(Re)Counting the poor in Peru: a multidimensional approach

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Abstract

After an impressive 12 point reduction in Peruvian monetary poverty, questions have been raised about the extent in which these figures mask deprivation in several other aspects critical for human development. We propose using the Alkire-Foster multidimensional headcount to address this issue, and devise a simple comparison framework to measure the tension between the incidence of monetary poverty and the overall level of deprivation based on the multidimensional measure. We select six dimensions and their respective indicators for the Peruvian case, and apply this framework using data for 2004 and 2008. Results indicate that we now face a larger risk of classifying as non-poor individuals who still endure significant deprivation if we rely on the conventional monetary dimension. In addition, inter and intraregional comparisons show that deprivations endured by the multidimensional poor are similar across regions and concentrated on the health and dwelling conditions dimensions, in particular, on the lack of adequate water and sanitation services. This last result reveals an opportunity to focalize public investment efforts.

1. Introduction and motivation

Official poverty figures in Peru reveal an impressive reduction of more than 12 percentage points in four years. In fact, the incidence of moderate (as opposed to extreme) poverty[1] fell from 48.6% in 2004 down to 36.2% in 2008. While government officials rushed to praise the achievements of social programs, others, more sceptic about the effectiveness of social policy interventions, highlighted the equally impressive economic expansion experienced between those years (per capita GDP grew at an average rate of 7.1%).

It is not difficult to observe a sharp decline in monetary poverty indexes while the economy is booming. In fact, the poverty-to-growth elasticity of -0.44% implicit in the figures above is not strange for Peruvian standards, and we have reached figures close to -0.60% 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 larger and less volatile consumption paths at the household level[2].

Confronted with this evidence, a natural question is whether our recent economic expansion has been accompanied by this delivery or if we have reasons to believe that monetary poverty figures mask deprivation in other aspects critical for human development. We believe adopting a multidimensional approach for poverty measurement can be of great aid to attempt an answer to this question in formal terms. Recent trends of other social indicators (e.g. calorie intake[3]) warn us against excessive optimism about the evolution of poverty, however, a consolidated measure is still missing and here is where a multidimensional indicator can play an important role.

Broad consensus now exists regarding the need to account for more than one dimension or attribute when trying to proxy 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 ability to develop) is also better represented as a multidimensional phenomenon. Conceptual and empirical contributions on this direction can be found in the writings of several authors[4].

As recognized in Battiston, *et al.* (2009), and despite extensive literature on multidimensional poverty measurement, the majority of research efforts on poverty in Latin America and the Caribbean (LAC) focus solely on the income or monetary dimension. More on the side of policymaking, however, the Unsatisfied Basic Needs

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

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

[3] According to the Peruvian *Instituto Nacional de Estadistica* (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), Foster, Greer and Thorbecke (1984); and Duclos and Araar (2006) for a complete survey on the different approaches for poverty measurement.

(UBN) approach has provided an important basis for a multidimensional understanding of poverty. 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). It fails, however, to combine this information in a unique index and, instead, relies on separate indicators measuring 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 aside from 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 allows to identify the minimum income the household head believes needs for subsistence. If the income perceived is less than this minimum, household members are identified as subjectively poor. Their results showed 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 our living-standards survey (the *Encuesta Nacional de Hogares -* 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 measurement, on the other hand, have not been yet attempted for Peru. Battiston, *et al.* (2009), documents studies for Uruguay, Brazil, Argentina and Bolivia, and even their very comprehensive cross-country study does not include Peru[5]. In addition, and despite its widespread use in other LAC countries, the UBN approach is not broadly acknowledged as a "poverty" measure in Peru. Thus, both academic and policy debates around the matter focus on our national extreme and moderate monetary poverty indices.

Given the above, three distinct (but related) issues motivate this paper. The first one has to do with the scepticism surrounding the recent decline in Peruvian official poverty figures[6]. The second one is the availability of information via an extremely rich living-standards survey and the fact that, despite this, multidimensional poverty measurement is an unexplored topic in Peru. Finally, the third one is the recent work by Alkire and Foster (see Alkire and Foster, 2008) on multidimensional poverty measures, which provides a simple yet insightful approach for 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.

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[5] 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 found 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.
[6] As already discussed, more than doubts about consumption figures or poverty lines, questions arise about the extent in which the latter suffice to reflect deprivation levels.

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 towards a multidimensional view for poverty measurement. We also present a simple framework to compare the monetary poverty line measure against the proposed multidimensional headcount. Following the controversy motivating this paper, we seek to evaluate up to what extent the poverty line indicator tends to over 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. With 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 answering "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 $\left(z_j; j = 1,..,d \right)$, 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 "union approach" (which requires deprivation in all dimensions to classify an individual as poor; $k = d$) and the "intersection 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 $\left(H = q/n \right)$, 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 under a unidimensional view. It implies that increases in non-deprived dimensions do not change a poverty status and this, as we will be discussed later, can have important implications for social policy design[7]. Another important property for social policy evaluation (not shared by methods as the monetary poverty line) is that it allows us to combine cardinal and ordinal data. The possibility of working with ordinal data is important since the delivery of social services is usually accounted for dichotomically.

