



# Regional Perspectives on the Multidimensional Poverty Index

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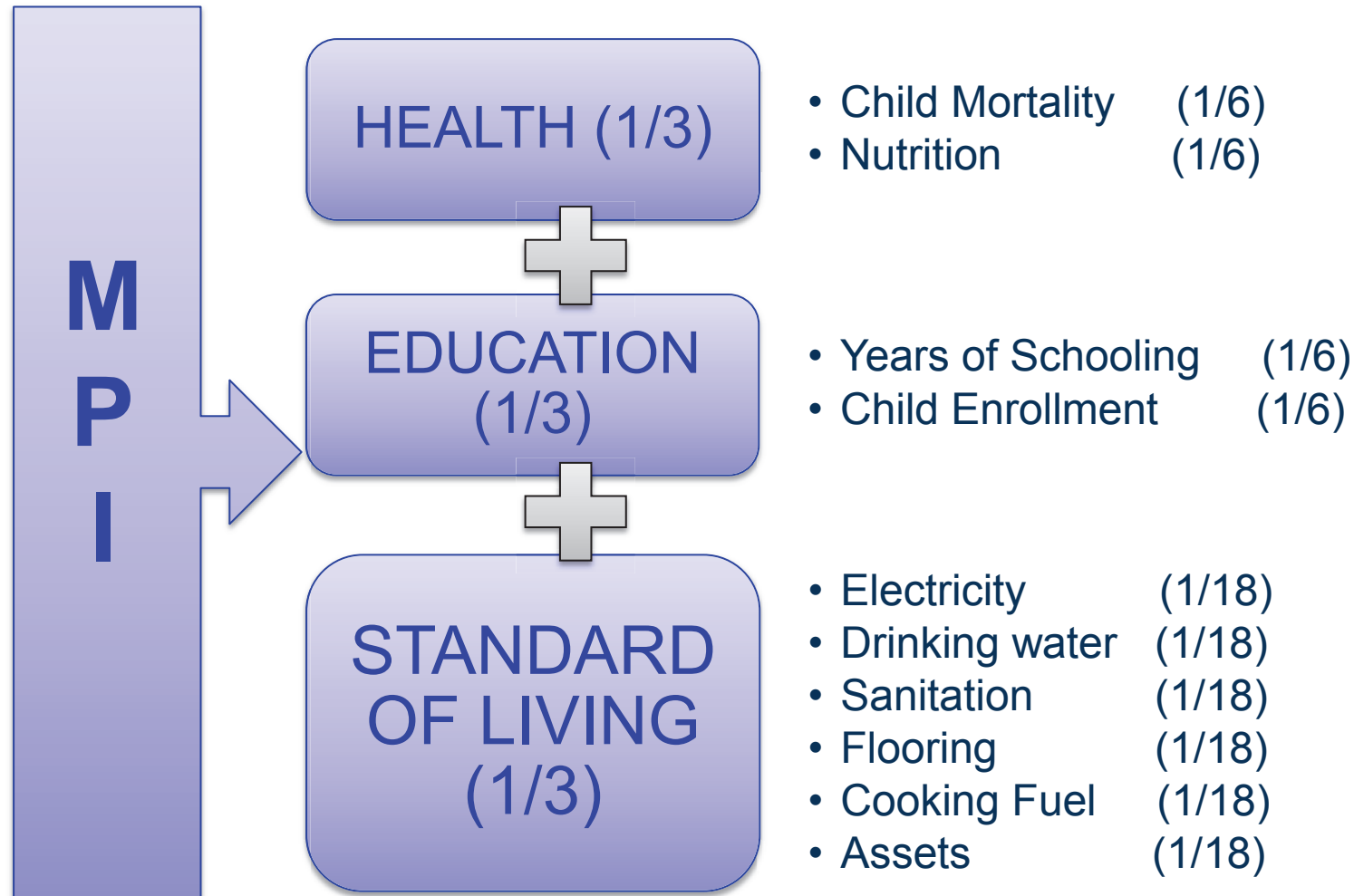
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## Outline

