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A New Index of Measuring Multidimensional Poverty

(A Synthesis Method)

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IPS04: Recent Innovations in
Poverty Mapping

Outline of the presentation

- Introduction
- Concepts and poverty measures
- Sen's Capability Approach
- Gaps identified
- Challenges
- Multidimensional poverty measures; new approach
- Contribution of the Synthesis Method
- Empirical analysis
- Significance of the empirical study



Introduction



- Alleviate Poverty: One of the focal themes in global development agendas, e.g. MDG, SDG
- The poverty related social issues generate primarily due the disparities of living standards. In this context, poverty causes due to two major facets;
 - (a) lack of enough capacity as a whole in a given society
 - (b) a few accessing to a larger part of the resources thereby leaving out some in the society with no resources.
- Many countries have permanent national income poverty to guide national policies. Income poverty is better representative but not accurate.
- Poor themselves consider their experience of poverty **broadly** : they are poor not only due to lack of income, but also due to lack of education, nutrition , health ,shelter etc.

Review of the literature

Concepts and Poverty measures



Mainly focus of this chapter is to review the popular approaches to conceptualizing poverty in the economics literature.

Concepts and definition of Poverty

- Monetary Approach
- Capability Approach
- Participatory Approaches
- Social exclusion

Poverty Axioms

- Focus axioms
- Monotonicity axioms
- Transfer axioms
- Replication invariance
- Subgroup consistency

Poverty Measures- Empirical Applications

Unidimensional poverty measures

- Objective poverty line
- Subjective poverty line

Multidimensional poverty measures

- Monetary aspects- Townsend 1979
- Capability approach
 - Dashboard method
 - Composite index
 - Statistical method
 - Counting method
 - Fuzzy sets method

Sen's Capability Approach



Sen (1992) defined 'capabilities' as the lack of basic capacity to achieve certain minimally acceptable levels of functioning, which varied from elementary requirements such as being well nourished, being in good health, having adequate clothes and shelter, to more complex social achievements such as being happy, having self-respect and being a part of the community.

This changed in the way that poverty was understood, transformed the field of poverty measurement as scholars attempted to develop alternatives to money-metric measures of poverty that could capture the phenomenon in its many dimensions.

MULTIDIMENSIONAL POVERTY MEASURES: NEW APPROACH



Synthesis method

Combination of the Fuzzy Sets Method (Cerioli & Zani, 1990) and the Counting Method (Alkire & Foster, 2007)

Two main steps

i) Identification of deprived people

Fuzzy Membership Function introduced by Cerioli and Zani (1990)

Being used to identify deprivation along the dimensions of individuals

ii) Aggregation of deprivations

Methods and procedures introduced by Alkire et al. (2015) is used to aggregate the fuzzy deprivation score

Identification of deprived people

Totally Fuzzy (TF) method calculates the degree of deprivation for each indicator in terms of fuzzy membership for each individual ; Cerioli and Zani (1990)

Denote each individual a grade of membership in the sub set poor(μ_{Ai}) ;

If $\mu_{Ai} = 0$; i^{th} individual is not definitely belong to poor

If $\mu_{Ai} = 1$; i^{th} individual is completely poor

If $0 < \mu_{Ai} < 1$ then i^{th} individual is partially belong to poor sub set

The value of the membership function is given by the following equation.

Consider q_{ji} is the value of i^{th} individual in j^{th} indicator where ($i=1,2,\dots,n$) and ($j=1,2,\dots,k$) in the poor set μ_A .

Then the membership fraction for each individual is;

$$\mu_{Ai}(j) = 1 \text{ if } q_{ij} < j_{min}$$

$$\mu_{Ai}(j) = \frac{q_{j,max} - q_{ij}}{q_{j,max} - q_{j,min}} \text{ if } j_{min} < q_{ij} < j_{max}$$

$$\mu_{Ai}(j) = 0 \text{ if } q_{ij} \geq j_{max}$$

Cont.....

