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Challenges in designing national multidimensional poverty measures

Maria Emma Santos

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Abstract

Countries are increasingly interested in having an official multidimensional poverty index (MPI). This is the expression of a growing consensus regarding the limitations of income poverty measures as standalone indicator. This paper analyses the challenges in designing such indices. Specifically, it addresses the selection of the unit of identification, the selection of dimensions and indicators, including the issue of missing values and the debate on whether to include an indicator of monetary deprivation or not, the weighting structure and the poverty cutoff. In general, for all the reviewed items, the bottom line is that there is no canonical procedure for making these choices. It is essential to critically assess the advantages and disadvantages of each option and the conceptual implications entailed, as well as to complete a careful empirical analysis, via robustness, sensitivity and bias checks, of the implications of the decisions taken.

Introduction

Countries are increasingly interested in having an official multidimensional poverty index (MPI). This is the expression of a growing consensus regarding the limitations of income poverty measures as standalone indicators.[1] This consensus emerges from different approaches and global agreements. These include the Millennium Development Goal (MDGs), now replaced by the Sustainable Development Goals (SDGs), which cover the multiple aspects of deprivation at the core of poverty and their inter-linkages. Conceptual frameworks such as the rights approach and the capability approach have also gained interest and recognition, fuelled by participatory studies that show that the poor themselves describe their deprivations in terms beyond a lack of income (Narayan et al., 2000; UNDP, 2013).

At the moment, there are 14 countries with an official national MPI. Nine countries are in the Latin American region (and belong to ECLAC): Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Honduras, Mexico and Panama; four countries are in the ESCAP region: Armenia,[2] Bhutan, Pakistan, Nepal; and one — Mozambique—is a member of UNECA.[3] [4] Its salient characteristics are summarised in Table 2.

Designing an MPI involves a number of normative decisions that require careful scrutiny and justification for the measure to satisfy its defined purpose. This paper addresses the key normative *technical* decisions in the construction of a national MPI, understood here as a poverty index following the Alkire and Foster (2011) methodology (AF hereafter), which is succinctly described in Box 1. Each

[1] Note, however, that income poverty is undeniably important, revealing a lack of command over resources and a lack of freedom to choose. The point here is that it is not a sufficient indicator.

[2] Armenia also belongs to UNECE.

[3] In the companion study (Santos, 2018a), eight other MPIs are also analysed; it includes four non-official national measures, three regional MPIs and the global MPI.

[4] References for each reviewed MPI are the following: Armenia (National Statistical Service of the Republic of Armenia, 2016), Bhutan (National Bureau of Statistics, 2014), Chile (Ministerio de Desarrollo Social de Chile, 2013, and Berner, 2016), Colombia (Angulo et al., 2013), Costa Rica (INEC, 2015), the Dominican Republic (Sistema Único de Beneficiarios [SIUBEN], 2017), Ecuador (Castillo Añazco and Perez, 2015), El Salvador (Government of El Salvador, 2015), Honduras (SCGG-INE, 2016), Mexico (CONEVAL, 2010), Mozambique (Ministério de Economia e Finanças Ministério de Economia e FinançasMinistério de Economia e FinançasMinistério de Economia e Finanças, 2016), Nepal (National Planning Commission Nepal, 2018), Pakistan (National Planning Commission Pakistan, 2016), Panama (Government of Panama, 2017), global MPI (Alkire and Santos, 2010, 2014; UNDP, 2010), MPI-LA (Santos et al. 2015; Santos and Villatoro, 2016), and Arab MPI (League of Arab States Ministerial Council for Social Affairs, 2017).

critical decision is first presented and the available alternative practices are discussed with their advantages and disadvantages. This document builds on Alkire et al. (2015, ch. 6–8) and Alkire et al. (2018), as well as on the experiences of the available national MPIs, the global MPI and regional MPIs.

Prior to considering the issues that will be addressed here, the MPI needs to have a clear purpose. Here it is assumed that the **purpose** of a national MPI is to monitor the evolution of poverty —understood in a multidimensional way— in a measure representative of the whole population, in order to inform public social policy aimed at its reduction.[5] Note that such a measure must enjoy a good degree of public support and appear adequate to measure poverty in that particular country, i.e. it must be legitimate. This affects the *process* by which such MPIs must be designed, as the process must involve not only policy makers and experts' opinions but also views from people experiencing poverty, from the civil society in general, from the private sector and from the media —that is, from a variety of stakeholders. Moreover, institutional arrangements must guarantee the sustainability and credibility of the measure over time and successive governments. Alkire et al. (2018) offer a more in-depth discussion of the process of engaging the different stakeholders and building support.[6]

A second, related fundamental decision is the **space** in which poverty will be measured. MPIs can be constructed with indicators of very different natures. The selection of the space is strongly linked to the underlying well-being concept, namely, which kind of indicators is considered to reflect well-being more accurately? The selection of the space of measurement is also linked to the understanding of the scope of public policy. To what extent and in which kind of achievements are governments accountable for? Is it access to resources, or observed functionings or reported satisfaction?

We can distinguish two broad categories frequently used as spaces for MPIs: resources and functionings.[7] Resources are goods or services that enable the satisfaction of needs. The basic needs approach, for example, advocated for the specification of minimum quantities of particular resources, "such things as food, clothing, shelter, water and sanitation that are necessary to prevent ill health, undernourishment, and the like" (Streeten et al. 1981, p. 25). In other words, although these resources are only means to valuable ends, and are subject to criticisms,[8] these means are closely connected with the ends they facilitate. Under data constraints, access to resources may be the best possible space to evaluate well-being. Also, even when access does not necessarily imply effective use, good service quality and so on, it is a valuable piece of information on itself as both markets and governments are imperfect.

However, the capability approach (Sen, 1979, 1997, 2009) has called attention to the relevance of functionings and capabilities for evaluating well-being, as these constitute valuable ends, reflect effective achievements and the freedom to choose. **Functionings** are "the various things a person may value *doing* or *being*", which range from fundamental ones such as being adequately nourished and being free from preventable diseases, to more complex ones such as taking part in the life of the community. The set of all functionings available to the person form the person's capability set or capabilities. Observed functionings —the ones that the person has actually chosen from her capability set— reflect that person's achievements.[9] Measuring functionings requires a different kind of indicator than when measuring access to resources. For example, it requires measuring the actual nutritional status of each household member, not their food consumption level, and evaluating their cognitive skills and not whether they have had access to schooling. Surveys are gradually incorporating instruments to capture functionings. Yet, as evidenced in the companion study (Santos, 2018a), most data sources are still far from offering a wide

[5] Within national measures there could be other purposes, such as group-specific MPIs —for example for children or for the elderly— or targeting measures, among others. Although the design of such measures shares most of the challenges discussed here, the challenges and decisions for measures with different purposes do not fully overlap.

[6] See Alkire et al. (2018) for a summary of the purposes of national MPIs so far.

[7] Income may be considered within the resources space (although income is a broad resource).

[8] For example, means may be of different quality, and people may have different personal characteristics and circumstances that affect the "conversion factors" of means into ends.

[9] For further details see Sen (1997), pp. 394–95. There is a related discussion on the difference between capabilities (which include available functionings that were not chosen) and observed functionings, and the role of freedom. In essence, there is a convergence towards the idea that low achievements in basic functionings reveal a lack of freedom (Sen, 1985; Fleurbaey, 2004; Sen, 2002; Alkire et al., 2015, ch. 6).

range of data on functionings. Thus, in current practice, indicators of functionings are frequently combined with indicators of access to resources in order to make the best possible use of available data. Also, as argued above, both kinds of indicators —specific resources and functionings— offer valuable and complementary information. For example, the indicator tracking children's school attendance reveals school availability and a household's compliance with national educational laws, whereas children's cognitive skills reveal (even if imperfectly) education quality.

There are also subjective indicators. Some subjective indicators, such as measures of self-respect, or sense of affiliation, have been considered among functionings (Nussbaum, 2000; also, Alkire, 2004) or —at least— good proxies of these. There are also indicators of *subjective well-being* (say, in the hedonic space), such as happiness and life satisfaction.[10] Subjective indicators indicators in general have the weakness of adaptive preferences.[11] For that reason, as well as because well-being is understood as intrinsically multidimensional, the capability or functionings approach cannot be reduced back to a unidimensional space of happiness or life satisfaction, but it may include some indicators of this kind.

