Poverty Measurement and Policy:
From FGT to the MPI

James E. Foster

George Washington University and OPHI, Oxford

G20 T20 TF5 Side Event

"Multidimensional Poverty in the Midst of the COVID-19 Pandemic: A Commitment to Reducing Poverty in All Its Forms"

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Introduction

- Universally agreed
  - Indonesia has high **statistical capacity**
    - See *Measuring the Statistical Capacity of Nations*, Oxford Bulletin of Economics and Statistics, 2021
- Reflected in national poverty statistics
  - Quality due to the good work of many at this event
  - Adheres to World Bank standards for consumption poverty
    - Rich, frequently gathered data sources; unified data
    - Frequent reporting of FGT measures to understand incidence, depth, and severity of poverty
  - <u>Note</u> Uses full spectrum of FGT's powers and properties
    - Decomposability – Connect up local with national poverty
    - Simplicity – move beyond headcounts intuitively
    - Other helpful axioms and characteristics

Introduction

- Recently Alkire-Foster (2011) extended FGT to multidimensional poverty
- This new technology was soon adopted by
  - UN in its Global MPI; a bit later by WB in MPM
  - Many nations as they grapple with SDG target 2.1
- Today's focus
  - What is the AF approach to poverty?
  - How does it relate to the FGT measures?
  - How might it augment the view offered by consumption poverty?
  - How might it help direct policy?
- Bottom line: MPI is as simple as the poverty gap, but is a far more powerful tool for directing policies

Introduction

- Outline (remembering time limit!)
  - Quick review of FGT
    - Motivation, definitions, axioms, applications
  - Brief presentation of AF
    - Motivation, definitions, axioms, applications
  - Discussion of possibilities

General Poverty Measurement

- Traditional framework of Sen (1976)
- Two steps
  - Identification: "Who is poor?"
    - Targeting
  - Aggregation: "How much poverty?"
    - Evaluation and monitoring

Consumption Poverty Measurement

- Uses **poverty line** for identification
  - Poor if consumption below the cutoff
    - Example: distribution $x = (7,3,4,8)$ poverty line $\pi = 5$
    - Who is poor?

Consumption Poverty Measurement

Uses **poverty measure** for aggregation

The FGT family is defined as

$$P_a(x;p) = m(g_1^a,\ldots,g_n^a) = m(g^a)$$

where x = $(x_1,\ldots,x_n)$ is the distribution of consumption.

π is the poverty line, and

g_i^α is $[(\pi - x_i)/\pi]^\alpha$ if *i* is poor and 0 if *i* is not poor

Key measures

P_0 is headcount ratio

P_1 is per capita poverty gap

P_2 is squared gap

Consumption Poverty Measurement

Example

Distribution $x = (7,\underline{1},\underline{4},8)$

Poverty line $\pi = 5$

Deprivation vector $g^0 = (0,1,1,0)$

Headcount ratio $P_0(x;\pi) = \mu(g^0) = 2/4$

Normalized gap vector $g^1 = (0, 4/5, 1/5, 0)$

Poverty gap = $HI = P_1(x;\pi) = \mu(g^1) = 5/20$

Squared gap vector $g^2 = (0, 16/25, 1/25, 0)$

FGT Measure = $P_2(x;\pi) = \mu(g^2) = 17/100$

Note that **FGT** or P_α is the mean of a vector

Consumption Poverty Measurement

- What properties are satisfied by FGT?
- Digression: rethinking the role of axioms
  - Old view: technical requirements
  - New view: nuggets of policy
  - Categories
    - Invariance axioms
      - Concern changes in the distribution should be ignored by the measure
    - Dominance axioms
      - Concern changes in the distribution that decrease poverty
    - Composition axioms
      - Specifies the impact of combining populations