Evidence-based data-driven weight function

- Compute the weighted deprivation score for each indicator for all individuals and create sum of weighted deprivation score for each individual in all dimensions.

$$\omega_j = \frac{\ln \frac{1}{f_j}}{\sum_{j=1}^k \ln \frac{1}{f_j}}$$

Gives more importance to the most widely prevalent poverty symptoms given socially acceptable living conditions in the community. It does so by using an **evidence-based, data-driven weighting method** for the indicators of deprivation

ω_j : Weight for j^{th} indicator

f_j : Individuals who are completely deprived in j^{th} indicator

- Weighted fuzzy deprivation was calculated using following equation:

$$W\mu_{Ai} = \frac{\sum_{j=1}^k \omega_j \times \mu_{Ai}(j)}{\sum_{j=1}^k \omega_j}$$

- Determine the deprivation cut-off (z) based on Kendall rank correlation (τ_b) coefficients .
- A person considered to be multidimensionally poor or not with respect to the selected poverty cut-off and aggregated weighted deprivation score.

Aggregation of deprivations

Counting approach

Aggregate the fuzzy deprivation score following the methods introduced by Alkire et al. (2015) which extend the methods introduced by Foster-Greer-Thorbeck (1984).

Five poverty indices are produced using the fuzzy deprivation scores of individuals:

- i) Fuzzy Headcount Index (FHI);
- ii) Fussy Intensity (FI) ;
- iii) Adjusted Fuzzy Deprivation Index (FM0);
- iv) Normalized Deprivation Gap Index (FM1); and,
- v) Squared Normalized Deprivation Gap Index (FM2).

Contribution of the Synthesis Method

- Developed a “new” method of multidimensional poverty measurement that combines the Fuzzy set approach and the Alkire-Foster method.
 - Retains the well recognized techniques of the AF and Fuzzy set method
 - Addresses the limitations of AF and Fuzzy set method
 - Go beyond the traditional way of measuring poverty ;
 - Measuring poverty in one-dimension
 - Arbitrariness set of weights and deprivation and poverty cut-offs
- Response to the discontinuity issue occurring in the identification of deprivation in indicators using standard methods
- Evidence based data driven weighting function –
 - Facilitates to compare poverty across space and over time:
 - The province or regions using one cut-off
 - Over time in absolute or relative terms