In fact, while no MPI has been designed entirely using subjective indicators, some MPIs have incorporated one or a few indicators of this kind, as it is the case of Armenia, which includes satisfaction with certain basic services. Relatedly, Chile and Dominican Republic's MPI include indicators of perception of discrimination.

In what follows, it is assumed that both the purpose of the measure and the measurement space of the MPI has already been defined. The different decisions addressed here are strongly interlinked, and, thus, although they are presented sequentially, many of them are simultaneous, as one affects the others. Note, for example, that the selected purpose and space of measurement impose data requirements. The purpose of monitoring poverty and informing policy requires data of annual frequency at least. The space, be it resources or functionings or some intermediate combination, requires covering a minimum set of dimensions, most likely present in multi-topic surveys.

10. See Villatoro (2012) for a review of the concept of subjective well-being in the psychological literature.

11 People tend to adjust desires and expectations to what they consider feasible. Thus, the happiness metric can be unfair to those persistently deprived. (Sen, 2009, p. 282, 283).

Box 1
The Alkire-Foster methodology

The construction of an MPI that uses the Alkire-Foster methodology is based on the M_0 measure, also called the adjusted headcount ratio, proposed by Alkire and Foster (2011). The following brief description is taken from Santos and Villatoro (2018).

Let $x_{ij} \in \mathbb{R}_+$ be the achievement of each person $i = 1, \dots, n$ in each indicator $j = 1, \dots, d$, and let z_j be the deprivation cutoff of indicator j. A person is deprived in this indicator if her achievement is below the deprivation cutoff. Formally, deprivation is defined as $g_{ij}^0 = 1$ when $x_{ij} < z_j$ and $g_{ij}^0 = 0$, otherwise. Then, the deprivation of each person is weighted by the indicator's weight, given by w_j, such that $\sum_j w_j = 1$. From this, a deprivation score is computed for each person, defined as the weighted sum of deprivations $c_i = \sum_{j=1}^{d} w_j g_{ij}^0$. Then, with this score the poor are identified using a second cutoff, the poverty cutoff, denoted by k, which represents the proportion of minimum deprivation a person must experience in order to be identified as poor. That is, someone is poor when $c_i \geq k$.

The deprivations of those not identified as poor are then ignored; technically, they are censored. Formally, censored deprivations are defined as $g_{ij}^0(k) = g_{ij}^0$ when $c_i \geq k$ and $g_{ij}^0(k) = 0$, otherwise. Analogously, the censored deprivation score is defined as $c_i(k) = \sum_{j=1}^{d} w_j g_{ij}^0(k)$.

Once the multidimensionally poor have been identified, the M_0 measure combines two fundamental sub-indices: the **proportion** of people who are multidimensionally poor (also called "poverty incidence") and their poverty **intensity** or the average (weighted) deprivations among the poor. Formally, the proportion of poor people is given by $H = q/n$, where q is the number of people identified as poor. Poverty intensity is given by $A = \sum_{i=1}^{n} c_i(k)/q$. MPI, as M_0, is the product of these two sub-indices:

$$\boldsymbol{MPI = M_0 = H \times A = \frac{1}{n} \sum_{i=1}^{n} \sum_{j=1}^{d} w_j g_{ij}^0(k)}.$$

By adjusting the incidence of multidimensional poverty by the intensity, M_0 satisfies **dimensional monotonicity** (Alkire and Foster, 2011a): if a poor person becomes deprived in an additional indicator, M_0 will increase.

Because of its additive structure, the M_0 measure allows two types of decompositions that are useful for informing policy. First, M_0 can be decomposed into population subgroups. This is because the M_0 of the overall society can be obtained as the population-weighted sum of subgroup poverty levels (subgroups need to be mutually exclusive and collectively exhaustive of the population). Then, the subgroup's percentage contribution to overall poverty can be computed as the subgroup M_0 weighted by its population share, over the overall M_0. Second, after identification, M_0 can be **broken down by indicator**. The overall M_0 can be expressed as the weighted sum of the proportion of the total population who have been identified as poor and are deprived in each indicator (weights refer to the *relative* weight of each indicator). These proportions are the so-called "censored headcount ratios". This enables analysis of the contribution of deprivations in each indicator to overall poverty. The percentage contribution of an indicator to overall poverty is computed as the censored headcount ratio multiplied by its relative weight, divided by the overall M_0 measure.

Last, but not least, the M_0 measure is robust to the use of ordinal variables, as it dichotomizes individuals' achievements into "deprived" and "non-deprived". This means that poverty values are not changed when the variables' scales change.

Source: Own elaboration.

I. Selecting the unit of identification

After defining the purpose and measurement space of a national MPI, a fundamental decision is selecting the unit of identification, which is the entity to be identified as poor or non-poor. Computing an MPI requires having information on each selected indicator for the unit of identification in the same data source. The most commonly used units of identification are the household or the individual. Each has advantages and disadvantages.

Selecting the individual as the unit of identification coheres with a human rights approach and allows analysis of the intra-household distribution of resources (in nutrition, health, and education, for example).[12] It also allows detailed subgroup decompositions (by gender and age for example), assuming the sample sizes are sufficiently big to allow representative estimates of such subgroups. These are important advantages that — in principle — contribute to the accuracy of the measure and information for policy makers.

However, selecting the individual as the unit of identification also has disadvantages. As this requires information on each indicator at the individual level, there is the problem of "applicable population". The applicable population of a certain achievement is defined here as the group of people for which such an achievement is relevant; namely, it can be measured and has been effectively measured, in this case, to inform poverty measurement (Alkire et al. 2015, p. 222).[13] Note that there are two components: "can be measured" and "has been measured". Each poses a separate issue.

The first issue refers to the fact that surveys do not collect information on all indicators at the individual level. For example, surveys that collect information on anthropometric indicators (the Multiple Indicator Cluster Survey [MICS] and Demographic and Health Survey [DHS], in particular) typically do so for children under five years old and women of reproductive age. Of course, if there is strong political

[12] Strictly speaking there are some human rights that are of collective nature (May, 2013). However, this does not affect the individualistic essence of a human rights approach (Haijar Lebb, 2011).

[13] "Applicable population" differs from "eligible population", which is the population that has been defined as eligible to collect information from for a specific indicator (say, nutrition) in a particular survey.

will to include certain indicators in an official MPI at the individual level, this issue is amendable, as the national survey that will serve as the database for the MPI can be re-designed accordingly.[14]

Solving the second issue is less straightforward. Certain achievements are conceptually inapplicable to certain groups of the population, for example, income earned by infants, the occupational status of children or school attendance for adults.[15] There seems to be three possible ways to deal with this and none is problem free.

The first option is to narrow the set of indicators to those that are "universal", that is, which are conceptually applicable to all individuals regardless of age and gender. Universal indicators include housing, basic services, nutrition and consumption.[16] Note that although "education" or "school achievement" is, in principle, universal, it requires appropriate age adjustments. Even for nutrition, different indicators are used according to age.

The second option is to use a broader set of individual indicators with different definitions ("adjustments") for each particular population subgroup. For example, for nutrition, using the stunting indicator (height-for-age) for children under five, BMI-for-age for older children and BMI for adults (15 years and older). For education, one could use school attendance or grade-for-age for children of school age (which does not eliminate the issue of how to treat infants), and maximum achieved level of education for adults. However, this practice is not easily applicable to all indicators. For example, what to do with adults in an indicator intended to capture deprivation in children's vaccinations (if there was will to include such indicator) or what to do with children in an employment indicator?

Also, even if it was possible to somehow "find" a meaningful indicator definition for each specific age subgroup, the main problem is that each indicator would actually encompass many (subgroup) indicators, each reflecting a different type of deprivation and requiring different kinds of policy interventions. For instance, a child not attending school reveals a failure of social policy and the educational system in guaranteeing the right to education. This deprivation can be reduced with strong combined social and educational policies that reach the specific population and guide the educational process of the child. In turn, adults with low educational achievement are the legacy of past educational standards. This deprivation requires a different kind of policy, for example training programmes and/or schooling programmes that are specially designed for adults. "Counting" these deprivations as if they were the same, may not be of much help when attempting to design better social policy, unless the numbers are carefully decomposed into the population subgroups.