It is worth mentioning that the last 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 quite strange: how can we determine who is poor before aggregating across dimensions? In fact, Alkire and Foster do not propose this, what they propose is 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.

We believe the above is an important contribution at the conceptual level. In fact, it 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 within individuals occurs before any meaningful process of identification: only after a single 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 within individuals occurs after the identification of deprivations.

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 up 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 depart from the fact that the dimensions have been chosen considering a set of attributes or assets that play an important role in human development, that we lack
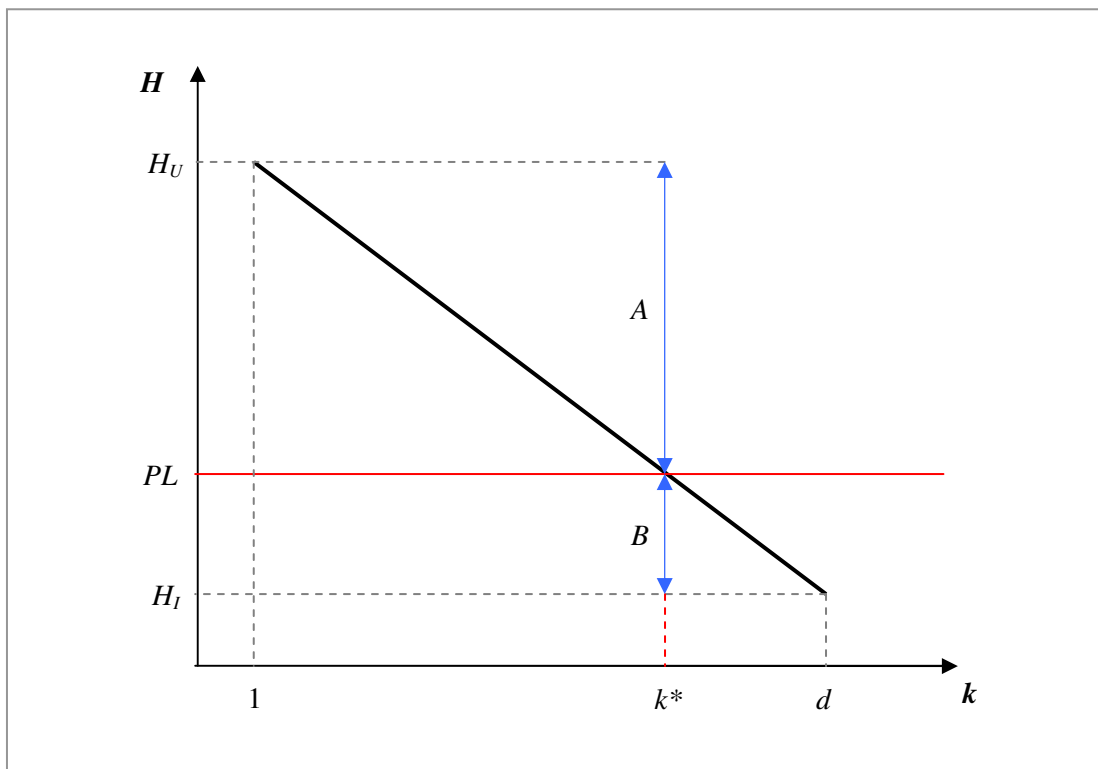
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[7] Alkire and Foster (2008) consider an ample array of properties when discussing their poverty measures. These poverty measures include generalizations that provide information about the breadth of deprivation. The simplest is given by the product of the headcount ratio (*H*) and 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 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 (e.g. it will fall if a deprivation is removed 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 analysing all their family of poverty measures. Instead, we focus on those satisfied by their "dual cut-off" identification function.

prior information or specific criteria to regard any one of them more important than another, 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 which extent of deprivation is required to classify an individual as "poor". In other words, and since no single asset can be univocally understood as essential nor substitutable, we prefer to stay away from both the "intersection" and "union" approaches.

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

Let us start 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 for H. In fact, increasing the value for k implies moving towards an "intersection approach". As it becomes more difficult to find individuals 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.

Graph 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 assets are distributed among the population. For example, in the extreme case in which access to one of the assets implies access to all of them (conversely, if deprivation from

any single asset implies deprivation from all of them), the *H(k)* function will be flat. Under this scenario, the use of a multidimensional indicator to measure deprivation will be of little relevance. Under a more general setting, however, one can expect function *H(k)* to exhibit a negative slope or, in terms of what is depicted in Graph 1, that multidimensional poverty incidence for $k = 1$ will be larger than its counterpart under $k = d \left(H_U > H_I \right)$.