Empirical Analysis

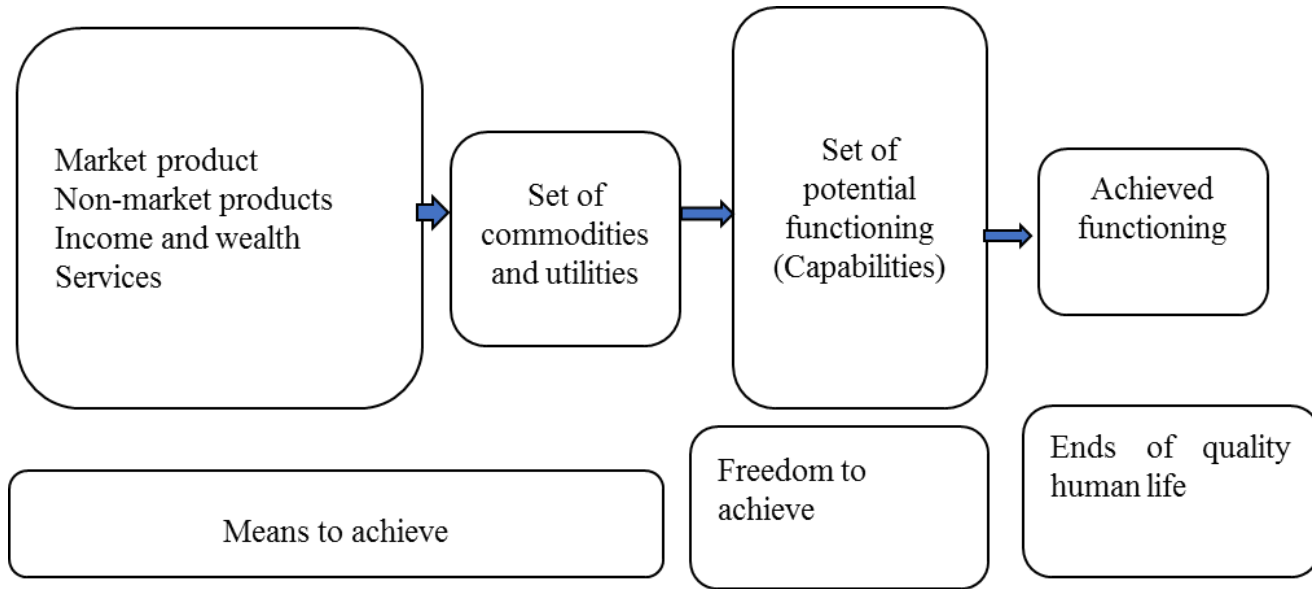
Data

- Study uses primary data collected from a survey of 1200 housing units in Uva province
- Two stage stratified sample design
- Primary Sampling Units (PSU's) are the Census Blocks
- Secondary Sampling Units are the housing units
- The unit identification was the responding adult, eighteen years of age and more, living in the household

- To synthesize and extend the two predominant methods which are used internationally to measure multidimensional poverty, by addressing some of their methodological limitations.
 - To examine the nature and magnitude of multidimensional poverty in Uva along different dimensions and their contributions to total multidimensional poverty using the Synthesis method.
 - To estimate the prevalence and depth of both multidimensional poverty.

Theoretical Foundation

Capability Approach



Capability Approach mainly focuses on opportunities to fulfil ends reason to value in particularly freedom they have rather than means

Dimensions of poverty



The three main dimensions and ten sub dimensions are proposed for the study of deprivation experienced by Poor

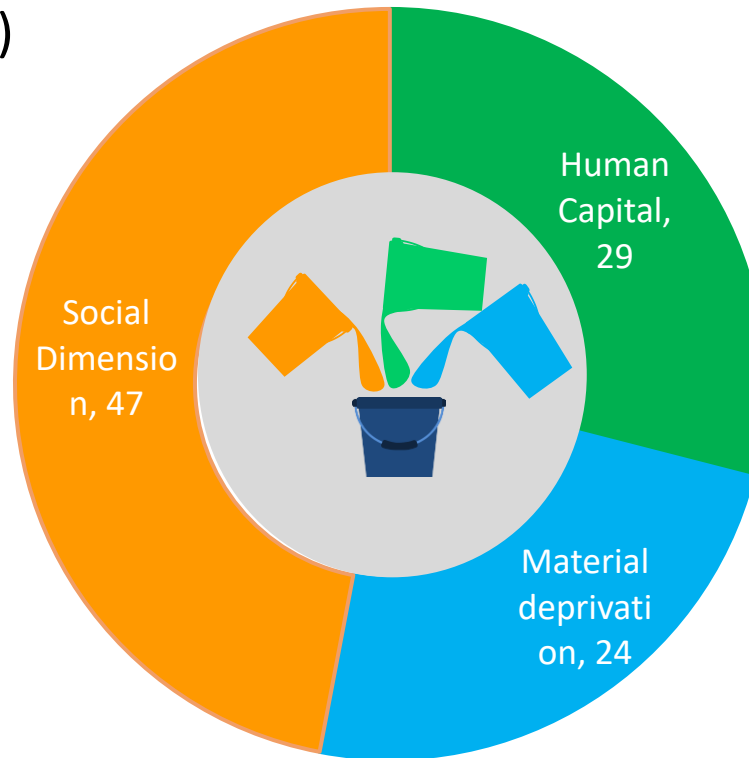
- Material deprivation
- Deprivation of Social factors
- Deprivation of Human Capital

