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Some aspects of the multidimensional poverty in Bosnia and Herzegovina-Evidence from household budget surveys

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Abstract

Poverty is still a big economic and social problem of almost every country. Therefore, it is very important to precisely define, identify and measure this phenomenon in order to be able to reduce poverty to a socially tolerable level. In the earliest approaches to measuring poverty, it was defined as the economic inability to meet basic needs and the minimum of living standards. However, modern methods of poverty analysis require a multidimensional approach to its measurement. In this sense, it includes many non-material dimensions of life, social and psychological dimensions of poverty and various forms of their manifestations. Analysing poverty based on only one, mainly monetary dimension, either income or consumption, has long been overcome. In addition to the level of income or consumption, various indicators can also indicate economic deprivation: housing quality indicators and possession of durable goods, share of a specific type of consumption in the total consumption, etc. As there is no universally accepted (only one) definition of poverty, there is no universal definition of multiple poverty either.

Poverty in Bosnia and Herzegovina was officially measured by using various definitions and poverty lines, but almost all of them were of the one-dimensional nature since only consumption expenditure was used as a monetary measure. To date, the official statistics in Bosnia and Herzegovina have not calculated multidimensional poverty indices and this issue was only a subject of rare academic researches.

The aim of this paper is to present one approach for measuring multidimensional poverty in Bosnia and Herzegovina, to calculate multidimensional poverty indices at national and subnational (entity) levels and to give more complete poverty picture in the country by presenting the dynamics of one-dimensional and multidimensional poverty indices during the period from 2004 to 2022.

For the production of above-mentioned indicators data from 2004, 2007, 2011, 2015 and 2021/2022 household budget surveys in Bosnia and Herzegovina was used and all calculations were performed in IBM SPSS Ver. 23.0.

The paper ends with a critical review of poverty indicators for Bosnia and Herzegovina and with proposals for improvement of measuring multidimensional poverty in nearest future.

Keywords: *poverty analysis, one-dimensional poverty indices multidimensional poverty indices.*

JEL classification: *I310, I320*

1. Introduction

Poverty has been one of the characteristics of the humanity since its very beginning. Parallel to the development of human society, this phenomenon changed in size and its appearance. However, it was never abolished, but became a permanent and global problem of every, in particular modern, society. Although detected very early, poverty became a more acute problem of modern economies, especially with the beginning of the industrial revolution. Practically, until the nineteenth century, poverty was not the subject of serious study and strategic approaches to its elimination or reduction. Although even in ancient times there were reported attempts to reduce poverty, the history of measuring and analyzing poverty in the world is about two centuries old (Maddison A., 2001). For a long time, most measures of poverty were unidimensional in nature, that is, they were based on only one, almost exclusively, monetary indicator. Much later, the approach to poverty analysis began to consider poverty measures from a multidimensional perspective and various non-monetary (material) factors were added to this analysis. The rapid development of human civilization has led to an increase in social empathy towards the poor and efforts to reduce poverty and inequality between people have become part of the development strategy of almost all countries in the world. The United Nations Sustainable Development Goals is a strategy that united and systematized all the main goals of the development of modern society, two of which are directly related to the problem of abolishing poverty and inequality: goals 1 and 10. To ensure that by 2030 all people enjoy peace and prosperity, poverty first should be measured and analyzed in all its dimensions. This is a main precondition for designing a good policy of poverty and inequality reduction.

This paper does not go into the broad methodological problems of measuring multidimensional poverty, nor the search for adequate solutions. It presents some aspects of this phenomenon and illustrates one out of several possible methods of multidimensional poverty index calculation based on consumption data collected within household budget surveys in Bosnia and Herzegovina. The idea was to use both monetary and nonmonetary indicators as determinants of poverty and to unite them into one indicator. For the production of above-mentioned indicators, data from household budget surveys in Bosnia and Herzegovina from the period 2004-2022 were used and all calculations were performed in IBM SPSS Ver. 23.0.

The paper also gives a critical view of the state of art of poverty analysis in Bosnia and Herzegovina and indicates steps for improvements.

