Changes Over Time in Multidimensional Poverty: Methodology and Results for 34 Countries

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Summary. — This paper sets out a systemic account of intertemporal changes in multidimensional poverty using the Alkire–Foster Adjusted Headcount Ratio and its consistent sub-indices. It uses three techniques to assess the pro-poorness of multidimensional poverty reduction. The analysis of changes in multidimensional poverty draws on the global Multidimensional Poverty Index (MPI) and related destitution measure in 34 countries and 338 sub-national regions, covering 2.5 billion people, for which there is a recent MPI estimation and comparable Demographic and Health Survey (DHS) dataset across time. First, it assesses overall changes in poverty and its incidence and intensity, and compares this with changes in $1.90 poverty. Next, utilizing the property of subgroup decomposability, it examines changes in the MPI and its consistent sub-indices over time across urban–rural regions, sub-national regions and ethnic groups. The decomposition analysis identifies relevant national patterns, including those in which the pace of poverty reduction is higher for the poorest subgroups. Finally, the paper analyzes the dynamics of a strict subset of the poor, who are identified as "destitute" using a more extreme deprivation cutoff vector, and studies relative rates of reduction of destitution and poverty by country and region. This extensive empirical analysis illustrates how to assess the extent and patterns of reduction of multidimensional poverty, as well as whether it is inclusive or whether some people or groups are left behind. Naturally, some further research questions emerge.
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1. INTRODUCTION

The aim of poverty measurement is to aid, incentivize, and confirm the successful reduction of disadvantages that blight people's lives. Comparing poverty levels in different countries across time reveals how and in what dimensions poverty has been reduced. These accounts illustrate what is possible and point out where progress has been slow or nonexistent. For example, the Sustainable Development Goal target 1.2 aims to halve the proportion of people experiencing poverty in all its dimensions. How can this be done?

Methodologically, this paper sets out the core components of intertemporal multidimensional poverty analysis then outlines how to analyze the pro-poorness of multidimensional poverty reduction patterns by considering changes in intensity as well as incidence of poverty, population subgroup decompositions, and changes in a destitute subset of the poor. Applying these techniques, it documents how multidimensional poverty and its incidence and intensity has changed in 34 countries representing 2.5 billion people, and further assesses the pro-poorness of those changes across 338 subnational regions, ethnic groups in three countries, and destitution in all 34 countries. In the course of this paper we rule out certain methodological options and illustrate others in some detail.

To measure multidimensional poverty, we use the global Multidimensional Poverty Index (MPI), which is an internationally comparable measure of acute poverty in over 100 developing countries. The MPI was developed by the Oxford Poverty and Human Development Initiative (OPHI) at the University of Oxford with the Human Development Report Office of the United Nations Development Programme (Alkire, Foster, & Santos, 2011; Alkire & Santos, 2014; UNDP, 2010a, 2010b). We also explore the changes over time in a destitution measure (Alkire, Conconi, & Seth, 2014a), which identifies the subset of the MPI poor who are destitute

according to more severe deprivation cutoffs (e.g. severe undernutrition instead of undernutrition).

The MPI follows a direct method by assessing the extent to which people satisfy minimum international standards in social rights or valuable ends. It is identically formulated across rural and urban areas. Thus it complements indirect methods that use income or consumption levels to identify a minimum living standard (Alkire & Santos, 2014), and in particular complements global monetary measures such as the $1.90/day figures (Chen & Ravallion, 2010, 2012; Ferreira et al., 2016). The MPI builds on the counting traditions used in Latin America and Europe (Alkire etr al., 2015; Atkinson, 2003, chap. 4) and seeks to advance the work of Amartya Sen (1979, 1992, 1997, 1999, 2009), who has persuasively argued for more comprehensive conceptualizations and measures of capability poverty. Drèze and Sen (2013) among others empirically motivate such analysis, observing that the level (and change) of income per capita or of monetary poverty does not necessarily predict the levels of achieved functionings in social indicators (c.f. Bourguignon & et al., 2010).

The MPI, like any internationally comparable poverty measure, is data constrained and imperfect. Alkire and Santos (2014) articulate its limitations at length, applied robustness tests for several parameters in the MPI, and found national comparisons to be robust to a wider range of deprivation cutoffs, poverty cutoff, and dimensional weights; they also explored household composition as raised by Dotter and Klasen (2014). They found comparisons using the DHS data-

sets to be particularly robust, hence this paper restricts analyses to DHS datasets. An important strength of the MPI is that the final measure reflects the joint distribution of deprivations and is sensitive to the intensity of deprivation among the poor. Also, because the measure is direct, comparisons do not require additional adjustments, such as for rural–urban prices, inflation, or PPPs (see Alkire and Foster, 2011b; Alkire et al., 2011). Acknowledging imperfections discussed elsewhere, we further explore MPI comparisons in this paper.

