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ADB Working Paper Series

**MEASURING MULTIDIMENSIONAL
POVERTY IN THREE SOUTHEAST
ASIAN COUNTRIES USING
ORDINAL VARIABLES**

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Abstract

The primary objective of this paper is to highlight the contribution of the recent methodological refinements of poverty measures based on counting approaches using ordinal variables to the understanding of the evolution of poverty in Cambodia, Indonesia and the Philippines. Using the general framework proposed by Silber and Yalonetzky (2013), this paper compares multidimensional poverty measures such as the Multidimensional Poverty Index used by the UNDP (an index based on the approach of Alkire and Foster (2011)) with others which are sensitive to the distribution of deprivation counts across individuals. To the latter family belong the poverty measures introduced by Chakravarty and D'Ambrosio (2006) and Rippin (2010) and those based on the extension of the approach of Aaberge and Peluso (2012), as suggested by Silber and Yalonetzky (2013). Poverty is estimated using Demographic and Health Surveys for three different years for Cambodia (2000, 2005 and 2010), for Indonesia (1997, 2003 and 2007), and for the Philippines (1997, 2003 and 2008) by considering the deprivations in education, health and standard of living.

Our findings indicate that Cambodia shows the highest level of poverty, followed by Indonesia and the Philippines, irrespective of the poverty measures used. At the national level, all countries reduced their multidimensional poverty over time using poverty measures as the one based on the approach of Alkire and Foster (2011) and those that are sensitive to the concentration of deprivations across individuals. As in most of Asian developing countries, poverty is largely a rural phenomenon. However, when examining the evolution of poverty over time for each country, conclusions drawn from the use of various poverty measures may differ regarding trends in poverty over time by area of residence as well as by region of residence.

JEL Classification:I32, D63

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1. INTRODUCTION

There is a broad consensus among academic and institutional organizations that poverty can no longer be defined only as a lack of monetary resources but reflects many factors that act as constraints on the achievement of the capabilities of the population and affect its well-being. The enlargement of the framework traditionally used to address poverty and well-being is at the origin of methodologies that attempt to capture the essence of the multidimensionality of poverty.

The recent use by the United Nations Development Programme (UNDP) of the so-called Multidimensional Poverty Index (MPI) is an illustration of the importance of taking into account and addressing the multiple dimensional aspects of poverty. The MPI draws on the counting approach developed by Alkire and Foster (2008) and assesses poverty along the same dimensions as the Human Development Index (HDI). It includes ten indicators that affect the well-being of the population and does not only count the percentage of the population that suffers from at least 30% of multiple deprivations but also provides a snapshot of the breadth of poverty in assessing the proportion of the total number of dimensions of well-being in which multidimensional poor are really poor.

As was the case with the inception of the HDI in 1990, the MPI led to a renewal of the discussion among researchers regarding the issues to be addressed when adopting a multidimensional approach to poverty and, in fact, recent literature points out some weaknesses of the MPI.

One of these points concerns the choice of the dimensions included in the index whereas others emphasize the arbitrariness of the cut-off used to identify the multidimensional poor across the dimensions. There are also those who question the sensitivity of the MPI to inequality in deprivation across individuals. In particular, due to the counting nature of the approach to the MPI, traditional indices of poverty that are based on continuous variables cannot be applied. Indeed, most of the indicators included in the MPI, or, more generally, in survey data that are used to capture direct achievements of individuals, are of an ordinal nature. Several recent studies suggested alternative ways of defining multidimensional poverty indices that comply with the basic axiomatic properties of multidimensional poverty indices using continuous variables (Bossert, Chakravarty and D'Ambrosio 2013). Recently, Silber and Yalonetzky (2013) proposed a general framework that measures multidimensional poverty with ordinal variables. They address concerns regarding the identification and aggregation steps involved in constructing any poverty measure. In particular, they make a distinction between an individual poverty function and a social poverty function. At the individual level, they review the properties of such individual functions that take into account the identification as well as the breadth of poverty. At the aggregation step, they highlight several ways to generate social poverty indices that deal with the issues of inequality in the distribution of deprivations. In particular, they suggested an extension of the approach of Aaberge and Peluso (2012) that makes it possible to address the issue of inequality in the distribution of deprivations and to capture additional information on poverty that is not well addressed by the MPI.

The main goal of this paper is to highlight the contribution of the methodological refinements of poverty measures based on counting approaches using ordinal variables to the understanding of multidimensional poverty in three Southeast Asian countries, namely, Cambodia, Indonesia and the Philippines. More precisely, we compare results obtained from poverty measures defined as the summation of individual deprivation functions such as the MPI (an index based on the approach of

Alkire and Foster (2011)) and others suggested by Chakravarty and D'Ambrosio (2006) and Rippin (2010) and those based on the extended approach of Aaberge and Peluso (2012), as suggested by Silber and Yalonetzky (2013).

The adoption of such an approach is of particular interest in the context of these countries. Indeed, Southeast Asia experienced rapid socio-economic changes during the past two decades which translated into high-growth performance and poverty reduction. Although the Asian financial crisis in the late 1990s severely affected the well-being of the population, human development achievements continued to show progress. However, these achievements have not been uniform. Indonesia was one of the fastest growing economies before the onset of the late 1990s crisis that generated drastic improvements in average incomes and in access to human development opportunities (Sumner, Suryahadi and Thang 2012). As the economy slowly recovers and welfare gains stabilize, Indonesia is on track to meet Millennium Development Goals (MDG) targets. In contrast, in the past decades, economic growth in the Philippines was low by the standards of the Southeast Asia and poverty estimates showed a lack of response of the incidence of income poverty to growth during the 2000s (Habito 2009; Balicasan 2011). Finally, Cambodia is one of the least developed countries of the region. However, since 1998, due to macroeconomic and political stability, Cambodia has experienced high and sustained economic growth. As a result, it has registered higher gains in human development between 1990 and 2012 in comparison with those that would have been predicted by its previous performances (UNDP 2013). Nevertheless, Cambodia is lagging in terms of human development relative to its neighbours.

Despite of the fact that the multidimensional nature of poverty is now well-recognized, studies of poverty in these countries are still dominated by the absolute monetary approach. Apart from the latest published statistics on the MPI in UNDP (2010), there does not seem to have been much work on these countries that take a multidimensional approach to poverty. To our knowledge, the only exceptions are Casimiro, Ballester, and Garingalao (2013) and Balicasan (2011) on the Philippines and a report on child deprivations and multidimensional poverty by the UNICEF (2011) in seven countries in East Asia and the Pacific.

The present paper is organized as follows. Section 2 presents a review of recent methodological refinements suggested in the literature dealing with counting approaches to multidimensional poverty measurement using ordinal indicators. Section 3 illustrates results obtained from the application of some multidimensional poverty indices presented in Section 2 using data from the Demographic Health Surveys for Cambodia (2000, 2005, 2010), Indonesia (1997, 2003, 2007), the Philippines (1997, 2003, 2008). An analysis of trends over time in multidimensional poverty is also provided for each country.

Given the availability of data and, for comparison purposes, our multidimensional measures include indicators relating to the same three dimensions included in the MPI, namely standard of living, health and education. Concluding comments are given in Section 4.

2. REVIEW OF COUNTING APPROACHES TO MULTIDIMENSIONAL POVERTY

During the last three decades, studies of poverty have moved from a traditional approach that relies on a single indicator of well-being, namely income or consumption, to one that increases the number of admissible attributes when measuring living conditions. The major advantage of such a wider concept of poverty is that it allows the researcher to go beyond the inclusion of only material conditions when attempting to capture the essential aspects of household living conditions.

The main areas of criticism of the traditional income and consumption data-based definition are now well known, whether they concern the limitations of income as a proxy for well-being (or its dual aspect, poverty) or the arbitrariness inherent in identifying poor individuals on the basis of a poverty line defined with reference to a whole population's mean or median income or a predefined consumption basket.

New definitions of poverty have emerged since the seminal works of Townsend (1979) and Sen (1985), each sharing the idea that income can only serve as an indirect indicator when assessing well-being. However, selecting a multidimensional approach to poverty implies addressing issues that need not be faced when taking a unidimensional approach. Thus, several approaches have been proposed in the literature to operationalise the multidimensionality of poverty. At the same time, there is a lack of consensus concerning the best methodology to derive multidimensional poverty measures. According to Thorbecke (2007), the first one involves aggregating several attributes of well-being into a single index via sophisticated techniques of aggregation and deriving a poverty measure on the basis of this aggregated index. Such an approach, however, de facto amounts to using a unidimensional view of poverty. Several studies have followed this route using methodologies borrowed from efficiency analysis (Lovell et al. 1994) and information theory (Maasoumi 1986, 1999), as well as inertia approaches (Klasen 2000; Sahn and Stifel 2000; Booysen et al. 2008).

As a whole these attempts may be criticized. Sen (1985: 33), for example, believes that "The passion for aggregation makes good sense in many contexts but it can be futile or pointless in others. ... When we hear of variety, we need not invariably reach for an aggregator." Another possibility is to analyse separately each dimension of poverty. The advantage of such an analysis lies in its simplicity, but, at the same time, it lacks synthesis, making it difficult to draw a clear picture of multidimensional poverty.

Finally, between these two extremes exists another strategy that preserves the essence of the multiple facets of poverty. This strategy first defines poverty as a combination of shortfalls in each dimension of an individual's well-being and then derives a multidimensional measure. This is precisely the route adopted by the axiomatic approach to multidimensional poverty. Unlike the one-at-a-time analysis, this approach provides a comprehensive picture of poverty by revealing complexities and ambiguities arising from the interaction between various dimensions and their correlation in the sampled population. The launch of the MPI, popularized by the work of Alkire and Foster (2011), provides an illustration of such an approach. Naturally there are situations where the choices of the researcher can be severely constrained if the data sets available include solely binary indicators of well-being, providing information only on the presence or absence of a deprivation but not on its extent.

Among the shortcomings of the MPI, one may stress its lack of sensitivity to the inequality in the distribution of deprivations. This aspect has been recently considered by Alkire and Seth (2014). The counting nature of the approach to the MPI prevents one from using traditional indices of poverty based on continuous variables. Recent contributions have indeed suggested alternative ways of defining poverty indices based on counting but having the same properties as multidimensional poverty indices using continuous variables (Bossert, Chakravarty and D'Ambrosio 2013). The main idea of these studies is to provide multidimensional poverty measures that go beyond evaluating some headcount ratio.

Although the axiomatic approach has largely been developed for the unidimensional case, a few studies have attempted to axiomatically derive multidimensional indices of poverty.¹ Since the seminal study by Chakravarty, Mukherjee and Ranade (1998), additional extensions and multidimensional classes of poverty have been proposed by Bourguignon and Chakravarty (2003), Alkire and Foster (2011) and Chakravarty and Silber (2008). Studies considering the case of ordinal variables are even more limited and have been recently reviewed by Silber and Yalonetzky (2012) whose contribution we now shortly summarize.

Suppose that the relevant population consists of n individuals. Let $z = (z_1, \dots, z_m)$ be the m -vector of poverty lines and $x^i = (x_{i1}, \dots, x_{im})$ the vector of achievements (ordinal indicators). Let X be an $n \times m$ matrix of these achievements so that x_{ij} denotes the level of the j^{th} attribute for individual i . More precisely, in the case of ordinal variables, that level might be related to the possession of a given good, the access to some basic services or concerns health status or education attainment. Because some attributes may be more important than others, we define a vector of indicator-specific weights:

$$w = (w_1, \dots, w_m) \text{ such that } w_j > 0 \text{ and } \sum_{j=1}^m w_j = 1.$$

The identification step raises some issues that are more acute in the multidimensional case based on ordinal variables. As suggested by Rippin (2012) and Silber and Yalonetzky (2013), it includes several stages rather than the one-step identification that occurs in the unidimensional approach to poverty.

2.1 The Individual Poverty Function

In counting approaches, the first step consists of defining for each dimension a dichotomous function which takes the value of 1 or 0 depending on whether the individual is deprived or not in that dimension.

Let $\xi(x_{ij}, z_j)$ be such a dichotomous function that is equal to 1 if the value x_{ij} of the attribute j falls short of the poverty line z_j , and to 0 otherwise, that is:

$$\xi(x_{ij}, z_j) = \begin{cases} 1 & \text{if } x_{ij} \leq z_j \\ 0 & \text{if } x_{ij} > z_j \end{cases} \quad (1)$$

In a second step, using this simple dichotomous function, it is possible to define a counting function for each individual which is then used to generate an individual poverty function that might reflect different ways of identifying the poor.

¹ We note the contributions of Tsui (1995, 1999, 2002) on axiomatic derivations of multidimensional inequality and poverty indices.

Let c_i be the deprivation vector of individual i that consist of values of 0 or 1 on each attribute according to (1). The counting function is then defined as follows:

$$c_i(x_i, z, w) = \sum_{j=1}^m \xi(x_{ij}, z_j) w_j \quad (2)$$

which provides the individual deprivation score as the weighted sum of dichotomous functions defined by (1) with w_j being the weight assigned to attribute j .

At this stage, the question is to decide when a given individual is classified as poor. Three main approaches have been suggested in the literature: the union, the intersection and an intermediate definition.

Under the intersection approach, individuals are deemed poor if and only if they are deprived in every dimension. In that case, attributes or dimensions of poverty act as substitutes because the absence of deprivation in a single dimension is sufficient to classify the person as not being poor. This approach can be regarded as a very conservative way of thinking about poverty, but it is interesting because it helps place the focus on the “extremely poor”.

On the contrary, the union approach states that individuals are poor if they are deprived with respect to at least one attribute. Because every dimension or deprivation counts and is considered as essential, this approach corresponds to an extensive way to identify the poor. It is extensively used in the literature on social exclusion measurement theoretically founded on an axiomatic approach.

Between these two extremes, Alkire and Foster (2011) introduce an innovative approach called the “intermediate approach” which, unlike multidimensional deprivation or social exclusion measures, uses a cross-dimensional cut-off to define the poor. Let k the minimum number of dimensions in which an individual should be deprived to be considered as poor. Because k corresponds to a number of weighted dimensions, k lies between 0 and 1.

This approach can be summarised using the following identification function ψ^{AF} that returns 1 when an individual is deemed poor relative to the set of poverty lines z and the threshold k :

$$\psi^{AF}(x_i, z, w, k) = \begin{cases} 1 & \text{if } \sum_{j=1}^m \xi(x_{ij}, z_j) w_j \geq k \\ 0 & \text{if } \sum_{j=1}^m \xi(x_{ij}, z_j) w_j < k \end{cases} \quad (3)$$

This approach is quite flexible and includes as special cases the two traditional identification functions, namely the intersection (that corresponds to $k=1$) and the union approach (with $k = \min(w_1, \dots, w_m)$).

As argued by Alkire and Foster (2011), such an approach is more helpful than the union approach in focusing on deprivations that are reflective of poverty and also for distinguishing and targeting the most extensively deprived. However, as for the choice of the poverty line in unidimensional poverty measurement, the choice of the dimensional cut-off is rather arbitrary (Ray and Kompal 2011). Indeed, it amounts to ignoring the deprivations of those who are deprived in less than k dimensions. In addition, a cross-dimensional cut-off that is reasonable in a given society might not be

so in another. As pointed out by Datt (2013), the use of k cannot, by itself, be an adequate solution for the need to identify a target group.

