



**An Individual-centred Approach to Multidimensional Poverty - The Case of Chile,
Colombia, Ecuador and Peru**

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An individual-centered approach to multidimensional poverty. The case of Chile, Colombia, Ecuador and Perú.*

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Abstract

This paper deals with the problem of selecting the unit of analysis in multidimensional poverty analyses, which is a central decision to take, both from academic and normative points of view. The paper compares the results of an individual-level Multidimensional Poverty Index for Chile, Colombia, Ecuador and Perú with a household-based measure. In the construction of the index, four dimensions were initially identified: living conditions, health, education and labor. The motivating theoretical framework is based on Sen's Capability Approach and the index used is the Adjusted Headcount Ratio (AHR) of the Alkire-Foster (2009) family of indicators.

Different literature fields acknowledged the fact that individuals have varying preferences depending on their age (Osberg, 2012), which do not necessarily agree with the collective preferences of the household. The present paper adopts Sen's approach, noting that capabilities are mainly an individual concept. The individual index is constructed using three age groups: children (less than 18 years old), adults (between 18 and 59 years) and elderly (60 year or older). Multidimensional poverty is considerably different than income poverty in all countries. A simple ranking constructed with the Multidimensional Index and using the four countries for every individual approach, shows that the ordering prevails for smaller levels of the deprivation cut-off. In every scenario, Chile has the best scores of multidimensional poverty, followed by Colombia. Differences between Ecuador and Perú show that the rank-ordering does not prevail when the unit of analysis or cut-offs change.

JEL-Classification: IE320, D630, D120

Keywords: counting methods, poverty measurement, multidimensional poverty, individual poverty, capability approach.

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1 Introduction

The measurement of poverty has been under a constant scrutiny from academics and policy-makers. For many years, income (or consumption/expenditures) has been used as a proxy to understand and measure poverty. Nonetheless, over the last decades, increasingly theoretical and methodological discussions have shifted the attention to what is nowadays called Multidimensional Poverty.

Starting with the seminal works of Amartya Sen (1976) and John Rawls (1971), social scientists have devised different approaches to understand poverty without solely relying on income. Some of these are the basic needs approach, the human rights approach, subjective well-being, and the capability approach. For the last four years, the Human Development Report (HDR), famous for the publication of the Human Development Index has included a ranking of Multidimensional Poverty (MPI) of more than 100 developing countries. The ranking was constructed based on the most widely used counting indicator of multidimensional poverty, the Adjusted Headcount Ratio of the Alkire-Foster (AF) family of indices or AHR.

The publication of the HDR not only sparked a debate about the interpretation of such rankings and comparisons of poverty between countries but also about the measurement of poverty in general.¹ Up to now there is no agreement among academics and policy makers about how to measure poverty from a multidimensional perspective. However, it seems that everyone agrees that poverty is inherently a multidimensional concept. Several points have been put forth as drawbacks of any multidimensional measure, but especially the AHR. More concretely, there are several arbitrary decisions involved in computing multidimensional indices which affect the final scores. There is no certainty about their impact on the overall result. Despite these criticisms, the AHR has become widely applied, not only in academic world but also as a tool for targeting, monitoring and evaluating social policies and programs; particularly noteworthy are Mexico (CONEVAL), Colombia (DNP) and Brazil (Minas Gerais Multidimensional Intervention).²

The main contribution of this paper is the introduction of an individual-level measure of multidimensional poverty. Most calculations of multidimensional poverty take the household as the primary unit of analysis, and thus forgo the opportunity to understand poverty from an individual perspective. Moreover, as Osberg and Sharpe (2014) argues, in the particular context of the economic insecurity literature, many dimensions of well-being are only relevant at the individual level, and these dimensions may vary over a person's lifetime. In addition, the internal decisions of a household are not, generally, democratic. They reflect a benevolent dictator's will, who is the main decision-maker for a particular household (Bolt and Bird, 2003).

¹Also see (Decanq and Lugo, 2010), (Ferreira and Lugo, 2012), (Ravallion, 2011) and (Alkire, 2011)

²Recently the Oxford Poverty and Human Initiative created the Multidimensional Poverty Peer Network with the objective to increase the use of the method as a public policy tool.

This paper compares the individual-based approach with the household-level approach, in order to assess the impact of this decision. First, a multidimensional poverty index is being calculated for three age groups in each country: children (12 indicators), adults, and the elderly (13 indicators). The results show that the elderly are by far the most deprived sub-population. Then, a simple ranking comparison for different poverty cut-offs is being conducted. Chile is the least multidimensionally deprived country, followed by Colombia, Perú and Ecuador. Second, an aggregated index is being calculated. The results are similar to the sub-population ranking. The paper also calculates results for different levels of the poverty cut-off (k). The ranking only prevails when low levels of k are considered (less or equal to 50%).

Third, a household-level analysis is conducted, taking into consideration the 16 indicators used in the individual index. In order to make both measures comparable, a household was considered deprived in a particular indicator if at least one member in the household is considered deprived. The last two places of the ranking reverse. Chile is still the least deprived country, followed by Colombia, Ecuador and Perú. Multidimensional poverty is consistently higher on this index than in the individual one. Hence, the selection of the unit of analysis is a major decision. It not only affects the way poverty is understood but also the identification of who is poor and thus how many poor there are.

The remainder is organized as follows. The next section discusses the unit of analysis. Section three briefly reviews counting methods to measure multidimensional poverty. Sections four and five briefly introduce the countries in the sample, describe the data, and detail the decisions taken to fix deprivation cut-offs. Section six presents the main results and section seven concludes.

2 Selection of the unit of analysis: Individual vs. Household

Most multidimensional poverty analyses use households as the unit of analysis. This decision implicitly assumes that every individual inside a household has the same level of poverty as the household itself.

Defining a household is problematic and complex, as mentioned by Bolt and Bird (2003, p 2) “the household means different things to different people, in different times and places, and by using the household as a unit, researchers and policy makers make a set of implicit assumptions about what takes place within it”. The most widely accepted definition of a household is the one used by the United Nations: “a household is a group of people who live and eat together” (Bolt and Bird, 2003, p 10), but although it is pragmatic this definition remains problematic.

Individuals within a particular household may have a different living arrangements, which makes

it difficult to differentiate the traditional household from other arrangements (e.g. a household member that lives temporarily in two different households). Assuming an equal distribution of poverty among the members of a household also implies the household acts like a unitary decision maker. Usually, it is assumed that the decision making process of a household is the result of an agreement among its members (assuming the household pools all resources to the benefit of the group). Nonetheless, this assumption is far from reality. There are often one or two members of the household who are the decision makers and act as benevolent dictators. Few households act as democratic units in which every decision and resource is submitted to a voting mechanism. These models of the household are known as *unitary models* (Chiappori et al., 1993, e.g. see). Further, this concept of the household and its measurement unavoidably excludes some populations from the sample (e.g. military, the homeless, the imprisoned, nursing home and foreign populations; all of which are not sampled in the household surveys). The European Union also recommends the measurement of social indicators using the individual as a unit of analysis. The argument behind that decision is to focus on citizens, or more broadly defined “all those living in the European Union” (Atkinson et al., 2002), which underlines the deficiencies in gathering information about excluded populations.

Sen (1992) also emphasizes the importance to define the space within which the capabilities of individuals are assessed and relates these spaces to equality considerations. Individuals not only begin life with different initial endowments but also get affected by the environment they grow up and live in. “Had all people been exactly similar, equality in one space (e.g. incomes) would tend to be congruent with equalities in others (e.g. health, well-being, happiness). One of the consequences of ‘human diversity’ is that equality in one space tends to go, in fact, with inequality in another” (p 20). Choosing a space implies choosing a unit of analysis. It is part of the type of information the researcher is acquiring and analyzing (e.g. which indicators, dimensions, and for which unit).

Considering a household as a unitary group has also implications for poverty and inequality measurement (e.g. see Chiappori et al., 1993, p 20). An equal distribution of resources among members of a household implies that poverty measures, irrespective of the unit of analysis used, will produce the same results.

This paper adopts an individual approach to the measurement of poverty based on the assumption that the household is a complex unit of analysis in which both cooperative and non-cooperative outcomes could occur. This approach allows measuring the differential poverty levels of individuals according to their age. Different indicators are constructed taking into account specific needs and situations, so that individuals are compared not with other members of the household but with other members of their society based on their age. Other examples of this approach are measurements of economic insecurity, where indicators by age group are often used (Osberg and Sharpe, 2014, e.g. see).

3 A brief summary of Multidimensional Poverty Measurement with Counting Methods

This paper uses the counting framework for measuring multidimensional poverty. These measures simply count the dimensions in which individuals are considered poor (see [Atkinson, 2003](#), p. 51). [Sen \(1976\)](#) points out that identification and aggregation procedures are needed to perform this process. Another important characteristic is that this approach can deal with ordinal and dichotomous data. This section briefly summarizes the dichotomous case.³

All counting measures involve three steps: a) identification of the dimensionally poor, b) identification of the multidimensionally poor, and c) aggregation to find the social poverty function.

