

## (RE)COUNTING THE POOR IN PERU: A MULTIDIMENSIONAL APPROACH\*

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Peruvian monetary poverty declined by 12 percentage points in only four years. Based on the Alkire-Foster multidimensional headcount, we build a simple comparative framework to measure the tension between this result and a broader indicator of deprivation. We select six dimensions and apply this framework to Peruvian data for 2004 and 2008. The results indicate that if we rely only on monetary standards, there is an increased risk of classifying as non-poor individuals who still suffer significant deprivation. Deprivations are similar across regions and are largely related to the lack of adequate water and sanitation services. This last result reveals an opportunity to focalize public investment efforts.

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### 1. INTRODUCTION AND MOTIVATION

Official poverty figures in Peru reveal a remarkable reduction of more than 12 percentage points in only four years, with the incidence of moderate (as opposed to extreme) poverty<sup>1</sup> falling from 48.6 percent in 2004 to 36.2 percent in 2008. While government officials have rushed to credit the achievements of social programs for this result, other observers, more skeptical about the effectiveness of social policy interventions, have highlighted the equally impressive economic expansion experienced between those years, in which per capita GDP grew at an average rate of 7.1%.

It is not difficult to anticipate a sharp decline in monetary poverty indices when the economy is booming. In fact, the poverty-to-growth elasticity of -0.44 percent implicit in the figures cited above is not

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1. Measured using a national monetary poverty line based on a basic consumption bundle.

abnormal by Peruvian standards, and the country has reached figures close to -0.60 percent in previous expansionary episodes (see Loayza and Polastri, 2004). As argued in Yamada and Castro (2007), however, these improvements will only be temporary if social policies have not delivered a minimum set of assets to guarantee higher and less volatile consumption paths at the household level<sup>2</sup>.

Confronted with this evidence, a natural question that arises is whether Peru's recent economic expansion has been accompanied by such a delivery of assets or if there are reasons to suspect that monetary poverty figures mask deprivation in other aspects that are critical for human development. Recent trends in other social indicators (for example, calorie intake<sup>3</sup>) and previous empirical analysis on this subject (Ruggeri, 1999; Alkire and Santos, 2010) warn against excessive optimism about the evolution of monetary poverty. In what follows, we intend to show how a multidimensional approach for poverty measurement can be of great assistance in attempting to provide a formal response to this debate.

Broad consensus now exists regarding the need to account for more than one dimension or attribute when seeking to obtain a proxy measure of a person's well-being and/or development capability. An immediate implication of this is that "poverty" (understood as the lack of this well-being or capability) is also better represented as a multidimensional phenomenon. Conceptual and empirical contributions toward this end can be found in the writings of several authors<sup>4</sup>.

As discussed in Battiston, *et al.* (2009), most research on poverty in Latin America and the Caribbean (LAC) has focused solely on the income or monetary dimension, despite the existence of extensive literature on multidimensional poverty measurement. While it is true that several countries in the region have adopted the Unsatisfied Basic Needs (UBN) approach for policymaking which considers several dimensions<sup>5</sup>, this approach fails to combine the information in a

2. As documented by these authors, the Peruvian economic recovery between 1991 and 1997 was accompanied by a significant reduction in the incidence of monetary poverty, from 54.2% to 46.4%. The mild recession from 1998 to 2001, however, wiped out these achievements and poverty was as high as 54.5% by the end of 2001.

3. According to Peru's *Instituto Nacional de Estadística* (INEI), the percentage of individuals living in households with a calorie intake below its specific requirement shifted from 28% to 31% between 2007 and 2008.

4. See, for example, Sen (1976), Chakravarty (1983), Atkinson (1987), and Foster, Greer and Thorbecke (1984). Kuklys (2005) provides a recent discussion on the theoretical and empirical implications of Sen's "capability approach". Duclos and Araar (2006) offer a complete survey of the different approaches to poverty measurement.

5. This approach uses information on dwelling conditions (non-precarious materials and non-crowded household; UBNs 1 and 2), access to sanitary services (UBN3), and the educational status of children and the household head (UBNs 4 and 5).

single index. Instead, it relies on separate indicators that measure the proportion of households unable to meet a certain number of needs.

Peru is not an exception in terms of the focus of research: Attempts to measure poverty using indicators other than the conventional monetary poverty line indicator are scarce. Monge and Ravina (2003) built a subjective measure based on the Subjective Poverty Line (SPL) method described in Kapteyn, *et al.*, (1985). The SPL method identifies the minimum income the head of household believes is needed for subsistence. If the actual income is less than this minimum, household members are identified as subjectively poor. Their results show significant differences (of up to 30 percentage points) with respect to the monetary headcount.

In a more recent study, Collantes and Escobedo (2007) analyzed the determinants of subjective economic welfare based on the Economic Ladder Questions (ELQ) included in the 2006 version of the Peruvian living-standards survey (*Encuesta Nacional de Hogares*, known as ENAHO). Based on their results, these authors concluded that political participation, education and health conditions have a significant effect on households' subjective welfare.

Specific studies proposing a multidimensional poverty measure for Peru are also scarce<sup>6</sup>. The analysis proposed in Ruggeri (1999) stands out as a pioneering contribution in this sense. It assessed the extent to which monetary poverty indicators provide a distorted picture of deprivation in Peru, with the latter understood in terms of Sen's "capability deprivation" (Sen, 1985).

To accomplish this, the author focused on a set of basic health and education achievements and relied on the information contained in the *Encuesta Nacional de Hogares Sobre Medición de Niveles de Vida* (National Standards of Living Survey, or ENNIV) for 1994. The analytical framework consisted of two blocks. The first one proposed measuring inconsistencies between poor and non-poor classifications based on a monetary indicator and deprived and non-deprived classifications based on the achievements considered. The second one was based on the estimation of a "capability production function" for each of these

6. Battiston, *et al.* (2009) only document studies for Uruguay, Brazil, Argentina and Bolivia. They develop a very comprehensive cross-country study but do not include Peru. The authors build several multidimensional poverty measures using comparable data from El Salvador, Brazil, Mexico, Chile, Uruguay and Argentina for the period 1992-2006. They find that the first four countries experienced significant reductions in multidimensional poverty regardless of the measure considered. Uruguay experienced only a small reduction while Argentina's estimates remained almost stagnant.

achievements. These “production functions” were estimated by means of limited dependant variable techniques and were used to explore the relationship between the achievement of a basic capability and household resources, after controlling for other household characteristics and access to publicly provided goods and services.

The author found that several determinants and mechanisms other than current monetary resources were in play when explaining capability deprivation. For example, parental education has proven to be an important deterrent of child stunting and a crucial determinant of children’s educational achievement. She also found significant differences between the incidence of monetary poverty and the incidence of deprivation in the achievements being analyzed, differences that depend on the geographical domain considered. Together, these results support the position that monetary poverty indicators do not sufficiently reflect capability deprivation.

More recently, Alkire and Santos (2010) built and analyzed the results of a multidimensional poverty index for 104 developing countries. Their index is based on the recent contributions of Alkire and Foster (see Alkire and Foster, 2008) to multidimensional poverty measures, and comprises 10 indicators corresponding to the same three dimensions as the Human Development Index: education, health and standard of living. Peru was among the countries studied and ranked 51st in the results. The greatest deprivations consisted of dwelling conditions such as appropriate sanitation, cooking fuel and flooring material.

The study found that people identified as poor by the multidimensional index were not necessarily the same as those identified as poor by international income poverty criteria. According to the authors, this supports the need for an internationally comparable multidimensional poverty index to complement income poverty measures. Another important conclusion is that developing countries in higher stages of development need a variant of their multidimensional poverty index, including different indicators and/or cut-off values, in order to reveal the specific types of deprivations experienced. According to the authors, Peru is among these countries.

