Summer School on Multidimensional Poverty Analysis

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Multidimensional Poverty Measurement Methodologies

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Session I
Chapter 3
Overview of Methods for Poverty Assessment

Later: Ch 4 - Counting
Motivation

• Various methodologies have been used for measurement and analysis of multidimensional poverty (MD)

• Aim of this class:
  – To bring the diverse contemporary methodologies into a common framework
  – To clarify each methodology and the data requirements, assumptions, and key choices made in measurement design
  – To evaluate the strengths and weaknesses of each approach hence to clarify how it can best be applied.
  – To enable readers to make informed choices regarding which approach will best address a given problem
Approaches to MD Poverty Measurement We Cover

- Dashboard Approach
- Composite Indices
- Venn Diagrams
- Dominance Approach
- Statistical Approaches
- Fuzzy Sets Approach
- Axiomatic Approach

These Marginal methods use aggregate data

These Methodologies use micro data and reflect the joint distribution of deprivations

poverty is assessed by \( d \) fixed dimensions
Dashboard Approach

• A set of dimensions (indicators), which applies “a unidimensional measure to each dimension”
  
(Alkire, Foster, Santos, 2011)

• Applications
  – Basic Needs Approach
    • As a first step, it might be useful to define the best indicator for each basic need…” (Hicks & Streeten, 1979)
  – Millennium Development Goals (UN, 2000): 49 indicators to monitor 18 targets to achieve the 8 goals

• Examples:
  – Percent of malnourished children, Infant Mortality Rate, Illiteracy rate
Dashboard Approach

• Let
  – $n_j$ denote the population size covered by dimension $j$
    • Note $n_j$'s are not same across all $j$
  – $x^j$ denote the vector summarizing achievements of all $n_j$ people
  – $z_j$ denote the deprivation cut-off of dimension $j$
• Then
  – $P_j(x^j; z_j)$ is the Deprivation index for dimension $j$
• Dashboard of indicators (DI): A $d$-dimensional vector containing $d$ deprivation indices.
  – Hence, technically, $DI = [P_1(x^1; z_1), \ldots, P_d(x^d; z_d)]$
Sample Dashboard: MDGs

- Proportion of population below $1 (PPP)/day
- Share of women in wage employment in the non-agricultural sector
- Net enrolment ratio in primary education
- Proportion of tuberculosis cases detected and cured under DOTS
- Literacy rate of 15-24 years-old
- Maternal mortality ratio
- Under 5 mortality rate
- Proportion of births attended by skilled personnel
- Prevalence of underweight children under 5 years of age
- Prevalence of deaths associated with malaria
- Proportion of seats held by women in national parliament
Dashboards – Note:

- Base or reference population differs by indicator, thus there may be or may not be overlapping subgroups of people (disjoint)
Dashboards

- Proportion of population below $1 (PPP)/day
- Prevalence of underweight children under 5 years of age
- Net enrolment ratio in primary education
- Literacy rate of 15-24 years-old
- Share of women in wage employment in the non-agricultural sector
- Proportion of seats held by women in national parliament
- Maternal mortality ratio
- Under-five mortality rate
- Prevalence of deaths associated with malaria
- Proportion of tuberculosis cases detected and cured under DOTS
- Proportion of births attended by skilled personnel
- BP: Total population
- BP: Total employed people
- BP: Number of children of official school age
- BP: Number of tuberculosis cases
- BP: Total occupied seats in parliament
- BP: Total number of people 15-24 years
- BP: Total recorded or estimated live births of under five children born alive
- BP: Total number of deaths
- BP: Children under 5 years of age
- BP: Total number of deaths
Dashboard Approach – Advantages

• Shares information on **many dimensions** of poverty
• Can use **cardinal or ordinal data**
• Can draw on **different data sources**
• Can show information on **disjoint populations**
  – Different base populations – e.g. Proportion of seats
  – Joint distribution is difficult for disjoint populations; a common unit of identification is required.
• Can show information of **different magnitudes**
  – Maternal mortality rates (per 100,000) vs school attendance (%)
  – Rare deprivations can be difficult to incorporate accurately into measures reflecting the joint distribution
Dashboard Approach - Disadvantages

• **Lack priorities**
  – ‘…dashboards suffer because of their heterogeneity, at least in the case of very large and eclectic ones, and most lack indications about…**hierarchies** among the indicators used.’ (Stiglitz Sen Fitoussi 2009, p63).