In order to identify the dimensionally poor, a matrix of achievements ($X_{n \times d}$) is constructed holding the raw information for each indicator [$j = 1, 2, \dots, d$] and each individual [$i = 1, 2, \dots, n$]. Then a threshold or *indicator specific deprivation cut-off* is set ($Z := z_1, z_2, \dots, z_d$) for each of the indicators. The value of x_{ij} is then compared to the cut-off z_j . All dimensionally poor individuals are identified as Indicator Deprived or $I(x_{ij}; z_j)$, as shown in equation 1.

$$I(x_{ij}; z_j) = \begin{cases} 1 & \text{for } x_{ij} < z_j \\ 0 & \text{for } x_{ij} \geq z_j \end{cases} \quad (1)$$

Aggregating this function for all i 's and j 's, gives the *matrix of deprivations* constructed, holding dimensions $n \times d$.

Each index typically includes a vector of weights, or $W := (w_1, w_2, \dots, w_d)$ satisfying two conditions shown in Equation (2): a) The weights sum to unity, and b) the weights are non-zero.

$$\sum_{j=1}^d w_j = 1 \quad \text{s.t.} \quad w_j > 0, \quad \forall j \in [1, d] \quad (2)$$

Adding up the number of deprivations by individuals gives the *vector of deprivation counts* or c_i . As shown by [Silber and Yalotnezky \(2014\)](#) the counting function is defined as the weighted sum of deprivations of each individual.

$$C_i \equiv \sum_{j=1}^d (x_{ij} < z_j) w_j \quad (3)$$

Then a second cut-off sets a minimum number of deprivations (k) that an individual should have to be considered *multidimensionally poor*. Or, any individual with $c_i \geq k$ is multidimensionally

³For a detailed exposition of counting methods see [Silber and Yalotnezky \(2014\)](#).

poor. With the second condition fixed the identification of multidimensionally poor individuals is completed. The matrix of deprivations is transformed into the *Poverty Identification Matrix*, or $\Psi(X_i; Z, W, k)$ –a censoring matrix which identifies all individuals who are multidimensionally poor.

$$\Psi(X_i; Z, W, k) = \begin{cases} 1 & \text{for } c_i \geq k \\ 0 & \text{for } c_i < k \end{cases} \quad (4)$$

Once the individuals have been identified, a measure of breadth of poverty is included in the indicator (g). With ordinal variables, the breadth of poverty is based on the number of deprivations in which the individual is considered deprived. Equation 5 is the individual poverty function based on the identification and breadth measures.

$$p_i(X_i; Z, W, k) = \Psi(X_i; Z, W, k) \times g(X_i; Z, W) \quad (5)$$

Finally, the last step is to construct the social poverty function (P) which is simply the average of the individual poverty functions (p_i).

$$P(X; Z, W, k) = \frac{1}{N} \sum_{i=1}^N p_i(X_i; Z, W, k) \quad (6)$$

This paper uses the Adjusted Headcount Ratio (AHR) of the Alkire-Foster family of poverty measures (Alkire and Foster, 2011; Alkire, 2011). This measure sets indicator deprivations cut-offs (z_{ij}), weights (w_j), and a poverty identification cut-off (k). The AHR is composed of two sub-indices: the headcount ratio (H) that measures the ratio of multidimensionally deprived individuals and the Average Deprivation (A), the measure of breadth.

4 Dataset Characteristics

4.1 The selected countries

The sample consists of four Latin American countries: Chile, Colombia, Ecuador and Perú, which accounts for almost 28% of the population of South America ⁴. The countries are located in the west of South America, covering north to south and border on the Pacific Ocean. They share common borders. Perú has northern borders with Ecuador and southern borders with Chile. Colombia borders Ecuador and Perú. Moreover, the Andean Mountain Range extends over the territories of all the countries in this sample. The common language is Spanish, although native dialects are widely used among the indigenous communities and are also recognized as official languages.

⁴According to figures for 2011 from the World Bank

Table 1 shows different measures of poverty and well-being for these countries. Levels of income poverty are measured by the National Poverty Line (two different sources) and the USD \$1.25 per day. Other measures are the Gini Coefficient, the Human Development Index (HDI) and the Multi-dimensional Poverty Indicator (MPI). Chile is by far the country which is least poor, while Ecuador and Perú are quite similar. Colombia is the poorest country in the sample on every indicator but the MPI.

Table 1: Measures of Poverty and Well-Being

	Poverty % of Population by Country			
	Chile	Colombia	Ecuador	Perú
	Income Poverty			
National Poverty Line ^a	14.4% (2011)	32.7% (2012)	25.6% (2013)	23.9% (2013)
Persons Living in Poverty ^b	11.0% (2011)	32.9% (2012)	32.2% (2012)	25.8% (2012)
PPP \$1.25 per day ^c	1.4%	8.16%	4.61%	4.91%
	Well-being by country			
Income Gini coefficient (2010) ^c	52.06 ^c	55.91	49.26	48.14
HDI score ^e	0.819	0.719	0.724	0.741
HDI place ^e	40	91	89	77
HDI level	Very High	High	High	High
Inequality Adjusted HDI score	0.664	0.519	0.537	0.561
MPI score ^f	...	0.022 (2010)	0.009 (2003)	0.043 ^g (2012)

^a Source: World Bank. World Development Indicators.

^b Source: Economic Commission for Latin America and the Caribbean (2013) Social Panorama of Latin America and the Caribbean. Calculations on the basis of household survey tabulations. For Colombia, figures are based on calculations of the National Statistical Office.

^c Source: Poverty and Equity Databank, World Bank, Povcal Net. Data refers to the most recent available information during the period 2000-2014. For the GINI coefficient with the exception of Chile (2009), the source is 2010. The closer to zero the most equal a country is.

^d 2013, UNDP. The figures show the value of the indicator, the position in the world ranking and the level of development. The closer to one, the higher the level of human development.

^e The place is based on a sample of 186 countries in the world.

^f UNDP (2013) Human Development Report 2013. The rise of the south: Human progress in a diverse world.

^g Oxford Poverty and Human Development Initiative (2014). Perú Country Briefing, Multidimensional Poverty Index Data Bank. OPHI, University of Oxford.

Since 2010, the UNDP measures multidimensional poverty using the AHR of AF. As stated before, the source of information varies between countries. In the 2011 HDI report the source for Colombia and Perú were the Demographic and Health Surveys, but for Ecuador it's the World Health Survey.

A measure for Chile is not included.

4.2 The selected datasets

Data for each country comes from the Living Standard Measurement Surveys (LSMS). Table 2 summarizes the sampling frame. The main objective of every set is to define and classify households and individuals, especially those who are poor and to identify subgroups of population for which the social policies are designed ⁵. The sample excludes individuals in the military, jails or hospitals.

The different sample sizes of each dataset do not affect the level of comparison for each country, as explained in Grosh and Muñoz (1996, p.54) “the sample size needed for a given level of precision is almost independent of the total population”. The sample size is related to the level of disaggregation desired by governments and statistical offices to explain different phenomena. In the particular case of Chile (see table 2), the sample is designed to validate results for national, regional, urban and rural, and communities⁶.

The surveys were conducted at different times. Of particular interest is the difference between Chile, Colombia and Perú compared to Ecuador. However, the last available LSMS for Ecuador is from 2005 (see table 2) which necessitates some caution in interpreting the findings.

Table 2: Description of Datasets

	Basics				
	Year	HH	Individuals	Sampling	Type
Chile	2009	71.460	246.924	Stratified, Two stage	LSMS
Colombia	2010	14.801	53.456	Probabilistic, Stratified Multi-stage	LSMS
Ecuador	2005	13.581	55.666	Probabilistic, Three-Stage	LSMS
Perú	2010	27.176	87.047	Probabilistic, Stratified Multi-stage	LSMS

Source: Statistical Offices Official Manuals: Chile; Ministerio de Desarrollo Social, Colombia: DANE, Ecuador: INEC, Perú: INEI

Appendix B matches the contents across the different datasets. In order to carry out comparisons between countries, all modules that are missing in at least one survey have been excluded (expenditures, disabilities, children care, information, communication and technology, ethnicity, governance

⁵Basic statistics of subgroup populations are presented in Annex A

⁶Communities are a Chilean political-administrative division.

and corruption, participation, migration, remittances, social capital and rural income).

The countries were chosen primarily due to the fact that different rankings can be constructed with different measures of poverty and well-being, due to data availability, and due to the homogeneity of the LSMS data. The latter is particularly important in Latin America.

5 Selecting the capability set

Following Sen's *capability approach*, the measure of multidimensional poverty requires a list of functionings. These functionings are understood "not in commodities that people can consume but in terms of what people are or do like being healthy, reading or writing" (Deneulin, 2006, p 4). Accordingly, in this paper, any measure of material well-being (e.g. material goods or assets) is disregarded and instead seemingly disparate aspects are included (e.g. level of education of the elderly). The variables selected must be perceived as having intrinsic value, instead of being reached as means to an end (Sen, 1999).

