Poverty of households due to their biological type in a multidimensional approach

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Abstract

The thesis involves the theme of poverty risk in Polish households due to their biological type, in terms of multidimensional analysis of poverty. The biological household type includes, among others, households of large families, which provides a verification of a hypothesis that large families are more at risk of poverty than other types of households. In addition, there has been verified a hypothesis on differentiation of poverty risk due to the biological household type.

The poverty risk research has been made using the TFR (Totally Fuzzy and Relative) approach. The analysis has been based on the household budget survey of 2012.

Keywords: multidimensional poverty, income distribution, household expenditure
JEL Classification: I32, D31

1. Introduction

Poverty is a major problem both in the individual and the social dimension. Defining it is essential for measuring the characteristics of poverty. In the literature, poverty is linked to the inability to meet certain requirements at the desired level (Panek, 2011). Such approach is widely accepted; however, it is not sufficient to expressly identify poor households, because it does not specify which needs are to be taken into consideration and what level of meeting them is to be considered as desirable.

Historically, the first widely-approved definition of poverty is the one enunciated in 1901 by S. B. Rowntree, who says that poverty is *the inability to meet basic needs* (Topińska, 2008). The above definition reflects the concept of absolute poverty, and was based on the works of the Material School of Poverty, which equated prosperity with the level of income (Panek, 2011).

Another approach to poverty, taking into account the social context, is the relative poverty conception. It is rooted in the welfare state tradition, which was set on eliminating excessive social inequalities (Topińska, 2008). Poverty in relative terms is based on the comparison of the level of meeting the needs of individuals to the level of meeting the needs of other

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members of society. Poverty in relative terms is, therefore, the result of different levels of meeting the needs in the society, and its measurement is primarily a measurement of inequality.

Critics of the relative approach suggests that it does not allow establishing of a permanent reference point for the analysis of poverty changes in time and space, and thus greatly complicates the assessment of the effectiveness of social policies aimed at combating poverty. On the other hand, the absolute approach creates conceptual and methodological problems associated with the choice of a set of needs which are to be met, specifying the desired level of meeting them, and their valuable estimate (Wolf, 2009).

Limitations of the poverty concept based on the possession of the necessary income and/or assets leads to a broader understanding of poverty as limiting the ability to perform vital functions. This approach is used by A. Sen, who defines poverty as a capability failure (Sen, 1997). Poverty cannot therefore be equated only with an insufficient income. It has to be considered concerning living standard of individuals, which may occur, and the opportunities that are genuinely available to them. The analysis of poverty defined in this way requires a multidimensional approach, which definition of poverty involves deprivation not only of the basic needs, but also of higher needs, including the conditions of life in a broader perspective (Golinowska and Broda-Wysocki, 2005). Several proposals have appeared in the literature that describe various aspects of measuring the level of multidimensional poverty (Ferreira and Lugo, 2013; Neff, 2013; Ravallion, 2011; Bossert et al., 2013). The axiomatic foundation of design multidimensional poverty indices has been described in (Tsui, 2002).

The aim of this treatise is to assess the poverty risk of Polish households due to their biological type in a multidimensional approach. Within the biological type, among others, the following categories are distinguished: households of childless marriages and marriages with children, and single parents households. A hypothesis that there are differences in the poverty risk due to the biological household type, and the biggest threat involves large families, will be verified.

2. Data and research method

To assess the degree of the poverty risk, individual data from the household budget research conducted by the Central Statistical Office (GUS) in 2012 will be used. The full data set included observations of 37427 households. The budget research covered issues related to both the income and expenditure of households and their characteristics and characteristics of the household members. On this basis, there may be taken an attempt to determine the scope

and depth of the impoverishment of society in its various sections by means of the multidimensional approach.

In practical terms, this approach generates additional problems to the classical method of poverty analysis. Multidimensionality implies that, in addition to monetary factors, we will take into account a number of non-monetary factors, treated as poverty symptoms. In the monetary dimension, there should be determined whether the poverty risk analysis are to be based on income or expenditure of households. In the case of the household budget research in Poland, the households' income and expenditure observation period is one month. The short duration of the survey favours more frequent registration of unusually high or low income of a household in respect of its permanent income. This causes a disorder of the poor households identification process. In such situation, it seems more appropriate to use total expenditure of households in the monetary dimension of poverty analysis. Households execute expenses primarily in relation to their permanent income, not the transitory income, although, in this case, extraordinary expenses in a month can also be noted. In the non-monetary aspect, primarily, there must be correctly selected the mentioned poverty symptoms; then they must be transformed into partial poverty indicators. Thus obtained partial indicators should be aggregated to the overall non-monetary poverty risk rate on the level of a given dimension, and then to a synthetic non-monetary poverty index. As demonstrated by the first part of the thesis, there is no widely applicable "operational" definition of poverty. This results in the loss of one universally acceptable approach to its identification and analysis, which is particularly evident in the multidimensional approach in the aspect of non-monetary symptoms.