• **Avoids weights** – yet tradeoffs often must be made
  – “A dashboard leaves the difficult questions about **tradeoffs** completely open. It does not catalyse expert, political, or public scrutiny and debate on these tradeoffs, nor encourage transparency and accountability.” (Alkire Foster Seth 2011)
Dashboard Approach - Disadvantages

• **No headline:**
  – ‘as communications instruments, one frequent criticism [of dashboards] is that they lack what has made GDP a success: the powerful attraction of a *single headline figure* that allows *simple comparisons* of socio-economic performance over time or across countries’ (Stiglitz Sen Fitoussi 2009, p63).

• **No summary trends:**
  – “…the prospect of headlines like ‘*Government says poverty is higher, lower and unchanged*’ hardly inspires confidence” (Alkire Foster Seth 2011)
Dashboard Approach – Disadvantages

Overlooks joint distribution of deprivations

<table>
<thead>
<tr>
<th></th>
<th>Undernourished</th>
<th>Uneducated</th>
<th>No safe water</th>
<th>No electricity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peter</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Ana</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>John</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Paula</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

The headcount ratios for each dimension are the same (25%), but the actual situation of people is not.  
Alkire and Foster (2011b)
Dashboard Approach - Disadvantages

- **Lack of hierarchies** amongst the indicators used
  - Stiglitz, Sen, and Fitoussi (2009)

- **Lack a single headline figure** (such as GDP)
  - Stiglitz, Sen, and Fitoussi (2009)

- **Leave the questions about tradeoffs** completely open
  - Alkire, Foster, and Santos (2011)

- **Does not identify** who is multidimensionally poor
  - Alkire, Foster and Santos (2011)

- **Ignores joint distribution** even when could reflect it
  - Alkire, Foster and Santos (2011)
Composite Indices

• While assessing quality-of-life requires a plurality of indicators, there are strong demands to develop a single summary measure (Stiglitz, Sen, and Fitoussi, 2009).

• The $d$ deprivation indices $P_j(x^j;z^j)$ (as in the dashboard) are aggregated to obtain the composite index (CI):

$$\text{CI} = f(P_1(x^1;z_1), \ldots, P_d(x^d;z_d)).$$

Further discussion on CIs: Nardo et al. (2005), Bandura (2008), Alkire and Sarwar (2009), and Santos and Santos (2013).
Illustrative Composite Indices

• Physical Quality of Life Index (PQLI) (Morris 1978)
• Human Development Index (HDI) (1990),
• Inequality-Adjusted HDI (IHDI)
• GDI, GII, SIGI & other gender-related indices
• Doing Business Index (WB)
• Mo Ibrahim Index of Good Governance
• Global Peace Index (IEP)
• Commitment to Development Index (CGD)
• Social Progress Index (Porter)
• Prosperity Index (Legatum)
• Transparency International (TI)
# Composite Indices: Example

## The Human Poverty Index (HPI-1)

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Survival deprivation</td>
<td>$P_1$: Probability at birth of not surviving to age 40.</td>
</tr>
<tr>
<td>Education deprivation</td>
<td>$P_2$: Adult illiteracy rate</td>
</tr>
<tr>
<td>Economic deprivation</td>
<td>$P_3$: Equally weighted average of:</td>
</tr>
<tr>
<td></td>
<td>• % of population without access to an improved water source</td>
</tr>
<tr>
<td></td>
<td>• % of children under weight for age</td>
</tr>
</tbody>
</table>

\[
HPI-1 = \left\{ \left[ (P_1)^3 + (P_2)^3 + (P_3)^3 \right] / 3 \right\}^{1/3}
\]
Composite Indices - Advantages

• Provide a **summary** measure
  – Useful for comparisons; ordering
• Can use **cardinal or ordinal** data
• Can combine **different data sources**
• Can combine information on **disjoint populations**
• Can draw on **normalized indices** (different magnitudes)
• Offer a hierarchy and make **trade-offs** explicit (for a debate, see Ravallion 2011).
Composite Indices - Disadvantages

• Implicit or no **Identification**
  – Does not identify who is poor if combines disjoint populations
  – If combines conjoint populations implicitly uses union
  – Does not tell us how many poor people there are, nor how poor they are (Alkire, Foster and Santos, 2011)

• Ignore **joint distribution** even when possible to capture

• Other properties, advantages and disadvantages may relate to the specific measurement methodologies implemented
Joint Distribution

