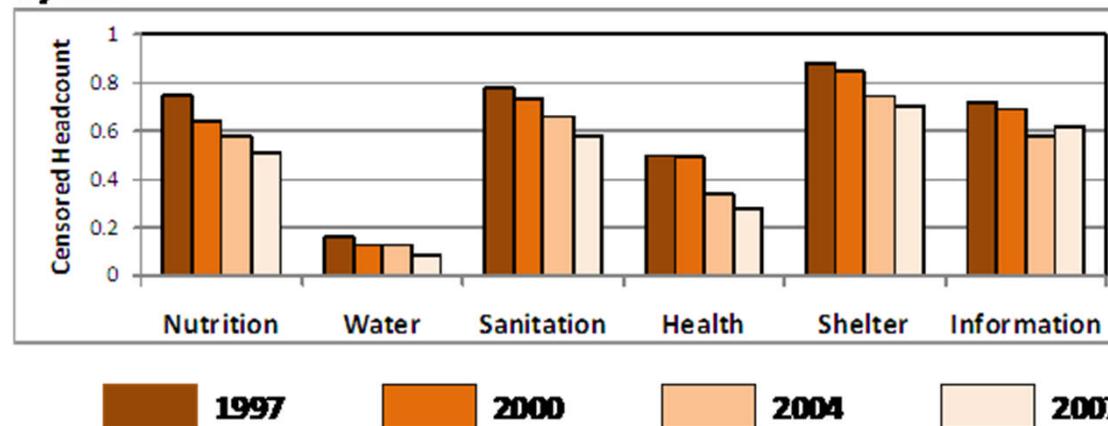
Child Poverty (Alkire & Roche 2010)