Consumption Poverty Measurement

- List of axioms for FGT
  - For $\alpha = 0$ (headcount ratio)
    - Invariance Axioms: Symmetry, Replication Invariance, Focus
    - Composition Axioms: Subgroup Consistency, **Decomposability**
  - For $\alpha = 1$ (poverty gap)
    - +Dominance Axiom: **Monotonicity**
  - For $\alpha = 2$ (FGT)
    - +Dominance Axioms: Transfer

Multidimensional Poverty Measurement

- How to measure poverty when there are many dimensions?
- Alkire and Foster (2011):
  - Based the **aggregation** step on FGT generalized to many dimensions
  - Proposed a new dual cutoff approach to **identification**
    - Deprivation cutoffs $z_1 \ldots z_j$ one per each of j deprivations
    - Poverty cutoff k across aggregate weighted deprivations
- Idea
  - A person is poor if multiply deprived enough
- Example

AF Methodology

Achievement Matrix

Dimensions

$$Y = \begin{bmatrix} 13.1 & 14 & 4 & 1 \\ 15.2 & \underline{7} & 5 & \underline{0} \\ \underline{12.5} & \underline{10} & \underline{1} & \underline{0} \\ 20 & \underline{11} & 3 & 1 \end{bmatrix}$$

Persons

$$z = (\,13 \quad 12 \quad 3 \quad 1\,)$$

Cutoffs

AF Methodology

Deprivation Matrix

$$g^0 = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 \\ 0 & 1 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 \\ 2 \\ 4 \\ 1 \end{bmatrix}$$

$\Rightarrow$

Censored Deprivation Matrix, k=2

$$g^0(k) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 1 & 1 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix} \quad \begin{bmatrix} 0 \\ 2 \\ 4 \\ 0 \end{bmatrix}$$

Identification Who is poor?

If poverty cutoff is k = 2

Then the two middle persons are poor

Now censor the deprivation matrix

Ignore deprivations of nonpoor

AF Methodology

If data cardinal, construct two additional censored matrices

Censored Gap Matrix

$$g^1(k) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0.42 & 0 & 1 \\ 0.04 & 0.17 & 0.67 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Censored Squared Gap Matrix

$$g^2(k) = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0.42^2 & 0 & 1^2 \\ 0.04^2 & 0.17^2 & 0.67^2 & 1^2 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

Aggregation

$$M_\alpha = \mu(g^\alpha(k)) \text{ for } \alpha \geq 0$$

Adjusted FGT M_α is the mean of the respective censored matrix

AF Methodology

- **However**
  - The poverty measures with $\alpha > 0$ use gaps, hence require **cardinal** data
  - Impractical given data quality
  - Focus has been on $\alpha = 0$ that handles **ordinal** data
- **Adjusted Headcount Ratio M_0** or **MPI**
  - Practical and applicable

Adjusted Headcount Ratio

Adjusted Headcount Ratio = M_0 = HA = $\mu(g^0(k))$

	Domains				c(k)	c(k)/d	
$g^0(k) =$	0	0	0	0	0		
	0	1	0	1	2	2 / 4	Persons
	1	1	1	1	4	4 / 4	
	0	0	0	0	0		

H = multidimensional headcount ratio = 1/2

A = average deprivation share among poor = 3/4

Adjusted Headcount Ratio

Axioms

- Invariance Axioms: Symmetry, Replication Invariance, Deprivation Focus, Poverty Focus
- Dominance Axioms: Weak Monotonicity, **Dimensional Monotonicity**, Weak Rearrangement, a form of Weak Transfer
- Composition Axioms: Subgroup Consistency, **Decomposability**, Dimensional Breakdown