- Where $x_{ij}$ is the achievement of person $i$ in dimension $j$
- $z_j$ is the deprivation cutoff of attribute or dimension $j$

$$X = \begin{bmatrix}
  x_{11} & \ldots & x_{1d} \\
  x_{21} & \ldots & x_{2d} \\
  \text{M} & \text{O} & \text{M} \\
  x_{n1} & \ldots & x_{nd}
\end{bmatrix}$$

$z = (z_1, \ldots, z_d)$

Marginal Distribution (without reference to other dimensions)
Approaches to MD Poverty Measurement We Cover

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poverty is assessed by $d$ fixed dimensions
Venn Diagrams

- Venn diagram: a set of **closed figures** showing all possible logical relation between a finite numbers of dimensions with binary options.
- John Venn formally introduced these (Venn 1880). They had been previously known—as Venn himself mentions—as Eulerian circles.
- When there are only two dimensions, a Venn diagram provides a diagrammatic representation of a $2 \times 2$ contingency table:

<table>
<thead>
<tr>
<th></th>
<th>Dimension 2</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Non-deprived</td>
<td>Deprived</td>
<td>Total</td>
</tr>
<tr>
<td>Dimension 1</td>
<td>$n_{00}$</td>
<td>$n_{01}$</td>
<td>$n_{0+}$</td>
</tr>
<tr>
<td>Non-deprived</td>
<td>$n_{10}$</td>
<td>$n_{11}$</td>
<td>$n_{1+}$</td>
</tr>
<tr>
<td>Deprived</td>
<td>$n_{+0}$</td>
<td>$n_{+1}$</td>
<td>$n$</td>
</tr>
</tbody>
</table>

![Venn Diagram](image)
The use of Venn Diagrams

- Two dimensions: a Venn diagram provides graphical representation of a 2x2 cross tabulation

<table>
<thead>
<tr>
<th>Dimension 1</th>
<th>Non-Deprived</th>
<th>Deprived</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Deprived</td>
<td>n_00</td>
<td>n_01</td>
<td>n_0+</td>
</tr>
<tr>
<td>Deprived</td>
<td>n_10</td>
<td>n_11</td>
<td>n_1+</td>
</tr>
<tr>
<td>Total</td>
<td>n_+0</td>
<td>n_+1</td>
<td>n</td>
</tr>
</tbody>
</table>

![Venn Diagram](image)
The use of Venn Diagrams - Example

Multiple indicators from the Europe 2020 target. Figures for EU-27 in million of persons

Easier to see than contingency tables for 3-4 variables

Venn Diagrams – 4+ Dimensions

• Venn Diagram becomes hard to read for 5+ dimensions
Venn Diagrams: Advantages

- A **visual tool** to explore overlapping and non-overlapping binary deprivations in the population
- Can use **cardinal or ordinal** data
- Considers the **joint distribution** of deprivations
- **Intuitive** and easy to understand for 2-4 dimensions
- Visually portrays a ‘**union**’ approach across the considered deprivations
Venn Diagrams: Disadvantages

- **May not identify** who is multidimensionally poor
- **No summary measure** (thus, no complete ordering)
- Regardless of the scale, every dimension is converted into the **binary** options, losing information on depth
- **Difficult to read** when there are more than 5 or more dimensions
  - “Beyond five terms it hardly seems as if diagrams offered much substantial help” – Venn (1880)
- **No numerical value** thus hard to report in tables
Dominance Approach

Motivation:

• To be able to ascertain whether poverty is unambiguously lower in A than in B *regardless* of:
  
  (a) the parameters and/or
  
  (b) the poverty measure

• Such a claim certainly has strong political power!
  
  – Clearly one wants to avoid the possibility of contradictory rankings at different parameters of identification or aggregation
Dominance Approach

Origins:

• **Unidimensional inequality:** Atkinson 1970
• **Unidimensional poverty:** Atkinson 1987, Foster and Shorrocks 1988a,b, Jenkins and Lambert 1998.

Extensions:

• **Multidimensional Welfare:** Atkinson & Bourguignon 1982, 1987; Bourguignon 1989
• **Multidimensional Poverty:** Bourguignon and Chakravarty (2002), Duclos, Sahn & Younger (2006a,b).
Dominance Approach

• **Key tool:** Cumulative distribution functions (cdf) of the variable/s of interest.

