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Multidimensional Poverty Dynamics: Methodology And Results for 34 Countries

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Motivation

- This paper set out a systemic account of multidimensional poverty dynamic using the Alkire-Foster Adjusted Headcount Ratio and its consistent sub-indices.
- It also scrutinizes three approaches to assessing the pro-poorness of multidimensional poverty reduction.
- These technics were then applied to the analysis of changes in multidimensional poverty based on the Global MPI and related destitution measure.

What is the MPI?

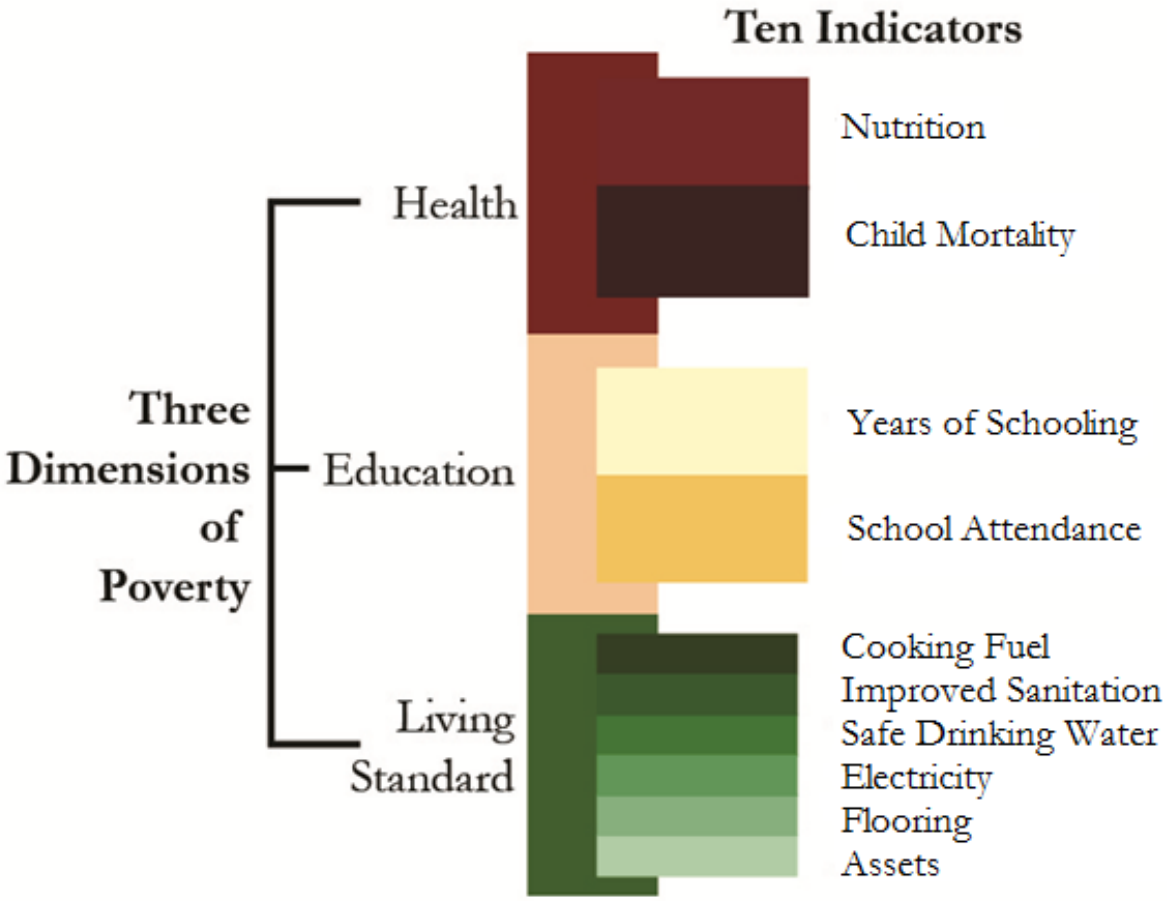
- The MPI is an internationally comparable index of acute poverty for 100+ developing countries.
- It was launched in 2010 in the *Human Development Report*, and updated in 2011, 2013 and 2014.
- The MPI methodology is being adapted for national poverty measures – using better indicators for that policy context.

Data: DHS surveys

- Coverage – poverty dynamics in this paper:
  - 34 countries
  - 338 sub-national regions + disaggregation for ethnic groups for Benin, Kenya and Ghana
  - Roughly 2.5 billion people (2010); on aggregate like Haiti.

- Comparisons across time are as strict as data permit.
- Survey years and intervals vary (2 to 12 years – 30 periods are 4 to 7 years, and for 20 countries most recent data are 2010-12).
- 29 countries have all 10 indicators; 5 have 9 indicators
- Significant updates are in progress.

Dimensions, Weights, Indicators



Dimensions Indicators, Weights, Cutoffs

Dimension (Weight)	Indicator (Weight)	Deprivation Cut-off
Health (1/3)	Nutrition (1/6)	*Any adult or child in the household with nutritional information is undernourished*[1]
	Child mortality (1/6)	*Any child has died in the household*[2]
Education (1/3)	Years of schooling (1/6)	*No household member has completed five years of schooling*
	Child school attendance (1/6)	*Any school-aged child in the household is not attending school up to class 8*[3]
Standard of Living (1/3)	Access to electricity (1/18)	*The household has no electricity*
	Access to improved sanitation (1/18)	*The household´s sanitation facility is not improved or it is shared with other households*
	Access to safe drinking water (1/18)	*The household does not have access to safe drinking water or safe water is more than 30 minutes walk round trip*
	Type of flooring material (1/18)	*The household has a dirt, sand or dung floor*
	Type of cooking fuel (1/18)	*The household cooks with dung, wood or charcoal.*
	Asset ownership (1/18)	*The household does not own more than one of: radio, TV, telephone, bike, motorbike or refrigerator, and does not own a car or truck*

Methodology

- Follows the global MPI, but with the comparable variables
- Uses the AF methodology with nested weights; k=33.33%
- **MPI_T** are rigorously comparable
- Methodology: Chapter 9 of AFSSRB OUP 2015

- Standard errors, sig levels, data tables available **online**
- Implements the **destitution** measure presented next
- A linked paper focuses on measured **growth elasticities**

Paper Structure

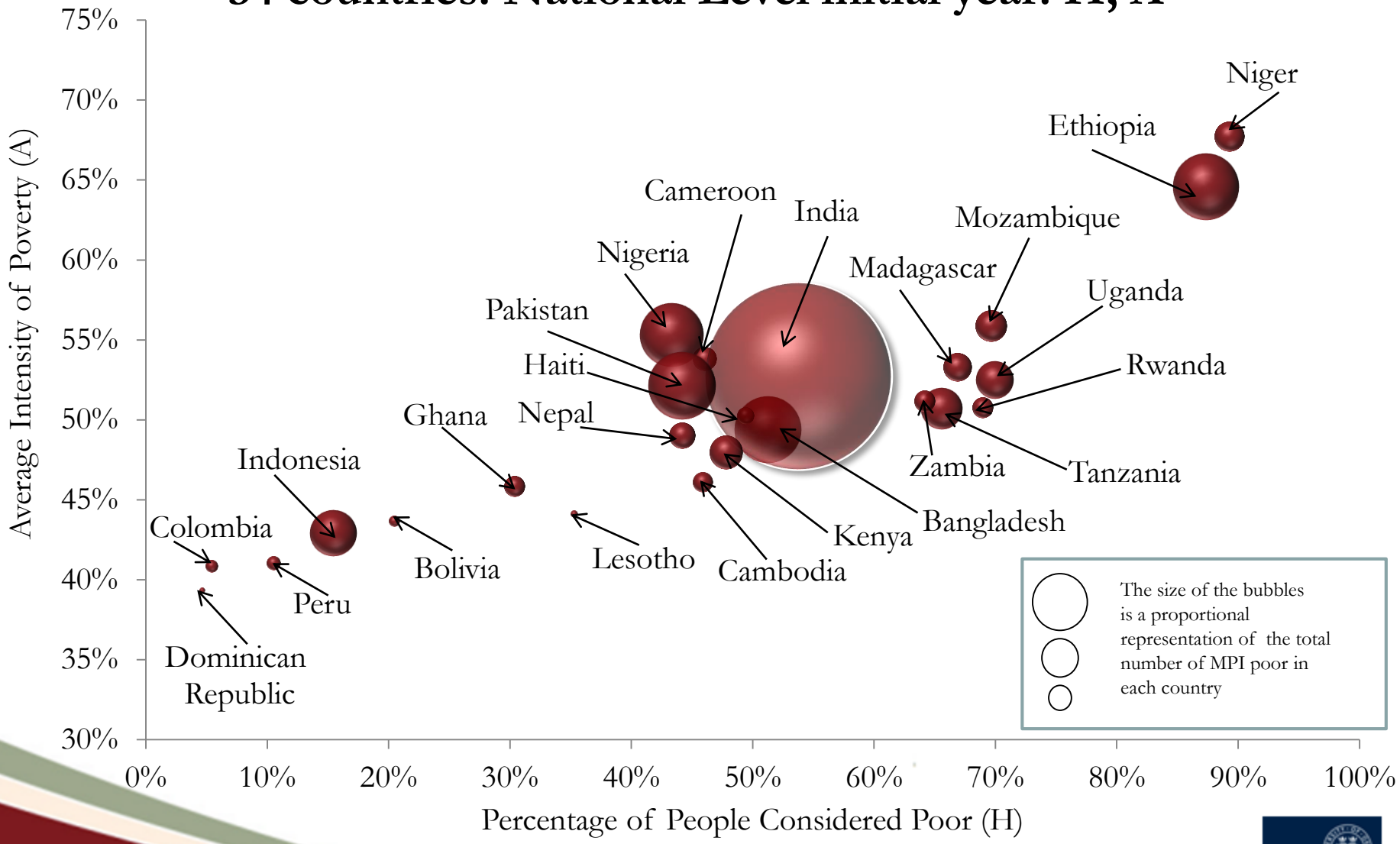
- Overview

- Methodological Detour: Theoretical decompositions

- Closer View: Leaving No One Behind:

  - Changes by Incidence and Intensity
  - Changes by ethnic groups & subnational regions
  - Changes by deprivation (indicator)
  - Reduction of the subset of the poor who are Destitute

34 countries: National Level initial year: H, A

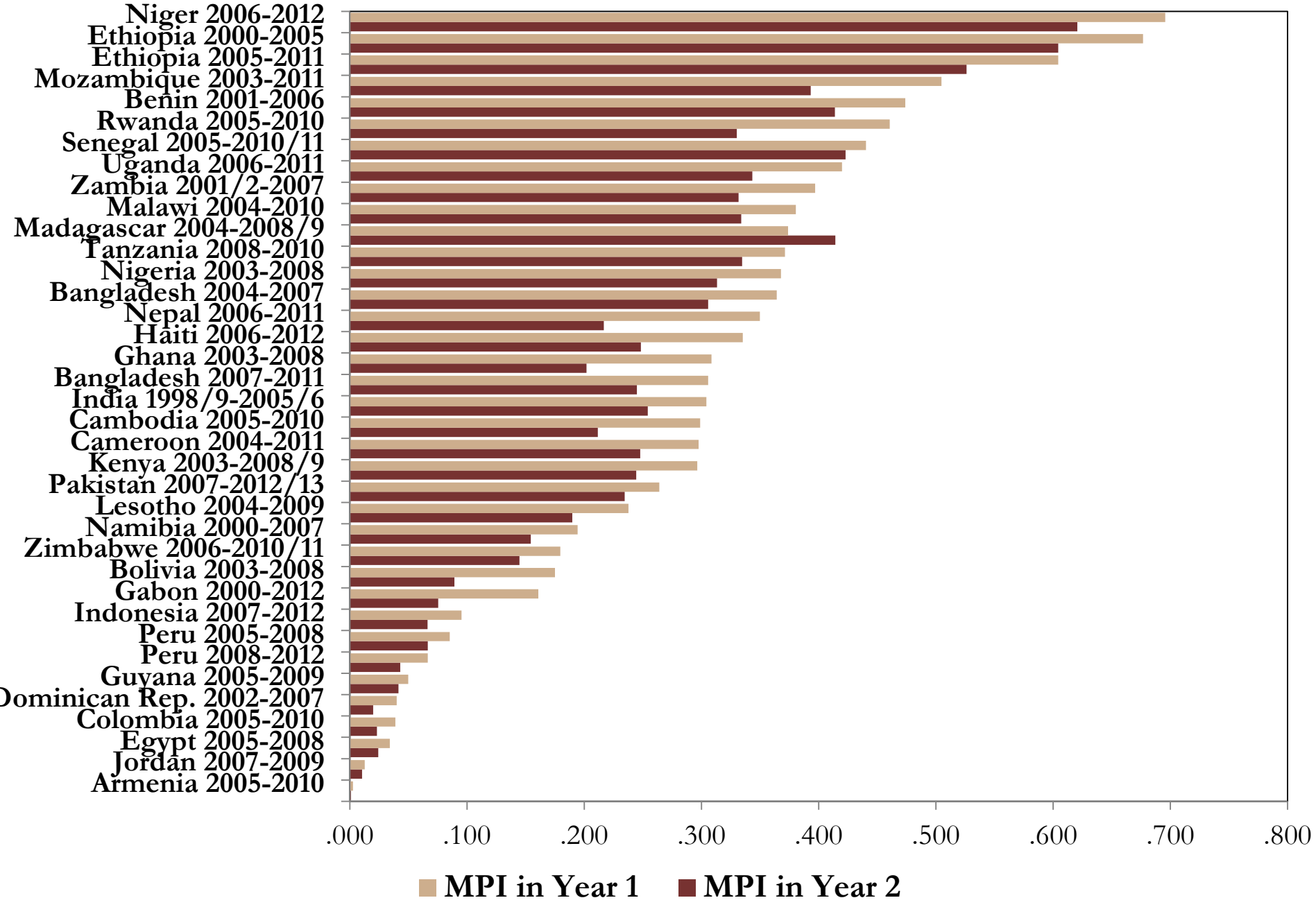


Overview

- 30 countries (98% of covered population) have significant* reductions in MPI by $\alpha = 0.05$; 29 countries by $\alpha = 0.01$.
- Guyana and Peru only at $\alpha = 0.10$
- Jordan and Senegal: no significant reductions
- Madagascar: significant increase in MPI ($\alpha = 0.01$)