In this tract, to capture the monetary poverty risk of individual households and their groups, the total expenditure will be used. On this basis and on the basis of food expenditure, there was set an equivalence scale (according to the Engel method), which allowed to convert total expenditure of a household of any number of members to the level of a single person household expenditure. The food expenditure method was also used to determine the poverty line value in the classical sense. The basic values of the extent and depth of poverty indicators obtained in this way became a reference for the relevant indicators in a multidimensional approach.

In terms of a multidimensional approach in its monetary dimension, there was used the theoretical Burr XII distribution to estimate the distribution of equivalent expenditures[3]. On the basis of this theoretical distribution, there was estimated a monetary poverty sphere

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[3] An extensive study of the theoretical income and expenditure distributions can be found in the work of (Kleiber and Kotz, 2003).

membership function, in the integrated, fuzzy and relative approach, proposed by Betti et al. (2006). This function for the *i-th* household is as follows[4]:

$$\lambda_i(y^e) = (1 - F_i^{MI})^{\alpha-1}(1 - L_i^{MI}), i = 1,2,...,n,$$ (1)

wherein:

$$(1 - F_i^{MI})^\alpha = \left(\frac{\sum_{\gamma=i+1}^{n} w_\gamma}{\sum_{\gamma=2}^{n} w_\gamma} \right)^\alpha ; \quad (1 - L_i^{MI})^\alpha = \left(\frac{\sum_{\gamma=i+1}^{n} w_\gamma y_\gamma^e}{\sum_{\gamma=2}^{n} w_\gamma y_\gamma^e} \right)^\alpha , \quad i = 1,2,...,n,$$

where F_i^{MI} value of the equivalent income distribution function $F(y_i^e)$ for *i*-th household; L_i^{MI} - value of Lorentz equivalent income distribution function $L(F(y_i^e))$ for *i*-th household; w_γ, y_γ^e, respectively, value and the equivalent income of a household of γ rank in the equivalent income distribution in the ascending order, α - parameter.

Aggregation of the function (1) leads to the monetary poverty risk range rate formula (Fuzzy Monetary Incidence – FMI):

$$FMI = \frac{\sum_{i=1}^{n} \lambda_i(y^e)w_i}{\sum_{i=1}^{n} w_i},$$ (2)

where: w_i - value of the *i*-th household.

In the same way, there can be determined the depth of monetary poverty risk rate (Fuzzy Monetary Depth – FMD) and the severity of the monetary poverty risk rate (Fuzzy Monetary Severity – FMS).

In terms of non-monetary poverty, the poverty risk range was measured in accordance with an approach of Betti and Verma (1999), which had been decrived in (Panek, 2011). See also (Panek 2010). On the basis of every poverty symptom there are determined the non-monetary poverty risk assessments, which are aggregated on the level of the poverty dimensions, and then in one assessment for the entire population of households. In an analogous manner to the monetary dimension, there are obtained non-monetary poverty risk range rates (Fuzzy Supplemenatry Incidence – FSI), the depth of non-monetary poverty risk rate (Fuzzy Supplementary Depth – FSD) and the severity of the non-monetary poverty risk rate (Fuzzy Supplementary Severity – FSS). In terms of non-monetary approach four dimensions of

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[4] All formulas for various measures of poverty sphere membership relating to the multidimensional approach were taken from the (Panek, 2011) work.

poverty risk were identified: a subjective household financial situation assessment (1), household housing situation (2), the characteristics of the household members (3) and housing equipment (4). The first dimension include assessment of the situation of a household and its financial management manner; in the second dimension: housing living area and its condition, location and major installations; the third dimension consisted of members' features related to the low level of education, labour inaction, unemployment, disability, and the fourth dimension included variables relating to the ownership of appliances such as a computer, washing machine, dishwasher, car or telephone.

