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Beyond Headcount: Measures that Reflect the Breadth and Components of Child Poverty

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Abstract

This paper presents a new approach to child poverty measurement that reflects the breadth and components of child poverty. The Alkire and Foster method presented in this paper seeks to answer the question 'who is poor' by considering the intensity of each child's poverty. Once children are identified as poor, the measures aggregate information on poor children's deprivations in a way that can be broken down to see where and how children are poor. The resulting measures go beyond the headcount by taking into account the breadth, depth or severity of dimensions of child poverty. The paper illustrates one way to apply this method to child poverty measurement, using Bangladeshi data from four rounds of the Demographic Health Survey covering the period 1997–2007. Results for Bangladesh show that the AF adjusted headcount ratio adds value because it produces a different ranking than the simple headcount, because it also reflects the simultaneous deprivations children experience (intensity). Given this, we argue that child poverty should not be assessed only according to the incidence of poverty but also by the intensity of deprivations that batter poor children's lives at the same time. The Bangladesh example is used to illustrate how to compute and interpret the child poverty figures, how the final measure can be broken down by groups and by dimensions in order to analyse child poverty, how to interpret changes over time, and how to undertake robustness checks concerning the poverty cut-off.

Keywords: child poverty, multidimensional poverty, poverty measurement, FGT measures, capability approach, Bangladesh

JEL classification: I32, J13, O1

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1. Introduction

Measures of child poverty undoubtedly influence policies to reduce child poverty. The accuracy, precision, and informational content of child poverty measures create value insofar as they enable policymakers, parents and other groups to eliminate the suffering and deprivation of children. Hence debates on measures of child poverty are motivated by a shared objective: creating tools that enable children to enjoy a childhood free from fear and want. This article presents a new approach to child poverty measurement, which learns from, and improves upon, previous methods.

The Alkire and Foster (2007, 2011) method presented in this paper seeks to answer the question 'who is poor' by considering the intensity of each person's poverty. Once people are identified as poor, the measures aggregate information on poor people's deprivations in a way that can be broken down to see where and how people are poor. The resulting measures go beyond the headcount by taking into account the breadth, depth or severity of dimensions of child poverty. For example, Country A and Country B might both experience 40 per cent child poverty; but in Country A, most children are deprived in three dimensions, whereas in Country B, most children are deprived in six of the same dimensions (these dimensions could include nutrition, water, sanitation, housing and education). Also, policy makers need to know the specific configuration of children's deprivations in their area in order to address it. But the headcount ratio cannot be broken down by dimension to uncover the components of child poverty in different regions or age group or by gender. The Alkire and Foster method deals systematically with these issues and can be easily applied to child poverty measurement to enhance the headcount measure. In this paper we explain how this can be done and illustrate the case by measuring multidimensional child poverty in Bangladesh using four rounds of the Demographic Health Survey.

We begin by reviewing the context of composite measures of child poverty. A key partner in dialogue is the 'Bristol approach' which has contributed substantially to child poverty measurement (Gorden et al., 2003), and their specification of indicators and cutoffs is used insofar as is feasible in the analysis. The subsequent section explains the Alkire-Foster method and the way in which it can enhance existing methodologies by offering a clear specification of the dual cutoff method – a deprivation cutoff and poverty cutoff – by reflecting the intensity of multidimensional poverty, and by enabling the child poverty measure to be broken down by dimension. This is then illustrated with a substantive empirical application in Bangladesh. The final section concludes.

2. Child poverty and multidimensional measurement

Issues of multidimensionality have received special attention in the recent literature on poverty and inequality. The seminal works of Amartya Sen (1980; 1985; 1992, 1999; Foster and Sen, 1997) have systematically critiqued the income and utility focus of neoclassical economics and proposed that well-being be understood as multidimensional and considered in the space of capabilities[1]. Interestingly, while multidimensional studies were – and perhaps still are – relatively scarce in welfare economics, the debate concerning child wellbeing has predominantly followed a multidimensional perspective (for some reviews see: Minujin et al., 2006; Roelen and Gassmann, 2008).

Recent literature on child poverty follows a rights perspective stimulated by international summits and conventions, including the 1989 Convention on the Rights of the Child (CRC), the 1990 World Summit

[1] Notice that Sen's approach is more than a simple multidimensional approach to human well being; it emphasises human agency and the substantial freedoms that people have to achieve valuable beings and doings in life.

for Children (WSC) and the 2002 declaration - 'A World Fit for Children' (WFFC)[2]. The growing interest in setting goals and targets to monitor progress has stimulated data collection and increased the availability of internationally comparable data. This has been particularly boosted by major international survey projects such as the Multiple Indicator Cluster Surveys (MICS) and the Demographic Household Survey (DHS). While richer data frequently provide the opportunity to share more comprehensive or holistic analyses, in practice a large array of indicators may overwhelm or confuse readers. An array also does not provide an overview of progress. Its biggest drawback is that it does not show whether the same children are deprived in multiple dimensions at the same time – yet the multiplicity of deprivations a child experiences directly affects that child's development. Such considerations can be addressed by developing robust indices that summarise multiple dimensions of child poverty in a single measure, and can be used for comparing child poverty across regions and across time. Several existing measures of child poverty were developed to meet this need.

The Bristol approach adopted by the Global Study (UNICEF, 2007) is one significant effort to provide a methodology for measuring multidimensional child poverty. It was developed by a research team from the Townsend Centre for International Poverty Research at the University of Bristol, and was used to produce the first internationally comparable estimates of child poverty across a large number of developing countries (Gordon et al., 2003; Gordon et al., 2001; UNICEF, 2004). Their substantial contribution was to propose a way to align child poverty measurement with the child rights approach and to implement, insofar as data permitted, indicators and cutoffs for child poverty that reflected the definition agreed in the World Social Summit in Copenhagen. This made the final measure arguably suitable for monitoring certain children's rights according to CRC and WFFC. At a more practical level, the study is attractive because it used DHS data and can be replicated with MICS data as shown in the Global Study.

Methodologically, the Bristol approach belongs to the 'counting' tradition of poverty measures used in Europe and in Basic Needs Approaches (Erikson, 1993; Feres and Mancero, 2001; Nolan and Whelan, 1996). Like all of the 'counting' approaches to multidimensional poverty measurement, it identifies the poor according to the total number of dimensions in which they are deprived. Then, in common with other counting methodologies, it reports the 'headcount' or percentage of children who have been identified as multidimensionally poor as the final measure. This headcount measure is theoretically relevant, easy and clear to compute, and straightforward to interpret - being analogous to the traditional income headcount ratio. But the headcount provides no incentive for policy makers to prioritise the poorest children of all.

As Delamonica and Minujin (2007) and Alkire and Foster (2007, 2011) observe, the drawback of the headcount is that it does not account for the average intensity of deprivation, much less for depth or severity[3]. The problem is that the headcount ratio remains unchanged when children that are already poor become deprived in an additional dimension, or when their level of deprivation in a particular dimension deteriorates. The traditional FTG measures in income poverty do account for these (see: Foster, Greer and Thorbecke, 1984). Imagine two policies which are addressed to 100 children. Policy 'A' focuses on the 30 poorest of poor children while policy 'B' focuses on the 30 poor children that are least poor – that is, that are closest to the limit of being non-poor. The headcount ratio would assess the success of each policy only in terms of reducing the number of children who are poor but completely overlook the intensity of poverty among the poor. As a result, policy 'B' could be judged very positively if it lifted, say 20 children out of poverty merely by reducing the number of children who were close to

[2] The rights based approach has important linkages with Amartya Sen's human development and capability approach: Sen (2005), Nussbaum (2003), Fukuda-Parr (2003), Osmani (2005), Vizard (2005).

[3] Notice that Delamonica and Minujin (2007) use a different terminology. For the remaining of the paper we follow Alkire and Foster's terminology.

the poverty threshold. Policy 'A', meanwhile, might be judged to be less successful, even if it significantly alleviated the level of deprivation experienced by all 30 of the poorest children.

Recent breakthroughs in multidimensional poverty methodologies now enable the construction of measures that reward policymakers for addressing the poorest poor, even if they do not reduce the headcount. This paper presents and implements one such methodology, which, very simply, uses the average number of deprivations poor children experience - called the 'intensity of poverty' to supplement the 'incidence of poverty' as captured by the headcount ratio.

The Alkire-Foster (AF) method (2007, 2011) combines the intuitive 'counting' approach that has a long history of empirical implementation in multidimensional poverty (Erikson, 1993; Feres and Mancero, 2001; Gordon et al., 2003; Mack, 1985) with the literature on axiomatic approaches to multidimensional poverty in welfare economics (e.g. Bourguignon and Chakravarty, 2003; Tsui, 2002; Chakravarty et al., 1998; Alkire, 2008). It improves upon existing approaches to multidimensional poverty measurement by creating a measure M_0 that reflects the intensity or breadth of multidimensional poverty when data are ordinal (as data on water, sanitation, and housing usually are). When data are cardinal, the measures can also reflect the depth and severity of multidimensional poverty). As we will see, the AF measure satisfies a series of properties including decomposability which allows the index to be broken down by population subgroup (such as region or ethnicity) or by dimension. As we will show in the illustration below, this can help us better understand the dimensions and intensity of poverty, and provides a wealth of data useful for policy-makers when planning or assessing interventions. We will first explain the method from a theoretical point of view and then present an empirical illustration from a study of child poverty measurement in Bangladesh.