Our analysis focuses on Peru and is motivated by three distinct (but related) issues. The first has to do with skepticism surrounding the recent decline in official Peruvian poverty figures. We revisit the potential tension between the incidence of monetary poverty and the incidence of a broader definition of deprivation during a period of

particular significance for monetary poverty reduction in Peru. The second is the availability of information from an extremely rich living-standards survey and the fact that, despite this, multidimensional poverty measurement is still a relatively unexplored topic in the country. The third is the recent work by Alkire and Foster (2008) on multidimensional poverty measures, which provides a simple yet insightful approach to identifying the poor. We believe this methodology not only provides a formal framework to address our concerns regarding the recent evolution of monetary poverty, but can also become a useful tool for social policy design.

The rest of the document is organized as follows. In Section 2, we describe the Alkire-Foster identification approach and briefly discuss its properties and contributions to a multidimensional view of poverty measurement. We also develop a simple framework for comparing the monetary poverty line measure to the proposed multidimensional headcount. Addressing the controversy motivating this paper, we seek to evaluate the extent to which the poverty line indicator tends to overstate or understate the overall level of deprivation in terms of the dimensions considered for the multidimensional measure. In Section 3, we select dimensions, indicators and their respective cut-off values for the Peruvian case. Using this, we build the multidimensional headcount indicator and apply the comparison framework described in Section 2 using data for 2004 and 2008. We further make inter- and intraregional comparisons between the monetary and multidimensional headcounts, and assess deprivations among the multidimensional poor in order to illustrate how this approach can aid policy design. Finally, in Section 4 we summarize our main findings and suggest some avenues for further research.

## 2. THE MULTIDIMENSIONAL VIEW

### 2.1 The Alkire-Foster dual cut-off method of identification

As discussed in Alkire and Foster (2008), poverty measurement relies on two distinct steps: identification and aggregation. The first has to do with determining “who is poor,” while the latter focuses on determining “how many are poor” and “how poor are the poor.” The abovementioned authors focus on the issue of identification and devise what they call a “dual cut-off” method.

As suggested by its name, this method consists of two steps: (i) given a population of  $n$  individuals, a set of  $d$  dimensions, and a cut-off value for each dimension ( $z_j$ ;  $j = 1, \dots, d$ ), identify those dimensions in which each individual is deprived; and (ii) count the number of deprivations for each individual and identify as “poor” those whose number of deprivations equals or exceeds a specific cut-off value ( $k$ ). With this, the authors propose a class of identifying functions where the “intersection approach” (which requires deprivation in all dimensions to classify an individual as poor;  $k = d$ ) and the “union approach” (which requires deprivation in any single dimension to classify someone as poor;  $k = 1$ ) are special cases.

At the aggregation stage, the authors propose a family of poverty measures associated with those of the FGT class developed by Foster, Greer and Thorbecke (1984). Their benchmark measure, thus, is a headcount ratio ( $H = q/n$ ), where  $q$  refers to the number of poor identified using the dual cut-off method. Our study will focus on this particular methodology and especially on the implications of using the identification function proposed by Alkire and Foster.

As discussed by the authors, their dual cut-off approach has several desirable properties. It is both “poverty focused” and “deprivation focused”. This first property is also shared by unidimensional methods (such as the monetary poverty line) and implies that the result provided by the identification function does not vary if a non-poor person increases an achievement. The second property, however, successfully distinguishes the dual cut-off approach from identification using a unidimensional view. It implies that increases in non-deprived dimensions do not change a poverty status and this, as will be discussed later, can have important implications for social policy design<sup>7</sup>. Another important property for social policy evaluation (not shared by methods such as the monetary poverty line) is that it enables the combining of cardinal and ordinal data. The possibility of working with ordinal data is important since the delivery of social services is usually accounted for dichotomically.

7. Alkire and Foster (2008) consider a broad array of properties when discussing their poverty measures. These poverty measures include generalizations that provide information about the breadth of deprivation. The simplest is given by the product of the headcount ratio ( $H$ ) and the average share of deprivations experienced by the poor:  $A = (1/qd)\sum_i c_i(k)$ , where  $c_i(k)$  is the number of dimensions in which a poor person  $i$  is deprived. An important property satisfied by this indicator ( $M_0 = HA$ ) is dimensional monotonicity, which implies that the indicator is sensitive to the degree of deprivation of the poor (that is, it will fall if a deprivation is eliminated from someone poor). Since our analysis will be based on the headcount ratio, we will not discuss all the properties considered by Alkire and Foster when analyzing their entire family of poverty measures. Instead, we focus on those satisfied by their “dual cut-off” identification function.

It is worth mentioning that the latter two properties discussed above depend, crucially, on the fact that *identification* occurs before *aggregation*. If we are working with several dimensions, this statement might seem strange: How can we determine who is poor before aggregating across dimensions? In fact, Alkire and Foster do not propose this; rather, they propose to start by *identifying deprivations* and then aggregating to *identify the poor*. The distinction between the concepts of “deprived” and “poor” is critical and lies at the core of their dual cut-off method.

The above suggests that the distinction between a unidimensional and a multidimensional view of poverty does not only rely on the number of dimensions considered, but must also factor in the timing of the aggregation stage. For instance, one could argue that most monetary poverty lines are multidimensional indicators in the sense that they consider a bundle of goods. However, it is clear that in all these cases aggregation at the individual level occurs before any meaningful process of identification: only after an aggregate measure of consumption is obtained, identification of the poor occurs based on a predetermined cut-off value. Under the multidimensional view proposed by Alkire and Foster, on the other hand, aggregation at the individual level occurs after the identification of deprivations. This ensures that a person’s poverty status will not be affected by changes in the levels of non-deprived achievements (Alkire and Foster, 2008).

## 2.2 Monetary poverty and multidimensional headcounts: a simple framework for comparison

In this section we develop a simple framework to compare the results obtained for the multidimensional headcount ratio ( $H$ ) against the conventional monetary poverty measure ( $PL$ ). In particular, we are interested in determining to what extent the  $PL$  indicator provides sufficient evidence regarding the level of deprivation (in terms of the dimensions considered for the multidimensional measure) or if it presents a potential bias in some particular direction.

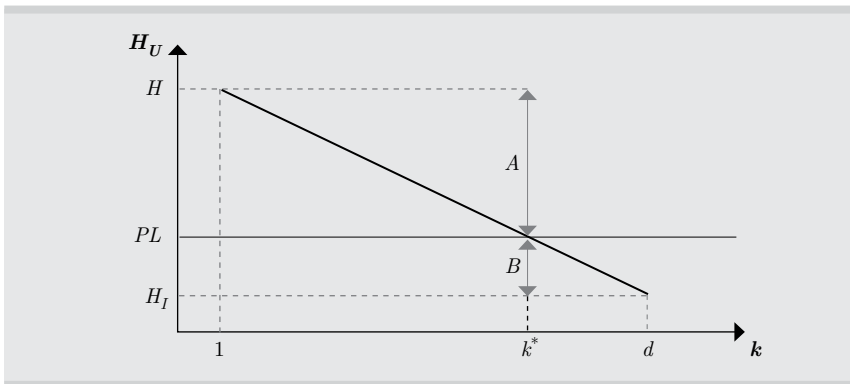
In doing so, we start with the fact that the dimensions have been chosen through consideration of a set of attributes or assets that play an important role in human development, that we lack prior information or specific criteria to regard any one of them as more important than the others, and that they share some (but not a perfect) degree of complementarity. This implies that, in principle, we would prefer to discard extreme approaches when deciding what extent of

deprivation is required to classify an individual as “poor”. In other words, and since no single asset can be unequivocally understood as either essential or substitutable, we prefer to avoid the “intersection” and “union” approaches.

Given the above, our comparison of the  $H$  and  $PL$  indicators and our assessment of the potential biases of the latter will be based on determining the extent to which the  $PL$  measure resembles any of these extreme approaches.