Barisal

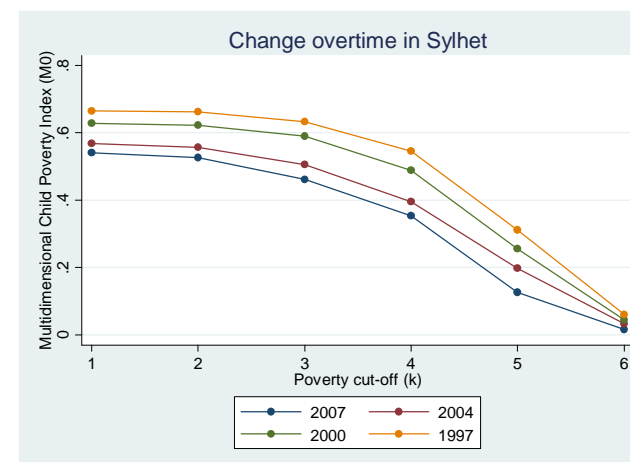
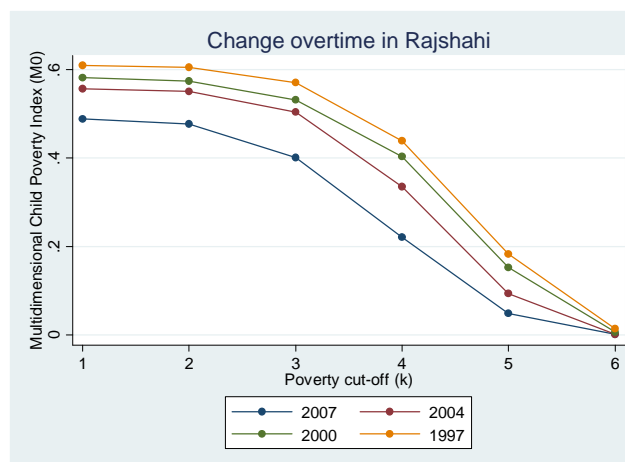
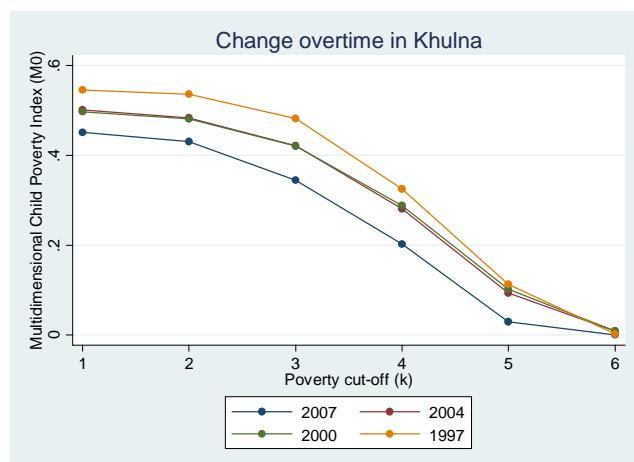
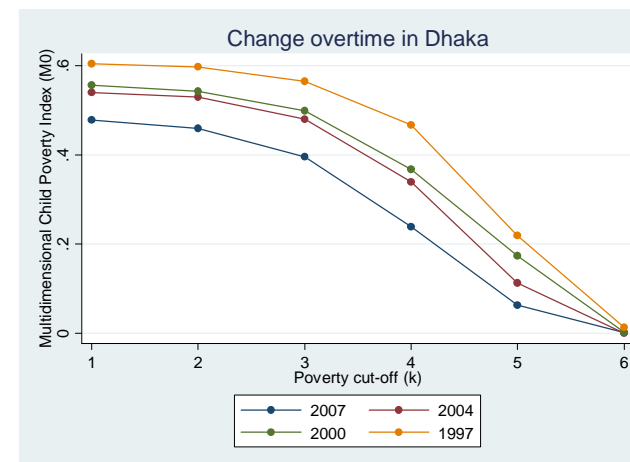
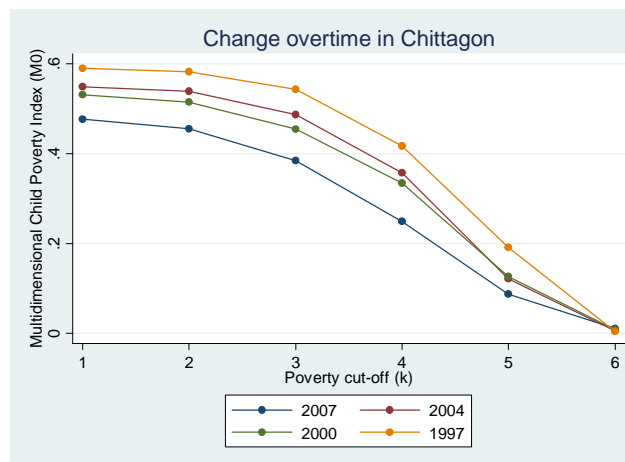
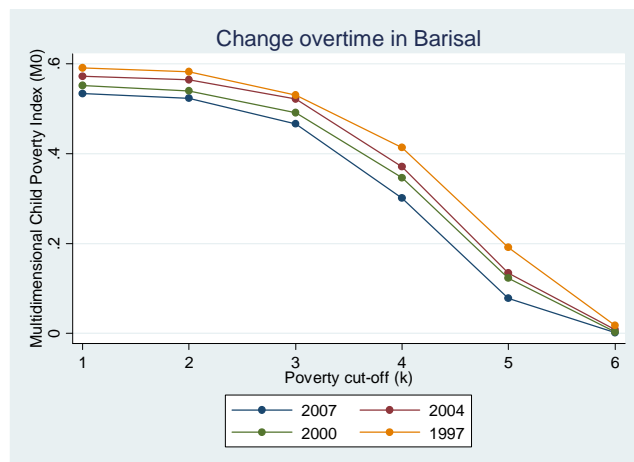


Sylhet



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.