2. Literature review

Following the Ravaillon`s statement that *"....the goal for future poverty monitoring efforts should be to develop a credible set of multiple indices, spanning the dimensions of poverty most relevant to a specific setting, rather than a single multidimensional index*" (Ravaillon M., 2011) we present in this paragraph the most used approaches to calculate multidimensional poverty indices. When we analyse poverty multidimensionally, we have to include into the calculation more than one poverty factor, which is more difficult in comparison to one-dimensional approach. There are four most famous groups of multidimensional poverty indices:

(i) *Foster-Greer-Thorbecke multidimensional poverty indices* represent a kind of the generalization of the corresponding one-dimensional indices to the case where more than one determinants of poverty is considered (Foster,Greer, Thorbecke, 1984). They belong to the group of additive multidimensional poverty indices. The general formula for calculating the Foster Greer-Thorbecke indices is

$$P_\alpha(X,z) = \frac{1}{n}\sum_{j=1}^{m}\sum_{i\in S_j} w_j \left(1-\frac{x_{ij}}{z_j}\right)^{\alpha_j} \qquad (1)$$

where

n = population size

m = number of (one-dimensional) poverty indicators

x_{ij} = value of jth poverty indicator for ith unit

z_j= poverty line for jth poverty indicator

$w_j > 0,\ j = 1,2,\dots,m$ are weights of the poverty indicators, and

$\alpha_j =$ measure of sensitivity to poverty; $\alpha_j \geq 1$.

When α increases, the importance of units at the bottom of the distribution of the poor also increases, because their weight increases. If all $\alpha_j = 1,\ j = 1,2,\dots,m$ the equation (1) represents *the multidimensional poverty gap index* (the weighted sum of poverty gap indices by dimensions). From the other side, if all $\alpha_j = 2,\ j = 1,2,\dots,m$ the equation (1) represents *the multidimensional poverty severity index* (the weighted sum of poverty severity indices by dimensions)

(ii) *Bourguignon-Chakravarty multidimensional poverty indices* were created by further generalization of Foster-Greer-Thorbecke's indices (Bourguignon-Chakravarty, 2003) and belong to the class of indices,

which satisfy the transfer axiom in a multidimensional sense. In a *m*-dimensional case, the general formula for the Bourguignon-Chakravarty class of indices is:

$$P(X;z) = \frac{1}{n}\sum_{i=1}^{n}\left[\sum_{j=1}^{m} w_j \left(Max\left\{1 - \frac{x_{ij}}{z_j}, 0\right\}\right)^{\theta}\right]^{\frac{\alpha}{\theta}} \quad (2)$$

where

$\theta =$ elasticity of substitution between dimension gaps, and

$\alpha =$ population aversion to poverty; $\alpha > 0$,

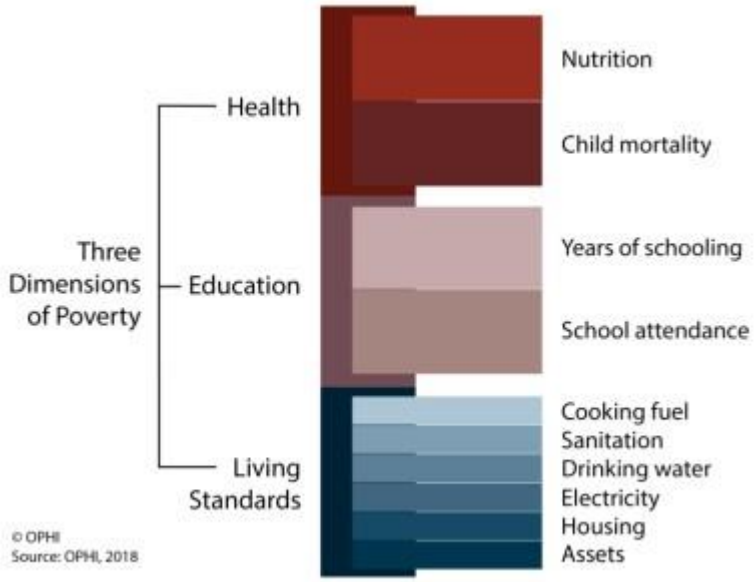
If $\alpha = 1$, the equation (2) represents *the multidimensional poverty gap index*.