Let us start by analyzing the behavior of  $H$  with respect to  $k$ . In principle, one can expect that the larger the cut-off value, the smaller the value of  $H$ . In fact, increasing the value of  $k$  implies moving towards an “intersection approach”. As it becomes more difficult to find individuals who are deprived in more dimensions, the poverty count should fall as  $k$  gets larger. On the other hand, moving towards  $k = 1$  implies moving towards a “union approach”. Finding someone deprived of at least one dimension is easier and, thus, the poverty count should rise.

Figure 1. Multidimensional vs. monetary poverty headcounts



The absolute value of the slope of the  $H(k)$  function will depend on the way in which the dimensions are distributed among the population. For example, in the extreme case in which access to one of the dimensions implies access to all of them (conversely, if deprivation of any single dimension implies deprivation of all of them), the  $H(k)$  function will be flat. In this scenario, the use of a multidimensional indicator to measure deprivation will be of little relevance. In a more general setting, however, one can expect function  $H(k)$  to exhibit a



negative slope or, in terms of what is depicted in Figure 1, that the multidimensional poverty incidence for  $k = 1$  will be larger than its counterpart under  $k = d$  ( $H_U > H_I$ ).

If we want to compare  $H$  and  $PL$  indicators, we need to start by asking ourselves whether the latter is an element of the former. If this is true, it implies that there exists a value for  $k$  between 1 and  $d$  at which both indicators will intersect. To see this, notice that when  $k = 1$ , all of those deprived in the monetary dimension (and, thus, poor under the  $PL$  measure) are also poor under a multidimensional perspective ( $H_U \geq PL$ ). Conversely, when  $k = d$ , all of those classified as poor according to the  $H$  measure are also deprived in the monetary dimension ( $PL \geq H_I$ ).

With this in mind, the value of  $k$  where our  $H$  indicator and the conventional  $PL$  indicator intersect ( $k^*$ ) can be informative of the potential tension between identification as “poor” according to the  $PL$  indicator and the overall level of deprivation in the dimensions considered. For example, let us assume the extreme case in which  $k^* = d$ . This implies that the  $PL$  measure is consistent with an “intersection” approach ( $PL = H_I$ ) and suggests that this measure tends to underestimate the level of deprivation: the percentage of poor for a given monetary poverty line can only be replicated if we assume that to be poor under a multidimensional perspective you have to be deprived of all possible dimensions. To the extent to which the dimensions selected comply with the characteristics discussed above, it can be argued that it is not necessary to wait until a person is deprived of all of them to consider them “poor”.

At the other end of the spectrum, a similar reasoning can be applied to support the fact that the  $PL$  measure tends to overstate the level of deprivation if  $k^* = 1$ . In this scenario, the  $PL$  indicator is consistent with deprivation in one or more dimensions ( $H_U = PL$ ) and this means that measuring poverty using only the monetary dimension is equivalent to identifying as poor even those who have access to the majority of assets considered.

As already discussed, the slope of the  $H(k)$  function is informative of the relevance of considering several dimensions for poverty measurement: A flat slope will indicate that introducing an additional dimension contributes little information to the analysis. This should be factored in when comparing the  $H$  and  $PL$  indicators. Consider, for example, a situation where  $k^*$  is very close to  $d$  and the slope of the  $H(k)$  function

is close to zero. According to the discussion above, the first piece of information will suggest that the  $PL$  indicator tends to understate the degree of deprivation. If we consider that  $H(k)$  is almost flat, however, we will need to reconsider this statement since little poverty increase is observed if we move towards  $k = 1$ . In other words, we cannot say that the  $PL$  measure is not sufficient to reflect the level of deprivation in terms of the dimensions considered if  $PL$  is among these dimensions and adding more of them does not change our poverty measure.

Considering the above, we propose comparing the differences  $(H_U - PL)$  and  $(PL - H_I)$  to account for the potential tension between the incidence of monetary poverty and the overall level of deprivation of the dimensions considered. In terms of Figure 1, this implies evaluating distances  $A$  and  $B$ . In fact,  $A = (H_U - PL)$  and measures the proportion of individuals deprived in one or more dimensions but not deprived in monetary terms. On the other hand,  $B = (PL - H_I)$  and measures the proportion of individuals deprived in the monetary dimension but not deprived in all of them. As such, both measures refer to the group of individuals deprived in 1 to  $d - 1$  dimensions, divided between those who exceed the monetary poverty line (considered within  $A$ ) and those who do not (considered within  $B$ ) (please refer to Appendix A for a detailed description of the sets involved).

In Figure 1 it is easy to see how (for a given slope) the larger the difference between distances  $A$  and  $B$ , the closer  $k^*$  will be to  $d$ . In terms of the prior discussion, this implies that the  $PL$  indicator tends to understate the level of deprivation. If we now refer to the sets described in the previous paragraph, a large positive difference between  $A$  and  $B$  implies that the majority of individuals deprived in 1 to  $d - 1$  dimensions are able to surpass the monetary poverty line. Consequently, classifying as poor only those who do not surpass it (that is, using the  $PL$  indicator to measure poverty) implies leaving out a considerable proportion of these individuals and introducing a potential downward bias in our poverty assessment.

At the other end of the spectrum, as  $k^*$  moves closer to 1,  $B$  will eventually surpass  $A$ , revealing an increasing risk of introducing an upward bias in our poverty assessment if it is solely based on the incidence of monetary poverty. Since the majority of individuals deprived in 1 to  $d - 1$  dimensions are not able to surpass the monetary poverty line, using this measure to identify the poor will imply classifying as such a large proportion of these individuals, including those who have access to many of the assets considered.

Because the population included in the numerators of  $A$  and  $B$  refers to the group of individuals deprived in 1 to  $d - 1$  dimensions, we can devise a simple relative measure to determine how this group is divided between those who surpass and those who do not surpass the monetary poverty line. Let us define as  $\%A$  the proportion of individuals deprived in 1 to  $d - 1$  dimensions who can be classified as non-poor in monetary terms, and as  $\%B$  the proportion of those who do not exceed the monetary poverty line. These relative measures can be easily computed using:

$$\%A = A \left[ \frac{1}{H(1, d - 1)} \right]; \%B = B \left[ \frac{1}{H(1, d - 1)} \right] \quad (1)$$

where  $H(1, d - 1) = H(1) - H(d)$  refers to the proportion of individuals (with respect to the total population) who are deprived in 1 to  $d - 1$  dimensions. Following our discussion above, if we rely on the  $PL$  indicator for poverty measurement, the risk of classifying as non-poor individuals who still endure considerable deprivation will increase as the value of  $\%A$  increases (or the value of  $\%B$  decreases). The opposite situation will occur as  $\%B$  moves towards 1.

None of these situations is desirable in terms of policy design. As  $\%A$  moves towards 1, the  $PL$  indicator “loses power” to reject the status of “non-poor”: While we can be sure that those classified as poor are in need, we cannot say that those deemed non-poor no longer suffer considerable deprivation. This can lead to under-coverage problems if social programs are targeted using the  $PL$  measure. On the other hand, leakage problems will arise as  $\%B$  moves towards 1 and the  $PL$  indicator is still used as the prime targeting tool. Under these circumstances, the  $PL$  indicator “loses power” to reject the status of “poor”: those classified as non-poor surely possess significant assets but we cannot be sure that those classified as poor do not.

Before applying this framework and discussing our results for the Peruvian case, it is important to stress that this is not intended as a tool to determine if the  $PL$  indicator underestimates or overestimates some underlying “true level” of poverty. For a given set of dimensions that reflect a broadened concept of poverty, our intention is to determine to what extent the  $PL$  indicator tends to understate or overstate the overall level of deprivation, and to use this information to assess the potential risks of relying solely on the monetary dimension for poverty analysis. Our assessment is done in relative terms, and the measure we propose relies on the fact that the dimensions considered in the

multidimensional approach are not perfect substitutes nor perfect complements for understanding poverty.