- Overview of the Multidimensional Poverty Index
  - Motivation: Why a regional analysis?
  - Why MCA over PCA?
  - Data
  - Empirical strategy
  - Results: PCA Analysis and India
  - Robustness checks
  - Conclusion
  - Other results & further research
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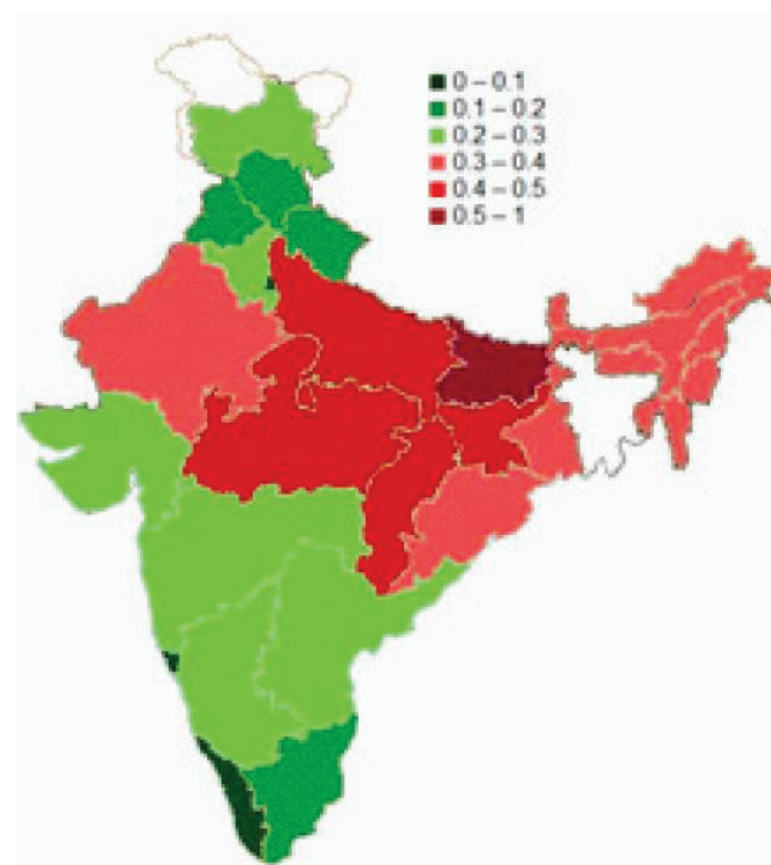
## Basic overview of the MPI



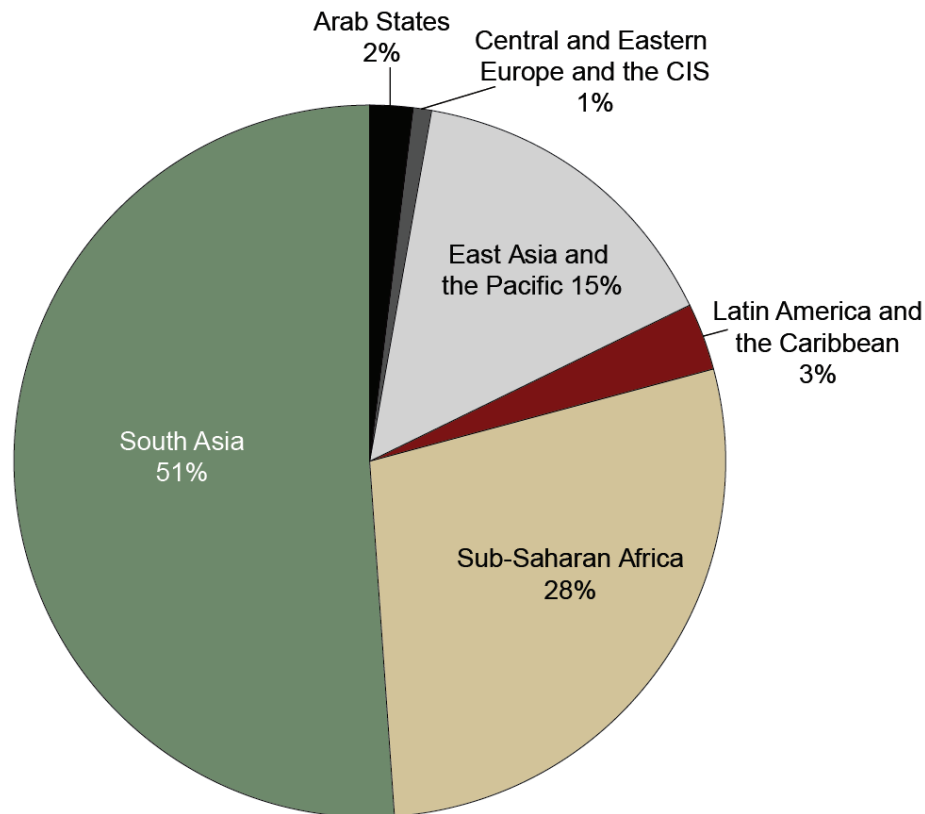
## Motivation: Why a regional analysis?