* significance refers to full period of comparison, not annualized changes

MPI_T over time



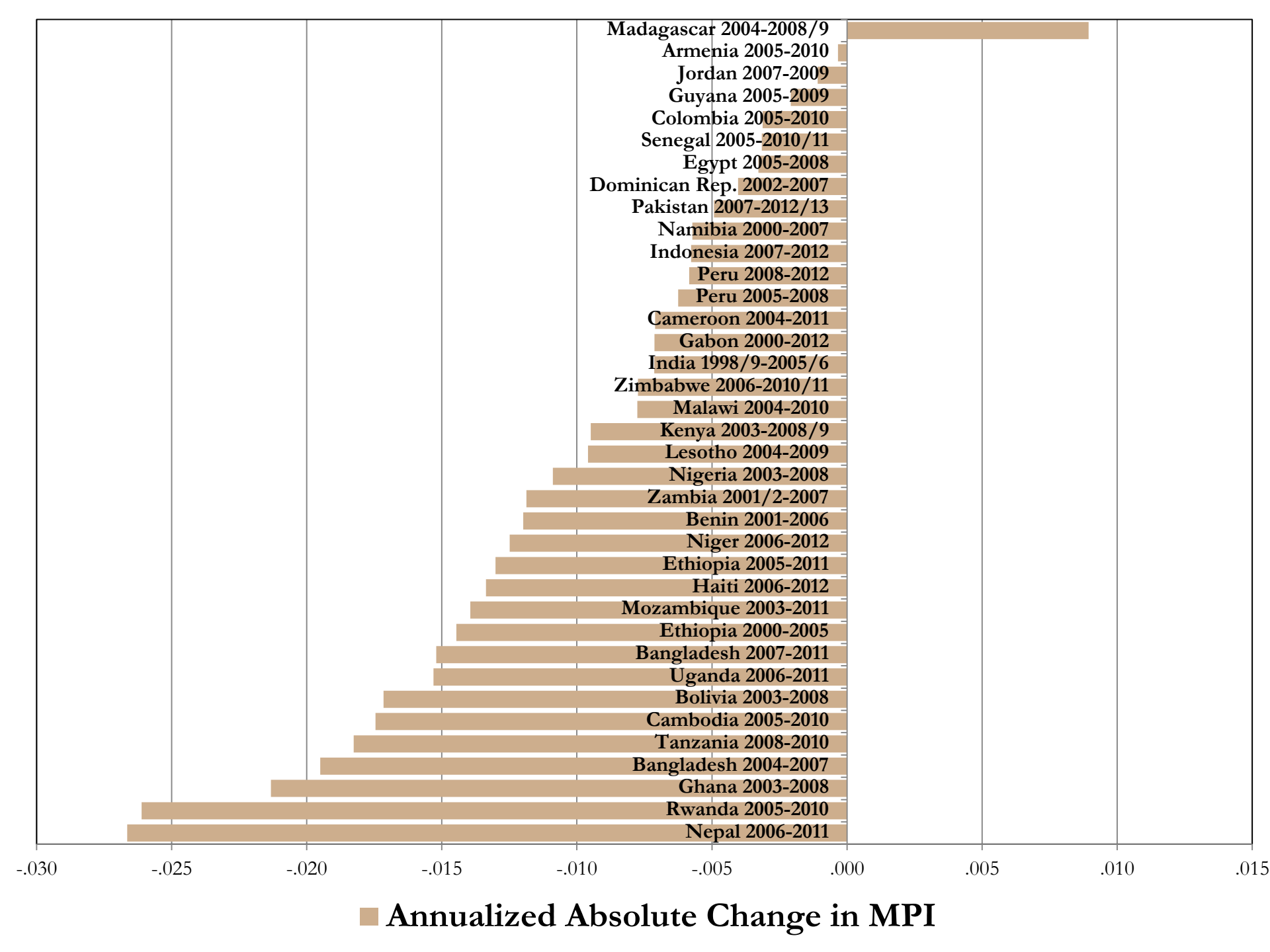
Annualized Changes

- Annualized Absolute Rate of Change: is the difference in levels across two periods divided by the difference in the two time periods.

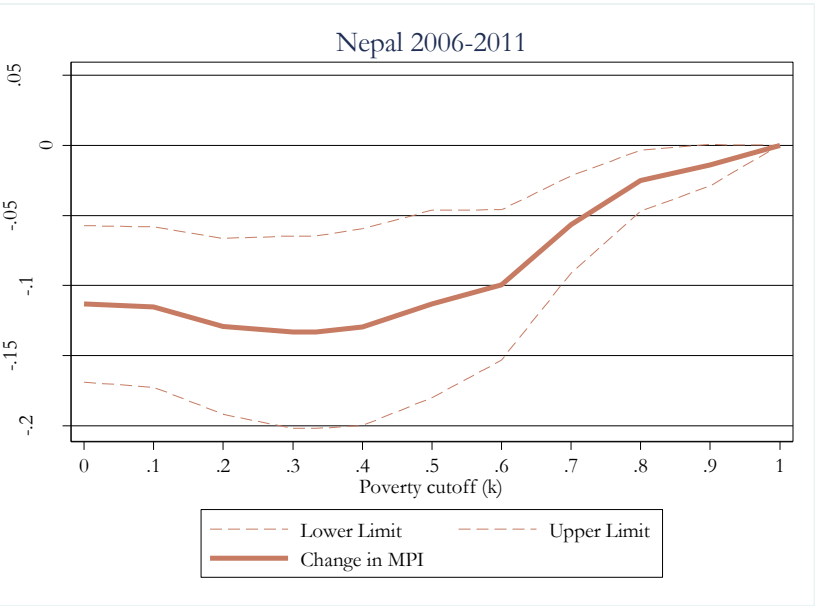
$$\bar{\Delta} M_0 = \frac{M_0(X_{t^2}) - M_0(X_{t^1})}{t^2 - t^1}$$

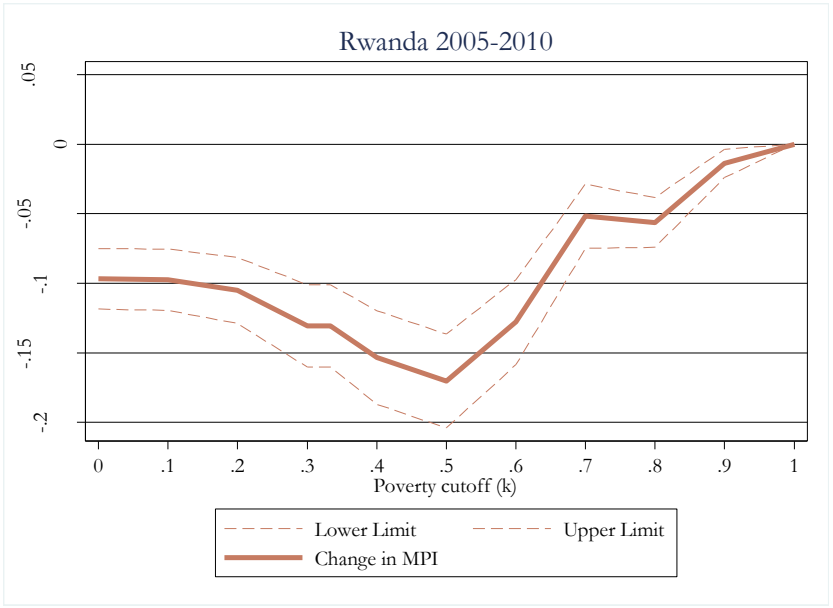
- Relative Rate of Change: is the compound rate of reduction per year between the initial and the final periods.

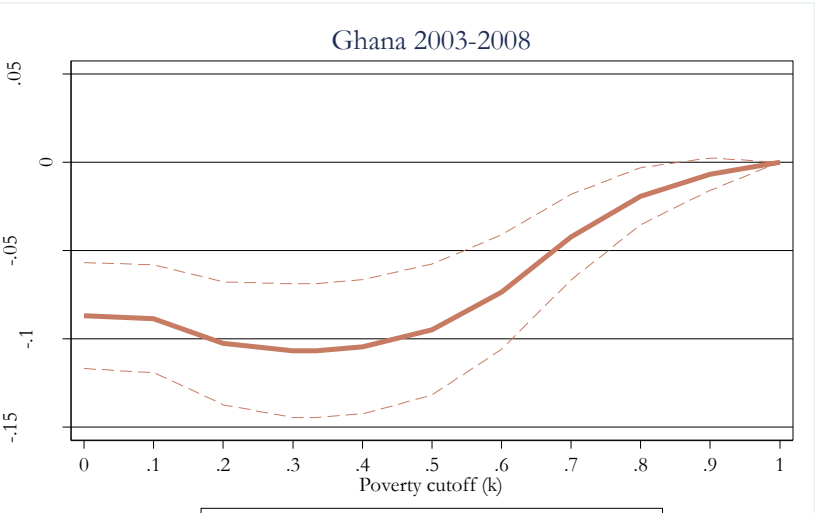
$$\bar{\delta} M_0 = \left[\left(\frac{M_0(X_{t^2})}{M_0(X_{t^1})} \right)^{\frac{1}{t^2 - t^1}} - 1 \right] \times 100$$

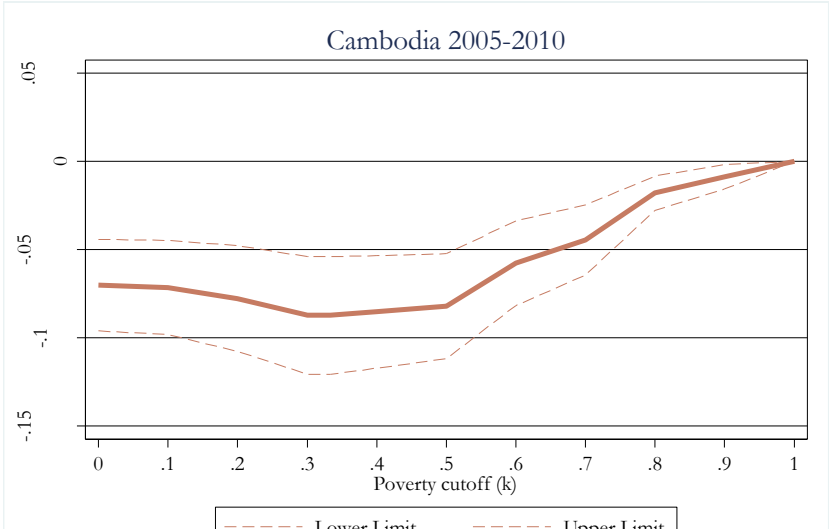

Madagascar 2004-2008/9
Armenia 2005-2010
Jordan 2007-2009
Guyana 2005-2009
Colombia 2005-2010
Senegal 2005-2010/11
Egypt 2005-2008
Dominican Rep. 2002-2007
Pakistan 2007-2012/13
Namibia 2000-2007
Indonesia 2007-2012
Peru 2008-2012
Peru 2005-2008
Cameroon 2004-2011
Gabon 2000-2012
India 1998/9-2005/6
Zimbabwe 2006-2010/11
Malawi 2004-2010
Kenya 2003-2008/9
Lesotho 2004-2009
Nigeria 2003-2008
Zambia 2001/2-2007
Benin 2001-2006
Niger 2006-2012
Ethiopia 2005-2011
Haiti 2006-2012
Mozambique 2003-2011
Ethiopia 2000-2005
Bangladesh 2007-2011
Uganda 2006-2011
Bolivia 2003-2008
Cambodia 2005-2010
Tanzania 2008-2010
Bangladesh 2004-2007
Ghana 2003-2008
Rwanda 2005-2010
Nepal 2006-2011
-.030
-.025
-.020
-.015
-.010
-.005
.000
.005
.010
.015
Annualized Absolute Change in MPI

Note: robustness tests online (e.g. for *k*)





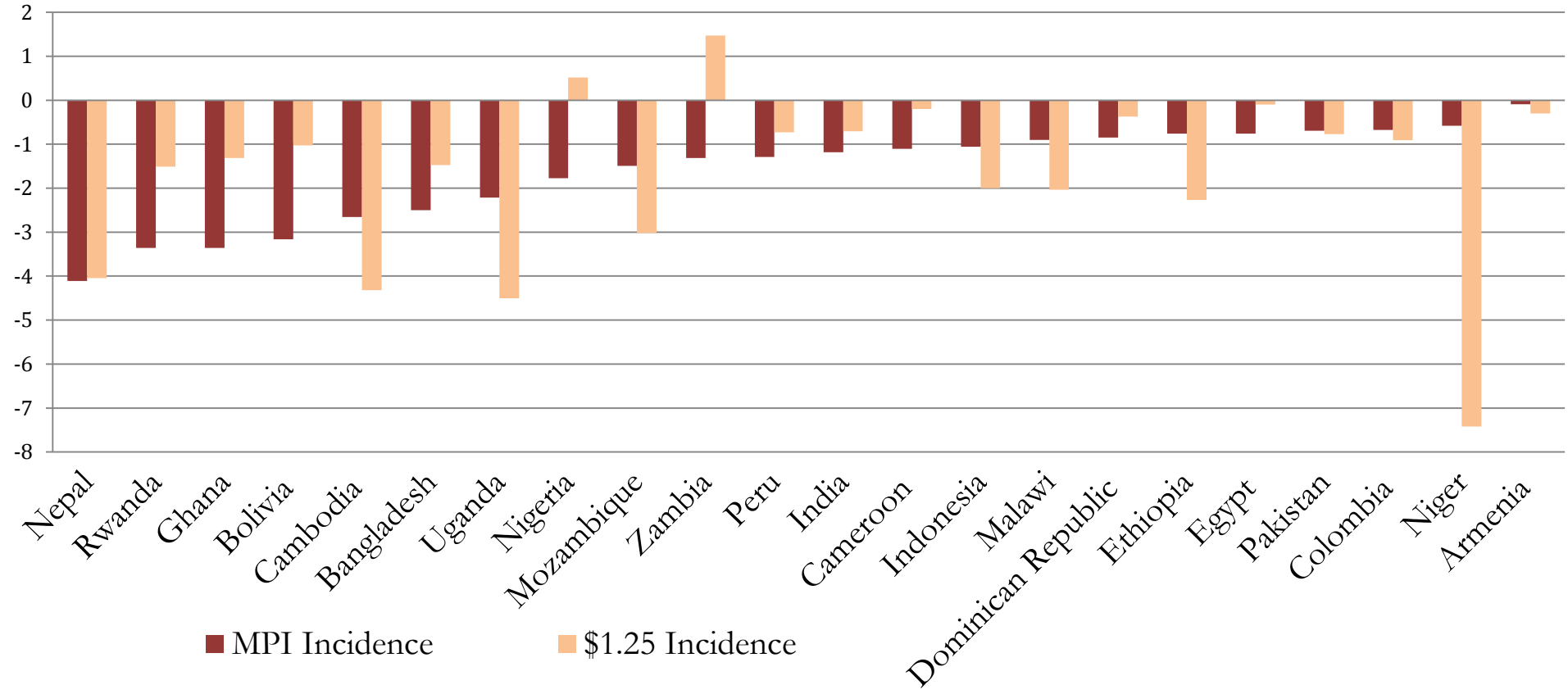




MPI (H) and $1.25/day Income poverty (H)

- Matching years available for 7 countries (Armenia, Colombia, Dominican Republic, Egypt, Ethiopia, Malawi: in 4 of these rate of $1.25/day reduction exceeds MPI reduction)
- Linear interpolation or extrapolation used for $1.25/day for 18 countries
- Total of 22 comparisons that reduced MPI (H) significantly.
- Initial levels of MPI (H) exceeded income poverty (H) in 19 of 25 countries.
- Reduction patterns are not identical, so require further study.

