

**UNITED NATIONS
ECONOMIC COMMISSION FOR EUROPE
CONFERENCE OF EUROPEAN STATISTICIANS**

Seminar on poverty measurement
5-6 May 2015, Geneva, Switzerland
Agenda item 4: Monetary poverty

**Note on the measurement of caloric intake in household surveys and its
relevance for measuring poverty**

Prepared by ECLAC¹

Introduction

The Statistics Division of UN-ECLAC estimates annually the magnitude of poverty in Latin American countries, as part of its regular follow-up of the social situation in the region. A few years ago it started a process of revision of the criteria used to measure poverty. That process has involved processing one or more income and expenditure surveys per country and overcoming some of the challenges posed by the ample heterogeneity of this kind of surveys. Based on that experience, this short note describes some issues related to the measurement of caloric intake through expenditure surveys. In particular, it provides some evidence on possible biases that may have an effect on the construction of absolute poverty lines. Methods for measuring absolute poverty generally require using information on household food expenditure (as proxy for food consumption) and deriving its corresponding caloric intake and cost-per-calorie.

Moreover, the usual methods for the selection of the reference group are based (either directly or indirectly) on the estimated caloric intake. The evidence shows that household surveys used to infer the caloric intake of the population may be subject to underestimation or overestimation.

Progress is needed on better measures of food consumption to have more robust poverty lines

¹ Note prepared by Xavier Mancero, Senior Statistician, and Rocio Miranda, Research Assistant, of the ECLAC Statistics Division, to be presented at the UNECE Seminar on Poverty Measurement, Geneva, 5-6 May 2015.

I. Data

The main source of information used in this analysis are household surveys that measure expenditure. In 15 countries data comes from income and expenditure surveys and in 3 countries from living conditions surveys. The surveys were collected between the mid 2000s and the early 2010s. Of these, 16 have a national geographical coverage and only 2 are exclusive to urban areas (see Table 1).

Table 1
Household Budget Surveys

Country	Name of survey	Coverage	Period
Argentina	National Survey of Household Expenditure	National	2012-2013
Bolivia	Continuous Household Survey	National	2003 - 2004
Brazil	Household budget survey	National	2008 - 2009
Chile	VI Household Budget Survey	Urban areas	2006 - 2007
Colombia	National Survey of Income and Expenses	National	2006 - 2007
Costa Rica	National Survey of Income and Expenses	National	2004 - 2005
Dominican Republic	National Income and Expenditure Survey of Households	National	2006 - 2007
Ecuador	National Survey of Income and Expenditure of Urban and Rural Households	National	2011 -2012
El Salvador	National Survey of Income and Expenditure Survey	National	2005 - 2006
Guatemala	National Survey of Living Conditions	National	2006
Honduras	National Survey of Living Conditions	National	2004
Mexico	National Household Income and Expenditure Survey	National	2012
Nicaragua	National Household Survey on Standard of Living	National	2005
Panama	Household Income and Expenditure Survey	Urban	2007 - 2008
Paraguay	Income and Expenditure and Living Conditions Survey	National	2011
Peru	National Household Survey	National	2008
Uruguay	National Income and Expenditure Survey of Households	National	2005 - 2006
Venezuela	IV National Survey of Family Budgets	National	2008 - 2009

From the information on food expenditure and quantities acquired recorded in surveys it is possible to obtain an estimate of the energy intake of households, using nutrient composition tables, which contain coefficients for calories and other nutrients as well as coefficients of utilization of food. The nutritional composition tables used for exercise are generally those developed by each country or taken from a country with similar characteristics.

Additionally, we use an estimation of the recommended caloric intake in each country. These were calculated based on the recommendations of FAO/WHO/UNU (2004)², taking into account the distribution of population by sex and age (ECLAC-Population Division estimates for 2005) and adopting some standard assumptions about the percentage of urban and rural each country who undertake moderate to vigorous activities.

II. Evidence of possible biases in the measurement of caloric intake

Below we show three different comparisons that illustrate the possible biases in the measurement of caloric intake by household surveys.

First, we compare the average caloric intake calculated from surveys with the FAO balance sheets³. In 12 countries the balance sheet figure is greater than the survey figure by at least 10%, including 8 where the difference is 25% or more. On the other hand, there is only one country where the average calories of the survey are more than 10% above the balance sheet estimate. (see Table 2).