If we want to compare *H* and *LP* indicators, we need to start by asking ourselves if the latter is or not an element of the former. Is this is true, it implies that there exists a value for *k* between 1 and *d* for 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 $\left(H_U \geq PL \right)$. Conversely, when $k = d$, all of those classified as poor according to the *H* measure are also deprived in the monetary dimension $\left(PL \geq H_I \right)$.

With this in mind, we argue that the value of *k* where our *H* indicator and the conventional *PL* indicator intersect (*k**) can be informative of the potential tension between the 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 $\left(PL = H_I \right)$ 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 assets. To the extent in which the attributes selected comply with the characteristics discussed above, it can be argued that we do not need to wait until a person is deprived of all of them to call her "poor".

At the other side 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 $k^* = 1$. Under this scenario, the *PL* indicator is consistent with deprivation in one or more dimensions $\left(H_U = PL \right)$ 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 little information in added to the analysis by introducing an additional dimension. We believe 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 above discussion, the first piece of information will suggest that the *PL* indicator tends to understate the degree of deprivation. If we consider the fact 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 from the attributes considered. In terms of Graph 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 up to $d - 1$ dimensions, divided between those who surpass the monetary poverty line (considered within *A*) and those who do not (considered within *B*) (please refer to Appendix 1 for a detailed graph on the sets involved).

From Graph 1 it is easy to see how (for a given slope) the larger the difference between distances *A* and *B*, the closer will *k** 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 (i.e. using the *LP* indicator to measure poverty) implies leaving behind a considerable proportion of these individuals and introducing a potential downward bias in our poverty assessment.

At the other side of the spectrum, as *k** gets close to 1, *B* will eventually surpass *A,* and this will reveal 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 that have access to many of the assets considered.

Since the population involved 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 is this group 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 that can be classified as non-poor in monetary terms, and as *%B* the proportion of those who fail to surpass the monetary poverty line. These relative measures can be easily computed using:

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

Where $H(1, d-1) = H(1) - H(d)$ refers to the proportion of individuals (with respect to the total population) which 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 be larger the larger the value for *%A* (or the smaller the value for *%B*). The opposite situation will occur as *%B* grows towards one.

None of these situations is desirable in terms of policy design. As $\%A$ grows towards one, the *PL* indicator "looses power" to reject the status of "non-poor": while we can be sure that those classified as poor are surely in need, we cannot say that those deemed as non-poor no longer suffer considerable deprivation. A situation like 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 $\%B$ grows towards one and the *PL* indicator is still used as the prime targeting tool. Under these circumstances, the *PL* indicator "looses power" to reject the status of "poor": those classified as non-poor surely enjoy a large endowment of assets but we cannot assure that those classified as poor do not.

Before applying this framework and discussing our results for the Peruvian case, we believe is important to stress that this is not intended as a tool to determine if the *PL* indicator under of 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 up to what extent the *PL* indicator tends to under 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 assets considered for the multidimensional approach are not perfect substitutes nor perfect complements in the understanding of 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 depart from a rather 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[8]. This, however, is not our intention. We simply want to select a reasonable set of aspects which enjoy of minimum consensus regarding their importance for human development in order to: (i) test drive the Alkire-Foster identification methodology; and (ii) compare these results against those obtained when identification is solely based on a monetary poverty line.

The question of whether we have selected too many or too few aspects to reflect poverty will never be free of controversy. To appease our minds we could argue that the four aspects selected are closely related to five of the eight Millennium Development Goals (MDGs)[9], and that these enjoy a broad consensus. Battistón, *et al.* (2009), also rely on the Alkire-Foster multidimensional approach and consider a similar set of dimensions, although no direct indicators for health or nutrition were proposed, and those related to

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[8] For instance, one could find reasons to classify nutrition within health or argue that housing conditions are more on the side of determinants than outcomes, and 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).

housing conditions were each considered as a specific dimension[10]. The dimensions chosen are also 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 can arise when selecting dimensions, even more can be expected when discussing the specific indicators chosen to reflect the achievements of interest. In our case, three critical elements came into play: (i) if the indicator reflects a relevant achievement within the chosen dimension; (ii) how well does it reflect an asset than we can require social policies to deliver; and (iii) the availability of information in a representative household survey.