Changes over time by regions in Bangladesh and Robustness checks of different dimensional cut-off (k)

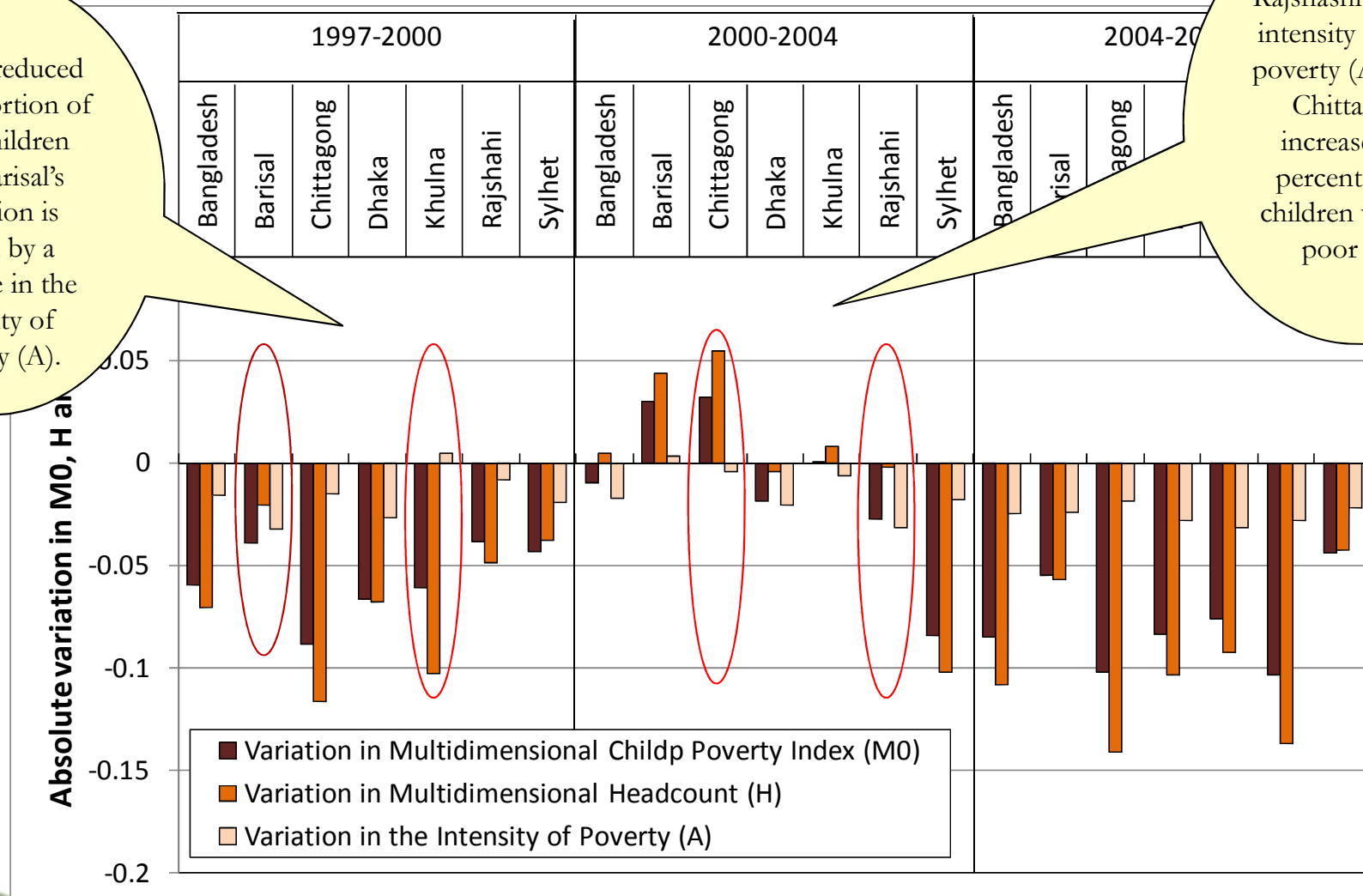


Child Poverty (Alkire & Roche 2010)

Changes in Headcount (H), Intensity of Poverty (A) and Adjusted Headcount (M)

Khulna reduced the proportion of poor children (H). Barisal's reduction is driven by a decrease in the intensity of poverty (A).

Rajshahi reduced intensity of child poverty (A), while Chittagong increased the percentage of children who are poor (H).



Child Poverty (Alkire & Roche 2010)