- India has a score of .283 on the MPI
- By 2012 estimates, there are 610 million (approx. 54%) multidimensionally poor people in India
- Huge inequality however: some states score lower than several sub-saharan African countries on the MPI

**Map of MPI Poverty in India  
(higher MPI value in dark red)**



## Motivation: Why a regional analysis?



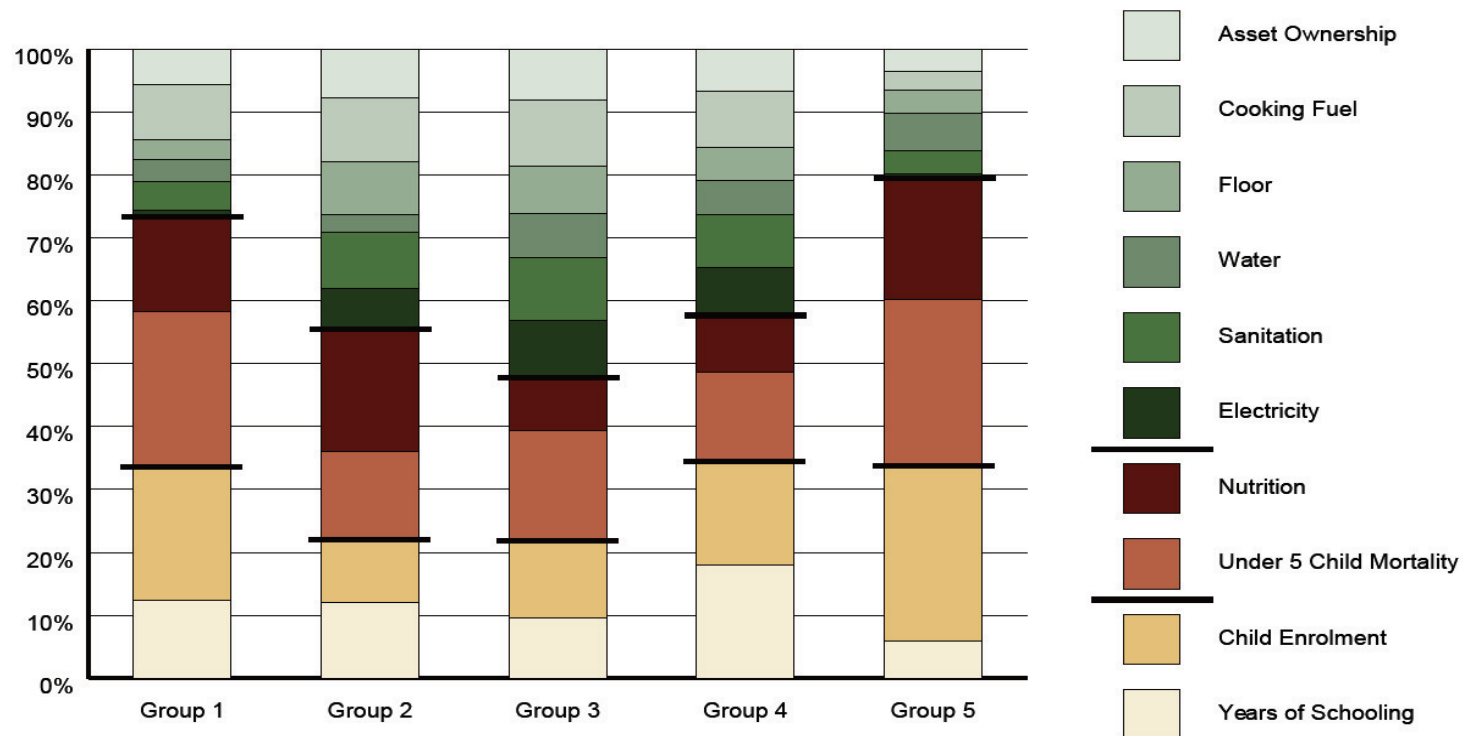
**Figure 1: Regional Distribution of People Living in MPI Poverty**