• **One dimension:** given dimension $x$ (income), the cdf $F_x(b)$ gives the proportion of people such that $x_i \leq b$
A two-dimensional cdf

Negative difference for all points of the two surfaces between urban and rural areas of Viet Nam. Thus rural areas are poorer than urban ones.

Duclos, Sahn and Younger (2006).

Fig. 5. Urban Minus Rural Dominance Surface for Viet Nam
Dominance Approach: Example

• Duclos, Sahn and Younger (2006).
  – Stunting and child survival probability in Cameroon and Madagascar (using DHS, 1997).

• By univariate dominance, Madagascar is poorer than Cameroon, either measured by stunting or survival probability

• BUT with the bivariate comparison they find there is no such dominance.
Dominance Approach - Advantages

• It offers a tool to produce strong empirical assertions about poverty comparisons.

• It considers the joint distribution

• It can use discrete or continuous data

• It avoids ‘controversial’ decisions on parameter values
  – But for the same reason, it does not promote discussion or thought on them
Dominance Approach - Disadvantages

• No summary measure, No complete ordering.

• By offering pair-wise dominance, it does not show cardinally meaningful extent of differences
  – E.g. cannot say if poverty fell faster in period 1 than 2

• Dominance conditions depend on the relationship between dimensions
  – In practice, empirical applications assume substitutability
Dominance Approach - Disadvantages

• For 2+ dimensions, there is limited real applicability when datasets are of smaller size:
  – “In theory, extending our results to more than two dimensions is straightforward. In practice, though, most existing datasets in developing countries are probably not large enough to support tests on more than a few dimensions of wellbeing.” (DSY 2006)

• Dominance beyond first order require more stringent conditions on the individual poverty function, which are less intuitive
Steps to Measurement

• Selection of the space

• **Identification**: Who is multidimensionally poor? We need an ‘identification function’ \((\rho)\), a criterion that decides who is considered multidimensionally poor.

• **Aggregation**: Given the identification method, a *poverty index* summarizes the information of the achievements among the poor into a real number.
Approaches to MD Poverty Measurement We Cover

• Dashboard Approach
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• Fuzzy Sets Approach
• Axiomatic Approach

poverty is assessed by $d$ fixed dimensions
Statistical Approaches

• The main aim is to reduce dimensionality (by reflecting on joint distribution)

• Some of these methods are used for identification purposes. Some are used for the aggregation steps of poverty measurement. Some are used for both.

• Sometimes these methods are also used during measurement design, to explore relationships across variables, or to set weights.
Statistical Approaches

Figure 3.6 Multivariate Statistical Methods

Statistical Methods

Descriptive Methods

- Cluster Analysis
- Principal Component Analysis (PCA)
- Multiple Correspondence Analysis (MCA)

Model-Based Methods (Latent Variable Models)

- Latent Class Analysis (LCA)
- Factor Analysis (FA)
- Structural Equation Models (SEM)
Statistical Approaches

Figure 3.6 Multivariate Statistical Methods

Recall:

PCA is used when variables are of cardinal scale.
MCA is appropriate when variables are categorical or binary.

The model-based methods are latent variable models and cover latent class analysis (LCA), factor analysis (FA), and, more generally, structural equation models (SEM) are all model-based methods.
Descriptive vs. Model-based
PCA, MCA         LA, FA, SEM

Similarities:
Both summarise the well-being/deprivation status of a population combining indicators into a ‘composite measure’, called *component*, *axis* or *factor*

Differences:
They differ in the mathematical or statistical procedure used for computing these composite measures
- Correlation/cross tab vs. regression analysis

Total variance vs. common variance
Sub-Steps in Aggregation within Multivariate Statistical Methods

Stage 1
Achievement matrix ($X$)

Stage 2
Vector of person specific achievement values ($Full$ aggregation across dimensions)

Stage 3
Overall assessment of the ‘society’

Scalar

$\text{Achievement matrix (}X\text{)}
\quad \text{Stage 1}
\quad \begin{pmatrix} n \\ d \end{pmatrix}
\quad \begin{pmatrix} \bar{d} < d \end{pmatrix}
\quad \text{Reduced matrix of ‘combined’ achievements}
\quad \text{Stage 2}
\quad \text{Vector of person specific achievement values ($Full$ aggregation across dimensions)}
\quad \text{Stage 3}
\quad \text{Overall assessment of the ‘society’}

Scalar

\[ n \times d \times d \times 1 \]
Sub-Steps in Aggregation within Multivariate Statistical Methods

Often the sub-stages of aggregation are not made explicit, but they are vital to understand (3.4.1).