To avoid high poverty rates yielded by the union approach, Rippin (2012) suggested another identification function that can take the following specific functional form:

$$\psi^{RI}(x_i, z, w) = \begin{cases} c_i^\gamma & \text{if } c_i \neq 0 \\ 0 & \text{if } c_i = 0 \end{cases} \quad (4)$$

with $\gamma \geq 0$ and c_i , according to expression (2), being the number of weighted deprived attributes experienced by individual i .

This function differentiates between the poor and the non-poor on one hand but takes into account the degree of poverty severity on the other hand. As mentioned by Silber and Yalonetzky (2013), it can be considered as a fuzzy identification function of the poor whose shape is dependent on the value of γ , which can be interpreted as a parameter of aversion to interpersonal inequality that takes into account association between attributes. Thus, ψ^{RI} is concave for any value of γ smaller than one. In that case, attributes are imperfect complements. They act as perfect complements when $\gamma = 0$ which coincides with the union view of the identification procedure. On the contrary, the function ψ^{RI} is convex if γ is greater than one which implies that attributes are substitutes. In the extreme case where $\gamma \rightarrow \infty$, emphasis is put on those individuals that suffer deprivation in every dimension according to the intersection approach. As pointed out by Rippin (2010), under the intermediate approach introduced by Alkire and Foster (2011), attributes are supposed to be substitutes below the threshold value k and then to act as complements above that value of k .

As mentioned by Silber and Yalonetzky (2013), it is possible to transform any fuzzy identification function into a dichotomized identification function. Because ψ^{RI} increases monotonically with c_i , then the choice of a cut-off value $d \in [0,1]$ implicitly defines a threshold k for the individual count c_i that solves the implicit function: $\psi^{RI}(k) = d$. Therefore, the new dichotomized function works like ψ^{AF} .

Although the identification step gives an answer on who is poor and what their number is, the measure obtained, at this stage, is rather restrictive. One may also want to take into account to what extent those individuals classified as poor are poor. One way to proceed is to consider the poverty gap that identifies the distance between each dimension cut-off and the achievement of the poor in the dimensions they are deprived of. However, unlike in the case of continuous indicators, it is not easy to tell something about the depth of poverty due to the arbitrariness of any scaling of an ordinal variable. The only thing that can be done in that case is to make the individual poverty function sensitive to the breadth of poverty which may be captured by the number of dimensions in which the individual is deprived.

Hence, the individual poverty function of the counting approach has the form:

$$p_i(x_i, z, w, k) = \psi(x_i, z, w, k) g(x_i, z, w) \quad (5)$$

which is the product of an identification function ψ and a function g that measures the breadth of poverty and may, in fact, be defined as a function of the deprivation score c_i . More generally, g is a real-valued function that maps into the interval $[0,1]$ and is nondecreasing when deprivation increases in any one dimension.

For instance, in the case of the adjusted headcount ratio or the MPI from the Alkire and Foster family of poverty measures, $g^{AF} = c_i$. In the case of the family of social exclusion measures, defined by Chakravarty and D'Ambrosio (2006), $g^{CD} = h(c_i)$ where h is increasing at a nondecreasing rate. In other words, the effect of an additional deprivation in any one dimension is more burdensome for an individual if it is accompanied by deprivation in other dimensions. The function h takes into account the compounding negative effects of multiple deprivations on the overall well-being of the individual. We note that concave breadth functions are never considered in the literature because otherwise whenever inequality among the poor increases, poverty would not decrease as is expected from any poverty measure (see Sen 1976).²

It is easy to show that p_i fulfills the following properties drawn from a broader set of properties discussed by Alkire and Foster (2011):

- Normalization: p_i reaches a minimum value of 0 if and only if the person is not poor, i.e., $\psi = 0$ and a maximum value of 1 if individual i is deprived in every dimension, i.e., $g = 1$;
- Scale invariance: p_i is not affected by a scale transformation of the ordinal attributes and thresholds;
- Individual deprivation focus: If an individual i , not deprived in dimension j , receives a transfer, then p_i does not change;
- Individual weak monotonicity: p_i does not increase where individual i receives a transfer;
- Individual dimensional monotonicity: p_i decreases when individual i receives a transfer which makes his/her non-deprived in that dimension.

Following the definition of individual poverty functions, the next step is to consider the different ways of aggregating individual poverty characteristics to derive poverty measures. Following Silber and Yalonetzky (2013), the aggregation procedure yields what they call a social poverty function.

2.2 The Social Poverty Function

There are two different ways of performing the aggregation of individual poverty functions to derive poverty measures with the counting approaches. The first one, which is extensively used in the literature, derives a class of poverty measures as an average of the individual poverty functions. The second one, suggested by Aaberge and Peluso (2012), defines the social poverty function directly as a function of the distribution of deprivation among the poor.

Averaging the Individual Poverty Functions and Additional Axiomatic Properties

The social poverty function P is then defined as:

$$P(X, z, w, k) = \frac{1}{n} \sum_{i=1}^n p_i(x_i, z, w, k) \quad (6)$$

² In that case, it would minimize the additional welfare cost of deprivation in an additional dimension. It would be easy to find examples to illustrate that the poverty measures derived from a concave g function would correspond to interpersonal inequality preference (Rippin, 2012).

We note that P has all the properties of the p_i s and also satisfies the following properties:

- Anonymity or symmetry: It ensures that if two individuals switch their deprivation vectors, the poverty measure P remains unaffected. It implies equal treatment of the equals.
- Principle of population: If each individual is replicated $\pi > 0$ times then P does not change. This property allows for comparisons across different sized populations.
- Poverty focus: Changes in the well-being of the non-poor that do not change their poverty status do not affect P .
- Additive decomposability: It states that overall poverty is a weighted average of the shares of the subgroup poverty levels. This axiom enables the identification of those groups that are the most afflicted by poverty.
- Subgroup consistency: If the population is partitioned in G non-overlapping groups of people, and poverty increases/decreases in one group, but does not change in others, then the overall poverty P should increase/decrease. This property is implied by additive decomposability.
- Factor decomposability: This property allows the poverty index to be broken down by dimensions and enables the evaluation of the contribution of each dimension to overall poverty (Chakravarty, Mukherjee and Ranade 1998; Alkire and Foster, 2011). This property is particularly suitable for policy targeting. However, it requires the individual poverty index to be additive across dimensions; this could prevent the fulfilment of some desirable transfer axioms.

Furthermore, the literature on multidimensional poverty measurement with ordinal variables has recently expressed some concern about inequality among the poor. Alkire and Seth (2014) suggested using a separate decomposable measure of inequality—a positive multiple variance—to analyse inequality in deprivation counts among the poor and disparity in poverty across population subgroups. However, drawing from the literature on one-dimensional poverty and on multidimensional poverty based on continuous attributes, a common approach to account for inequality among the poor has been to adjust the poverty function through the introduction of a parameter of aversion to inequality. Because, unlike the approaches using continuous indicators, it is not possible to capture inequality within each dimension, the only way to address inequality is to consider the distribution of deprivation scores among the poor.

Indeed, following Sen (1976), although changes of poverty can be analysed considering the evolution of its incidence and intensity, it is also important to analyse whether the changes have been equitable among the poor.

As pointed out by Silber and Yalonetzky (2013), three definitions of reductions in inequality among the poor have been proposed. In all three cases, the social poverty indices are required to increase when inequality increases, or at least not to decrease (in a weak form).

The first definition of change in inequality in deprivations among the poor, which is analogous to a *Pigou-Dalton transfer*, is the rank-preserving transfer of a deprivation from the poorer to the less-poor person, in which the degree of poverty corresponds to the weighted number of deprivations. A measure that is sensitive to inequality among the poor is supposed to decrease in the presence of such a transfer. Rippin (2010) used this definition and defined an axiom called the “*nondecreasingness under*

inequality-increasing switch” (NDS). Under this axiom, a transfer of one deprivation from a less poor individual to a poorer individual should not decrease poverty. As shown by Rippin (2010), this property makes it possible to consider situations that are not covered by the Pigou-Dalton transfer principle.

Chakravarty and d’Ambrosio (2006) proposed a similar axiom called “*nondecreasingness of marginal social exclusion*” (NMS). This axiom states that an increment of deprivation in a poorer person induces a higher, or at least as high, poverty than the same deprivation increase in a less-poor person. The fulfilment of this property requires the individual poverty function to be quasiconvex.

As demonstrated by Silber and Yalonetzky (2013), the social poverty function, P , satisfies NMS if and only if it satisfies NDS. A strong version of this property, also called “*cross-dimensional convexity*” by Datt (2013), is particularly appealing because it takes into account the fact that the impact of multiple disadvantages on an individual’s well-being cannot be reduced to the sum of their individual effects. In other words, the effect of an increase in deprivation in a given dimension increases with the level of deprivation in other dimensions.

The second definition has been generalized in the multidimensional context following the study of Kolm (1977) of inequality in a multidimensional context. The *multidimensional transfer principle* (MTP) states that poverty should not increase if it is obtained by a redistribution of attributes among individuals according to a bistochastic transformation.³ In other words, MTP requires that the post-transfer distribution of attributes should be more even than the initial distribution.⁴ This definition has been considered both by Alkire and Foster (2011) and Bossert, Chakravarty and D’Ambrosio (2013) but is more suitable for continuous variables. Bossert, Chakravarty and D’Ambrosio (2013) propose a property called “*S-convexity*” whereas Alkire and Foster (2011) call it “*weak transfers*”. Because Alkire and Foster (2011) use a more general approach to poverty identification, they modify the bistochastic matrix so that the averaging of deprivation counts only takes place among the poor.

Finally, the third definition was proposed by Alkire and Foster (2011) and is called the “*association decreasing rearrangement among the poor*”. Under this property, any rearrangement of attributes between two poor individuals i and i' that breaks the dominance of the initial distribution of deprivation counts between i and i' (individual i being initially poorer than individual i') implies that poverty should not increase. The fulfilment of this property requires quasiconvex individual poverty functions. However, Alkire and Foster (2011) propose a weaker version of this axiom.

Based on some of these properties, five classes of counting poverty measures can be found in the literature. Some of them are explicit counting measures of multidimensional poverty, as those introduced by Alkire and Foster (2011) and Rippin (2010). Others are implicit measures of poverty because they have been introduced as a class of social exclusion measures by Chakravarty and D’Ambrosio (2006) and Bossert, Chakravarty and D’Ambrosio (2013) or are subgroups of this family (Jayaraj and Subramanian 2010).

We consider the class of Alkire and Foster poverty measures that are “dimension-adjusted” multidimensional poverty measures based on the traditional Foster-Greer-Thorbecke measures of poverty.

³ A bistochastic matrix is a square matrix with the sum of each column and row equal to one.

⁴ PDP and MTP both require that the individual poverty function to be convex.

Alkire and Foster Dimension-adjusted⁷ Multidimensional Poverty Measures

This class of measures satisfies an array of desirable axioms, including decomposability and dimensional monotonicity, and is defined by:

$$P_{\alpha}^{AF}(X, z) = \frac{1}{n} \sum_{i=1}^n \psi^{AF}(x_i, z, c) \sum_{j=1}^m \xi(x_{ij}, z_j) w_j \left[1 - \frac{x_{ij}}{z_j} \right]^{\alpha_j}.$$

In situations where attributes of poverty are represented by dichotomized variables, this class of measures is restricted to the case with $\alpha = 0$. The social poverty function is then:

$$P_0^{AF} = \frac{1}{n} \sum_{i=1}^n \psi^{AF}(x_i, z, k) c_i \quad (7)$$

where c_i is given by (2).

This measure is the adjusted headcount ratio used for the MPI) and designated as M_0 by Alkire and Foster (2011). As is well-known, M_0 can be expressed as $M_0 = P_0^{AF} = H \times A$, i.e., the product of the percentage of the multidimensional poor (H) times the average deprivation share across the poor (A).

It is easy to show that P_0^{AF} violates the NDS axiom. Indeed, at best, P_0^{AF} remains unaffected when a transfer does not change the poverty status of people involved. This is the case of a progressive transfer of deprivations. However, it would be easy to find examples when a regressive transfer in a single dimension implies a decrease of poverty for certain values of k . This occurs because the transfer to the less-poor not only eliminates a particular deprivation for that individual but can also render the individual non-poor. It is also possible to show that P_0^{AF} does not satisfy the rearrangement axiom in cases of increasing association switches of attributes among the poor for certain values of k . In that sense, P_0^{AF} is insensitive to how a given set of deprivations is distributed across individuals.

The Multidimensional Rippin (2010) Class of Ordinal Poverty Measures

$$P_{\gamma}^{RI} = \frac{1}{n} \sum_{i=1}^n \psi^{RI}(x_i, z, w) \sum_{j=1}^m w_j \xi(x_{ij}, z_j). \quad (8)$$

Replacing ψ^{RI} by its expression given by (4) and rearranging the terms of the summations, it is easy to show that P_{γ}^{RI} can be equivalently expressed as:

$$P_{\gamma}^{RI} = \frac{1}{n} \sum_{i=1}^n c_i^{\gamma+1}. \quad (9)$$

This class of measures provides poverty measures that are insensitive to the concentration of deprivations because it satisfies NDS and NMS for $\gamma \geq 0$. We note that strong versions of NDS and NMS are satisfied for $\gamma > 0$ even when the adopting identification approaches are based on a cross-dimensional cut-off. Moreover, the identification function has been made to take into account the association between

attributes while preserving an additive structure of (8) so that this class of poverty measures satisfies not only subgroup decomposability but also factor decomposability.

The Multidimensional Chakravarty and D'Ambrosio Class of Poverty Measures

$$P^{CD} = \frac{1}{n} \sum_{i=1}^n \psi(x_i, z, w, k = \min(w_1, \dots, w_m)) h(c_i)$$

with h increasing at a nondecreasing rate whereas k corresponds to the union approach to identification.

We consider the following specific functional form of $h(c_i)$:

$$P_{\alpha}^{CD} = \frac{1}{n} \sum_{i=1}^n c_i^{\alpha} \quad (10)$$

Taking an implicit union approach, this class of measures complies with NDS and NMS if $\alpha \geq 1$. Strong versions of these axioms require that $\alpha > 1$, which is also satisfied even for more general identification approaches. We note that P_{α}^{CD} becomes more sensitive to the higher deprivation scores as α increases from 2 to infinity. For $\alpha = 1$, P_{α}^{CD} becomes the average deprivation score of the society (designated as A by Chakravarty and D'Ambrosio) which corresponds to $P_0^{AFunion}$ in the case of the union approach. It is easy to show that, for $\alpha = 2$, P_{α}^{CD} can be rewritten as the sum of the average deprivation score squared ($P_0^{AFunion}$)² and the variance of the society deprivation scores σ^2 :

$$P_2^{CD} = (P_0^{AFunion})^2 + \sigma^2. \quad (11)$$

Thus, given $P_0^{AFunion}$, a reduction in σ^2 reduces poverty measures in (11). However, unlike the Rippin class of measures, P_{α}^{CD} does not satisfy factor decomposability.

A subgroup of this family of measures has been also derived by Jayaraj and Subramanian (2010).⁵

As mentioned earlier, an alternative aggregation method of individual poverty functions has been suggested by Aaberge and Peluso (2012) and extended by Silber and Yalonetzky (2013). This is dealt with in the section immediately below.