Source: Multidimensional Poverty Index 2011: Brief Methodological Note

- Some regions are barely poor with the current definitions of multidimensional poverty
- In some more than half of the population is multidimensionally poor
- Large difference between South Asia and Latin America

## Motivation: Why a regional analysis?

**Figure 5: The MPI Reveals Five Distinct Types of Deprivation Across Countries: Percentage Contribution of Each Dimension to the Overall MPI Poverty in Each Group (below)**



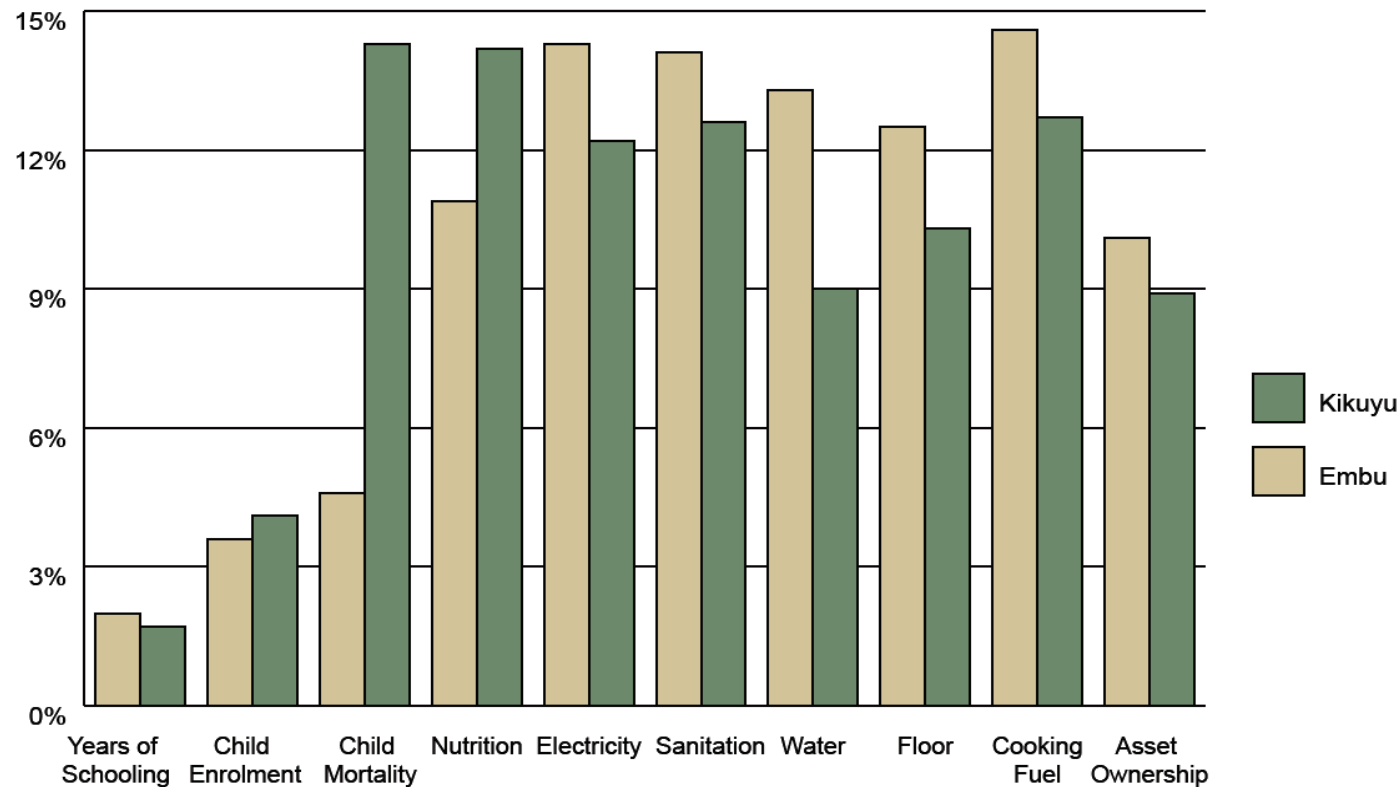
Source: Multidimensional Poverty Index 2011: Brief Methodological Note

Five types of policy responses required for the five types of Multidimensional poverty!

