

## Monetary poverty indicators at local level: definitions, methods of estimations and comparisons in real terms

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### Abstract

The importance of poverty measures (indicators and number of poor) at sub-national level is widely attested. Particularly, the local poverty indicators are relevant both for a detailed planning of the policy actions against poverty and social exclusion and for the citizens to evaluate their effect.

However, there are still open problems to compute adequate sub-national poverty indicators. They refer to: 1) the definition of poverty lines; 2) the methods for accounting the spatial variation of cost of living to make comparisons in real terms between different areas; 3) the use of Small Area Estimation methods when sample size is not enough to obtain accurate estimates of the indicators at local level.

In this paper, we discuss all these problems in a coherent way, presenting analyses on the impact of the different choices on the value of poverty rates for the 20 Italian Regions and computing the estimations of the poverty rates at the sub-regional level by using SAE methods.

The key results underlined the strong differences in the territorial distribution of poor by using national specific versus sub-national specific poverty lines, while the effect of the heterogeneity of the spatial price indexes seems less important.

**Keywords:** local poverty indicators; poverty lines; spatial price indexes, small area estimation.

### 1. Introduction

The important role played by the poverty measures at sub-national and local level in setting policy actions against poverty and social exclusion is widely attested. Particularly, the local poverty indicators are relevant both for a detailed planning of the policies actions and for the citizens to evaluate their effect. However, there are still open problems to compute adequate sub-national poverty indicators that ask for attention, verification and deeper discussion.

The poverty indicators to be used are many, also because they try to highlight the various aspects of the multidimensionality of poverty, but in this work, that is part of the deliverables of a large research infrastructure (INGRID2 –EU H2020), we consider only the relative monetary poverty indicators.

As it is well known, a common method used to measure the monetary poverty is based on income or consumption levels. Individuals or families are poor if their income or consumption level falls below a minimum level (called poverty line, PL) defined necessary to satisfy basic needs. This level varies in time and place, and the countries use poverty lines which are appropriate to ~~its~~ their level of development, social organization and scale of values. Here we refer to the Poverty incidence or Head Count Ratio (HCR), the simplest poverty indicator usually elaborated by most of the National Statistical Offices using consumption expenditures data.

To estimate this at sub-national and local level, the main issues discussed at international and national level are: i) the choice of the national specific versus sub-national specific poverty lines; ii) the use of the spatial price indexes, and in particular of the Purchasing Power Parities (PPPs) for accounting the spatial variation of cost of living, to make comparisons in real terms between different areas; iii) the use of Small Area Estimation methods when sample size is not enough, in order to obtain accurate estimates of the indicators at local level and/or of the whole local distribution of consumption expenditures. These issues are relevant because their solution sometimes strongly affects both the final values of the poverty indicators and the number of the poor, impacting on the policy actions.

In this paper, we discuss all these problems in a coherent way, in two subsequent steps, as this requires to present the analyses at two different territorial levels: for areas for which direct estimates of poverty are statistically significant and, separately, for smaller areas for which the sample size is not enough, in order to obtain accurate estimates of poverty.

First, in section 2, we present the analyses of the impact of the choice of the national or sub-national poverty lines on the value of the poverty incidence. We use spatial price indexes (?) to compare the poverty incidence of sub-national areas in real terms. This is done for the 20 Italian Regions, which represent the first sub national administrative level in Italy. At regional level the direct estimates of the poverty rate are accurate and the distribution of the consumption expenditures is available. The analyses have been carried out on the stratified sample of households selected by the Italian National Statistical Institute (Household Budget Survey–HBS, Istat) to collect consumption expenditures data in 2012. We chose this dataset, because only for 2012 the PPPs values are estimated and available at regional level in Italy.

Second, in section 3 we present a tentative estimation both of the poverty incidence and the whole distribution of consumption expenditures at sub-regional level, where the sample size is not enough to have accurate (reliable?) direct estimates. We have done it for the Italian Provinces, which represent the second sub national administrative level in Italy. The poverty incidence has been estimated by SAE methods and the distributions by using specific parametric models. In order to compare the spatial distribution of poverty rates in real terms, the cost of housing has been used as a proxy of the province's price indexes.

## **2. Issues to measure poverty rates at territorial levels for which the sample size allows reliable direct estimates**

### *2.1 The impact of the regional-specific vs national-specific poverty lines on the evaluation of the poverty incidence*

This issue has been discussed since long time and more recently by Jolliffe and Prydz (2015) and Ayala et al. (2014), which assert the inconvenience to use only one poverty line (the national), as usually made the National Statistical Offices. The issue arises when there are large differences in the values of per capita income or consumption among the different areas to be compared.

In Italy, the differences in the per capita household consumption expenditures are very high, with a percentage difference that reaches the 50% comparing Northern with Southern Italian Regions (for example Lombardia with Campania). It is therefore important to evaluate the impact of the use of different poverty lines in measuring the poverty incidence and consequently counting the poor.