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

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	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	42.5%	47.7%
Dwelling conditions	Adequate water supply; adequate sewage service; non-precarious materials; non-crowded household	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	48.6%	36.2%
Vulnerability	Household head literacy condition	Household head is reported as illiterate	11.3%	9.2%

The table above 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 Battistón, *et al*. (2009), we seek to complement our direct "basic needs" indicators with an "indirect measure" of deprivation such as

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[10] As will be discussed soon, we propose integrating several housing conditions indicators into a single dimension.

household per-capita expenditure. More importantly, however, the inclusion of the *PL* criterion will ease comparability between the results obtained by 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 access to basic education by children, and a second one related to the household head educational attainment. Although both are related to human capital, the first one has more to do with the current investment flow while the latter measures the available stock within the household. In fact, educational attainment of children determines the household's future consumption path, while that of the parents is behind 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 household per capita consumption. However, its inclusion seeks to reflect household's vulnerability rather than its consumption level[11]. We decided to work with the household head's literacy condition because this reflects a minimum standard in cognitive skills and, quite importantly, because its status is responsive to contemporaneous policy intervention.

All the information used to build the indicators proposed was obtained from *the Encuesta Nacional de Hogares* (ENAHO) for years 2004 and 2008. This survey retains representativeness down to the regional level and is the basis for poverty measurement in Peru. 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 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 later is calculated using calorie equivalences for each of the goods consumed by the household[12]. 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 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, 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 less 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* (INEI).

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[11] Several studies (e.g. 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.
[12] As the Peruvian extreme poverty line is measured in terms of food intake, one could argue that household identification as extreme poor or non-extreme poor could suffice to measure deprivation in the nutrition dimension. The extreme poverty line, however, is based on food consumption of a representative household while the measure we propose considers the specific composition and calorie 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.
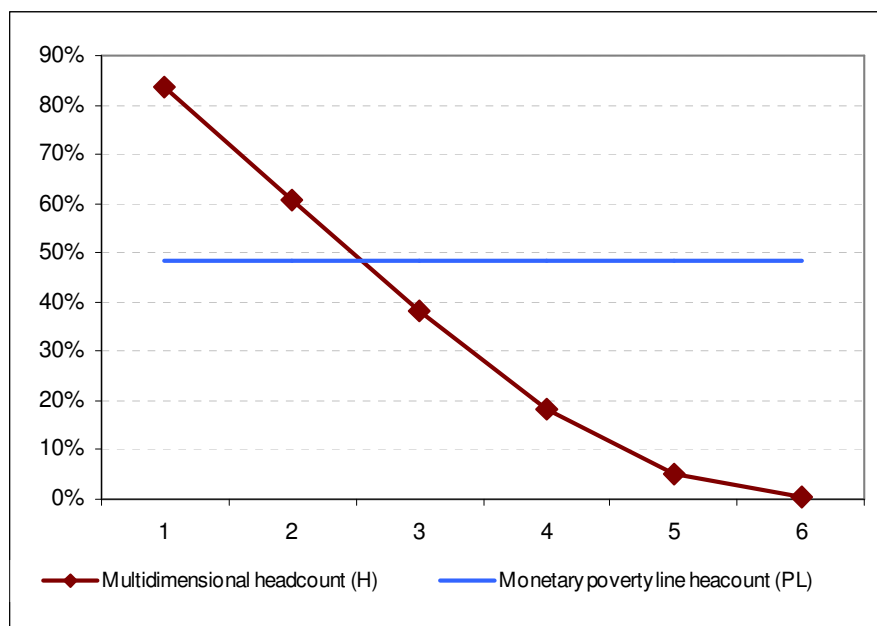
A quick comparison of the extent of deprivation from each of the dimensions considered between 2004 and 2008, already provides some insight regarding the potential differences between the standard unidimensional measure and a multidimensional approach based on the indicators proposed. In fact, and while the percentage of households deprived in the monetary dimension (which is equivalent to the official poverty figure in Peru) has fallen considerably, the rest of indicators have not improved at a similar rate. A reasonable prior, thus, 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 Graph 2 show empirical versions of Graph 1 using the indicators described in the previous section and Peruvian data for years 2004 and 2008. A quick inspection reveals that the reduction in the level of the *PL* indicator that 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 larger tendency to understate the overall level of deprivation.