# Motivation: Why a regional analysis?

## Intra-national differences in poverty

**Figure 3: Comparison of the Percentage of People Who are Poor and Deprived in Each Indicator in two Ethnic Groups in Kenya (below)**



Source: Multidimensional Poverty Index 2011: Brief Methodological Note

## Motivation: Why a regional analysis?

Limitations of using the current MPI →

1. Are these MPI values for each country **really feasible**? (Arbitrary Weights)
2. Do these **10 indicators** facilitate comparison? (Necessary indicators?)
  - A solution could be to simply use OLS to predict the weights (coefficients) for these 10 different indicators based on global data → **multicollinearity**
  - How can we ensure comparability across nations: **number of indicators to be used?**

Solution → Principal Component Analysis (**PCA**) and  
Multiple Correspondence Analysis (**MCA**)

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## Motivation: Why a regional analysis?

- Study by **Georges Nguéfack-Tsague, Stephan Klasen, Walter Zucchini (2011)**
- They wrote a paper, conducting **Principal Component Analysis on HDI**
- Found first component explains **78% to 90% of variation** in data.
- Normalizing the coefficients, the **simple average weighting scheme of HDI is obtained (1/3, 1/3, 1/3)**.
- The ranks of countries obtained using the PCA weightings are very similar to those based on the HDI

## Motivation: Why MCA over PCA?

- PCA and MCA are both useful as **data reduction techniques** and used to create indices
- MCA preferable in cases of **categorical and binary data**.
- **Poverty is a latent concept** and we define it from what we assume would be the **best proxies for deprivation** and deficiencies in basic well-being
- We use these **10 variables to determine this “hidden poverty”**, using **weights which are representative** to the variation across the population.

## Empirical Strategy I : global

Derive new weights( $W$ ) and new MPI for each country using the **first Principal Component** and **multiple correspondence analysis**

$$W_1X_{1n} + W_2X_{2n} + \dots + W_{10}X_{10n} \rightarrow PCA_{10*n}$$

where,

$W_i$  are the weights derived from the first component of PCA

$X_{in}$  are the values for each of my dummy indicators

**$PCA_{10*n}$  are the predicted MPI values for each household  $n$**

and,

$$Y_1X_{1n} + Y_2X_{2n} + \dots + Y_{10}X_{10n} \rightarrow MCA_{10*n}$$

where,

$Y_{in}$  are the weights derived from MCA

**$MCA_{10*n}$  are the predicted MPI values for each household  $n$**

## Empirical Strategy II : India

Indian DHS contains information concerning:

1. Access to financial institutions, and
2. Property and land ownership

Made possible the construction of an alternative poverty index using 12 indicators for India.

Additional robustness checks conducted:

- a) Using Multiple Correspondence Analysis (MCA) to create indices as well
- b) Using more than one Principal Component to create Index

## Data

Use **Demographic and Health Surveys (DHS)** data to create these indices

For the PCA and MCA analysis, had to use different DHS years for each country- on average they are for the year 2005

For the PCA and MCA on India alone, the 2005 dataset is used.



## Results: PCA Analysis

	Years of Schooling	Child Enrolment	Child Mortality	Nutrition	Electricity	Sanitation	Drinking Water	Flooring	Cooking Fuel	Assets
<b>Original</b>	<b>16.67%</b>	<b>16.67%</b>	<b>16.67%</b>	<b>16.67%</b>	<b>5.56%</b>	<b>5.56%</b>	<b>5.56%</b>	<b>5.56%</b>	<b>5.56%</b>	<b>5.56%</b>
Cameroon	11.73	5.04	2.22	1.16	24.08	0.4	16.26	13.67	3.96	21.48
Congo DMR	4.87	2.14	0.70	0.20	22.68	6.28	14.49	20.99	11.90	15.75
Congo Rep.	5.05	1.09	0.64	0.44	20.20	7.86	10.57	18.88	15.13	20.13
Ethiopia	9.82	3.86	1.52	0.62	18.13	5.91	12.15	18.22	13.62	16.15
Kenya	6.77	2.97	2.18	3.35	20.06	1.13	13.59	20.62	18.69	10.64
Malawi	9.24	1.47	0.61	0.68	25.45	3.39	8.0	24.02	16.43	10.7
Namibia	3.93	1.42	0.69	0.96	20.31	16.39	6.03	17.39	19.92	12.95
Niger	10.64	3.56	1.16	0.34	19.73	11.24	11.23	19.47	6.11	16.52
Nigeria	10.69	7.14	4.07	2.52	18.24	7.26	9.60	16.25	17.41	6.81
Zambia	4.71	1.52	0.18	0.29	21.69	11.74	11.83	18.05	19.17	10.82
Armenia	3.19	6.80	5.24	0.24	5.15	14.17	7.79	4.07	21.76	31.58
Azerbaijan	2.83	3.74	5.27	3.35	4.55	7.91	6.47	20.00	11.92	33.97
India	2.93	3.93	8.27	4.97	14.76	3.09	13.29	17.21	17.11	14.43
Nepal	9.07	4.35	2.24	3.68	17.44	11.30	2.21	18.46	15.46	15.79
	<b>6.58</b>	<b>3.38</b>	<b>2.40</b>	<b>1.59</b>	<b>17.39</b>	<b>9.17</b>	<b>9.96</b>	<b>17.06</b>	<b>16.11</b>	<b>16.37</b>