Key Findings - Magnitude of poverty in Uva province

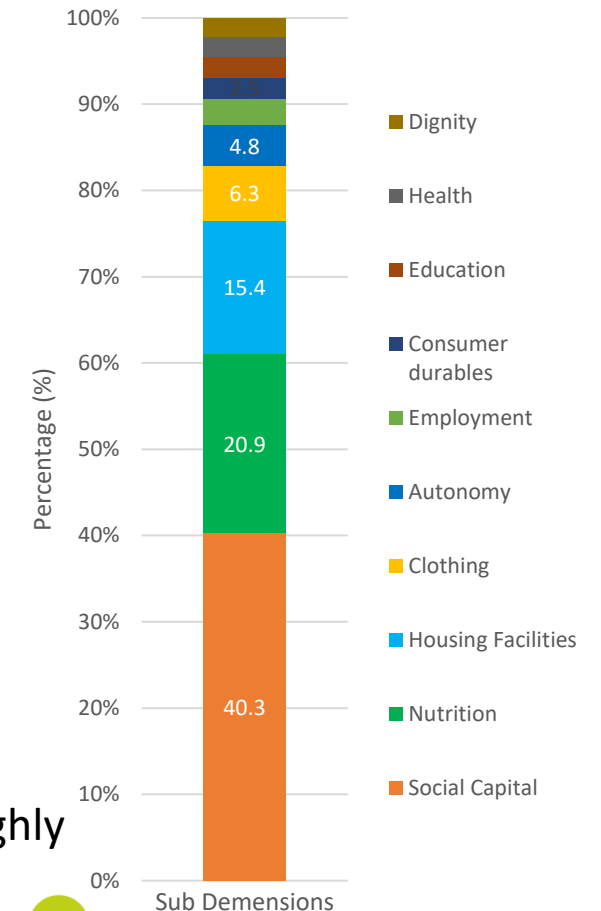


Indicators	Value (%)	CV(%)
Average Fuzzy Deprivation	42.3	1.2
Fuzzy Headcount Index (FHI)	56.0	4.9
Fussy Intensity (FI)	48.6	0.8
Adjusted Fuzzy Deprivation Index (FM0)	27.2	5.0
Normalized Deprivation Gap Index (FM1)	12.1	7.0
Squared Normalized Deprivation Gap Index (FM2)	4.3	9.7