### 3. (RE)COUNTING POVERTY IN PERU

#### 3.1 What is poor in Peru?

In this section, we present and discuss a set of attributes to reflect a broadened concept of poverty. For this, we use a standard set of aspects involved in human development: nutrition, education, health, and housing conditions. We acknowledge that several pages could be written discussing the possible interactions and causal relationships between these dimensions, and that several other classifications could be proposed<sup>8</sup>. This, however, is not our intention. We simply want to select a reasonable set of aspects that enjoy a minimum level of consensus regarding their importance for human development in order to: (i) test-drive the Alkire-Foster identification methodology; and (ii) compare these results to those obtained when identification is solely based on a monetary poverty line.

The issue of whether we have selected too many or too few aspects to reflect poverty will always be open to debate. As discussed above, we look for dimensions that enjoy a minimum consensus. In this regard, it is worth noting that the four aspects selected are closely related to five of the eight Millennium Development Goals (MDGs)<sup>9</sup>, and that these are widely agreed upon. In addition, the dimensions we propose are closely related to the three dimensions used in the Alkire and Santos (2010) comprehensive cross-country exercise<sup>10</sup>. As discussed by these authors, these dimensions are emphasized both by the human capability approach (Nussbaum, 2003) and the human capital approach.

Battiston, *et al.*, (2009) also rely on the Alkire-Foster multidimensional approach and consider a similar set of dimensions, although they do not propose any direct indicators for health or nutrition, and indicators related to housing conditions are each considered separately as a specific

8. For instance, one could find reasons to classify nutrition within health or argue that housing conditions are determinants rather than outcomes and should have a different order of exogeneity than education.

9. Specifically: eradicate extreme poverty and hunger (MDG 1), achieve universal primary education (MDG 2), reduce child mortality (MDG 4), improve maternal health (MDG 5), and ensure environmental sustainability (MDG 7).

10. "Education" is a dimension shared by both, and our "housing conditions" is the same as their "standard of living" dimension. Our health and nutrition dimensions fall within their broader health dimension. These authors also discuss the relationship between their selected dimensions and the MDGs.

dimension<sup>11</sup>. Finally, it is also worth noting that the dimensions chosen are closely related to the “needs” considered under the UBN approach which, as already discussed, is widely used in Latin America to reflect several aspects of poverty other than the monetary dimension.

If controversy arises in the selection of dimensions, even more may be expected when discussing the specific indicators chosen to reflect the achievements of interest. In our case, three critical elements came into play: (i) whether the indicator reflects a relevant achievement within the chosen dimension; (ii) how well the indicator reflects an asset that social policies can be expected to deliver; and (iii) the availability of information from a representative household survey.

Table 1 summarizes the dimensions, indicators, and proposed cut-off values or criteria for identifying the poor according to the Alkire-Foster approach. The reader will notice that we have also included a monetary dimension directly captured by the standard poverty line (*PL*) indicator. As in Battiston, *et al.*, (2009), we seek to complement our direct “basic needs” indicators with an “indirect measure” of deprivation such as household per-capita expenditure. More importantly, and as discussed in the previous section, the inclusion of the *PL* criterion will allow comparability of the results obtained from using only this indicator and the use of a multidimensional approach to identify the poor.

The reader will also notice that we have considered two different achievements that could be easily grouped within a single educational dimension: one related to children’s access to basic education and a second one related to the household head educational attainment. Although both are related to human capital, the first has more to do with the current investment flow while the latter measures the available stock within the household. In fact, the educational attainment of children determines the household’s future consumption path, while that of the parents determines the current consumption path.

Given this, the second education indicator might seem redundant as we are also considering the monetary dimension which is based on per capita household consumption. However, it is included in order to reflect the household’s vulnerability rather than its consumption level<sup>12</sup>. We decided to work with the household head’s literacy condition because this

11. As will be discussed subsequently, we propose integrating several housing conditions indicators in a single dimension.

12. Several studies (for example, Castro, 2008) have shown that household head’s educational attainment is a significant determinant of the vulnerability of consumption with respect to idiosyncratic income shocks.

reflects a minimum standard for cognitive skills and, quite importantly, because its status is responsive to contemporaneous policy intervention.

All of the information used to build the indicators proposed was obtained from the *Encuesta Nacional de Hogares* (ENAH) for 2004 and 2008. This survey retains representativeness down to the regional level and is the basis for poverty measurement in Peru<sup>13</sup>. Although most of the indicators are quite standard in any LSMS, some of the cut-off criteria deserve further discussion.

The nutrition indicator is built by comparing the specific calorie requirement of each household against its effective calorie intake. The former is based on household members' age, gender and physical activity (Herrera, 2001). The latter is calculated using calorie equivalences for each of the goods consumed by the household<sup>14</sup>.

Regarding the health dimension, the reason for not attending a health establishment was labelled as "insufficient resources" if the respondent reported "insufficient money" or "excessive distance to health establishment". Adequate water source, on the other hand, requires access to a public tap connected to a water network (or better) in urban areas or a well (or better) in the rural domain. An adequate sewage service implies a flush toilet connected to a sewage network or septic tank if the household is located in an urban area, or a pit latrine (or better) if it is rural<sup>15</sup>.

Precarious materials, on the other hand, refer to household walls made of straw, or made of stone and mud or wood combined with a soil floor, or households improvised at locations inadequate for human habitation. A non-crowded house requires an average of three or fewer people per room. Finally, monetary poverty lines are computed for each of the eight geographical domains and updated each year by the *Instituto Nacional de Estadística* (National Statistics Institute, or INEI).

A quick comparison of the extent of deprivation in each of the dimensions considered between 2004 and 2008 already provides

13. See Appendix B for a more detailed description of this survey.

14. Since Peru's extreme poverty line is measured in terms of food intake, one could argue that household identification as extreme poor or non-extreme poor would suffice to measure deprivation in the nutrition dimension. The extreme poverty line, however, is based on the food consumption of a representative household while the measure we propose considers the specific composition and caloric needs of each household. A shortcoming, however, is that it does not account for the way in which food is distributed within the household unit.

15. It is common practice in MDG assessment to use different water and sanitation standards (or cut-off values) for urban and rural areas (see Vos, *et al.*, 2008). From a broader perspective, Thorbecke (2005) proposes using different minimum bundles for rural and urban areas due to greater access to social capital and support networks in the rural domain.

Table 1. Selected indicators, deprivation cut-off values, and recent values

Dimension	Indicators	Cut-off value: Person is deprived if...	% deprived 2004	% deprived 2008
Nutrition	Household calorie consumption	Household calorie consumption is below threshold given household composition <sup>a</sup>	32.3%	30.90%
Education	Children between 8 and 17 years of age attending school	Household has one or more children between 8 and 17 years of age not attending school	16.0%	12.4%
Health	Access to health establishment in the event of illness	Person reported illness and was unable to access a health establishment due to insufficient resources <sup>b</sup>	42.5%	47.7%
Dwelling conditions	Adequate water supply; adequate sewage service; non-precarious materials; non-crowded household <sup>c</sup>	Dwelling lacks one or more characteristic	52.0%	51.1%
Monetary	Household monetary value of per capita consumption	Household per capita consumption is below poverty line <sup>d</sup>	48.6%	36.2%
Vulnerability	Household head literacy condition	Household head is reported as illiterate <sup>e</sup>	11.3%	9.2%

Source: Own calculations based on ENAHO 2004 and ENAHO 2008.

a. Household calorie requirements are based on household members' age, gender and physical activity (see Herrera, 2001). Household calorie intake is calculated using calorie equivalences for each of the foods consumed by the household.

b. The reason for not attending a health establishment was labelled as "insufficient resources" if the respondent reported "insufficient money" or "excessive distance to health establishment".

c. An adequate water source requires access to a public tap connected to a water-network (or better) in the urban area or a water-well (or better) in the rural domain. An adequate sewage service implies a flush toilet connected to a sewage network or septic tank if the household is located in an urban area, or a pit latrine (or better) if it is rural. Precarious materials refer to household walls made of straw, or made of stone and mud or wood combined with a soil floor, or households improvised at locations inadequate for human habitation. A non-crowded house requires an average of three or fewer people per room.

d. According to the official poverty lines calculated by the *Instituto Nacional de Estadística* for 2004 and 2008. These are used to compute official monetary poverty figures.

e. According to a brief test applied together with the survey.

some insight into the potential differences between the standard unidimensional measure and a multidimensional approach based on the indicators proposed. In fact, and although the percentage of households deprived in the monetary dimension (which is equivalent to the official poverty figure in Peru) has fallen considerably, the other indicators have not improved at a similar rate. A reasonable prior, therefore, is that our multidimensional poverty headcount will not exhibit the same decline as the monetary poverty measure. In what follows we apply our comparison framework to address this issue in more formal terms.