⁵ In particular, in cases where attributes are equally weighted (weight for each attribute is equal to $1/m$) the authors define the corresponding class of headcount measures:

$$P_{\beta}^{JR} = \sum_{j=1}^m \left(\frac{j}{m} \right)^{\beta} H_j$$

where H_j is the proportion of individuals deprived in exactly j dimensions. This family satisfies the properties mentioned previously. In particular, range sensitivity, which is similar to the Pigou-Dalton transfer principle, is verified for all $\beta > 1$ whereas strong-range sensitivity is fulfilled for all $\beta > 2$. Jayaraj and Subramanian (2010) show that P_{β}^{JR} is identical to P_{α}^{CD} in the special case where each dimension receives an equal weight.

The Aaberge and Peluso (2012) Approach

Drawing on the rank-dependent framework introduced by Sen (1974) and Yaari (1988), Aaberge and Peluso (2012) introduced summary measures of deprivation that are derived from an alternative aggregation method. Indeed, the social poverty function is directly a function of the distribution of deprivation counts because it takes into account the proportions of individuals with j deprivations, $j=1,\dots,m$. More precisely, for a number of deprivations h , let $F(h) = \Pr(c_i \leq h)$ be the cumulative probability of individuals with up to h deprivations. Then, applying the theorem on the dual theory of choice under risk due to Yaari (1987), and using axioms similar to those defined by Yaari (1988), Aaberge and Peluso (2012) concluded that a cumulative distribution F_1 is preferable to distribution F_2 if and only if:

$$\sum_{j=0}^{m-1} \Gamma(F_1(j)) \geq \sum_{j=0}^{m-1} \Gamma(F_2(j))$$

where Γ is a continuous and nondecreasing real function defined on the unit interval and subscripts 1 and 2 refer to the two distributions, F_1 and F_2 . It is important to note that the function Γ acts as a weight function used to distort probabilities in the rank-dependent framework. The shape of Γ reflects whether the preference of the social evaluator is turned towards those people suffering deprivation over many dimensions or those suffering from at least one dimension.

Aaberge and Peluso (2012) then defined the social deprivation measure D_Γ :

$$D_\Gamma(F) = m - \sum_{j=0}^{m-1} \Gamma(F(j)). \quad (12)$$

It is easy to understand that $D_\Gamma(F)$ is equal to 0 if no one in the population has any deprivation. Then $F(j)=1 \quad \forall j=1,\dots,m-1$ so that $\sum_{j=0}^{m-1} \Gamma(F(j))=m$. If, on the contrary, everyone has the maximal number of deprivation, then $F(j)=0 \quad \forall j=1,\dots,m-1$ and $F(m)=1$ so that $D_\Gamma(F)$ is equal to m .

As demonstrated by Aaberge and Peluso (2012), $D_\Gamma(F)$ may be decomposed into the extent of and dispersion in multiple deprivations. In addition, $D_\Gamma(F)$ satisfies all the properties mentioned earlier except subgroup consistency. The fulfilment of the inequality axioms requires the shape of Γ to be convex. An extension of the approach of Aaberge and Peluso (2012) was proposed by Silber and Yalonetzky (2012).

Extension Proposed by Silber and Yalonetzky (2013)

Drawing on the same framework as Aaberge and Peluso (2012), Silber and Yalonetzky (2013) develop a social poverty function that can be manipulated to account for different methods of identification of the poor. Unlike Aaberge and Peluso (2012), Silber and Yalonetzky (2013) work with the concept of the “survival function” or the “decumulative distribution function”.⁶ More precisely, for a number of deprivations h , they consider $S(h) = \Pr(c_i \geq h)$. Then, they suggest the following social poverty function:

⁶ For more details, see Silber and Yalonetzky (2013).

$$P^{SY}(x, z) = \frac{1}{m-k+1} \sum_{h=k}^m \Gamma(S(h)), \tag{13}$$

where Γ is a non-negative, nondecreasing, real-valued function mapping from, and into, the real interval $[0,1]$ and taking the values $\Gamma(0)=0$ and $\Gamma(1)=1$. The first and second derivatives satisfy $\Gamma' > 0$ and $\Gamma'' \leq 0$.

The class of measures defined by (13) corresponds to a union approach to poverty whenever $k=1$. However, by manipulating the choice of k , it is possible to produce measures that identify the poor using the intersection or any other intermediate approach, as in the case of Alkire and Foster (2011).

For empirical purposes, this class of measures has to be adjusted for general weighting. Because the underlying aggregation procedure is concerned with the interrelationship between given population proportions and the weighted average of the corresponding number of deprivations, there is only one vector of possible values of deprivation scores for a particular choice of weights.

Suppose we have m dimensions whose weights are given by the vector $w = (w_1, \dots, w_m)$ with $\sum_{j=1}^m w_j = 1$. In this case, the maximum number of nonzero deprivation scores m' will be higher than the given number of dimensions m .

Suppose that deprivation scores are ranked by increasing order of deprivation and that we define $c = (c_0, c_1, \dots, c_h, \dots, c_{m'})$. We therefore let $c_h \in [0,1]$ with $h=0, 1, \dots, m'$ all possible values of deprivation scores. The case where $c_{m'} = 1$ denotes the deprivation score of an individual deprived in every dimension. It should be mentioned that the deprivation score c_h does not give a number of dimensions but a percentage of the overall dimensions in which the individual suffers from deprivation.

Hence, because the deprivation scores are ranked by increasing order, the cut-off value k means that we consider as multidimensional poor those individuals with deprivation scores at least equal to c_k . The identification and the counting of the poor are now based on $(m' - k + 1)$ values of all possible nonzero values of c .

In that case, the class P^{SY} can be expressed as follows:

$$P^{SY} = \frac{m'}{m' - k + 1} \sum_{h=k}^{m'} \omega_h \Gamma(S(h)) \tag{14}$$

where $\omega_h = c_h - c_{h-1}$ acts as a weight associated with Γ , which is a function of the proportion of individuals who have at least a deprivation score equal to c_h . If all dimensions are equally weighted, then $w_j = 1/m$ for all $j=1, \dots, m$. In this case, $m = m'$ and $c = (1/m, \dots, h/m, \dots, 1)$ with $c_h - c_{h-1} = 1/m$ for all h , it is easy to recover (13).

In addition, as for the Aaberge and Peluso (2012) measures, we can prove that the family of indices defined in (14) may be broken down into components reflecting the impact of the mean and dispersion of the distribution of deprivation counts.

Let μ be the mean of the deprivation counts which is defined by:

$$\mu = \sum_{h=1}^{m'} c_h q_h$$

where q_h is the proportion of individuals with a deprivation score equal to c_h . To supplement information provided by P^{SY} and μ , it is useful to introduce a measure of

$$\text{dispersion } \Delta_{\Gamma}(S) = \left[\sum_{h=1}^{m'} \left[\Gamma(S(h)) - \sum_{j=h}^{m'} q_j \right] \right].$$

We note that, in the case of the union approach, the mean of the distribution coincides with index Λ of Chakarvarty and D'Ambrosio (2006) and with the M_0 of Alkire and Foster (2011). By using (14), it is then possible to identify the contribution to P^{SY} of the average number of deprivations, μ , as well as of the dispersion of deprivations across the population.⁷

3. EMPIRICAL APPLICATION TO THREE ASIAN COUNTRIES

Despite of the fact that the multidimensional nature of poverty is now well-recognized in the academic community as well as in international development institutions, studies of poverty in these countries are still dominated by the absolute monetary approach. Thus, it is instructive to begin the analysis by providing comparative evidence on monetary poverty rates along with the economic performances captured by the GDP growth in the three countries under study. Table 1 relates income poverty reduction figures, as measured by the World Bank's \$1.25-a-day, and income growth performance within periods chosen as being as close as possible to those associated to the databases available to investigate trends in multidimensional poverty. The results show a wide variation in poverty reduction experience among the three countries. Over the first period, Indonesia emerges as the best performer because poverty decreases from 43.4% in 2006 to 29.3% in 2002 whereas the annual average growth rate was only 0.68% during that period.

Table 1: GDP Growth Rates and Poverty Changes for Three Asian Countries

Country	Period	GDP Growth in the Period	Poverty Rate \$1.25 Initial	% Poverty Change
Cambodia	1994–2004	109.5 (7.7)	44.5	–15.3 (–1.4)
	2004–2009	47.6 (8.1)	37.7	–50.7 (–8.5)
Indonesia	1996–2002	4.2 (0.7)	43.4	–32.5 (–4.8)
	2002–2008	38.3 (5.6)	29.3	–22.9 (–3.5)
Philippines	1997–2003	19.8 (3.1)	21.6	1.9 (0.3)
	2003–2009	32.2 (7.5)	22.0	–16.4 (–2.6)

N.B. Numbers in brackets refer to annual average growth (or reduction) rates.

Sources: Data on poverty and on GDP growth are from the World Bank (World Development Indicators) and from the ADB (ADB Key Indicators of Developing, Asian and Pacific Countries).

⁷ For more details regarding the decomposition of the extension of the approach of Aaberge and Peluso (2012) for any intermediate approach to the identification of the poor, see Bérénger (2015).

By contrast, the Philippines show an increase of poverty within the period 1997–2003 although the economy grew. Also, in Cambodia high performance in the GDP growth rate was accompanied by a slow reduction in monetary poverty during the period 1994–2004. However, over the second period, Cambodia experienced the strongest poverty reduction with economic growth whereas, in comparison, the increase of the GDP translates into more moderate declines of poverty in Indonesia and the Philippines.

However, at this stage, it is necessary to supplement the analysis of the trends in the well-being of the population in these countries taking a multidimensional approach to poverty. As we show in the following subsections, multidimensional poverty comparisons over time provide useful information to assess whether income growth translates into social gains.

3.1 Data Description

The use of Demographic and Health Surveys (DHS) initiated by the US Agency for International Development (USAID) offers an alternative instrument to the lack of available data to perform poverty analysis. This is also one of the main sources of data used by the UNDP (2010) for measuring the MPI in several countries. Although these surveys do not include data on income and expenditure, they contain significant information on the living conditions of the populations in Cambodia (2000, 2005, 2010), Indonesia (1997, 2003, 2007) and the Philippines (1997, 2003, 2008). In these databases, two main sources of information are available: a list of characteristics of the households and an individual questionnaire for women of reproductive age (15–49), which can be combined to extract dimensions of interest. Following the methodology used in the UNDP 2010 report, poverty estimates are performed along the same dimensions as the HDI, namely, education, health and standard of living, and are based on eight attributes available for each country and each year considered. The list of these indicators is presented in Table 2.

Table 2: List of Dimensions and Variables Used to Compute Poverty Measures

Dimension	Indicator	Cut-off	Relative Weight
Education	Child Enrollment	Any school-aged child (6–14) is not attending school	1/6
	Years of Schooling	No household member has completed 5 years of schooling	1/6
Health	Mortality	Any child has died in the household	1/3
Standard of Living	Water	Household does not have access to clean drinking water according to MDG guidelines	1/15
	Electricity	Household has no electricity	1/15
	Sanitation	Household's sanitation facility is not improved	1/15
	Floor Assets	Household has rudimentary floor Household does not own more than one of radio, TV, telephone, bike or motorbike and does not own a car	1/15

In addition, because one of our goals is to make poverty comparisons over time and across countries, poverty is estimated for three different years for each country: 2000, 2005 and 2010 for Cambodia; 1997, 2003 and 2007 for Indonesia; and 1997, 2003 and 2008 for the Philippines. Following the methodology of the 2010 UNDP report, a nested-weight structure is adopted where each of the three dimensions mentioned previously has the same weight and each indicator for a given dimension also has the same weight.⁸

3.2 Empirical Results based on the Methodology of Alkire and Foster (2011)

We begin this section by analysing the results obtained from the multidimensional poverty measures based on the methodology of Alkire and Foster (2011). Hence, poverty measures are calculated using different values of the cut-off k which corresponds to the minimum weighted sum of indicators in which a household should be deprived to be identified as poor.

Tables 3.1, 3.2 and 3.3 present the results obtained using the Alkire and Foster multidimensional poverty measures for different values of the cross-dimensional cut-off values of k for Cambodia, Indonesia and the Philippines, respectively. In particular, we consider the union approach and the intermediate approach using the threshold value of $k=33\%$ chosen in UNDP (2010) and the value of $k=50\%$ capturing households affected by severe poverty. As expected, poverty incidence (H) decreases with the dimensional cut-off value of k , indicating that higher poverty thresholds provide lower levels of poverty and the values of H are higher than the corresponding values of the adjusted headcount ratio (M_0) because poor individuals are rarely deprived in all dimensions.⁹

Comparisons across countries show that the incidence of multidimensional poverty is lower in the Philippines (13.8% in 2008) and Indonesia (18.9% in 2007) than in Cambodia where 33% of people are multidimensional poor in at least 33% of dimensions in 2010. This ranking remains the same over time for whatever the chosen value of k . As is evident from Figures 1, 2 and 3, the incidence of poverty (H) and the adjusted headcount ratios (M_0) become close to 0 with $k = 93\%$ for Cambodia in 2010; $k = 82\%$ for Indonesia in 2007; and $k=77\%$, for the Philippines in 2008. This suggests that, in Cambodia, and to a lesser extent in Indonesia, the dimensions of poverty seem to be more correlated than in the Philippines.

⁸ Because our main goal is to highlight empirically the contribution of methodological refinements of counting approaches to poverty measurement, the issue of sensitivity of poverty estimates to the choice of weighting schemes is not addressed here. Note that there is no consensus in the literature on weighting that should be used. For more details, see Decancq and Lugo (2013) who identify three types of methods to assign weights. Here, we adopt a normative approach assuming that each dimension is equally important in terms of well-being. The advantage is that weights remain constant and are thus relevant for comparisons over time and across countries.

⁹ Of course, the two measures are equal when adopting the intersection approach because poor individuals are then, by definition, systematically deprived with respect to all attributes.