Capabilities are combinations of functionings for which an individual makes a free choice. As mentioned by Alkire (2002, p 8-9): "The definition of capability does not delimit a certain subset of capabilities as of peculiar importance; rather the selection of capabilities on which to focus is a value judgment (that also depends partly on the purpose of the evaluation), as is the weighting of capabilities relative to each other". Sen himself did not define a particular set of functionings, arguing the following reasons: 1) To avoid over-specification of the human nature, 2) To adapt it to different theoretical and practical needs, 3) To apply it in different contexts and in different moments of time, and 4) To value the incompleteness, both theoretically and practically. Sen has explained that the capability approach is not an "all or nothing exercise" (p 48). He argues that the lack of clarity and agreement about the concepts of well-being, poverty and inequality should be made explicit, as well as the value judgments adopted. Finally, he also states that the availability of information limits the selection of the capabilities set ⁷.

This paper defines four categories or dimensions of functionings, based on the concept of achievements⁸. Achievements are perceived as a *proxy* to measure functionings. "Living may be seen as consisting of a set of interrelated 'functionings', consisting of beings and doings. A person's achievement in this respect can be seen as the vector of his/her functionings" (see Sen, 1992, p 39). Indicators included in this comparative analysis measure if an individual has fulfilled (or not) a normative threshold.

⁷(Sen, 1992) Chapter 3.

⁸It is not possible to measure capabilities with the available information. This paper assumes that the reached achievements are the desired result of a voluntary choice. An exploratory analysis to test the domains is performed in section 5.1

Additionally, two practical considerations are taken. First, the individuals were classified in three different groups, adapted to the Latin American context: children⁹ (individuals less than 18 years old), adults (between 18 and 59 years old) and the elderly (60 or more years old). An age threshold to separate children from adults is set considering the legal definition of majority of age in the countries of the sample¹⁰. The other age threshold fixed is 60 years old to differentiate between adults and the elderly. This arbitrary definition coincides with the legal age for retirement and the epidemiological profile of the population in the region¹¹ (Del Popolo, 2001).

Second, a process of pairing every question across the four datasets is performed. Indicators are excluded if their objective is to measure material well-being (e.g. assets: telephone, mobile, internet, personal computer, cable tv, fridge, car and washing machine, and so on) or monetary poverty (e.g. income or consumption/expenditures), for reasons explained above. Indicators that represent a subjective account of well-being are disregarded as only objective measures are considered¹².

5.1 Factor analysis to select domains

This paper performs an exploratory factor analysis to assess if there is an underlying structure of dimensions, and if the indicators are a latent construct of multidimensional poverty. “Factor analysis refers to a set of distinct constructs needed to account for the pattern of correlations among a set of measures” (Fabrigar and Vegener, 2012, p. 1 -3). The constructs are known as factors or latent variables. This unknown variables measure the variation and covariation between the indicators. If a common factor is found then the indicators share an underlying structure.

Table 3 shows similar results for the subgroups population models. Using the *Kaiser Criterion*¹³ (see Brown et al., 2011, p. 148) at least one factor was found determinant. This proves that, with the exception of children in Chile, the indicators share a common factor. As the structure of dimensions is disproved, equal weights (w_j) are applied to each indicator.

⁹A more specific division of this sub-group, for instance children younger than 5, children from 5-14, and teenagers, would had been desirable. The datasets do not contain the necessary information to perform it.

¹⁰The majority of age is defined as the age in which legally an individual is not longer considered a child or in other words, when the person becomes 18 years old. See Chile: Ley 19221 18th of May of 1993, Colombia: Ley 27 de 1977, Ecuador: Art.21 Código Civil Ecuatoriano, and Perú: Ley 26.579, Art. 1.

¹¹According to the laws in each country the ages of retirement are: Chile 65 years old, Colombia 55 for women and 60 for men, Ecuador 60 years old, and Perú 65 years old

¹²Two additional indicators are not included: preventive use of health care and protection for retirement. Particularly for the case of Ecuador, strong assumptions needed to be use, to include them, besides that their correlation with other indicators (i.e. effective use of health and unemployment) was either perfect positive or perfect negative.

¹³The Kaiser criterion establishes as a rule of thumb to define the number of factors counting the eigenvalues greater than 1. The scree plot was also used but the conclusion was less straightforward compared with the Kaiser criterion.

Table 3: Factor Analysis Eigenvalues -Rotated

Group	Chile	Colombia	Ecuador	Perú
Children	0.9584	1.4352	1.0366	2.2078
Adults	1.0000	1.4109	1.0391	2.3064
Elderly	1.07220	1.4217	1.1419	2.4318

Source: Own calculations

5.2 Indicators Proposed

Table 4 presents the final list of indicators with their definition, unit and subgroup identification. Common or public household characteristics (e.g. electricity) were attributed indistinctly to all individuals living in the same household.¹⁴

Table 4: List of indicators proposed

Name	Definition	Group
<i>Household Level</i>		
Type of Dwelling	Assess the fitness of the housing unit for human habitation	All
Wall Material	Measure of quality of the structure of the housing unit. Determines if the materials of the dwelling are permanent	All
Floor Material	Measure of quality of the structure of the housing unit. Assess the quality of the material of the floor	All
Electricity	Measure of the lack of basic services inside the housing unit	All
Overcrowding	Determines the shortage of space based on the number of rooms and persons in the household	All
Sanitation	Measures the presence of basic sanitary facilities in the housing unit	All
Water	Assess the access of the housing unit to a clean water source	All
Tenure	Qualifies the legality of possession of the land and building in which the housing unit is set	All
<i>Individual Level</i>		
Literacy	Measures the ability of an individual to read and write	Adults and Elderly
Early Education	Defines the access of children to a program of early education	Children (Less than 5)
Education	Quantifies the enrollment of individual in the educational system	Children (5 to 17 years)

Continued on next page

¹⁴Questions related to the living conditions are shared among all the household members.

Table 4 – *Continued from previous page*

Name	Definition	Population
Years of Schooling	Measures the human capital stock of the individual according to minimum international standards	Adults and Elderly
Access to health insurance	Ascertains the coverage of health insurance by individuals	All
Effective access to health services when needed	Measures the extent of use of the health system in case of medical need	All
Long run unemployment	Measure of social exclusion of the labour market	Adults
Income security in old age	Evaluates the access to an income source for old-age individuals, either job related income or pension transfers	Elderly
Child labour	Measures unacceptable form of labour for children	Children

5.3 Deprivation and Poverty Cut-offs

The next step to calculate the Adjusted Headcount Ratio (AHR) of Alkire-Foster (AF), is to define the deprivation cut-offs. Setting a threshold is a normative decision. In Annex C the cut-offs are described in terms of deprivation (lack of fulfillment). Then a particular poverty cut-off ($k = 30\%$) is selected. The decision is taken based on the threshold defined by the UNDP. Nonetheless, this paper will calculate and analyze the results of the multidimensional index when different levels of k are used, beyond this section.

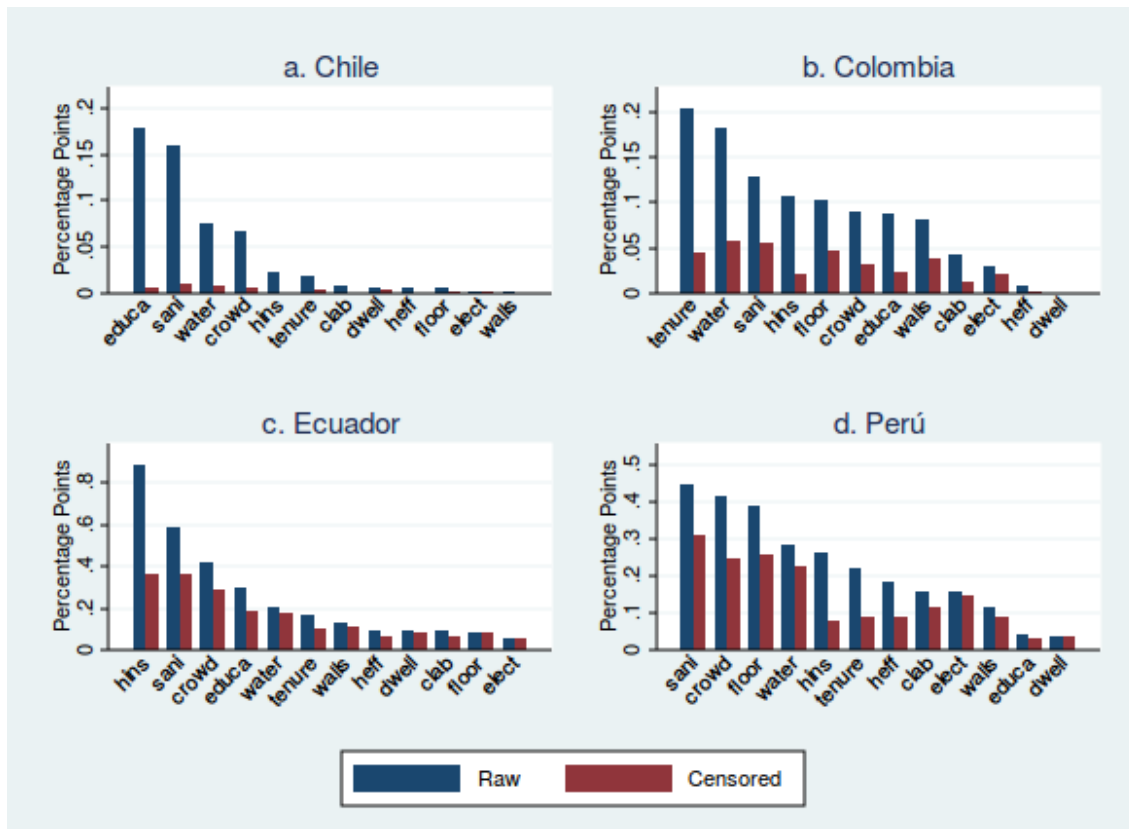
An analysis of both *raw* (uncensored results by indicator) and *censored* (when the second cut-off is imposed) is shown and analysed in the remaining of this subsection (see Figures: 1, 2, and 3). The union approach (deprived in at least one dimension) is compared to the intermediate approach ($k = 30\%$) to highlight the biased analyses of censored headcounts, exclusively. The analysis below gives further information with regards to the particular context and the situation for each population subgroup.