(iii) *Watts' multidimensional poverty index* was created by generalizing the corresponding one-dimensional index. A multidimensional extension of the Watts poverty index is expressed as a function of five determinants: Watts poverty gap ratio, Bourguignon–Theil index of inequality among the poor, overall headcount ratio, weights of the various dimensions, and correlation between the various dimensions of poverty (Chakravarty, Deutsch, Silber, 2008). But, this index is sensitive to the distribution of poverty determinants and, except in comparisons, its value is not of great importance. This index is calculated by the following formula:

$$P_W(X,z) = \frac{1}{n}\sum_{j=1}^{m}\sum_{i\in S_j} w_j \, ln\frac{z_j}{x_{ij}} = \frac{1}{n}\sum_{j=1}^{m}\sum_{i\in S_j} w_j \left(lnz_j - lnx_{ij}\right), x_{ij} > 0, \forall i,j. \quad (3)$$

(iv) *Alkire-Foster multidimensional poverty indices* are very specific to multidimensional poverty measurement. They are calculated as a combination of the Foster-Greer-Thorbecke multidimensional poverty indices and the intensity of poverty. (Alkire, Kanagaratnam, Suppa, 2023). The important feature of these indices is the possibility of their disaggregation by regions, various socio-demographic groups and other domains of interest. The Alkire-Foster multidimensional poverty indices are used by the United Nations Development Programme and the Oxford Poverty & Human Development Initiative for the purpose of the calculation of the Global Multidimensional Poverty Indices for 110 countries in the world (UNDP&OPHI, 2023). Originally, the global multidimensional poverty index (MPI) is composed of the following dimensions and indicators:

Figure 1. Composition of the Global MPI – Dimensions and Indicators



Source: OPHI, 2018; Alkire , Kanagaratnam, Suppa, 2023.

The global MPI measures the poverty in the interconnection with various deprivations and, in this way, it combines the SDGs 1, 2, 3, 4, 6, 7 and 11 (UNDP&OPHI, 2023). The most commonly used, and, at the same time, the simplest, multidimensional poverty index from the Alkire-Foster class of MPIs, is the *Adjusted poverty headcount ratio (M_0)*, which is calculated by the formula (Alkire, Kanagaratnam, Suppa, 2023):

$$M_0 = P_0 \,.\, A_s \qquad (4)$$

where

P_0= headcount ratio

A_s = intensity of poverty.

The second index from the Alkire-Foster class of indices is M_1, which is calculated by the formula (5):

$$M_1 = M_0 \,.\, P_1 = P_0 \,.\, A_s \,.\, P_1 \qquad (5)$$

where P_1 is the poverty gap index or the average poverty depth by all poverty dimensions. The M_1 indicates the incidence, intensity and depth of poverty.

The third index from the same class, M_2, is calculated as a product of the adjusted headcount ratio (M_0) and the poverty severity index (P_2):

$$M_2 = M_0 \,.\, P_2 = P_0 \,.\, A_s \,.\, P_2 \tag{6}$$

At the same time, the M_2 indicates the incidence, intensity and depth of poverty, but also the inequality in the distribution of selected indicators of poverty within the population of the poor.

In practice, the indices from the Alkire-Foster class of the multidimensional indices are claculated in the step-by-step procedure.

The first step is the identification of the poor. It is done by calculating poverty lines for every of the poverty indicators and the identificating the poor by indicators. Every poverty indicator is weighted and the weighted sum of deprivations by poverty dimensions is calculated. In order to identify multidimensionally poor, the total poverty line is defined and it is related to number of deprivations by dimensions.

In order to define the incidence of poverty or the multidimensional headcount index, P_0, in *the second step*, the matrix of deprivations is used:

$$D = \left[d_{ij}\right]_{nxm}, \tag{7}$$

where

$$d_{ij} = \begin{cases} 1, x_{ij} \leq z_j \\ 0, x_{ij} > z_j \end{cases}. \tag{8}$$

The average incidence of poverty, A_s, is calculated as an average of all weighted deprivations of the poor. This procedure continues in order to calculate higher order multidimensional poverty indices of the Alkire-Foster class.