3. Alkire-Foster approach to multidimensional poverty measurement

Let us start by explaining briefly the Alkire and Foster method (for a complete formal explanation see: Alkire and Foster, 2007, 2011). The method can be intuitively introduced in 12 steps. The first 6 steps are common to many multidimensional poverty measures; the remainder are more specific to the Alkire-Foster method.

Step 1: Choose Unit of Analysis. The unit of analysis is most commonly the individual or the household. In our case, it is the child, so that we can see how each child is doing.

Step 2: Choose Dimensions. The choice of dimensions is important yet also more straightforward than is often assumed (see: Alkire, 2008). In choosing general categories such as 'health' or 'education', most researchers implicitly draw upon five selection methods, either alone or in combination:

- Ongoing deliberative participatory exercises that elicit the values and perspectives of stakeholders. A variation of this method is to use survey data on people's perceived necessities (an example for child poverty is Biggeri et al., 2006).

- A list that has achieved a degree of legitimacy through public consensus, such as the universal declaration of human rights, the MDGs, or similar lists at national and local levels. For example, Gordon et al. (2003) rely on the consensus agreed in the 1995 World Summit for Social Development in Copenhagen.

- Implicit or explicit assumptions about what people do value or should value. At times these are the informed guesses of the researcher; in other situations they are drawn from convention, social or psychological theory, or philosophy (as using Nussbaum's list of capabilities by Di Tommaso, 2007).

- Convenience or a convention that is taken to be authoritative or used because these are the only data available that have the required characteristics (for example available variables in the survey at hand).

- Empirical evidence regarding the core dimensions that are vital for child development; these are often psychological and/or longitudinal studies.

Clearly these processes overlap and are often used in tandem empirically; for example, nearly all exercises need to consider data availability or data issues, and often participation, or at least consensus, is required to give the dimensions public legitimacy.

Step 3: Choose Dimensional Indicators. Particular indicators are also chosen for their empirical properties, as well as according to their accuracy (using as many indicators as necessary so that analysis can properly guide policy) and to parsimony (using as few indicators as possible to ensure ease of analysis for policy purposes and transparency). For example, indicators must be accurate reflections of each child's own well-being rather than accurate only on average. The purpose of the measure will shape the indicators also: for example, if comparisons are to be made across space and time, then such differences must be interpretable. Statistical properties are often relevant – for example, when possible and reasonable, choosing indicators that are not highly correlated. Note that we will continue to use the word 'dimension' to reflect a particular indicator – so use these terms to some extent interchangeably. Sometimes – as in Alkire and Santos 2010 – it becomes convenient to distinguish these terms.

Step 4: Set and Apply Deprivation Cutoffs. A deprivation cutoff (similar to a poverty line for income) is set for each dimension/indicator. This step establishes the first cutoff in the methodology. Every child can then be identified as deprived or nondeprived with respect to each dimension. For example, if the dimension is schooling ('How many years of schooling have you completed?') then for 14 year olds, '6 years or more' might identify nondeprivation while '1–5 years' might identify deprivation in the domain. Deprivation cutoffs can be tested for robustness, or multiple levels of thresholds can be used to clarify explicitly different categories of the poor (such as poor and extreme poor).

Having been set, the deprivation cutoffs are applied to the data. This step replaces the child's achievement with their status with respect to each cutoff – for example, in the dimension of health where the indicators are 1) 'having received all vaccinations' and 2) 'vitamin A supplementation', children are identified as being deprived or nondeprived for each indicator. The process is repeated for all indicators for all other dimensions. Table 1 provides an example for a group of four children. ND indicates that the child is not deprived (in other words, his or her achievement in that dimension is equal to or higher than the cutoff), and D indicates that the child is deprived (his or her achievement is strictly lower than the cutoff).

Step 5: Set and Apply Weights. Weights must be applied to each dimension. There is some appeal in the use of 'equal weights' due to the easy interpretability of the index. Alternatively, general weights are applied, such that the total weights across all dimensions add up to the number of dimensions. For example, if there are 4 dimensions, and one dimension is to weight one-half, and the others 1/6, then the weights will be (2, 2/3, 2/3, 2/3), because the sum of these four weights is equal to the number of dimensions, namely 4. If a person is deprived in a dimension, then their 'D' is now replaced with the weight on that dimension; a 0 is applied for people who are not deprived.

Step 6: Count the Number of Deprivations for Each Child. The weighted sum of deprivations for each person is now calculated. This step is demonstrated using equal weights in the last column of Table 1.

Table 1—Example, part I

Children	Health		Living standard		Education	Total count
	Measles Immunization	Vitamin A	Tenure or eviction	Overcrowded housing	School attendance	
Child 1	ND	D	D	ND	D	**3**
Child 2	ND	ND	ND	D	ND	**1**
Child 3	ND	D	D	ND	ND	**2**
Child 4	D	D	D	D	D	**5**

Step 7: Set the Second Cutoff (Poverty Cutoff). Assuming equal weights for simplicity, set a second poverty cutoff, k, which sets the sum of weighted dimensions (in this case, the number of dimensions) in which a child must be deprived in order to be identified as multidimensionally poor. In practice, it may be useful to calculate the measure for several values of k. In the example in Table 1, k is set to 3 and the shaded children are identified as poor.

Step 8: Apply Cutoff k to Obtain the Set of Poor Children and Censor All Nonpoor Data. This step is novel and often overlooked. After censoring, the focus is now exclusively on the poor children and the dimensions in which they are deprived. All information on the non-poor children is replaced with zeros. This step is shown in Table 2. Recall that by changing the value of k you can see all deprivations or only those of the poorest poor, so the poverty cutoff k is rather like a sliding scale, that brings to light different aspects of poverty as it changes.

Table 2—Example, part II

Children	Health		Living standard		Education	Total count
	Measles Immunization	Vitamin A	Tenure or eviction	Overcrowded housing	School attendance	
Child 1	0	1	1	0	1	**3**
Child 2	0	0	0	0	0	**0**
Child 3	0	0	0	0	0	**0**
Child 4	1	1	1	1	1	**5**

Step 9: Calculate the Headcount, H. Divide the number of poor children by the total number of children. In our example, when k = 3 the headcount is merely the proportion of children who are poor in at least 3 dimensions. For example, as seen in Tables 1 and 2, two of the four children were identified as poor, so H = 2 /4 = 50 percent. This is precisely the measure used by the Bristol approach and it is analogous to the income headcount ratio. The multidimensional headcount is a useful measure, but it does not increase if poor children become more deprived, nor can it be broken down by dimension to analyze how poverty differs among groups. For that reason we augment it by using the information on the intensity of deprivation.

Step 10: Calculate the Average Intensity, A. A is the average number of (sum of weighted) deprivations a poor child suffers. It is calculated by adding up the proportion of total deprivations each child suffers (for example, in Table 2, Child 1 suffers 3 out of 5 deprivations and Child 4 suffers 5 out of 5) and dividing by the total number of poor children. A = (3/5 + 5/5)/2 = 4/5.

Step 11: Calculate the Adjusted Headcount, M_0. If the data are binary or ordinal, a multidimensional poverty index is measured by the adjusted headcount, M_0, which is simply calculated as H times A[4] . The headcount is multiplied by the 'average' intensity. In our example, $HA = 2/4 * 4/5 = 2/5$.

Related Multidimensional Measures: Calculate the Adjusted Poverty Gap (M_1) and Squared Poverty Gap (M_2). If the data are cardinal, replace the '1' for each deprived child by their normalized poverty gap (the deprivation cutoff minus their achievement divided by the deprivation cutoff), and calculate the average normalized poverty gap G, which is the sum of the values of the poverty gaps, divided by the number of deprivations (in the case of ordinal data, the poverty gap will always be 1). The adjusted poverty gap M_1 is given by HAG, or the measure above multiplied by the average poverty gap. The squared poverty gap M_2 is calculated by squaring each poverty gap individually and replacing G with the average squared normalized poverty gap S, so the measure is HAS. The squared measure reflects inequality among the poor.

Step 12: Decompose by Group and Break Down by Dimension. The resulting measures - M_0, M_1 or M_2 can be decomposed by population subgroup (such as region, rural/urban, or ethnicity). For example, after constructing M_0 for each subgroup of the sample, we can break M_0 apart to study the contribution of each dimension to overall poverty. To break down by dimension, let Aj be the contribution of dimension j to the average poverty gap A. Aj could be interpreted as the average deprivation share across the poor in dimension j. The dimension-adjusted contribution of dimension j to overall poverty, which we call M_0j, is then obtained by multiplying H by Aj for each dimension.