From the figures it is easy to conclude that the subgroups have different performance by country, although some patterns are identified. Orders of magnitude in the depicted graphs are different, specially when comparing the data of Ecuador and Perú with Chile and Colombia. The former two countries exhibit higher percentages of deprived population.

For children, in every country sanitation is a serious concern (consistently in the top 3). It is counter-

intuitive to find, for instance, that in the case of Chile (1a), education is the indicator with the highest level of deprivation (18% raw) as it is compulsory. After $k=30\%$ restriction is applied, only 0.55% of children are deprived in education. In Colombia, see Figure 1b, the levels of deprivation of various indicators (raw) are above 10% of the subgroup (e.g. tenure (20.5%), access to clean water (18.2%) and sanitation facilities (13%)). The results reflect increasing levels of insecurity about land ownership and the reduction on basic services coverage, particularly important for the poorest population. The levels of deprivation of every indicator fall into the range of 0% and 6%, once the k is set. Water (5.71%) and sanitation (5.55%) are the ones with the highest percentage of deprived children.

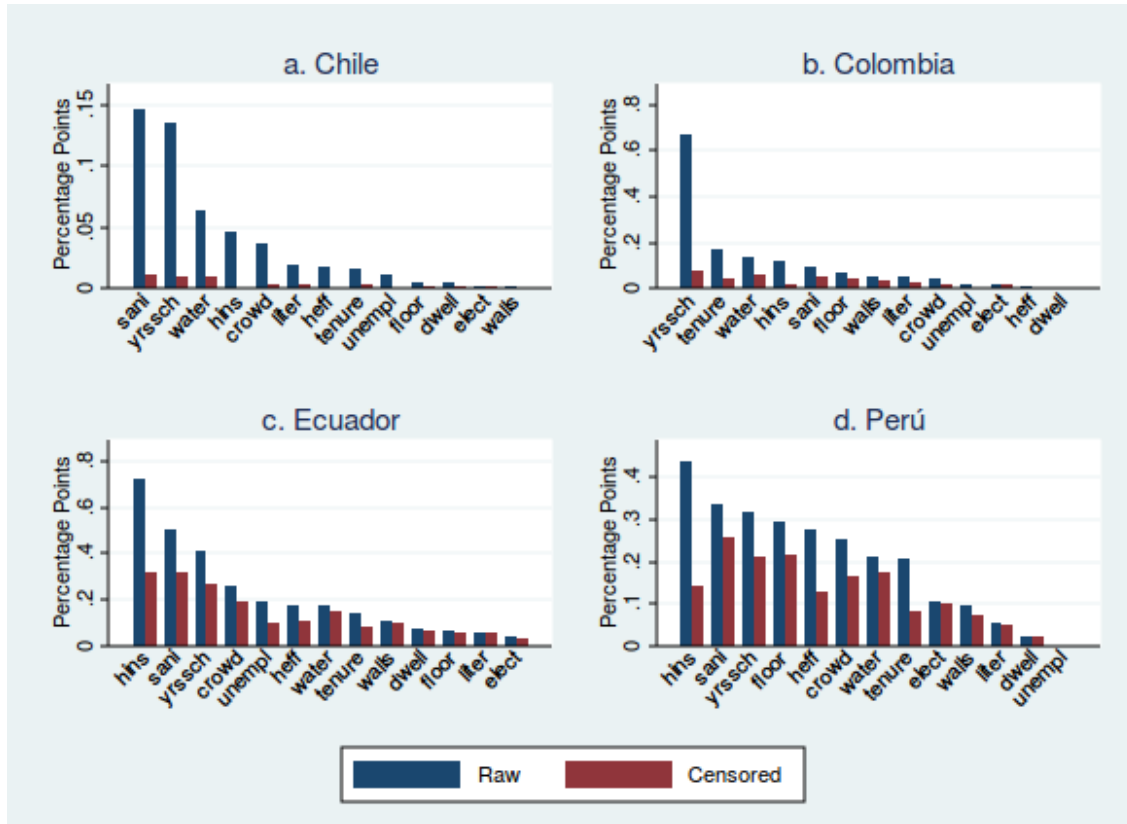
Figure 1: Children



In Ecuador (see Figure 1c), Children are more deprived in access to health insurance (88%), phenomenon that occurs also in the other subgroups but in a lesser extent. When k is imposed, deprivation percentages fall in the range between 37% and near 0.5%. Health insurance (36.5%) and Sanitation (36.25%) remain as the indicators with the lowest performance. Perú (see Figure 1d) shows a better performance when compared to Ecuador. The indicator with the highest deprivation is access to sanitation (44.6%). Crowdedness (42%) and poor material of the floor (38.8%) are also lagging. There is not a big change when the k threshold is imposed.

The most important issues for adults are education, measure by years of schooling, and health insurance. Chilean adults (2a) are more deprived in education (13.6%) and sanitation (14.7%), than in other dimensions. When the data is censored, the levels of deprivation reduce to the range between 1% and 0%. Raw indicators for Colombia show a similar trend when compared to Chile; but this falters away when the censure is applied. Colombia shows a high level of deprivation in terms of educational attainment (67.42% uncensored and 8% censored). Tenure still shows important deprivation levels (17% -uncensored- of adults are deprived).

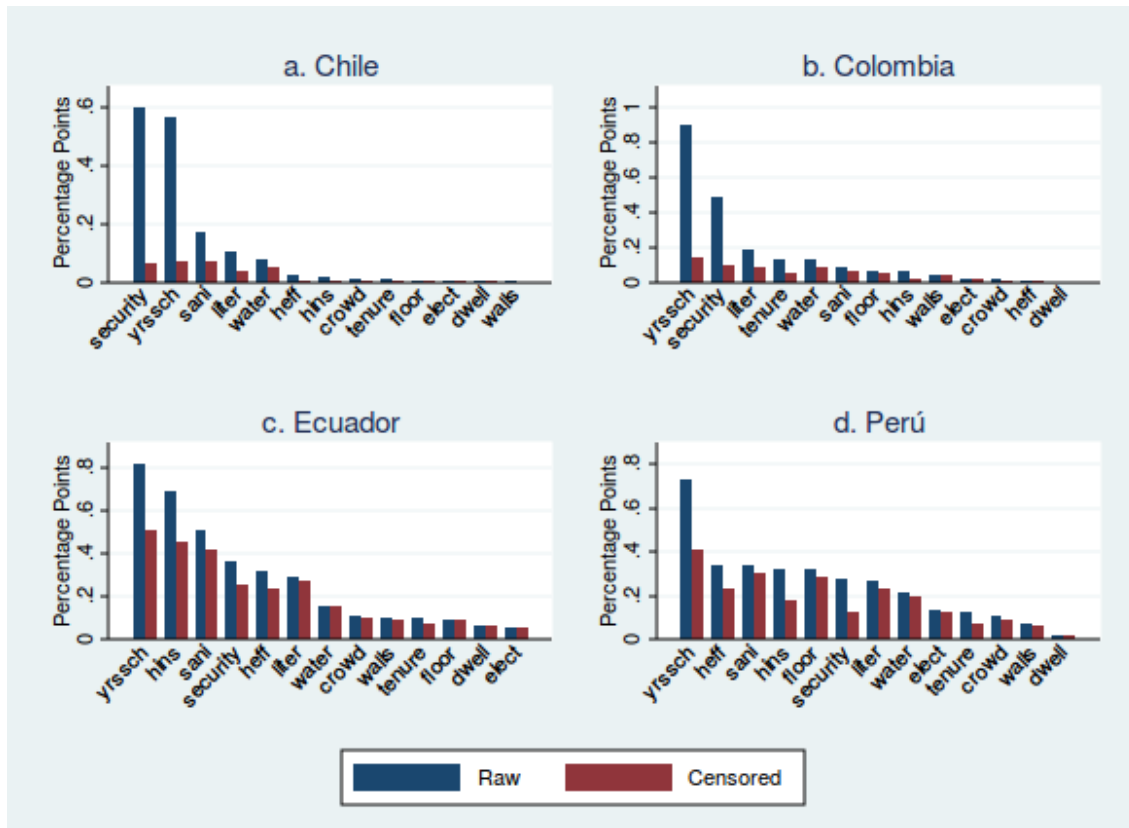
Figure 2: Adults



Ecuador is the most deprived country of the sample, as shown in Figure 2c. The same pattern of deprivation found on children is replicated for adults: health insurance (72.4%), sanitation facilities (50.4%), education (41.4%) and crowdedness (26.2%). The fifth indicator, only measured for adults, is long term unemployment (19.22%). When the restriction over k is applied, sanitation has the highest level of deprivation (31.6%). Perú, see Figure 2d, reflects the smaller levels of health insurance coverage (43.8%). The indicators of sanitation (33.5%) and educational attainment (31%) are also important. A particularity found is the highest level of deprivation of effective use of health care in case of need (27.6%). When the censored condition is applied, sanitation (25.6%), poor material of floor (21.6%) and educational attainment (21.2%) show the most deprived percentage of individuals in this subgroup.

