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Małgorzata Grzywińska-Rąpca, PhD Eng.[1]
Faculty of Economics
University of Warmia and Mazury in Olsztyn

Regional differentiation of households in the context of a subjective assessment of the level of income

Introduction

In this era of global competition and ever-changing consumer preferences, households usually adjust the consumption structure to the real opportunities resulting from earned income etc. Inequalities in income, as shown by the analyses, affect the structure of consumption of household goods and services, as well as the quality of goods and services consumed. All households, irrespective of the level of obtained income, first focus on satisfying essential basic needs, such as: housing, energy carriers and food and non-alcoholic beverages, leaving small amounts (or none) for additional purchases in their budget (Bywalec, 2007).

According to the Polish Central Statistical Office (*Budżety gospodarstw domowych*, 2017), the average monthly expenditure in households per capita in 2016 was 4.3% higher than in 2015, and accounted for 76.7% of income (78.7% in 2015). Expenditure on consumer goods and services averaged 4.5% higher compared to 2015 (in 2015, real growth of expenditure on consumer goods and services was 2.0%). One of the most likely factors to influence the increase in spending was the introduction of the Family 500+ program by the Ministry of Family, Labour and Social Policy. This benefit (launched on 1 April 2016) in the households entitled to this supplement represented an average increase of 16.8% in disposable income per capita. Expenditure on food and non-alcoholic beverages constituted the highest share in the expenditure of all households (those receiving and not receiving 500+), at 25.1% of the total expenditure. Expenditure on the use of an apartment or house and energy carriers accounted for 17.8% of total expenditure. A noticeably higher

[1] Correspondence address: Uniwersytet Warmińsko-Mazurski w Olsztynie, Wydział Nauk Ekonomicznych, Katedra Metod Ilościowych, ul. Oczapowskiego 4 p. 330, 10-719 Olsztyn, tel.+48 89 523 37 79; e-mail: malgo@uwm.edu.pl. ORCID: 0000-0003-2088-2795.

share of expenditure on households receiving childcare benefit than on households not receiving it occurred, especially in the group of expenditures on recreation and culture (by 2.0 percentage points) and clothing and footwear (by 1.8 percentage points) (GUS, *Warunki...*). The subjective needs assessment has an impact on the level and structure of expenses. The subjective character of needs means that certain regularities occur in the process of consumption development. Satisfying needs does not limit them, even when we meet all the needs occurring at the moment; on the contrary, it leads to new needs (Bywalec, Rudnicki, 2002).

When there is progress and economic development in a given society, one can notice a decrease in the share of foodstuffs and an increase in non-food services and articles. This is in line with economic theory, i.e. with Engel's law (Gregor, 2003). Sometimes this decrease is not noticeable in the first period of increase in household incomes. This is related to the consumption of more expensive substitute goods, which often gives a subjective feeling of belonging to a better segment (according to the consumer's assessment). The sustained increase in income in the long run causes a drop in the share of foodstuffs in favour of, for example, the consumption of durable goods or the consumption of free time. In the subject literature we find two research approaches to analysing changes in consumption:

- directly, by analysing the level of household income, solely on the basis of data from surveys of household budgets conducted by the Polish Central Central Statistical Office (CSO),
- indirectly, by accepting consumption as an indicator of social change (e.g. living standards).

The first approach was selected in the present article. The analysis of the diversity of the differentiation of income level assessments was carried out in a spatial cross-section (variation of the phenomenon by voivodeship) (Słaby, Czech, 2011).

Data from the Household Budget Survey (CSO database) provided information on the assessment of the actual economic situation, but also included subjective assessments of this situation. The assessment of prosperity, conditions and quality of life consisted of both objective and subjective aspects of the financial situation, as well as the way in which the person perceives his material and immaterial financial situation (Joo, Grable, 2004). The relationship between the income level and the financial satisfaction of households is also significant. Van den Berg and Ferrer-I-Carbonell (2007) showed that income has a positive impact on the level of financial satisfaction.

The behaviour of the household becomes important in the options of managing its finances. Indebtedness or debt is an objective measure in measuring the financial vulnerability of households. Households with similar financial abilities can make different decisions (Vlaev, Elliott, 2014). A survey of household budgets, carried out by the Central Statistical Office, used the opinions of respondents regarding the financial situation of the household. The following assessments of the material situation could be distinguished: very good, rather good, average, rather bad, bad. From the point of view of the set objective, this article focuses on the second group of information

provided by households, i.e. information on the level of net income, defined by the households as: very bad, insufficient, barely sufficient, good, very good. These variables, although subjective in nature, are used increasingly often in surveys of the degree of satisfying needs (Podolec, 2008).