3.1 Basic properties of the multidimensional measure

Because cardinal data are often not available, it is likely that the most commonly appropriate measure of child poverty will be M_0. Hence it is quite interesting to note that the adjusted headcount. M_0 is particularly useful, for a variety of reasons worth mentioning:

- It can be used to compare different groups in the population, such as children from different regions, ethnic groups, or genders.

- It can be broken down into dimensions to reveal to policymakers what dimensions contribute the most to multidimensional poverty in any given region or population group.

- The poverty level increases if one or more children become deprived in an additional dimension, so it is sensitive to the multiplicity of deprivations (or intensity of poverty among the poor).

- It adjusts for the size of the group for which it is being calculated, allowing for meaningful comparisons across different-sized regions or countries.

In this section we have explained the Alkire-Foster method intuitively; we will now move on to illustrate it with a direct application to child poverty measurement based on four periods of DHS data in Bangladesh.

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[4] Note that Delamonica and Minujin (2007) were the first to highlight that one of the weakness of the Bristol approach was not being sensitive to the intensity of poverty which FGT measures in unidimensional (income/consumption) measures does. They instead propose to measure the average deprivation across the whole population. As will be seen shortly, when $k > 1$, focusing on the poor allows computing a final adjusted headcount ratio that satisfies the properties of decomposability and poverty focus. These properties would not be satisfied if we use the average of deprivation across the whole population.

4. An illustrative application: indicators of child poverty in Bangladesh

The Alkire-Foster method can be applied to various contexts and purposes. A widely known example is the Multidimensional Poverty Index (MPI) launched by the United Nation Development Program (UNDP) in the 2010 Human Development Report. The MPI provides internationally comparable estimates of multidimensional poverty across more than one hundred developing countries (Alkire and Santos, 2010; UNDP, 2010).

However, the method can be adapted to other contexts and purposes by adopting different specifications: unit of analysis, choice of dimensions, choice of indicators, dimensional cutoffs, poverty cutoff and weights. There are currently a growing number of applications of multidimensional poverty measurement in academic research (e.g. Alkire and Seth, 2009; Batana, 2008; Battiston et al., 2009; Santos and Ura, 2008). Interest in policy applications at a national level is also growing fast. A very significant methodology of this type is the official national poverty measure for Mexico (CONEVAL, 2010). There have also been applications to other multidimensional measurement problems such as targeting of conditional cash transfers (Azevedo and Robles, 2010) and measuring energy provision (Nussbaumer et al., 2011).

The first adaptation of the AF methodology to child poverty measurement was undertaken by Roche (2009) using Multiple Cluster Indicator Survey (MICS) data from Bangladesh, while more recent research by Apablaza and Yalonetzky (2011) has applied the method to study child poverty dynamics using the Young Life and Times Survey[5]. The method was also applied to measure trends on child poverty in Egypt as part of the Global Study on Child Poverty and Disparities (El-Laithy and Armanious, 2010). The diversity of applications shows the flexibility of the Alkire-Foster method which can be adapted to multiple contexts and purposes.

We will now illustrate the method and different steps in Bangladesh. In this example we use similar specifications to the Bristol approach in order to show the new insights provided by the Alkire-Foster method to a familiar set of indicators. Clearly all specifications can be adjusted according to the context and purpose of the application. In particular, we will show how the Alkire-Foster method provides a fuller understanding of what drives changes in poverty levels over time. We show this by looking at changes in three ways. Firstly we show how poverty has been reduced and whether changes to the incidence or intensity of child poverty have made the biggest contribution to overall reductions. We then look at the performance of each deprivation such as water, shelter and health individually to see where the biggest gains (and losses) have occurred. Finally, we look into regional decompositions to examine subnational variations in child poverty.

4.1 Data

Our example is based on the Bangladesh Demographic Health Survey (BDHS) data from 1997, 2000, 2004 and 2007. The BDHS survey is part of the worldwide Demographic Health Survey program, which is designed to collect data on fertility, family planning and maternal and child health (http://www.measuredhs.com/). The surveys in Bangladesh are implemented through a collaborative effort of the Bangladesh National Institute of Population Research and Training (NIPORT), Macro International, USA, and Mitra & Associates with the financial support from the United States Agency for International Development (USAID). The international standards and purposes of the Demographic Health Surveys make them especially well-suited to the proposed child poverty measure as they have

[5] For details on the Young Life study see: http://www.younglives.org.uk/

good quality child specific indicators to measure health dimensions that are not normally included in living standards household surveys[6].

The BDHS follows a multistage cluster sampling which is designed to provide separate estimates at the national level for urban and rural areas, and for all six provinces in Bangladesh: Barisal, Chittagong, Dhaka, Khulna, Rajshahi and Sylhet. The survey consists of three questionnaires: 1) a household questionnaire, 2) a questionnaire for individual women aged 10-49, 3) a questionnaire for individual men aged 15-54, 4) a community questionnaire, and 5) a facility questionnaire. The fieldwork activities were implemented during March-August 2007, January-May 2004, November 1999-March 2000, and November 1996-March 1997 respectively. The final sample corresponds to 10,268 households in 2007; 10,053 households in 2004; 10,919 households in 2000; and 9,099 households in 1997. The households and women response rate are respectively of 99.4 per cent and 98.4 per cent in 2007; 99.8 and 98.6 per cent in 2004; 99.3 per cent and 96.9 per cent (2000); and 99.1 per cent and 97.8 per cent in 1997.

4.2 Unit of analysis

As would be expected from a child poverty measure, our estimations use each child as the unit of analysis rather than the household as a whole or an aggregate of all its members. We chose to focus specifically on under-five child poverty, in order to provide policy-relevant information about the incidence and breadth of multidimensional poverty among this particular age group[7]. While poverty can be measured jointly for all age groups in order to provide a general evaluation of child and youth poverty (as in Gordon et al., 2003), age-specific measures allow the identification of areas for particular interventions. Naturally, children's rights and needs are age-specific and social protection should be designed accordingly. The flexibility of the AF method leaves space to adapt the unit of analysis according to the purpose of the measure. The analysis in this paper takes full advantage of the BDHS design and the broad information regarding the situation of children under five. The values of the indicators of dwelling are ascribed to the children from their household, while all the other indicators are under-five specific.

4.3. Indicators, deprivation cutoffs, and weights

The extensive review in Minujin et al. (2006) and in Roelen and Gassmann (2008) shows the wide spectrum in the choice of dimensions and indicators among the various child poverty measurement exercises. These are important choices which are subject to various considerations. For example, the Bristol indicators were chosen for an international measure of child poverty. Therefore, the choice of indicators was justified with respect to international consensus and general agreements reached at world summits[8]. However, a national measure might require indicators and cutoffs that are context-specific in order to orient national public policy and stimulate public debate in that particular country. We do not attempt in this paper to propose an exhaustive list of dimensions and indicators for Bangladesh[9], but instead chose a set of indicators and cutoffs which is as close as possible to the Bristol indicators, simply for illustrative purposes. Following that methodology also, the indicators are equally weighted.

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6 Note that the DHS surveys were also used to compute the Multidimensional Poverty Index (Alkire and Santos, 2010) and Child poverty figures the Global Study (Gordon et al., 2003).

7 Note that the Multidimensional Poverty Index launched by UNDP identifies all members of the household as equally deprived or poor (Alkire and Santos, 2010). This methodological decision was necessary due to data availability.

8 In particular the Bristol indicators are based on the definition of poverty agreed in the World Summit for Social Development in Copenhagen 1995.

9 Please see Alkire (2008) for a more detailed discussion.

Table 3. Selected indicators and deprivation thresholds

Dimension	Deprivation Thresholds
Nutrition	Children who are more than two standard deviations below the international reference population for stunting (height for age) or wasting (weight for height) or are underweight (weight for age). The standardization follows the algorithms provided by the WHO Child Growth Reference Study (WHO, 2006)
Water	Children using water from an unimproved source such as open wells, open springs or surface water (Time to water is not included because this information is not available for BHDS 1997).
Sanitation	Children using unimproved sanitation facilities such as pit latrine without slab, open pit latrine, bucket toilet and hanging toilet. Surveys were standardized for comparability.
Health	Children who have not been immunized by 2 years of age. A child is deprived if the child has not received eight of the following vaccinations: bcg, dpt1, dpt2, dpt3, polio0, polio1, polio2, polio3, measles or did not receive treatment for a recent illness involving an acute respiratory infection or diarrhoea.
Shelter	Children living in a house with no flooring (i.e. a mud or dung floor) or inadequate roofing. (Overcrowding was not taken into account because BHDS 1997 does not register the number of room used for sleeping).
Information	Children with no access to a radio or television (i.e. broadcast media). This indicator applies only for children above 3 years of age.

Note: Education deprivation was not included because it is not relevant for under-five children. The indicators from the Bristol study 'Severe Deprivation of Access to Basic Services' was not available for all four BDHS rounds.

