



Improving of the Reliability of Ukrainian Poverty Indicators Estimation Using Auxiliary Information

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Abstract

The reliability of the poverty indicators direct estimation on base of the state Ukrainian Household Living Conditions Survey (HLCS) data at the regional level is, in general, insufficient. One of main factors of this is the high nonresponse rate, especially among the well-to-do population strata. This affects the income and consumption profiles which are determined from the HLCS, and may leads to biased estimates of poverty indicators. Other significant factor is the rather small effective sample size in some regions which can make less than 250 households. In the paper an efficient approach to enhancing statistical reliability of the poverty indicators estimation at the regional level based on using of auxiliary information is submitted. The approach provides calibration of HLCS statistical weights using National Accounting System (NAS) adjusted data on structure of the final consumption expenditures of Ukrainian households and multivariate composite estimation of poverty indicators. It is shown that estimation on base of the approach can significantly improve the reliability of the poverty indicators estimates. Moreover, it is established that on base of calibrated HLCS data the potential bias of the Gini coefficient estimate can be reduced.

Keywords: sample survey, bias, calibration, composite estimation.

1. Introduction

The state Household Living Conditions Survey (HLCS) provided by the State Statistics Service of Ukraine on quarterly basis, which has been carried out since 1999 in accordance with the international methodology, is the main source of information for measuring of a number of important indicators which in details reflect incomes, expenditures, consumption features, poverty of Ukrainian households and many others. In Ukraine, there are 24 oblasts, one autonomous republic (Autonomous Republic of Crimea – AR of Crimea) and two cities (the city of Kyiv and the city Sevastopol) which are all consisted as administrative regions (at present AR of Crimea, city Sevastopol and partly two eastern regions are temporally occupied by Russia). Each administrative region is subdivided into lower level administrative units. Analysis of reliability of the poverty indicators estimates defined on base of HLCS data, first of all of the relative poverty rate by national poverty line which is defined as 75% of median household equivalence income, has proved the indicators direct estimates at the regional level to be insufficiently reliable. The most important factors of this are the high nonresponse rate and small effective sample size in some regions which can make less than 250 households. Respectively, this limit the possibilities of efficient poverty monitoring in Ukraine, especially in the context of government decentralization policy implementation, and affects the income and consumption profiles (distributions) which are determined from the survey.

The high nonresponse rate registered among the territories with relatively high rate of well-off population (primarily the capital Kyiv and other cities) and some other estimates, for example analysis of the Gini values, make the possibility to suggest about incomplete coverage of well-to-do households by the HLCS (Fig. 1).

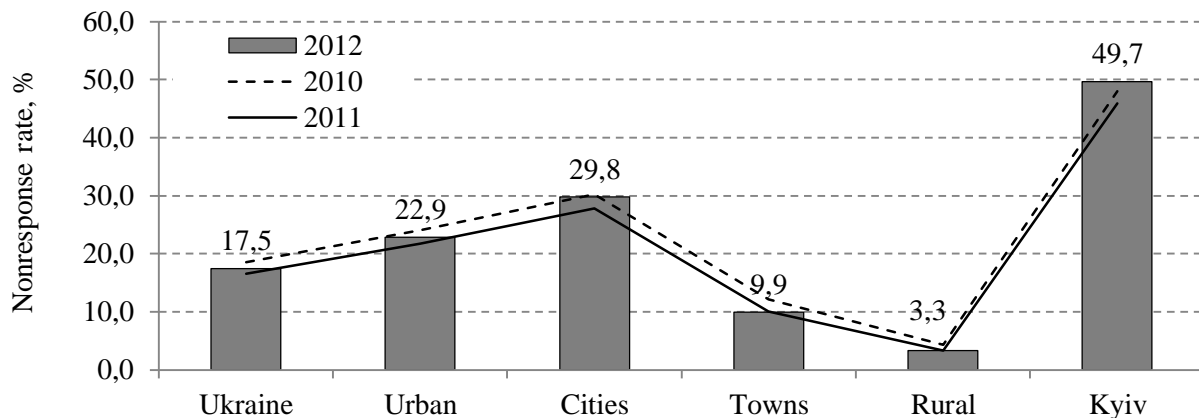


Figure 1. The average nonresponse rates by subgroups of the sample (HLCS, 2010–2012)