The third option would be to construct group-specific MPIs (child poverty measures, poverty among the elderly, etc.). However, first, this would not satisfy the purpose defined at the beginning, i.e. to monitor the evolution of poverty in a measure *representative of the whole population*. But even leaving that aside, discriminating by groups may lessen but will not eliminate applicability issues (Alkire et al. 2015, p. 224). No group is perfectly homogeneous, and indicators may need to be adjusted even within population subgroups, as is the case for nutritional and educational indicators for infants versus older children. Also note that group-specific poverty measures offer fragmented information that "may miss the overlaps of disadvantaged groups and fail to fully exploit possible synergies in policy design" (Alkire et al. 2015, p. 224).

When the unit of identification is the **household**, all household members' information is taken together and combined into household-level deprivation, and all household members receive the same deprivation score. For certain indicators that imply the use of common resources, namely housing and basic services, this is relatively straightforward. For example, if the household has access to safe

[14] The Dominican Republic created a specific survey instrument to collect information for the computation of the national MPI. However, the unit of identification is the household.

[15] Defining an "equivalent" deprivation to unemployment in adulthood for children does not seem straightforward.

[16] For consumption, note that *individual* consumption information would be required, which is not the usual practice in consumption surveys.

drinking water, it is assumed that all members enjoy the same access.[17] This has been the procedure traditionally used in monetary poverty measures, where the income of individual members is added up and then compared to the household poverty line for the equivalent number of adults.[18] However, indicators that are originally defined at the individual level, such as nutrition, employment, school attendance, school achievement or health insurance, need to be "transformed" so that they reflect deprivations at the household (Alkire et al., 2015, p. 221). Of course, the transformation procedure requires decisions and assumptions that must be transparent and explicit. Alternative procedures are discussed in section II.A.1. Again, no procedure is perfect.

It is worth noting that using the household as the unit of identification acknowledges intra-household positive and negative externalities that arise from individual achievements. Intuitively, all household members benefit from a better-educated member, and a member with a health condition can affect other members.[19] Additionally, some (although not all) social policies have households as the targeting unit. This is the case with Conditional Cash Transfer programs and housing programmes, but it is not the case with non-contributory pensions, for example. Finally, as explained above, using the household as the unit of identification imposes lower requirements on the data source. These reasons explain why using the household as the unit of identification has been the dominant practice in MPIs so far. One exception is the MPI for the European Union constructed using EU-SILC data by Alkire and Apablaza (2016), which has individuals 16 years and older as the unit of identification (excluding children from the measure).

It is also worth noting that even when the unit of identification is the household, the unit of analysis can still be the individual, reporting the poverty measure in terms of proportion and number of people.

In sum, while a priori and in theory selecting the individual as the unit of identification is a preferred option, in practice it entails several difficulties (conceptual applicability of indicators to different subgroups and data availability) that seem to justify using the household as the unit of identification as a second-best option.

[17] Admittedly, access to basic services can be unequally distributed within the household. Analogously, there is evidence that deprivations in safe water and clean energy, for example, are more burdensome for women and girls, who, in many contexts, are the ones who collect the water, gather the wood and spend more time at home. Yet capturing such inequalities (or intensities of deprivations) in surveys would require (a) several additional questions and (b) a different measurement technology, not yet developed in a rigorous way for ordinal variables. For the time being, dichotomizing into deprived and non-deprived is the most robust procedure for ordinal variables (Alkire et al., 2015, ch. 2.3).

[18] Analogously if consumption is used, overall household consumption is compared against the household poverty line according to its demographic composition.

[19] Measures that use the household as the unit of identification and that transform individual indicators into household ones have been called "combined measures" by Alkire et al. (2015, p. 224).

II. Selecting dimensions, indicators and weights

A. Dimensions and indicators

In this report, "dimensions" refer to conceptual categorizations and groupings of indicators; they facilitate the communication and interpretation of results. Indicators are the *d* variables that appear in columns of the achievement and deprivation matrices and are used to construct deprivation scores and to measure poverty (see Box 1 for the technical methodology) (Alkire et al., 2015, ch.6).[20]

It should be clear by now that the selection of dimensions and especially the selection of indicators are tied to the purpose of the measure, the space of measurement and the unit of identification. Reflecting on the purpose of the measure is also a fundamental guide for choosing dimensions and indicators. The focus of the measure may, for example, be on the acutely poor. This requires the measure to capture a set of more fundamental deprivations that are presumably linked to a biological approach to poverty, that is, people who are not meeting the minimum necessaries for the maintenance of mere physical existence. Such a purpose directs attention towards nutrition, (child or premature) mortality, housing, basic services (water, sanitation, energy), and elementary education. The global MPI (Alkire and Santos, 2010, 2014) is a reflection of these priorities. Of course, even in this approach there might some be variation according to the geography and culture of the country. Alternatively, the goal may be to capture poverty in slightly broader sense, including what may be referred to as a "second layer" of poverty. In that case, the services indicators can include other services such as public transport availability or solid waste collection, more demanding educational achievements, access to labour market opportunities (or, the more demanding indicator of decent work) and basic elements of social protection (contributory pensions, health insurance). The MPI-LA (Santos et al., 2015; Santos and Villatoro, 2018) is a reflection of a broader scope, as are many of the national MPIs. Chile, for example, has been innovative in including the presence of nearby sources of contamination, transport, and garbage collection services in its MPI, whereas Costa Rica, El Salvador and Panama have included access to internet in their MPIs.

[20] It is worth noting that an indicator may be grouped into different dimensions in different MPI designs. For example, access to clean water is most typically considered among the dimension of basic services or living standard, but, under data constraints and given that it is a health risk factor, it has sometimes been considered within the health dimension (Mozambique's MPI for example).

The selected space also delimits the kind of indicators to be used or, at least, privileged. If there is a preference for functionings over resources, for example, anthropometric indicators will be preferred over household consumption or food access, and cognitive skills over school attendance or educational achievement (i.e. maximum grade approved). The unit of identification poses additional constraints; certain indicators, such as employment, will not be easy to include in an individual measure of poverty.

The selection of dimensions and indicators tied to a national MPI's purpose may be justified by a human rights approach or by national legislation (as was the case in Mexico)[21] or by national development plans (as was the case in Colombia and Pakistan) or by participatory processes (as was the case in El Salvador) or by wide consultations with experts and different stakeholders (as was the case in Panama, Ecuador, Honduras and Pakistan).

Statistical approaches may also *inform* the selection of dimensions and indicators. In this case, dimensions are understood as latent factors of which one only observes certain indicators (with a pre-specified model or not, depending on the statistical technique used). However, any selection based on this kind of information needs to be validated from normative arguments, be transparent and enjoy some degree of consensus and support. The selection of dimensions, indicators and weights of an MPI purely based on statistical techniques would pose comparability issues over time and across subgroups.

The MPI design process was iterative in all cases and in some cases, even the first proposal was then validated on the ground. In other words, the purpose, the selection of dimensions and indicators, *and* the *process* by which the MPI was designed are strongly interlinked aspects.

It is worth noting that one prevalent approach in Europe is the so-called "consensual" approach to poverty, where the list of items considered as necessities is constructed using a survey about the public's perceptions of minimum needs (1983 Breadline Britain).[22] This approach has not yet been implemented in any MPI, and the "consensual" name is debatable (Walker, 1987; Piachaud, 1987), as the "consensus" is reached through a survey that uses a pre-established list of items. However, in combination with other methodologies, it may be useful.

Also, a good practice is to start from a comprehensive list of possible indicators (Alkire et al., 2018), especially if there is the possibility of designing or at least modifying the data source that will be used for the MPI computation. The list will then be narrowed down according to the purpose, space, unit of identification, design process and data possibilities.

While the range of possible dimensions seems a priori too wide, certain dimensions have been included in virtually all national MPIs so far, namely, education, health, housing, basic services and living standard (see Table 1), reflecting a strong consensus on their priority.[23] Of course, within each dimension, different indicators have been used. The companion study (Santos, 2018a) offers a detailed analysis of indicators used (which implicitly entail a selection of deprivation cutoffs) and a summary of indicators used in MPIs thus far in table 1 of that paper.

[21] In Mexico the indicators to be included in the national MPI were determined by the Ley de Desarrollo Social (CONEVAL, 2010).

[22] Mack and Lansley (1985) (based on Townsend, 1979) is the reference pioneer study on this approach.

[23] See also table 6.1 of Alkire et al. (2015) and the related discussion for more on consensus regarding relevant dimensions of poverty, and Alkire (2008) for common processes for selecting dimensions.