Graph 2: Peruvian multidimensional and monetary poverty headcounts

Panel (a): 2004

Panel (b): 2008

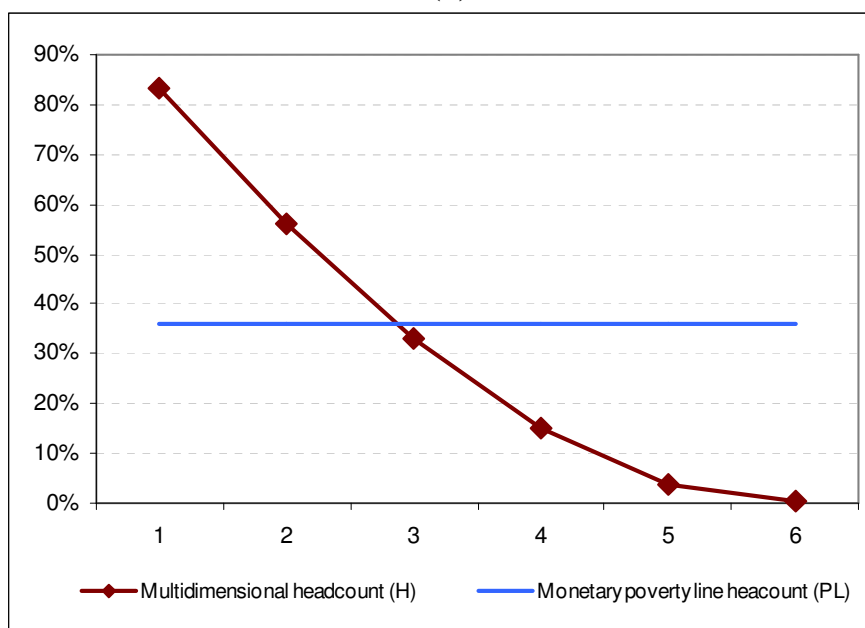

Table 2: Measuring the tension between the incidence of monetary poverty and the overall degree of deprivation

	Mulditimensional headcount (H)						PL	Hu - PL (A)	PL - Hi (B)	%A	%B
	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%

To formalize this, Table 2 presents values for "distances" $A = (H_U - PL)$ and $B = (PL - H_I)$, and our summary 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 has remained practically unchanged between 2004 and 2008, results provided by the *PL* indicator have 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 happened in 2004, more than half of the individuals deprived in 1 to 5 of the dimensions considered are now able to surpass the monetary poverty line. Thus, if we continue relying on the poverty line indicator for identification purposes, we now face a larger risk of classifying as non-poor individuals who still endure considerable deprivation.

In terms of the motivation of this analysis, the results discussed above should suffice to warn us against excessive optimism regarding the recent evolution of the monetary

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poverty indicator. The expansion in consumption levels that has allowed a 12 point reduction in the incidence of monetary poverty in the last five years has not been accompanied by increases in other achievements crucial for human development. While a simple inspection of deprivation levels from these assets could have shed some light on the matter, we believe a multidimensional approach for poverty measurement and the identification method exploited above have provided a formal framework to address this issue.

3.3 Poverty and policy

The advantages of the multidimensional approach are not limited to contributing with a dose of formality in discussions like the above. We believe poverty measures should convey information regarding the effectiveness of social policies, and the Alkire-Foster identification method exhibits a series of desirable features to track 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 to build an aggregate measure that conveys information regarding access to basic services which 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 removing such deprivation. Put it in other terms, the policy maker would not be able to provoke a significant reduction in the multidimensional headcount ratio (H) unless it focuses on guaranteeing increases in those dimensions in which the poor are deprived[13].

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 intraregional comparisons in order to determine: (i) if differences between PL and H measures are homogeneous between regions; and (ii) what are the reasons that explain these differences within regions.

The dimensional cut-off value chosen for this assessment is two. Discussing the appropriateness of such value is beyond the scope of this exercise. As discussed in the previous section, we do not seek to uncover a "true" incidence of poverty and compare this value against official figures. Our previous analysis was conducted in relative terms[14] and for a given set of attributes, and we have intentionally avoided prioritizing any of them. At this stage, however, the analysis requires us to select a dimensional cut-off value and it is difficult to do so without loosing a considerable degree of impartiality. Thus, and while we claim 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

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

[14] Note that our previous discussion has focused on the evolution of our comparative measures and not on their level values.

any person who lacks one third or more of a set of important attributes for human development is not an unreasonable standard.

Although the indicators considered are not exactly the same as ours, Battistón, *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 year 2006 was close to 65%, Mexico and Brazil followed behind with indices around 40% and 25%, respectively, while Argentina, Chile and Uruguay were at the bottom of their ranking with multidimensional poverty figures below 10%. As shown in the table above, with a dimensional cut-off value of two, Peru's multidimensional poverty headcount is 56.2% in year 2008. This places Peru below El Salvador but ahead Mexico and Brazil, a similar relative position as that obtained if we compare monetary poverty figures for these countries between 2006 and 2008 (see ECLAC, 2009).