Some design decisions in PCA and MCA:
- Are components extracted from: a) the unstandardized covariance matrix or b) the correlation matrix?
- How decide which components/factors to ‘keep’ (step 1)
  - Percentage of variance accounted for
  - Eigenvalue greater than one
  - Break in scree plot
- How combine these components/factors across $d$? (step 2)
  - Weighted using ‘loadings’ (rescaled weights from covariance/corr matrix)?

Users of PCA or MCA are often unaware of these choices and their consequences for a final poverty measure/vector.
Sub-Step 1: Create reduced matrix

Aim: reduce the $n \times d$ achievement matrix to a $n \times d$ matrix $d (<d)$

- PCA and MCA replace the original $d$ indicators with a smaller set of $d$ variables that account for most of the information in the original set.
- In PCA the $d$ variables are uncorrelated or orthogonal, and each principal component is a weighted sum of the observed indicators.
- The $d$ variables are called ‘components’ in PCA and ‘axes’ in MCA.

- FA assumes that a set of indicators vary according to some underlying statistical model, which partitions the total variance across indicators into common and unique variances.
- In FA, one retains $d$ number of common factors that explain the common variance among the $d$ original indicators.
- The common variance is represented by the factors.
Sub-Step 2: Create individual index vector

Aim: combine the $d$ variables for each person to create a $n \times 1$ vector that represents the aggregate values for each of $n$ persons.

• The individual aggregate can be a weighted average of the $d$ variables

• The individual aggregate can generated by a multivariate model

• Naturally, there are many ways of aggregating the $d$ variables
Sub-Step 3: Aggregate across people

Aim: summarize the $n \times 1$ vector to a scalar reflecting poverty of society

- Assess each person’s achievement against a poverty line to identify the poor (the poverty line may be relative or absolute)
- Aggregate information across all people into a poverty measure
- Naturally, there are many ways of identification and aggregation
The DHS Wealth Index: PCA, steps 1&2

Filmer and Pritchett (1999, 2001) applied PCA to a set of asset variables in DHS, and retained the first principal component.

They standardized the asset index scores to a standard normal distribution with a mean of 0 and a standard deviation of 1.

All individuals in each household were assigned the household’s standardized asset index score, and all individuals in the sample population were ranked according to that score.

The sample population was then divided into quintiles of individuals, with all individuals in a single household being assigned to the same quintile. No scalar societal measure was generated (Step 3).

Some applications of Filmer and Pritchett index: Sahn and Stifel 2000, Stifel and Christiaensen 2007, Mckenzie 2005
Statistical Approaches - Advantages

• Addresses multidimensionality
• Consider joint distribution
• Some (MCA) can be used with ordinal data
• Help clarify relations among indicators hence strengthen indicator design.
Properties unclear (monoton, focus, subgroup decomp)

Comparisons across space and time may be difficult
  – Purely data driven

May be difficult to communicate (individual score)

Identification of the poor often relative (percentiles)

Results sensitive to design decisions
  – seemingly minor methodological choices may affect results
  – design decisions rarely understood or justified
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Poverty is assessed by $d$ fixed dimensions
Fuzzy Sets Approach

Motivation:

• Thresholds dichotomize people into crisp sets of the deprived and non-deprived or poor and non-poor.
• Yet there may be uncertainty about where to set cutoffs
• Fuzzy sets can reflect this uncertainty for: deprivation cutoff, poverty cutoff,

Is living with $0.99/day really different from living with 1.01/day?
Motivation

Amartya Sen suggests taking ambiguity seriously

• If an underlying idea has an essential ambiguity a precise formulation of that idea must try to capture that ambiguity rather than attempt to lose it. Even when precisely capturing an ambiguity proves to be a difficult exercise, that is not an argument for forgetting the complex nature of the concept and seeking a spuriously narrow exactness. In social investigation and measurement, it is undoubtedly more important to be vaguely right than to be precisely wrong. Sen 1992:48-9.

• Fuzzy set techniques explore how to be ‘vaguely right’
• Mostly applied to deprivation and poverty cutoffs to date.
Fuzzy Sets – Identification

• Extend venn diagrams: rather than identifying the deprived/ non-deprived or poor/non-poor, allow varying degrees of membership $m_j(x_{ij})$ to each set.