MPI (H) and $1.25/day Income poverty (H)



Methodological Interlude:

Dynamic Subgroups Analysis using repeated Cross-Sectional data

Dynamic Subgroups – Repeated Cross-Section Data

- It is impossible to decompose ΔM_0 with the empirical precision as when using panel data
- However we do care about the extent to which the **poorest of the poor** reduced the **intensity** of their poverty or **exited** poverty.
- Consider 2 groups:

Movers: those who changed status across periods (ΔH)

Stayers: ongoing poor plus the proportion of previously poor people who were replaced by 'new poor' ($H(X_{t^2})$)

Change in M_0

- If poverty reduced and the group of people who entered poverty is empirically small (assumptions)
- Change in M_0 can be decomposed as follows:

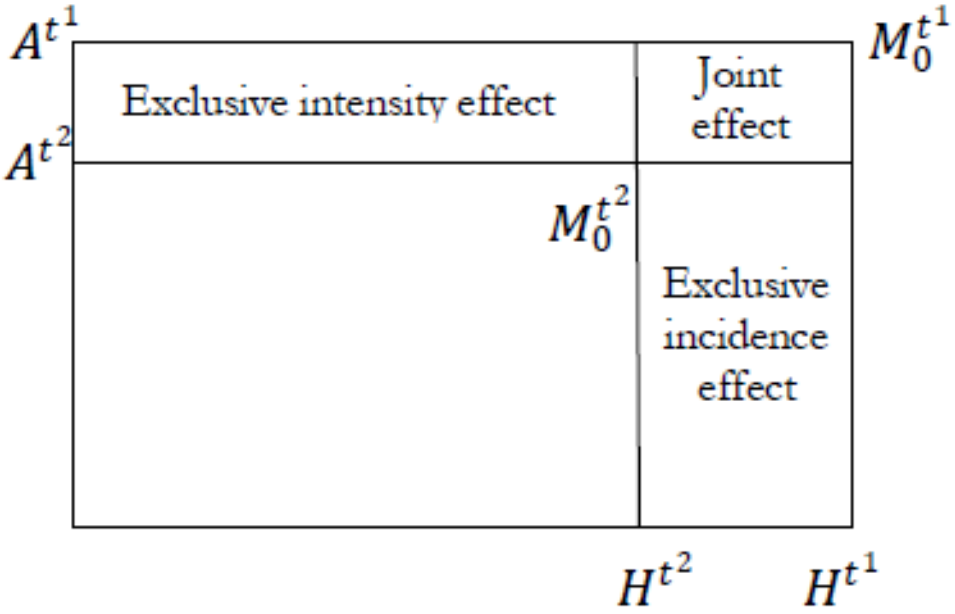
$$\Delta M_0 = \underbrace{\Delta H \times A^{\hat{E}}}_{\text{Movers Effect}} + \underbrace{H(X_{t^2}) \times \Delta A^{\hat{O}}}_{\text{Stayers Effect}}$$

How to obtain $A^{\hat{E}}$ and $A^{\hat{O}}$?

Apablaza and Yalonetzky

Assumptions:

- $A^{\hat{E}}$ is assumed to be the **average intensity** in period 2.
- $\Delta A^{\hat{O}}$ is assumed to equal the **simple difference in intensities** of the poor across the two periods



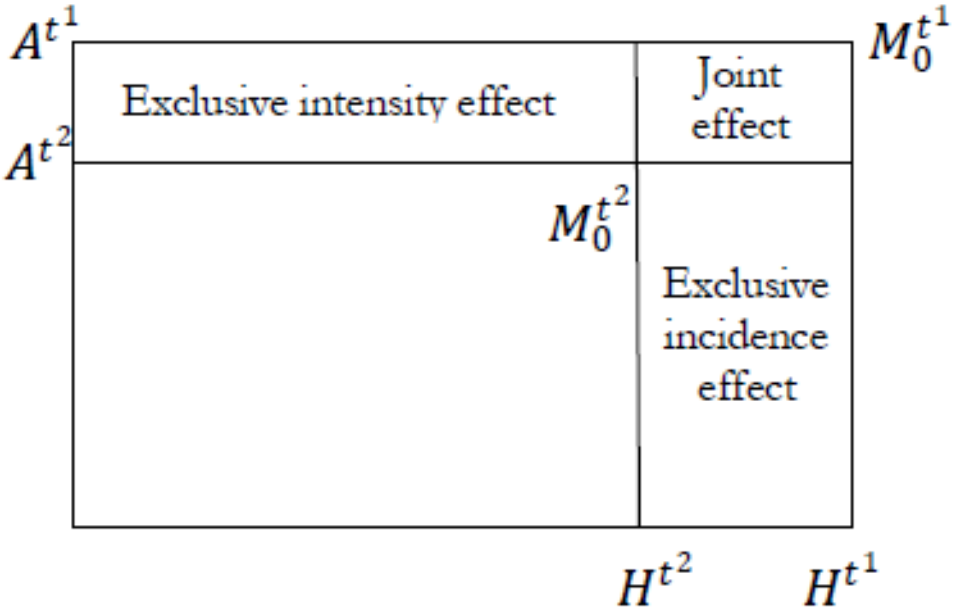
Apablaza and Yalonetzky

$$\Delta M_0 = A^{t^2}\Delta H + H^{t^2}\Delta A + \left(H^{t^2} - H^{t^1}\right)\left(A^{t^2} - A^{t^1}\right)$$

Effect from entry and exit

Effect among ongoing poor

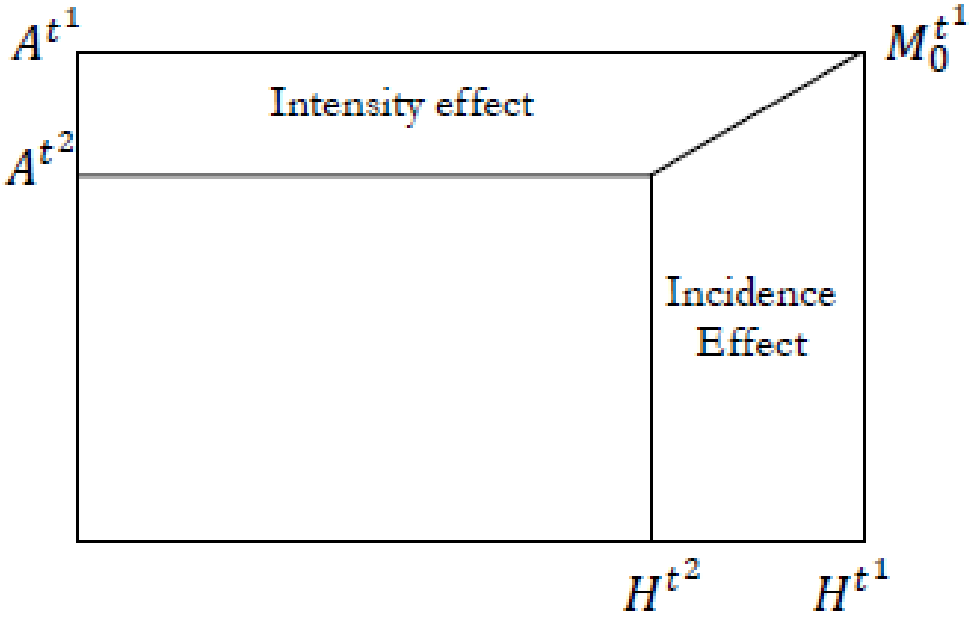
Interaction effect



Roche – Shapley Decomposition

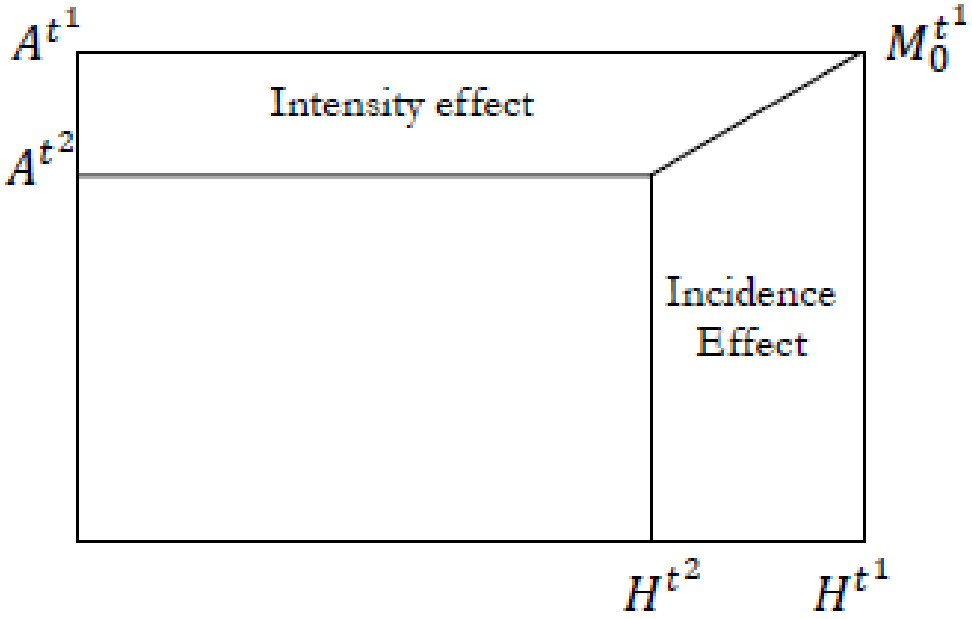
Assumptions:

- $A^{\hat{E}}$ is assumed to be the **average intensity** for the two periods.
- The percentage of ongoing poor is assumed to be the **average incidence** for the two periods



Roche – Shapley Decomposition

$$\Delta M_0 = \underbrace{\frac{A^{t^2} + A^{t^1}}{2}\Delta H}_{\text{Incidence effect}} + \underbrace{\frac{H^{t^2} + H^{t^1}}{2}\Delta A}_{\text{Intensity effect}}$$



Upper and Lower Estimates - empirical

Estimate lower and upper bound estimates for $A^{\hat{E}}$, $\Delta A^{\hat{O}}$

If less poor people moved out of poverty

- Identify the $\Delta H \times n$ poor persons having the lowest intensity
- Use the average of those scores for $A^{\hat{E}}$ then solve for $A^{\hat{O}}$

If poorest people moved out of poverty

- Identify the $\Delta H \times n$ poor persons having the highest intensity
- Use the average of those scores for $A^{\hat{E}}$ then solve for $A^{\hat{O}}$

Example

	Upper Bound				Lower Bound			
Country	A Movers	ΔA Stayers	Movers Effect	Stayers Effect	A Movers	ΔA Stayers	Movers Effect	Stayers Effect
Ethiopia 2005-2011	0.99	-0.03	68.7%	31.3%	0.38	-0.07	26.6%	73.4%
Nepal 2006-2011	0.74	0.04	113.4%	-13.4%	0.38	-0.13	58.2%	41.8%
Peru 2005-2008	0.59	0.02	119.5%	-19.5%	0.33	-0.04	67.1%	32.9%
Rwanda 2005-2010	0.78	0	101.4%	-1.4%	0.36	-0.1	47.1%	52.9%
Senegal 2005-2010/11	1	-0.02	26.8%	73.2%	0.33	-0.02	8.9%	91.1%

- The upper and lower bounds are wide apart and vary across countries.
- The real contributions could vary within this range.
- Can we guess which effect had the biggest contribution? Not necessarily (Ethiopia, Rwanda)

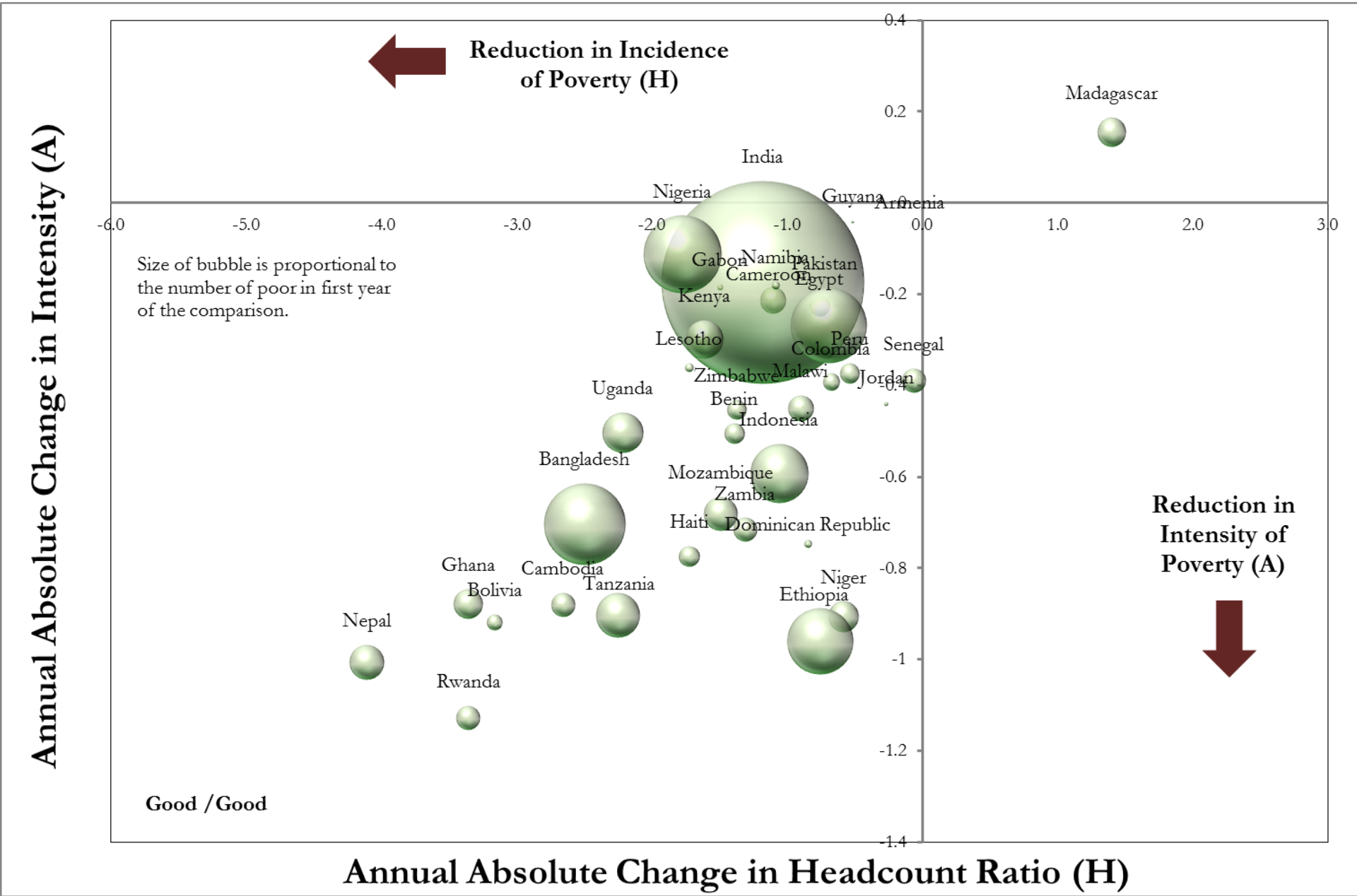
Example: Shapley

	Upper Bound				Lower Bound				Decomposition	
Country	A Movers	ΔA Stayers	Movers Effect	Stayers Effect	A Movers	ΔA Stayers	Movers Effect	Stayers Effect	Incidence Effect H	Intensity Effect A
Ethiopia 2005-2011	0.99	-0.03	68.7%	31.3%	0.38	-0.07	26.6%	73.4%	45%	55%
Nepal 2006-2011	0.74	0.04	113.4%	-13.4%	0.38	-0.13	58.2%	41.8%	79%	21%
Peru 2005-2008	0.59	0.02	119.5%	-19.5%	0.33	-0.04	67.1%	32.9%	86%	14%
Rwanda 2005-2010	0.78	0	101.4%	-1.4%	0.36	-0.1	47.1%	52.9%	68%	32%
Senegal 2005-2010/11	1	-0.02	26.8%	73.2%	0.33	-0.02	8.9%	91.1%	16%	84%