Percentage contribution of each dimension to Adjusted Fuzzy Headcount index

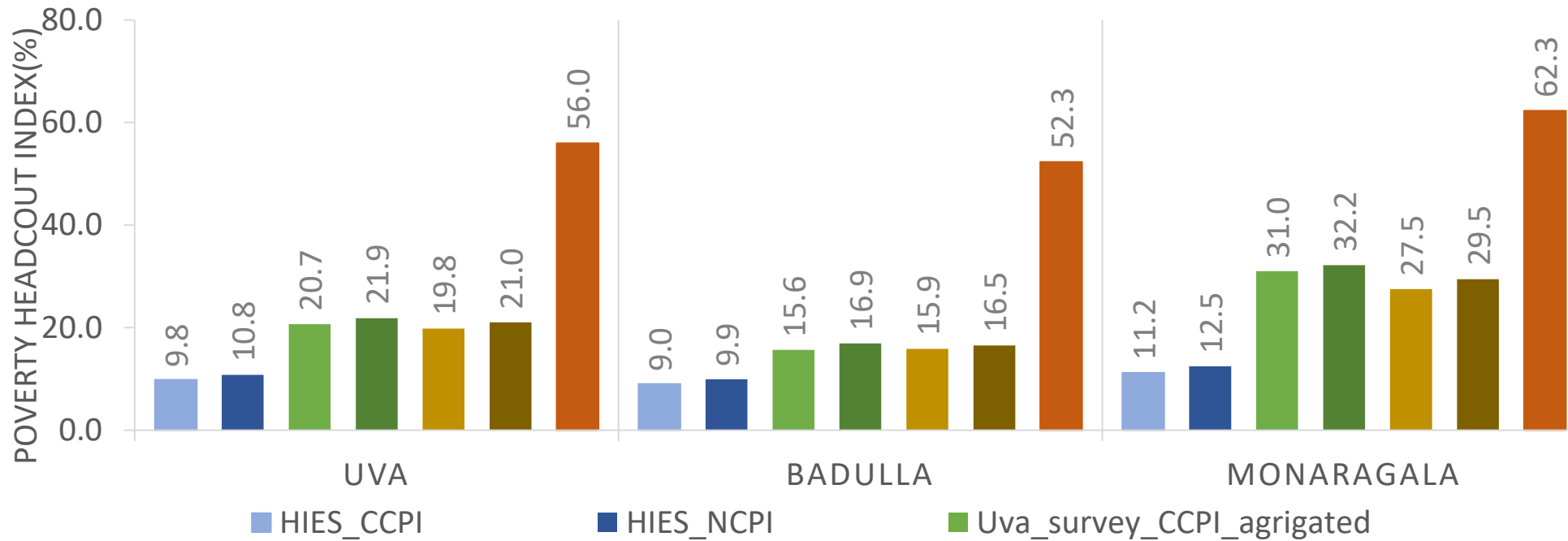


Percentage contribution of each sub dimensions to total social capital dimensions

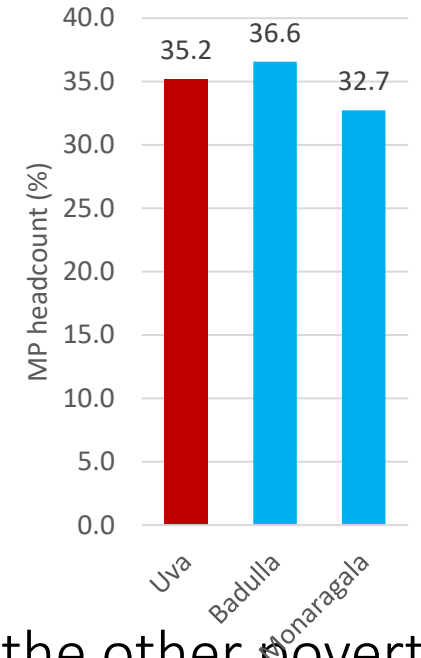


According to the findings, the dimensions of social capital, nutrition and housing facilities are highly contributing to the poverty in Uva province