THE MPI AND THE POVERTY GAP

MPI = M_0 = H x A

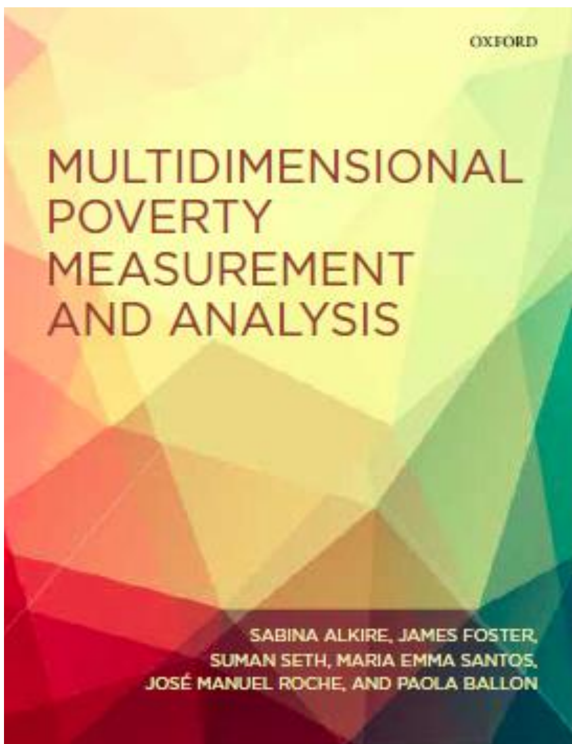
H = Multidimensional poverty rate

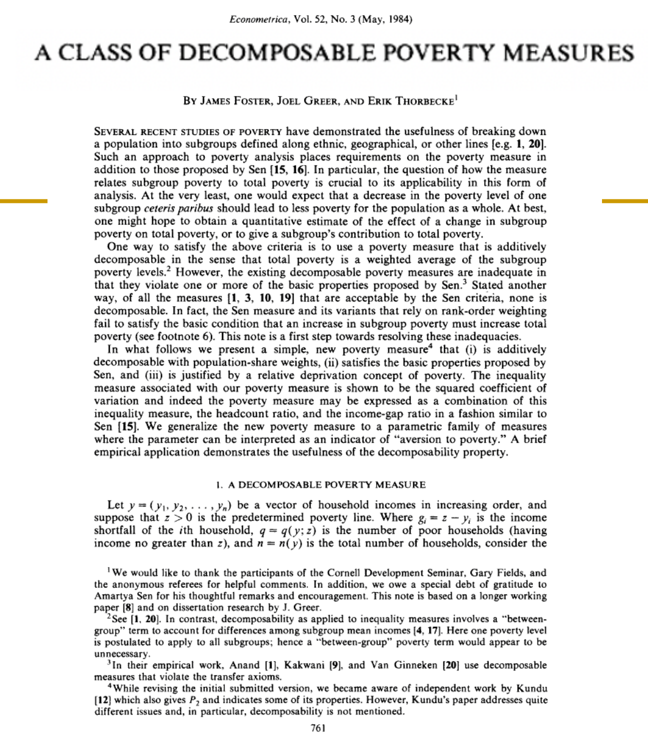
A = Average intensity (breadth) of poverty

Poverty Gap = P_1 = H x I

H = Monetary poverty rate

I = Average intensity (depth) of poverty





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A CLASS OF DECOMPOSABLE POVERTY MEASURES

BY JAMES FOSTER, JOEL GREER, AND ERIK THORBECKE[1]

SEVERAL RECENT STUDIES OF POVERTY have demonstrated the usefulness of breaking down a population into subgroups defined along ethnic, geographical, or other lines [e.g. **1**, **20**]. Such an approach to poverty analysis places requirements on the poverty measure in addition to those proposed by Sen [**15**, **16**]. In particular, the question of how the measure relates subgroup poverty to total poverty is crucial to its applicability in this form of analysis. At the very least, one would expect that a decrease in the poverty level of one subgroup *ceteris paribus* should lead to less poverty for the population as a whole. At best, one might hope to obtain a quantitative estimate of the effect of a change in subgroup poverty on total poverty, or to give a subgroup's contribution to total poverty.