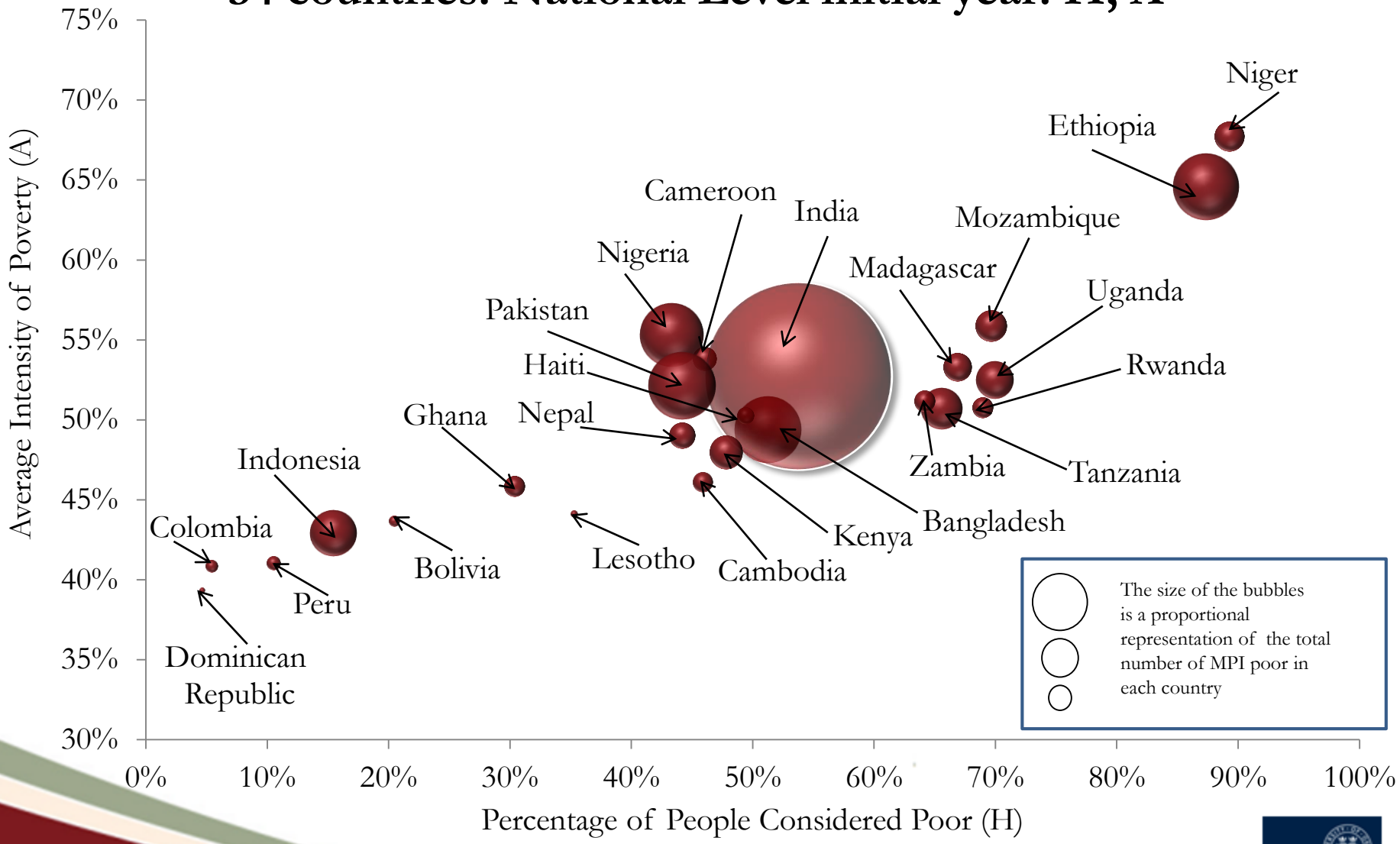
- Shapley decomposition lies between the upper and lower bounds.
- Shapley decomposition has the appeal of appearing to provide point estimates.
- But the underlying assumptions are strong and not validated.

It may be better to be 'vaguely right than precisely wrong'.

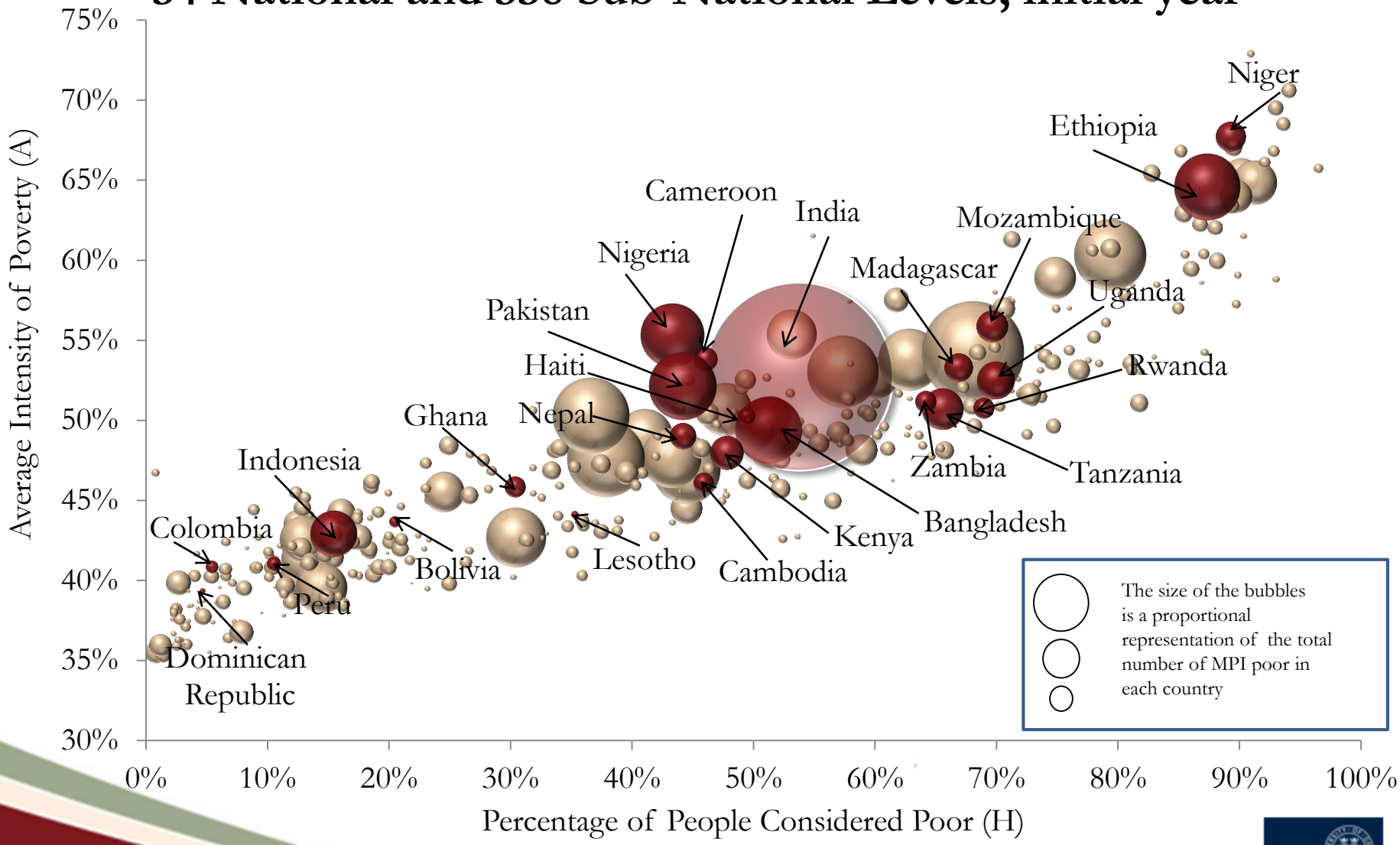
Reductions in Headcount ratio H and Intensity A



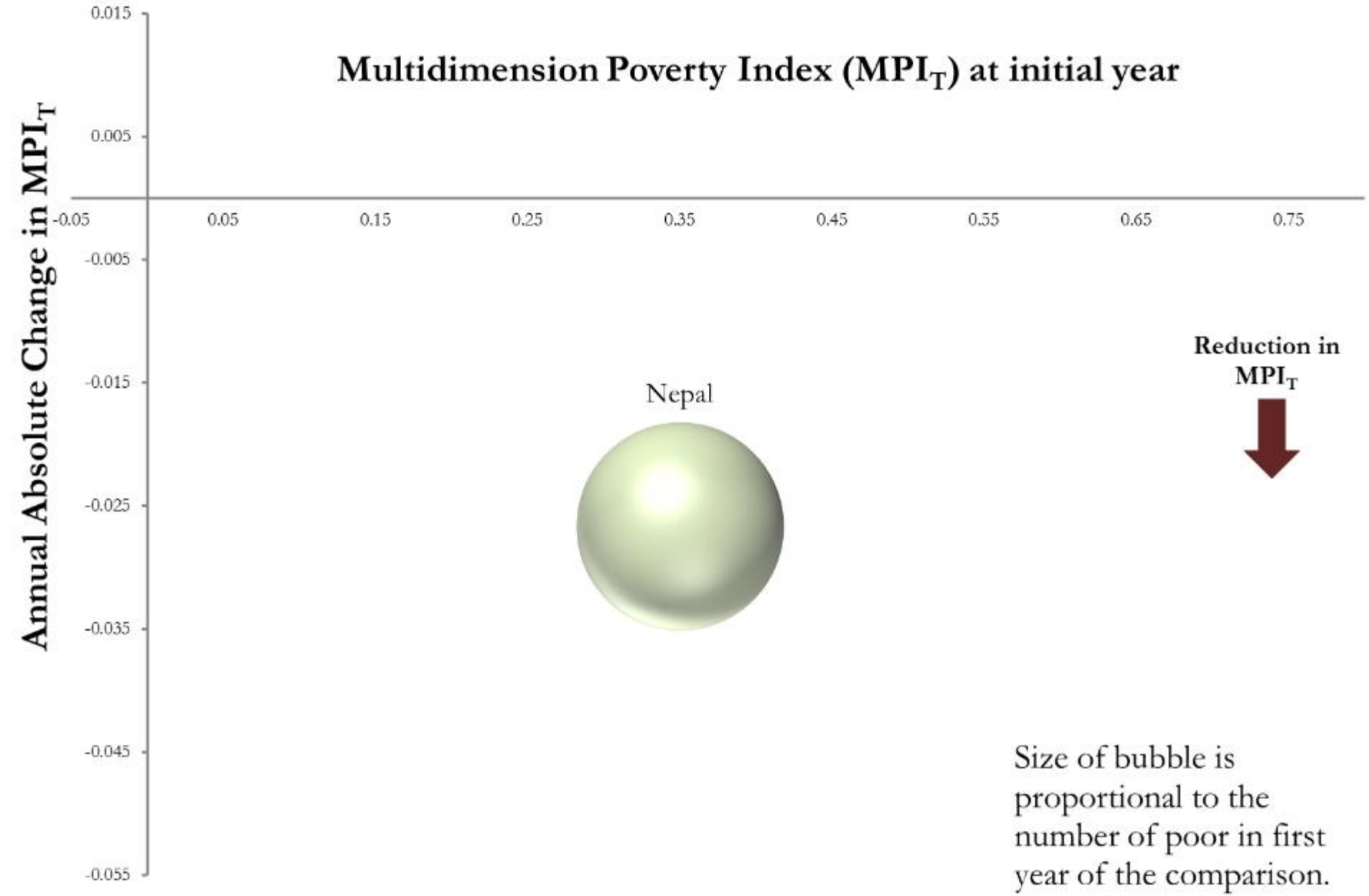
34 countries: National Level initial year: H, A