\*Countries originally in Sample: Cameroon, Congo DMR, Congo Rep, Ethiopia, Ghana, Kenya, Liberia, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Swaziland, Zambia; India, Nepal; Bolivia, Haiti; Armenia, Azerbaijan, Moldova

\*\*Cronbach's Alpha was calculated for each country and each Indicator within

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Cameroon	11.73	5.04	2.22	1.16	24.08	0.4	16.26	13.67	3.96	21.48
Congo DMR	4.87	2.14	0.70	0.20	22.68	6.28	14.49	20.99	11.90	15.75
Congo Rep.	5.05	1.09	0.64	0.44	20.20	7.86	10.57	18.88	15.13	20.13
Ethiopia	9.82	3.86	1.52	0.62	18.13	5.91	12.15	18.22	13.62	16.15
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Niger	10.64	3.56	1.16	0.34	19.73	11.24	11.23	19.47	6.11	16.52
Nigeria	10.69	7.14	4.07	2.52	18.24	7.26	9.60	16.25	17.41	6.81
Zambia	4.71	1.52	0.18	0.29	21.69	11.74	11.83	18.05	19.17	10.82
Armenia	3.19	6.80	5.24	0.24	5.15	14.17	7.79	4.07	21.76	31.58
Azerbaijan	2.83	3.74	5.27	3.35	4.55	7.91	6.47	20.00	11.92	33.97
India	2.93	3.93	8.27	4.97	14.76	3.09	13.29	17.21	17.11	14.43
Nepal	9.07	4.35	2.24	3.68	17.44	11.30	2.21	18.46	15.46	15.79
	<b>6.58</b>	<b>3.38</b>	<b>2.40</b>	<b>1.59</b>	<b>17.39</b>	<b>9.17</b>	<b>9.96</b>	<b>17.06</b>	<b>16.11</b>	<b>16.37</b>

\*Countries originally in Sample: Cameroon, Congo DMR, Congo Rep, Ethiopia, Ghana, Kenya, Liberia, Malawi, Mali, Mozambique, Namibia, Niger, Swaziland, Zambia, Bangladesh; Cambodia, India, Nepal, Bolivia; Haiti, Armenia, Azerbaijan, Moldova

\*\*Cronbach's Alpha was calculated for each country and each Indicator within

It seems that the weights assigned to the indicators seems to differ widely and may exhibit a regional trend.

## Results: India and additional variables

### PCA and MCA constructed indices with additional variables for India

Indicator	PCA (%)	MCA(%)	PCA(%)	MCA(%)
Years of Schooling	7.91	8	2.93	8
Enrolment	3.23	3.3	3.93	2.9
Child Mortality	2.09	2.1	8.27	2.1
Nutrition	2.82	2.9	4.97	2.8
Electricity	12.72	12.7	14.76	15
Drinking Water	11.88	12	3.09	12.7
Sanitation	2.71	2.7	13.29	2.4
Flooring	15.37	15.3	17.21	19.2
Cooking fuel	16.26	16.3	17.11	19.5
Assets	13.84	13.9	14.43	15.6
Property/ Land ownership	0.92	0.6		
Access to Financial Institutions	10.25	10.3		



## Results: India and additional variables

### PCA and MCA constructed indices with additional variables for India

Indicator	PCA (%)	MCA(%)	PCA(%)	MCA(%)
Years of Schooling	7.91	8	2.93 ←	8
Enrolment	3.23	3.3	3.93	2.9
Child Mortality	2.09	2.1	8.27 ←	2.1
Nutrition	2.82	2.9	4.97	2.8
Electricity	12.72	12.7	14.76 ←	15
Drinking Water	11.88	12	3.09 ←	12.7
Sanitation	2.71	2.7	13.29	2.4
Flooring	15.37	15.3	17.21	19.2
Cooking fuel	16.26	16.3	17.11	19.5
Assets	13.84	13.9	14.43	15.6
Property/ Land ownership	0.92	0.6		
Access to Financial Institutions	10.25	10.3		