3. The poverty risk in Poland

The poverty risk in Poland will be analysed in particular regarding the biological household type. Within this type 13 household categories can be distinguished, ranging from childless marriages, marriages with dependent children, single parents and households of a different (often more complex) demographic composition. A special type of a household is the single person household. The research on diversity of poverty risk in the biological type system allows to identify the areas of deprivation, in particular in those households where children are brought up. The increased poverty risk of family households with dependent children results in the negative attitude of young marriages to having many children, which has and will have negative socio-economic impacts.

As a result of the food expenditure method used to estimate the equivalence scale for total expenditure, there was obtained a elasticity of this scale due to the number of individuals per household of 0,704. On this basis, there was converted the total expenditure of households of different compositions so as to compare them with the expenditure of a single person household. In a further step, for such household, there was determined a poverty line, assuming that the limit share of food expenditure in total expenditure amounted to 32.39%. This share was defined for households that stated that they had to conserve money carefully every day. Ultimately, the line for the single person households amounted to PLN 929.62. On this basis, in the classical approach, the poverty rate, poverty depth and poverty severity for the society in general were counted. The poverty rate was 0.2569, the poverty depth (the income gap index) was 0.0624, and the poverty severity was estimated at 0.0222. The values of these measures were used to assess the poverty sphere membership function parameter[5] due to the extent, income gap and squared income gap both in terms of monetary and non-

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[5] In the formula (1), it is the parameter α parameter. The analogous formulas for the income gap and squared income gap, these are the β and δ parameters.

monetary factors. In this way, for each household there can be determined values of a poverty sphere membership function due to the range, depth and severity in the dimension of monetary and non-monetary factors, which, in turn, allows to aggregate these values for social groups by the poverty range, depth and severity indicators, in both dimensions. The results of the procedure described above for the Polish households regarding the biological household type is presented in Table 1.

Biological type of household	Monetary poverty			Non-monetary poverty		
	FMI	FMD	FMS	FSI	FSD	FSS
1	0.180	0.034	0.011	0.216	0.040	0.014
2	0.216	0.044	0.014	0.144	0.026	0.009
3	0.287	0.068	0.023	0.155	0.027	0.008
4	0.410	0.124	0.046	0.270	0.072	0.030
5	0.565	0.232	0.099	0.439	0.149	0.057
6	0.358	0.114	0.047	0.366	0.120	0.046
7	0.337	0.112	0.045	0.301	0.115	0.056
8	0.343	0.091	0.033	0.258	0.057	0.020
9	0.404	0.125	0.046	0.433	0.158	0.066
10	0.397	0.116	0.048	0.416	0.150	0.078
11	0.425	0.132	0.051	0.394	0.133	0.062
12	0.221	0.048	0.017	0.344	0.088	0.028
13	0.273	0.068	0.025	0.291	0.079	0.030
Total	0.257	0.062	0.022	0.257	0.062	0.022

1 – couple without children, 2 – couple with one child, 3 – with two children, 4 – with three children, 5 – with four and more children, 6 – mother witch children, 7 – father with children, 8 – couple with children and other persons, 9 – mother with children and other persons, 10 – father with children and other persons, 11 – other persons with children, 12 – single, 13 – other households

Table 1 The poverty in Poland in account of the biological type of household.

The poverty risk is diverse both in the biological household type system and because of the dimension of the poverty analysis (monetary or non-monetary). The biggest poverty risk range in both dimensions occurred in large family households. A relatively high non-

monetary poverty range also applies to single-parent households living with other people (types 9 and 10). It should be noted that single parents with dependent children have a relatively low level of poverty risk range. Similar conclusions can be drawn by analysing the results for the depth and severity of poverty risk. Again, the deepest and the most severe poverty afflicts marriages with several dependent children, although single parents with dependent children living also with other people feel a little more severity in the non-monetary dimension. The lowest risk of poverty in the monetary dimension is present in the case of married couples without dependent children, while in the non-monetary dimension – of married couples with one or two children. These are usually young couples who attach great importance to the quality of life. The group of married couples without children includes many relationships of the elderly (pensioners) whose income situation is relatively good, while non-monetary aspects of their lives more often speak for the impoverishment of their households than it is for young married couples.

Table 2 shows the results of the assessments within the poverty risk range in monetary and non-monetary dimensions for households distinguished by the biological household type in the nature of the place of residence setting.

In the monetary dimension, the poverty risk increases with the decrease in size of the place of residence of the household, regardless of its biological type. However, in the case of non-monetary poverty symptoms, the issue is not as obvious. Often the risk of poverty in rural areas is lower than in medium and small cities, and in some situations lower than in large cities. Studies on the diversity of the household income shows that the income situation of rural households is significantly worse than urban households, but, in terms of non-monetary aspects, the situation of these households is not so bad in relation to urban households.