The level of current incomes of the population is therefore a key economic indicator of consumption shaping, co-deciding together with other determinants the amounts spent on satisfying consumption needs (Grzywińska-Rąpca, 2018). Therefore, it can be said that the income obtained by consumers is an economic pillar of the functioning of each family, thus defining the standard of living, the level of consumption and the ability to meet the needs of common and individual members of households (Carroll, Summers, 1991; Zalega, 2012). In a situation where financial resources are treated as a key limiter of consumption, changes in the level and scope of income differentials per capita begin to play a significant role. This means that for the assessment of the household consumption structure, the income generated by individual members of the household is significant. The amount of income has a direct impact on the individual attitudes and behaviour of consumers, affecting their market behaviour, regardless of the relationship to the objective situation.

The aim of the presented material was to show the diversity of voivodships depending on the subjective assessment of the level of household income.

To assess regional differences related to the subjective economic assessment of households, data were used to present the households' expectations regarding the level of income per capita in a household, including administrative division units. Based on the data from the Household Budget Survey conducted in 2016, the average values for five levels were determined. Households participating in the Household Budget Survey assessed the value of income that could be described as: very weak, insufficient, barely sufficient, good and very good. A qualitative assessment of the households was not taken into account, due to the desire to indicate specific values of income that, in the subjective assessment of households, would allow the meeting of consumption needs. Grouping of voivodships was carried out depending on the main source of income for households. Groups of employees, farmers and households whose main source of income was self-employment were selected for the analysis.

Methodical assumptions

Based on data from the household budget survey conducted by the Central Statistical Office, in 2016 a grouping of the households representing individual voivodeships was carried out. The focus was on a subjective assessment of the level of net income indicated by the households participating in the survey. Each of the respondents indicated the amount of net income in one of five categories: very poor, insufficient, barely sufficient, good and very good. Thanks to such a data system, these levels can be treated as successive variables.

In order to demonstrate the diversity of voivodships, the number of clusters was determined and taxonomic units were allocated to groups to minimize intra-group variability while maximizing inter-group variability.

Among the methods used to analyse economic phenomena were hierarchical methods based on such measures as Euclidean distance, urban distance and the Mahalanobis measure. Another method often used in the analysis of socio-economic phenomena is the Ward method, based on the analysis of variance. An equally common method is k-means analysis, which belongs to the group of non-hierarchic methods of cluster analysis (Grzywińska-Rąpca, Markowski, 2018). According to Panek and Zwierzchowski (2013) and Walesiak and Gatnar (2009), this method requires an arbitrary decision about the number of classes to which the input set of observations can be divided.

To date, many methods have been developed in the field of cluster analysis, in which different approaches to solving the problem have frequently been used, but there are no premises that explicitly support the choice of any one of them. However, the methods always aim to divide the set into such subsets as the main goal, ensuring that the elements in the subsets are as similar as possible, although the elements from separate subsets clearly differ from each other.

An interesting approach to cluster issues seems to be the use of neural networks, which are an important part of what is known as artificial intelligence. For the purposes of this article, a self-organizing neural network (TeMax Kohonen), developed in 1982, was proposed. Kohonen's network is a self-learning, unsupervised learning network, but it involves learning with competition. A characteristic feature of self-learning networks is that they do not use "external" information. The Kohonen network learns alone, by observing only the data sent to it, where the internal structure and unknown logic hidden in the structure determines the final picture of the classification and the final operation of the network (Tadeusiewicz, Gąciarz, Borowik, Leper, 2007). The SOM application allows, like other methods such as k-means, the analysis of multidimensional data sets. The network itself consists of neurons placed in two layers – the input and output. Each input layer neuron is coupled to all the neurons of the output layer (Kohonen, 2001; Tadeusiewicz, 1993).

As a result, the application of the Kohonen network to the multidimensional data space provides a two-dimensional structure, whereby the obtained image retains the topology of the input file. In the case of cluster weight analysis, the neurons of the output layer are determined by centroids, which are the centre of gravity for the groups. For each component cluster analysed, the distances to the centroid are calculated, from which the minimum distances are searched. All elements centred on a given centroid form one group.