Table 1
Dimensions included in existing MPIs

Dimension	Global MPI	MPI-LA	Arab-MPI	Armenia	Bhutan	Chile	Colombia	Costa Rica	Dominican Republic	Ecuador	El Salvador	Honduras	Mexico	Mozambique	Nepal	Panama	Pakistan
Education	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Health	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Housing, living standards and basic services	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Employment and social protection		✓		✓		✓	✓	✓	✓	✓	✓	✓	✓			✓	
Environment						✓			✓		✓					✓	
Digital divide, networks and social cohesion						✓			✓		✓						
Child and youth conditions							✓										

Source: Alkire et al. (2018), based on official national reports detailed in the introduction.

In their work on social indicators for Europe, Atkinson et al. (2002) recommended six properties for single indicators: (1) the ability to **identify the essence of the problem** and have a clear and accepted normative interpretation, (2) **robustness** and statistical validity, (3) **responsiveness** to policy interventions (but not subject to manipulation), (4) **comparability** (across geographical units and over time), (5) to be **timely and susceptible to revision** and (6) **not too demanding** in terms of data collection (so as not to impose too large a burden).

Atkinson et al. (2002) also recommended having a balanced number of indicators across dimensions. In cases where this is not possible, the selection of weights can help balance the impact that a single indicator can have in the final MPI (Alkire et al., 2018). Discussion of the specific indicators for each dimension and their quality, comparability and data availability in the context of SDG 1.2 and 1.4 are discussed in detail in the companion report by Santos (2018a).

1. Dealing with group-specific indicators

As discussed in section I, the fact that certain indicators are specific to certain groups of the population (children, women, the elderly and so on) creates a challenge when designing a poverty measure. When the unit of identification is the individual, there are advantages and disadvantages (described in section I). When the unit of identification is the household, indicators that were originally defined at the individual level need to be transformed into a household indicator.

The approach most commonly followed when the unit of identification is the household has been "to use achievements drawn from a subset of household members (those for whom the individual indicator is conceptually applicable *and* has been measured), and make explicit assumptions about the distribution of such achievements and potential positive or negative intra-household externalities" (Alkire et al., 2015, pp. 224–225). When following this route, the most common procedure has been to use two levels of cutoffs: one at the individual level and another at the household level.[24]

[24] Note that these "two levels of cutoffs" occur prior to the *dual cutoffs* referred to in the Alkire-Foster (2011) methodology. The dual cutoffs of the Alkire-Foster methodology refer to having an indicator cutoff (to determine whether the unit of identification is deprived or not in each indicator) and a poverty cutoff (to determine whether the household is multidimensionally poor). The point is that when the unit of identification is the household, indicators that are primarily defined at the individual level require an additional cutoff *before* the household-level indicator cutoff. The union, intersection and intermediate criterion options apply to distinguishing household-level cutoffs (from individual ones) as well as to defining poverty cutoffs (from the different deprivations).

The individual-level cutoff identifies whether an individual household member is deprived or not in a certain indicator, such as whether a school-aged child is not attending school or whether an adult's BMI is below 18.5. The household-level cutoff, determines whether the household is deprived or not. In this respect, there are two possible extreme criterions to follow, as well as some intermediate criteria. The union criterion defines a household as deprived in a certain indicator if there is at least one person experiencing deprivation in that indicator. For example, a household can be considered deprived in school attendance if there is at least one school-aged child not attending school. The underlying logic is that even when household members are not themselves deprived, they are negatively affected by the deprivation of other household members. At the other extreme, there is the intersection criterion, which requires all the (applicable population) household members to be deprived in a certain indicator in order to identify the household as deprived.[25] An intersection criterion type of indicator would require all school-aged children not to be attending school in order to identify the household as deprived in school attendance. In between, intermediate indicators can be defined using some proportion of the household members experiencing deprivation as the benchmark for identifying the household as deprived.

Just as selecting the individual as the unit of identification is not problem free, transforming individual indicators into household indicators is not problem free either. When computing the MPI, depending on the criterion used for transforming individual achievements into household ones, there will be people considered deprived in an indicator when they may not actually be so, and vice versa. In that sense, one may think that there is a form of "inclusion error" (counting all household members as deprived if there is at least one who is deprived, for example), or "exclusion error" (not counting members as deprived because there is not a "sufficient" number of deprived people in the household).

Both identification errors tend to be bigger in larger households. Also, inclusion error tends to be bigger when a union criterion is used to transform individual achievements into household ones, whereas exclusion error tends to be bigger when an intersection criterion is used to transform individual achievements into household ones. Using an intermediate criterion is one way of attenuating the overall identification error when transforming individual-level indicators into household-level indicators, but it has been used less frequently in practice. For example, the union criterion has been used in indicators of child school attendance in all national MPIs that include it (presumably inspired by a children's rights approach). In the case of adult schooling, both union and intersection criterions have been used fairly equally (an intermediate criterion has only been used in the case of Colombia) (see Santos 2018a, section II.A).

A second relevant issue to consider when going from indicators of individual deprivation to indicators of household deprivation is how to treat households that do not have any member to whom a certain indicator is applicable. For example, how should households with no school-aged children for the school attendance indicator or households with no nutritional information because there are no children under five years of age be treated? One option would be to drop the households with no applicable population. However, this would bias the estimates, as – most likely – the inapplicability of a certain achievement to a particular population subgroup is due to the demographic composition, and, thus, it is not random. Another option would be to drop the indicator for those households and reassign its weight to the other observable indicators in the dimension. However, this would affect dimensional break-down and comparability (Alkire et al., 2015). A third option, which has been the practice so far, is to consider households with no applicable population for a certain indicator as non-deprived in that indicator. The logic is that — by definition — such households cannot experience such deprivation (they do not have members who may experience it). Thus, under this procedure, households with no school-aged children are considered non-deprived in school attendance.

Note, however, that when the indicator is conceptually applicable to household members but data is not collected (as is frequently the case with nutritional indicators), assuming that there is no deprivation in the household in this indicator is a conservative approach that will lead to a lower-bound estimate (Alkire et al., 2015, pp. 225–226).

[25] An example of an intersection criterion is the adult schooling indicator of the global MPI. The household is deprived if *no household member* completed five years of education. The logic there is that a satisfactory achievement by one household member somewhat mitigates (generates a positive externality) the deprivation of members who do not have such an achievement.

Precisely because there is no problem-free procedure for defining the unit of identification and for transforming individual indicators into household-level ones (if the household is selected as the unit of identification), it is recommended that the indicators included in the MPI are not all group specific and, especially, that there are not too many focused on a particular group – say children. In other words, when including group-specific indicators, the specific subgroup for which the achievement is applicable needs to be big enough so that a known and significant proportion of households have at least one member for whom the achievement is relevant (Alkire et al., 2015, p. 226). Otherwise, household composition will strongly affect the probability of a household being MPI-poor.

In any case, it is recommended that a household composition analysis of the likelihood of being identified as poor is performed. Alkire and Santos (2014) perform two analyses of this kind. On the one hand, they do hypothesis tests to evaluate whether MPI-poor households have a significantly different average sizes, average numbers of children under five, numbers of females, and other demographic characteristics, compared to non-poor households. On the other hand, they decompose the MPI into gender and age groups (keeping the household as the unit of identification).[26]

An additional note of caution pertains to the *prevalence* of a certain indicator. While there may be indicators that are intrinsically important, such as antenatal care, the prevalence of deprivation is low in the *total* population. Thus, including such indicators in an MPI will not effectively reflect deprivations, and it seems better to consider keeping such indicators separate.

[26] They find that larger households with more children and women are more likely to be MPI poor in the poorest countries but not necessarily in other countries. They suggest that the MPI indicators may be slightly biased but in a justified way, capturing the deprivations that certain vulnerable groups actually experience and that were (and are) a focus of the MDGs (and SDGs).

Table 2
Structure of the national official MPIs, the global MPI and two regional MPIs

MPI of	Dimensions and indicators			Weighting scheme		k-cutoff (in % of total weighted deprivations)	k-Implication for minimum deprivation
	Dim.	Ind.	Includes income or consum.?	Across dimensions	Within dimensions-across indicators		
Armenia	5: Basic needs, housing, education, labour, health.	23	Yes, consumption. (Extreme food poverty line)	Equal (20% each)	Equal within basic needs, education and labour. Unequal within housing and health	Strictly above 25%	Deprived in more than one full dimension.
Bhutan	3: Health, education, living standard.	13	No	Equal (33.33% each)	Equal, except within living standard, where land, assets and livestock together count the same as the other individual indicators in this dimension	At or above 30.7% (4/13) (and intensely poor if 5/13=50%)	Deprived in one full dimension or its equivalent.
Chile	5: Education, health, labour and social security, housing and the built environment, network and social cohesion.	15	No	Equal for four dimensions (22.5%) except network and social cohesion (10%)	Equal	At or above 22.5%	Deprived in one full dimension or its equivalent.
Colombia	5: Education, childhood and youth, labour, health, housing and basic services.	15	No	Equal (20% each)	Equal	At or above (5/15=)33.33%	Deprived in more than one full dimension.
Costa Rica	5: Social protection, education, health, housing and internet.	19	No	Equal (20% each)	Equal	At or above 20%	Deprived in more than one full dimension.
Dominican Republic	5: Health, education and infant care, livelihood and labour, digital gap.	24	No	Equal (20% each)	Equal	At or above 33.33%	Deprived in more than one full dimension.