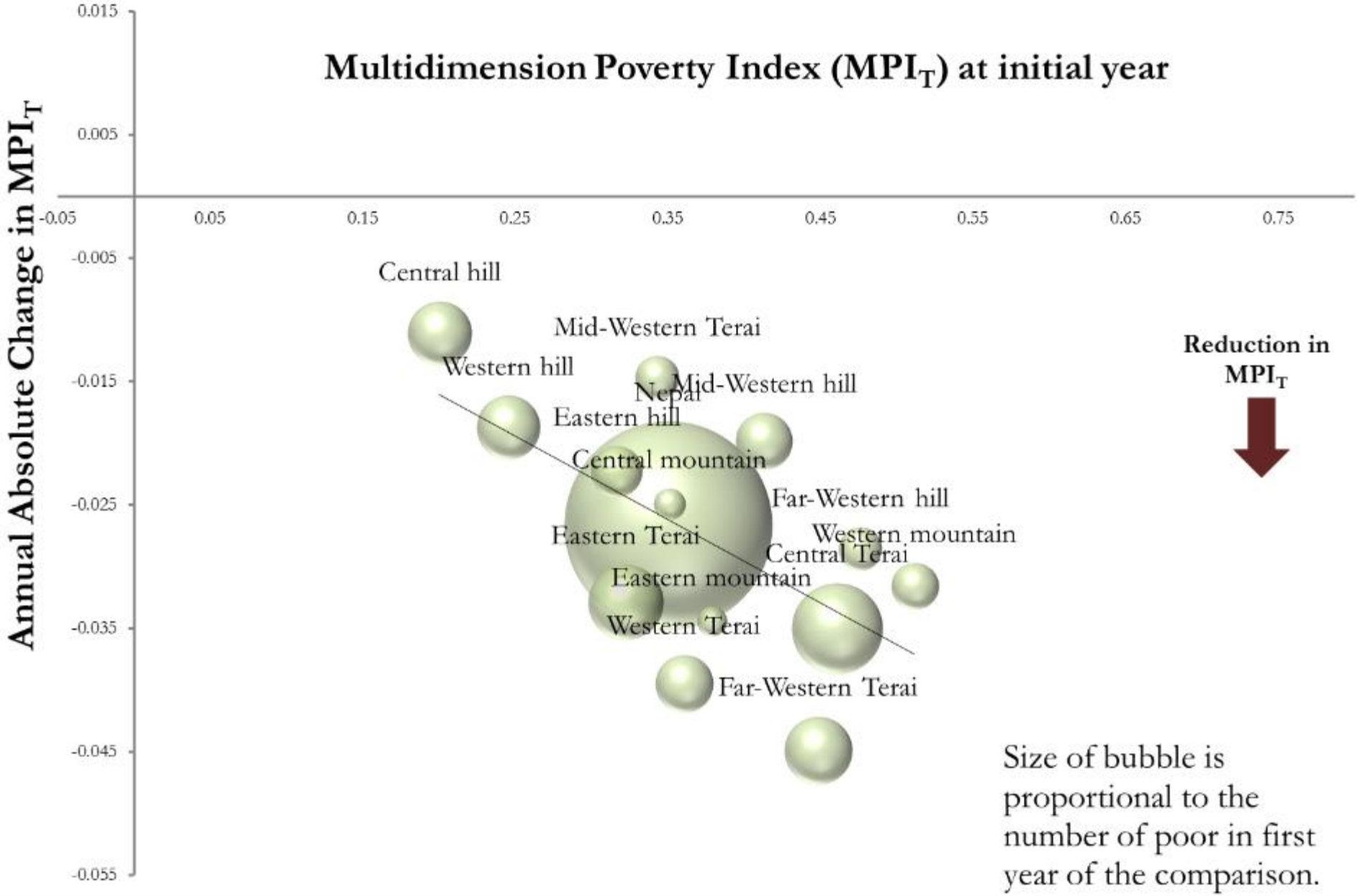
34 National and 338 Sub-National Levels, initial year



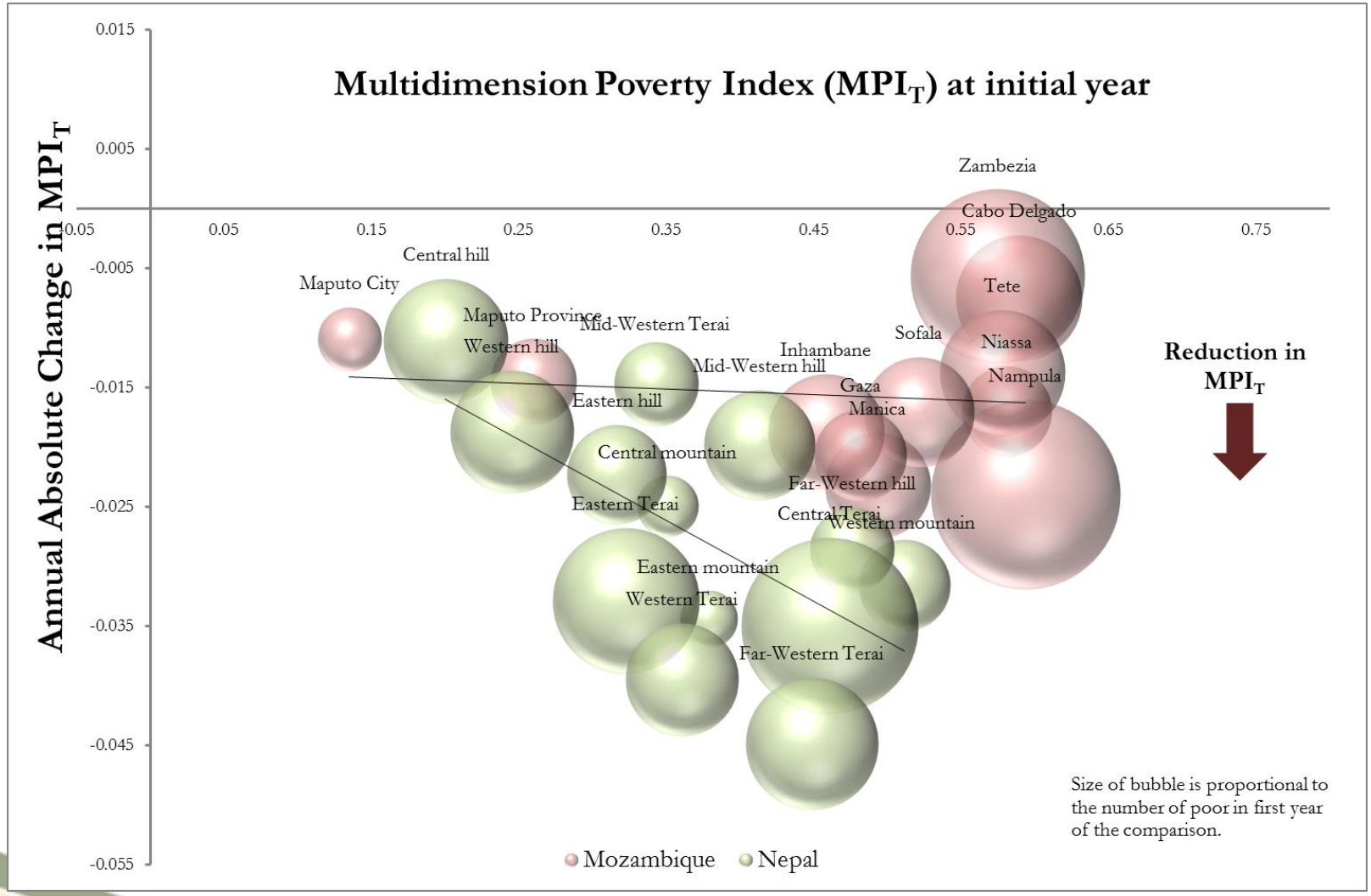
Subgroup Decompositions



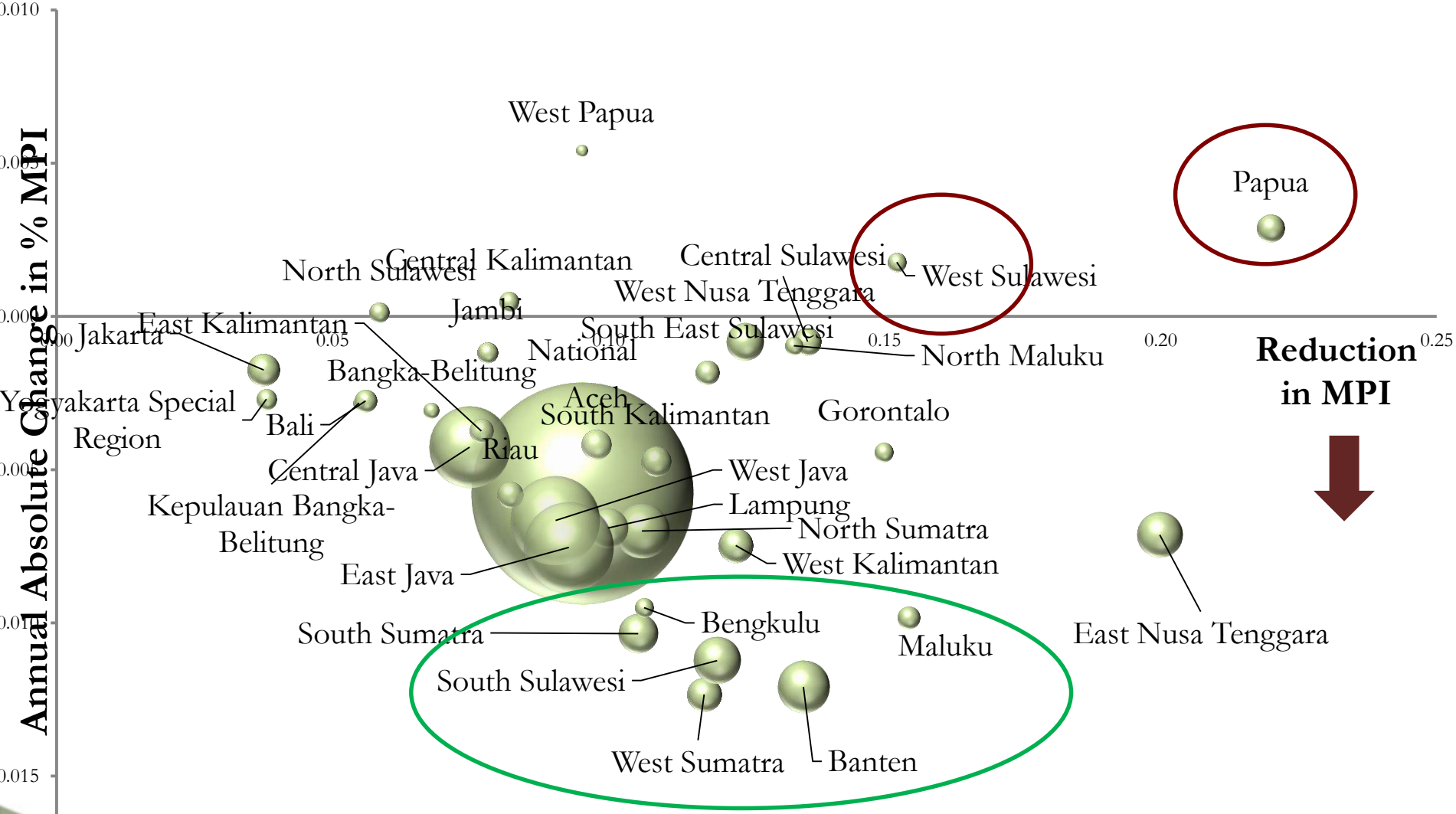
Subgroup Decompositions



Poverty reduction in regions of Mozambique and Nepal



Indonesia MPI Reduction 2007-12 by subnational regions



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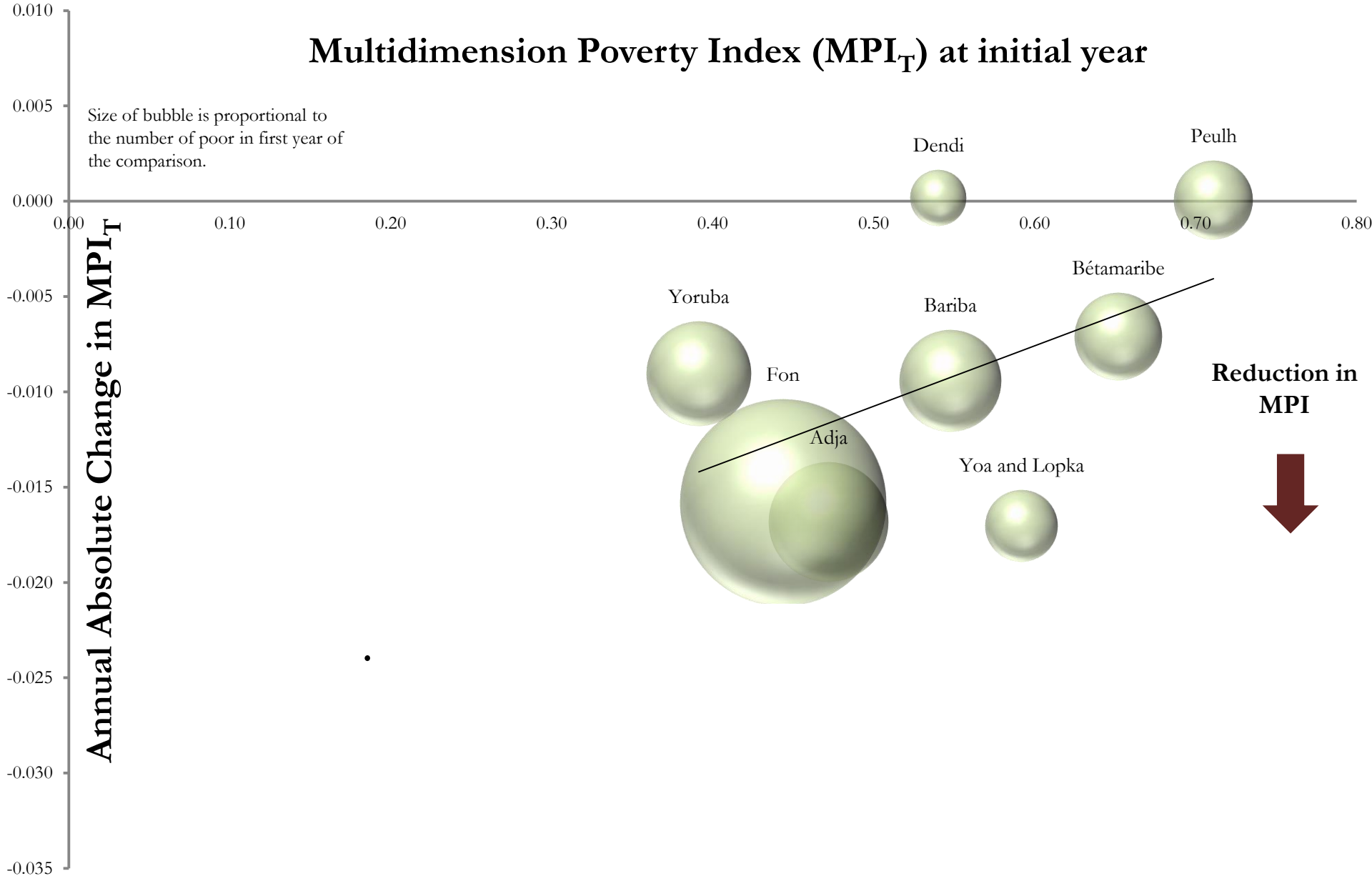
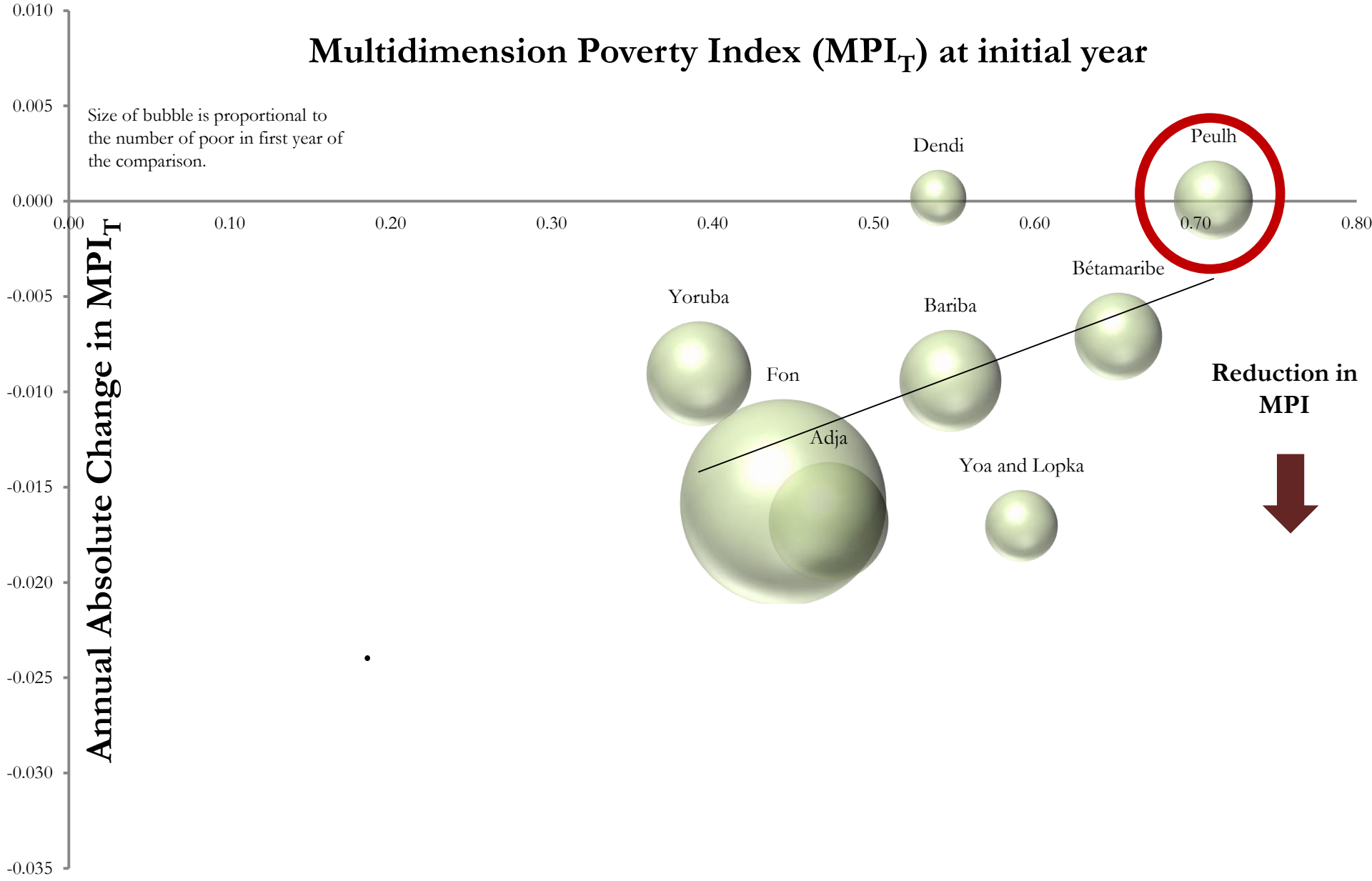
Disaggregation by subnational regions: Summary results