As shown in figure 1, the size of the difference between the two sources is not directly correlated to the average caloric intake measured by the survey. For example, Bolivia has one of the lowest caloric intakes as measured by the survey but its difference with the balance sheet estimate is of only 14%. Nevertheless, the greatest discrepancies are found in

² FAO (2004). *Human energy requirements. Report of a Joint FAO/WHO/UNU Expert Consultation, Rome 17-24 October 2001*. Food and Nutrition Technical Report Series 1.

³ See <http://faostat3.fao.org/download/FB/FBS/E>.

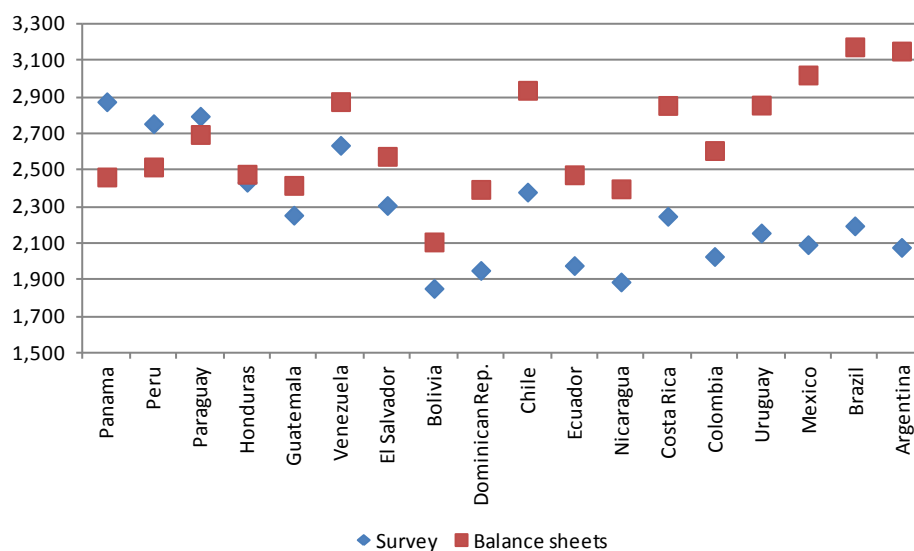
Argentina, Brazil, Colombia, Mexico and Uruguay (all around or above 30%), all of which have a similar measurement of caloric intake by surveys around 2,100 Kcal per day.

Table 2
Energy intake estimated from surveys and from balance sheets
(Kcal. daily per capita)

	Survey	Balance sheets	B.Sheets / Survey
Argentina	2,079	3,155	1.52
Bolivia	1,854	2,109	1.14
Brazil	2,197	3,178	1.45
Chile	2,382	2,940	1.23
Colombia	2,029	2,610	1.29
Costa Rica	2,249	2,857	1.27
Dominican Rep.	1,953	2,397	1.23
Ecuador	1,980	2,477	1.25
El Salvador	2,309	2,578	1.12
Guatemala	2,255	2,419	1.07
Honduras	2,436	2,480	1.02
Mexico	2,094	3,024	1.44
Nicaragua	1,890	2,400	1.27
Panama	2,877	2,465	0.86
Paraguay	2,798	2,698	0.96
Peru	2,757	2,520	0.91
Uruguay	2,158	2,859	1.32
Venezuela	2,638	2,878	1.09

Source: Author's estimations based on household surveys collected and processed by ECLAC and FAO Balance Sheets.

Figure 1
Energy intake estimated from surveys and from balance sheets
(Kcal. daily per capita)