Table 3 presents the list of six indicators used in this measure and the cutoff values that define deprivations in each particular dimension. Four of the indicators are designed to measure progress in specific millennium development goal (MDG) targets: nutrition, access to safe drinking water, access to improved sanitation, and health (United Nations, 2003). All indicators were standardized to allow comparability across the four datasets[10]. Only indicators that are relevant to under-five children were selected, so we excluded educational deprivations as these are relevant only to school-age children. We could have good reasons to wonder if this is an exhaustive list of under-five child poverty indicators and whether it is informative enough for the Bangladesh context. There might be some 'missing dimensions' in this list such as love, care and social relatedness, support for learning and child development, the right to identity, protection against eviction, violence, and natural disasters, among others. The list of indicators for a national measure would be adjusted further to suit the context. National poverty measures can also be useful in stimulating the production of more and better data as was the case in Mexico (CONEVAL, 2010).

5. Under-five child poverty in Bangladesh (1997-2007)

[10] This required simplifying indicators. For example in source of water we do not include distance to water because the information was not available for 1997. Similarly in shelter we did not include overcrowding index because the variable 'number of room used for sleeping' was not included in 1997.

5.1 Incidence of deprivation and adjusted headcount ratio

Let us start by exploring the incidence of deprivation in relation to the indicators (e.g. health, water, nutrition, etc) for the most recent year: 2007. Deprivation rates are highest overall for shelter where over 90 per cent of children live in a house with no flooring or inadequate roofing. Shelter is followed by nutrition, sanitation and information (access to broadcast media) where deprivation rates are nearly 60 per cent. The picture is somewhat better for health and water access, with around 20 per cent of children deprived in health and less than 5 per cent lacking access to an improved source of water.

Naturally though, suffering from only one deprivation is not the same as suffering from multiple deprivations at the same time. If we now examine the intensity of poverty (or 'joint distribution' of deprivations), we find that 10 per cent of children suffer from only one deprivation, nearly 20 per cent are deprived in two dimensions, 30 per cent from three deprivations, and 27 per cent from four deprivations. After four deprivations the percentage decreases considerably: those with five or six deprivations experience an 'intensity' of poverty which is significantly high in absolute and relative terms[11].

As previously explained, step 7 in the Alkire-Foster method involves defining a 'poverty' cutoff - the number of dimensions children must to be deprived in order to be identified as multidimensionally poor. Table 4 presents all possible outcomes depending on the different cutoff values. Column 2 shows the headcount ratio or proportion of children who are considered to be poor according to each poverty cutoff. If the cutoff is set as k=1 (children with one or more deprivations), around 96 per cent of children would be identified as poor which seems to be a high headcount ratio for Bangladesh[12]. If the cutoff is set as k=2, the headcount ratio is 86 per cent, and if k=3 it is around 66 per cent. The headcount ratio decreases to 8 per cent when the cutoff is set at 5. For our analysis we will consider cutoffs between k=2 and k=4.

[11] In absolute term they suffer a very high number of total deprivations. On the other hand this appears to be very uncommon in Bangladesh, and therefore a sign of very extreme relative deprivation.

[12] The Bristol study estimates 54 per cent of child poverty in Bangladesh (k=2) while 92 per cent in severe deprivation (k=1) (Gordon et al., 2003). The figures from the World Bank below 1.25$ a day are around 50 per cent (http://data.worldbank.org/).

Table 4 Comparison of multidimensional child poverty for different poverty cut-offs. Bangladesh DHS 2007

	1	2	3	4
Poverty Cutoff (k)	**Multidimensional Child Poverty Index (M0 = HA)**	**Multidimensional Headcount (H)**	**Intensity of Deprivation (A)**	**Average Deprivation among the poor**
1	0.487	0.964	0.504	3.03
2	0.470	0.864	0.544	3.26
3	0.400	0.655	0.611	3.67
4	0.248	0.351	0.707	4.24
5	0.068	0.081	0.842	5.05
6	0.004	0.004	1.000	6.00

Note: For this example we are considering equal weights but as explained in the methodology different weights can also be used.

Column 1 presents a figure which can be used as the child poverty index – the adjusted headcount ratio. This is the product of the headcount ratio (column 2) and the intensity of deprivation (column 3). The intensity of deprivations (A) is measured according to step 10 of the methodology. What these figures show is that the average number of deprivations among children who experience at least two deprivations is 3.26 dimensions; and among children who experience at least 3 dimensions (k=3) it is 3.67. M_0 takes into account these variations by adjusting the headcount accordingly.

5.2 Changes over time and robustness tests

The choice of poverty cutoff of course depends on the purpose of the exercise. For example, if the measure is for targeting purposes, we might decide to set a cutoff that corresponds to the proportion of beneficiaries that can be included in the program (for example, as determined by budgetary constraints). As we will see, in practice it is recommendable to compute the results for several cutoffs and then assess the most suitable threshold according to the robustness of the conclusions.

Table 5 presents the multidimensional poverty figures for Bangladesh for the period 1997 to 2007 (based on a k=3 cutoff). It is clear from the results that poverty has decreased. The conclusion is the same if we observe the percentage of children who are poor (H) or the intensity of poverty (A) or the final multidimensional child poverty figure (M_0). For example, the child poverty headcount decreased from 83 per cent in 1997 to around 66 per cent in 2007, and the intensity of poverty from 67 per cent to 61 per cent over the same period.

Table 5 Changes over time in Multidimensional Poverty. Bangladesh 1997 – 2007

	Multidimensional Child Poverty Index (M0)	Multidimensional Headcount (H)	Intensity of Poverty (A)
1997	0.555	0.829	0.669
2000	0.495	0.758	0.653
2004	0.485	0.763	0.636
2007	0.400	0.655	0.611
Absolute Variation			
1997-2000	-0.060	-0.071	-0.016
2000-2004	-0.010	0.005	-0.017
2004-2007	-0.085	-0.108	-0.025

Note: The results correspond to a poverty cutoff k=3.

The question we need to ask is whether the conclusion would be different had we chosen a different cutoff. Figure 1 presents a robustness check of how different cutoffs (k) change over time. We can see a first order dominance among the curves, which means that no matter which k cutoff is considered, multidimensional poverty decreased between 1997 and 2007[13]. As we will see shortly, this robustness check does not always provide such straightforward conclusions, hence the importance of undertaking this analysis.

A crucial question now for policy makers is what has driven the reductions in the child poverty index? Has the percentage of children living in poverty reduced or has the intensity of poverty declined? Table 5 shows how much of the reduction in the multidimensional poverty index (M_0) is due to a decrease in the proportion of children who are poor (H) and how much is due to a reduction in the intensity of deprivation (A). In the first and third period the reduction is observed in both in headcount and intensity. In second period, meanwhile, the small reduction is entirely driven by a decrease in the intensity of poverty, which declined at a similar absolute level as in the first period (-0.017)[14].

Figure 1 Robustness check of different cut-off (k) in changes in multidimensional poverty over time.

Bangladesh 1997 – 2004

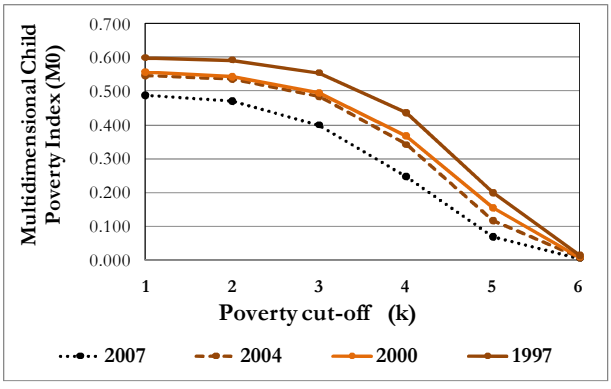
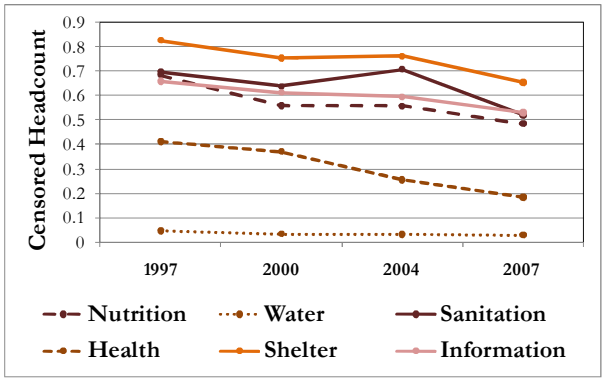


Figure 2 Changes over time in censored headcount by indicators.

Bangladesh 1997 – 2004 (k=3)



[13] Differences might not be statistically significant, but the first order dominance is clear.

[14] Please see Apablaza and Yalonetzky (2011) for further details on how to analyse changes over time using the Alkire and Foster method.