One way to satisfy the above criteria is to use a poverty measure that is additively decomposable in the sense that total poverty is a weighted average of the subgroup poverty levels.[2] However, the existing decomposable poverty measures are inadequate in that they violate one or more of the basic properties proposed by Sen.[3] Stated another way, of all the measures [**1**, **3**, **10**, **19**] that are acceptable by the Sen criteria, none is decomposable. In fact, the Sen measure and its variants that rely on rank-order weighting fail to satisfy the basic condition that an increase in subgroup poverty must increase total poverty (see footnote 6). This note is a first step towards resolving these inadequacies.

In what follows we present a simple, new poverty measure[4] that (i) is additively decomposable with population-share weights, (ii) satisfies the basic properties proposed by Sen, and (iii) is justified by a relative deprivation concept of poverty. The inequality measure associated with our poverty measure is shown to be the squared coefficient of variation and indeed the poverty measure may be expressed as a combination of this inequality measure, the headcount ratio, and the income-gap ratio in a fashion similar to Sen [**15**]. We generalize the new poverty measure to a parametric family of measures where the parameter can be interpreted as an indicator of "aversion to poverty." A brief empirical application demonstrates the usefulness of the decomposability property.

1. A DECOMPOSABLE POVERTY MEASURE

Let $y = (y_1, y_2, \ldots, y_n)$ be a vector of household incomes in increasing order, and suppose that $z > 0$ is the predetermined poverty line. Where $g_i = z - y_i$ is the income shortfall of the ith household, $q = q(y; z)$ is the number of poor households (having income no greater than z), and $n = n(y)$ is the total number of households, consider the

[1] We would like to thank the participants of the Cornell Development Seminar, Gary Fields, and the anonymous referees for helpful comments. In addition, we owe a special debt of gratitude to Amartya Sen for his thoughtful remarks and encouragement. This note is based on a longer working paper [**8**] and on dissertation research by J. Greer.

[2] See [**1**, **20**]. In contrast, decomposability as applied to inequality measures involves a "between-group" term to account for differences among subgroup mean incomes [**4**, **17**]. Here one poverty level is postulated to apply to all subgroups; hence a "between-group" poverty term would appear to be unnecessary.

[3] In their empirical work, Anand [**1**], Kakwani [**9**], and Van Ginneken [**20**] use decomposable measures that violate the transfer axioms.

[4] While revising the initial submitted version, we became aware of independent work by Kundu [**12**] which also gives P_2 and indicates some of its properties. However, Kundu's paper addresses quite different issues and, in particular, decomposability is not mentioned.

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Who Is Using MPIs?

- Governments
  - Many national measures, including India; MPPN 60 countries
- United Nations
  - 2010 Global MPI
  - 2015 Sustainable Development Goals (**SDGs**)
    - Target 1.2: by 2030, reduce at least by half the proportion of men, women and children of all ages living in **poverty in all its dimensions** according to national definitions
- World Bank
  - 2016 Poverty Commission (**Atkinson Report**)
    - Recommendation 19: The Complementary Indicators should include a multidimensioned poverty indicator based on **the counting approach**.

Rationale for Using MPIs

- Transparent **headline** metric for communication/monitoring
  - **Simple** yet sophisticated
  - Linked to well-embedded **FGT**
- Coordinated **dashboard** for policy analysis
  - **Decomposability** axiom links overall to local
  - **Dimensional Breakdown** axiom reveals structure of poverty
  - Ex: Global MPI across Africa
- Supports good **governance**
  - Consistent with **political cycle** – can observe results
  - Reduces **political risk** from income shocks (eg, Mexico)
  - **Aligns** government and citizen

Rationale for Using MPIs

- Can help **coordinate** national development policy
  - **De-siloing** government ministries (Ex: Colombia)
  - "Measurement as leadership"
  - Guiding development **budgets** (Ex: Costa Rica)
- **Upgradeable** technology to account for inequality
  - If data are cardinal – **M1** or **M2** (captures inequality)
  - If ordinal – **M-gamma** measures
- Fully **localizable**
  - Global MPI – regional MPIs – National MPIs – Local MPIs

What do you think? Could these rationales apply here?

Thank you!