Figure 1: Multidimensional Poverty Headcount Ratios in Cambodia

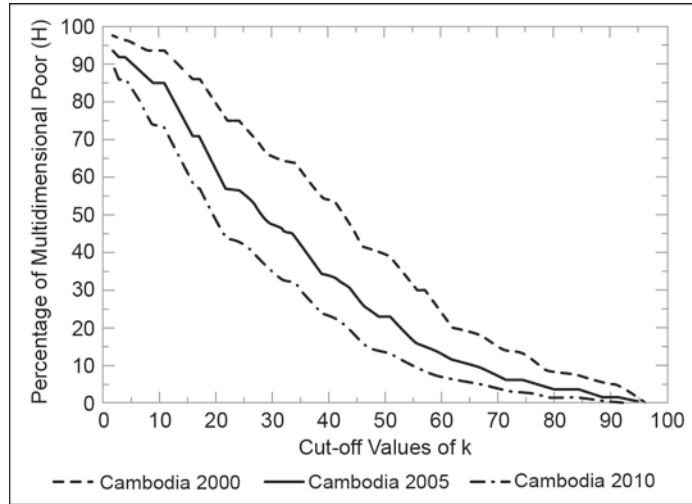


Figure 2: Multidimensional Poverty Headcount Ratios in Indonesia

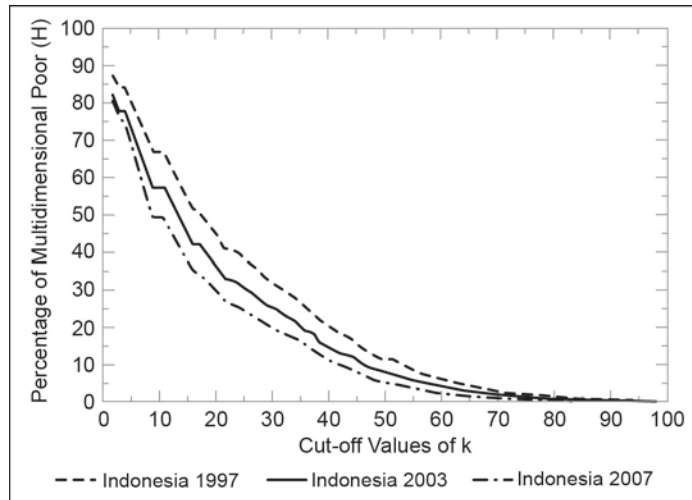
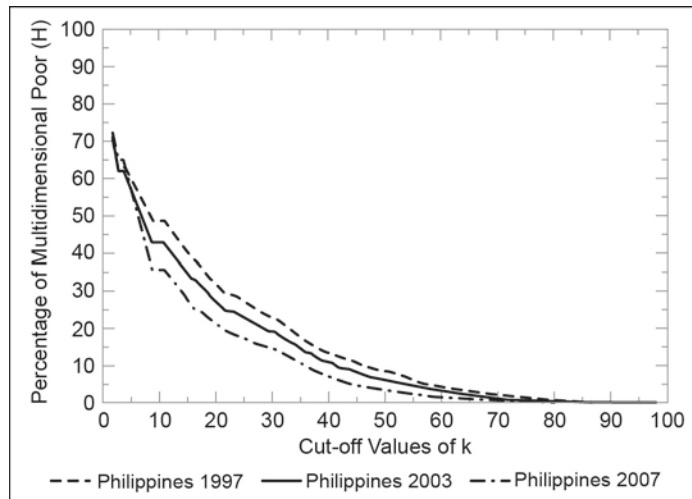


Figure 3: Multidimensional Poverty Headcount Ratios in the Philippines



All countries reduced their multidimensional poverty over time at the national level, irrespective of the approach adopted for the identification of the poor. In particular, taking $k=33\%$, the incidence of poverty decreased from 64.5% in 2000 to 33% in 2010 for Cambodia; from 30.0% in 1997 to 18.9% in 2007 for Indonesia; and from 22.0% in 1997 to 13.8% in 2008 for the Philippines. More interesting are the results obtained once the headcount ratio (H) is adjusted by the share of deprivations of the poor (A), which provides the adjusted headcount ratio, M_0 . In particular, declines in M_0 are larger in relative terms than those in H, in particular for lower values of k (Tables 3.1, 3.2. and 3.3). This is due to the fact that there are fewer deprived people but those who are deprived experienced fewer deprivations, on average. However, the proportional variation in each component of M_0 differs also according to the values of k . We observe that the contribution of the variation of H increases with k , implying a more significant contribution of the share of deprived dimensions to the variation of M_0 when moving to a more extensive identification approach.

Table 3.1: Multidimensional Poverty Measures Following the Alkire and Foster Approach: Cambodia

Cambodia	Headcount			M_0			A in %		
	2000	2005	2010	2000	2005	2010	2000	2005	2010
k=union									
National	0.966	0.917	0.858	0.434	0.326	0.252	44.9	35.5	29.4
Urban	0.801	0.631	0.449	0.279	0.193	0.091	34.8	30.6	20.2
Rural	0.997	0.967	0.947	0.463	0.349	0.287	46.4	36.1	30.3
Gap Ratio	1.245	1.532	2.107	1.660	1.804	3.164	1.3	1.2	1.5
k=33%									
National	0.645	0.456	0.330	0.371	0.243	0.165	57.6	53.3	50.1
Urban	0.401	0.272	0.118	0.219	0.139	0.052	54.4	51.2	44.2
Rural	0.690	0.488	0.375	0.399	0.261	0.190	57.9	53.5	50.5
Gap Ratio	1.718	1.794	3.171	1.827	1.875	3.623	1.064	1.045	1.1
k=50%									
National	0.397	0.230	0.136	0.270	0.152	0.087	68.1	65.9	64.0
Urban	0.220	0.122	0.031	0.146	0.081	0.020	66.5	66.4	63.7
Rural	0.429	0.249	0.158	0.293	0.164	0.101	68.2	65.9	64.0
Gap Ratio	1.953	2.035	5.117	2.004	2.018	5.141	1.026	0.992	1.005
	Variation in % of H		Annual Rate of Change of H		Variation in % of M_0		Annual Rate of Change of M_0		
	2000–05	2005–10	2000–05	2005–10	2000–05	2005–10	2000–05	2005–10	
k=union									
National	-5.1	-6.4	-1.0	-1.3	-25.0	-22.6	-5.6	-5.0	
Urban	-21.2	-28.8	-4.6	-6.6	-30.7	-53.1	-7.1	-14.0	
Rural	-3.009	-2.066	-0.609	-0.417	-24.6	-17.7	-5.5	-3.8	
k=33%									
National	-29.3	-27.7	-6.7	-6.3	-34.5	-32.0	-8.1	-7.4	
Urban	-32.23	-56.5	-7.5	-15.3	-36.2	-62.4	-8.6	-17.8	
Rural	-29.2	-23.1	-6.7	-5.1	-34.6	-27.4	-8.1	-6.2	
k=50%									
National	-41.9	-41.1	-10.3	-10.0	-43.8	-42.8	-10.9	-10.6	
Urban	-44.3	-74.7	-11.0	-24.0	-44.3	-75.8	-11.0	-24.7	
Rural	-41.9	-36.5	-10.3	-8.7	-43.9	-38.3	-10.9	-9.2	

Table 3.2: Multidimensional Poverty Measures Following the Alkire and Foster Approach: Indonesia

Indonesia	Headcount			M ₀			A in %		
	1997	2003	2007	1997	2003	2007	1997	2003	2007
k=union									
National	0.838	0.774	0.755	0.230	0.189	0.160	27.4	24.5	21.2
Urban	0.647	0.633	0.639	0.126	0.129	0.109	19.4	20.4	17.0
Rural	0.918	0.900	0.840	0.274	0.243	0.198	29.8	27.0	23.6
Gap Ratio	1.419	1.423	1.316	2.179	1.886	1.826	1.536	1.325	1.388
k=33%									
National	0.300	0.238	0.189	0.148	0.113	0.087	49.2	47.4	45.9
Urban	0.155	0.169	0.127	0.067	0.074	0.054	43.3	43.8	42.7
Rural	0.361	0.300	0.235	0.181	0.148	0.111	50.2	49.2	47.2
Gap Ratio	2.329	1.778	1.841	2.701	1.998	2.034	1.159	1.124	1.105
k=50%									
National	0.120	0.082	0.056	0.076	0.051	0.034	62.9	62.2	60.9
Urban	0.030	0.040	0.024	0.018	0.024	0.014	59.5	60.6	59.0
Rural	0.158	0.119	0.080	0.100	0.075	0.049	63.2	62.7	61.4
Gap Ratio	5.238	3.003	3.271	5.569	3.103	3.401	1.063	1.033	1.040
	Variation in % of H		Annual Rate of Change		Variation in % of M ₀		Annual Rate of Change		
	1997-03	2003-07	1997-03	2003-07	1997-03	2003-07	1997-03	2003-07	
k=union									
National	-7.6	-2.6	-1.3	-0.6	-17.6	-15.5	-3.2	-4.1	
Urban	-2.2	0.9	-0.4	0.2	2.8	-15.8	0.5	-4.2	
Rural	-1.9	-6.682	-0.3	-1.7	-11.1	-18.5	-1.9	-5.0	
k=33%									
National	-20.7	-20.6	-3.8	-5.6	-23.6	-23.1	-4.4	-6.4	
Urban	8.9	-24.5	1.4	-6.8	9.9	-26.3	1.6	-7.3	
Rural	-16.9	-21.8	-3.0	-6.0	-18.7	-25.0	-3.4	-6.9	
k=50%									
National	-32.0	-31.0	-6.2	-8.9	-32.8	-32.5	-6.4	-9.4	
Urban	31.6	-38.5	4.7	-11.4	34.3	-40.1	5.0	-12.0	
Rural	-24.5	-32.9	-4.6	-9.5	-25.2	-34.3	-4.7	-10.0	

Table 3.3: Multidimensional Poverty Measures Following the Alkire and Foster Approach: The Philippines

Philippines	Headcount			M ₀			A in %		
	1997	2003	2008	1997	2003	2008	1997	2003	2008
k=union									
National	0.629	0.617	0.650	0.166	0.145	0.120	26.4	23.5	18.5
Urban	0.481	0.507	0.632	0.101	0.093	0.091	21.1	18.3	14.3
Rural	0.776	0.735	0.668	0.231	0.201	0.150	29.7	27.4	22.5
Gap Ratio	1.613	1.450	1.057	2.276	2.177	1.660			

continued on next page

Table 3.3 continued

Philippines	Headcount			M_0			A in %		
	1997	2003	2008	1997	2003	2008	1997	2003	2008
k=33%									
National	0.220	0.181	0.138	0.106	0.085	0.061	48.0	47.2	44.1
Urban	0.140	0.112	0.096	0.059	0.047	0.040	42.5	42.2	41.5
Rural	0.300	0.254	0.181	0.152	0.126	0.082	50.6	49.6	45.5
Gap Ratio	2.148	2.271	1.874	2.557	2.671	2.057			
k=50%									
National	0.089	0.063	0.036	0.055	0.040	0.022	62.4	62.8	60.9
Urban	0.037	0.022	0.017	0.022	0.013	0.010	58.3	60.3	60.5
Rural	0.141	0.107	0.055	0.089	0.068	0.033	63.5	63.4	61.0
Gap Ratio	3.762	4.854	3.188	4.093	5.106	3.217	1.088	1.052	1.009
	Variation in % of H		Annual Rate of Change		Variation in % of M_0		Annual Rate of Change		
	1997-03	2003-08	1997-03	2003-08	1997-03	2003-08	1997-03	2003-08	
<i>k=union</i>									
National	-1.9	5.3	-0.3	1.0	-12.6	-17.0	-2.2	-3.7	
Urban	5.3	24.7	0.9	4.5	-8.8	-2.0	-1.5	-0.4	
Rural	-5.3	-9.1	-0.9	-1.9	-12.7	-25.3	-2.2	-5.7	
<i>k=33%</i>									
National	-18.0	-23.3	-3.3	-5.2	-19.4	-28.4	-3.5	-6.5	
Urban	-20.0	-13.8	-3.7	-2.9	-20.7	-15.3	-3.8	-3.3	
Rural	-15.5	-28.9	-2.8	-6.6	-17.1	-34.7	-3.1	-8.2	
<i>k=50%</i>									
National	-28.9	-43.4	-5.5	-10.8	-28.4	-45.1	-5.4	-11.3	
Urban	-40.89	-22.5	-8.4	-5.0	-39.0	-22.2	-7.9	-5.0	
Rural	-23.7	-49.1	-4.4	-12.6	-23.8	-51.0	-4.4	-13.3	

More interesting are the results obtained from the analysis of poverty trends over time for each country and by area of residence.

For the case of Cambodia, the reduction of poverty has been larger in relative terms between 2000 and 2005 than between 2005 and 2010, whatever the value of k . As is evident from Table 3.1, multidimensional poverty is higher in rural areas where most of the population lives (84.48%, 85.10% and 82.20% in 2000, 2005 and 2010, respectively) than in urban areas: the incidence of poverty (H) as well as the intensity of poverty (A) are higher among the poor living in rural areas than in urban areas for every year analysed, implying higher values of M_0 in rural areas. However, poverty decreased in both urban and rural areas over the whole period. More precisely, the alleviation of multidimensional poverty has been higher in urban than in rural areas over the first subperiod 2000–2005 despite of the fact that the poor in rural areas benefited from higher reduction in the intensity of poverty (A) than those living in urban areas, whatever the k values. For instance, we note that in 2005 the intensity of poverty is lower in rural than in urban areas when considering the most severely deprived ($k=50\%$). The rate of decrease has also been reinforced over the second subperiod 2005–2010 in urban areas due to the compounding effect of higher rates of decrease in the incidence of poverty, as well as in the share of deprived dimensions among the poor (A) than in rural area. Despite the fact that the magnitude of the rural/urban gap decreases significantly between 2000 and 2005, it increases or remains roughly stable between 2005 and 2010 depending on the values of k chosen. However, when

examining the ratio between rural and urban areas, the results show that the gap ratio for H and M_0 increased over the whole period and more significantly between 2005 and 2010 whatever the value of k . This implies that rural populations have benefited less from improvements in dimensions of well-being than urban populations. In addition, we note too that the rural/urban gap ratios exhibit higher values when moving to a more restrictive view of poverty.

Decomposition by region of residence provides interesting insights. Table 3.1.A.1 in the Appendix displays poverty estimates based on the Alkire and Foster's approach by region of residence. First, we note that the Plains and Tonle Sap regions concentrate the highest proportion of the population (roughly 70% over the whole period: 39.8% and 30.5% in 2010 in Plains and Tonle Sap, respectively) followed by Mountains (13%). In comparison, Phnom Penh and Coastal concentrates 9.3% and 7% of the whole population, respectively. Our results indicate that the Phnom Penh region registers the lowest levels of multidimensional poverty in comparison with the remaining regions where poverty incidence has values from 65.3% in Plains to 76.5% in Mountain for $k=33\%$. We also observe that all poverty measures (H and M_0) decrease over time for each region whatever the value of k . Plains region registers the fastest reduction in poverty over the first subperiod when adopting a restrictive view of poverty, but it is not the case according to the union approach. Indeed, in that case, it is Phnom Penh that exhibits the highest performance as the decrease of the adjusted headcount (M_0) is mainly due to the high value of the rate of decrease of H whereas the intensity of poverty (A) increases. Further, the intensity of poverty increases in Phnom Penh when emphasis is put on the severely poor ($k=50\%$). Over the second subperiod 2005–2010, population living in Phnom Penh benefited the most from social interventions than people living in other regions whatever the values of k . However, despite the fact that individuals cumulating simultaneously more than 50% of deprivations experienced the fastest improvements, they are also deprived in a higher number of dimensions than in 2005 and also than the poor living in the Plains and Coastal regions during the year 2010. The rates of decrease of poverty were roughly the same values for the other regions except for the Mountains region that records, after Phnom Penh, the highest decrease between 2005 and 2010 although this rate has been among the lowest ones over the first subperiod. However, the results show a slowdown of poverty decrease in the Plains region. By contrast, the Mountains region, where the population is worse off than in other regions, is experiencing a catch-up process because the decrease of poverty over the period 2005–2010 has been among the fastest ones.

Overall, the results provide evidence of a widening gap between urban and rural areas and also between Phnom Penh and the remaining regions. They reveal that the development process has been uneven regarding the areas and the regions of residence.