Table 2 (continued)

MPI	Dimensions and indicators			Weighting scheme		k-cutoff (in % of total weighted deprivations)	k-Implication for minimum deprivation
	Dim.	Ind.	Includes income or consum.?	Across dimensions	Within dimensions-across indicators		
Ecuador	4: Education; labour and social security; health, water and food; habitat, housing and environment.	12	Yes (extreme income poverty)	Equal (25%)	Equal	At or above (4/12=)33.33%	Deprived in more than one full dimension.
El Salvador	5: Education, living standard; labour and social security; health, basic services and food security; habitat.	20 (same number of ind. per dim)	No	Equal (20% each)	Equal	At or above (7/20=)35%	Deprived in more than one full dimension.
Honduras	4: Health, education, work, housing.	15	No	Equal (25% each)	Equal	At or above 25% (~4/15)	Deprived in one full dimension or its equivalent.
Mexico	7: Income and six social rights (education, health, social security, quality and space of dwelling, access to basic services, access to food).	7	Yes	Income 50% Social rights 50%	Equal within social rights (8.33% each)	Above 50%	Income deprived + deprived in one social right.
Mozambique	3: Education, health, living standard.	17	No	Equal	Equal	At or above 40%	Deprived in more than one full dimension.
Nepal	3: Health, Education, Living Standard	10	No	Equal	Equal	At or above 33.33%	Deprived in one full dimension or its equivalent.
Pakistan	3: Health, Education, Living Standard	15	No	Equal	Unequal	At or above 33.33%	Deprived in one full dimension or its equivalent.

Table 2 (concluded)

MPI of	Dimensions and indicators			Weighting Scheme		k-cutoff (in % of total weighted deprivations)	k-Implication for minimum deprivation
	Dim.	Ind.	Includes income or consum.?	Across dimensions	Within dimensions-across indicators		
Panama	5: Education; housing, basic services and internet; habitat; labour; health.	17	No	Equal	Equal	At or above 30%	Deprived in more than one full dimension (5 or 6 deprivations, depending on weights).
Global MPI	3: Education, health, living standard.	10	No	Equal	Equal	At or above 33.33%	Deprived in one full dimension or its equivalent.
MPI-LA	5: Housing, basic services, education, living standard, employment and social protection.	13	Yes	Equal except for Employment and social protection	Equal except for living standard and employment and social protection	At or above 25%	Deprived in more than one full dimension.
Arab-MPI	3: Education, health, living standard.	12	No	Equal	Equal	At or above 33.33%	Deprived in one full dimension or its equivalent.

Source: Own elaboration with information from the corresponding MPI reports.

2. Handling missing values

Missing values are an issue in any empirical work and, in particular, in poverty estimates. Missing values are particular cases for which a variable that is collected by the survey is not available, also known as survey non-response. This occurs, for example, if there is a woman for whom BMI information should have been collected, given the survey design, but for whom this information is incidentally not available.

There are essentially two ways of dealing with missing values in MPIs. One option is to drop the units of identification (say, households) that have missing information for any MPI indicator. The disadvantage of this procedure is that the observations with missing values may systematically differ from those with observed values and, in such cases, the MPI estimates will be biased. Thus, and especially when missing values are above 10%, it is recommended that a bias analysis be performed. Bias analysis means analysing whether the group of observations with missing values in an indicator is (statistically) significantly different in demographic characteristics and in the other indicators of deprivation from the group with observed values. If they are significantly different, one may still proceed with the estimation with a smaller sample size but should explicitly clarify whether poverty estimate is expected to be a lower- or an upper-bound estimate, based on the results of the bias analysis (Alkire and Santos, 2014; Alkire et al., 2015, p. 228). However, if the percentage of missing information leads to a significant sample reduction (say, higher than 15%), it is preferable to look for another related indicator with a lower incidence of missing data.[27]

The other option is to define a criterion that reduces the impact of missing data, especially when transforming individual-level indicators into household-level indicators and when data may be missing for some but not for all household members. For example, in the global MPI, if at least one member aged 10 or older has five or more years of education (although other members have missing values), the household is classified as non-deprived. If there is information on at least two-thirds of household members, each having less than five years of education, the household is classified as deprived; otherwise it is dropped from the sample (Alkire and Santos, 2014).

In all cases however, care must be taken regarding the correct computation of missing values. In particular, one needs to check whether the questions used were only asked of a specific group of individuals or if the questionnaire uses some filters to obtain the real percentage of missing values at the individual and household level (Alkire et al., 2018).[28]

In income poverty estimates, imputation techniques have been a common way of dealing with the problem of missing income information. There are different imputation techniques, including the hot deck imputation method (which replaces each missing value with an observed response from a "similar" unit) or replacing the missing value with the predicted value according to a regression model. However, these techniques have been developed and implemented for imputing missing income. They have not yet been adapted for the multidimensional case, and they have several potential problems (Alkire et al. 2015, ch. 7). In the first place (even in the income case), the accuracy of the imputed value critically depends on the accuracy of the model used for its prediction. Second, if there are several indicators with missing values, several models would be required, one for each indicator.[29] This imputation would also have to be performed so that it was accurate for each unit of identification, not merely on average. However, as mentioned, this has not yet been developed, nor even explored.

3. Including income deprivation in an MPI

One significant decision in terms of the dimensions and indicators is whether to include income (i.e. monetary deprivation) in an MPI. Below, a number of considerations of including income in the MPI are exposed, which can be advantages or disadvantages, depending on which aspect prevails. Each country should assess whether the pros or cons of including income outweighs the other in their particular case.

[27] See Alkire et al., 2015, ch. 7, for further discussion

[28] Also note that response categories such as "do not know" or "do not answer" *are* missing values.

[29] In such case, models would obviously fall into endogeneity issues.

So far, income has been included in only three national MPIs, namely in Armenia, Ecuador and Mexico (which was the first country to introduce an official MPI) (see Table 2). However, in the case of Ecuador, the extreme income poverty indicator was included alongside Access to pipe water in a dimension called "Health, Water and Food"; that is, as a proxy for access to minimum required nutrition. Income has also been included in the MPI-LA proposed by Santos et al. (2015) for 17 Latin American countries.

a) The power of a headline indicator?

One integrated poverty measure has "the powerful attraction of a single headline figure" (Stiglitz, Sen, Fitoussi, 2009, 10, p.63).[30] Citizens, policy makers and politicians usually do not have that much time to process different kind of statistics. They want to know about what happened to the poor all in all. In the end, aren't they the same people?

At the same time, income poverty measures are in many cases deeply rooted in the minds of the average citizen and in the media. Thus, integrating income with non-monetary indicators into an MPI can be confusing for some people, and it might be perceived as interrupting the continuity of a public statistic. This issue can be dealt with by reporting not only the MPI (which would include income deprivation) but also income poverty separately. For instance, Mexico reports the headcount ratios of different population subgroups using various combinations of income deprivation and deprivations in social rights. The communication strategy plays a central role in facilitating the understanding of the poverty figures. In any case, the trade-offs between one headline indicator (including income) versus more than one poverty measure, which keeps monetary poverty intact, remains.

b) Different kinds of poverty?

One genuine argument for keeping income poverty in a separate measure from multidimensional non-monetary poverty is that each may reflect different kinds of poverty, requiring different policy action. In the case of the Latin American region, this argument was supported by the studies of Beccaria and Minujin (1985) for Argentina and by Kaztman (1989) for Uruguay, which produced contingency tables between the (income) poverty line method and the unsatisfied basic needs (UBN) method (using non-monetary indicators).[31] The exercise indicated that there were mismatches in the identification of the poor by each method.