<table>
<thead>
<tr>
<th>Poor ($m_j(x_{ij}) = 1$)</th>
<th>Non-Poor ($m_j(x_{ij}) = 0$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional</td>
<td></td>
</tr>
</tbody>
</table>

Fuzzy unbounded

Certainly Poor

Fuzzy bounded

The selection of the membership function $m_j(x_{ij})$ is key.
Fuzzy Sets - Aggregation

Individual Aggregation:

For each person $i$, $M_i$ is the degree of membership to the group of the poor. Typically, a weighted mean:

$$M_i = \frac{m_1(x_{i1})w_1 + ... + m_d(x_{id})w_d}{w_1 + ... + w_d}$$

Note $M_i$ (as $m_j$) also ranges between 0 to 1

Overall Index: $P = f(M_1, ..., M_n)$

Example: $P = \frac{(M_1 + ... + M_n)}{n}$
Fuzzy Sets Applications

• Interesting applications of the approach to different countries
  – Italy (Chiappero-Martineti (2000))
  – Belgium (Lelli 2001)
  – Israel (Deusch & Silber 2005)
  – Venezuela (Roche 2009)
  – Uruguay (Amarante et al. 2010)
  – Different European countries (D’Ambrosio et al. 2011)
  – Portugal (Bastos and Machado 2009)
Fuzzy Sets Approach - Advantages

- May be used with **ordinal and cardinal** data*
- Emphasises the **identification** step
- Compatible with **different aggregation** methodologies
- Offers a **summary measure**, a **hierarchy** among dimensions, explicit **tradeoffs** and a complete **ranking**
- Some approaches comply with standard **axioms** of poverty measurement (Chakravarty 2006)
- Can consider **joint deprivation**

* The membership function must reflect the kind of data used.
Fuzzy Sets Approach - Disadvantages

• How to justify a membership function?
• Membership functions affect results, but are hard to assess.
• Robustness tests are not always provided.
• Some membership functions misuse ordinal data
• Fuzzy results may conflict with Dominance results
• Properties of fuzzy measures may not be specified.
• If multiple fuzzy sets are used, adds layers of complexity.
• Policy appeal fades if it becomes hard to communicate
Fuzzy Sets Approach - Disadvantages

- May not be intuitive, hard to interpret the numbers
- Its contribution is not clear in poverty measurement
  - Unbounded membership (Why need a poverty measure!)
  - Bounded membership (may provide wrong policy incentive)
- What about the Fuzzyness of Fuzzy bounds?
Fuzzy Sets Approach - Disadvantages

May result in counter-intuitive conclusion

\[ x = (4,5,7,7,10) \text{ and } y = (1,2,8,8,10) \]

• By second order dominance \( y \) has more poverty for any poverty line

• Use bounded Fuzzy with bounds 6 and 9
  – No Fuzzy measure would conclude \( y \) has more poverty
Fuzzy Sets Approach - Observations

• Considering ambiguity remains essential

• Other methods than Fuzzy can be used:
  – Different poverty cutoffs (33%, 50%)
  – Different deprivation cutoff vectors (destitution and poverty)
  – Robustness/Sensitivity tests on cutoffs/weights/indicators
  – Dominance analyses
  – Qualitative studies to complement and enrich
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Axiomatic Approach

Motivation:

• To develop a poverty measure that complies with a number of desirable properties

• A poverty measure that does not change under certain transformations of people’s achievements

• It does change in a particular direction under other transformations of people’s achievements.
Axiomatic Approach

Origins:


Axiomatic Approach

Two possible procedures:

1. Introduce a number of properties considered desirable and derive a measure satisfying these properties (characterization): the only measure satisfying these properties

Properties
A, B, C

Measure
P*

Necessary Condition

Sufficiency Condition
Axiomatic Approach

Two possible procedures:

2. Introduce a number of properties considered desirable and propose a measure satisfying these properties (but without claiming it to be the only measure).