Since official statistics poverty indicators for BiH were calculated as one-dimensional poverty indices, the first calculations of the multidimensional poverty indices were made in the researcher`s academic work (Delalić, 2016). They were designed as a modified version of the Alkire-Foster multidimensional poverty indices. We used the same methodology in this paper for two reasons:

- comparability with indicators from previous surveys, and
- limited scope of this paper.

We describe this method in the next chapter.

3. Measuring multidimensional poverty in Bosnia and Herzegovina

Poverty in Bosnia and Herzegovina is still measured on the basis of consumption expenditure data collected within household consumption surveys conducted approximately every four years. Up to now, these surveys were conducted five times: in 2004, 2007, 2011, 2015 and 2021/2022 on the basis of net samples of about 7500 households representing the general Bosnian population. Samples were designed as two-stage stratified samples where stratification was made by region (Federation of Bosnia and Herzegovina, Republika Srpska and Brčko district B&H), type of settlements (urban and non-urban) and quarters within the survey year.

The focus of this paper is on the method of calculating multidimensional poverty index for Bosnia and Herzegovina, which is closest to the UNDP approach in calculating the MPI-Multidimensional Poverty Index, as a replacement for the previously used HPI-Human Poverty Index. This multidimensional poverty index was calculated at the level of households and the maximum number of available variables from household budget surveys in Bosnia and Herzegovina in the period 2004-2022 were used in order to cover various aspects of living standards. In this way, the paper is an extension of the work from 2016 (Delalić, 2016) and provides a partial comparative overview of multidimensional poverty in Bosnia and Herzegovina in the above mentioned period.

In the calculation of the multidimensional poverty indices for Bosnia and Herzegovina, following dimensions/indicators were used:

1. *Housing quality indicators* (possession of internal bathroom with toilet, possession of running water, electricity connection and connection to the public sewage system);
2. *Possesion of durable goods* [gas, wood or electric stove, fridge/freezer, washing machine, cleaning equipment (vacuum cleaner, etc.), car, fixed or mobile phone, TV, DVD or VCR player, HI-FI system (CD, MP3, radio-cassette player, etc.) and personal computer];
3. *Monetary indicator of poverty* calculated on the basis of relative poverty line (60% of the median of monthly-equalized household consumption expenditure[1]);
4. *Internet access*, which, especially recently, has become an important measure of social inclusion.

Table 1 shows the indicators of household deprivation by individual items used in the calculation of multidimensional poverty in BiH.

Most indicators show an improving trend, except for indicators related to DVD&VCR player and HI-FI, as these represent old-fashioned durable goods that will certainly need to be replaced by modern durables in future analyzes (surveys).

[1] OECD-modified equivalence scale was used.

In the next step, it is needed to select the poverty indicators for the calculation of the Alkire-Foster multidimensional poverty indices. For this purpose, a robustness analysis and calculation of an adequate total poverty line[2] were performed (Delalić, 2016).

Table 1. Deprived households by geographical areas in Bosnia and Herzegovina, 2004, 2007, 2011, 2015, 2021/2022, %