Table 3
Contingency table of different poverty measures

Income \ Basic Need	UBN poor	UBN non-poor
Income poor	Chronically poor	Recently poor
Income non-poor	With structural deprivations	Socially integrated

Source: The categories in this table replicate those in Beccaria and Minujin (1985) and Kaztman (1989), but "UBN poor" may be replaced by "non-monetary" poor/non-poor (or materially deprived/non-deprived) in other contexts.

[30] In a way, it is the same argument expressed by Alkire et al. (2011) against dashboards only that referred to a dashboard of two indicators.
[31] Contingency tables between (relative) income poverty and material deprivation have also been widely used in Europe, exhibiting sizeable mismatches (Nolan and Whelan, 2011).

The income method would capture cyclical income fluctuations, connected to the labour market, and would reveal insufficient resources to satisfy needs through the market. The UBN method would capture situations of sustained deprivation over time reflected in less volatile indicators such as poor housing, deprivation in access to basic services and poor education.

While the categories defined in Table 3 is an attractive and intuitive classification, it may not hold for different contexts and over time. In the first place, the conformation of each of the four groups is naturally contingent on the specification of the indicators used. Second, over the 1990s Latin American countries decentralised and often privatised basic services (Herrera and Post, 2014. Thus the classification valid in the 1980s may no longer be valid. In fact, an exploratory factor analysis (EFA) performed on the 13 indicators of the MPI-LA for 17 Latin American countries at two points in time, which include income and non-monetary deprivations, does not suggest different groups of indicators, such as UBN versus income, loading on different factors.[32] This exercise suggests the importance of performing an evaluative analysis of income versus non-income indicators of poverty in the particular country where the MPI is going to be designed.

c) Confusing contingency tables?

Even if evidence suggests that there are not "two kinds" of poverty, there may still be interest in building contingency tables in order to discriminate between the incidence of income versus the non-material deprivations. In that case, if the MPI includes income, the MPI-poor column in the contingency table would include people suffering income deprivation. This may be less neat or clear as a category for policy makers.

Regardless of whether income is included or not in an MPI, there is a relationship between the poverty cutoff used in the MPI and the possible size of the mismatches between income poverty and MPI poverty. Recall that the poverty cutoff, denoted by k, is the proportion of deprivations that the unit of identification needs to exhibit in order to be identified as poor (see Box 1). It can range from a union (exhibiting at least one deprivation) to an intersection (exhibiting all deprivations) criterion.

The following relationship is worth noting. The **inclusion mismatch** or error, defined as the proportion of people who would be identified as income poor but who may not be multidimensionally poor increases as the MPI poverty cutoff increases. This is because using a more demanding poverty cutoff (i.e. requiring a higher number of deprivations to be identified as poor) makes it more likely that income-poor people are not multidimensionally poor (they may not exhibit many of the other deprivations). Conversely, the **exclusion mismatch**, that is, the proportion of people who, being multidimensionally poor would not be identified as poor using income, decreases as the poverty cutoff increases. This is because using a more demanding poverty cutoff makes it less likely that people identified as multidimensionally poor at increasing k values are not income deprived. When income is included as an MPI indicator, the relationship described above becomes even more systematic, as described in Santos (2013) and summarised in Table 4.

[32] Given that all the indicators were dichotomous, tetrachoric correlations were used in EFA. Ten out of the thirteen indicators included in the index have average factor loadings of 0.55 or more over the first factor, and one — children's school attendance — has an average loading just below 0.50. These data comply with the rule of thumb that a factor with five or more strongly loading items (.50 or better) are desirable and indicate a solid factor (Santos et al., 2015).

Table 4
Relationship between proportion of mismatches between income poverty and multidimensional poverty when income is an indicator of the MPI

Poverty cutoff	Union	Intermediate	Intersection
Inclusion mismatch (Proportion of income poor but multidimensionally non-poor)	0	Increasing as k increases	*(Maximum)* =Income poverty rate-multidimensional poverty rate
Exclusion mismatch (Proportion of multidimensionally poor but income non-poor)	*(Maximum)* =Multidimensional poverty rate-income poverty rate	Decreasing as k increases	0

Source: Own elaboration based on Santos (2013).

However, being aware of this relationship does not invalidate the analysis and does not eliminate cross-country variation. For example, with the MPI-LA, using a k=25%, the inclusion mismatch was 2% in Bolivia (in 2011) versus 11% in the Dominican Republic (in 2012), whereas the exclusion mismatch was 23% in Bolivia versus 8% in the Dominican Republic (Santos et al., 2015). An even more nuanced analysis can be performed for the number and kind of deprivations, as exhibited by Table 5. Again, the communication strategy and the kind of statistics that will be reported periodically can contribute to an appropriate understanding of the MPI.

Table 5
Distribution of the population by number of unmet basic needs and income deprivation status, urban areas of six Latin American countries in 2006

	Percentage sample	No. of UBN [0]	[1]	[2]	[3]	[4]	[5]	Total
Argentina								
Income deprived	**9.1**	39.6	36.7	17.0	6.1	0.6	0.0	**100**
Income non-deprived	**90.9**	78.0	17.9	3.4	0.7	0.0	0.0	**100**
Brazil								
Income deprived	**10.6**	28.7	35.6	23.8	9.4	2.3	0.2	**100**
Income non-deprived	**89.4**	53.9	34.4	9.6	1.8	0.3	0.0	**100**
Chile								
Income deprived	**3.0**	60.3	28.3	7.5	3.2	0.6	0.0	**100**
Income non-deprived	**97.0**	80.9	16.3	2.4	0.3	0.1	0.0	**100**
Uruguay								
Income deprived	**6.0**	49.8	29.5	18.0	2.8	0.0	0.0	**100**
Income non-deprived	**94.0**	80.8	16.3	2.5	0.4	0.0	0.0	**100**
Mexico								
Income deprived	**10.3**	17.3	21.5	28.1	22.8	9.7	0.7	**100**
Income non-deprived	**89.7**	54.2	24.1	14.2	6.1	1.3	0.1	**100**
El Salvador								
Income deprived	**25.6**	14.9	21.1	27.3	22.1	12.1	2.5	**100**
Income non-deprived	**74.4**	46.0	24.7	17.6	8.8	2.5	0.3	**100**

Source: Battiston et al. (2013), table A.2.
Note: Five unsatisfied basic needs were considered, alongside income deprivation.

d) Simultaneous deprivations, interlinked policies

An advantage of an integrated MPI is that it reveals simultaneous deprivations in monetary and non-monetary poverty indicators. This contributes to identifying the four groups described in section II.A.1, especially the so-called "consistently poor" (Ringen, 1987) (those who are in monetary poverty *and* in non-monetary poverty), a group that may require a special policy focus. Also, it may contribute to the design of interlinked policy interventions, such as a "shock therapy" of multiple deprivations at once aimed at breaking a poverty trap. However, in strict sense, this advantage derives not necessarily from including income into the MPI, but from having all the indicators in the same micro-data.

On the other side of the coin, it may be claimed that reporting income poverty separately from an MPI that does not include income can provide more complete information for *each* kind of policy.

e) Advancing poverty data?

As is known (also exposed in Santos, 2018a), at the moment there is a trade-off between data sources with good health indicators (such as anthropometric indicators and mortality) and data sources with good income or consumption indicators (DHS and MICS versus the Living Standard Measurement Survey [LSMS], Household Budget Surveys [HBS] and Household Income and Expenditure Surveys [HIES]). Including). Including income alongside some key functioning health indicators will push the development of an integrated core survey instrument to monitor poverty. Most likely this will be more feasible if income (rather than consumption) data is collected, as the first is seemingly less costly.

However, it is also well known that income data is far less accurate than consumption data (Deaton, 1997, 2000) and even if consumption data is collected, MPI indicators require "unit level of accuracy" (Alkire et al., 2015, ch. 7), namely: each indicator needs to accurately reflect the deprivations of the unit of identification (and not just on average), as identification is done based on the degree of joint deprivations.

In other words, pushing towards an integrated survey instrument is cuts both ways. While it may successfully push the data poverty frontier forward, it has the risk of (a) posing too much of a burden on the data collection institution and budget (recall the Atkinson et al., 2002, requirements), (b) sacrificing the quality of some indicators or (c) reducing the frequency of the data collection.

f) Can income "drive" the MPI?