So now we want to know, which dimensions have driven these changes? Figure 2 shows an interesting pattern in the 'censored headcount' – the proportion of children who are simultaneously poor and deprived in a particular dimension. While there is an overall decrease in each dimension over the whole period, deprivations in sanitation, shelter and nutrition actually increased between 2000 and 2004. Interestingly, the health dimension shows important improvements over the same period (see the censored headcount and absolute variation in appendix A2). The unique advantage of using this 'censored headcount' approach is that it allows us to unpack the index further and show the factors that drive changes over time using a statistic that is completely mathematically related to the overall index[15].

5.3 Decomposition by subgroup of population

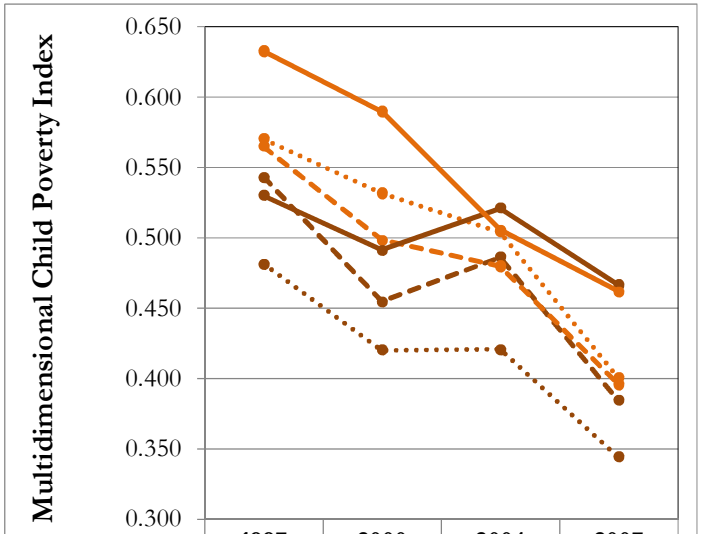
We frequently also want to measure the level of poverty at a regional level, whether for targeting purposes or in order to assess how much a poverty reduction in a region contributes to the overall national change. An important property of the Alkire-Foster method is that the final index can be broken down by population subgroup.

Figure 3 shows the changes over time in multidimensional child poverty (M_0) at a provincial level in Bangladesh. While under-five child poverty had been decreasing in the preceding decade, there was a resurgence of poverty in the low-lying coastal regions including Barisal and Chittagong between 2000-2004, where the percentage of poor under-five children deprived of improved sanitation facilities, adequate shelter and nutrition actually rose (see figure 4). Strikingly, the region of Barisal was not able to recover as fast as other regions. By 2007 the level of under-five child poverty in Barisal was equivalent to Sylhet – a region from the northeast that had much higher poverty than Barisal in 1997. Sylhet is an example of the successes in the eastern part of the country probably linked to a faster rate of urbanization (World Bank, 2008). The poor progress in the low-lying coastal regions, meanwhile, is coherent with findings from research on environmental vulnerability (Azam and Imai, 2009).

We might wonder again about the extent to which the conclusions are sensitive to the cutoff decision. Figure A1 in the appendix shows robustness checks for different poverty cutoffs in changes in multidimensional poverty over time for all provinces over the period 1997–2004. We can see that the trend is completely robust to changes in poverty cutoff. Provinces such as Dakah, Rajshashi and Sylhet showed improvements over the whole period. Barisal and Chittagong showed improvements in the periods 1997-2000 and 2004-2007, but a resurgence of poverty between 2000 and 2004 (robust to $1 < k < 4$). The Khunla province showed improvements between 1997-2000 and 2004-2007, but no statistically significant changes between 2000 and 2004. Similar robustness checks can be performed for ranking comparisons (see figures A2 in the appendix). We find first order dominance from all provinces on Khulna which appears to be the country's least poor region (robust to all k values). We see, for example, that by 1997 Barisal and Chittagong were the regions with the lowest multidimensional poverty (robust for $1 < k < 4$), but that by 2007 Barisal was at the same level as Sylhet (robust for $1 < k < 3$). As figure A2 shows, the robustness check for ranking comparisons is particularly useful.

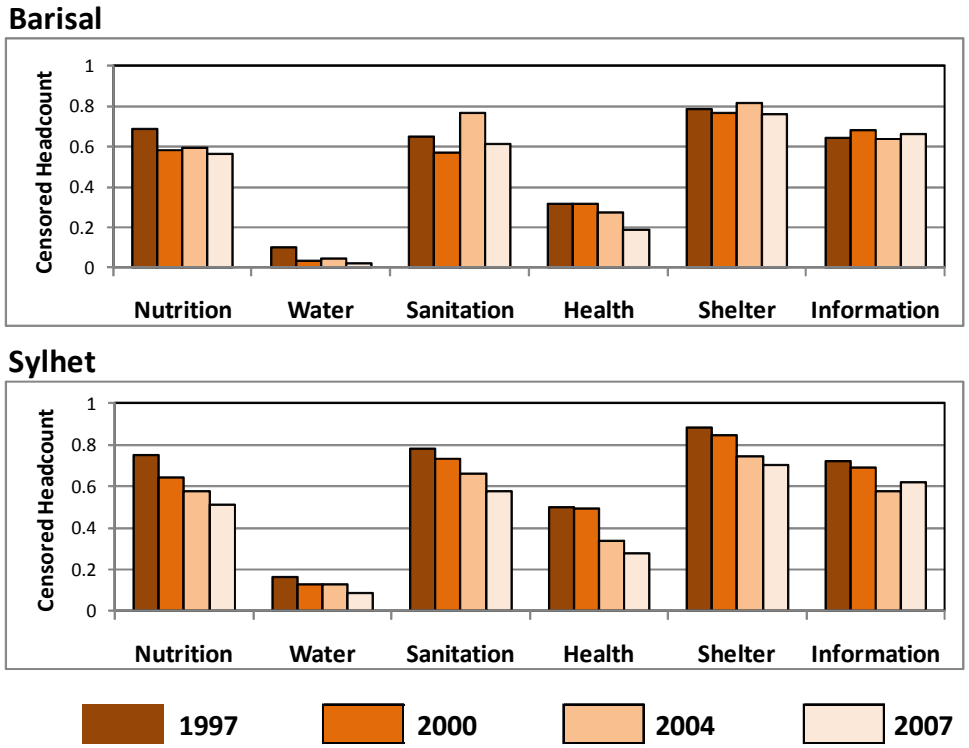
[15] The censored headcount is directly computed from the censored matrix which was obtained in step 7 and represented in example part II in table 2. The censored headcount is computed by dividing the total number of children who are poor and deprived in each dimension by the total number of children. Children who are deprived but not poor are not included in the numerator. The (weighted) average of the censored headcounts is the overall headcount.

Figure 3 Changes over time in Multidimensional Poverty at a province level, Bangladesh 1997 – 2004 (k=3)



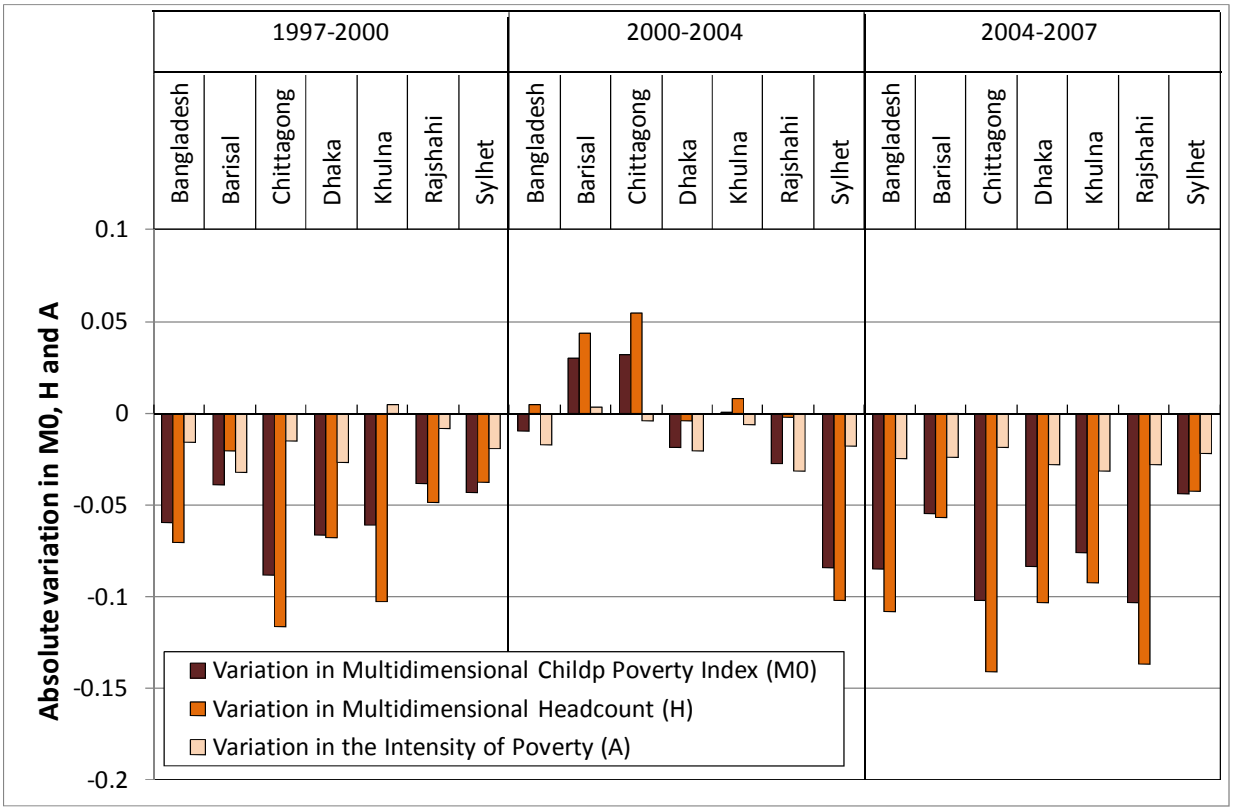
	1997	2000	2004	2007
Chittagon	0.543	0.455	0.486	0.384
Dhaka	0.565	0.498	0.480	0.396
Khulna	0.481	0.420	0.421	0.345
Rajshahi	0.571	0.532	0.504	0.401
Barisal	0.530	0.491	0.521	0.467
Sylhet	0.633	0.590	0.506	0.462