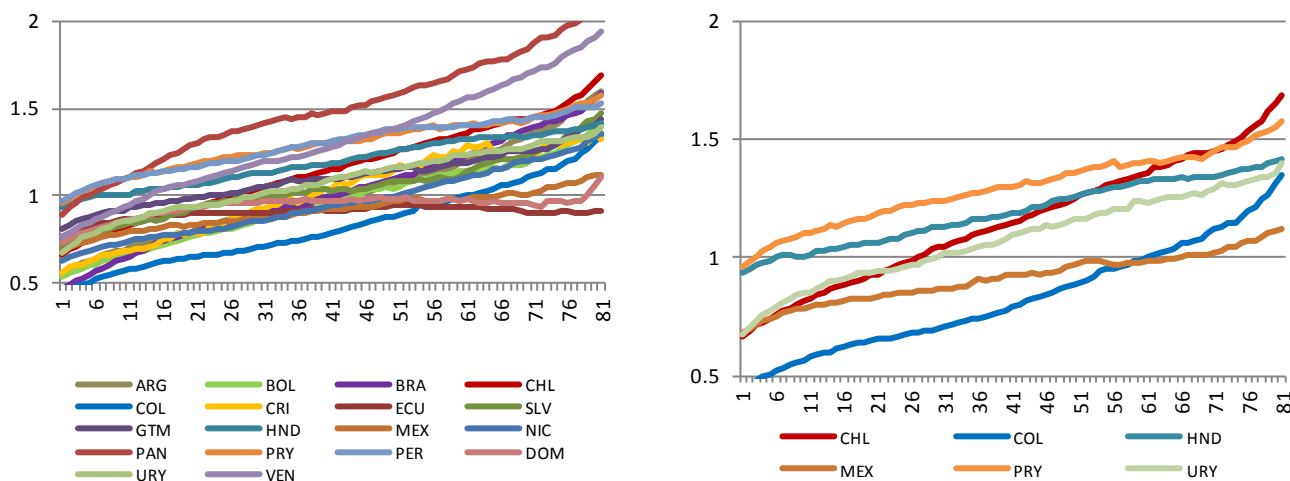


Source: Author's estimations based on household surveys collected and processed by ECLAC and FAO Balance Sheets.

Note: Countries sorted by relative difference between balance sheets and surveys.

A second piece of information comes from the comparison between the caloric intake measured in the survey and the average caloric requirement. We estimate the "caloric adequacy ratio" (CAR), ie the ratio between a household's caloric intake and its caloric requirement (according to the age and sex of each member). Figure 2 shows the average caloric adequacy ratio by "mobile quintiles"⁴ of per capita expenditure. As expected, as the amount of kilocalories grows along with household spending, so does the caloric adequacy ratio. There are important differences among surveys regarding which is the group with the lowest expenditure that reaches the recommended caloric intake (i.e., the first mobile quintile for which the adequacy ratio is equal to 1). In some countries the caloric requirement is satisfied by the first quintile, while in others the group is well above the median. We should expect some correlation between the ordering of countries by the position of the first group with CAR=1 in the distribution and ordering by poverty levels (as not being able to reach an adequate caloric intake is a clear manifestation of absolute poverty). Nevertheless, as shown in the right panel of figure 2, both orderings are not consistent: Chile and Uruguay have poverty rates below 15% but the first group with CAR=1 is near percentiles 26-45; Honduras' and Paraguay's poverty rates are well above 20%, but their first deciles already reach CAR=1; etc.

Figure 2
Average caloric adequacy ratio by "mobile quintile"



Source: Author's estimations based on household surveys collected and processed by ECLAC.