Income poverty is predictably an indicator that is more sensitive to economic cycles than non-monetary indicators of poverty such as housing, access to basic services, school attendance, schooling achievement or child mortality. Thus, when income is included in the MPI, there may be a risk of this indicator "driving" most of an improvement or a worsening of the poverty level. Politically, this could discourage certain type of policies (say, educational or social housing programmes) as the MPI will mostly reflect the upward and downward turns of the economy, or of cash transfer programmes. However, this is an empirical question, and papers including income in the MPI have not always reflected such income dominance.

For example, Santos et al. (2010) estimated a multidimensional poverty index for six Latin American countries over five years between 1992 and 2006, including ncome deprivation ($2/day line) and five indicators of unsatisfied basic needs. They found that multidimensional poverty was significantly reduced over the period in Brazil, Mexico, Chile and El Salvador, and this was not driven by a reduction in income poverty but rather by a rather uniform improvement in all dimensions. The MPI-LA (Santos et al., 2015), which was computed for a larger number of countries (17) at two points in time (around 2006 and 2012) and a broader set of indicators (13), including income, does not exhibit dominance of the income indicator either. Even when income had a higher explicit weight, the correlation between the MPI reduction and reductions in the different indicators (censored headcount ratios) was high for many indicators, including not only income but also social protection, adult school achievement, water, sanitation and overcrowding (see Table 6).[33]

33 Censored headcount ratios are the proportion of people in poor households deprived in that particular indicator. See Box 1.

Table 6
Correlation between MPI reduction and changes in censored headcount ratios of MPI-LA for the period 2006–2012

Censored headcount ratio	Correlation with MPI reduction
Social protection	0.9921
Income	0.9713
School achievement	0.9654
Water	0.9405
Sanitation	0.9337
Overcrowding	0.9273
Employment	0.8955
Housing materials	0.8879
Schooling gap	0.8558
Durable goods	0.8157
Housing tenure	0.8066
Energy	0.7282
School attendance	0.6132

Source: Own computations based on results from Santos et al. (2015).

A third example is the estimate of an MPI for Bhutan (not the official one) between 2003 and 2007 by Santos (2013). For rural areas, this MPI included consumption poverty alongside education, access to safe drinking water, improved sanitation, electricity, room availability (overcrowding), health, access to roads and land ownership. It was found that between 2003 and 2007, regardless of the (three alternative) weighting structure used, there were substantial reductions in all deprivations except precisely for the consumption expenditure, which registered an increase (in the context of the global financial crisis). MPI decreased unambiguously over the time period, at the different k values and with the different weighting structures.

A counterexample however is the case of Mexico. The official MPI in Mexico increased between 2008 and 2010 in 1.7 percentage points. However, this was in fact led by an increase in income poverty (again, in the context of the global crisis); deprivation was reduced in all the other six indicators. The dominance of income in this case is due to the poverty cutoff used in the case of Mexico's MPI, by which a person is poor only if it is deprived in income and in at least one social right. People deprived in social rights only (even if in more than one) are not identified as poor.

Thus, while empirical evidence shows that income or consumption deprivation tends to have a significant contribution to total MPI (varying with the explicit weight), MPI trends in Latin American countries and in Bhutan do not seem to have been driven by the evolution of income deprivation. However, this is of course contingent to the explicit weight assigned to income and the selected poverty cut-off.

B. Selecting the weighting structure

The construction of an MPI entails the selection of weights across dimensions and indicators. Weights need to be in accordance with the purpose of the measure. Note that, as explained in Alkire et al. (2015, ch. 6), weights in an MPI with the AF's M_0 structure (which is based on dichotomized deprivations) reflect the relative impact that the *presence or absence* of a deprivation has on the person's deprivation score. They do not govern trade-offs across different levels of achievement in different variables, as is the case in measures based on cardinal variables using normalized gaps for example. This feature makes the selection of weights somewhat less critical.

Procedures for setting weights can be broadly grouped into statistical or normative approaches, or some combination of the two (Decancq and Lugo, 2012). Statistical approaches include principal components analysis and factor analysis, among others. The disadvantage with statistical approaches is that they are too dependent on the particular dataset used, and so weighting based on statistical approaches makes comparisons over time (and across countries) difficult. Normative approaches imply setting weights based on a value judgment, which needs to be properly justified. This is sometimes based on expert opinion and sometimes even on empirical evidence about the importance of certain dimensions. Normative weights have been the dominant procedure in the design of national MPIs so far. An interesting alternative method is setting weights based on participatory studies where people express their relative valuations of different dimensions; the aforementioned surveys on perceived necessities could also serve this purpose. These methods have not yet been used to define weights in national MPIs. However, participatory exercises were conducted in Bhutan after the measure was designed in order to validate the rank of deprivations used in the MPI (Alkire et al., 2018).

The advantage of normative weights is that they are transparent and stable over time and across units of analysis (say, geographical regions) for comparison. Within normative weights, a natural option is equal weighting, under the premise that that no dimension is more important than another. Whenever dimensions have a different number of indicators, "equal" weighting implies setting "nested weights" (Alkire and Foster, 2011): equal weighting across dimensions and equally distributing the dimension-weight across indicators within each dimension. Atkinson et al. (2002) recommend equal weighting.

In table 1 it can be seen that most official MPIs (10 out of 14) follow a nested weights approach, with unequal weighting across indicators, as the number of indicators across dimensions is unequal. In the case of Costa Rica, because it has the same number of indicators per dimension, the nested weights result in equal weighting across indicators. Mexico and Chile give different weights to one dimension: Mexico to income deprivation (with half the total weight) and Chile a lower weight to network and social cohesion. Armenia and Bhutan give different weights across indicators within specific dimensions.

The MPI-LA also gave the employment and social protection dimension half the weight of the other four dimensions for two reasons. First, the deprivations contained in this dimension go a step beyond the traditional conception of poverty in the region. Second, the effective weighting of a dimension is a result of the explicit weight and the deprivation cutoffs used. The deprivation rates in employment and social protection are high (the cutoff used was demanding). Thus, it was decided to give less weight to these more widespread deprivations.[34] In turn, income received twice the weight within its dimension as the durable goods indicator because it was understood that in highly mercantile economies it is a fundamental resource for satisfying needs and because it is a synthetic indicator that serves as a surrogate for deprivations that could not be included.

Countries seem to have found equal-nested weights a reasonable option for their national MPIs. However, given that there is no canonical procedure for setting weights, robustness tests should be undertaken to assess whether the main policy prescriptions are robust to a range of weights. "A broad range of not fully congruent weights could yield rather similar principal guidelines" (Sen, 2009, 243). Alkire and Santos (2014) have performed detailed robustness analysis on four widely diverse weighting structures for the global MPI. Alkire et al. (2015, ch. 8) describes techniques for assessing the robustness of the MPI to alternative weights. These include computing the proportion of pairwise comparisons that have the same ordering and/or rank correlation coefficients between them (this could be different geographical regions within a country, or different observations over time).

Santos et al. (2015) perform extensive robustness tests to the MPI-LA. Specifically, they estimated a total of 58 alternative specifications of the MPI-LA, varying one parameter at a time (with respect to the proposed measure) as well as several at the same time, and all of them were estimated for the full range of k poverty cutoffs (from 10 to 100%). The 58 alternative specifications involved very different weighting structures, from equal-nested weights but using different groupings of the indicators into dimensions, as well as using non-equal weighting structures. Considering seven values of k (10% to 70%) across the

[34] Desai and Shah (1988) have proposed this practice under the assumption is that individuals tend to attribute more importance to less prevalent deprivations. This is an empirical argument, and it is related to "frequency based weights".

58 specifications, there were a total of 98 variants. They found that 85% of all possible pairwise comparisons were robust to those 98 variants. When the range of k values was restricted to 20%, 30% and 40%, the proportion of robust pairwise comparisons increased to 91%. Santos and Villatoro (2018) additionally compute the proportion of people identified as multidimensionally poor under alternative weighting structures (who may be called the "consistently poor") and the proportion of people identified as poor under one, two or three of the four alternative weighting structures – but not the fourth one (a group that may be called the "inconsistently poor").[35]

[35] They find an inverted-U relationship between the proportion of "inconsistently poor" and the proportion of poor as identified by the baseline set of weights. That is, countries with a lower incidence of poverty (below 30%) and a higher incidence of poverty (above 60%), both have low proportions of inconsistently poor people (between 3% and 12%). This is intuitive: most people in these countries are, correspondingly, either non-poor or poor enough to be identified as poor by any weighting structure. Countries in the mid-range of poverty are the ones with higher levels of inconsistently poor people.