The contribution of this paper is threefold. First, it is the first paper to set forth a systematic account of changes over time in multidimensional poverty using the Alkire–Foster Adjusted Headcount Ratio and its consistent sub-indices. Such an account is essential to the Sustainable Development Goal's (SDGs) aim to halve the proportion of people who are poor in many dimensions. Second, it provides three methodological approaches to assessing the pro-poorness of poverty reduction. Such methods are required in order to assess policy success related to the "Leave No One Behind" pledge in the SDG 2030 agenda. Third, it applies these methodologies exhaustively using the global MPI and a linked destitution measure in 34 countries representing 2.5 billion people. The data are harmonized to enable definitive assessments across poverty and destitution for two or three points of time for each country contributing to evaluating progress during the era of the Millenium Development Goals (MDGs), and laying the groundwork for SDG analyses. Although precise indicator definitions across countries vary, country experiences can also be compared in informative ways, as can monetary poverty trends for certain countries.

The paper is organized as follows. Section 2 presents the measurement methodology for poverty and destitution, and the associated statistics used to analyze changes over time, subnational and ethnic decompositions and dimensional breakdown. Section 3 describes the DHS datasets used in this study and their harmonization, and delineates the levels of comparability that have been achieved over time and across countries. Section 4 presents key findings from the MPI estimates at the national level. Section 5 analyzes changes over time by regional and ethnic groups, finding diverse country patterns. Section 6 explores the changes over time in destitution among the poor. Section 7 concludes.

2. MEASUREMENT METHODOLOGY

(a) *Alkire and Foster M_0 measure*

The global MPI follows the functional form of the Adjusted Headcount Ratio (M_0), which is the simplest measure within the family of poverty measures developed by Alkire and Foster (2011a). The methodology begins at the level of the person or household, identifies the set of indicators in which they are deprived at the same time by applying a vector of deprivation cutoffs (denoted z) and creating a deprivation matrix which provides a score each person in each dimension, denoting their entry as one if they are deprived in that indicator and zero otherwise. Using a vector of weights on each dimension, denoted w_j, that sum to one their poverty profile is summarized in a weighted deprivation score c_i. If their deprivation score exceeds the poverty cutoff (denoted k), they are identified as multidimensionally poor. After identification, the deprivations of non-poor persons are *censored* or replaced with zero values in the censored deprivation matrix. The Adjusted Headcount Ratio M_0 reflects all deprivations of persons who have been identified as poor, and is the mean of this weighted

matrix, multiplied by the number of indicators it contains. More intuitively, the M_0 can also be expressed as the product of two intuitive partial indices incidence and intensity $M_0 = HA$. The: headcount ratio or *incidence* is defined by $H = q/n$, where q is the number of poor persons. The average deprivation share across the poor, or *intensity*, is denoted by A and reflects the percentage of deprivations the average poor person experiences—their average deprivation score value.

Consistent Subindices: The M_0 can be broken down after identification into consistent dimensional subindices called "censored headcount ratios" that depict the percentage of the population who are poor and are deprived in dimension j. These are the mean of the respective column vector of the censored matrix and are denoted $h_j(k)$. The percentage contribution of the jth dimension is $(w_j h_j(k))/M_0$ (Alkire et al., 2015, chap. 5).

The global MPI is an Adjusted Headcount Ratio M_0 implemented with specific parameters. The MPI is based on ten indicators, which are organized into three equally weighted dimensions: health, education, and living standards. Its ten indicators and deprivation cutoffs reflect deprivations within a household such as undernutrition or child mortality, being educated, or lacking access to safe water and adequate sanitation, and are equally weighted within each dimension (Table 1). A person is identified as poor if they are deprived in at least one-third of the weighted indicators.

This paper also analyzes a related measure of destitution (Alkire et al., 2014a Alkire & Seth, 2016). This measure has the same indicators, weights, and poverty cutoff as the MPI. However for eight of the ten indicators, destitution deprivation cutoffs are used: for example, severe malnutrition instead of malnutrition, losing at least two children, having all primary school-aged children out of school, not having anyone with at least a year of schooling in the household, practicing open defecation, and so on. For electricity and flooring, the cutoffs do not change. A person is destitute if he or she is deprived in at least a third of the weighted destitution indicators. By definition, a destitute person is always multidimensionally poor. The destitution Adjusted Headcount Ratio (and other consistent partial indices) is constructed using the same mathematical formulations as the MPI and is denoted by a superscript 'D' as in MPI^D. Table 1 presents the structure of both MPI and Destitution measures.

(b) *Changes in M_0, H, and A across two time periods*

This section describes how to compare M_0 and its associated partial indices over time using repeated cross-sectional data. Such comparisons may also be importantly affected by migration and demographic shifts, which require separate treatment.

The basic component of poverty comparisons is the absolute pace of change across periods. The *absolute rate of change* is the simple difference in poverty levels between two periods. Changes (increases or decreases) in poverty across two time periods can also be reported as a relative rate. The *relative rate of change* is the difference in levels across two periods as a percentage of the initial period. The analysis of absolute and relative changes together provides an elementary sense of overall progress.

For any two periods we denote the initial period by t^1 and the final period by t^2. The achievement matrices for periods t^1 and t^2 are denoted by X_{t^1} and X_{t^2}, respectively. The same set of parameters—deprivation cutoff vector z, weight vector w, and poverty cutoff k—are used in each period.

The *absolute rate of change* (Δ) is simply the difference in Adjusted Headcount Ratios (M_0) between two periods and is computed as