The KEY question is…

which are the truly desirable and justifiable properties?
Axiomatic Approach

Extensions to the Multidimensional case:

Key papers:
Chakravarty, Mukherjee and Ranade (1998)
Tsui (2002)
Bourguignon and Chakravarty (2003)
Chakravarty and D’Ambrosio (2006)
Alkire and Foster (2007, 2011)
Bossert, Chakravarty and D’Ambrosio (2009)
Axiomatic Approach

• Identification: Two types commonly used among many
  – Aggregate Achievement approach: achievements are aggregated to obtain a score and then an overall poverty cutoff is selected to identify the poor
    • Maasoumi and Lugo (2008)
  – Censored Achievement Approach: individuals are identified as deprived or not in each dimension and then identified as poor using the deprivation information
Axiomatic Approach

- Most measures are extensions of unidimensional poverty measures, FGT (most prominently) or Watts, or Chakravarty (1983). But some also use some other formulas such as the general means.
Axiomatic Approach Requirements

- Information should be available from the same source (to address joint deprivation)
- Most of the measures require cardinality of the dimensions used
- Measures applicable to meaningful ordinal dimensions *(counting framework)*:
  - Alkire and Foster (2011)
  - Chakravarty and D’Ambrosio (2006)
  - Bossert, Chakravarty, and D’Ambrosio (2009)
  - Aaberge and Peluso (2012)
Axiomatic Approaches - Advantages

- Allow looking at joint deprivations
- When combined with an aggregation measure (which is usually the case), they offer a summary measure, a complete ranking
- Allow for both cardinal and ordinal variables
- Biggest advantage: It provides clearer understanding on how measures behave due to different transformations
  - A pilot of a plane ought to have a sound understanding of how the plane responds to different operations
Axiomatic Approaches-Disadvantages

• Rely on normative judgments
  – May require various robustness tests
• No single poverty measure satisfies all properties
• The final poverty figures of some measures are difficult to interpret intuitively when they are made to satisfy many properties simultaneously
• Many require cardinal data
Concluding Remarks

• It is important to understand how different measures behave and what aspects capture

• Properties are extremely important
  – We have discussed them here
Chapter 4
Counting Approaches
Counting Approaches

• Refers to a particular method for identifying the poor.

Motivation:

• From late 19th century to the 1970s the prevailing approach to measuring poverty used monetary measures.

• The poor were those below the poverty line, which represented the “minimum necessaries for the maintenance of merely physical efficiency” (nutritional requirements) in monetary terms + minimum sums for clothing, fuel and hh sundries according to family size (Townsend, 1954).
Counting Approach in Steps

1. Define a list of relevant indicators
2. Assign a weight to each considered indicator
3. Define a threshold (deprivation cutoff) for each indicator
4. Create binary deprivation scores for each person in each indicator: “1” = deprived, “0” = non-deprived
5. Produce a deprivation score - a weighted sum of deprivations.
6. Set a threshold score of poverty (or poverty cutoff score) such that if the person has a deprivation score at or above the threshold, she is considered poor.
Counting Approach

Motivation:

• In the 1970s, concerns for non-income objectives were explicitly raised by ‘basic human needs’ approaches, initially in Latin America.

• “Human beings have basic needs: food, shelter, clothing, health, education. (...) We are still in a stage where the most important concern of development is the level of satisfaction of basic needs for the poorest sections in each society(...)” (Cocoyoc Declaration, UNEP-UNCTAD, 1974).

• Endorsed or used by other institutions over time.
  – World Bank
  – Arab/MENA countries

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OPHI Oxford Poverty & Human Development Initiative
Counting Approach

Motivation:

• The Basic Needs Approach drew attention to the importance of measuring the *actual* satisfaction of basic needs (or at least access to key commodities)

• Thus, it fostered the so-called **direct method** to measure poverty (Sen, 1981):

• A *list* of basic needs alongside minimum levels of achievement (cutoffs) were specified.

• *Counting* the number of deprivations naturally emerged as a method for identifying who is poor.
Counting Approach

Motivation in Europe:

• Criticisms of GNP per capita as a measure of welfare in the 1950s led to a 1954 UN expert group, which proposed to measure wellbeing using ‘level of living’.

• In 1968 Sweden implemented a Level of Living Survey that was repeated and spread, especially in Scandinavia.

• Delors (1971) work on social indicators enabled empirical studies of non-monetary aspects of social welfare and catalysed discussions of poverty measurement.