Figure 4 Changes over time in the censored headcount by indicator in the provinces of Barisal and Sylhet, 1997 – 2004 (k=3)



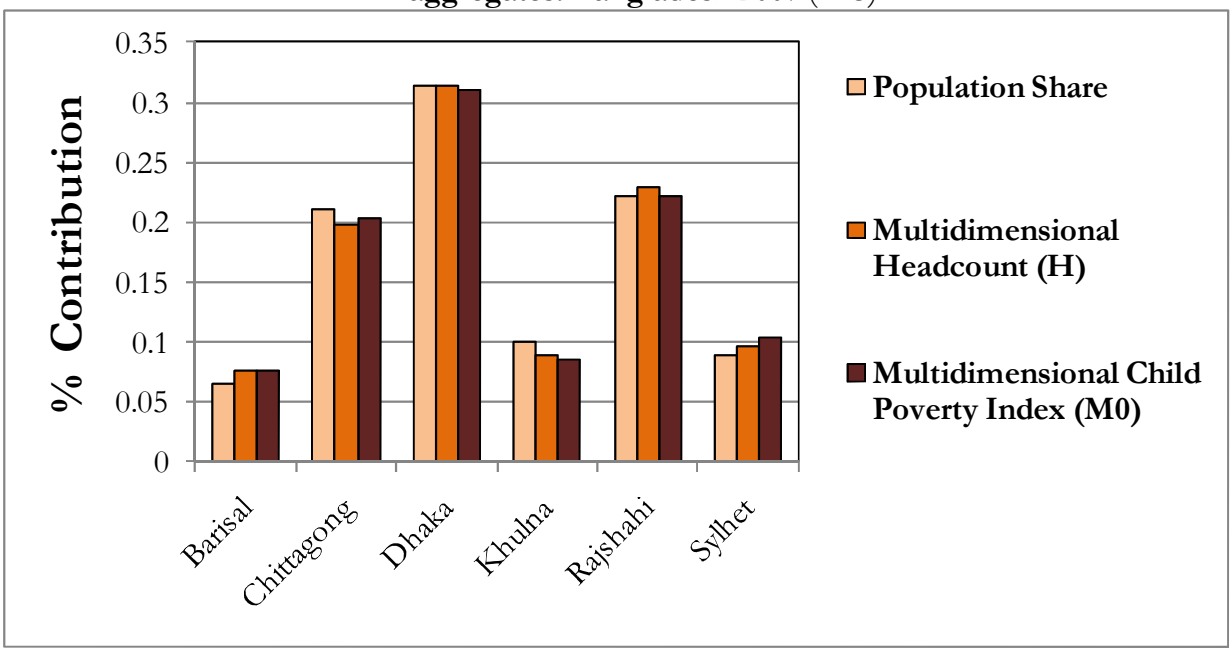
What has driven the reduction of child poverty in each province? Figure 5 presents the absolute variation in the multidimensional poverty index (M_0), headcount ratio (H) and intensity of poverty (A) for each province (see table A1 in the appendix for detailed figures). We find some very interesting patterns. Khulna reduced overall multidimensional poverty between 1997 and 2000 almost exclusively by decreasing the proportion of poor children (H). In contrast Barisal's reduction in multidimensional poverty is driven to a much greater extent by a decrease in the intensity of poverty (A). The period 2000-2004 is very notable. Dhaka and Rajshashi reduced multidimensional poverty by decreasing the intensity of child poverty (A), while Barisal and Chittagong actually increased their levels of child poverty through a rise in the percentage of children who are poor (H). The censored headcount in table A2 (appendix) provides information on which dimensions drove these changes in each province – complementing figure 5.

Figure 5 Absolute variations in the Multidimensional Child Poverty Index (M_0), Multidimensional Headcount (H), and in the Intensity of Poverty (A) by province. Bangladesh 1997 – 2004 (k=3)



Which province contributes most to overall national poverty? Let's imagine that a child poverty intervention was to be implemented across provinces depending on the level of their need. This would be a function of the size of the region (population share) and the level of multidimensional poverty (H or M_0). Figure 6 illustrates how important it is to adjust the poverty headcount ratio (H) by the intensity of poverty (A). A province like Sylhet has a higher contribution to overall poverty than we would expect due its population share, but interestingly the contribution increases even more with M_0 than with H. This is because Sylhet is significantly more poor than other provinces and the intensity of poverty among the poor (A) is also higher. Khulna has the exact oppose pattern. Barisals contribution by H and M_0 are relatively similar. What these figures show is that if an intervention were going to be implemented to redress child deprivations, it really matters whether we use the headcount ratio (H) or the multidimensional poverty index (M_0). For it is not only the proportion of poor children that matter, but also the intensity of poverty those children experience. This is why M_0 is such a significant tool for policy makers.

Figure 6 Percentage contribution of each province to national population and poverty aggregates. Bangladesh 2007 (k=3)



6. Conclusions

This paper has explained how a new methodological approach to multidimensional poverty measurement can improve the simple headcount approach to child poverty measurement so that our measures of child poverty reflect the intensity of children's deprivations and also the different contours of poverty in different regions or for different age groups. We have described and applied the Alkire-Foster methodology to demonstrate and assess its potential contribution to multidimensional child poverty measurement.

The results for Bangladesh have shown that the choice of measure does matter, and that measurement has important implications for a range of practical policy applications. The results show that the adjusted headcount ratio is a significant tool for policy makers as it is likely to produce a different output to the headcount alone, particularly in ranking orders and percentage of contribution to the overall poverty. This is because in contrast to the traditional measures, the adjusted headcount ratio is sensitive to differences in the average deprivations experienced by the poor and – at least in Bangladesh – intensity varies in important ways across regions and over time. Given this, we argue that child poverty should not be assessed only according to the incidence of poverty but also by the intensity of deprivations that batter poor children's lives at the same time. The adjusted headcount ratio M_0 is so useful because it accounts for both.

We have also shown other insights and advantages of the adjusted headcount ratio M_0 – that is easy to compute and interpret, and can be broken down by groups and by dimensions. It also gives rise to a multitude of policy-relevant insights and comparisons. These properties are particularly relevant for targeting and for identifying areas for priority interventions. We also showed how M_0 can be used to analyse changes over time. M_0 can be decomposed by its components to reveal changes that are due to variations in the headcount ratio (H) and those that are attributable to increases or decreases in the intensity of deprivation among the poor. The example of Bangladesh shows that headcount and intensity do not always move together and that any full understanding of changes over time must take these into account.

Finally, a distinct advantage of the Alkire-Foster method is its clear specification of the 'dual cutoff method' – a deprivation cutoff and a poverty cutoff. In many circumstances the cutoff k can seem arbitrary – this might, for example, happen with the poverty measures in the Bristol approach. The Alkire-Foster method, in contrast, allows us to carry out sensitivity analysis of our results according to different decisions we might take concerning the cutoff k. Naturally, this ability to assess the robustness of the results is useful for making better informed decisions. In addition, the dual cutoff method provides the flexibility to adapt the measure to the specific context, the purpose of the measure, and the available or relevant indicators. Should we decide to use the method for targeting, we might decide to adapt the cutoffs limits according to budgetary considerations.

But of course there are other relevant aspects of the Alkire-Foster method that we did not get the chance to discuss here. For example, we did not explain in detail the possibility of incorporating a system of weights into the adjusted headcount ratio and then assessing the sensitivity of the results given a different weighting structure. Clearly the weight that is attributed to each indicator brings an implicit value judgment with it on the importance of that dimension; while views on weights may vary, the Alkire-Foster method is flexible enough to incorporate general weights.