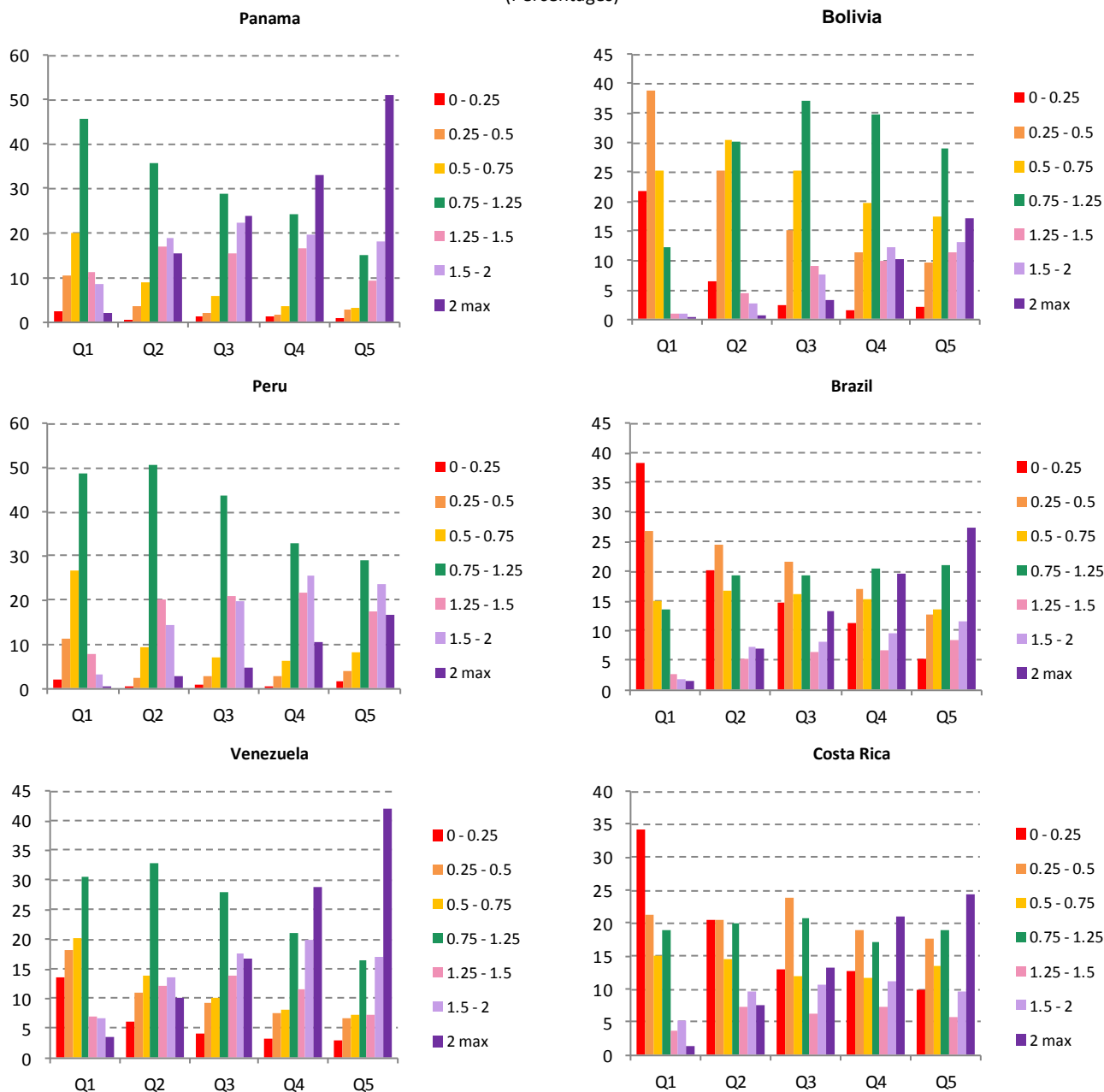
Figure 3 shows the distribution of households according to the adequacy ratio, by expenditure quintile for selected countries. Even though these countries differ in the degree of underestimation or overestimation of average caloric intake, in all of them there is a large percentage of households whose caloric adequacy ratio is outside an acceptable range in biological terms. The probability of finding a household with an adequacy ratio between 0.75 and 1.25 is less than 50%. Moreover, the percentage of observations within the middle ranges of caloric adequacy (0.50-0.75, 0.75-1.25, 1.25-1.50) does not vary significantly with household income. Most of the differences in average caloric intake between quintiles is explained by differences in the extreme ranges of caloric adequacy.

Figure 4 compares the population with CAR below 0.5 with the undernourishment rates around 2012⁵. The evidence tends to confirm that household surveys are underestimating caloric intake in some countries (those in the left side of the figure), while others are overestimating it (those at the right side).

⁴ Usually "mobile quintiles", which are 81 partially overlapping groups formed by 20 centiles.

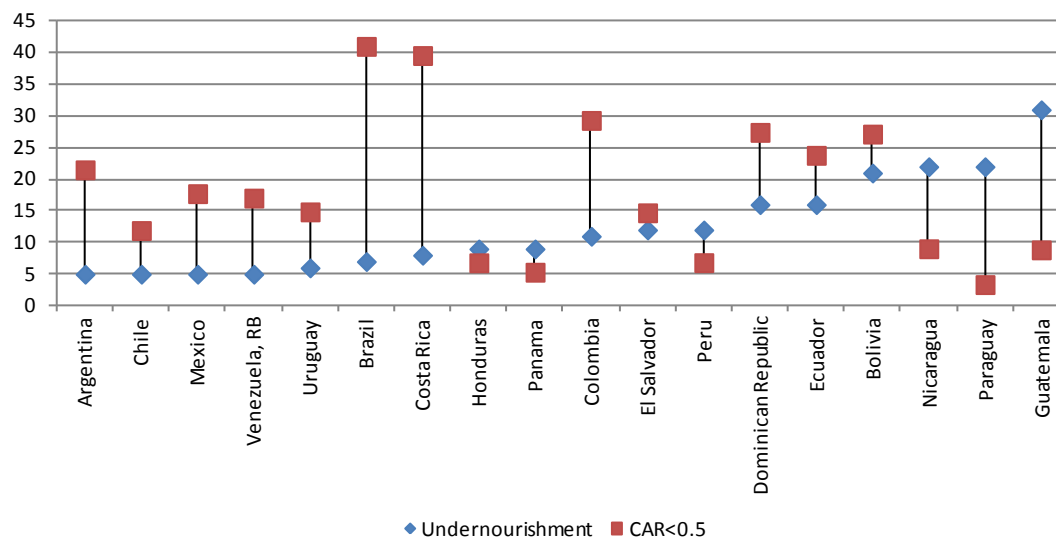
⁵ See World Development Indicators (<http://wdi.worldbank.org/table/2.18#>)