Deprivation item	B&H					FB&H					RS					BD				
	2004	2007	2011	2015	2021/ 2022	2004	2007	2011	2015	2021/ 2022	2004	2007	2011	2015	2021/ 2022	2004	2007	2011	2015	2021/ 2022
Internal bathroom with toilet	11,0	6,9	4,8	2,9	1,2	7,0	4,1	2,4	1,5	0,9	17,7	12,0	8,9	5,6	1,7	7,4	5,0	5,2	1,1	0,7
Running water	10,5	5,9	14,1	8,8	6,5	7,7	3,1	4,3	4,0	3,8	15,4	10,4	30,7	16,5	11,1	6,2	11,1	31,7	26,1	17,9
Electricity	0,5	0,1	0,0	0,1	0,0	0,4	0,0	0,0	0,0	0,0	0,7	0,4	0,1	0,2	0,0	0,0	0,0	0,2	0,0	0,0
Pubic sewage	55,4	52,3	46,8	45,7	33,6	48,4	44,7	40,1	38,3	26,3	68,0	66,2	60,0	60,3	47,1	34,7	42,7	31,9	24,8	46,2
Stove	0,2	0,1	0,2	0,6	0,9	0,2	0,1	0,1	0,7	0,7	0,1	0,1	0,2	0,4	1,1	0,0	1,1	0,2	0,0	0,4
Fridge/freezer	4,0	2,4	1,3	1,4	1,1	3,7	1,7	1,0	1,3	0,8	4,8	3,7	1,9	1,7	1,7	0,8	0,6	1,7	0,2	1,1
Washing machine	20,9	13,9	8,1	7,0	2,8	17,4	10,5	5,8	5,7	2,2	26,8	19,9	12,3	9,6	4,1	15,2	13,3	6,0	5,2	3,5
Cleaning equipment	16,7	11,2	5,7	10,7	3,1	13,9	8,1	3,9	8,7	2,0	21,9	17,0	9,0	14,6	4,2	12,0	7,0	5,5	7,0	2,9
Car	52,5	48,1	46,4	51,3	33,1	51,3	46,7	44,5	45,9	33,5	54,9	50,4	50,0	61,3	32,3	43,1	47,8	42,1	45,4	30,9
Fixed/mobile phone	19,9	7,9	4,7	22,0[3]	1,2	14,8	5,3	3,3	23,4[4]	1,0	27,6	12,2	7,4	18,9[5]	1,8	29,9	10,2	3,0	32,5[6]	0,7
TV	5,0	3,2	1,6	2,2	1,5	3,8	2,2	1,0	1,7	0,8	7,3	5,2	2,8	3,2	2,9	1,1	1,1	0,9	1,9	1,8
DVD, VCR player	54,0	42,9	37,1	76,1	71,2	48,8	34,8	30,0	74,4	69,4	63,0	56,9	50,7	79,4	73,9	45,7	46,4	27,7	73,3	85,2
HI-FI	56,8	37,2	39,9	50,9	80,6	45,4	27,8	29,9	54,5	85,5	75,1	51,8	57,4	43,4	72,5	62,8	68,3	47,9	66,9	83,5
PC	87,3	74,8	60,4	50,9	43,5	85,5	71,8	57,4	46,5	45,7	90,3	79,6	65,6	59,3	38,0	86,0	82,3	62,8	44,0	59,2
Internet	93,4	81,6	70,2	50,7	12,6	95,2	87,7	67,8	43,5	8,4	95,2	91,3	74,5	64,2	20,7	93,7	94,6	70,3	45,3	15,9
Poverty rate	18,1	18,4	17,2	16,5	13,3	18,3	16,3	16,0	16,0	13,9	18,3	21,7	19,6	17,4	12,4	7,8	23,6	12,2	15,9	9,1

Source:
Agency for statistics of Bosnia and Herzegovina: HBS 2004, HBS 2007, HBS 2011, HBS 2021/2022, main results.
Data for 2004, 2007 and 2011, Delalić, 2016.
Data for 2015 and 2021/2022, author`s calculation.

[2] Number of deprivations by all included indicators.
[3] Because of lacking the relevant data in the HBS questionnaire for 2015, this deprivation rate could not be calculated correctly. For this reason the phone deprivation rate in 2015 is higher than it should be.
[4] Ibid.

[5] Ibid.

[6] Ibid.

For differently defined total poverty lines, the percentages of multidimensionally poor households were calculated by including all 16 indicators, 14 indicators, and 12 indicators and the following total poverty lines were defined:

Table 2. Number of indicators and total poverty lines

Number of indicators	Treshold for multidimensional poverty
16	6 or more deprivations
14	4 or more deprivations
12	3 or more deprivations

Source: Delalić, 2016.

The poverty line based on 12 indicators and the threshold defined as 3 or more deprivations was selected as the most suitable[7] for Bosnia and Herzegovina. For reasons of comparability with previous analyses[8], we kept the same methodology and calculated the adjusted headcount indices (M_0)[9] for Bosnia and Herzegovina and its entities for last two survey years. The results are shown in the table 3:

Table 3. Multidimensional poverty indicators for Bosnia and Herzegovina, by geographical area, 2004, 2007, 2011, 2015, 2021/2022