- A total of 208 regions, representing 78% of our sample, showed **statistically significant** reduction in MPI.
- Eight countries: Bangladesh 2007-11, Bolivia, Gabon, Ghana, Malawi, Mozambique, Niger and Rwanda – had significant reductions in **each subnational region**.
- In nine countries the **poorest region** had the fastest reduction (Bangladesh 2007-11, Bolivia, Colombia, Egypt, Kenya, Malawi, Mozambique, Namibia, Niger)
- Subnational **disparities increased** in Ethiopia (2000-5), Indonesia, Jordan, Mozambique, Niger, Nigeria, Pakistan, Tanzania and Zambia.

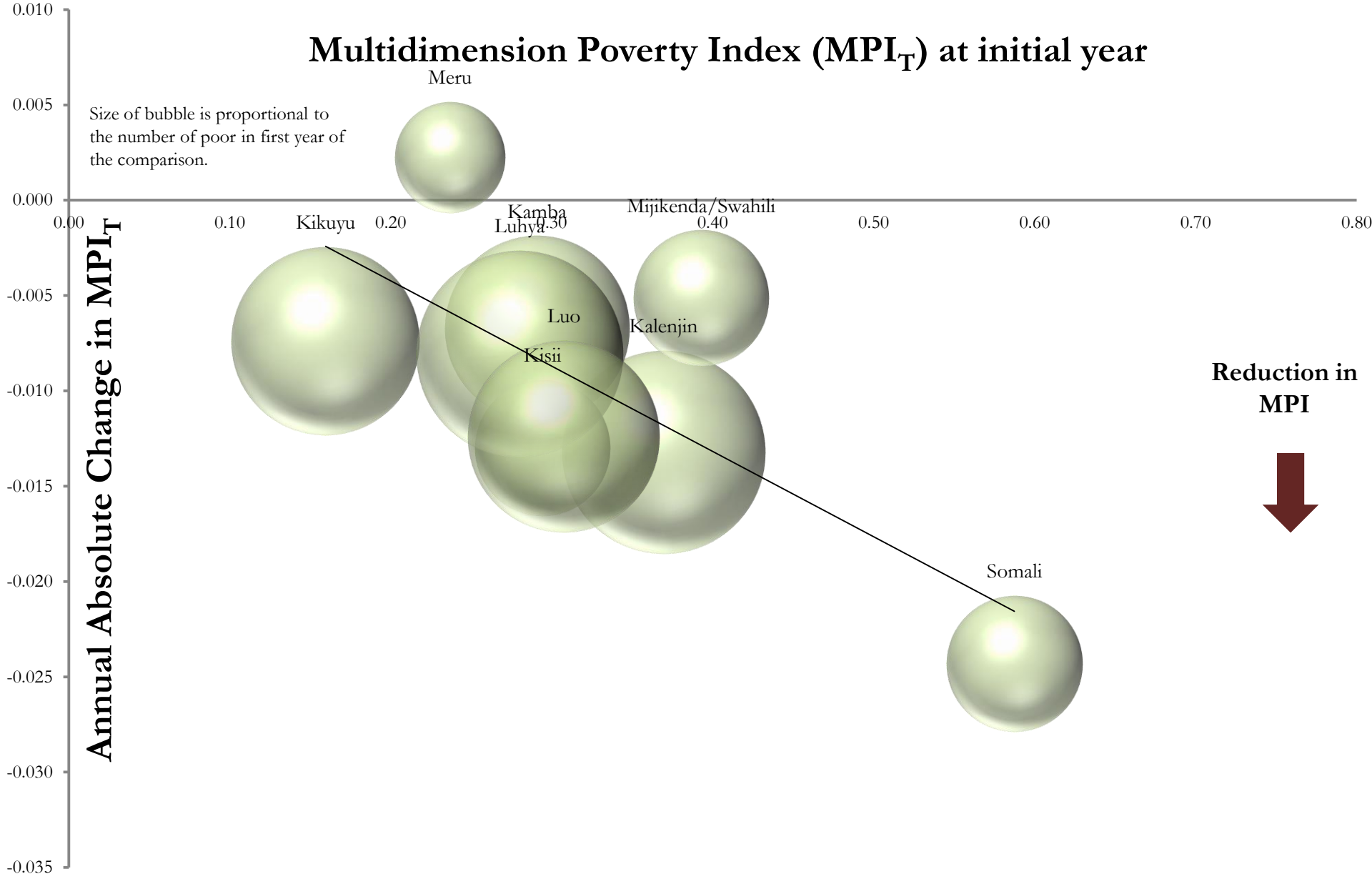
Disaggregating by ethnic group - Benin



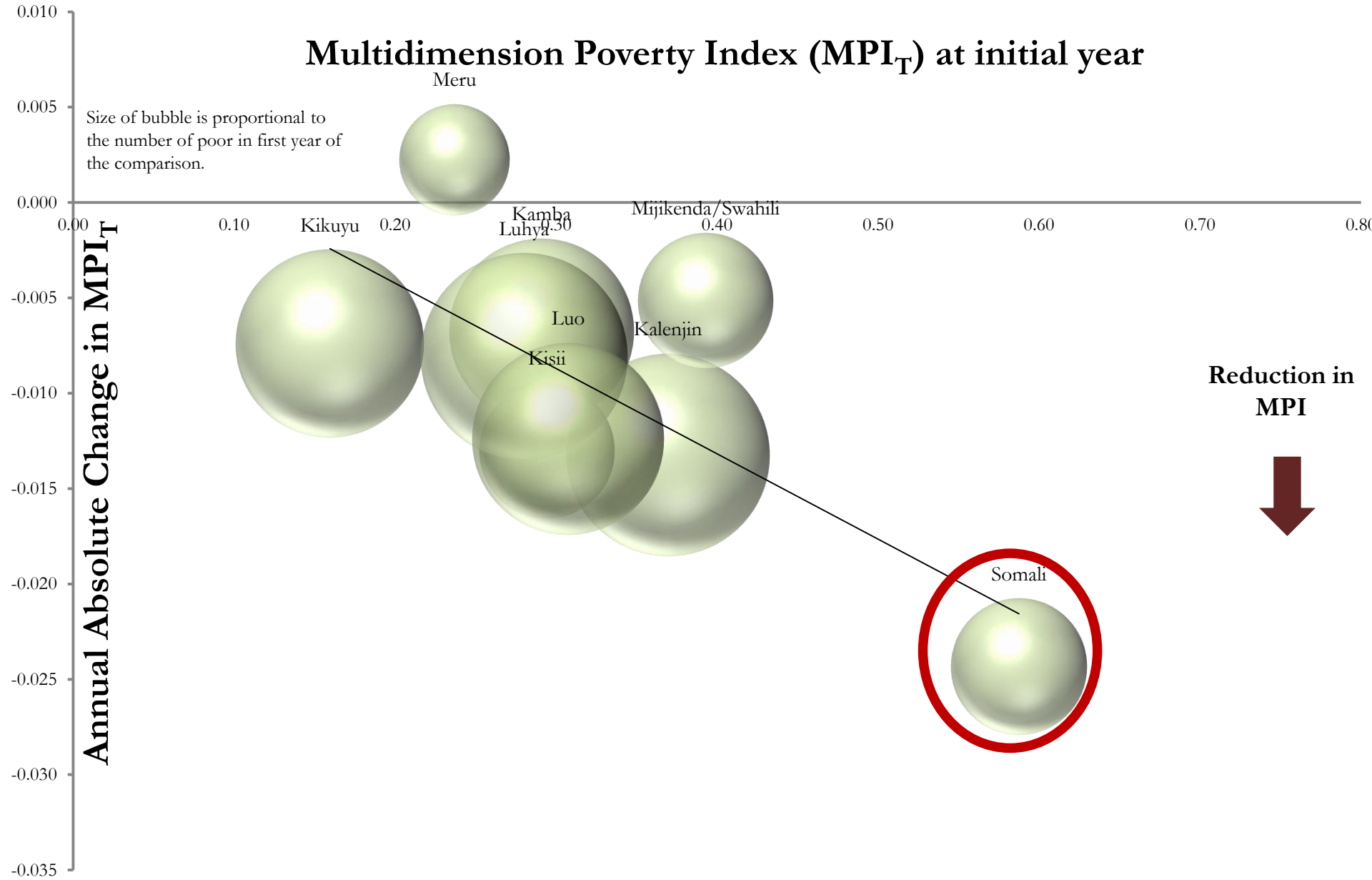
Disaggregating by ethnic group - Benin



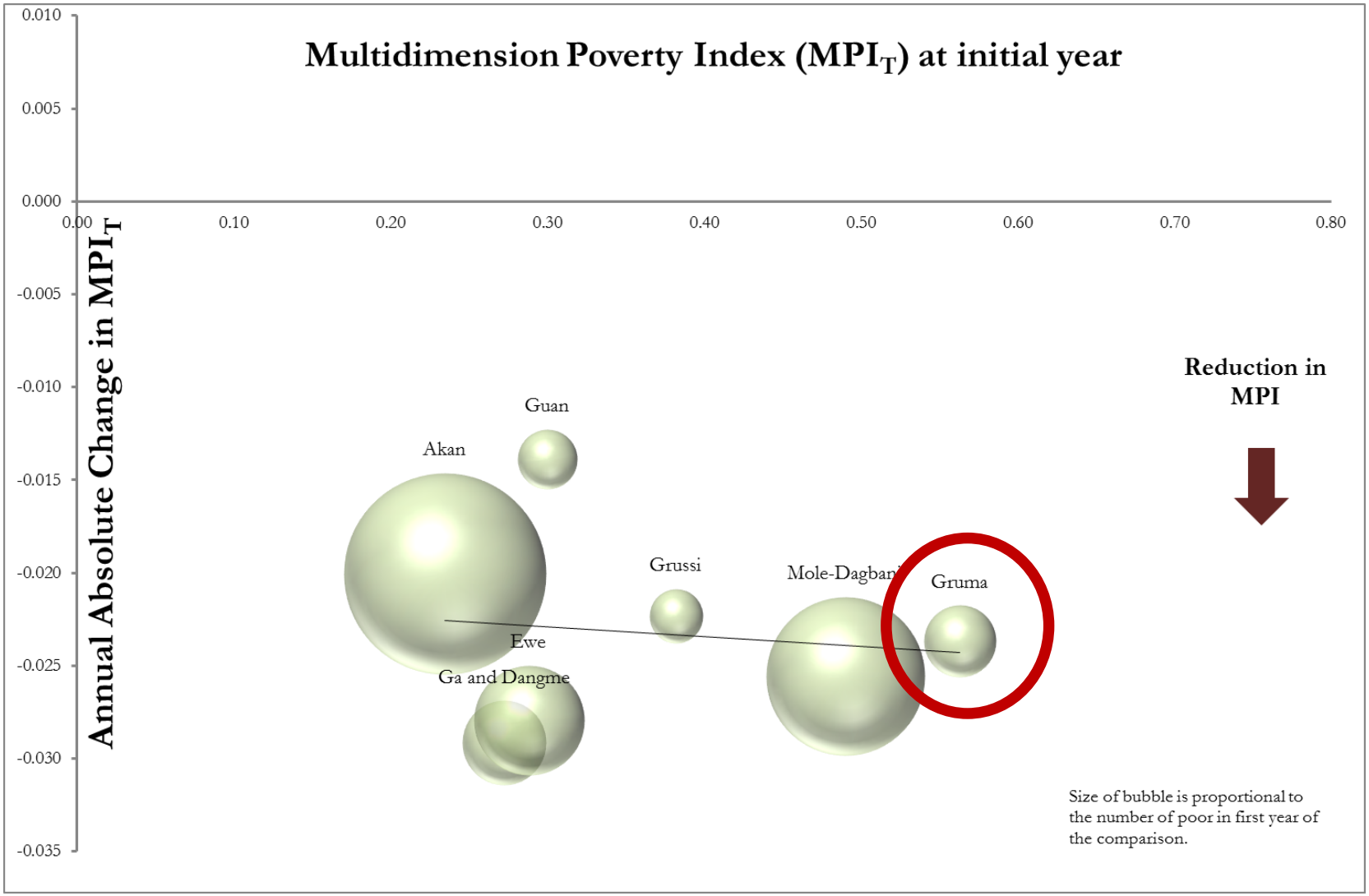
Disaggregating by ethnic group - Kenya



Disaggregating by ethnic group - Kenya



Disaggregating by ethnic group - Ghana



Dimensional Changes

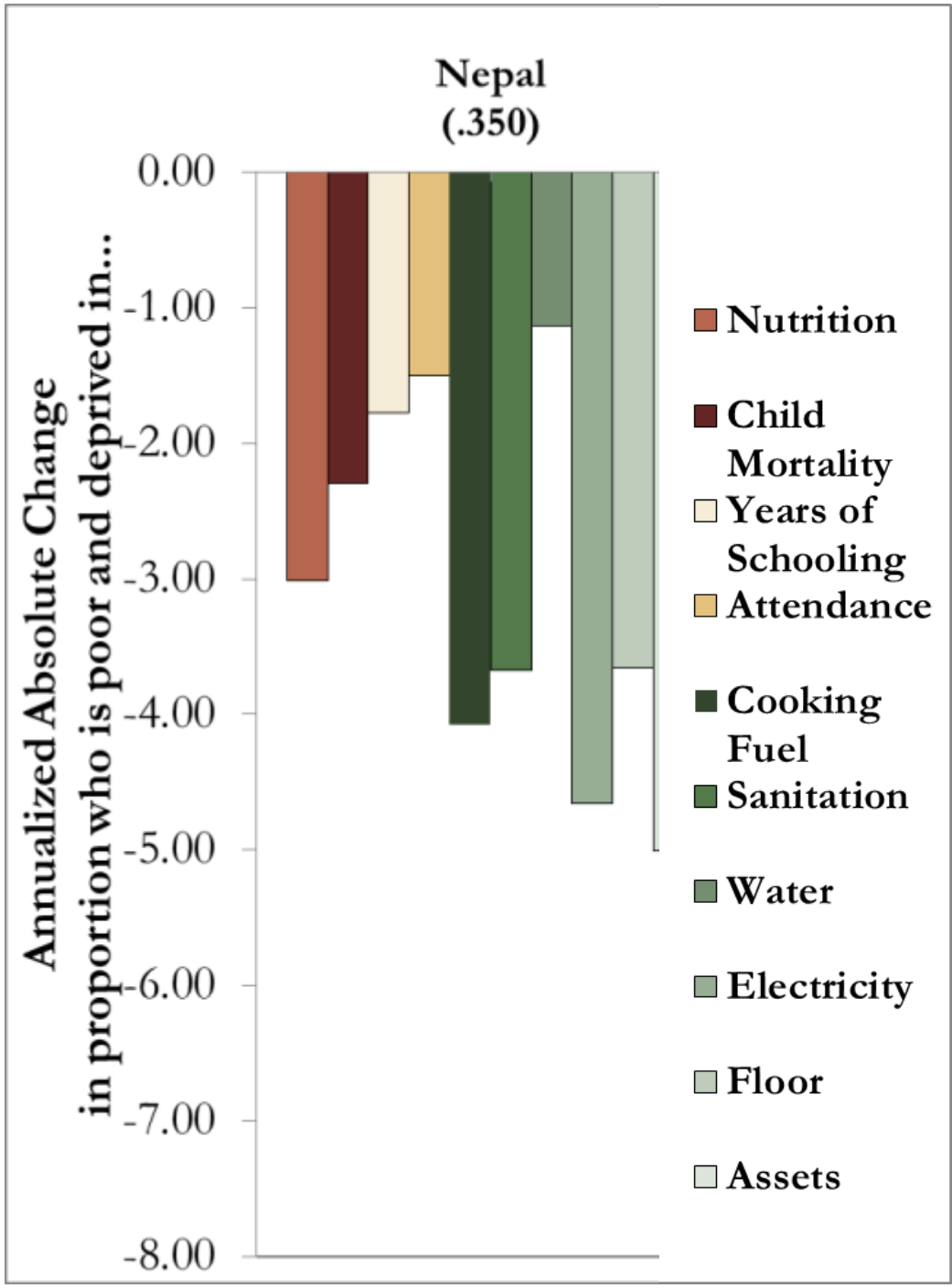