Elderly are more deprived in education measured by years of schooling and income security in old age¹⁵. Compared with children and adults, the levels of deprivations of the elderly in Chile are comparatively higher, see Figure 3a. Income insecurity (60.4%) and educational attainment (56.8%) are the indicators with the highest percentage of deprived individuals in Chile. The levels of deprivation of the third indicator, sanitation (17.2%) are considerably lower. After censoring the same indicators remain as the ones with the worst performance, but at different levels. In Colombia, see Figure 3b, educational level measured by years of schooling (90.21%) is the indicator with the highest percentage of deprivation. This result reflect the lack of enforcement of policies to assure primary education several decades ago. Income security (49.03%) is the second worst indicator showing the poor coverage of the social security system. When $k=30\%$ is imposed, the levels of deprivation reduce to a range between 14% (Years of schooling) to 0.1% (Type of housing).

Figure 3: Elderly



In Figure 3c, the analysis for Ecuador is shown. Ecuador remains as the country with the highest deprivations. Consistently with the case of Chile and Colombia, educational attainment (81.4%) and income insecurity (36.2%) are the indicators with highest deprivations within this subgroup. Access to health insurance is also an important indicator (69.2%). When the censoring is applied

¹⁵The exception is Perú, showing higher levels of deprivation on income security. For this particular country it is much more relevant the level of deprivations on health, see Figure 3d.

the results follow the same trend. Ecuador and Perú show a poorer performance in the indicator of literacy, both raw and censored (27% and 23% censored results respectively), when compared to Chile and Colombia. After the k restriction is imposed, the results vary. Most of the indicators found to show higher deprivations in raw terms remain as the worst ones (years of schooling (41%), sanitation (30.2%), poor material of the floor (28.6%), literacy (23.5%) and effective use of health care (23.2%)). It is not the case of health insurance, once the restriction is used, it is replaced by the use of health care services. In Perú, a long waiting list is an important obstacle to effectively use health care services.

The analysis contrasting raw and censored headcount shows the importance of digging deeper into the results before and after censoring, if the objective is to use the measure as a policy tool. Other analysis that should be performed, although not explored in this paper are, for instance, the contributions of each indicator to the final index.

6 Multidimensional Poverty Index -Results

In this section, the results of the headcount ratio, the average intensity and the adjusted headcount ratio are presented for different values of the poverty cut-off (k), as well as differences among the values of the final AHR are presented in this section. Differences are calculated using the definition of [Saltelli et al. \(2005, p 309\)](#) as presented in Equation 7. A and B are two different countries, $AHR_{q,A}$ and $AHR_{q,B}$ are their respective Adjusted Headcount Ratio. The measure is performed for the final index or q ¹⁶.

$$D_{AB} = \sum_{q=1}^Q (AHR_{q,A} - AHR_{q,B})w_q \quad (7)$$

In subsection 6.1 subgroup population comparisons between countries and their subsequent aggregation is introduced. In order to compare the effects on the variation of the unit of analysis, household multidimensional poverty is shown in subsection 6.2.

6.1 Individual Multidimensional Poverty

Chile is by far the least multidimensionally poor country, followed by Colombia, Perú and Ecuador. The second place of Colombia in this ranking is a surprise, not only because of its behaviour in terms of income poverty but also in multidimensional poverty. The last two countries in the ranking (Ecuador and Perú) have a similar performance. An overlapping of curves, for adults and elderly, occurs when considering higher values of k ¹⁷.

¹⁶Differences between indicators and weights or w_q can be also calculated but they are not used in the application of this paper.

¹⁷For the following cases: $k=50-60\%$ and $k=80\%$ for adults and $k=50-60\%$ and $k=90\%$ for elderly.

The average intensity of poverty (A) is a measure of breadth of poverty. It is expected to increase with higher values of k . Chile also performs consistently better than the rest of the countries in terms of breadth.

The differences between countries confirm the overlapping of the curves depicting the final index in the cases of Ecuador and Perú, for the elderly and adults. The results show that the elderly subgroup is the most deprived, particularly important to note the Chilean case. Nonetheless, when the national level is calculated, the level of poverty of the elderly does not affect the position of Chile in the ranking¹⁸.