In Indonesia, poverty also declined at the national level over the two subperiods (Table 3.2.). However, this trend conceals a nonmonotonic evolution of poverty according to the areas of residence and the identification approach to the poor selected. Indeed, according to the union view of poverty, the incidence of poverty decreased in urban areas between 1997 and 2003 but the poor were poorer in 2003 than in 1997 because they suffered from a higher number of deprivations implying an increase of M_0 . In contrast, the second subperiod (2003–2007) registers a higher percentage of the poor, compensated by a higher decrease of the intensity of poverty (A). Similarly, the nonmonotonic evolution of poverty in urban areas is confirmed when moving to a more restrictive identification approach. The results indicate an increase of poverty between 1997 and 2003 followed by a decline over the second subperiod

2003–2007. In contrast, there are clear continued reductions in multidimensional poverty rates in rural areas where around 57% of the population lives in 2007. In addition, the estimates tend to show an acceleration of poverty reduction between 2003 and 2007 though being lower than the urban ones during the same period, except for the union approach. Therefore, as shown in Table 3.2, the magnitude of the gap between rural and urban poverty rates highlights a continued decrease over time irrespective of the dimensional cut-off chosen. However, the rural/urban gap ratio provides a somewhat different picture regarding the second subperiod. Although a clear decline of the disparities between rural and urban areas is observed between 1997 and 2003, largely due to the increase of urban poverty, the trends within the second subperiod seem to be highly dependent on the choice of the cut-off value of k . The slight decrease of the rural/urban gap ratio, according to the union approach, should be contrasted with the slightly widening gap between rural and urban areas that emerges from using $k=50%$ and $k=33%$. Analysis by region of residence shows that Java which concentrates about 60% of the population is better off in comparisons with other regions (see Table 3.2.A.1). By contrast, Bali, which only accounts for less than 6% of the whole population, has the highest rates of multidimensional poor. We note that the ranking of the other regions in terms of incidence of poverty is dependent on the values of k . The same is true when we attempt to identify the region that benefited the most from poverty reduction over the two subperiods. Indeed, following the union approach, the highest decline in the percentage of multidimensional poor (H) is found in Kalimantan over the first subperiod whereas Java followed by the Sulawesi region shows higher performance in adjusted headcount values (M_0) because the intensity of poverty declines at a faster rate especially in the Java region. However using a more restrictive view of poverty, it is the Java region that exhibits the fastest decline in poverty rates and Kalimantan the slowest over the first subperiod. In contrast, over the second subperiod, a catching-up process can be observed as Bali records the highest progress. Moreover, we point out the case of Sulawesi and Sumatera, which show very similar poverty rates in 1997, apart from the union approach, but their poverty trends over time are rather different. Indeed, Sumatera outperforms Sulawesi over the first period and witnesses an acceleration of the poverty decline over the second subperiod widening the gap with Sulawesi where the weakening of poverty decline is particularly evident according to $k=33%$.

Turning now to the case of the Philippines, a decline of poverty is observed at the national level over the two subperiods but this trend is more ambiguous when adopting an extensive view of poverty (see Table 3.3). Indeed, the percentage increase in the multidimensional poor between 2003 and 2008 is compensated by a higher decline of the share of deprivations among the poor. In addition, the second subperiod witnesses an acceleration of poverty reduction, except for the union view of poverty.

As for Cambodia and Indonesia, poverty remains a rural phenomenon where about 50% of the population lives. Remarkably, as for Indonesia, conclusions drawn from comparisons of percentage rates of change of poverty over the two subperiods between urban and rural areas are highly dependent on the identification approach adopted. The union approach shows that rural population benefited from a faster reduction of poverty than urban population over time, implying a decrease of the rural/urban gap, as shown in Table 3.3. This is largely driven by the increase of the poverty headcount ratio in urban areas although reductions in the intensity of poverty tend to be more in favour of the urban population. By contrast, conflicting trends may be observed when we move to more restrictive views of poverty. Hence, according to $k=33%$, it may be observed that urban population benefited more from social progress than rural population within the period 1997–2003 whereas the reverse is true over the second subperiod because the percentage rate of decline in rural areas is higher than

in urban areas. However, when emphasis is put on the more severely deprived ($k=50\%$), the results indicate inverted trends characterized by an increase, followed by a decline, of the rural/urban gap ratio over the two subperiods, respectively. Remarkably, it is important to mention that the intensity of poverty increases over time in urban areas counteracting the ameliorating effect of changes to the poverty headcount ratio.

Consequently, it is not easy to obtain conclusive results regarding changes in the rural/urban gap for the whole period under study. The same conclusion holds when we look at poverty changes over the period by region of residence (see Table 3.3.A.1). We see that the Luzon region where more than 56% of the population is living seems to be the least-deprived region, according to H and M_0 , whatever the identification approach adopted. In addition, whereas Mindanao was worse off than Visayas in 1997 (according to H and M_0) whatever the values of k , it registers the highest performance in poverty reduction between 1997 and 2003, explaining the very similar poverty rates between the two regions in 2003. However, this no longer holds over the second subperiod because Visayas exhibits higher percentage poverty changes than Mindanao, except for $k=50\%$. It is not easy to identify which region has benefited from the highest drop in poverty over the period 2003–2008 because the results differ according to the dimension cut-off value of k .

The previous discussion is largely based on poverty measures where an individual's contribution to aggregate poverty depends on his/her own achievement vector. As emphasized in Section 2, the implicit assumption underlying the Alkire and Foster approach is that the overall effect of multiple deprivations is summarized by the sum of their individual effects. Thus, these measures are completely insensitive to the distribution of a given set of deprivations.

3.3 Empirical Results from Poverty Measures Sensitive to Inequality

We now proceed to look at poverty measures that place a greater emphasize on the compounding effect of multiple deprivations and, thus, are sensitive to the impact of the spread of the deprivations across individuals.

Tables 4.1, 4.2 and 4.3 present for the three countries, respectively, the measures based on the family of Rippin's indices for values of $\gamma=1.5$ and $\gamma=2$. These tables also display poverty measures obtained from a subgroup of the Chakravarty and D'Ambrosio family of social exclusion indices ($\alpha=2$) and from the extension of the Aaberge and Peluso approach suggested by Silber and Yalonetzky. All of these measures take implicitly or explicitly a union approach to poverty. At first sight, these measures are not directly comparable with M_0 because they consider deprivation for the whole population and not just the poor (as is the case for $k \neq \min(w_1, \dots, w_m)$). Even in the case of the union approach, the comparison could be misleading because these measures involve the choice of an inequality aversion parameter. With higher values of the parameter measuring the degree of aversion to inequality, higher weights are assigned to larger deprivation scores. In that case, the concern of the social evaluator tends to be more in favour of the intersection approach. In particular, as mentioned in Section 2, it is easy to observe an equivalence between P^{CD} and P^{RI} for $\alpha = \gamma + 1$. Hence, looking at the Chakravarty and D'Ambrosio measures and the Rippin measures (see Tables 4.1 to 4.3), we see that poverty estimates decreases as α (γ) increases. These measures seem to be more related to those obtained when taking a more restrictive view of poverty, following Alkire and Foster. In contrast, the estimates

provided by extension of the Aaberge and Peluso approach are completely different and their range of variation is, to some extent, closer to the one obtained for M_0 using the union approach. It is also interesting to note that for the three countries the rural/urban gap ratio becomes more important with higher values of α or γ . This suggests that when more weight is assigned to the most deprived populations in rural areas they are more likely to suffer simultaneously from multiple disadvantages than those living in urban areas. In other words, deprivations are more related in rural than in urban areas for the most deprived.

For Cambodia, generally speaking, accounting for the dispersion of deprivation counts does not seem to change the overall picture obtained with the Alkire and Foster poverty measures. Poverty declines over the whole period but we observe that these poverty measures provide ambiguous conclusions regarding the trends in the rural/urban gap. Although the Ripplin measures indicate that poverty declines at a faster rate in rural than in urban areas between 2000 and 2005, implying a slight decrease of the rural/urban gap ratio, the reverse is true following the Chakravarty and D'Ambrosio measure and the extension of the Aaberge and Peluso measure. Also, as shown in Table 4.1.A, the trends observed by area of residence are consistent with those obtained when adopting a more restrictive identification approach to poverty, as for $k=33\%$ and $k=50\%$ in the case of the Alkire and Foster measures. Overall, accounting for the concentration of deprivation counts across individuals makes it possible to highlight the strong performance of Phnom Penh between 2005 and 2010 in comparison with the other regions. Similarly, the Mountains region that was the worse off over the first subperiod was playing a catching-up process over the second subperiod. Hence, its rates of poverty decline accelerated within 2005 and 2010 and accounted for about half the rate of Phnom Penh. The results also confirm the slowdown in the process of poverty reduction pointed out previously for the Plains region.

As for Indonesia, unlike the ambiguous conclusions derived from the Alkire and Foster measures regarding the trends in urban poverty, Table 4.2 emphasises a marked increase of urban poverty between 1997 and 2003, followed by a significant decline at a rate very close to that of the rural one over 2003–2007. In addition, it is interesting to note that with the exception of Java and Bali where the population is better-off and worse-off, respectively, poverty was very similar in the other regions in 1997. However, social progress has not favoured equally every region, confirming the trends underlined especially for the case of Kalimantan and Sulawesi, according to the Alkire and Foster measures (see Table 4.2.A)

Finally, as for the Philippines, Table 4.3 shows that poverty measures provide results that support findings drawn from the restrictive approach to poverty. Poverty decreases over the whole period and rural population have benefited more from social improvements than the urban population especially during the second subperiod (2003–2008). The results in Table 4.3.A are also consistent with the trends observed by region of residence over time derived from the Alkire and Foster measures, except for the union approach to the identification of the poor.

Table 4.1: Poverty Measures Sensitive to the Dispersion of Deprivations Across Individuals: Cambodia

Cambodia	Measures			Variation in %		Annual Rate of Change	
	2000	2005	2010	2000–05	2005–10	2000–05	2005–10
Rippin $\gamma=1.5$							
National	0.197	0.119	0.076	-39.5	-36.45	-9.6	-8.7
Urban	0.109	0.067	0.021	-39.1	-68.8	-9.4	-20.8
Rural	0.213	0.129	0.088	-39.7	-31.7	-9.6	-7.3
Gap Ratio	1.949	1.927	4.216				
Rippin $\gamma=2$							
National	0.162	0.093	0.056	-42.4	-39.6	-10.4	-9.6
Urban	0.087	0.052	0.015	-40.6	-71.8	-9.9	-22.3
Rural	0.176	0.100	0.065	-42.8	-35.0	-10.6	-8.3
Gap Ratio	2.010	1.936	4.456				
Chakravarty and D'Ambrosio for $\alpha=2$							
National	0.247	0.158	0.107	-35.9	-32.7	-8.5	-7.6
Urban	0.142	0.089	0.031	-37.0	-65.0	-8.8	-19.0
Rural	0.266	0.170	0.123	-36.0	-27.9	-8.5	-6.3
Gap Ratio	1.876	1.907	3.934				
Extension of Aaberge and Peluso							
National	0.572	0.454	0.366	-20.6	-19.3	-4.5	-4.2
Urban	0.419	0.312	0.158	-25.5	-49.4	-5.7	-12.7
Rural	0.593	0.472	0.398	-20.3	-15.7	-4.4	-3.4
Gap Ratio	1.413	1.512	2.518				

Table 4.2: Poverty Measures Sensitive to the Dispersion of Deprivations Across Individuals: Indonesia

Indonesia	Measures			Variation in %		Annual Rate of Change	
	1997	2003	2007	1997–03	2003–07	1997–03	2003–07
Rippin $\gamma=1.5$							
National	0.066	0.049	0.036	-26.4	-25.7	-5.0	-7.2
Urban	0.025	0.028	0.020	11.9	-29.2	1.9	-8.3
Rural	0.083	0.067	0.048	-19.6	-28.1	-3.6	-7.9
Gap Ratio	3.324	2.389	2.427				
Rippin $\gamma=2$							
National	0.049	0.035	0.025	-28.5	-28.0	-5.4	-7.9
Urban	0.017	0.019	0.013	15.5	-32.2	2.4	-9.2
Rural	0.062	0.049	0.034	-21.6	-30.3	-4.0	-8.6
Gap Ratio	3.742	2.539	2.610				
Chakravarty and D'Ambrosio for $\alpha=2$							
National	0.094	0.072	0.055	-24.0	-23.1	-4.5	-6.4
Urban	0.040	0.043	0.032	8.6	-25.9	1.4	-7.2
Rural	0.117	0.097	0.072	-17.3	-25.6	-3.1	-7.1
Gap Ratio	2.938	2.237	2.247				
Extension of Aaberge and Peluso							
National	0.341	0.290	0.249	-14.8	-14.2	-2.6	-3.7
Urban	0.203	0.210	0.177	3.5	-15.9	0.6	-4.2
Rural	0.387	0.349	0.295	-9.8	-15.5	-1.7	-4.1
Gap Ratio	1.904	1.660	1.668				

Table 4.3: Poverty Measures Sensitive to the Dispersion of Deprivations Across Individuals: The Philippines

Philippines	Measures			Variation in %		Annual Rate of Change	
	1997	2003	2008	1997–03	2003–08	1997–03	2003–08
Rippin $\gamma=1.5$							
National	0.046	0.037	0.024	-19.9	-34.3	-3.6	-8.0
Urban	0.022	0.018	0.015	-18.89	-17.0	-3.4	-3.7
Rural	0.071	0.058	0.034	-18.3	-40.9	-3.3	-10.0
<i>Gap Ratio</i>	3.279	3.300	2.349				
Rippin $\gamma=2$							
National	0.034	0.027	0.017	-21.1	-38.0	-3.9	-9.1
Urban	0.015	0.012	0.010	-20.2	-18.1	-3.7	-3.9
Rural	0.053	0.043	0.024	-19.4	-44.8	-3.5	-11.2
<i>Gap Ratio</i>	3.649	3.685	2.484				
Chakravarty and D'Ambrosio for $\alpha=2$							
National	0.066	0.054	0.038	-18.2	-29.9	-3.3	-6.9
Urban	0.034	0.028	0.024	-16.7	-14.7	-3.0	-3.1
Rural	0.099	0.082	0.052	-16.9	-36.5	-3.0	-8.7
<i>Gap Ratio</i>	2.934	2.927	2.178				
Extension of Aaberge and Peluso							
National	0.268	0.237	0.196	-11.6	-17.5	-2.0	-3.8
Urban	0.174	0.158	0.147	-9.3	-6.4	-1.6	-1.3
Rural	0.348	0.311	0.240	-10.6	-22.9	-1.8	-5.1
<i>Gap Ratio</i>	2.003	1.975	1.627				

3.4 Decompositions into the Mean and Dispersion of Deprivation Counts

One of the advantages of the measures based on Chakravarty and D'Ambrosio and those derived from the extension of the Aaberge and Peluso approach is that they allow decomposition into the mean and dispersion of the deprivation counts. Tables 5.1, 5.2 and 5.3 display the results of such decomposition for each country. We remind the reader that the Chakravarty and D'Ambrosio measure for $\alpha=2$ can be expressed by summing-up the square of the average deprivation score and the variance of deprivation scores. Similarly, the measure derived from the extension of the Aaberge and Peluso measure can also be defined as the sum of M_0 and a dispersion measure of the distribution of deprivation counts. This is the reason why the values obtained from the latter measure are of the same order of magnitude as those related to M_0 .

First, we may observe that there is a positive relationship between poverty levels and inequality in deprivations. However, the reverse is true because the inequality component is expressed as a percentage of the poverty measure. It is also interesting to observe that the dispersion in deprivation counts is higher in rural than in urban areas in Indonesia and in the Philippines over the whole period. We now proceed to analyse trends over time in the inequality components for each country to see whether the decomposition of the measure brings something new to our understanding of poverty.