- The (annualized) absolute rate of change in M_0 can be expressed as the weighted w_j average of the (annualized) absolute rates of change in censored headcount ratios h_j.

$$\bar{\Delta} M_0 = \sum_{j=1}^{d} w_j \bar{\Delta} h_j(k)$$

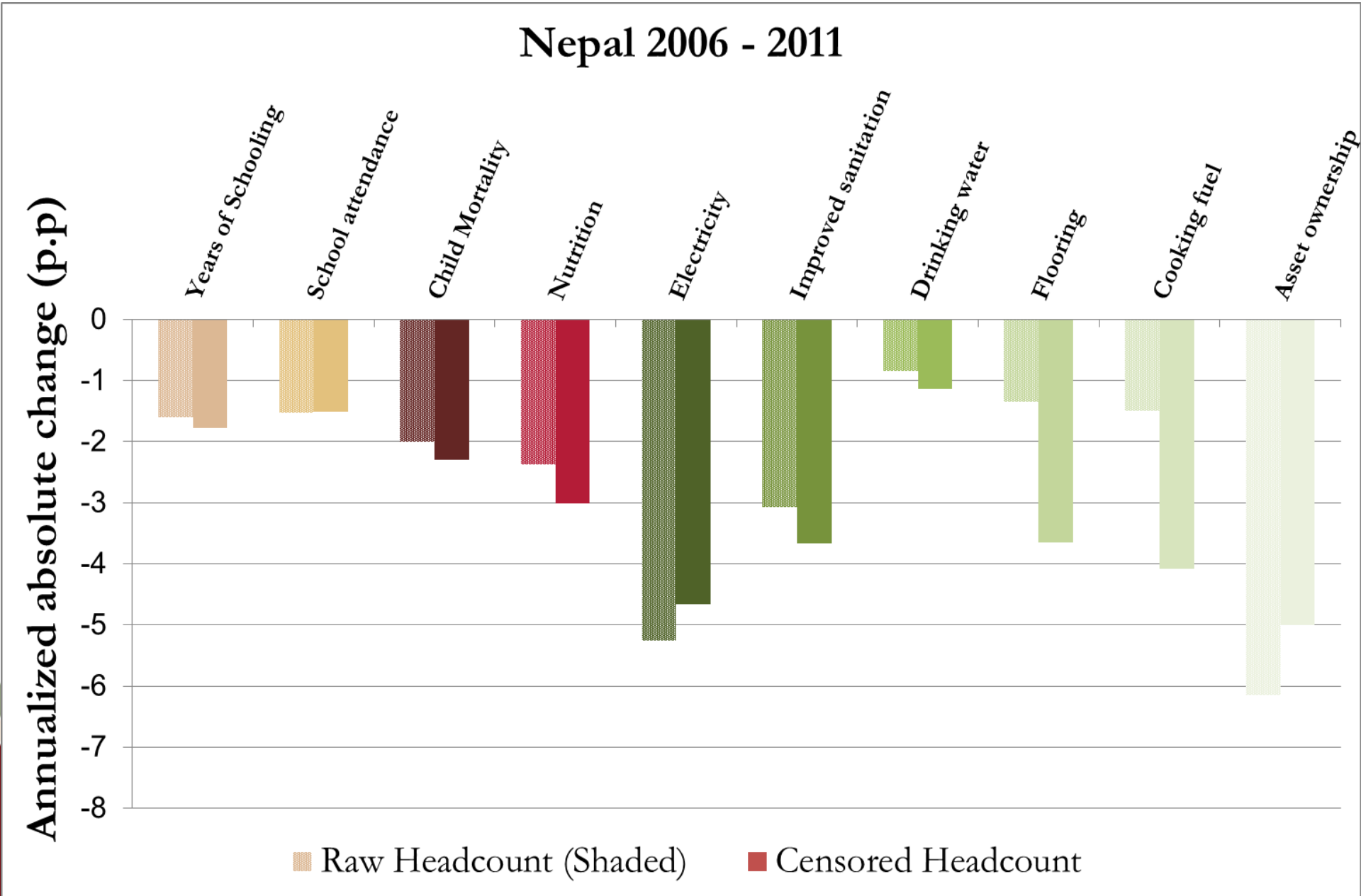
- When different indicators have different weights, the effects of their changes on the change in M_0 reflect these weights.

Change in censored headcount ratios

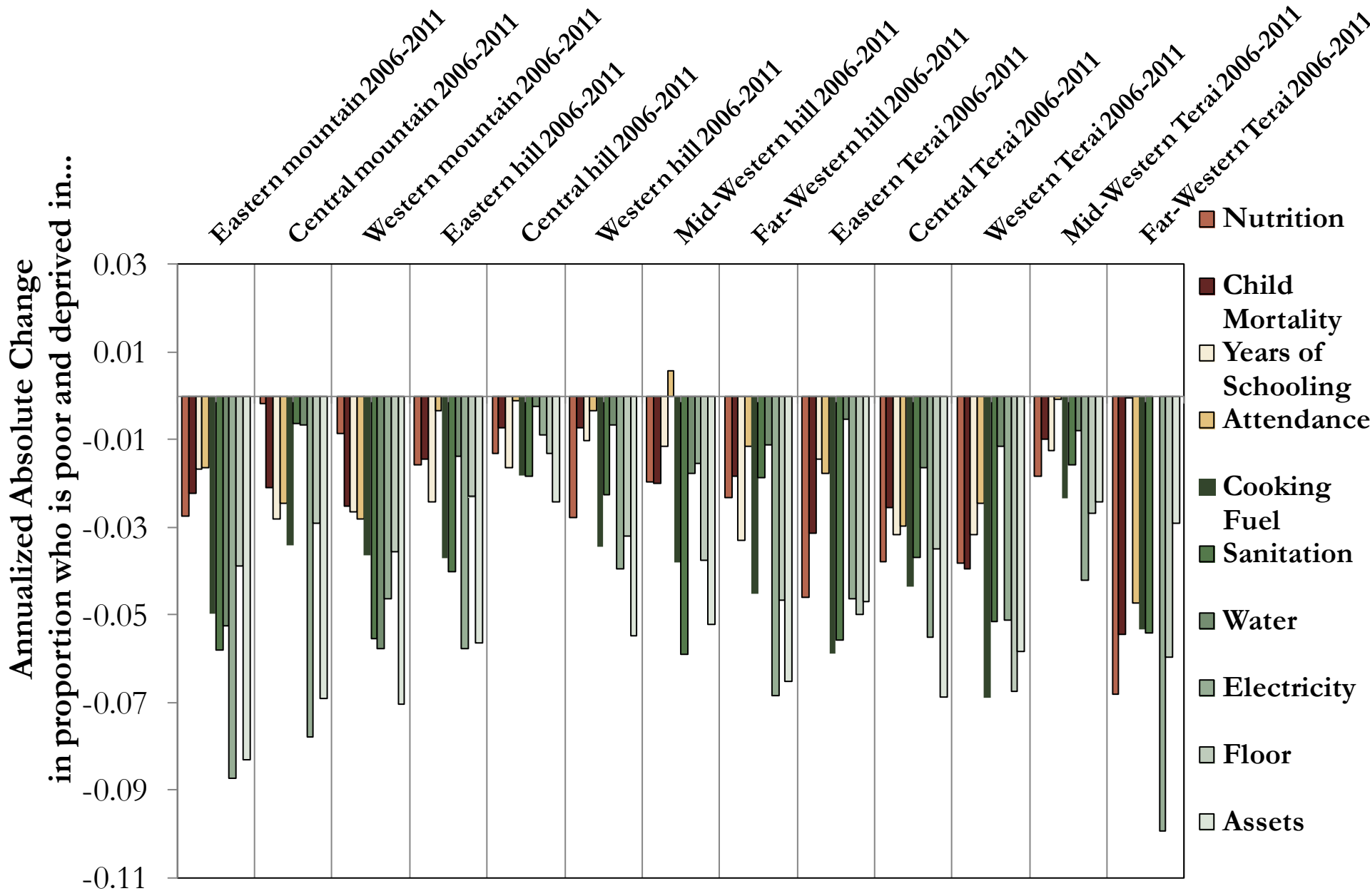
- If a deprivation is reduced
- If a person deprived in that indicator becomes non-poor



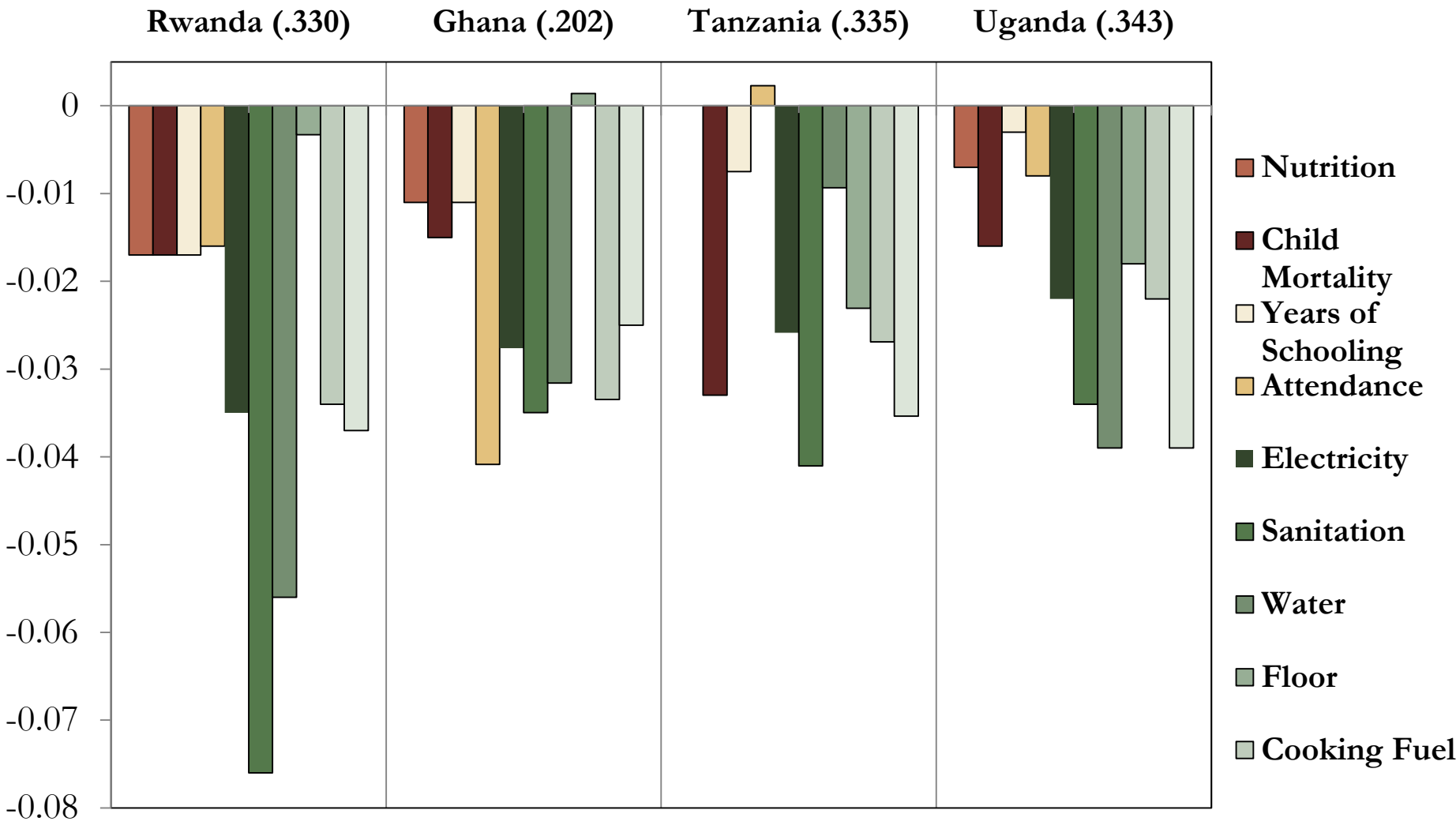
Changed in Censored and Uncensored h_j



Indicator Changes by region (Nepal)



Changes in censored headcount ratios



Changes in Indicators: Summary results

- Ten countries had significant reductions in **each indicator** (censored headcount ratios): Bolivia, Cambodia, Colombia, the Dominican Republic, Gabon, India, Indonesia, Mozambique, Nepal, and Rwanda.
- Each of the 10 component indicators had the **fastest** reduction in some region.
- Overall, the fastest absolute reduction on average was access to sanitation.