Figure 4: Children

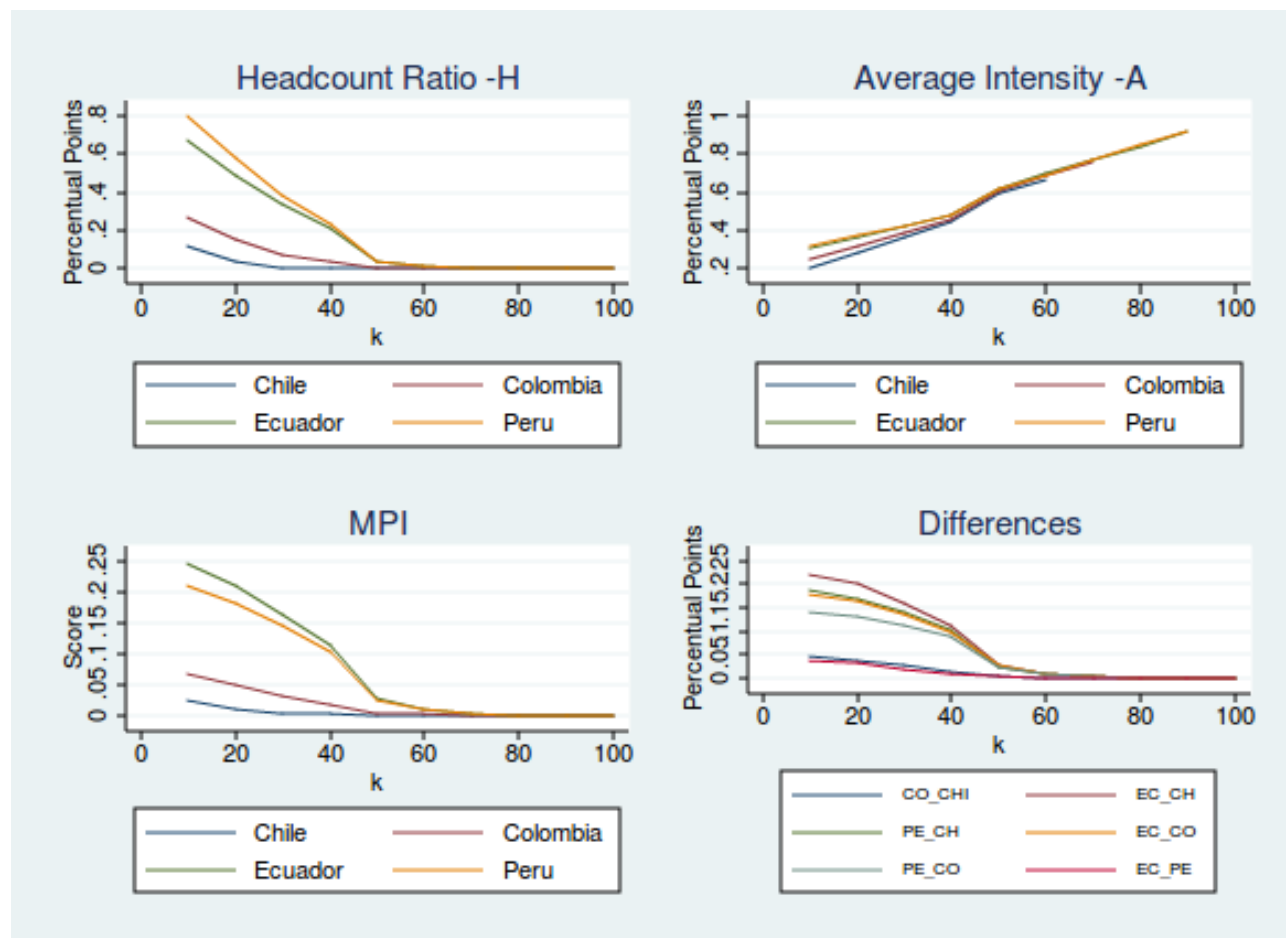


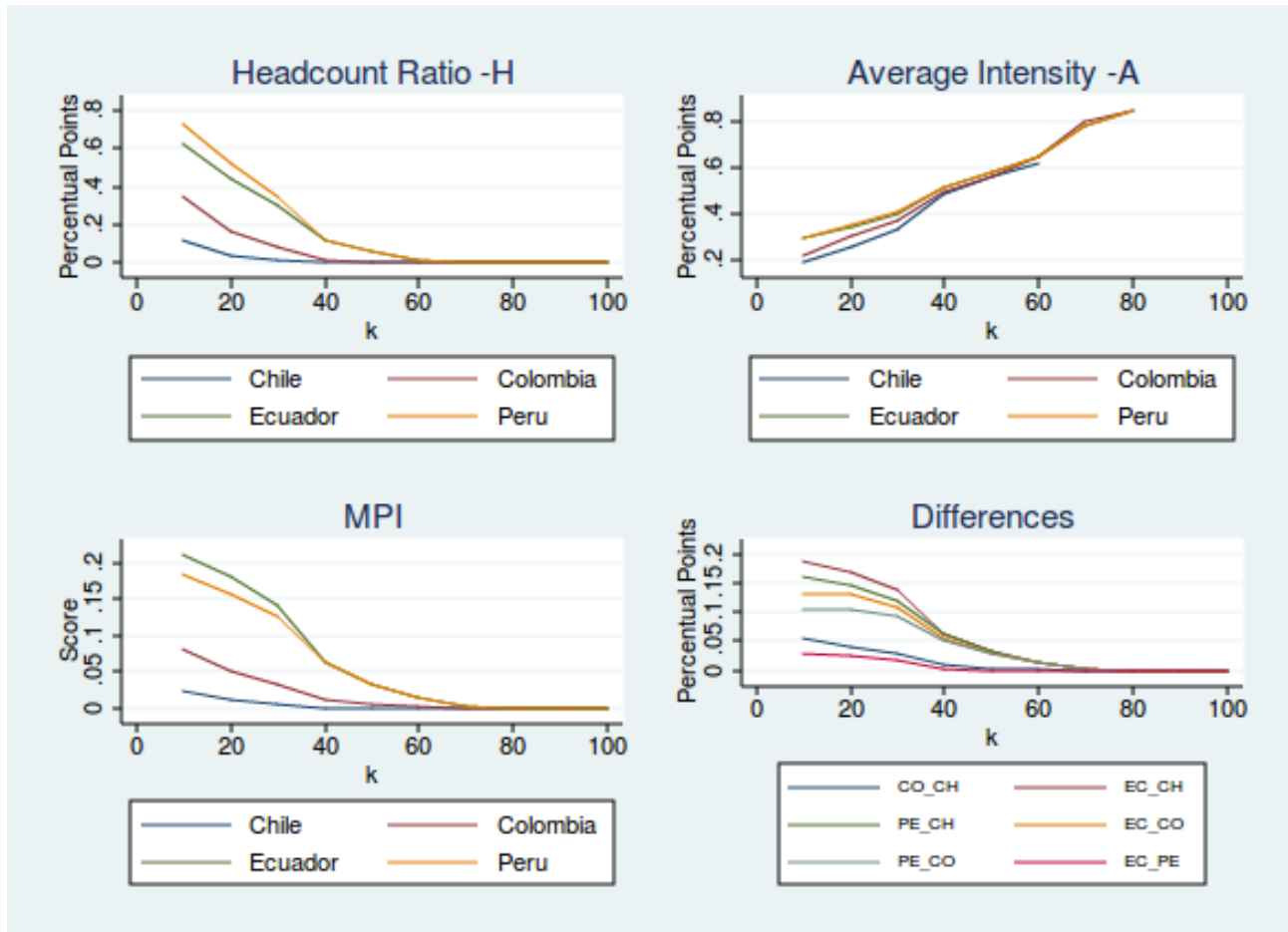
Figure 4 presents the case of children. The AHR score ranges from 0.1234 (Chile) to 0.7934 (Ecuador) when the lowest level of k is considered.¹⁹ When higher levels of k , for instance 90%

¹⁸In forthcoming work, the effects of population shares change will be assess to explore this issue.

¹⁹As explained in Atkinson (2003) the union approach is defined as the percentage of individuals deprived in at

are considered, the ranking is reversed. Perú is the worst off country of this sample. When the standard poverty cut-off is considered, $k=30\%$, the results for the AHR score are: Chile (0.0036), Colombia (0.0297), Perú (0.1441) and Ecuador (0.1639). Differences between countries tend to be insignificant to values of k higher than 60%. The highest difference between countries is found between Chile and Ecuador (More than 20 points).

Figure 5: Adults

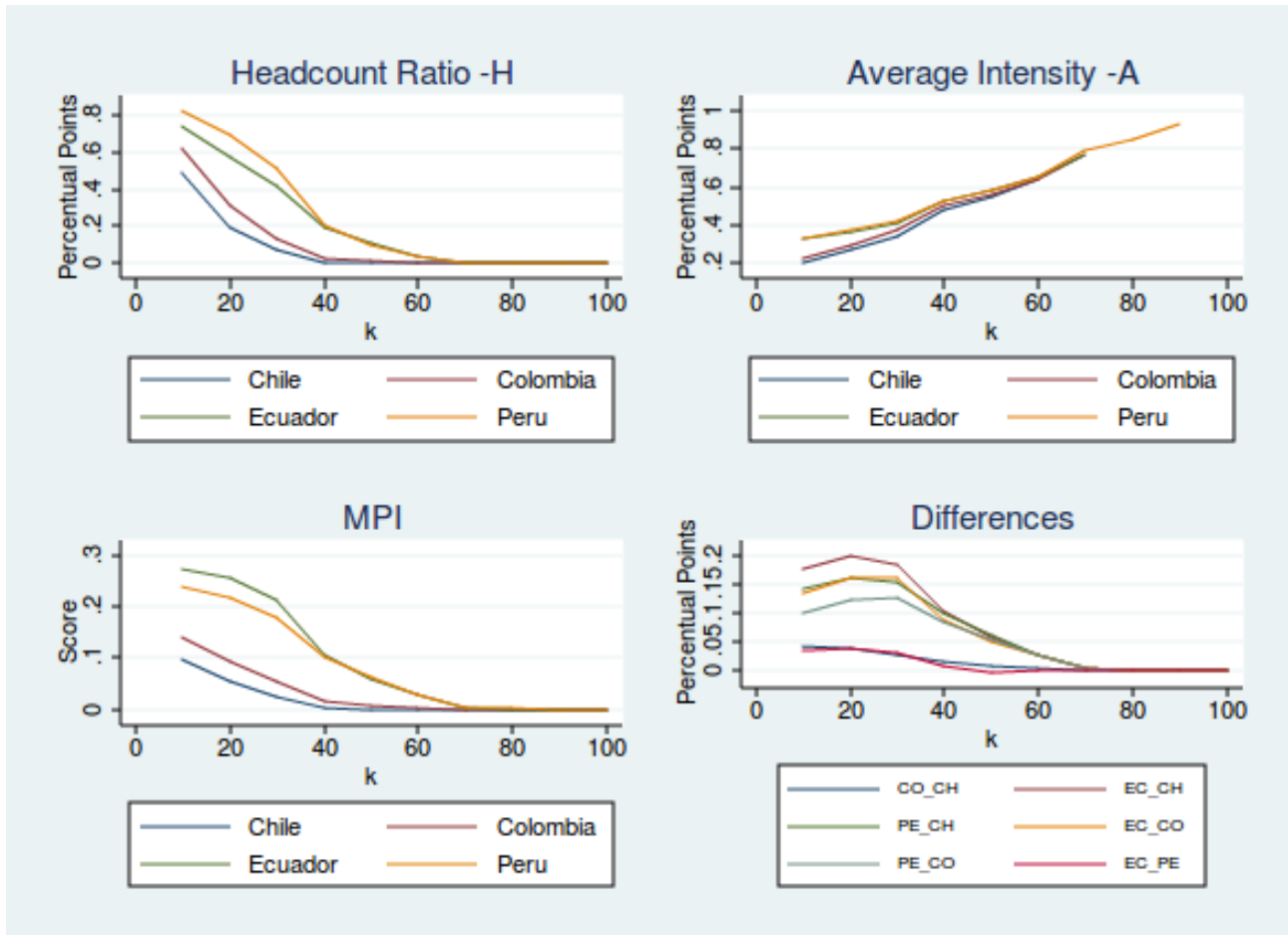


The less multidimensionally poor subgroup is adults (Figure 5). When $k=30\%$ is considered, Chile is the least poor country with a score of (0.0038), followed by Colombia (0.0316), Perú (0.1247) and Ecuador (0.1412). The differences between country are smaller when compared to those of children. Ecuador and Perú are the closest countries and the gap between Chile and Colombia is bigger for this subgroup. The differences become insignificant to levels of k equal or higher than 70% of the indicators. The highest difference is found between Chile and Ecuador.

least one indicator or in our case $k=10\%$ of the indicators

The results of the index for the elderly subgroup (Figure 6) are consistent with the results of the two previous subgroups. The headcount ratio for the union approach ranges from 48% in Chile to 82.45% in Ecuador. The final index result ranges from a score of 0.10 (Chile) to a score of 0.27 (Ecuador). The differences in the MPI, show that for values of $k=50\%$, Perú and Ecuador invert their ordering. This indicator proves the overlapping of the measure. The level of multidimensional poverty is higher for this subgroup.

Figure 6: Elderly



Using the cut-off of $k=30\%$, as shown in Table 5, children are the less deprived population subgroup in Chile and Colombia. In Perú and Ecuador, the less deprived population are adults.