2. Methodology

An efficient approach to enhancing the reliability of the poverty indicators estimates at the regional level is their estimation using auxiliary information (Longford, 2005; Longford, 2010). Wherein, the possibility of the adequate procedures development and their further practical usage depends essentially on the available additional information. Sources of auxiliary information which can be potentially used for improving of the reliability of poverty and household income and consumption expenditures estimates are: administrative data of tax administration, National Accounting System (NAS), labor statistics, data of energy companies on household electricity consumption and so on. According to results of our researches today one of the most effective approaches in Ukraine is using of household final consumption expenditures by NAS data. The sense of the approach is calibration (Deville, J.-C. and Särndal, C.-E., 1992) of HLCS statistical weights using the structure of the NAS final consumption expenditures by groups of goods and services in order to ensure maximum proximity of the HLCS structure to NAS structure (Fig. 2). It should be noted that it may be necessary to eliminate the main differences between expenditures measures in NAS and in survey (for example, imputed rent) taking into account the methodological features.

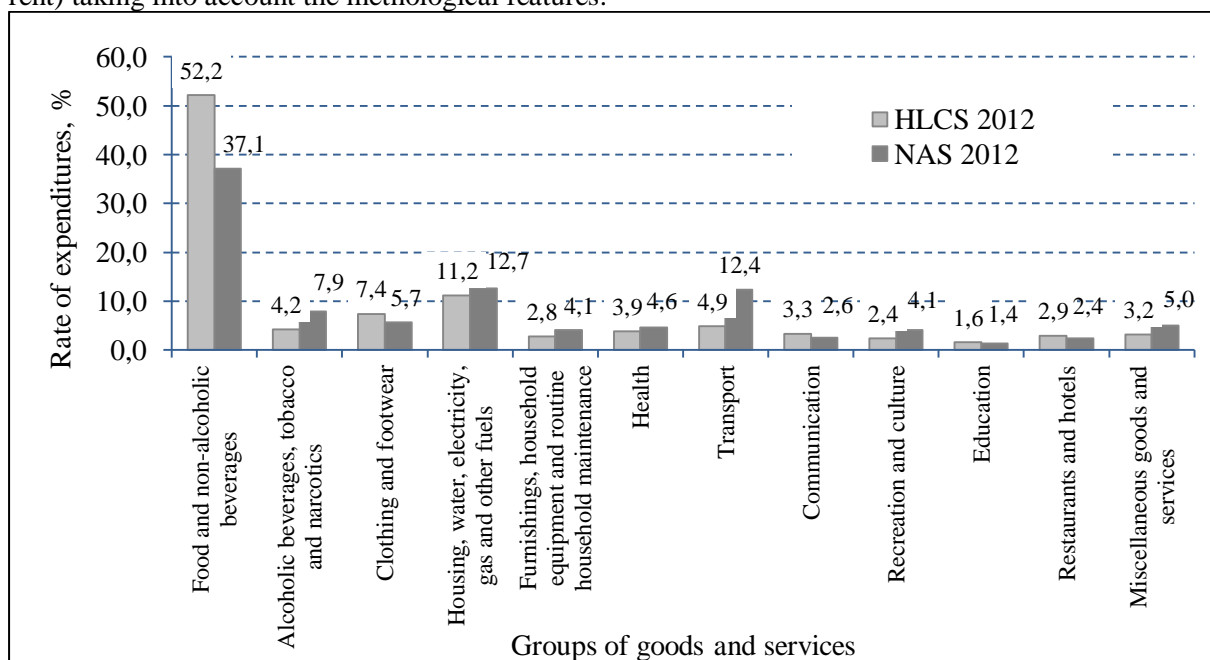


Figure 2. Comparison of household expenditures structures by results of HLCS, 2012 and NAS, 2012