Destitute: A Subset of the Poor

We implement destitution measures across each of these 34 countries and study their dynamics

- **Indicators:** **Same as MPI**
- **Weights:** **Same as MPI**
- **Poverty cutoff:** **Same as MPI**
- **Deprivation cutoffs:** **Deeper**

All destitute people are also MPI poor.

Alkire, Conconi and Seth 2014

Deprivation cutoffs: Destitute

Indicator		Destitution Cutoff
Schooling	1/6	**No one has completed more than one year of schooling**
Attendance	1/6	**All primary school aged children are out of school**
Nutrition	1/6	**Someone is severely malnourished at home**
Mortality	1/6	**Household has lost two or more children**
Electricity	1/18	**The household has no electricity (No change)**
Sanitation	1/18	**No facility available** so practice open defecation
Water	1/18	**No Safe water or a 45 minute walk**
Floor	1/18	**The household has a dirt, sand, or dung floor (No change)**
Fuel	1/18	**Cooks with Wood or Dung**
Assets	1/18	**Owns No Assets – Radio, television, mobile phone, bicycle etc.**

Any person who is deprived in 1/3 of these weighted indicators is Destitute.

Overview

Over half of all MPI poor people are destitute.

28 countries reduced destitution (0.05); 29 reduced H^D

Largest reductions in: Ethiopia, Niger, Ghana, Bolivia, Rwanda, Tanzania, Nepal, Haiti, Bangladesh (2004-7) and Zambia.

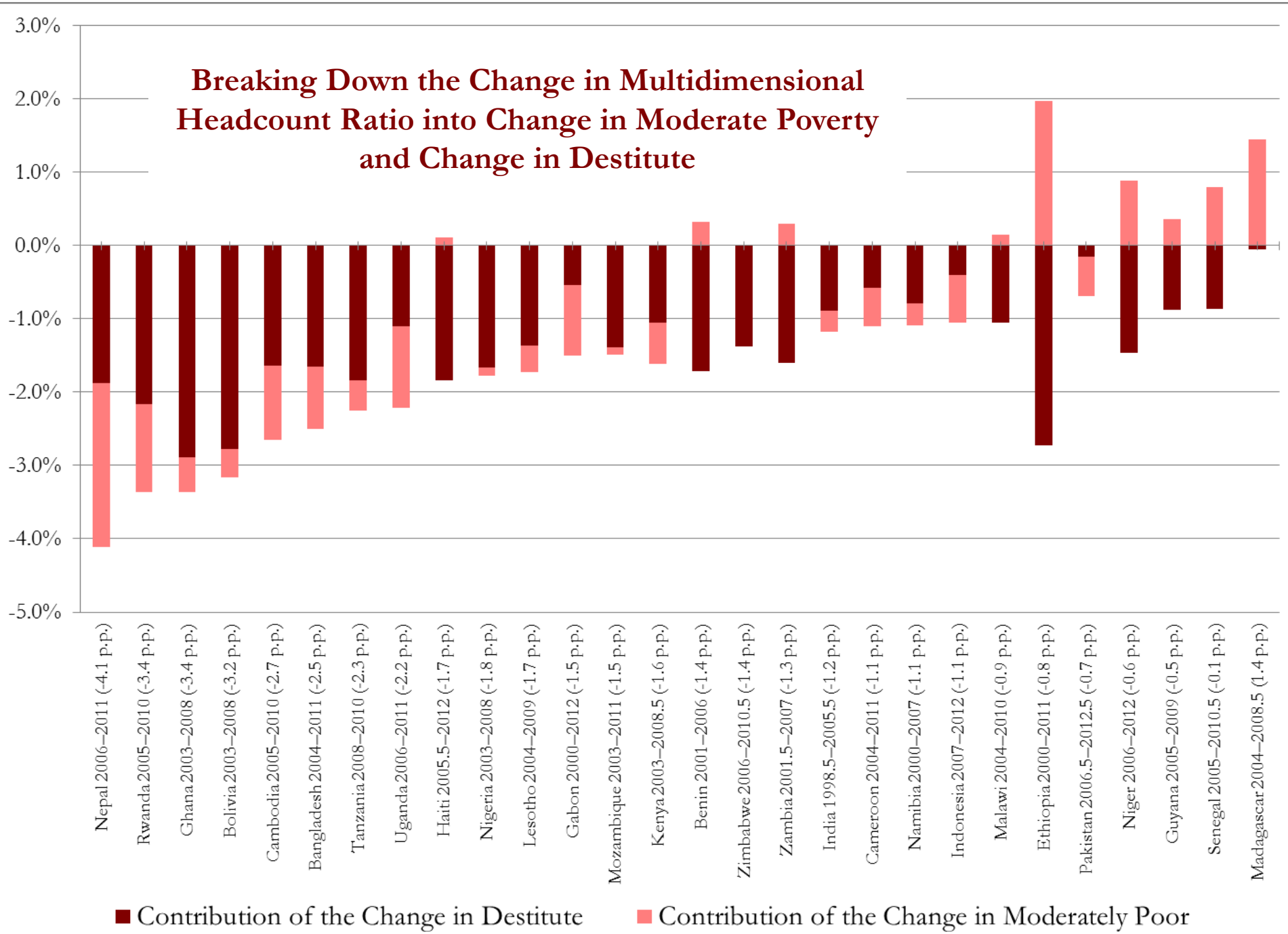
These are **LDCs or LICS** except Ghana & Bangladesh

Overview

In most countries, destitution is being reduced **faster than MPI** in relative terms; in 4 countries this is also true in absolute terms.

Nine countries reduced all destitution indicators significantly: Cambodia, Dominican Republic, Ethiopia (2000-5), Haiti, India, Indonesia, Mozambique, Niger and Rwanda (0.05).

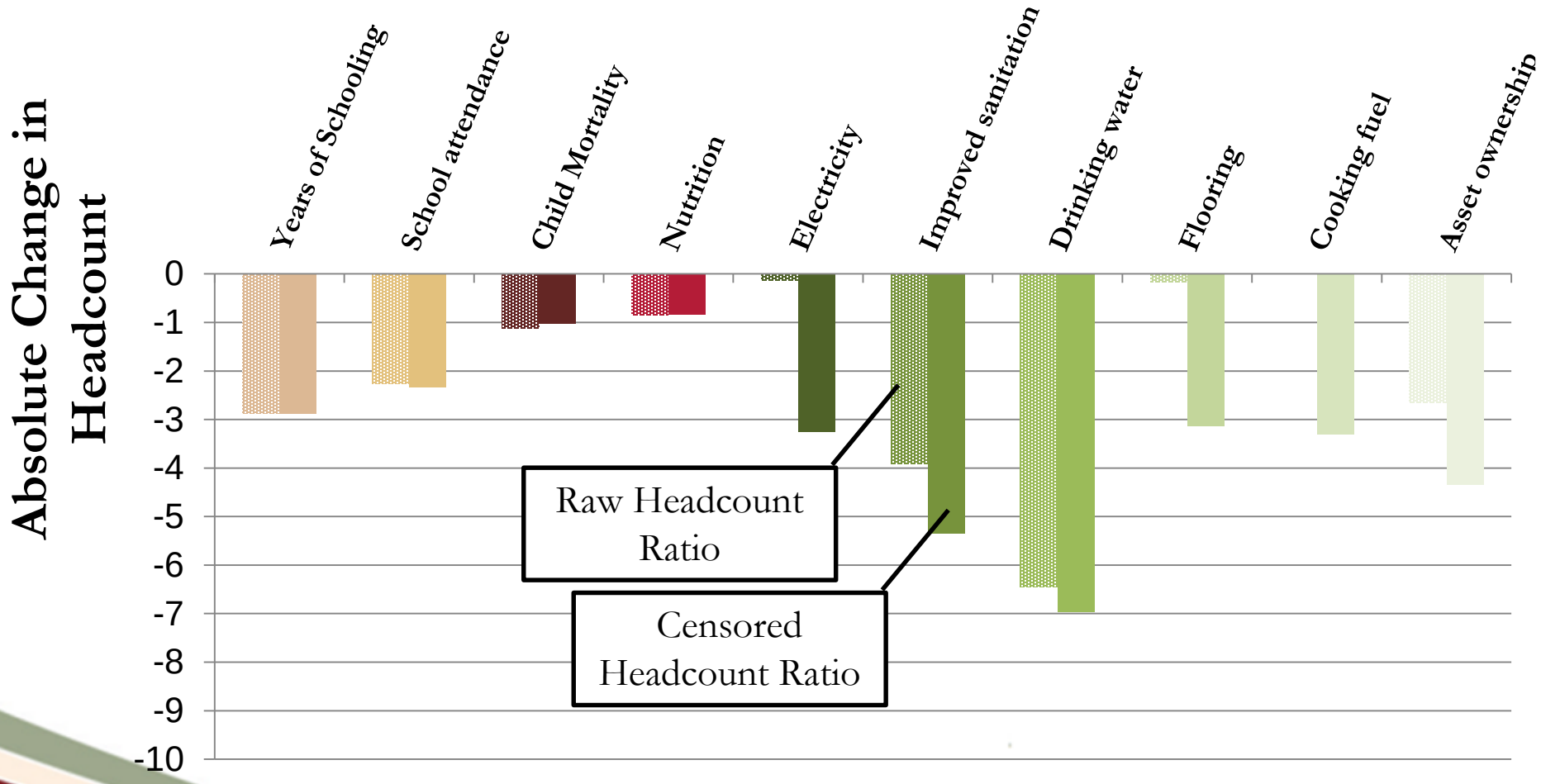
27 countries had significant reductions of destitution in **rural** areas, and 20 countries in **urban** areas.


Breaking Down the Change in Multidimensional Headcount Ratio into Change in Moderate Poverty and Change in Destitute
3.0%
2.0%
1.0%
0.0%
-1.0%
-2.0%
-3.0%
-4.0%
-5.0%
Nepal 2006–2011 (-4.1 p.p.)
Rwanda 2005–2010 (-3.4 p.p.)
Ghana 2003–2008 (-3.4 p.p.)
Bolivia 2003–2008 (-3.2 p.p.)
Cambodia 2005–2010 (-2.7 p.p.)
Bangladesh 2004–2011 (-2.5 p.p.)
Tanzania 2008–2010 (-2.3 p.p.)
Uganda 2006–2011 (-2.2 p.p.)
Haiti 2005.5–2012 (-1.7 p.p.)
Nigeria 2003–2008 (-1.8 p.p.)
Lesotho 2004–2009 (-1.7 p.p.)
Gabon 2000–2012 (-1.5 p.p.)
Mozambique 2003–2011 (-1.5 p.p.)
Kenya 2003–2008.5 (-1.6 p.p.)
Benin 2001–2006 (-1.4 p.p.)
Zimbabwe 2006–2010.5 (-1.4 p.p.)
Zambia 2001.5–2007 (-1.3 p.p.)
India 1998.5–2005.5 (-1.2 p.p.)
Cameroon 2004–2011 (-1.1 p.p.)
Namibia 2000–2007 (-1.1 p.p.)
Indonesia 2007–2012 (-1.1 p.p.)
Malawi 2004–2010 (-0.9 p.p.)
Ethiopia 2000–2011 (-0.8 p.p.)
Pakistan 2006.5–2012.5 (-0.7 p.p.)
Niger 2006–2012 (-0.6 p.p.)
Guyana 2005–2009 (-0.5 p.p.)
Senegal 2005–2010.5 (-0.1 p.p.)
Madagascar 2004–2008.5 (1.4 p.p.)
Contribution of the Change in Destitute
Contribution of the Change in Moderately Poor

Ethiopia: Reduction of Destitution

		National		Urban		Rural	
		Level	Annualised Change	Level	Annualised Change	Level	Annualised Change
MPI^D	2000	.471	-	.115	-	.530	-
	2005	.339	-0.26***	.055	-.012***	.377	-.031***
	2011	.248	-0.015***	.054	-0.000	.290	-0.014***
Headcount Ratio	2000	82.1	-	25.9	-	91.4	-
	2005	65.4	-3.3***	12.7	-2.6***	72.6	-3.8***
	2011	52.1	-2.2***	12.9	.0	60.7	-2.0***
Average Intensity	2000	57.4	-	44.4	-	58.0	-
	2005	51.8	-1.1***	43.5	-0.2	52.0	-1.2***
	2011	47.6	-0.7***	42.1	-0.2	47.8	-0.7***

Destitution in Ethiopia 2000 - 2005



Conclusions

- ✓ Systemic account of multidimensional poverty dynamics using AF Adjusted Headcount Ratio and its consistent sub-indices
- ✓ 31 out of the 34 countries under study significantly reduced multidimensional poverty over two or three periods
- ✓ Variable relationships between the pace of multidimensional poverty reduction and reduction in $1.25/day poverty require further study.
- ✓ Rather than theoretical or Shapley decompositions we simply study absolute changes in H and A at this point to avoid overly precise assumptions.
- ✓ Subnationally 208 regions had statistically significance reduction in MPI.
- ✓ There were significant changes in all of the ten MPI indicators, although the dimensional reduction profile varied across country.
- ✓ Destitution affected a disturbing proportion of the MPI poor, pointing to the need to explore ordinal 'depth' or at least subsets of the poor further.
- ✓ Destitution dynamics did not mirror MPI reduction, and were strongest in LICS and LDCs.