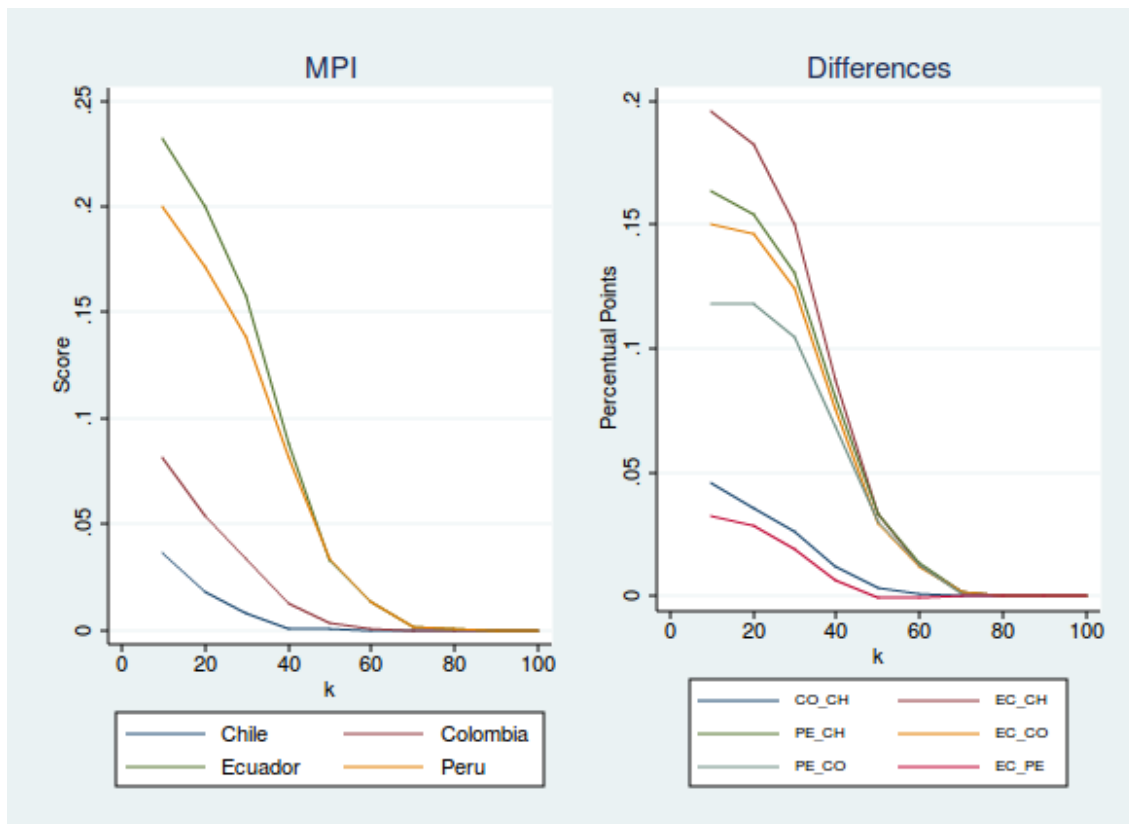
Table 5: AHR score for k=30% by subpopulation

AHR	Chile	Colombia	Ecuador	Perú
Children	0.0036	0.0297	0.1639	0.1441
Adults	0.0038	0.0316	0.1412	0.1247
Elderly	0.0257	0.0525	0.2132	0.1809

Aggregating to get the national MPI for each country is performed (see Figure 7). The share of each sub-group, understood as the percentage of population in the sample that falls into each age category, was used to find the final index. The results show the impact of the size of the population (see Annex A).

In every country, the smallest share is for elderly, ranging between 9.2% in Ecuador to 16.8% in Chile. The smaller amount of population in this age group benefits Ecuador in the overall general ranking. When considering the size of the population Ecuador is consistently well off compared with Perú.

Figure 7: Total



In summary, the ordering is similar once the values of the MPI by sub-groups are added, using the

population share for each country. Chile remains as the least multidimensional deprived country (0.0077), followed by Colombia (0.033), Perú (0.1382) and Ecuador (0.1573), for the particular case of $k=30\%$. At higher values of k , the ordering does not prevail. The ranking is reverted for the last two countries (Ecuador and Perú), as shown in Figure 7. A ranking reversal is evident when the lines of two different countries cross.

Table 6 presents the rankings for different levels of k . Perú and Ecuador switch places due to the differences in multidimensional poverty of the elderly. The graph of differences among countries confirm this finding.

Table 6: Rankings for different k

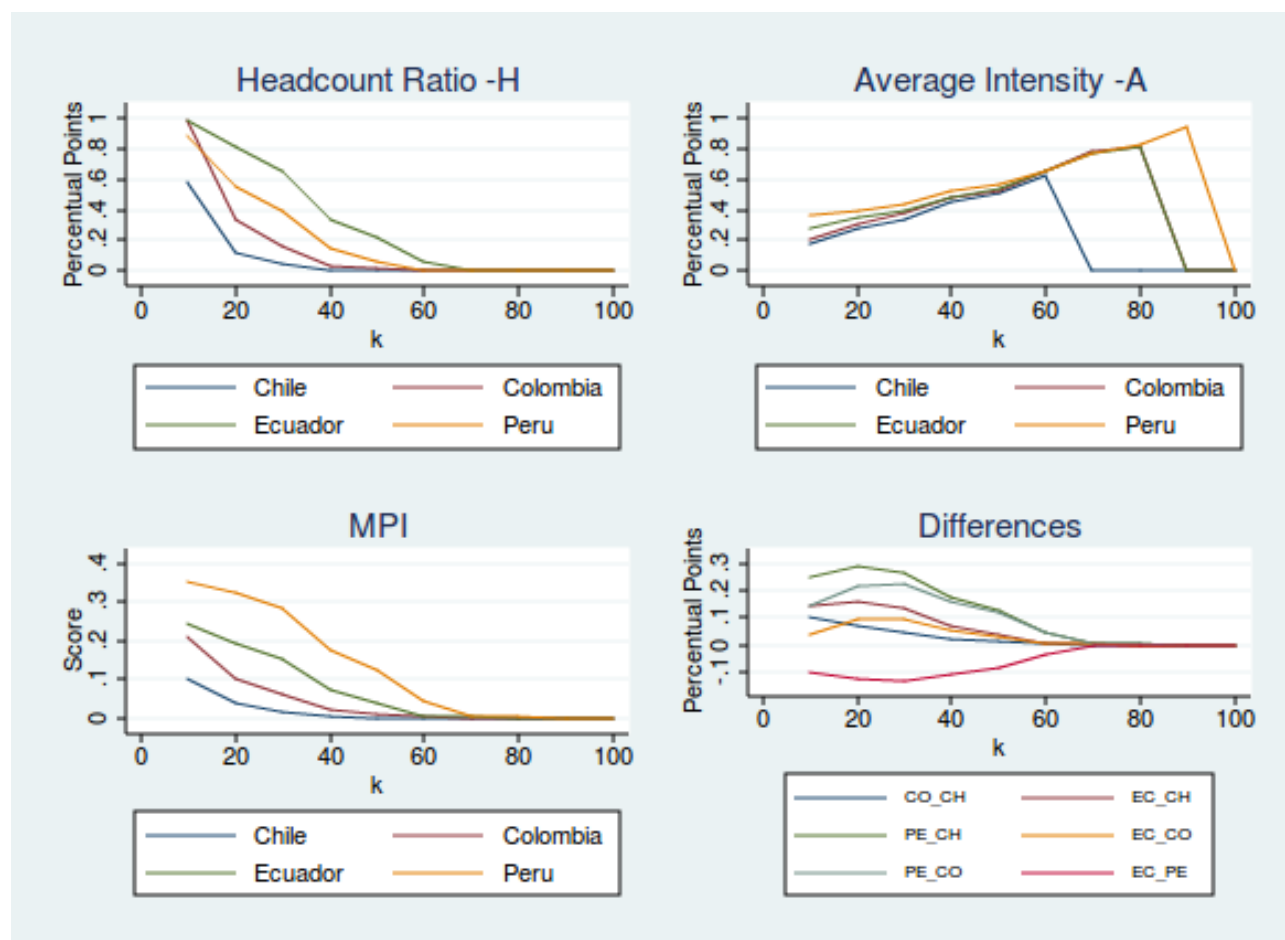
k	Chile	Colombia	Ecuador	Perú
10	1	2	4	3
20	1	2	4	3
30	1	2	4	3
40	1	2	4	3
50	1	2	3	4
60	1	2	3	4
70	1	2	4	3
80	1	2	3	4
90	1	2	3	4
100	1	2	4	3

6.2 Household Level Multidimensional Poverty Index

By means of comparison the same index is calculated but using households as a unit of analysis. The same indicators and cut-offs explained in section 5.3 are considered. Equal weights are applied to the 16 indicators. A household is considered deprived in one particular indicator when at least one member is deprived ²⁰

²⁰The decision is adopted to make both measures, individual and household-based, comparable. The most popular application of household-level MPI, performed by the UNDP and the OPHI, considers for instance in the dimension of education the complete opposite condition stated here. The cut-off defined is having at least one household member who has complete five years of schooling and having at least one school-age child (up to grade 8) who is not attending school. (UNDP, 2013, Technical Notes p 7).