Overall, the Alkire-Foster method builds upon and improves the counting-based headcount measures of multidimensional child poverty, and in turn it can draw upon the significant advances that others are making in identifying the appropriate indicators and thresholds for child poverty measures in different contexts. We hope that this paper encourages others to explore and critically engage with improved child poverty measures using this methodology, so that more children become free to enjoy a childhood free from fear and want.

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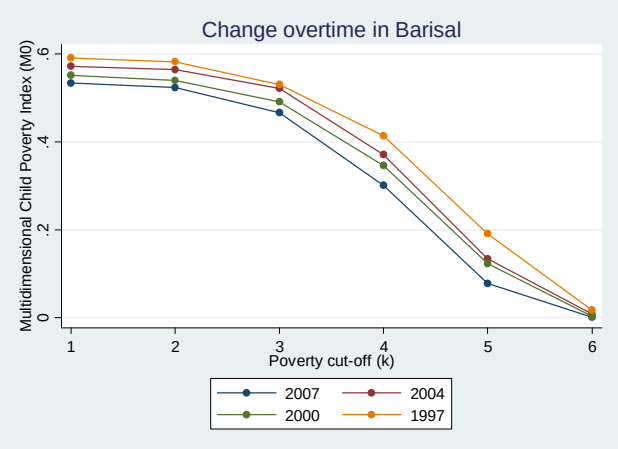
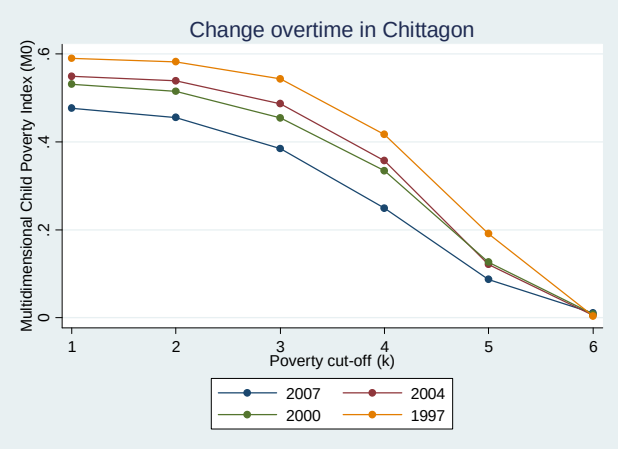
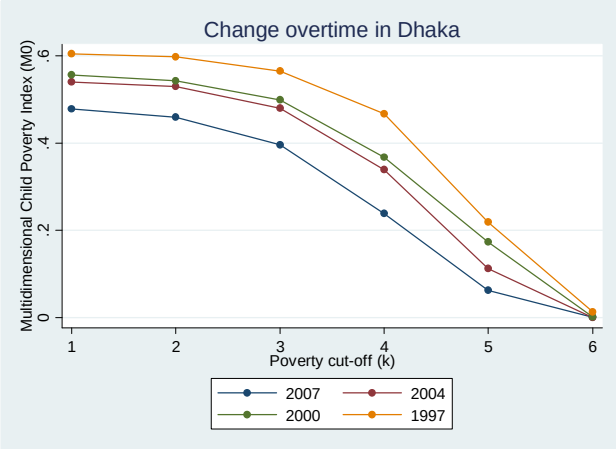
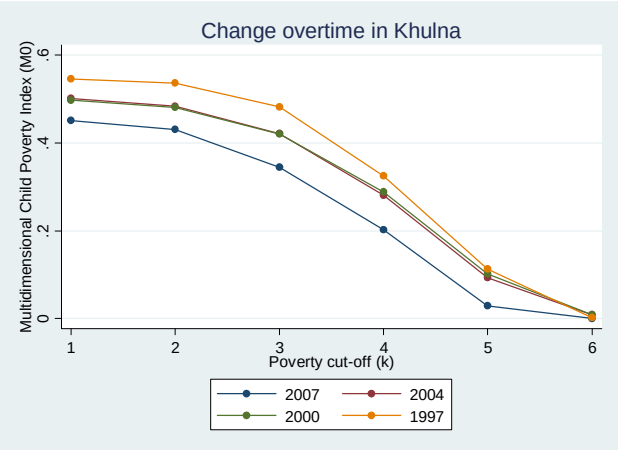
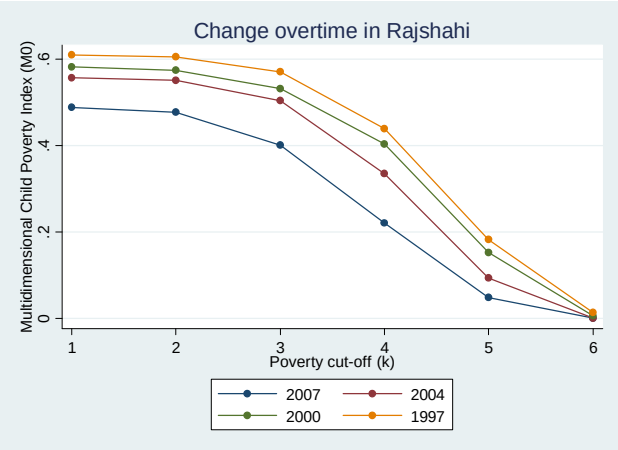
Figure A1: Robustness checks of different dimensional cut-off (k) in changes in multidimensional poverty over time for provinces in Bangladesh 1997 – 2004