In the following Fig. 1 the estimations of the household HCR for the 20 Italian regions are reported, by using the National Poverty Line (NPL) and the Regional Poverty Lines (RPLs). The definition of poverty threshold used for the NPL and RPLs is that applied by Istat. The Figure contains also the 95% confidence intervals.

The interpretation of the results should be done with caution, because as we can see from Fig.1 not all the differences among the different estimates of the HCRs can be considered as statistically significant (similar results are obtained by Giusti et al., 2017).

In any case, the results obtained clearly show that the variability of the spatial distribution of the HCRs is quite smaller by using the RPLs (the max and min values of the HCRs become 13,1%-5,6% instead of 30,9% and 5,3% by using the NPL). Abandoning the reference to the NPL, the HCRs estimated by the RPLs are higher in 12 regions and lower in 8 regions and some of the differences in the ranking are striking. In Lombardia and Campania, the Italian largest regions in terms of population, the value of poverty incidence and the correspondent number of poor households show relevant variations: Lombardia +3.8 points and + 148,000 poor households; Campania -21.6 points, and -445,258 poor households. Summarizing, the national HCR using the RPLs instead of the NPL decreases of 4,4 points and the number of poor households decreases of about 1,100,000 (from 3,283,000).

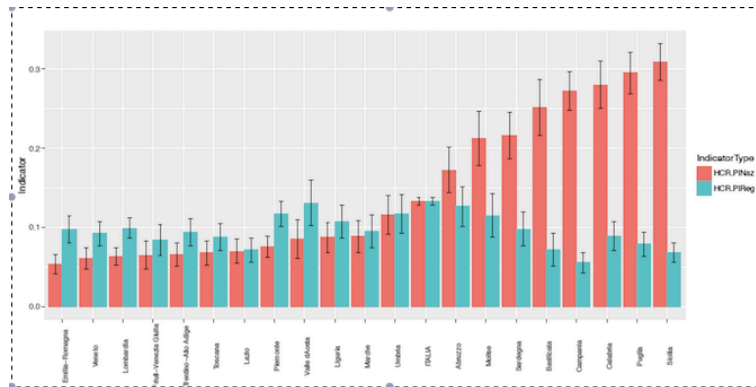


Fig. 1 Household HCR for Italian regions computed with National Poverty Line and Regional Poverty Lines – 2012

Apart from the difficulty of obtaining an exact measure of the poverty, it is clear that the use of different poverty lines have strong geographical implications in the evaluation of poverty.

On the other hand, the choice of the poverty definition and of the poverty line depend on the level of analysis and the kind of the policy to be implemented (Kangas and Ritakallio, 2007). However, for the comparisons of relative monetary poverty at regional (local) level, it seems justified the use of specific-region (local) poverty lines (Mogstad et al., 2007).

The results obtained for the different regions certainly depend on the different levels of the average household expenditure of each region, which are used to establish the RPLs. When the regional level is below the national ones' the poverty lines is of course lower. However, there is evidence that for every region the main part of the difference between the national and regional values of the poverty line is due to the shape (skewness and kurtosis) of the distribution of the expenditure in the region.

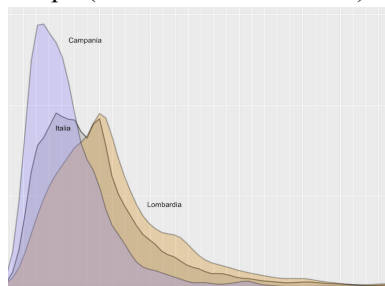


Fig.2 Estimates of the expenditures distribution – 2012

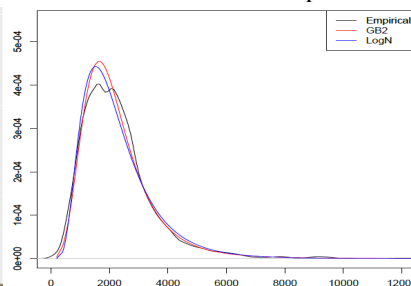


Fig.3 Estimated distributions for Lombardia region -2012

The empirical expenditure distribution shows very different shapes when estimated at national level or at regional level (Fig.2). Even if Lombardia and Campania distributions look very different, the Log Normal and General Beta2 distribution models can be used to represent them, as it is show in the Fig. 3, for the Lombardia region. Note that practically the left side of the distribution is well followed by both models and this is useful when estimating the poverty rate at sub-regional level.

## 2.2 The impact of the regional cost-of-living differences on the measure of the poverty incidence

The need to account for the cost-of-living differences in the comparison of poverty between different territorial areas (including urban, suburban, and rural areas) by using a spatial price index is recognized everywhere (Jolliffe, 2006). To assure that the poverty line(s) represent approximately the same standard of living across the different areas, there are two groups of indexes that are used at sub-national level: the Purchasing Power Parities (PPPs) and the Cost of Housing, which have different background and justification (Renwick, 2009).