Poverty headcount index by different poverty lines in Uva province by districts



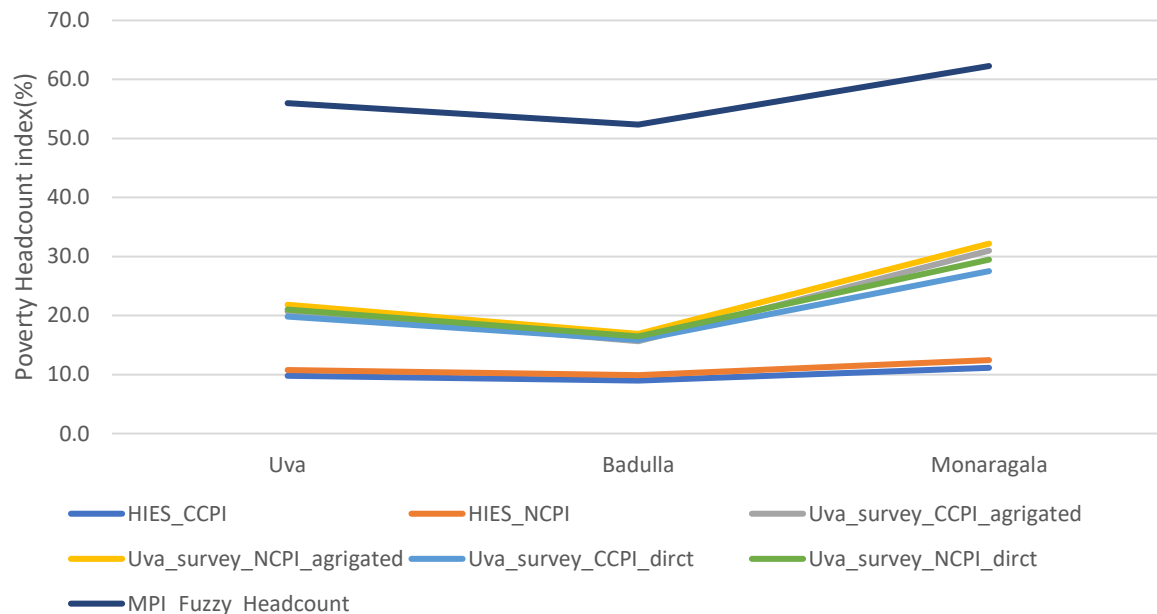
Official NMPI -2019



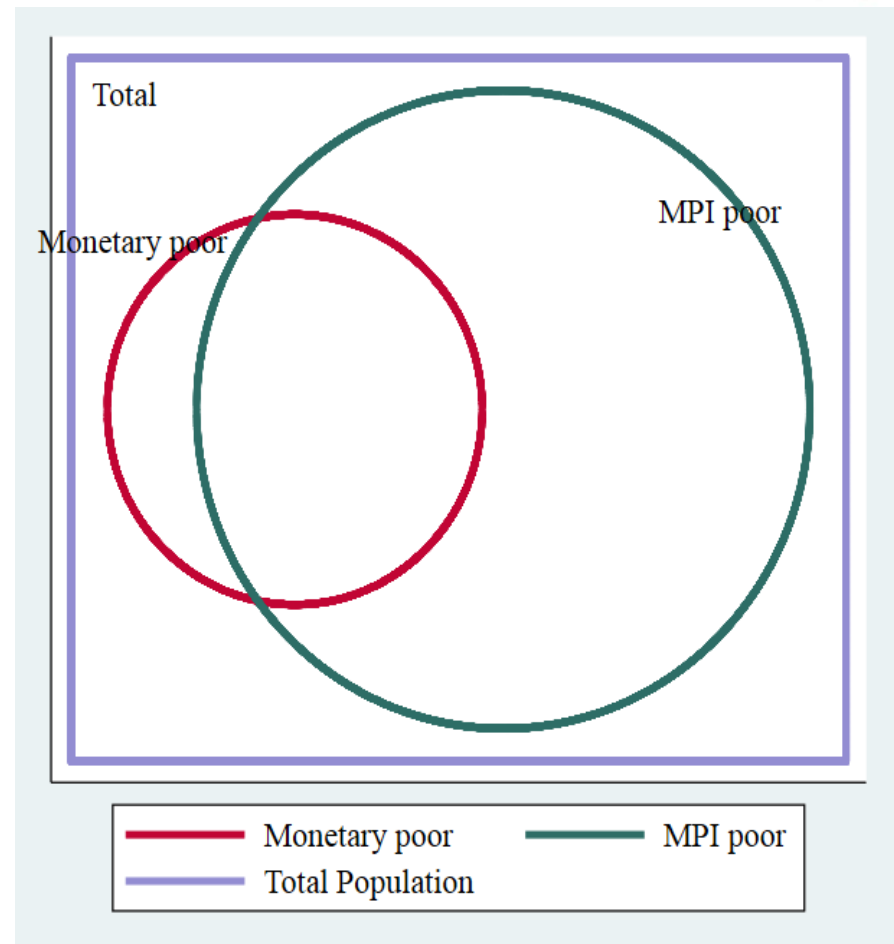
- Fuzzy poverty headcount indices(Non-Monetary) are higher than that of all the other poverty headcount indices(Monetary) .
- Multidimensional approach are more precious and capture reality than that of monetary approach.

Note: All indices do not include imputed housing rent and inflated into Uva survey period

Poverty headcount index by different poverty lines in Uva province by districts



- Multidimensional poor people could be monetary poor at the same time.
- Monetary poor are not necessarily poor in multidimensionally in non-monetary aspect
- People can be multidimensionally poor but not monetarily poor