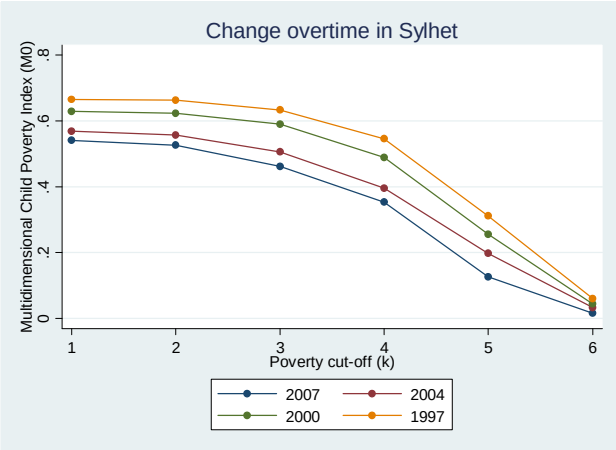




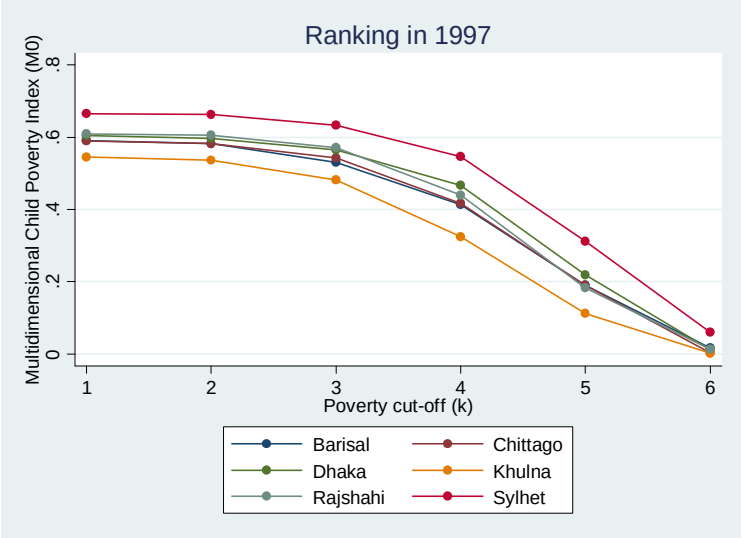


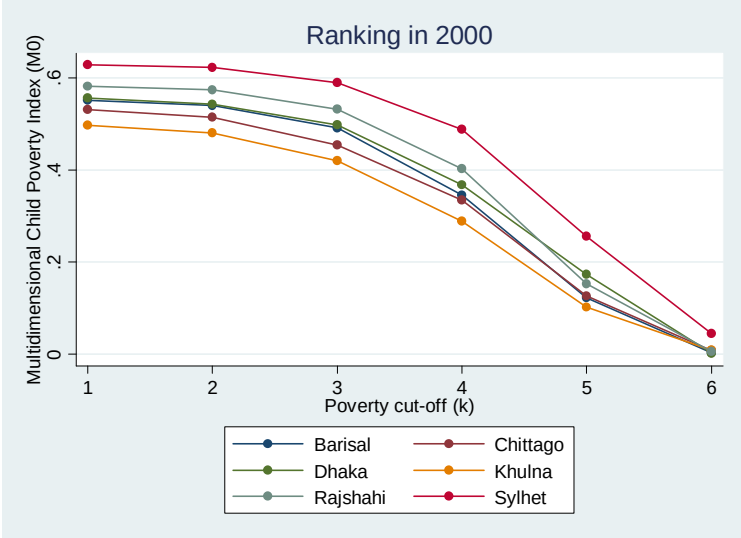


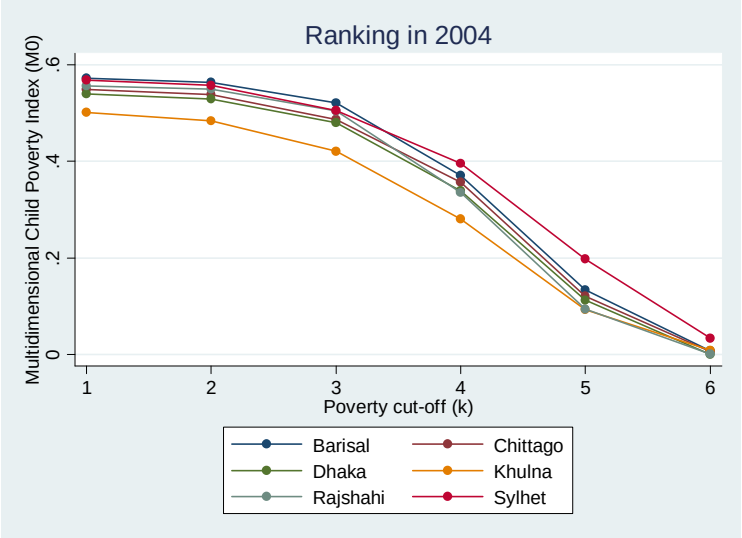




Figures A2: Robustness checks of different dimensional cut-off (k) in ranking among provinces across time







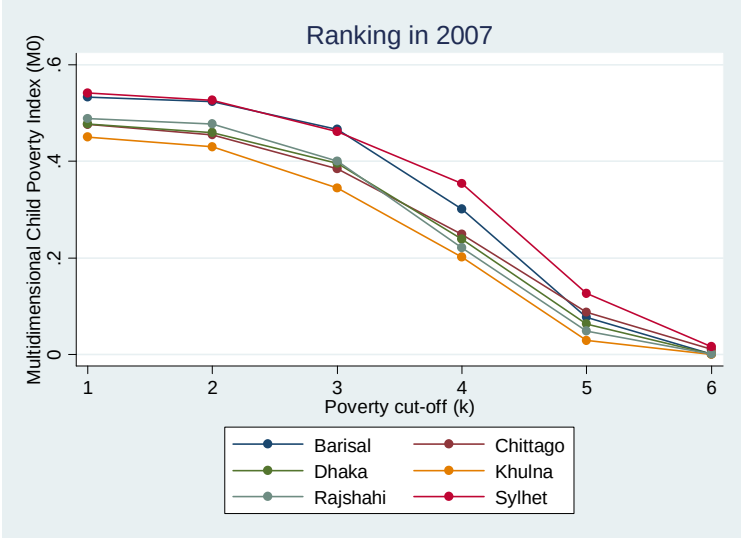


Table A1: Changes over time in Multidimensional Poverty by Province. Bangladesh 1997 - 2007

					Absolute Variation		
	1997	2000	2004	2007	1997-2000	2000-2004	2004-2007
Multidimensional Child Poverty Index (M0)							
Bangladesh	0.555	0.495	0.485	0.400	-0.060	-0.010	-0.085
Khulna	0.481	0.420	0.421	0.345	-0.061	0.000	-0.076
Chittagon	0.543	0.455	0.486	0.384	-0.088	0.032	-0.102
Dhaka	0.565	0.498	0.480	0.396	-0.067	-0.019	-0.084
Rajshahi	0.571	0.532	0.504	0.401	-0.039	-0.028	-0.104
Sylhet	0.633	0.590	0.506	0.462	-0.043	-0.084	-0.044
Barisal	0.530	0.491	0.521	0.467	-0.039	0.030	-0.055
Multidimensional Headcount (H)							
Bangladesh	0.829	0.758	0.763	0.655	-0.071	0.005	-0.108
Khulna	0.767	0.664	0.672	0.579	-0.103	0.008	-0.092
Chittagon	0.819	0.703	0.757	0.616	-0.117	0.054	-0.141
Dhaka	0.828	0.761	0.757	0.653	-0.068	-0.004	-0.103
Rajshahi	0.864	0.815	0.813	0.676	-0.049	-0.003	-0.137
Sylhet	0.887	0.849	0.748	0.705	-0.038	-0.102	-0.042
Barisal	0.793	0.772	0.816	0.759	-0.020	0.044	-0.057
Intensity of Poverty (A)							
Bangladesh	0.669	0.653	0.636	0.611	-0.016	-0.017	-0.025
Khulna	0.628	0.633	0.626	0.595	0.005	-0.007	-0.032
Chittagon	0.663	0.647	0.643	0.624	-0.016	-0.005	-0.018
Dhaka	0.682	0.655	0.634	0.606	-0.027	-0.021	-0.028
Rajshahi	0.661	0.652	0.621	0.593	-0.008	-0.032	-0.028
Sylhet	0.713	0.694	0.676	0.655	-0.019	-0.018	-0.022
Barisal	0.669	0.636	0.639	0.615	-0.033	0.003	-0.024

Note: The results correspond to a poverty cutoff k=3

Table A2: Censored Headcount for each indicator by province. Bangladesh 1997 – 2007

					Absolute Variation		
	1997	2000	2004	2007	1997-2000	2000-2004	2004-2007
Bangladesh							
Nutrition	0.684	0.560	0.557	0.485	-0.125	-0.003	-0.072
Water	0.046	0.034	0.033	0.029	-0.012	-0.001	-0.003
Toilet	0.698	0.638	0.708	0.520	-0.060	0.070	-0.188
Health	0.413	0.371	0.255	0.183	-0.041	-0.117	-0.072
Shelter	0.826	0.754	0.761	0.653	-0.073	0.007	-0.108
Inform	0.660	0.613	0.595	0.529	-0.047	-0.018	-0.066
Barisal							
Nutrition	0.685	0.581	0.594	0.562	-0.104	0.013	-0.033
Water	0.099	0.033	0.043	0.021	-0.066	0.011	-0.022
Toilet	0.648	0.571	0.764	0.610	-0.077	0.193	-0.154
Health	0.317	0.315	0.273	0.187	-0.002	-0.042	-0.085
Shelter	0.787	0.770	0.816	0.759	-0.017	0.046	-0.057
Inform	0.645	0.678	0.638	0.660	0.033	-0.040	0.022
Chittagon							
Nutrition	0.705	0.538	0.572	0.488	-0.167	0.034	-0.084
Water	0.018	0.033	0.041	0.039	0.015	0.008	-0.002
Toilet	0.640	0.565	0.702	0.473	-0.076	0.138	-0.229
Health	0.466	0.318	0.279	0.224	-0.148	-0.040	-0.055
Shelter	0.819	0.696	0.754	0.612	-0.123	0.058	-0.142
Inform	0.610	0.579	0.571	0.470	-0.031	-0.008	-0.100
Dahka							
Nutrition	0.676	0.564	0.565	0.484	-0.112	0.001	-0.080
Water	0.032	0.013	0.003	0.009	-0.019	-0.010	0.006
Toilet	0.724	0.661	0.702	0.516	-0.063	0.041	-0.186
Health	0.444	0.412	0.257	0.192	-0.032	-0.155	-0.065
Shelter	0.827	0.752	0.756	0.652	-0.074	0.003	-0.103
Inform	0.689	0.588	0.596	0.522	-0.101	0.008	-0.075
Khulna							
Nutrition	0.626	0.479	0.485	0.405	-0.147	0.006	-0.080
Water	0.032	0.054	0.066	0.064	0.022	0.013	-0.003
Toilet	0.590	0.528	0.611	0.475	-0.062	0.083	-0.136
Health	0.287	0.259	0.181	0.100	-0.028	-0.078	-0.081
Shelter	0.764	0.663	0.667	0.579	-0.101	0.004	-0.088
Inform	0.590	0.538	0.514	0.444	-0.052	-0.024	-0.070
Rajshashi							
Nutrition	0.681	0.579	0.551	0.488	-0.103	-0.028	-0.063
Water	0.052	0.024	0.010	0.011	-0.029	-0.014	0.001
Toilet	0.768	0.711	0.770	0.541	-0.057	0.059	-0.229
Health	0.370	0.394	0.229	0.129	0.024	-0.166	-0.100
Shelter	0.859	0.815	0.813	0.676	-0.044	-0.003	-0.137
Inform	0.692	0.668	0.653	0.558	-0.024	-0.015	-0.095
Sylhet							
Nutrition	0.752	0.646	0.579	0.510	-0.106	-0.067	-0.068
Water	0.165	0.126	0.129	0.085	-0.039	0.004	-0.044
Toilet	0.781	0.735	0.664	0.575	-0.046	-0.071	-0.089
Health	0.497	0.491	0.340	0.278	-0.007	-0.151	-0.062
Shelter	0.881	0.848	0.747	0.702	-0.034	-0.101	-0.044
Inform	0.720	0.693	0.576	0.619	-0.027	-0.117	0.043

Note: The results correspond to a poverty cutoff k=3