Table 5.1: Decomposition of Poverty Measures with Regard to the Mean and Dispersion of the Deprivation Counts Distribution

Poverty Measures of Chakravarty and D'Ambrosio for $\alpha=2$					
Cambodia	2000	2005	2010	2000–05	2005–10
National	0.247	0.158	0.107	-35.9	-32.7
Urban	0.142	0.089	0.031	-37.0	-65.0
Rural	0.266	0.170	0.123	-36.0	-27.9
Phnom Penh	0.074	0.052	0.014	-29.4	-73.4
Plains	0.243	0.134	0.103	-44.7	-23.3
Tonle Sap	0.279	0.186	0.120	-33.4	-35.5
Coastal	0.259	0.170	0.110	-34.4	-35.3
Mountains	0.304	0.239	0.150	-21.5	-37.2
Indonesia	1997	2003	2007	1997–03	2003–07
National	0.094	0.072	0.055	-24.0	-23.1
Urban	0.040	0.043	0.032	8.6	-25.9
Rural	0.117	0.097	0.072	-17.3	-25.6
Sumatera	0.100	0.077	0.058	-23.0	-24.2
Java	0.085	0.062	0.047	-26.7	-24.2
Bali	0.146	0.122	0.081	-16.4	-33.9
Kalimantan	0.103	0.088	0.063	-14.6	-28.4
Sulawesi	0.102	0.081	0.075	-20.3	-7.5
Philippines	1997	2003	2008	1997–03	2003–08
National	0.066	0.054	0.038	-18.2	-29.9
Urban	0.034	0.028	0.024	-16.7	-14.7
Rural	0.099	0.082	0.052	-16.9	-36.5
Luzon	0.045	0.037	0.028	-18.3	-25.5
Visayas	0.086	0.075	0.048	-12.3	-35.8
Mindanao	0.101	0.078	0.056	-23.1	-28.6
Inequality Component					
Cambodia	2000	2005	2010	2000–05	2005–10
National	0.058	0.052	0.043	-2.5	-5.9
Urban	0.064	0.052	0.023	-8.6	-32.4
Rural	0.052	0.049	0.041	-1.2	-4.9
Phnom Penh	0.039	0.037	0.011	-2.5	-49.8
Plains	0.050	0.041	0.038	-3.8	-2.2
Tonle Sap	0.057	0.053	0.043	-1.3	-5.7
Coastal	0.057	0.049	0.039	-3.0	-5.8
Mountains	0.055	0.058	0.050	1.1	-3.7
Indonesia	1997	2003	2007	1997–03	2003–07
National	0.041	0.036	0.029	-6.0	-8.8
Urban	0.024	0.027	0.020	6.4	-14.7
Rural	0.042	0.038	0.033	-3.9	-5.0
Sumatera	0.044	0.038	0.031	-6.5	-9.0
Java	0.038	0.032	0.026	-8.1	-8.8
Bali	0.054	0.049	0.038	-3.3	-9.7
Kalimantan	0.038	0.041	0.032	3.2	-10.9
Sulawesi	0.041	0.041	0.036	-0.4	-6.2

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Table 5.1 *continued*

Philippines	Inequality Component				
	1997	2003	2008	1997–03	2003–08
National	0.039	0.033	0.024	-8.4	-17.8
Urban	0.023	0.020	0.016	-11.6	-13.5
Rural	0.046	0.042	0.030	-4.1	-14.8
Luzon	0.029	0.025	0.018	-10.2	-18.1
Visayas	0.043	0.040	0.027	-3.5	-17.1
Mindanao	0.048	0.041	0.030	-7.8	-13.0

Note: Columns 2000–05 and 2005–10 (1997–03, 2003–07; 1997–03, 2003–08) display changes of the components expressed as percentages of the value of the initial year of the period.

Table 5.2: Decomposition of Poverty Measures with Regard to the Mean and Dispersion of the Deprivation Counts Distribution

Cambodia	Measures Based on the Extension of Aaberge and Peluso				
	2000	2005	2010	2000–05	2005–10
National	0.572	0.454	0.366	-20.6	-19.3
Urban	0.419	0.312	0.158	-25.5	-49.4
Rural	0.593	0.472	0.398	-20.3	-15.7
Phnom Penh	0.291	0.211	0.090	-27.5	-57.5
Plains	0.566	0.418	0.363	-26.2	-13.2
Tonle Sap	0.607	0.494	0.392	-18.6	-20.6
Coastal	0.585	0.472	0.375	-19.3	-20.6
Mountains	0.632	0.562	0.440	-11.1	-21.6
Indonesia	1997	2003	2007	1997–03	2003–07
National	0.341	0.290	0.249	-14.8	-14.2
Urban	0.203	0.210	0.177	3.5	-15.9
Rural	0.387	0.349	0.295	-9.8	-15.5
Sumatera	0.352	0.303	0.258	-14.0	-14.8
Java	0.322	0.270	0.228	-16.2	-15.4
Bali	0.435	0.394	0.313	-9.4	-20.6
Kalimantan	0.360	0.324	0.270	-9.9	-16.7
Sulawesi	0.357	0.308	0.299	-13.7	-2.9
Philippines	1997	2003	2008	1997–03	2003–08
National	0.268	0.237	0.196	-11.6	-17.5
Urban	0.174	0.158	0.147	-9.3	-6.4
Rural	0.348	0.311	0.240	-10.6	-22.9
Luzon	0.210	0.185	0.160	-12.0	-13.8
Visayas	0.319	0.294	0.228	-7.7	-22.4
Mindanao	0.350	0.300	0.250	-14.2	-16.7

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Table 5.2 *continued*

Cambodia	Inequality Component of P^{SY}				
	2000	2005	2010	2000–05	2005–10
National	0.138	0.128	0.114	–1.6	–3.1
Urban	0.141	0.119	0.067	–5.2	–16.5
Rural	0.130	0.124	0.111	–1.0	–2.7
Phnom Penh	0.105	0.090	0.041	–5.4	–23.3
Plains	0.127	0.111	0.107	–2.7	–1.1
Tonle Sap	0.136	0.130	0.115	–0.96	–3.2
Coastal	0.136	0.125	0.109	–1.9	–3.3
Mountains	0.133	0.137	0.124	0.7	–2.40
Indonesia	1997	2003	2007	1997–03	2003–07
National	0.111	0.101	0.089	–3.0	–4.1
Urban	0.078	0.081	0.068	1.8	–6.2
Rural	0.113	0.106	0.097	–1.9	–2.6
Sumatera	0.115	0.104	0.092	–3.2	–4.2
Java	0.106	0.094	0.083	–3.7	–4.4
Bali	0.131	0.124	0.105	–1.7	–4.8
Kalimantan	0.105	0.108	0.090	0.9	–5.6
Sulawesi	0.112	0.109	0.102	–1.0	–2.0
Philippines	1997	2003	2008	1997–03	2003–08
National	0.102	0.092	0.075	–3.8	–7.1
Urban	0.072	0.065	0.057	–4.2	–5.2
Rural	0.117	0.110	0.089	–2.1	–6.6
Luzon	0.085	0.075	0.063	–4.6	–6.7
Visayas	0.112	0.107	0.084	–1.6	–7.7
Mindanao	0.120	0.107	0.091	–3.8	–5.3

Note: Columns 2000–05 and 2005–10(1997–03, 2003–07; 1997–03, 2003–08) display changes of the components expressed as percentages of the value of the initial year of the period.

Tables 5.1, 5.2 and 5.3 show that inequality decreases over time in the urban and rural areas. In particular, the contribution of the inequality component to the poverty reduction increases over time. The decrease in the dispersion in deprivations accounts about 50% and 34% of the rate of decrease of urban poverty between 2005 and 2010 according to the Chakravarty and D'Ambrosio (CDA) and the extension of Aaberge and Peluso (Ext. AP) measures, respectively. At the regional level, the decrease of poverty in Phnom Penh is largely driven by the inequality component (about 68% and 41% following CDA and Ext. AP) over the second-period. In addition, we see that the Mountain region registers an increase of inequality over the first period (2000–2005) that may explain the low rate of decrease of poverty reduction compared with other regions.

As for the case of Indonesia, the increase of urban poverty between 1997 and 2003 seems to be largely driven by an increase of the inequality component. It contributes to more than 74% (and 51% in Table 5.2) to the rate of poverty increase. By contrast, inequality decreases in rural areas but its contribution to the percentage variation of poverty slows down over the second subperiod. At the regional level, we see that Kalimantan exhibits a slight increase of the inequality component during the first period that hampers about 21% (about 33% in Table 5.2) of the reduction of poverty. By

contrast, in spite of the fact that Sulawesi registers very low performance in poverty reduction between 2003 and 2007, more than 80% (96% in Table 4.2) comes from the decline in the dispersion of deprivations. Finally, decrease of inequality goes hand in hand with poverty decrease over the whole period in the Philippines. In particular, it is in the Luzon region, which is better off in comparison with the other regions, that the contribution of inequality to the variation of poverty has been the highest.

3.5 Decompositions by Dimension

Finally, as mentioned in Section 2, a significant advantage of the Alkire and Foster family of measures is that once multidimensional poor have been identified, the aggregate poverty measure may be broken down into the sum of the contributions of the different dimensions. This provides interesting information that is particularly suitable for policy targeting. However, most of the measures that are sensitive to the breadth of the distribution of deprivation counts do not allow dimensional decomposability except the Rippin family of measures. Here, it is instructive to compare the results obtained with those based on the decomposition of the Alkire and Foster and the Rippin measures.

Tables 6.1, 6.2 and 6.3 report the percentage contributions of each of three dimensions¹⁰ to the overall poverty for the Alkire and Foster measure using the cut-off value of $k=33\%$ and for the Rippin measure with $\gamma=1.5$. The last columns of these tables also display deprivations by dimension. In addition, because the Alkire and Foster approach makes it possible to interpret the censored headcount ratios with respect to the percentage of people who are poor, Table 6.4 presents the intensity of poverty in each dimension among the poor.

In Table 6.1, 6.2 and 6.3 considering first the decomposition of the Alkire and Foster measure, we see that for every country the main contributor to overall poverty is deprivation in health dimension which refers to children mortality. Note that health contribution is particularly disproportionately high in comparison with the contributions of other dimensions in urban areas. We also find that the contribution of health dimension increases over time in all three countries, regardless of the area of residence. Indeed, the percentage change over time in health deprivation has been lower than changes in education and standard of living dimensions. As shown in Table 6.4, we also find that health registers an increase of deprivations among the poor in each country. By contrast, it is education that shows the highest progress at the national level and regardless of the area of residence, except for Indonesia between 1997 and 2003 in urban areas. It is observed that the increase of urban poverty in Indonesia between 1997 and 2003 was mainly due to an increase of deprivations in education and health dimensions.

Finally, turning to the Rippin decomposition that takes into account the dispersion in the distribution of deprivation counts, the results do not differ significantly. The contributions in indicators related to health and standard of living remain the highest contributors to overall poverty. However, some differences with the previous decomposition are worth mentioning. For Cambodia, results drawn from the Rippin approach indicate a slight decrease in the contribution of health deprivation over the period 2000–2005. This suggests that people experiencing cumulative deprivations benefited from higher progress in the health dimension in rural areas than is suggested by the Alkire and Foster measures. Although decompositions by areas of residence are

¹⁰ For an easier presentation, the contributions of the eight indicators of poverty have been grouped into three dimensions: education, health and standard of living.

not reported here, the lowest performance of the Mountains region between 2000 and 2005 is mainly due a disproportional increase in the health contribution. In Indonesia, deprivations increase in every dimension, albeit slightly in the standard of living in urban areas over the period 1997–2003 according to the decomposition drawn from the Rippin measures. As for Cambodia, the results suggest that progress has been higher in the health dimension than in the standard of living in rural areas between 1997 and 2003. This explains why the percentage changes of contribution of these dimensions have opposite signs in comparison with those obtained from the Alkire and Foster approach. Moreover, although the results are not reported, Sulawesi registers an increase in health deprivation over the period 2003–2007 which is only replicated by the Alkire and Foster decomposition of the intensity of poverty among the poor. Note that deprivations among the poor are also recorded in Sulawesi within the period 1997–2003 whereas the reverse is true according to the decomposition following the Rippin measures.

Table 6.1: Contribution of Each Dimension to Overall Poverty Following Alkire and Foster's Methodology with $k=33\%$ and Rippin Measure

Cambodia	Contributions in %			% Change in Contribution	
	2000	2005	2010	2000–05	2005–10
Alkire and Foster for $k=33\%$					
National					
Education	32.5	28.7	25.6	-11.7	-10.6
Mortality	28.2	34.2	36.1	21.5	5.7
Std of Living	39.4	37.1	38.2	-5.7	3.0
Urban					
Education	28.9	26.7	17.7	-7.6	-33.5
Mortality	37.2	41.9	60.3	12.8	43.8
Std of Living	33.9	31.4	21.9	-7.6	-30.1
Rural					
Education	32.8	28.8	26.1	-12.1	-9.6
Mortality	27.2	33.5	34.7	22.8	3.6
Std of Living	39.9	37.7	39.2	-5.6	4.1
Rippin ($\gamma=1.5$)					
National					
Education	31.6	28.4	25.3	-10.3	-10.6
Mortality	31.1	34.6	34.5	11.5	-0.4
Std of Living	37.3	37.0	40.2	-0.9	8.6
Urban					
Education	30.1	29.0	23.7	-3.7	-18.2
Mortality	35.0	37.9	47.5	8.1	25.6
Std of Living	34.9	33.2	28.7	-4.9	-13.4
Rural					
Education	31.8	28.3	25.4	-10.9	-10.3
Mortality	30.7	34.4	33.8	11.9	-1.5
Std of Living	37.5	37.3	40.8	-0.6	9.2

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Table 6.1 *continued*

Cambodia	Deprivations			% Change in Deprivation	
	2000	2005	2010	2000–05	2005–10
Alkire and Foster for k=33%					
National					
Education	36.2	20.9	12.7	-42.2	-39.3
Mortality	31.4	24.9	17.9	-20.5	-28.2
Std of Living	43.9	27.1	19.0	-38.2	-30.0
Urban					
Education	18.9	11.2	2.8	-41.1	-75.0
Mortality	24.4	17.5	9.5	-28.0	-46.0
Std of Living	22.3	13.1	3.4	-41.1	-73.7
Rural					
Education	39.3	22.6	14.8	-42.5	-34.4
Mortality	32.6	26.2	19.7	-19.6	-24.8
Std of Living	47.8	29.5	22.3	-38.3	-24.4
Rippin ($\gamma=1.5$)					
National					
Education	0.187	0.102	0.058	-45.7	-43.3
Mortality	0.184	0.124	0.079	-32.5	-36.7
Std of Living	0.221	0.132	0.091	-40.0	-30.9
Urban					
Education	0.099	0.058	0.015	-41.3	-74.5
Mortality	0.115	0.076	0.030	-34.1	-60.8
Std of Living	0.115	0.066	0.018	-42.1	-72.9
Rural					
Education	0.203	0.109	0.067	-46.3	-38.7
Mortality	0.196	0.132	0.089	-32.552	-32.7
Std of Living	0.240	0.144	0.107	-40.1	-25.4

Table 6.2: Contribution of Each Dimension to Overall Poverty Following Alkire and Foster Methodology with k=33% and Rippin Measure