Table 3 reveals that discrepancies between the *PL* indicator and our proposed *H(2)* measure have raised considerably between 2004 and 2008. In particular, the percentage of multidimensional poor that are deemed non-poor according to monetary standards have raised from 25.8% up to 39.0%. This is just the flip side of the coin of the results discussed in the previous section and warns us against relying solely on the monetary dimension for poverty assessment.
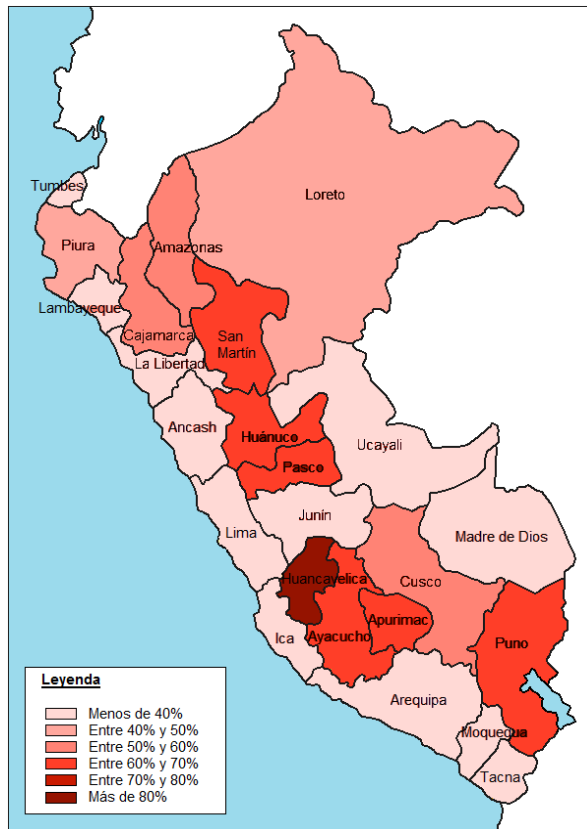
Table 3: Multidimensional poor and non-poor classified according to the *PL* indicator

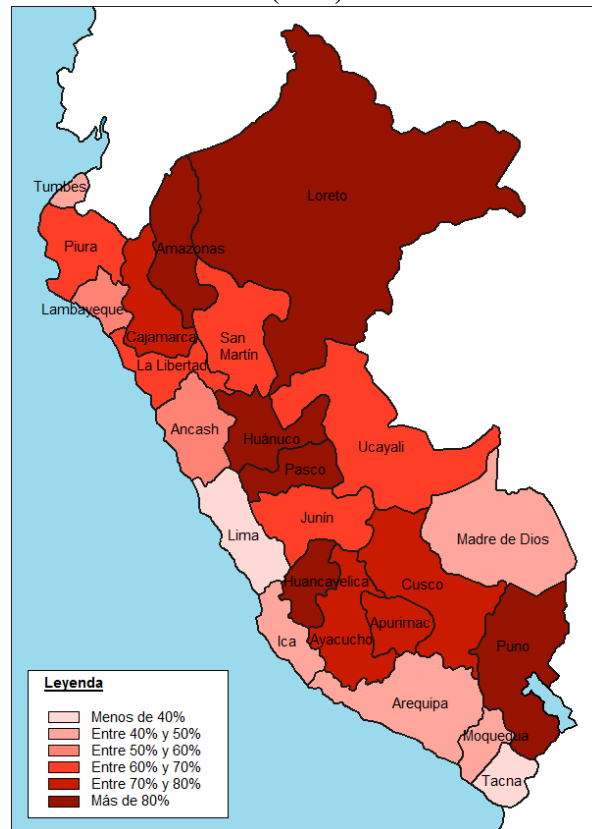| 2004			2008		
PL classification	Multidimensional classification (k = 2)		*PL* classification	Multidimensional classification (k = 2)	
	Non poor	Poor		Non poor	Poor
Non poor	94.3%	25.8%	Non poor	97.1%	39.0%
Poor	5.7%	74.2%	Poor	2.9%	61.0%
Total	100.0%	100.0%	**Total**	100.0%	100.0%

More interesting is the interregional comparison proposed in panels (a) and (b) of Graph 3. The use of poverty maps to offer a quick overview of interregional differences regarding poverty incidence is now widespread. In this case, we propose using six poverty groups. A rapid comparison between panels (a) and (b) reveals that our *H(2)* indicator provides (uniformly) a less optimistic panorama regarding the incidence of poverty. In fact, 21 out of 24 regions shift to a higher poverty group and 13 of them shift more than one group ahead.