Figure 3
Distribution of households by caloric adequacy ratio and expenditure quintile
(Percentages)



Source: Author's estimations based on household surveys collected and processed by ECLAC.

Figure 4
Population with caloric adequacy ratio below 0.5 and undernourishment rates



Source: Author's estimations based on household surveys collected and processed by ECLAC and World Development Indicators (<http://wdi.worldbank.org/table/2.18#>).

Effect on the measurement of poverty

Information on caloric intake is especially relevant when looking to estimate absolute poverty by the method of cost of basic needs. Broadly, the method requires a) selecting a reference population, b) determining the cost per kilocalorie of food purchased by the group, c) estimating the extreme poverty line as the product of the recommended caloric intake and cost per kilocalorie, d) obtaining the poverty line by multiplying extreme poverty line by the inverse of the Engel coefficient.

The reference population is the population group that provides information on food consumption patterns and prices to build the CBA and to determine the Engel coefficient to be used in the construction of the poverty line.

In the region two methods for selecting the reference population are commonly used. The first one, used by ECLAC in the 80s to calculate poverty lines for Latin American countries, sorts the population in ascending order by per capita income and looks for to the first group⁶ whose average calorie intake per person per day is equal to or higher than the average caloric requirement for the population (such as in Figure 2). That is, the selection of the reference group is directly based on the comparison of caloric intake with caloric requirement.

The second method is an iterative process in which a position is chosen a priori for the group and the poverty rate resulting from this reference groups is estimated⁷. If the resulting poverty rate is not within the boundaries of the group, the selected position is corrected and the calculations are repeated until convergence is attained.

Although this method does not explicitly depend on caloric intake, in practice it does. The average expenditure of any subgroup can be written as $CpC_i \times CI_i \times 1/E_i$, where CpC_i is the cost per calorie of the i -th group, CI_i is the caloric intake and E_i is the Engel coefficient. The poverty line obtained using group i as reference population can be expressed as $PL = CpC_i \times R \times 1/E_i$. Therefore, the difference between average expenditure of any subgroup and the poverty line obtained using that subgroup as reference population comes exclusively from the difference between CI_i and R . If the reference group to be selected is

⁶ Usually "mobile quintiles", such as those shown in figure 2.

⁷ Proposed in M. Ravallion (1998). *Poverty lines in theory and practice*. LSMS Working Paper N.133, The World Bank.

the one where average expenditure is similar to the poverty line (and therefore the poverty rate is close to the midpoint of the group), the choice of reference group is entirely dependent on the difference between average intake (CI_i) and recommended intake (R), just as in the first method.

Taking some countries from figure 2 as examples, both methods would yield reference groups close to the first quintile in Honduras or Paraguay, around the third quintile in Argentina, Chile and Uruguay and around the fourth quintile in Colombia or Mexico. This ordering of countries is far from similar to an ordering based on poverty rates, per capita income or undernourishment rates, showing that the possible biases in the measurement of calories directly affect the choice of reference population and, therefore, the value of the poverty line.

Conclusions

- Evidence shows that expenditure surveys vary greatly in their ability to reflect household caloric intake. In some cases it is clearly underestimated, while in others it may be overestimated.
- The possible biases in the measurement of caloric intake have a direct impact on the measurement of poverty. Common methods for identifying the reference group yield inadequate results in a large group of countries analyzed.
- Evidence also shows that for a considerable percentage of survey observations spending on food survey cannot be considered representative of the consumption patterns of households. Therefore, microdata on household expenditure should be used with caution.
- Differences in the ability to measure food expenditure may be related to the form in which surveys collect the information (diary vs. recall, short vs. long period of recall, short vs. long list of items, etc). Further research is necessary to understand what is behind the biases in the measurement of food expenditure and caloric intake.