At the international level, the use of PPPs computed by the International Comparison Program (ICP) of the World Bank (World Bank, 2015) is the most adequate spatial index to do poverty comparisons. However, the computed PPPs refer to the whole population and are not specific for the consumption or income of the poor. Some researchers, and in particular Deaton and Dupriez (2011), suggested to compute the poor-specific PPPs by using the same vector of general average prices of groups of

products and different weights which take into account that the baskets of goods and services are different at the different quintiles or percentiles of the consumption distribution. This is a first good attempt to solve the problem. However, it is not enough. The consumer behavior of households and in particular of the poor varies for quality of the commodities, channels of distributions, location of the markets and, above all, are likely to be lower. It is known that the variability and the relative variation of prices (of elementary price indexes) by type of outlet and area are usually rather high (ISTAT, 2014). More difficulties emerge when sub-national PPPs are needed, mainly because of data collection complexity and in fact few countries are computing them.

For sub-national cost-of-living adjustments to compare poverty, also spatial indexes based on the cost of housing are used, in particular in the US, because their variation across areas can be significant. The most used index refers to the average monthly rent for different type of house on the hypotheses that it is the most important issue to be faced by poor, representing 40%-50% of their total consumption expenditure. Moreover, it is important to consider that many policies against the poverty are based on rental housing subsidies or on providing no cost house to the poor.

To try to evaluate the impact of the regional cost-of-living differences on the measure of poverty incidence in Italy, we can use two different conversion factors: i) the 2009 PPPs for households consumption computed by Istat for the chief-towns of the regions; they have been computed following the ICP method and updated by Marchetti and Secondi (2017) to the year 2012; ii) the median monthly expenses of the households to rent a house, estimated on the basis of HBS data. The PPPs for chief-towns are adequate conversion factors to adjust the regional poverty lines as they refer to the household expenditures, but they do not represent the level of prices for the whole Region, and in any case, at the moment, they are not currently available for Regions and for sub-regional local areas in Italy. On the other hand, the regional median monthly rent (RMRHs) is currently available, but it does not cover the poor, which are owners of the house.

These two regional conversion factors are applied to the NPL to obtain new Regional Poverty lines and then to estimate the household HCRs which account for the spatial cost-of-living differences. As suggested by other researchers we applied the MRHs to the 50% of the National Poverty Line.

The results are illustrated in Fig. 4. As we can see the use of the conversion factors reshuffle in some way the territorial distribution of the HCRs values. However, using the PPPs the resulting shift does not seem so radical in comparison with the changes obtained by using the RPLs. More reshuffling effect is evident when the MHR is used. The range of the two spatial indexes is quite different: 13,2 percent points for PPPs; 68,8 percentage points for MHR.

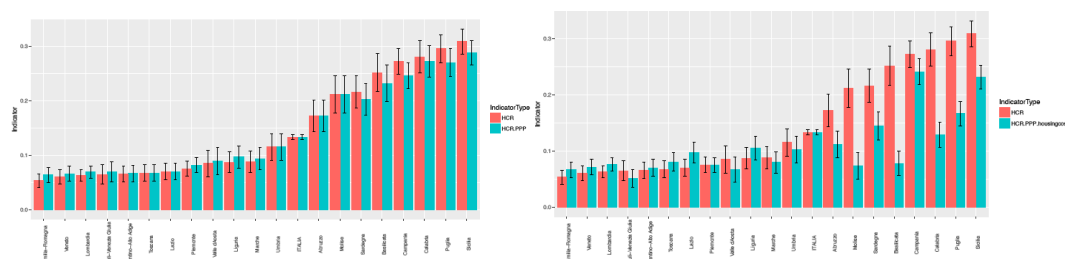


Fig. 4 Household HCR for Italian regions computed with NPL adjusted by PPPs (left) and RMHRs (right) – 2012

Similar results are obtained in other researches (Ayala et al., 2014) and they indicate that the general PPPs are not the best appropriate conversion factors for both the poverty line and the expenses of the poor. In any case within-country differences in poverty lines reflect in principles both difference in prices and needs. The effect of the cost-of-living differences is only one explanation of the total difference highlighted by using the RPLs. Some researchers consider that the best approach is using local poverty lines directly because it is assumed that the regional standard better approximates the community standards for social standing. Moreover, to interpret correctly the reasons of the differences among the regional HCR is necessary to analyse the effect of the different characteristics

of the households (age of the components, profession, location and type of the house, etc.) under the poverty line, also to better define appropriate policy actions.