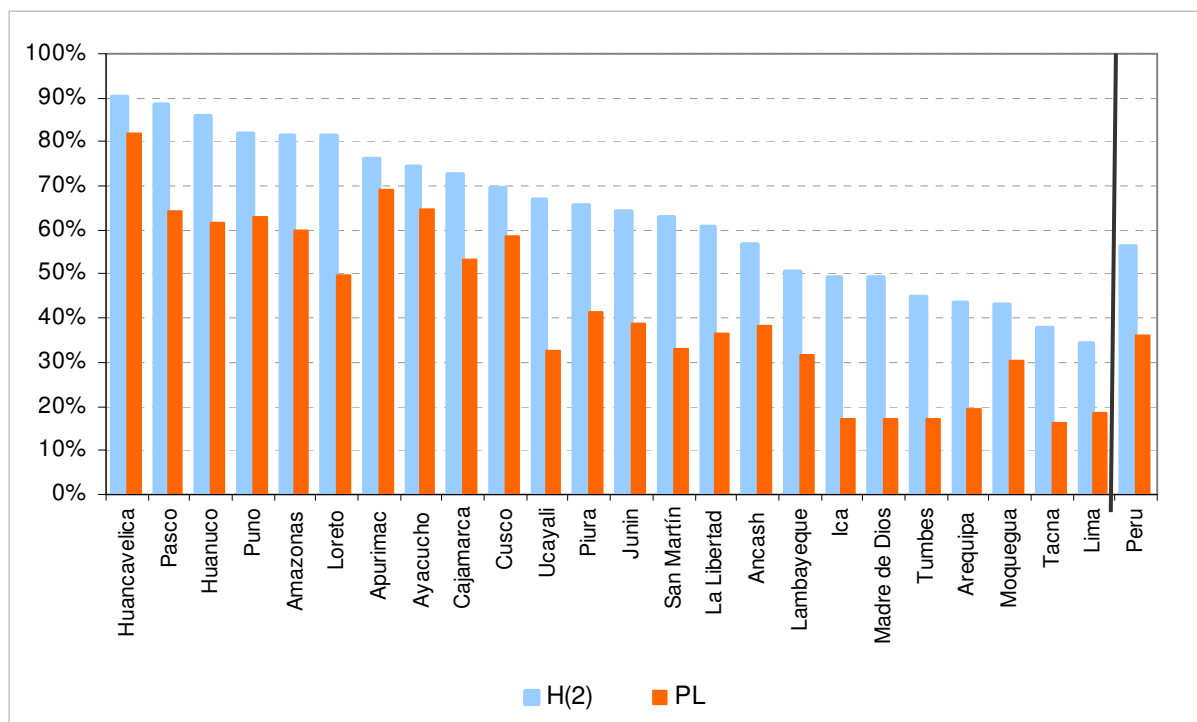# Graph 3: Peruvian monetary vs. multidimensional poverty maps (2008)

Panel (a) Monetary poverty map

Panel (b): Multidimensional poverty map (k =2)

Graph 4: Regional incidence of monetary and multidimensional poverty (2008)

Graph 4 provides more detail on interregional differences and reveals that the *PL* indicator is below the multidimensional headcount ratio across all regions. Differences, however, rage 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 on Peru's southern highlands. However, and unlike the monetary measure, the multidimensional indicator uncovers significant levels of deprivation affecting the northern Amazon area.

On an interregional basis, our multidimensional measure instructs the policy maker to increase (although in different degrees) its concerns regarding the overall level of deprivation throughout the country. An intraregional analysis, however, could reveal that the specific focus of these concerns should differ across regions. 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 focus on providing more access to adequate dwelling conditions and health services.

Table 4: Percentage of multidimensional poor deprived in each dimension

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%
PERU	**61.0%**	**19.3%**	**66.1%**	**75.9%**	**15.6%**	**55.2%**

Dwelling conditions is a particularly interesting dimension since nearly 76% of the multidimensional poor (at the national level) are deprived from it. A closer look reveals that most of this deprivation status is due to the lack of access to an adequate water supply: 74% of the multidimensional poor deprived in the dwelling conditions dimension lack this attribute[15].

4. Concluding remarks and avenues for further research

In this analysis we have pursued two main objectives. First, we wanted to address the apparent controversy between the recent evolution of monetary poverty figures and the levels of deprivation of the Peruvian population. For this, we relied on a multidimensional approach for poverty measurement and, in particular, on 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 years 2004 and 2008. Our results indicate that the recent 12 point reduction in the incidence of monetary poverty has not been accompanied by increased access to other assets important for individuals' well-being and ability to develop. Nowadays (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 pass the monetary poverty line. An immediate implication is that we currently face a larger risk of classifying as non-poor individuals who still endure significant deprivation if we only rely on the monetary dimension for identification purposes. According to 2008 figures, 39% of individuals lacking one third or more of the attributes considered would be classified as non-poor according to the monetary poverty line. This proportion was only 26% in year 2004.

Our second objective was to illustrate how the multidimensional measure proposed can aid policy design by providing correct incentives to focalize interventions. For this, and in similar fashion as in a recent regional study relying on the same methodology, 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 uncovered several results worth highlighting: (i) the multidimensional headcount is larger 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 uncovers significant deprivation in the northern Amazon; (iv) deprivations endured by the multidimensional poor are similar across regions and concentrated on the health and dwelling conditions dimensions; and (v) at the national level, 76% of the multidimensional poor are deprived in the dwelling condition dimension, 74% of these lack an adequate water supply and 52% lack an adequate sewage service.