Indonesia	Contributions in %			% Change in Contribution	
	1997	2003	2007	1997–03	2003–07
Alkire and Foster for k=33%					
National					
Education	22.2	20.7	17.7	-6.7	-14.7
Mortality	41.1	46.8	51.5	13.9	10.0
Std of Living	36.7	32.5	30.9	-11.5	-5.0
Urban					
Education	11.8	14.3	12.1	20.8	-15.2
Mortality	65.6	65.9	67.1	0.5	1.8
Std of Living	22.5	19.8	20.7	-12.3	4.9
Rural					
Education	23.8	23.6	19.7	-1.0	-16.5
Mortality	37.2	38.2	45.7	2.7	19.6
Std of Living	38.9	38.1	34.5	-2.0	-9.5

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Table 6.2 continued

Indonesia	Contributions in %			% Change in Contribution	
	1997	2003	2007	1997–03	2003–07
Rippin ($\gamma=1.5$)					
National					
Education	23.6	22.8	20.5	-3.4	-9.9
Mortality	37.1	39.7	41.8	7.0	5.3
Std of Living	39.3	37.5	37.6	-4.5	0.3
Urban					
Education	17.6	20.3	17.7	15.3	-12.6
Mortality	52.1	52.4	53.0	0.6	1.1
Std of Living	30.3	27.3	29.3	-9.9	7.2
Rural					
Education	24.3	23.7	21.4	-2.6	-9.8
Mortality	35.2	35.0	38.4	-0.7	9.9
Std of Living	40.4	41.302	40.175	2.2	-2.7
Deprivations					
Indonesia	1997	2003	2007	1997–03	2003–07
Alkire and Foster for k=33%					
National					
Education	9.8	7.0	4.6	-28.7	-34.4
Mortality	18.2	15.8	13.4	-12.9	-15.4
Std of Living	16.3	11.0	8.0	-32.4	-26.9
Urban					
Education	2.4	3.2	2.0	32.8	-37.5
Mortality	13.2	14.6	11.0	10.4	-25.0
Std of Living	4.5	4.4	3.4	-3.6	-22.7
Rural					
Education	13.0	10.5	6.5	-19.4	-37.4
Mortality	20.3	16.9	15.2	-16.5	-10.3
Std of Living	21.2	16.9	11.5	-20.2	-32.1
Rippin ($\gamma=1.5$)					
National					
Education	0.047	0.033	0.022	-28.9	-33.1
Mortality	0.074	0.058	0.045	-21.3	-21.8
Std of Living	0.078	0.055	0.041	-29.7	-25.5
Urban					
Education	0.013	0.017	0.011	29.0	-38.2
Mortality	0.039	0.044	0.032	12.5	-28.4
Std of Living	0.023	0.023	0.017	0.8	-24.1
Rural					
Education	0.061	0.048	0.031	-21.7	-35.2
Mortality	0.088	0.070	0.056	-20.2	-21.0
Std of Living	0.102	0.083	0.058	-17.8	-30.1

Table 6.3: Contribution of Each Dimension to Overall Poverty Following Alkire and Foster Methodology with $k=33\%$ and Rippin Measure

Philippines	Contributions in %			% Change in Contribution	
	1997	2003	2008	1997–03	2003–08
Alkire and Foster for $k=33\%$					
National					
Education	20.3	18.9	14.7	-7.1	-21.9
Mortality	49.3	50.1	58.9	1.6	17.5
Std of Living	30.4	31.0	26.4	2.1	-15.0
Urban					
Education	12.8	11.2	8.7	-12.4	-22.6
Mortality	69.6	67.9	73.7	-2.5	8.5
Std of Living	17.6	20.9	17.7	18.8	-15.6
Rural					
Education	23.3	22.0	17.7	-5.7	-19.4
Mortality	41.4	43.0	51.7	3.9	20.2
Std of Living	35.4	35.1	30.6	-0.9	-12.6
Rippin ($\gamma=1.5$)					
National					
Education	23.0	21.8	18.1	-5.2	-17.2
Mortality	41.6	41.0	45.9	-1.4	11.9
Std of Living	35.4	37.2	36.0	5.0	-3.1
Urban					
Education	19.6	17.5	15.1	-10.5	-13.5
Mortality	54.8	51.8	55.5	-5.6	7.2
Std of Living	25.6	30.7	29.3	20.0	-4.5
Rural					
Education	24.1	23.2	19.3	-3.6	-16.8
Mortality	37.5	37.5	41.8	-0.0	11.3
Std of Living	38.4	39.3	38.9	2.3	-0.9
Philippines	Deprivations			% Change in Deprivation	
	1997	2003	2008	1997–03	2003–08
Alkire and Foster for $k=33\%$					
National					
Education	6.4	4.8	2.7	-25.1	-44.1
Mortality	15.6	12.8	10.8	-18.1	-15.9
Std of Living	9.6	7.9	4.8	-17.7	-39.1
Urban					
Education	2.3	1.6	1.0	-30.5	-34.4
Mortality	12.4	9.6	8.8	-22.6	-8.0
Std of Living	3.1	3.0	2.1	-5.8	-28.5
Rural					
Education	10.6	8.3	4.4	-21.8	-47.4
Mortality	18.9	16.2	12.7	-13.9	-21.6
Std of Living	16.1	13.3	7.6	-17.9	-43.0

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Table 6.3 continued

Philippines	Deprivations			% Change in Deprivation	
	1997	2003	2008	1997–03	2003–08
Rippin ($\gamma=1.5$)					
National					
Education	0.032	0.024	0.013	-24.1	-45.5
Mortality	0.058	0.046	0.034	-21.0	-26.4
Std of Living	0.049	0.041	0.026	-15.8	-36.3
Urban					
Education	0.013	0.009	0.007	-27.4	-28.2
Mortality	0.036	0.027	0.024	-23.3	-11.1
Std of Living	0.017	0.016	0.013	-2.6	-20.7
Rural					
Education	0.051	0.040	0.020	-21.2	-50.8
Mortality	0.080	0.065	0.043	-18.3	-34.2
Std of Living	0.082	0.068	0.040	-16.4	-41.5

Table 6.4: Intensity of Poverty by Dimension Following Alkire and Foster Approach for $k=33\%$

Cambodia	% of MPI Poor-deprived			% Change	
	2000	2005	2010	2000–05	2005–10
National					
Education	56.1	45.8	38.5	-18.3	-16.0
Mortality	48.6	54.7	54.3	12.4	-0.6
Std of Living	68.0	59.4	57.5	-12.7	-3.2
Urban					
Education	47.2	41.0	23.5	-13.1	-42.6
Mortality	60.7	64.4	80.0	6.1	24.2
Std of Living	55.4	48.2	29.1	-13.1	-39.6
Rural					
Education	57.0	46.3	39.5	-18.8	-14.6
Mortality	47.3	53.7	52.6	13.5	-2.2
Std of Living	69.4	60.5	59.4	-12.8	-1.7

Indonesia	% of MPI Poor-deprived			% Change	
	1997	2003	2007	1997–03	2003–07
National					
Education	32.8	29.5	24.4	-10.1	-17.4
Mortality	60.6	66.5	70.9	9.7	6.6
Std of Living	54.2	46.2	42.5	-14.8	-8.0
Urban					
Education	15.4	18.8	15.5	22.0	-17.2
Mortality	85.3	86.559	86.025	1.457	-0.6
Std of Living	29.3	25.945	26.559	-11.412	2.4
Rural					
Education	35.9	34.9	27.9	-3.0	-19.9
Mortality	56.1	56.4	64.8	0.5	14.8
Std of Living	58.6	56.3	48.9	-4.0	-13.1

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Table 6.4 *continued*

Philippines	% of MPI Poor-deprived			% Change	
	1997	2003	2008	1997–03	2003–08
National					
Education	29.3	26.7	19.5	–8.7	–27.1
Mortality	71.1	71.0	77.9	–0.1	9.7
Std of Living	43.8	44.0	34.9	0.4	–20.6
Urban					
Education	16.3	14.148	10.8	–13.1	–23.9
Mortality	88.8	85.948	91.7	–3.3	6.7
Std of Living	22.5	26.485	22.0	17.8	–17.1
Rural					
Education	35.3	32.7	24.2	–7.552	–26.0
Mortality	62.8	64.0	70.5	1.877	10.3
Std of Living	53.7	52.2	41.8	–2.839	–19.8

4. CONCLUSION

Using the general framework proposed by Silber and Yalonetzky (2013), this paper compares poverty measures based on the approach of Alkire and Foster (2011) and used for the construction of the MPI by the UNDP with measures which are sensitive to the distribution of the distribution counts. Among such measures are those introduced by Chakravarty and D'Ambrosio (2006) and Rippin (2010) and those based on the extension of the approach of Aaberge and Peluso (2012) as suggested by Silber and Yalonetzky (2013).

Poverty was estimated using Demographic and Health Surveys in three Asian countries for three different years: for Cambodia in 2000, 2005 and 2010; for Indonesia in 1997, 2003 and 2007; and for the Philippines in 1997, 2003 and 2008.

Our findings indicate that Cambodia shows the highest level of poverty, followed by Indonesia and Philippines irrespective of the poverty measures used and the identification approach adopted for the Alkire and Foster measures. At the national level, all countries reduced their multidimensional poverty over time according to the poverty measures based on the Alkire and Foster approach and those that are sensitive to the concentration of deprivations across individuals. As in most of Asian developing countries, poverty is largely a rural phenomenon. However, when examining the evolution of poverty over time for each country, conclusions drawn from the use of the various poverty measures differ regarding trends in poverty over time, by area of residence, as well as by region of residence.

Broadly speaking, our results highlight that trends in poverty (especially in urban areas in the Philippines and Indonesia) could be highly dependent on the identification approach selected when adopting the Alkire and Foster approach. It is noteworthy that poverty measures sensitive to inequality in deprivations provided results consistent with those obtained using a restrictive approach to the identification of the poor. Moreover, this study provided an illustration of some attractive features of the various measures, namely the dimensional decomposability of the Alkire and Foster and the Rippin measures and the decomposition into the mean and dispersion of the deprivation counts of the Chakravarty and D'Ambrosio measures as well as the extension of the Aaberge and Peluso measures.

The conclusions obtained for each country are especially interesting, as outlined below. For Cambodia, multidimensional poverty declined over the two subperiods, 2000–2005 and 2005–2010, but at a faster rate over the first period whatever the poverty measures used. However, poverty reduction has been overly biased toward urban areas that registered an impressive acceleration of the rate of poverty decline between 2005 and 2010. Analysis by region of residence also made clear the growing tendency of an uneven spread of progress across the regions. Among the regions, it is the Phnom Penh region, initially the least deprived, that was the best performer. Although the Plains region (the least deprived after Phnom Penh in 2000) registered a significant decline of poverty between 2000 and 2005, a slowdown of poverty decrease was observed. By contrast, the Mountains region, where the population is worse off than in other regions, seems to be experiencing a catch-up process because the decrease of poverty over the period 2005–2010 has been among the fastest ones. Interestingly, the decrease of poverty in Phnom Penh seems to have been largely driven by a decline in the concentration of deprivations. By contrast, the Mountains region registered an increase of inequality over the first period that may explain the low rate of decrease of poverty reduction compared with other regions. In addition, decomposition by dimensions emphasised that percentage changes over time in health deprivation have been lower than changes in education and the standard of living dimensions. Finally, these results showed that progress in poverty alleviation has been faster in the most prosperous parts of the country. In addition, keeping in mind that the growth rates of GDP over the two periods, 2000–2005 and 2005–2010, were 56.25% and 38.24%, respectively, these findings may question the inclusiveness of the growth process.

As for Cambodia, poverty also declined in Indonesia at the national level over the two subperiods, 1997–2003 and 2003–2007, with an average annual decrease higher over the period 2003–2007 than over 1997–2003. Note that during the period 1997–2003, the annual average GDP growth rate was only 1.2% due to the impact of Asian financial crisis and the share of the urban population also increased. In particular, our results indicated a nonmonotonic evolution of poverty by areas of residence over time. Unlike the ambiguous conclusions derived from the Alkire and Foster measures, regarding the trends in urban poverty, poverty sensitive to the dispersion of deprivations emphasised a marked increase of urban poverty between 1997 and 2003, followed by a significant decline at a rate very close to that of the rural one over 2003–2007. In particular, decompositions of poverty measures by dimension showed that deprivations increased in every dimension, albeit slightly in the standard of living in urban areas over the period 1997–2003, according to the decomposition drawn from the Rippin measures. In addition, the increase of urban poverty between 1997 and 2003 seems to have been largely driven by an increase of the inequality component.

Thus whereas disparities between urban and rural areas weakened during 1997–2003, the trend is ambiguous between 2003 and 2007, even according to poverty measures sensitive to the dispersion of deprivation counts. In addition, with the exception of Java and Bali where the population was the better-off and the worse-off, respectively, poverty was very similar in the other regions in 1997. However, social progress has not favoured equally every region over the period. The Java region exhibited the fastest decline in poverty rates and Kalimantan the slowest one over the first subperiod. In contrast, over the second subperiod, a catching-up process was observed as Bali recorded the highest progress.

Being the least deprived in comparison with Cambodia and Indonesia, the Philippines registered the lowest rate of poverty decline over the first subperiod but exhibited a higher percentage rate of decline than Indonesia between 2003 and 2008. As for Indonesia, trends of poverty over time by areas of residence were dependent on the identification approach used. Nevertheless, the results revealed that when emphasis is put on the most deprived, disparities between urban and rural areas, albeit being relatively stable within the period 1997–2003, clearly exhibited a downward trend between 2003 and 2007. In addition, the reduction of poverty went hand-in-hand with a decrease in the concentration of deprivations. Note also that health dimension should be prioritized because its contribution remained disproportionately high and increased over time. These findings mitigate the conclusions drawn from those based on monetary measures that showed a lack of response of income poverty incidence to growth during the 2000s (Habito 2009; Balicasan 2011). Poverty incidence at \$1.25 had even increased between 2003 and 2006 when the economy grew.