Biological type of household	Monetary poverty (FMI)			Non-monetary poverty (FSI)		
	Cities	Towns	Villages	Cities	Towns	Villages
1	0.105	0.168	0.242	0.166	0.207	0.258
2	0.124	0.220	0.277	0.110	0.153	0.159
3	0.180	0.283	0.334	0.128	0.161	0.161
4	0.284	0.418	0.429	0.270	0.305	0.251
5	0.335	0.526	0.596	0.390	0.503	0.422
6	0.246	0.374	0.443	0.316	0.380	0.392

7	0.292	0.351	0.353	0.153	0.341	0.363
8	0.237	0.326	0.361	0.261	0.286	0.248
9	0.312	0.412	0.440	0.386	0.446	0.444
10	0.267	0.328	0.483	0.527	0.356	0.427
11	0.358	0.381	0.460	0.459	0.420	0.370
12	0.132	0.213	0.340	0.262	0.346	0.440
13	0.186	0.265	0.310	0.247	0,303	0.300
Total	0.151	0.242	0.325	0.210	0.261	0.278

Table 2 The poverty in Poland in account of the biological type of households and the type of living place.

Conclusion

Poverty is an invariably present problem, and its effects involve the whole society. The multidimensional approach in the study of poverty enabled to include the subjective assessment of the financial situation of a household and its housing situation, equipment, and characteristics of its members, to the analysis. The research on the poverty risk range in regard to the biological household type allowed to identify the areas of deprivation, in particular in those households where children are brought up.

The problem of poverty in large families has a double meaning. Firstly, the poverty decreases the chance for preservation of good health and getting a good education, limits access to cultural goods, etc., cutting down a children's chance to get good jobs and improve living conditions in adult life for children. In addition, the increased poverty risk of large family households with dependent children results in the negative attitude of young marriages to having children, which has and will have negative socio-economic impacts.

References

Betti, G., Cheli, B., Lemmi, A., & Verma, V. (2006). On the construction of fuzzy measures for the analysis poverty and social exclusion. *Statistica & Applicazioni*, IV(1), 77-97.

Bossert, W., Chakravarty, S. R., & D'Ambrosio, C. (2013). Multidimensional poverty and material deprivation with discrete data. *Review of Income and Wealth*, *59*(1), 29-43.

Ferreira, F. H. G., & Lugo, M. A. (2013). Multidimensional poverty analysis: Looking for a middle ground. *World Bank Research Observer*, *28*(2), 220-235.

Golinowska, S., & Broda- Wysocki, P. (2005). Kategorie ubóstwa i wykluczenia społecznego. Przegląd ujęć. In Golinowska, S., Tarkowska, E. & Topińska, I. (Eds.), *Ubóstwo*

i wykluczenie społeczne. Badania, metody, wyniki. Warszawa: Instytut Pracy i Spraw Socjalnych.

Kleiber, C., & Kotz, S. (2003). *Statistical size distributions in economics and actuarial sciences* (Vol. 470). John Wiley & Sons.

Neff, D. (2013). Fuzzy set theoretic applications in poverty research. *Policy and Society*, *32*(4), 319-331.

Panek, T. (2010). Multidimensional approach to poverty measurement: Fuzzy measures of the incidence and the depth of poverty. *Statistics in Transition*, *11*, 361-379.

Panek, T. (2011). *Ubóstwo, wykluczenie społeczne i nierówności. Teoria i praktyka pomiaru.* Warszawa: Oficyna Wydawnicza Szkoła Główna Handlowa.

Ravallion, M. (2011). On multidimensional indices of poverty. *Journal of Economic Inequality*, *9*(2), 235-248.

Sen, A. (1997). *Inequality reexamined.* (2nd ed.). New York, Oxford: Russell Sage Foundation, Clarendon Press.

Topińska, I. (2008). Kierunki zmian w statystyce ubóstwa. In Topińska, I. (Ed.), *Pomiar ubóstwa. Zmiany koncepcji i ich znaczenie.* Warszawa: Instytut Pracy i Spraw Socjalnych.

Tsui, K. (2002). Multidimensional poverty indices. *Social Choice and Welfare*, *19*(1), 69-93.

Wolf, E. N. (2009). *Poverty and income distribution.* (2nd ed.). Wiley-Blackwell.