Figure 8: Multidimensional Poverty Index for Households



Results are presented in Figure 8. By changing the unit of analysis a different scenario is portrait. Ecuador remains as the most multidimensionally poor country. Analysing only the H, Colombia is the country with the higher percentage of individual deprived in at least one indicator. This is due to the levels of deprivation in the education indicator, in which more than 9.7 households from every 10 have at least one member which had not complete at least 8 years of education. Considering the MPI, and due to the effect of the A, Perú is the most multidimensionally deprived country, followed by Ecuador, Colombia and Chile. The graph showing the differences among countries confirm the switch in the ordering between Ecuador a Perú when the AHR is calculated using the household as unit of analysis.

7 Conclusion

Composite indicators are increasingly used as tools for governance. Indices are perceived as data simplification of highly complex process or phenomenon (see [Davis et al., 2012](#), p 18). Results from rankings are one of the most popular statistics used by media, public official and academics. Although easy to communicate, the simplicity cited is just forge. The process that converts raw data into the index itself is not easy to communicate, and when so, it is not easy to understand by the general public. Advocates of composite indexes and their antagonists claim the need to assess the robustness of the final rankings. Transparency of decisions is asked for, as well as a clear assessment of the impact of this decisions.

On the measurement of poverty, the debate about which is the best methodology to assess what has been called multidimensional poverty is not yet settled. Nonetheless, the use of a particular indicator, the AHR of AF one, is increasingly being used as a governance tool. With this method not only comparative countries rankings are constructed but also, public policies and monitoring mechanisms are implemented.

Most of the data used in any multidimensional index is originally categorical, ordinal or dichotomous. Counting methods to measure multidimensional poverty are better to handle non continuous data. Particularly, AHR converts original categories or continuous variables in dichotomous variables in order to calculate the censored headcount ratio. That is to “count” in how many indicators a person or a household is considered deprived and censored those which are lower than a pre-determined threshold.

The method and its advocates had openly debated and showed step by step the moments in which the process requires normative decision-making. The arbitrary setting of parameters is a need on the multidimensional index calculation (e.g. weights, indicators, unit of analysis, aggregation method, and so on). By using different robustness tests and showing the results, the developer of an index, can assess not only the reliability of its own measure but also improve what is being measured. A clear and transparent report of the extent in which the normative decisions alter the overall result, strengths not only the quality of the measure but also the understanding of a broader audience.

The question this paper tries to reply is in what extent the use of the individual as a unit of analysis changes the depicted picture of a multidimensional index. Using the AHR index, a comparison of four similar countries in South America, is performed (Chile, Colombia, Ecuador and Perú). In order to include individual results, three age groups are defined: children (less than 18 years old), adults (18 to 59 years old), and elderly (older than 59 years old). An AHR index is calculated for each group and country. The indicators included follow the capability approach theoretical framework. Indicators are included is the following conditions are fulfilled: 1. The indicators express an achievement for individuals in the sense of creating or improving human capabilities, 2. The indicators do not express subjective well-being, 3. The indicators are not a measure of material or

income poverty, and 4. The indicators are comparable among the four datasets.

The result of the individual approach showed that the elderly, as opposed to children, is the most multidimensional deprived population subgroup. The driven factors are the minimum years of education and the access to sources of income after retiring age (either pension or labor). In the particular case of Ecuador and Perú, the poor coverage of health insurance and the limited access of effective health care in case of need were also a driven factor²¹. For children and adults, living conditions are the main source of deprivations. Lack of piped water and adequate facilities for sanitation is known for increasing probabilities of contagious diseases which, although had decreased in the region are still a major cause of death. Conflicts with the ownership of the land are of particular interest in the Colombian case. Crowdedness is a conflicting aspect in the case of Perú.

When comparing the raw and censored headcount between countries the levels of Chile are comparatively lower than those of the rest of the countries. The AHR, shows that Chile is the country with the best performance in this ranking.

In order to compare the consistency of the individual-based results a household-level index is constructed. Including all the possible indicators, a household was considered deprived if at least one individual was considered deprived. The last choice was taken in order to make both thresholds, individual and household comparable. A common pattern was found. Chile was still the least multidimensional poor country followed by Colombia, Ecuador and Perú. The ranking of the two last countries was reverted from the individual case. Also the differences among Colombia (2nd) and Ecuador (3rd) are not as wide as before. The multidimensional poverty scores of individuals (after aggregation according to the percentage of subgroup population in the sample) are close to 1/3 in the cases of Chile and Colombia, 1/2 for Perú and almost the same for Ecuador. Household multidimensional poverty is consistently higher.

As mentioned in section 6.1 and section 6.2 a constant crossing of the headcount ratio and multidimensional poverty curves for Ecuador and Perú was found for the elderly and adults subgroups, for the aggregation of the individual indexes and for the household index, when higher levels of the *Poverty Threshold or k* were considered. The decision about the poverty cut-off induces arbitrariness in the calculation of the overall result and could cause contrary conclusions (Lasso de la Vega, 2009). Interestingly, in the empirical case presented in this paper, it is not possible to establish a consistent ranking between Ecuador and Perú when a k higher than 50% was considered. This result is consistent with previous findings in the literature and debates about the consistency of the results (Lasso de la Vega, 2009) and (Ravallion, 2011).

In this paper, the goal was to compare the effect of the selection of the unit of analysis. Also a local

²¹In the case of Ecuador, health insurance was a determinant factor for every subgroup, in both raw and censored headcounts

robustness test is performed to the different levels of poverty cut-off. Also, this paper introduced one simple application of local uncertainty and sensitivity analysis, called the differences among countries. Nonetheless, further research has to be conducted to analyse the effect in the overall ranking of other sources of arbitrariness.

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A Basic Descriptive Statistics

	Chile	Colombia	Ecuador	Perú
Population Shares				
Children	26.97%	35.5%	41.7%	36.9%
Adults	56.22%	53.8%	49.1%	51.84%
Elderly	16.8%	10.7%	9.2%	11.22%
Basic Descriptive Statistics				
Household Size	4.35	3.47	5.13	5.11
Male Head of Household	66.93%	67.31%	79.04%	75.74%
Mean age	34.35	29.88	43.29	30.77

Source: Own calculations based on country LSMS

B Cross-checking the contents in the datasets

	Modules			
	Chile	Colombia	Ecuador	Perú
Demographics	Y	Y	Y	Y
Education	Y	Y	Y	Y
Health	Y	Y	Y	Y
Labour	Y	Y	Y	Y
Income	Y	Y	Y	Y
Expenditures		Y	Y	Y
Living Conditions	Y	Y	Y	Y
Disabilities	Y	Y	Y	
Children		Y	Y	
ICT	Y		Y	Y
Ethnicity	Y	Y	Y	
Governance	Y			Y
Participation	Y			Y
Migration	Y	Y	Y	
Social Mobility	Y	Y	Y	Y
Remittances			Y	Y
Social Capital		Y	Y	Y
Rural		Y	Y	Y

Source: Statistical Offices Official Manuals: Chile; Ministerio de Desarrollo Social, Colombia: DANE, Ecuador: INEC, Perú: INEI. Y=Information is available

C Indicators Cut-off and particularities of each dataset

Indicator	Cut-off	Exemptions
<i>Household Level</i>		
Dwelling	The individual does not live in a house, apartment or room. It includes options not made for human habitation	None
Wall	Material that is not permanent and resistant	None although materials differ in name
Floor	Earth or sand	None
Electricity	Do not have access to electricity	If access to other types for Perú and Ecuador (gas, kerosene, among others)
Overcrowded	Relation number of persons and number of sleeping rooms is higher than 3	None
Sanitation	Not connected to a pipe or lack of service	None
Water	Main source is not a pipe	It also includes not bottle water for Colombia
Tenure	Not legal and/or not supported by a title	The cut-offs includes de facto occupation and other types of squatters
<i>Individual Level</i>		
Literacy	Does not read and write	None
Early Education	The child is not assisting to a program of early education and the reasons for not attending are not related to personal beliefs from parents	Ecuador and Perú datasets do not provide a reason
Education	The reason for not being enrolled is related to either the service (e.g. there are not schools nearby) or to the socio-economic conditions of the individual (e.g. economic difficulties, disability)	None
Years of Schooling	Less than 8 years of schooling	The deprivation is not stated by the individual but calculated of a combination of the highest education level achieved and the last year approved
Access to health insurance	Individual does not have access to health insurance	None
Effective access to health services when needed	If the individual that manifests a need did not access to professional health services (excluding cases in which the manifested need was low impact)	A combination of three questions was used: need, where did you seek for health care? and reasons to not seek for professional health care

Continued on next page

Table 7 – *Continued from previous page*

Indicator	Cut-off	Exemptions
Long run unemployment	Only applies to unemployed individuals with three conditions: i) available to work, ii) still looking for a job, iii) during 24 or more weeks	Unemployment is considered a short term effect specially in high informal economies. In order to find the individuals which were deprived the long run unemployment concept was used. The international threshold of one year was modified to 6 months or 24 weeks.
Income security in old age	Elderly are not receiving any source of income (pension transfers or labour income)	None
Child labour	Applies to individuals younger than 18 years old, who are not studying and work a minimum of hours	Every country has a different cut-off which is related to the commitments signed for them with the International Labour Organization Convention's for Minimum Age and Worst Forms of Child Labour