### 3.2 Who is poor in Peru?

Panels (a) and (b) in Figure 2 show empirical versions of Figure 1 using the indicators described in the previous section and Peruvian data for years 2004 and 2008. A quick inspection reveals that the decline in the level of the  $PL$  indicator has not been accompanied by a similar shift in the  $H(k)$  function and, thus, the value of  $k^*$  has increased. According to our discussion above, this provides a first piece of evidence to support the fact that the  $PL$  indicator now exhibits a greater tendency to understate the overall level of deprivation.

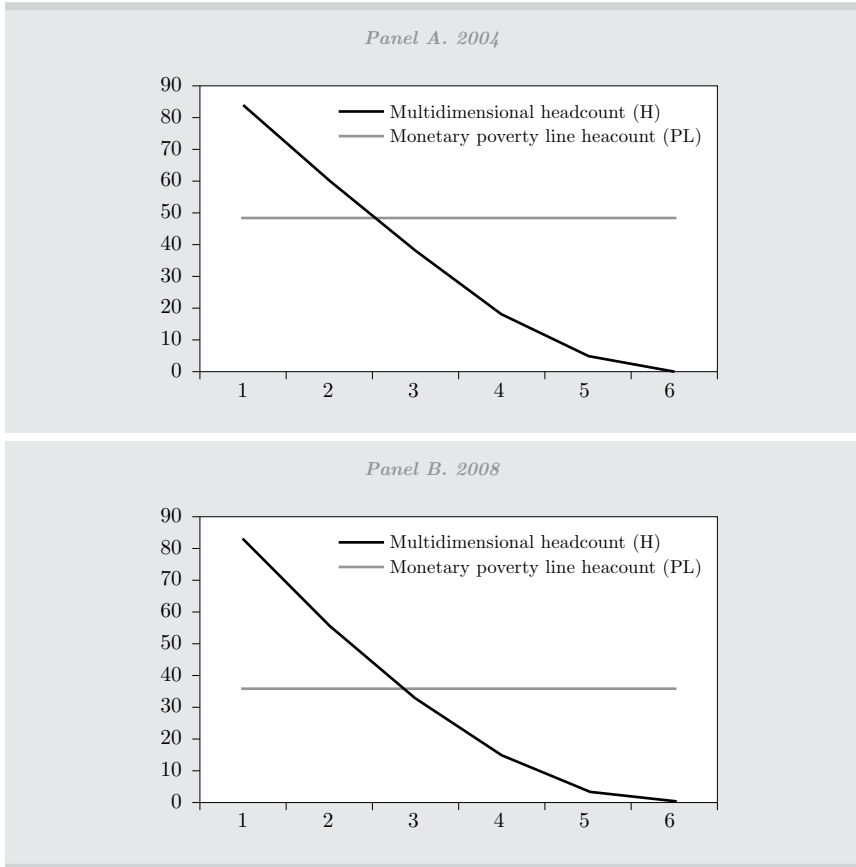
To formalize this, Table 2 presents values for “distances”  $A = (H_U - PL)$  and  $B = (PL - H_l)$  and our relative measures  $\%A$  and  $\%B$  according to the definitions provided above. An important result emerges regarding the tension between the incidence of monetary poverty and the overall degree of deprivation in terms of the dimensions considered. While the “size” of this tension remained practically unchanged between 2004 and 2008, results provided by the  $PL$  indicator shifted from a tendency to overstate to a tendency to underestimate the overall level of deprivation of the Peruvian population. Put in terms of the discussion above, and contrary to what occurred in 2004, more than half of the individuals deprived in 1 to 5 of the dimensions considered were able to surpass the monetary poverty line in 2008. Thus, if we continue relying on the poverty line indicator for identification purposes, we face a larger risk of classifying as non-poor individuals who still experience considerable deprivation.

In terms of the motivation for this analysis, the results discussed above should provide sufficient warning against excessive optimism regarding the recent evolution of the monetary poverty indicator. The increase in



**Figure 2. Peruvian multidimensional and monetary poverty headcounts**

(in percent)



Source: Own calculations based on ENAHO 2004 and ENAHO 2008.  
 H: Multidimensional poverty incidence using the dimensions described in Table 1 and all possible cut-off values ( $k = 1, 2, \dots, 6$ ).  
 PL: Monetary poverty incidence according to the official poverty lines calculated by the *Instituto Nacional de Estadística*.

consumption levels that allowed a 12-point reduction in the incidence of monetary poverty between 2004 and 2008 has not been accompanied by increases in other achievements crucial for human development. While a simple inspection of deprivation levels in these dimensions could shed some light on the matter, a multidimensional approach for poverty measurement and the identification method explained above have provided a formal framework to examine this issue.

**Table 2.** Measuring the tension between the incidence of monetary poverty and the overall degree of deprivation

(in percent)

	Multidimensional headcount $H(k)$ for all possible cut-off values						PL <sup>a</sup>	Hu - PL (A) <sup>b</sup>	PL - Hi (B) <sup>c</sup>	%A <sup>d</sup>	%B <sup>e</sup>
	k=1	k=2	k=3	k=4	k=5	k=6					
2004	83.8	60.8	38.3	18.4	5.2	0.5	48.6	35.2	48.1	42.3	57.7
2008	83.3	56.2	32.9	15.2	3.9	0.4	36.2	47.1	35.8	56.8	43.2

Source: Own calculations based on ENAHO 2004 and ENAHO 2008.

a. PL: monetary poverty incidence.

b.  $H_u = H(1)$ : multidimensional poverty incidence under the “union” approach.

A =  $H_u - PL$ : proportion of individuals deprived in one or more dimensions but not deprived in monetary terms.

c.  $H_i = H(6)$ : multidimensional poverty incidence under the “intersection” approach.

B =  $PL - H_i$ : proportion of individuals deprived in the monetary dimension but not deprived in all dimensions.

d. %A =  $A/[H(1) - H(6)]$ : proportion of individuals deprived in 1 to 5 dimensions who are not deprived in monetary terms.

e. %B =  $B/[H(1) - H(6)]$ : proportion of individuals deprived in 1 to 5 dimensions who are deprived in monetary terms.

### 3.3 Poverty and policy

The advantages of the multidimensional approach are not limited to contributing a dose of formality to discussions such as the one above. Poverty measures should convey information regarding the effectiveness of social policies, and the Alkire-Foster identification method exhibits a series of desirable features for tracking the provision of basic public services. In particular, it is “deprivation focused” and allows us to combine cardinal and ordinal data.

As already discussed, the latter is particularly useful for building an aggregate measure that conveys information regarding access to basic services that are usually measured on a binary (yes or no) basis. The first property, on the other hand, is especially desirable when using the indicator to focalize interventions, since it creates incentives to provide those assets from which the poor are deprived up to the point of eliminating such deprivation. In other words, policymakers would not be able to stimulate a significant reduction in the multidimensional headcount ratio ( $H$ ) unless they focus on guaranteeing increases in those dimensions in which the poor are deprived<sup>16</sup>.