For indirect estimation of the poverty indicators by regions of Ukraine for a particular year the small area estimation approach was applied as the main one, being described by a trivariate composite estimator:

$$P_{comp,k}^{(j)} = (1 - \hat{\gamma}_{1k}^{(j)}) \cdot P_k^{(j)} - \hat{\gamma}_{2k}^{(j)} \cdot x_{1k}^{(j)} - \hat{\gamma}_{3k}^{(j)} \cdot x_{2k}^{(j)} + \hat{\gamma}_{1k}^{(j)} \cdot P^{(j)}, \quad j = 1, 2, 3. \quad (1)$$

where $P_{comp,k}^{(j)}$ - the composite estimator of the j -th poverty indicator for the k -th region in the considered year; $P_k^{(j)}$ - the direct estimator of the j -th poverty indicator for the k -th region in the considered year; $P^{(j)}$ - the direct estimator of the j -th poverty indicator for the national level in the considered year; $x_{1,k}^{(j)}$ - the composite estimator of the j -th poverty indicator for the k -th region in the previous year; $x_{2,k}^{(j)}$ - the per capita final consumption expenditures according to the NAS data for the k -th region in the considered year; $\hat{\gamma}_{1k}^{(j)}, \hat{\gamma}_{2k}^{(j)}, \hat{\gamma}_{3k}^{(j)}$ - the weighting coefficients of the composite estimator for the k -th region when estimating the j -th poverty indicator; “ j ” index relates the poverty level indicators to the corresponding criteria: $j = 1$ - “The poverty rate by the national line”; $j = 2$ - “The poverty rate by the regional line”; $j = 3$ - “The poverty rate by the cost of living rate”.

3. Results

As the result, applying of the reliability improvement procedures led to changing of the distribution of household income by decile groups (Table 1) and the income inequality indices (Table 2).

Table 1. Rates of the household income by decile groups before and after applying of the reliability improvement approaches

Decile groups	Before, %	After, %
1	4.5	4.2
2	6.1	5.5
3	7.0	6.3
4	7.7	7.1
5	8.6	8.2
6	9.4	9.2
7	10.5	10.5
8	11.8	12.1
9	13.8	14.7
10	20.6	22.3
Total	100.00	100.00

Table 2. Inequality Indices before and after applying of the reliability improvement approaches

Index	HLCS	HLCS calibrated
Gini	0.23	0.27
Decile group 10/ Decile group 1	4.60	5.36
Decile group 9,10/ Decile group 1,2	3.30	3.85

The degree of reliability improvement as result of the composite estimation of the poverty rate by the national line is illustrated by data presented in the Table 3.

Table 3. The results of the composite estimation of the 2012 poverty rate by the national line

Region	Composite estimate, % $P_{comp,k}^{(1)}$	Coefficient of variation of the direct estimate, %	Relative error of the composite estimate, %
AR of Crimea	23.9	11,46	7,81
Vinnitsia region	24.4	16,06	8,18
Volyn region	31.9	14,23	8,16
Dnipropetrovsk region	28.8	10,50	5,80
Donetsk region	24.2	12,58	6,49
Zhytomyr region	38.3	9,74	7,54
Zakarpattia region	19.9	12,20	11,22
Zaporizhia region	14.9	21,59	12,40
Ivano-Frankivsk region	29.3	24,56	8,44
Kyiv region	23.4	12,81	9,42
Kirovograd region	32.0	13,81	8,72
Lugansk region	23.1	12,31	7,54
Lviv region	28.2	10,36	6,25
Mykolaiv region	17.4	19,93	10,69
Odesa region	31.5	15,89	6,27
Poltava region	22.7	16,58	9,43
Rivne region	46.8	19,42	7,03
Sumy region	34.1	18,93	8,00
Ternopil region	40.0	20,79	7,70
Kharkiv region	14.0	19,20	9,87
Kherson region	28.3	10,50	7,53
Khmelnyskyi region	27.1	13,98	8,98
Cherkasy region	18.9	27,67	12,25
Chernivtsi region	17.9	15,01	12,38
Chernigiv region	18.9	20,44	11,55
the city of Kyiv	6.6	25,85	18,13
the city of Sevastopol	5.3	37,89	36,93



As it is seen from the presented data the reliability level has decreased on average 1.7 times. Some different auxiliary data sources, their quality and approaches to the HLCS indicator reliability improvement have been analyzed.

3. Conclusions

On base of the obtained results it was shown that the reliability of poverty indicator estimates in Ukraine can be enhanced by using of NAS data on household final consumption expenditures on different stages of the indicators estimation process. The calibration of statistical weights using NAS data can decrease biases of estimates for regions as it provides the possibility of better accounting of well-to-do households' expenditures by the HLCS data. The indirect estimation using NAS data and poverty indicators direct estimates for the national level and composite ones for the regional level from previous year can significantly decrease the total error of estimation.

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