### 3. The estimation of poverty rates at territorial levels for which sample size is not enough, in order to obtain direct accurate estimates

The results obtained with the previous analyses guide us in the tentative estimation of the poverty incidence and the whole distribution of consumption expenditures at sub-regional level that is for 109 Italian Provinces for which the sample size of HBS is not enough, in order to obtain accurate estimates. Also the problem of the different cost-of-living of the provinces is considered.

#### 3.1 The estimation of the provincial HCR

For the estimation of the HCR at provincial level, we have used both the SAE methods and the parametric estimation of the distribution of the consumption expenditure.

A wide range of methods have been proposed and used in literature to obtain reliable small-area estimates (mostly model-based estimators (Pratesi, 2016)). We follow what already done by Marchetti and Secondi (2017), which, taking into account the availability of the data, used the area-level approach proposed by Fay and Herriot. The area-level estimator is a linear combination of the small area direct estimator and a predicted component based on a linear mixed model. The model relates the parameter of interest (in our case the HCR) to auxiliary variables that are known for each area, and includes area effects to account for the between area heterogeneity.

The auxiliary variables included in the model are the provincial mean taxable income (per capita), computed by using data available from the Italian Ministry of Economy and Finance archives; the share of households in the province that have the ownership of their house, computed by using data of the Housing and Population Census 2011.

As a second approach, we used the HCR estimates computed using only the data coming from the HBS, by using the national poverty line.

The variance of the estimates is sometimes large, but in any case we obtain useful information on the spatial distribution of the HCR. However, applying the Fay and Herriot model we obtain only which percentage of the distribution is below the poverty line and not the whole distribution of the expenditure.

The other approach followed to estimate the provincial HCRs is the use of parametric model-fitting of some theoretical distribution usually employed for the estimation of income distribution (Bandourian et al., 2002). We assumed that the model well fitted at regional level can be used for the estimation at provincial level, using the data available at this second territorial level. As already said in par. 2.1, we fitted the Log Normal and General Beta2 distribution models finding that the second model represented better the data of the various regions. Therefore, at provincial level we applied the General Beta2 model. In addition it includes as special or limiting case the Weibull, Dagum and other important models for the income distribution.

In our case, we fitted the function separately for each province and for each region, on the data of the equalized household consumption expenditure using the survey weights multiplied by the number of components of the household. By using the values of the GB2 estimated parameters we then computed the HCR using different poverty lines (national, regional, provincial). Also in this case the variance of the estimations is sometimes large. All the obtained estimates provide coherent results that cannot be illustrated here.

	SAE-NPL	SAE-RPLs	GB2-NPL	GB2-RPLs	GB2-PPLs
Maximum	33.9	26.6	42.2	31.1	18.0
Minimum	0.9	0.9	1.4	0.4	1.0
Range	33.0	25.7	40.8	30.7	17.0
C. V.	0,66	0,51	0,75	0,52	0,35

Table 1. Different estimations of provincial HCRs (in %) - Measure of their variation among provinces

In the previous Table 1 we report a summary description of the dispersion of the estimated HCRs (in %) among the provinces, obtained by using different methods (SAE and GB2) and different poverty lines (NPL, RPLs and P(rovincial) PLs).

As we can see, the result of the HCRs estimated are not so different in term min-max values obtained, while the variability of the HCRs among provinces became smaller passing from NPL to RPLs and PPLs as expected.

### *3.2 The impact of the provincial cost-of-living differences on the measure of the poverty incidence*

Indeed, PPPs conversion factors are not currently available for sub-regional (provincial) local areas in Italy. Istat is now implementing a project to compute the PPPs for household consumption in provincial capital cities.

We estimated the conversion factor by using median monthly rent estimates for the household at provincial level (PMRHs). In some provinces due to the small sample size the variance of the estimates are sometimes large. However, the summary results of the spatial variability of the PMRHs normalized to Italy =1 (max =1.67; min = 0.32; C.V. = 0.3) and normalized to Region=1 (max=1.49; min= 0.45; C.V.= 0.2) show clearly the importance of the differences in the provincial cost-of-living measured by the housing cost proxy and the need for better measures of it.

## **4. Concluding remarks**

The paper presents the first results of an extended research group belonging to the Italian Inter-University Dagum Centre, involved in Ingrid2. The research can continue along many directions. We need to improve the method of estimation of the poverty rates at local level (provinces and sub-provinces areas) and of the cost-of living correction factors (spatial price indexes). For the spatial price ,, we are involved and we are waiting for the Istat estimation of PPPs at provincial level by using also scanner data (but the problem of prices payed by poor still exist). However, we need also to try to improve the spatial housing cost indexes considering house specific characteristics (included the territorial location and the quality of the house) by using the administrative data available in Italy (Tax Agency). But it is also necessary to better investigate, with adequate methodology, the demographic characteristics of the groups of population who live beyond the poverty lines.

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