## Robustness: Change in rankings

Country	Rank MPI	Rank PCA
Armenia	1	1
Azerbaijan	2	2
Swaziland	3	4
Ghana	4	6
Namibia	5	7
Congo Republic	6	9
Nigeria	7	5
Nepal	8	11
Cameroon	9	8
Kenya	10	10
India	11	3
Zambia	12	14
Malawi	13	19
Mozambique	14	15
Congo DMR	15	16
Liberia	16	13
Mali	17	12
Ethiopia	18	17
Niger	19	18

## Robustness: Only poor HHs

	Years of Schooling	Child Enrolment	Child Mortality	Nutrition	Electricity	Sanitation	Drinking Water	Flooring	Cooking Fuel	Assets
<b>Original</b>	16.67%	16.67%	16.67%	16.67%	5.56%	5.56%	5.56%	5.56%	5.56%	5.56%
<b>Cameroon</b>	16.94	0.73	20.39	2.55	22.50	0.02	0.08	20.03	6.41	10.36
<b>Congo DMR</b>	4.87	1.05	6.34	4.40	21.54	3.49	13.89	20.77	6.87	16.79
<b>Congo Rep.</b>	8.25	1.42	7.40	6.41	12.83	5.45	11.38	21.96	8.80	16.08
<b>Ethiopia</b>	5.25	0.29	0.60	0.52	25.24	4.89	11.70	20.93	14.08	16.49
<b>Kenya</b>	8.12	0.02	7.21	0.49	16.79	5.21	11.16	25.58	12.32	13.08
<b>Malawi</b>	19.93	0.46	16.21	5.73	10.47	5.39	3.96	13.72	7.50	16.65
<b>Namibia</b>	3.99	0.30	6.27	5.16	17.52	17.31	6.72	12.75	18.68	11.30
<b>Niger</b>	8.51	0.04	1.28	0.54	22.77	9.28	14.30	23.19	1.57	18.51
<b>Nigeria</b>	10.75	0.00	5.86	5.78	23.35	6.26	3.71	22.19	10.21	11.88
<b>Zambia</b>	5.87	0.19	7.69	3.30	20.34	6.05	9.92	17.82	17.52	11.30
<b>Armenia</b>	16.24	0.12	7.55	17.17	4.81	12.37	0.86	12.26	12.57	16.03
<b>Azerbaijan</b>	17.39	0.91	12.84	12.74	5.63	2.71	2.26	8.64	13.48	23.41
<b>India</b>	12.30	0.30	5.58	5.93	15.96	10.89	1.10	15.01	16.80	16.12
<b>Nepal</b>	14.78	0.00	5.97	6.90	18.59	7.72	5.47	9.09	9.21	22.26
	<b>10.94</b>	<b>0.42</b>	<b>7.94</b>	<b>5.54</b>	<b>17.02</b>	<b>6.93</b>	<b>6.89</b>	<b>17.42</b>	<b>11.14</b>	<b>15.73</b>

Correlation between 65%-97% apart from Malawi (27%), Armenia (24%), Azerbaijan (54%) and India (52%)

## Conclusion I

There are some key points that could be taken from this analysis :

1. It may not be (statistically) the best strategy to have an absolute indicator to depict poverty across countries, regardless country comparability
2. For some countries a statistical approach seems to be not the certain route
3. Inclusion of new indicators changes the weighing and on may question country comparability with given indicators

## Conclusion II

Practical application of the MPI:

1. The current arbitrary weighing scheme is at best valid in a more static analysis rather than a dynamic one
2. A country specific and needs based MPI is more preferable for dynamic comparisons as needs change over time and regions
3. A standard on-glove-fits-all index may be rather hard to obtain for comparability purposes across nations.

## Other results & further analysis

### Other results:

1. Conditional Correlation on HDI with regional dummies
2. PCA with 2/3 components

### Things that I hope to do next:

1. Specific study for India and South Africa:
  - a) Include more indicators and create other types of reduced Indices
  - b) Using more waves for India to study the dynamic trends



Thank You for your attention!





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