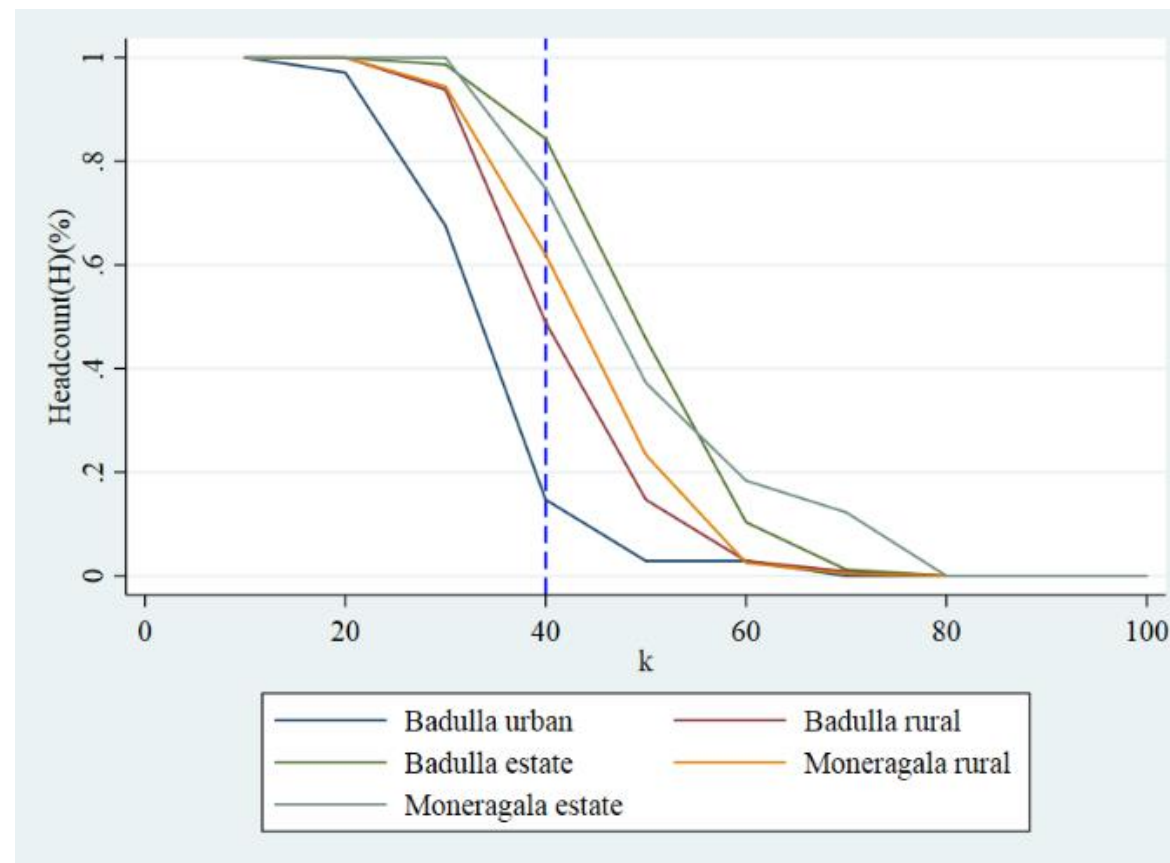


Robustness of the multidimensional poverty measures

Changing ;

- Choice of indicators or dimensions
- Weights,
- Deprivation cut-offs, and poverty cut-offs

Headcounts index for different values of deprivation cut-offs



Correlation of DS Division's rank for different poverty cut-off with $k=0.4$

Pair of ranking compared to MPI of $k=0.4$ with	Correlation coefficient	$K=0.4$
$k=0.35$	Spearman	1
	Tau_b	1
$k=0.45$	Spearman	1
	Tau_b	1
$k=0.55$	Spearman	0.9
	Tau_b	0.8
$k=0.65$	Spearman	0.8
	Tau_b	0.6

The results show that the domain comparison for poverty cut-offs between 0.35 to 0.55 are robust in comparison with the selected cut-off of $k=0.4$.

Significance of the empirical study

- Provide comprehensive picture of the poverty introducing a new method “Synthesis Method” in multidimensional approach
- Help in identifying the nature of poverty more broadly in Uva province
- Allow to see how many individuals /households are experiencing different deprivation at the same time.
- Explore the experiencing of deprivation by different dimensions and indicators
- In addition to poverty, the indices can be used to design policies to reduce the inequalities among the people.
- Programme and policies can be designed to reduce poverty more effectively.

Thank you