• This availability of new data enabled counting approaches
Motivation in Europe: Social Exclusion

- Lenoir (1974) articulated the concept of social exclusion that has most widely motivated European approaches to measurement for public policy (although needs also used)

- Social exclusion became seen as going ‘beyond the elimination of poverty’ to focus on ‘the mechanisms whereby individuals and groups are excluded from taking part in the social exchanges, from the component practices and rights of social integration’ (European Commission 1992).
Counting Approach
Some Implementations in Europe

• Townsend (1979): “Poverty in the UK”.
• Defined 60 indicators covering 12 dimensions (diet, clothing, fuel and light, home amenities, housing conditions and facilities, the immediate environment of the home, conditions at work, family support, recreation, education, health and social relations).
• Equal weights to all indicators, although the number of indicators within each dimension varied greatly.
Counting Approach Implementations

Townsend (1979):

- For ‘illustrative purposes’, he then focused on a shorter list of 12 items covering major aspects of dietary, household, familial, recreational and social deprivation.
- Discarded union criterion because: “No single item by itself, or pair of items by themselves, can be regarded of symptomatic of general deprivation. People are idiosyncratic and will indulge in certain luxuries and apply certain prohibitions for religious, moral, educational or other reasons, whether they are rich or poor”
Townsend (1979):

- He explored the correlation between deprivation scores and household income (adjusted for household size) in order to derive an income threshold below which people are “disproportionately deprived” (p. 255).

- In other words, he used a direct approach to ‘validate’ the poverty line to be used in the income approach to poverty measurement.

- Yet his work inspired a prominent body of subsequent work within and outside Europe.
Counting Approach Implementations

Mack and Lanslay (1985): “Poor Britain”

2 innovations: 1) ‘socially perceived’ necessities

- the list of items considered as necessities was constructed using a survey (1983 Breadline Britain), for the first time ever, about the public’s perceptions of minimum needs.
- Method referred to as the ‘consensual or perceived deprivation approach to measuring poverty’.
- Of the original 35 considered items, they retained the 26 items that were considered to be a necessity by strictly more than 50% of the population.
Counting Approach Implementations

Mack and Lanslay (1985): “Poor Britain”

2 innovations:  2) Enforced lack

- It discriminated between people who did not have an item because they could not afford it, from those for whom it was a voluntary choice
- Who were the poor?
- Those who could not afford three or more items from a list of 22, each equally weighted (poverty cutoff selected after crossing the enforced lack of necessities with income levels and spending patterns).
Counting App. Implementations
Europe & beyond – implementations of the consensual approach, and the consistent approach

- **Netherlands** Muffels et al. (1992) index of relative deprivation
- **Outside Europe:** Mayer and Jencks (1989) and Bauman (1998, 1999) in the US.
Counting App. Implementations

Latin America

• **Unsatisfied Basic Needs (UBN) Approach** –
  – Prominent in Latin America
  – Seminal work in Chile (Kast and Molina, 1975) and Argentina by INDEC (1984), together with CEPAL.

• **Ususally used five census indicators:**
  – Overcrowding (3+ people/room)
  – Housing
  – Sanitation
  – Children attending primary school
  – HH: (head has 2 years or less education) or high dependency (4+/worker).
Counting App. Implementations

• Unsatisfied Basic Needs (UBN)
• Reported as official statistics in: Bolivia, Chile, Colombia, Ecuador, Guatemala, Honduras, Nicaragua, Paraguay, Peru, Uruguay, Venezuela.

• Identification: Reported headcount ratio with 1+, 2+ and 3+ deprivations (different poverty cutoffs)

• Powerful in terms of policy: used for policy mapping at very disaggregated levels (Census information)

• Limited flexibility because of few census indicators.
Counting App. Implementations

• **Further Developments:**
  • ‘Integrated method’ identified hh that were income poor AND had Unsatisfied basic needs, or experienced only income poverty/ubn
  
  ![Diagram](https://via.placeholder.com/150)
  
  • Non-counting proposal to cardinalize ordinal data and combine it with income poverty (Boltvinik)
  • Targeting (NGO programmes – Kudumbashree)
  • ‘Graduation’ from programmes (BRAC)
  • Poverty Scorecards (NGOs, Schreiner)
Counting Approaches - Pros

• Clarity, Simplicity, Transparency, Intuition for identifying the multiply deprived.
• Powerfully considers joint deprivations.
• Can be used with cardinal and ordinal variables.
• When combined with an aggregation measure, offer a summary measure, a complete ranking.
• Tradeoffs are explicit and clear.
• Policy use was often very strong
Counting Approaches - Cons

- Often only headcount ratio to aggregate, so not sensitive to **breadth** of deprivations.
- Sometimes assigned **cardinal meaning to ordinal** values
- Sometimes aggregation method removes intuition
- **Dichotomises** (deprived/non-deprived) so not sensitive to the depth for identification.