Geographical area	2004			2007			2011			2015			2021/2022		
	P_0	**A_s**	**M_0**	**P_0**	**A_s**	**M_0**	**P_0**	**A_s**	**M_0**	**P_0**	**A_s**	**M_0**	**P_0**	**A_s**	**M_0**
B&H	0,267	0,426	**0,114**	0,206	0,421	**0,087**	0,176	0,376	**0,066**	0,218	0,336	**0,073**	0,073	0,306	**0,022**
FB&H	0,212	0,403	**0,085**	0,159	0,387	**0,061**	0,116	0,351	**0,041**	0,175	0,322	**0,056**	0,049	0,296	**0,015**
RS	0,360	0,449	**0,162**	0,289	0,455	**0,131**	0,285	0,395	**0,112**	0,298	0,353	**0,105**	0,119	0,315	**0,037**
BD	0,205	0,367	**0,075**	0,209	0,382	**0,080**	0,155	0,378	**0,059**	0,209	0,312	**0,065**	0,090	0,303	**0,027**

Source:
Agency for statistics of Bosnia and Herzegovina: HBS 2004, HBS 2007, HBS 2011, HBS 2021/2022, main results.
Data for 2004, 2007 and 2011, Delalić, 2016.
Data for 2015 and 2021/2022, author`s calculation.

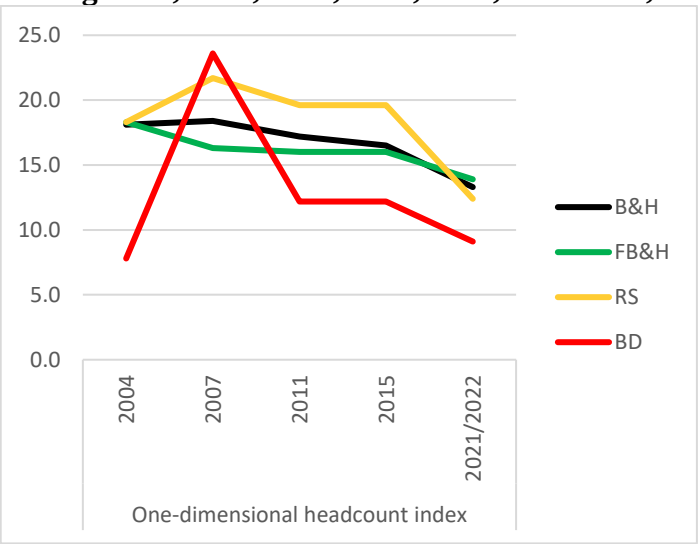
According the multidimensional poverty measure (the adjusted headcount index, M_0), the Republika Srpska is the poorest area in Bosnia and Herzegovina with 3,7% od the poor households. But, only in this entity, the clear downward trend of the multidimensional poverty is observed, since that trend was interrupted in 2015 in other areas of the country. That break was caused by the break in the downward trends of the multidimensional headcount index, P_0, in 2015 in all areas. A significant improvement in the values of the multidimensional headcount index is evident in 2021/2022. On the other hand, only in the Federation of B&H (and, consequently, at the country level) there is a clear downward trend in the intensity of poverty measured by the average number

[7] See more in Delalić, 2016.
[8] Delalić, 2016.
[9] Since the selected indicators consisted of dichotomous variables, the other two indicators from the Alkire-Foster class (M_1 and M_2) were not calculated.

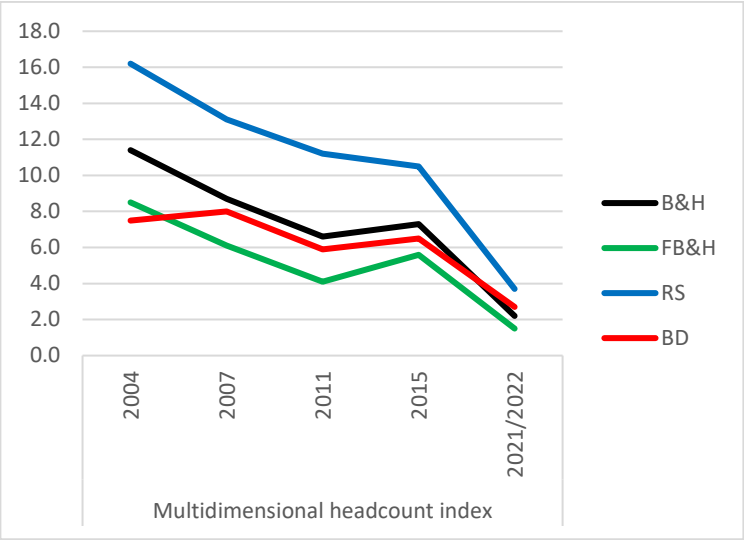
of deprivations, A_s, since that indicator increased in the Republika Srpska and in the Brčko district of B&H in 2007.