16. The dimension adjusted headcount ratio  $M_0$  (discussed in a previous note) measures the depth of deprivation and, as such, will decline as poor persons are deprived in fewer dimensions. The headcount ratio, on the other hand, will only fall if enough deprivations are removed so as to place the poor below the dimensional cut-off value ( $k$ ).

To illustrate the above, in what follows we further discuss the differences between the monetary poverty headcount and the multidimensional indicator for a pre-established value of  $k$ . In particular, we are interested in making inter- and intra-regional comparisons in order to determine: (i) if differences between  $PL$  and  $H$  measures are homogeneous between regions; and (ii) the reasons for these differences within regions.

The dimensional cut-off value chosen for this assessment is 2. Discussing the appropriateness of this value is beyond the scope of this exercise. As discussed in the previous section, we do not seek to reveal a “true” incidence of poverty and compare this value against official figures. For that reason, our previous analysis was conducted in relative terms: We focused on the evolution of our comparative measures rather than on their absolute levels.

At this stage, however, the analysis would benefit from selection of a dimensional cut-off value and it is difficult to do so without losing a considerable degree of impartiality. Thus, and although we state that the main objective of this exercise is to illustrate how a multidimensional approach can aid policy design, we also argue that classifying as poor any person who lacks one-third or more of a set of important attributes for human development is not an unreasonable standard<sup>17</sup>. Table 3 reveals that discrepancies between the  $PL$  indicator and our proposed  $H(2)$  measure increased considerably between 2004 and 2008. In particular, the percentage of multidimensional poor that is deemed non-poor according to monetary standards increased from 25.8 percent to 39.0 percent<sup>18</sup>. This is simply the flip side of the results discussed in the previous section and serves as a warning against relying solely on the monetary dimension for poverty assessment.

More interesting is the interregional comparison proposed in panels (a) and (b) of Figure 3. The use of poverty maps to offer a quick overview

17. Battiston, *et al.* (2009) also work with a dimensional cut-off value of two out of six dimensions. With this, their multidimensional headcount for El Salvador in 2006 was close to 65 percent, Mexico and Brazil followed behind with indices around 40 percent and 25 percent, respectively, while Argentina, Chile and Uruguay were at the bottom of their ranking with multidimensional poverty figures below 10 percent. As shown in the table above, with a dimensional cut-off value of two, Peru’s multidimensional poverty headcount is 56.2 percent in 2008. This places Peru below El Salvador but ahead of Mexico and Brazil, a similar relative position as that obtained by comparing monetary poverty figures for these countries between 2006 and 2008 (see ECLAC, 2009).

18. An increase between 2004 and 2008 in the percentage of multidimensional poor who would be identified as non-poor by the monetary standard occurs regardless of the dimensional cut-off value used. We performed this same analysis for different dimensional cut-off values. As expected, for larger values of  $k$ , fewer multidimensional poor are identified as non-poor using the  $PL$ . However, in relative terms, in 2008 there is always a larger risk of classifying the multidimensional poor as non-poor using the  $PL$ .

**Table 3. Multidimensional poor and non-poor classified according to the *PL* indicator (%)**

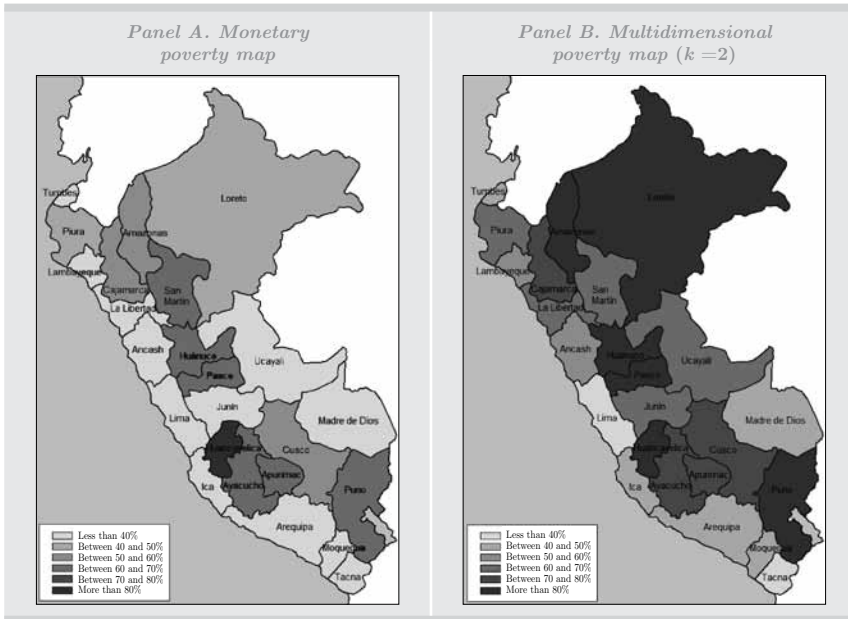
<i>PL</i> classification	Multidimensional classification ( $k = 2$ )	
	Non-poor (A) <sup>a</sup>	Poor (B) <sup>b</sup>
<b>2004</b>		
Non-poor	94.3	25.8
Poor	5.7	74.2
Total	100.0	100.0
<b>2008</b>		
Non-poor	97.1	39.0
Poor	2.9	61.0
Total	100.0	100.0

**Source:** Own calculations based on ENAHO 2004 and ENAHO 2008.

a. Column (A) shows the proportion of multidimensional non-poor classified as non-poor and poor according to monetary standards.

b. Column (B) shows the proportion of multidimensional poor classified as non-poor and poor according to monetary standards.

**Figure 3. Peruvian monetary vs. multidimensional poverty maps (2008)**



Source: Own calculations based on ENAHO 2008.

Panel A is based on regional results for the incidence of monetary poverty according to the official poverty lines calculated by the *Instituto Nacional de Estadística* for 2008.

Panel B is based on regional results for the incidence of multidimensional poverty using the dimensions described in Table 1 and a cut-off value of two ( $k = 2$ ).

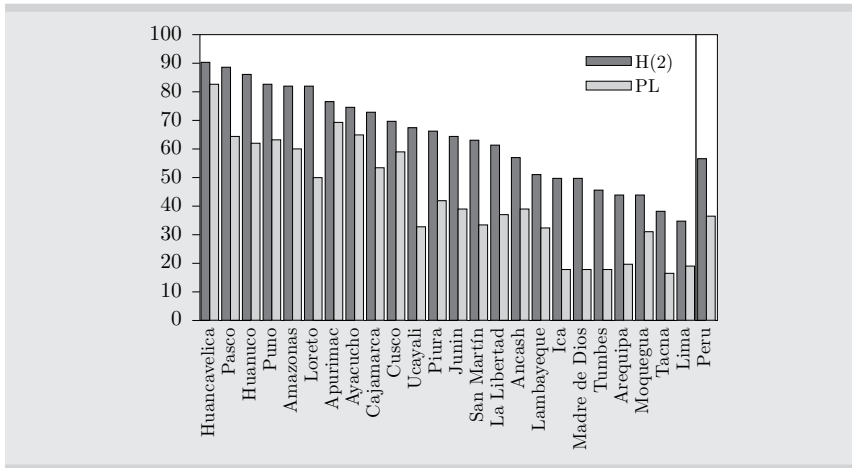
of interregional differences in poverty incidence is now widespread. In this case, we propose using six poverty groups. A rapid comparison of panels (a) and (b) reveals that our  $H(2)$  indicator provides, uniformly, a less optimistic panorama of the incidence of poverty. In fact, 21 out of 24 regions shift to a higher poverty group and 13 move up by more than one group.