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APPENDIX

Table 3.1.A.1: Multidimensional Poverty Measures Following the Alkire and Foster Approach: Cambodia by Region

Cambodia	Headcount			M0			A in %		
	2000	2005	2010	2000	2005	2010	2000	2005	2010
<i>k=union</i>									
Phnom Penh	0.711	0.436	0.296	0.186	0.121	0.049	26.2	27.8	16.6
Plains	0.993	0.962	0.911	0.440	0.306	0.256	44.3	31.9	28.1
Tonle Sap	0.988	0.957	0.916	0.471	0.364	0.278	47.7	38.0	30.3
Coastal	0.986	0.940	0.904	0.449	0.348	0.266	45.6	37.0	29.4
Mountains	0.994	0.981	0.937	0.499	0.424	0.317	50.2	43.3	33.8
<i>k=33%</i>									
Phnom Penh	0.250	0.199	0.064	0.119	0.093	0.025	47.8	46.6	39.1
Plains	0.653	0.409	0.325	0.370	0.208	0.160	56.6	50.9	49.2
Tonle Sap	0.700	0.519	0.369	0.414	0.283	0.186	59.1	54.6	50.4
Coastal	0.654	0.492	0.345	0.383	0.262	0.171	58.6	53.2	49.5
Mountains	0.765	0.617	0.430	0.453	0.355	0.228	59.1	57.6	53.0
<i>k=50%</i>									
Phnom Penh	0.092	0.068	0.008	0.057	0.043	0.005	61.4	63.9	64.9
Plains	0.393	0.182	0.124	0.264	0.116	0.078	67.1	63.8	62.6
Tonle Sap	0.450	0.278	0.154	0.310	0.185	0.099	69.0	66.7	64.5
Coastal	0.426	0.254	0.141	0.290	0.166	0.089	68.0	65.4	63.0
Mountains	0.484	0.374	0.213	0.337	0.257	0.141	69.7	68.7	66.1

Table 3.1.A.2: Percentage Changes in Multidimensional Poverty Measures Following the Alkire and Foster Approach: Cambodia by Region

Cambodia	Variation in % of H		Annual Rate of Change of H		Variation in % of M ₀		Annual Rate of Change of M ₀	
	2000–05	2005–10	2000–05	2005–10	2000–05	2005–10	2000–05	2005–10
<i>k=union</i>								
Phnom Penh	-38.7	-32.1	-9.3	-7.5	-34.7	-59.5	-8.2	-16.5
Plains	-3.2	-5.3	-0.6	-1.1	-30.3	-16.5	-7.0	-3.5
Tonle Sap	-3.1	-4.3	-0.6	-0.9	-22.8	-23.7	-5.0	-5.3
Coastal	-4.7	-3.9	-1.0	-0.8	-22.7	-23.5	-5.0	-5.2
Mountains	-1.3	-4.5	-0.3	-0.9	-14.9	-25.4	-3.2	-5.7
<i>k=33%</i>								
Phnom Penh	-20.3	-67.8	-4.4	-20.3	-22.3	-73.0	-4.9	-23.0
Plains	-37.4	-20.5	-8.9	-4.5	-43.7	-23.2	-10.8	-5.1
Tonle Sap	-25.9	-28.9	-5.8	-6.6	-31.5	-34.3	-7.3	-8.1
Coastal	-24.8	-29.9	-5.5	-6.9	-31.6	-34.9	-7.3	-8.2
Mountains	-19.4	-30.3	-4.2	-7.0	-21.5	-35.8	-4.7	-8.5
<i>k=50%</i>								
Phnom Penh	-26.4	-88.8	-6.0	-35.4	-23.4	-88.6	-5.2	-35.2
Plains	-53.7	-31.7	-14.3	-7.3	-56.0	-32.9	-15.2	-7.7
Tonle Sap	-38.2	-44.6	-9.2	-11.2	-40.3	-46.5	-9.8	-11.8
Coastal	-40.3	-44.6	-9.8	-11.1	-42.7	-46.6	-10.5	-11.8
Mountains	-22.7	-42.9	-5.0	-10.6	-23.9	-45.1	-5.3	-11.3

Table 3.2.A.1: Multidimensional Poverty Measures Following the Alkire and Foster Approach: Indonesia by Region

Indonesia	Headcount			M ₀			A in %		
	1997	2003	2007	1997	2003	2007	1997	2003	2007
<i>k=union</i>									
Sumatera	0.822	0.780	0.760	0.237	0.199	0.166	28.8	25.4	21.9
Java	0.825	0.764	0.737	0.216	0.175	0.146	26.1	23.0	19.8
Bali	0.872	0.842	0.813	0.303	0.270	0.208	34.8	32.1	25.6
Kalimantan	0.975	0.828	0.797	0.255	0.216	0.177	26.1	26.1	22.2
Sulawesi	0.857	0.751	0.792	0.245	0.200	0.197	28.6	26.6	24.8
<i>k=33%</i>									
Sumatera	0.313	0.249	0.201	0.157	0.121	0.093	50.1	48.5	46.3
Java	0.277	0.218	0.167	0.133	0.100	0.075	48.2	45.8	44.8
Bali	0.453	0.383	0.268	0.234	0.193	0.128	51.7	50.5	47.9
Kalimantan	0.317	0.261	0.197	0.159	0.132	0.094	50.3	50.6	47.7
Sulawesi	0.316	0.252	0.248	0.157	0.125	0.118	49.6	49.6	47.6
<i>k=50%</i>									
Sumatera	0.135	0.097	0.065	0.085	0.060	0.039	63.1	62.0	60.3
Java	0.103	0.062	0.042	0.064	0.038	0.025	62.4	61.5	60.8
Bali	0.221	0.177	0.102	0.143	0.113	0.062	64.5	63.7	61.4
Kalimantan	0.122	0.105	0.064	0.078	0.068	0.040	63.4	65.0	63.0
Sulawesi	0.131	0.113	0.094	0.083	0.070	0.057	63.3	62.2	61.0

Table 3.2.A.2: Percentage Changes in Multidimensional Poverty Measures Following the Alkire and Foster Approach: Indonesia by Region

Indonesia	Variation in % of H		Annual Rate of Change of H		Variation in % of M ₀		Annual Rate of Change of M ₀	
	1997-03	2003-07	1997-03	2003-07	1997-03	2003-07	1997-03	2003-07
<i>k=union</i>								
Sumatera	-5.1	-2.7	-0.9	-0.7	-16.1	-16.2	-2.9	-4.3
Java	-7.4	-3.6	-1.3	-0.9	-18.7	-16.9	-3.4	-4.5
Bali	-3.4	-3.4	-0.6	-0.9	-11.0	-23.0	-1.9	-6.3
Kalimantan	-15.1	-3.8	-2.7	-1.0	-15.2	-18.1	-2.7	-4.9
Sulawesi	-12.3	5.5	-2.2	1.3	-18.6	-1.4	-3.4	-0.3
<i>k=33%</i>								
Sumatera	-20.5	-19.4	-3.6	-5.2	-23.1	-23.0	-4.3	-6.3
Java	-21.3	-23.4	-3.9	-6.4	-25.4	-25.0	-4.8	-6.9
Bali	-15.6	-30.0	-2.8	-8.5	-17.5	-33.7	-3.2	-9.8
Kalimantan	-17.5	-24.4	-3.2	-6.8	-16.9	-28.8	-3.0	-8.1
Sulawesi	-20.1	-1.7	-3.7	-0.4	-20.1	-5.6	-3.7	-1.4
<i>k=50%</i>								
Sumatera	-28.1	-32.5	-5.3	-9.4	-29.3	-34.3	-5.6	-10.0
Java	-40.2	-32.2	-8.2	-9.3	-41.1	-33.0	-8.4	-9.5
Bali	-19.9	-42.7	-3.6	-13.0	-20.9	-44.7	-3.8	-13.8
Kalimantan	-13.9	-39.2	-2.5	-11.7	-11.7	-41.1	-2.0	-12.4
Sulawesi	-13.9	-16.8	-2.5	-4.5	-15.4	-18.3	-2.7	-4.9

Table 3.3.A.1: Multidimensional Poverty Measures Following the Alkire and Foster Approach: The Philippines by Region

Philippines	Headcount			M ₀			A in %		
	1997	2003	2008	1997	2003	2008	1997	2003	2008
<i>k=union</i>									
Luzon	0.535	0.543	0.603	0.126	0.110	0.097	23.5	20.2	16.0
Visayas	0.734	0.699	0.728	0.207	0.187	0.145	28.2	26.8	19.9
Mindanao	0.763	0.722	0.699	0.229	0.193	0.159	30.1	26.7	22.7
<i>k=33%</i>									
Luzon	0.167	0.134	0.108	0.075	0.060	0.045	44.8	44.5	42.0
Visayas	0.264	0.244	0.159	0.131	0.119	0.074	49.9	48.7	46.3
Mindanao	0.311	0.237	0.195	0.159	0.118	0.089	51.0	49.7	45.5
<i>k=50%</i>									
Luzon	0.053	0.036	0.022	0.032	0.022	0.013	60.7	62.0	60.5
Visayas	0.117	0.098	0.055	0.075	0.062	0.033	63.6	62.7	60.9
Mindanao	0.152	0.098	0.055	0.096	0.062	0.034	63.1	63.6	61.3

Table 3.3.A.2: Percentage Change in Multidimensional Poverty Measures Following the Alkire and Foster Approach: The Philippines by Region

Philippines	Variation in % of H		Annual Rate of Change of H		Variation in % of M ₀		Annual Rate of Change of M ₀	
	1997-03	2003-08	1997-03	2003-08	1997-03	2003-08	1997-03	2003-08
<i>k=union</i>								
Luzon	1.5	11.0	0.2	2.1	-12.5	-12.0	-2.2	-2.5
Visayas	-4.7	4.2	-0.8	0.8	-9.4	-22.8	-1.6	-5.0
Mindanao	-5.4	-3.2	-0.9	-0.6	-15.9	-17.8	-2.8	-3.8
<i>k=33%</i>								
Luzon	-19.9	-19.4	-3.6	-4.2	-20.5	-23.9	-3.7	-5.3
Visayas	-7.3	-34.8	-1.3	-8.2	-9.5	-38.1	-1.7	-9.1
Mindanao	-23.9	-17.4	-4.4	-3.8	-25.9	-24.3	-4.9	-5.4
<i>k=50%</i>								
Luzon	-31.9	-40.1	-6.2	-9.8	-30.4	-41.6	-5.9	-10.2
Visayas	-16.3	-44.2	-2.9	-11.0	-17.4	-45.8	-3.1	-11.5
Mindanao	-35.5	-44.1	-7.1	-11.0	-35.0	-46.1	-6.9	-11.6

**Table 4.1.A: Poverty Measures Sensitive to the Dispersion of Deprivations
Across Individuals: Cambodia by Region**

Cambodia	Measures			Variation in %		Annual Rate of Change	
	2000	2005	2010	2000–05	2005–10	2000–05	2005–10
Rippiny=1.5							
Phnom Penh	0.051	0.037	0.008	-27.0	-77.3	-6.1	-25.7
Plains	0.191	0.097	0.072	-49.5	-26.0	-12.8	-5.9
Tonle Sap	0.226	0.142	0.086	-36.9	-39.7	-8.8	-9.6
Coastal	0.208	0.128	0.077	-38.6	-39.5	-9.3	-9.5
Mountains	0.249	0.191	0.112	-23.6	-41.2	-5.2	-10.1
Rippiny=2							
Phnom Penh	0.037	0.028	0.005	-24.7	-80.2	-5.5	-27.7
Plains	0.155	0.072	0.052	-53.3	-28.4	-14.1	-6.5
Tonle Sap	0.188	0.113	0.064	-39.8	-43.3	-9.7	-10.7
Coastal	0.172	0.099	0.057	-42.1	-42.9	-10.4	-10.6
Mountains	0.210	0.157	0.087	-25.2	-44.4	-5.7	-11.1
Chakravarty and D'Ambrosio for $\alpha=2$							
Phnom Penh	0.074	0.052	0.014	-29.4	-73.4	-6.7	-23.3
Plains	0.243	0.134	0.103	-44.7	-23.4	-11.2	-5.2
Tonle Sap	0.279	0.186	0.120	-33.4	-35.5	-7.8	-8.4
Coastal	0.259	0.170	0.110	-34.4	-35.3	-8.1	-8.3
Mountains	0.304	0.239	0.150	-21.5	-37.2	-4.7	-8.9
Extension of Aaberge and Peluso							
Phnom Penh	0.291	0.211	0.090	-27.5	-57.5	-6.2	-15.7
Plains	0.566	0.418	0.363	-26.2	-13.2	-5.9	-2.8
Tonle Sap	0.607	0.494	0.392	-18.6	-20.6	-4.0	-4.5
Coastal	0.585	0.472	0.375	-19.3	-20.6	-4.2	-4.5
Mountains	0.632	0.562	0.440	-11.1	-21.6	-2.3	-4.8

**Table 4.2.A: Poverty Measures Sensitive to the Dispersion of Deprivations
Across Individuals: Indonesia by Region**

Indonesia	Measures			Variation in %		Annual Rate of Change	
	1997	2003	2007	1997–03	2003–07	1997–03	2003–07
Rippin $\gamma=1.5$							
Sumatera	0.071	0.053	0.039	-25.5	-27.2	-4.8	-7.6
Java	0.059	0.041	0.030	-29.9	-26.3	-5.7	-7.3
Bali	0.109	0.089	0.055	-18.3	-37.8	-3.3	-11.2
Kalimantan	0.072	0.062	0.042	-13.6	-32.6	-2.4	-9.4
Sulawesi	0.072	0.057	0.051	-20.6	-10.3	-3.8	-2.7
Rippin $\gamma=2$							
Sumatera	0.053	0.038	0.027	-27.7	-29.7	-5.3	-8.4
Java	0.042	0.029	0.021	-32.8	-28.0	-6.4	-7.9
Bali	0.084	0.068	0.040	-19.8	-41.1	-3.6	-12.4
Kalimantan	0.053	0.046	0.029	-12.1	-36.4	-2.1	-10.7
Sulawesi	0.053	0.042	0.036	-20.8	-13.0	-3.8	-3.4
Chakravarty and D'Ambrosio for $\alpha=2$							
Sumatera	0.100	0.077	0.058	-23.0	-24.2	-4.3	-6.7
Java	0.085	0.062	0.047	-26.7	-24.2	-5.0	-6.7
Bali	0.146	0.122	0.081	-16.4	-33.9	-2.9	-9.8
Kalimantan	0.103	0.088	0.063	-14.6	-28.4	-2.6	-8.0
Sulawesi	0.102	0.081	0.075	-20.3	-7.5	-3.7	-1.9
Extension of Aaberge and Peluso							
Sumatera	0.352	0.303	0.258	-14.0	-14.8	-2.5	-3.9
Java	0.322	0.270	0.228	-16.2	-15.4	-2.9	-4.1
Bali	0.435	0.394	0.313	-9.4	-20.6	-1.6	-5.6
Kalimantan	0.360	0.324	0.270	-9.9	-16.7	-1.7	-4.5
Sulawesi	0.357	0.308	0.299	-13.7	-2.9	-2.4	-0.7

**Table 4.3.A: Poverty Measures Sensitive to the Dispersion of Deprivations
Across Individuals: The Philippines by Region**

Philippines	Measures			Variation in %		Annual Rate of Change	
	1997	2003	2008	1997–03	2003–08	1997–03	2003–08
Rippin $\gamma=1.5$							
Luzon	0.030	0.024	0.017	-19.5	-29.9	-3.5	-6.9
Visayas	0.061	0.053	0.032	-13.8	-39.6	-2.4	-9.6
Mindanao	0.073	0.055	0.037	-25.4	-33.2	-4.8	-7.7
Rippin $\gamma=2$							
Luzon	0.021	0.017	0.011	-19.9	-33.7	-3.6	-7.9
Visayas	0.045	0.038	0.022	-15.2	-42.4	-2.7	-10.4
Mindanao	0.055	0.040	0.025	-27.1	-37.4	-5.1	-8.9
Chakravarty and D'Ambrosio for $\alpha=2$							
Luzon	0.045	0.037	0.028	-18.3	-25.5	-3.3	-5.7
Visayas	0.086	0.075	0.048	-12.3	-35.8	-2.2	-8.5
Mindanao	0.101	0.078	0.056	-23.1	-28.6	-4.3	-6.5
Extension of Aaberge and Peluso							
Luzon	0.210	0.185	0.160	-12.0	-13.8	-2.1	-2.9
Visayas	0.319	0.294	0.228	-7.7	-22.4	-1.3	-5.0
Mindanao	0.350	0.300	0.250	-14.2	-16.7	-2.5	-3.6