The dynamics of one-dimensional and multidimensional poverty indicators in Bosnia and Herzegovina is presented in the figure 2.

Figure 2. Overview of one-dimensional and multidimensional poverty indicators in Bosnia and Herzegovina, 2004, 2007, 2011, 2015, 2021/2022, %



Source: Agency for statistics of Bosnia and Herzegovina, household budget surveys, 2004, 2007, 2011, 2015, 2021/2022



Source: Data for 2004, 2007 and 2011, Delalić, 2016
Data 2015 and 2021/2022, author`s calculation

In general, one-dimensional and multidimensional poverty indices in Bosnia and Herzegovina showed different dynamics in the period 2004-2022. It is a clear indication that an effective poverty reduction policy must be based on its multidimensional analysis, i.e. it must not be based only on one, and exclusively, monetary measure of that phenomenon.

4. Conclusion

Poverty in BiH began to be measured in 2004, and to date, the methodology of its measurement and analysis has remained the same. It means that poverty was defined as the economic inability to meet basic needs and the minimum of living standards. According to that approach, poverty indicators were always one-dimensional and were based on household consumption as a monetary aggregate, while the poverty line was calculated according to the EU methodology of relative poverty line (60% of the median of monthly-equalized household consumption expenditure). The poverty analysis was later extended with indicators of material deprivation (Agency for Statistics of Bosnia and Herzegovina, 2013), however, they were never incorporated into the poverty indicator/s as its/their determinants, but only expanded the analysis of poverty.

Modern methods of poverty analysis require a multidimensional approach to its measurement. In this sense, it includes many non-material dimensions of life, social and psychological dimensions of poverty and various forms of their manifestations. Analyzing poverty based on only one, mainly monetary dimension, either income or consumption, has long been overcome. In the last decades, the analysis of poverty from a multidimensional aspect was very fruitful and resulted in indices that satisfy a smaller or larger number of desirable mathematical conditions (axioms). But, there is no unique method of the calculation of multidimensional poverty indicators.

In this paper, we limited our attention to the four most commonly used multidimensional poverty indicators, namely Foster-Greer-Thorbecke, Bourguignon-Chakravarty, Watts and Alkire-Foster multidimensional indices of poverty. Respecting the limited scope of this paper and for reasons of the comparability with indices from previous surveys, in the empirical section of this paper, we produced the Alkire-Foster multidimensional index for years 2015 and 2021/2022, and we presented the dynamics of both, the multidimensional and the one-dimensional poverty indices in Bosnia and Herzegovina. Since we noticed differences in trends of these indices, we concluded that poverty in Bosnia and Herzegovina should certainly be measured and analyzed from its multidimensional perspective. Only in this way is it possible to design effective policies for poverty reduction, which are two important sustainable development goals on a global scale.

Our analysis certainly has significant limitations. First of all, the paper did not cover the calculation of other multidimensional indices such as Foster-Greer-Thorbecke, Bourguignon-Chakravarty, Watts and other known multidimensional indices. Second, the analysis does not contain income data since this data, although collected, was not analyzed within household budget surveys in Bosnia and Herzegovina. Further, the analysis was based only on the data available from the household budget surveys in Bosnia and Herzegovina, i.e. it did not take into the calculation other poverty dimensions such as health, education and others.

First step for improvement the poverty analysis in Bosnia and Herzegovina is to use data collected within EU-SILC. Our first full-scale SILC was conducted in 2022 but the data is still unavailable for analysis. Using SILC data, the analysis of one-dimensional relative poverty will be fully harmonized with EU standards. Further improvement should be focused on the inclusion of new dimensions and indicators of poverty in the calculation of multidimensional indices and to use other well-known formulas for their calculation. All these aspects of the multidimensional poverty should be in the focus of our future work.

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