Figure 4 provides more detail on interregional differences and reveals that the  $PL$  indicator is lower than the multidimensional headcount ratio across all regions. Differences, however, range from 34.4 percentage points (in Ucayali) to 7.1 percentage points (in Apurimac). Combined with the poverty maps, this evidence reveals that the incidence of multidimensional poverty is (like its monetary counterpart) concentrated in Peru's southern highlands. However, and unlike the monetary measure, the multidimensional indicator reveals significant levels of deprivation affecting the northern Amazon area.

On an interregional basis, the lesson of our multidimensional measure in terms of policy is that more emphasis should be placed (although to different degrees) on improving the overall level of deprivation

**Figure 4. Regional incidence of monetary and multidimensional poverty (2008)**

(in percent)



Source: Own calculations based on ENAHO 2008.  
 H(2): Incidence of multidimensional poverty using the dimensions described in Table 1 and a cut-off value of two ( $k = 2$ ).  
 PL: incidence of monetary poverty according to the official poverty lines calculated by the *Instituto Nacional de Estadística* for 2008.

throughout the country. An intraregional analysis, however, could reveal that the specific focus of these efforts should vary by region. This is not particularly true in our case since in all regions, except Moquegua, the health and/or dwelling conditions dimensions are among the top two in terms of the incidence of deprivation among the multidimensional poor (see Table 4). This means that a significant impact on the incidence of multidimensional poverty across most regions could be attained if policymakers were to focus on providing greater access to adequate dwelling conditions and health services<sup>19</sup>.

Dwelling conditions is a particularly interesting dimension since nearly 76 percent of the multidimensional poor (at the national level) show deprivation in this area. A closer look reveals that most of this deprivation status is due to lack of access to an adequate water supply: 74 percent of the multidimensional poor deprived in the dwelling conditions dimension lack this attribute<sup>20</sup>.

#### 4. CONCLUDING REMARKS AND AVENUES FOR FURTHER RESEARCH

In this analysis we have pursued two main objectives. First, we sought to address the apparent disagreement between the recent evolution of monetary poverty figures and the levels of deprivation of the Peruvian population. For this, we used a multidimensional approach to poverty measurement and specifically the Alkire-Foster identification methodology. Based on this, we devised a simple comparison framework to measure the tension between the incidence of monetary poverty and the overall level of deprivation in terms of a set of basic attributes for human development.

After choosing dimensions, indicators and cut-off values for the Peruvian case, we built the Alkire-Foster multidimensional poverty headcount and applied the comparison framework proposed using data for 2004 and 2008. Our results indicate that the recent 12-point reduction in the incidence of monetary poverty has not been accompanied by

19. Larger values of  $k$  imply that the percentage of multidimensional poor deprived in each dimension increases. However, for all possible cut-off values, dwelling conditions is the dimension in which most of the multidimensional poor are deprived. For cut-off values above 4, the incidence of deprivation among the multidimensional poor in the dwelling conditions dimension is above 95%, a result shared by the monetary dimension.

20. In addition, 51.8% lack adequate sewage service, 25.2% live in a crowded household, and 18.8% inhabit a precarious dwelling.

**Table 4. Percentage of multidimensional poor deprived in each dimension<sup>a</sup>***(in percent)*

Region	Monetary	Education	Health	Dwelling conditions	Vulnerability	Nutrition
Amazonas	70.3	21.5	69.7	89.9	11.9	44.3
Ancash	63.8	21.9	72.0	68.5	23.0	45.1
Apurimac	84.3	19.0	44.4	79.2	23.9	52.0
Arequipa	43.4	17.4	63.2	65.5	13.6	63.0
Ayacucho	82.1	20.5	39.4	76.3	24.0	65.8
Cajamarca	70.6	20.7	69.4	73.3	25.6	57.4
Cusco	78.5	16.5	57.2	76.0	17.7	59.1
Huancavelica	89.8	14.0	41.2	88.2	19.7	65.1
Huanuco	69.8	17.7	67.8	88.3	21.4	66.0
Ica	32.4	14.2	75.9	72.3	10.0	54.2
Junin	58.4	19.8	75.0	82.4	11.9	48.0
La Libertad	58.5	21.4	69.3	75.0	14.4	57.4
Lambayeque	57.2	16.2	71.2	62.3	17.4	54.8
Lima	47.1	20.6	66.3	59.2	9.0	52.6
Loreto	59.4	25.2	79.8	93.6	11.0	55.9
Madre de Dios	33.9	27.3	41.6	96.5	11.5	50.7
Moquegua	65.9	15.8	59.6	53.8	13.4	74.6
Pasco	72.4	16.4	70.8	92.1	14.0	71.8
Piura	60.0	19.7	73.7	78.6	16.7	53.1
Puno	74.7	11.6	62.8	89.7	19.5	58.2
San Martin	50.8	20.0	68.8	84.6	10.9	41.8
Tacna	38.4	18.0	63.1	55.1	6.5	61.6
Tumbes	35.9	29.5	56.4	81.8	11.8	40.8
Ucayali	47.1	28.3	58.2	97.9	12.6	51.9
<b>Peru</b>	<b>61.0</b>	<b>19.3</b>	<b>66.1</b>	<b>75.9</b>	<b>15.6</b>	<b>55.2</b>

Source: Own calculations based on ENAHO 2008.

a. Table indicates deprivation per dimension for the multidimensional poor at the regional and national levels (cut-off value  $k = 2$ ) in 2008.

Dark grey cells indicate the dimension in which the region's multidimensional poor are most deprived.

Light grey cells indicate the second most deprived dimension for the region's multidimensional poor.

increased access to other assets important for individuals' well-being and ability to develop. Currently (and contrary to what happened in 2004), more than half of the individuals deprived in 1 to 5 of the 6 dimensions considered are able to exceed the monetary poverty line. An immediate implication is the greater risk of classifying as non-poor individuals who still endure significant deprivation if we rely solely

on the monetary dimension for identification purposes. According to 2008 figures, 39 percent of individuals lacking one-third or more of the attributes considered would be classified as non-poor using the monetary poverty line measurement. This proportion was just 26 percent in 2004.

Our second objective was to illustrate how the multidimensional measure proposed can aid policy design by providing appropriate incentives to focalize interventions. For this, we decided to classify as multidimensional poor those individuals deprived in two or more of the dimensions considered. Inter- and intraregional comparisons made with this identification criterion revealed several results worth highlighting: (i) the multidimensional headcount is greater than or equal to the poverty line indicator in all regions; (ii) like its monetary counterpart, the incidence of multidimensional poverty is concentrated on Peru's southern highlands; (iii) unlike its monetary counterpart, the multidimensional indicator shows significant deprivation in the northern Amazon; (iv) deprivations endured by the multidimensional poor are similar across regions and concentrated in the health and dwelling conditions dimensions; and (v) at the national level, 76 percent of the multidimensional poor are deprived in the dwelling conditions dimension: 74 percent lack an adequate water supply and 52 percent lack adequate sewage service.

These last two results have an important policy implication: To achieve a significant reduction in our multidimensional poverty headcount across most regions (and, thus, at the national level), policymakers should focus on the provision of improved water and sanitation services. At the national level, this finding is not at odds with results obtained for several other LAC countries (see Battiston, *et al.*, 2009). Within Peru, the fact that the main contributor to multidimensional poverty is similar across regions should not be ignored, as it represents an important opportunity to focalize public investment efforts.

This analysis can be extended in several ways in order to contribute to multidimensional poverty measurement in Peru. In terms of methodology, it should be noted that potential correlation between the indicators can lead to biases in the analysis towards a particular dimension. One way to address this is by performing a factor analysis and using the resulting uncorrelated factors as inputs for the dual cut-off method. Bourguignon and Chakravarty (2003) also provide an alternative methodology that accounts for the potential degree of substitution among dimensions. Subjective poverty measures can also



play a role in providing different weights for different deprivations. Alkire and Foster (2008) discuss how to implement a weighted sum of deprivations.