III. Selecting the (k) poverty cutoff

In the AF methodology, the (cross-dimensional) poverty cutoff, denoted by k, is the proportion of weighted deprivations the unit of identification needs to experience in order to be identified as multidimensionally poor (Box 1). "Normatively it reflects a judgement regarding the maximally acceptable set of deprivations a person may experience and not be considered poor" (Alkire et al., 2015, p. 213). It is therefore a normative decision, which certainly needs to be "reasonable" for the country. The normative content of the k-cutoff could come from participatory processes, as well as from subjective poverty assessments and qualitative studies (Alkire et al., 2015, p. 213). Occasionally, the poverty cutoff could be chosen to reflect policy priorities. But in all cases, it should be communicated in a transparent way and should enjoy public support. It is also important to understand under which conditions some intervals of values of k will identify the same proportion of the population as multidimensionally poor.[36]

As is well known, the k-cutoff can range from union to intersection criterions, with intermediate ones in between (Atkinson, 2003, was a pioneer paper on this matter). The selection of this threshold (its reasonability) clearly depends on all the previous decisions, especially on the purpose of the measure, the number and type of indicators considered (including the deprivation cutoffs chosen), and the relative weights. For example, when indicators refer to extremely fundamental deprivations, assuming the data used are very accurate, a union approach would be reasonable, especially from a human rights perspective. However, if indicators are more demanding in terms of the deprivation cutoffs (say, piped water or decent work for all household members), an intermediate criterion may be more reasonable. The intersection criterion is in general too demanding and has never been used in practice so far.

Different countries have gone through different processes for selecting the k-value. For example, Colombia explicitly used three criteria: first, that the poverty estimates at that k-value would have an estimated coefficient of variation lower than 15%; second that the confidence interval of the poverty estimate at the selected k-value would not overlap with the confidence interval of the poverty estimate at another k value;[37] third they cross-matched the average number of deprivations experienced by different groups of the population

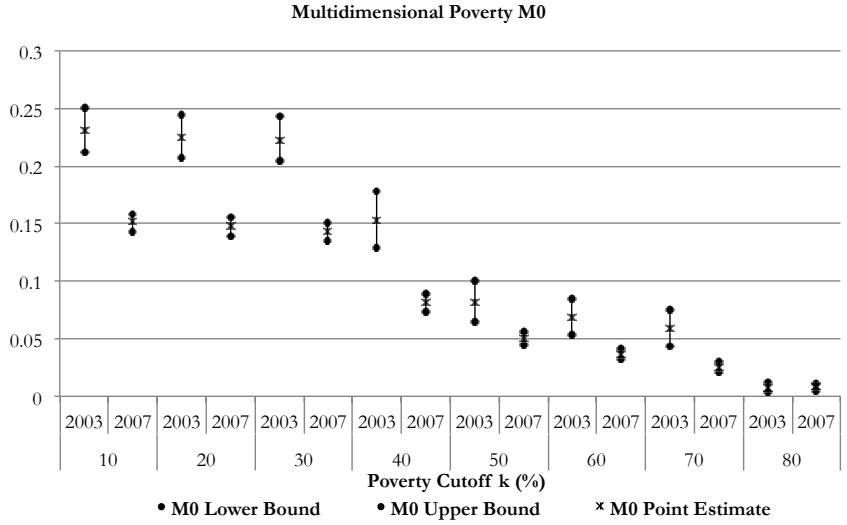
[36] For example, in the MPI-LA a poverty cutoff of 23% identifies as poor the same population as a poverty cutoff of 25% (given that the minimum weight is 3.7%), but a poverty cutoff of 25% is easier to communicate than one of 23%.

[37] They found that the upper-bound limit of the M_0 estimate with k=5 overlapped with the lower-bound estimate of the M_0 with k=4 (out of 15 deprivations), from which they deduced that it was somehow indifferent to choosing any of the two poverty cutoffs.

and the subjective perception of poverty by these groups.[38] Based on the combination of the statistical criteria and subjective poverty assessments, a poverty cutoff of 1/3 was selected. Other countries have followed slightly different approaches. For example, to obtain its k value, El Salvador combined statements from national legislation, results from qualitative studies on poverty, international experience, and consultative processes with the citizenship and experts, as well as the analysis of alternative MPI designs.[39] In turn, Bhutan selected a poverty cutoff that identifies a proportion of the population as MPI-poor that is similar to the proportion of consumption-poor people (National Statistic Bureau Royal Government of Bhutan, 2013). Interestingly, Table 2 shows that, despite different processes and cultural contexts, there seems to be some convergence in the poverty cutoff used. Most national MPIs use an intermediate criterion that identifies as poor units that are deprived in one full dimension or, alternatively, deprived in strictly more than one dimension. One exception is Mexico, which requires being deprived in income and experiencing deprivation in at least one (out of six) social rights. That means that people deprived in several social rights but not in income are not identified as multidimensionally poor.[40] It is also worth noting that some countries also use a second poverty cutoff (closer to intersection criterion) to identify the group of people in severe (or acute) multidimensional poverty. This is the case of Pakistan, Ecuador and Honduras.

Regardless of the selected poverty cutoff, it is important to compute the MPI for a wide range of k-values, or at least for a certain reasonable interval, and perform a robustness analysis of the measure across different poverty cutoffs. Alkire et al. (2015, ch. 8) introduce various techniques for robustness analysis. Figure 1 is an illustration of a kind of robustness analysis of the full range of poverty cutoffs in an MPI for Bhutan, designed with four dimensions, seven indicators and equal-nested weights (Santos, 2013). The lower and upper bounds of each poverty estimate were obtained by bootstrapping the sample.[41]Robust pairwise comparisons are another instrument for testing robustness (see Alkire and Santos, 2014, table 4, to see it applied to the poverty cutoff).

Figure 1
Illustration of robustness to the poverty cutoff
an MPI for Bhutan with seven indicators



Source: Santos (2013).

[38] They found that the group of non-income poor households with three deprivations (out of the 15 considered) did not perceive themselves as poor, whereas households that perceived themselves as poor experienced an average of 5.2 deprivations.

[39] These are the different instruments used for all the normative decisions involved in the construction of an MPI, not only the poverty cutoff.

[40] However, those who experience one or more deprivation in social rights but have an income above the poverty line, are identified as the group vulnerable in social rights (and this deprivation rate reported). Also, those who experience three or more social rights and are below the food poverty line are identified as population in extreme multidimensional poverty.

[41] For example, in the figure it can be seen that the M_0 measure (the MPI) unambiguously decreased between 2003 and 2007 for all k poverty cutoffs from 10% to 70 %, because for each k value the confidence intervals between years do not overlap. Above the 70% cutoff the reduction is no longer robust simply because the M_0 estimate is virtually zero. The decrease in M_0 was high and relatively homogeneous across the k cutoffs, with the highest reduction occurring for people deprived in 70% of the weighted indicators.

IV. Concluding remarks

This paper has looked briefly at the different technical decisions involved in designing a national MPI. The starting point is, naturally, defining the purpose of the measure, followed by setting the space (or union of spaces) where indicators will be drawn from, and then selecting the unit of identification, the dimensions and indicators. Within the selection of indicators there are a number of interrelated decisions. In particular, if the selected unit of identification is the household (the most prevailing practice so far), the procedure for transforming individual-level indicators into household ones is not trivial, as it critically affects the number of people identified as poor. However, using the individual as the unit of identification is not problem-free either. The inclusion or non-inclusion of income among MPI indicators also has pros and cons that need to be balanced. So far, most countries have preferred to keep income poverty separate from their MPIs. Setting weights and defining the poverty cutoff are two other central decisions. For the time being, most countries have preferred an equal-nested weighting approach and a poverty cutoff that identifies as multidimensionally poor people living in households that are deprived in one full dimension or its equivalent. In general, for all the reviewed items, the bottom line is that there is no canonical procedure for making these choices and that it is essential to critically assess the advantages and disadvantages of each option and the conceptual implications entailed, as well as to complete a careful empirical analysis, via robustness, sensitivity and bias checks, of the implications of the decisions taken.

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Annex

Acronyms

DHS: Demographic and Health Surveys
HBS: Household Budget Surveys
HIES: Household Income and Expenditure Surveys
LSMS: Living Standard Measurement Survey
MICS: Multiple Indicators Cluster Surveys
MPI-LA: Multidimensional Poverty Index for Latin America
MPI: Multidimensional Poverty Index
UNECA: United Nations Economic Commission for Africa

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