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[15] In addition, 51.8% lack an adequate sewage service, 25.2% live in a crowded household, and 18.8% inhabit a precarious dwelling.
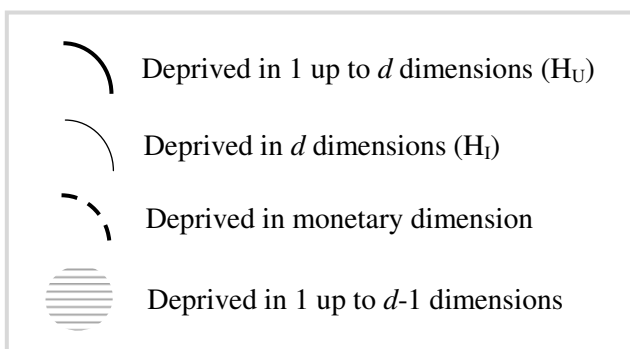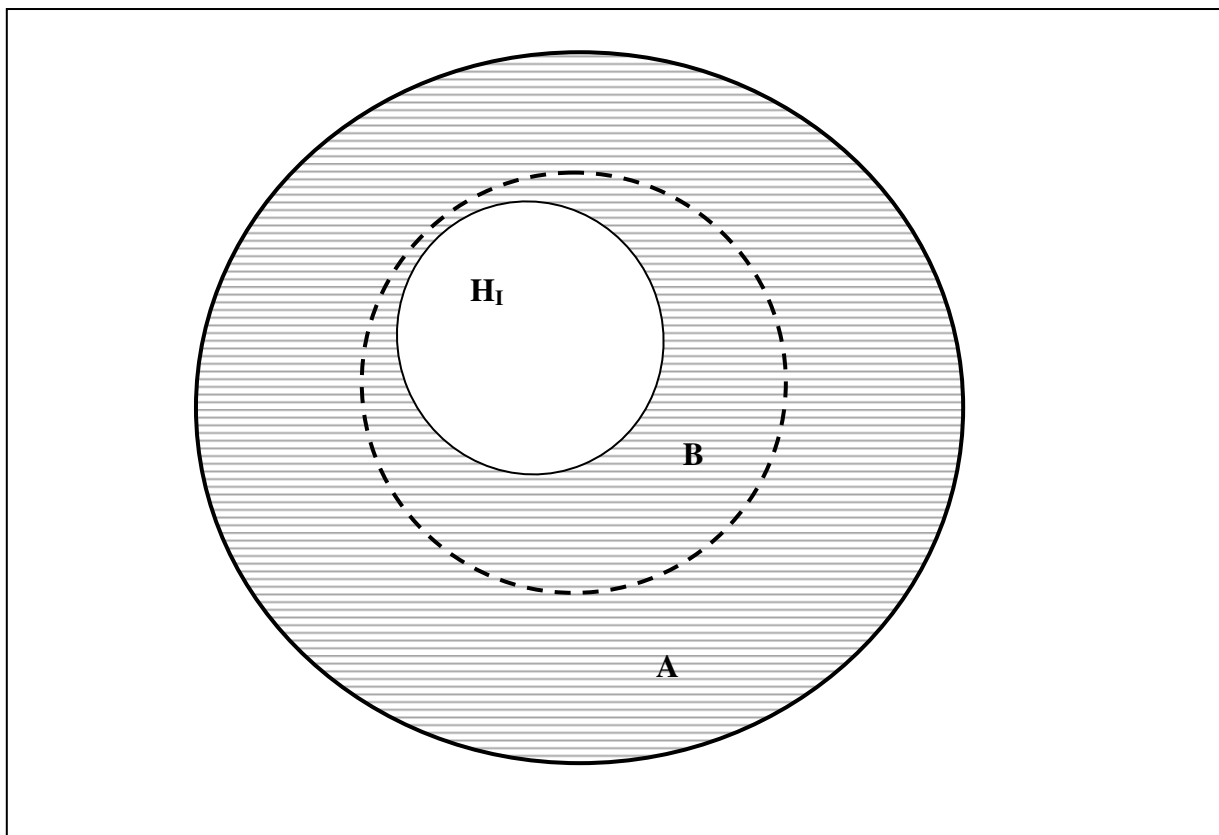
These last two results have an important policy implication: to achieve a significant reduction in our multidimensional poverty headcount across most regions (and, thus, at the national level), policymakers should focus on the provision of improved water and sanitation services. At the national level, this finding is not at odds with results obtained for several other LAC countries (see Battistón, *et al*., 2009). Within Peru, the fact that the main contributor to multidimensional poverty is similar across regions should not be overlooked as it represents an important opportunity to focalize public investment efforts.

Finally, further research efforts on the matter could focus on the use of weights to account for dimensions with different degrees of importance. Alkire and Foster (2008) discuss how to implement a weighted sum of deprivations, while subjective poverty measures could be used to estimate these weights. More along the lines of exploiting these tools to focalize policy interventions, an important extension for education indicators in Peru would be to account for quality via the results of national standardized tests. The prime challenge to accomplish this, is to match test results with children's household characteristics found in our LSMS.

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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 up to d-1 dimensions.