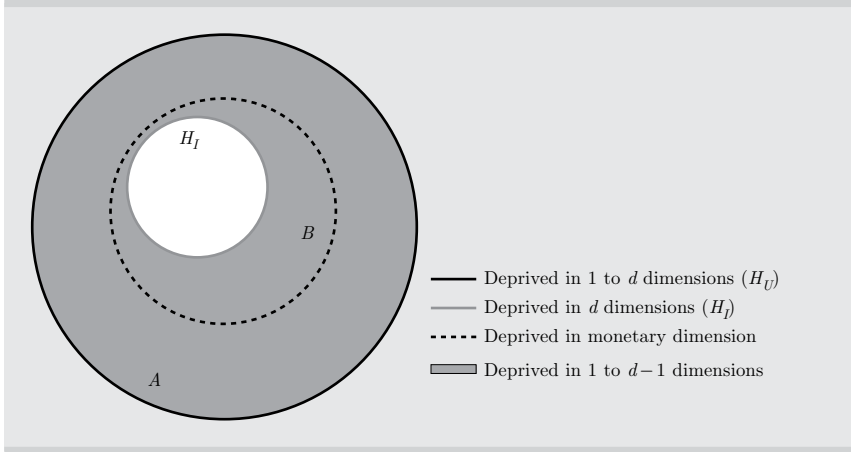
Other issues related to the Peruvian context have to do with the possibility of including a spatial dimension when considering deprivations. Escobal and Ponce (2008) discuss how poverty dynamics in Peru are related to spatial characteristics such as altitude, distance to markets and access to infrastructure services. Also, an important extension for education indicators in Peru would be to account for education quality using the results of national standardized tests. The primary challenge in accomplishing this is matching test results with children's household characteristics as provided by the living standards survey.

## REFERENCES

- Alkire, S. and E. Santos (2010), "Acute multidimensional poverty: a new index for developing countries," Oxford Policy and Human Development Initiative (OPHI) Working Paper Series No. 38, OPHI.
- Alkire, S. and J. Foster (2008), "Counting and multidimensional poverty measurement," OPHI Working Paper Series No. 07, OPHI.
- Atkinson, A. (1987), "On the measurement of overty", *Econometrica*, Vol. 55, No. 4: 749-764.
- Battiston, D., G. Cruces, L.F. López, M. Lugo, and M. Santos (2009), "Income and beyond: multidimensional poverty in six Latin American countries," OPHI Working Paper No. 17, OPHI.
- Bourguignon, F. and S. Chakravarty (2003), "The measurement of multidimensional poverty", *Journal of Economic Inequality*, Vol. 1: 25-49.
- Castro, J.F. (2008), "Política fiscal y gasto social en el Perú: cuánto se ha avanzado y qué más se puede hacer para reducir la vulnerabilidad de los hogares," *Apuntes* (Universidad del Pacifico), No. 62: 55-76.
- Chakravarty, S.R. (1983), "A new index of poverty," *Mathematical Social Sciences*, Vol. 6, Issue 3: 307-313.
- Collantes, H. and J. Escobedo (2007), "Más allá de lo monetario: cómo evalúan su bienestar los peruanos," *Apuntes* (Universidad del Pacifico), No. 60/61.
- Duclos, J.Y. and A. Araar (2006), *Poverty and equity: measurement, policy, and estimation with DAD*, Berlin and Ottawa: Springer and IDRC.
- Escobal, J. and C. Ponce (2008), "Dinámicas provinciales de pobreza en el Perú 1993-2005," Documento de Trabajo No. 11, Centro Latinoamericano para el Desarrollo Rural.
- Foster, J., J. Greer and E. Thorbecke (1984), "A class of decomposable poverty measures," *Econometrica*, Vol. 5, No. 3: 761-766.
- Herrera, J. (2001), "Food requirements and deficits, Peru 1997-2000," Instituto Nacional de Estadística e Informática.
- Kapteyn, A., S. van de Geer, and H. van de Stadt (1985), "The Impact of changes in income and family composition on subjective measures of well-being", in David, M. and T. Smeeding, eds., *Horizontal equity, uncertainty and economic well-being*, University of Chicago Press.
- Kuklys, W. (2005), *Amartya Sen's capability approach: theoretical insights and empirical implications*, Berlin: Springer Verlag.
- Loayza, N. and R. Polastri (2004), "Poverty and growth in Peru," Background Report for Peru's Poverty Assessment, The World Bank.
- Monge, A. and R. Ravina (2003), "Más allá del componente objetivo en la medición de la pobreza: análisis geográfica de las dimensiones objetiva y subjetiva en el Perú," in Vásquez, E., ed., *Buscando el bienestar de los pobres ¿Cuán lejos estamos?*, Lima, CIUP.

- Nussbaum, M. (2003), "Capabilities as fundamental entitlements: Sen and social justice," *Feminist Economics*, Vol. 9, No. 2-3: 33-59.
- Ruggeri, C. (1999), "The many dimensions of deprivation in Peru: theoretical debates and empirical evidence," Queen Elizabeth House Working Paper 29, University of Oxford.
- Sen, A. (1976), "Poverty: an ordinal approach to measurement," *Econometrica*, Vol. 44, No. 2: 219-231.
- Sen, A. (1985). *Commodities and Capabilities*, Amsterdam: North-Holland.
- Statistical Yearbook for Latin America and the Caribbean* (2009), Economic Commission for Latin America and the Caribbean.
- Thorbecke, E. (2005), "Multi-dimensional poverty: conceptual and measurement issues," UNDP International Poverty Centre, Brasilia.
- Vos, R., E. Ganuza, H. Lofgren, M. Sánchez, and C. Díaz-Bonilla (2008), *Public policies for human development*, United Nations Development Program (UNDP).
- Yamada, G. and J.F. Castro (2007), "Poverty, inequality and social policies in Peru: as poor as it gets," Documento de Discusión, CIUP DD/07/06, Universidad del Pacífico.

## APPENDIX A



As explained in the main text, group A refers to those individuals deprived in one or more dimensions but not deprived in monetary terms. Group B, on the other hand, contains those individuals deprived in monetary terms but not deprived in all dimensions. Areas A and B, thus, contain those individuals deprived in 1 to  $d - 1$  dimensions.

## APPENDIX B

### Household survey description

The *Encuesta Nacional de Hogares* (ENAHO) is Peru's official annual household survey conducted by the *Instituto Nacional de Estadística* (National Statistics Institute, or INEI) since 1995. Until 2002, the survey captured information only in the fourth quarter of each year. Since 2004, the survey has been continuous, capturing information during all 52 weeks of the year. Since 2008, it has included a panel subsample.

The target population comprises all private households and their occupants residing in urban and rural areas in the country's 25 regions. Members of the national army and other individuals living in collective households are excluded from the sample. Sample design is probabilistic, by areas, stratified and independent in each region. Total sample size comprises 22,640 observations at the household level (13,824 from urban areas and 8,816 from rural areas).

Sampling units are defined according to the location. In urban areas, the primary sampling unit is the "urban population center" which concentrates around 2,000 individuals. The secondary sampling unit is a "conglomerate", with an average of 120 independent households. Each household represents a tertiary sampling unit. In rural areas the scheme differs slightly due to the presence of areas with low population. Statistically significant inference can be performed at the national, urban, rural, and regional levels.

The survey comprises 336 questions. The data collected is organized in 29 modules covering information on household characteristics, household members' demographic characteristics, consumption and spending patterns, income sources, household assets, and household members' educational attainment, health conditions, and labor market participation. The database not only comprises raw data, but also includes specific indicators of interest. Among these, information on consumption and spending patterns is used to update extreme and national monetary poverty figures each year.

All survey modules are publicly available at: [www.inei.gob.pe/web/enaho/](http://www.inei.gob.pe/web/enaho/).