The Kohonen neural network (SOM) was used as a tool for the classification of households according to the variables selected for the analysis of variables. This is a tool used to group input value vectors, describing the subjective assessment of

the household income level in spatial terms. Tarka (2010), Wehrens and Buydens (2007) used SOM as a tool to implement non-linear transformations of any metric space into a discrete space, and also to match the code vectors to the distribution of objects in the space of features. In fact, SOM is a method rarely used in the analysis of consumer behaviour, instead being most often used in issues related to the analysis of financial markets. The SOM method was used to identify clusters generated on the basis of the variables accepted for analysis.

Assessment of the financial situation of households based on earned income

The subjective assessment of one's own economic situation may be largely divergent from the actual economic situation of a given household and not coincident with the objective research results. Often satisfaction with material living conditions is not proportional to changes in income. In 2016, the largest number of households living in the Pomorskie voivodeship reported having a very good financial situation (Table 1).

Table 1. Assessment of the overall financial situation of the household

Specification	Assessment of the overall financial situation of the household				
	Very good	Rather good	Average	Rather bad	Bad
	[% of households]				
Dolnośląskie	13.42	20.35	53.74	9.31	3.17
Kujawsko-Pomorskie	12.35	17.73	57.88	7.83	4.22
Lubelskie	7.76	19.16	57.27	12.37	3.44
Lubuskie	14.41	19.32	50.35	11.11	4.80
Łódzkie	9.82	17.02	58.57	9.74	4.85
Małopolskie	12.45	22.33	55.09	8.05	2.09
Mazowieckie	14.49	19.40	53.35	9.30	3.45
Opolskie	16.24	27.65	47.07	6.78	2.26
Podkarpackie	7.93	19.33	59.37	10.70	2.66
Podlaskie	9.20	20.05	55.90	9.98	4.86
Pomorskie	18.39	19.15	49.01	8.88	4.57
Śląskie	17.48	18.78	51.25	9.26	3.23
Świętokrzyskie	9.47	21.12	57.59	9.81	2.01
Warmińsko-Mazurskie	14.41	18.20	53.25	11.03	3.11
Wielkopolskie	11.81	20.87	56.65	8.25	2.41
Zachodniopomorskie	13.78	21.52	49.54	11.94	3.22

Source: Author's own work based on CSO data.

The largest number of households (over 50% in each voivodeship) assessed their current economic situation as average. In the Podkarpackie voivodeship, 59.37% of the household budgets participating in the survey indicated this answer. In the subjective assessment of households for the Podlaskie voivodeship, the general financial situation of their household was bad, according to 4.86% of respondents. This was the highest value in the structure of responses given by respondents. Another aspect included in the survey of household budgets was the subjective assessment of income generated by the household. The assessment of the overall financial situation of households (Table 1) can be treated by respondents as an assessment of material resources along with the obtained income. For a subjective assessment of the income level, the results should be interpreted as: what level of household income participating in the survey in the context of a current consumer is considered: very bad, insufficient, barely sufficient, good or very good by voivodeships (Table 2).

Table 2. Average level of income recognized as: very poor, insufficient, barely sufficient, good or very good, by voivodeship

Specification	Average level of income recognized as:				
	Very poor	Insufficient	Barely sufficient	Good	Very good
	[PLN]				
Dolnośląskie	1593.36	2094.07	2700.09	4319.45	6194.17
Kujawsko-Pomorskie	1546.85	2004.28	2561.19	3941.12	5492.23
Lubelskie	1343.68	1795.62	2368.06	3812.77	5540.79
Lubuskie	1735.31	2197.31	2734.71	4173.07	5621.82
Łódzkie	1639.24	2146.66	2769.61	4551.61	6458.05
Małopolskie	1518.65	2042.85	2684.25	4226.66	5918.82
Mazowieckie	1784.03	2343.30	3019.53	5071.68	7599.18
Opolskie	1600.21	2038.68	2584.53	4018.57	5536.18
Podkarpackie	1489.04	1956.17	2498.17	3932.27	5472.52
Podlaskie	1398.24	1846.11	2432.42	3814.47	5249.74
Pomorskie	1805.40	2317.69	2966.64	4659.03	6760.22
Śląskie	1660.94	2185.25	2812.84	4390.35	6294.15
Świętokrzyskie	1415.33	1794.82	2248.06	3767.38	5239.48
Warmińsko-Mazurskie	1528.11	2012.61	2579.28	3994.25	5656.94
Wielkopolskie	1717.82	2238.31	2853.67	4577.75	6655.45
Zachodniopomorskie	1547.12	2054.16	2644.72	4204.78	6159.65

Source: Author's own work based on CSO data.

According to the households participating in the household survey, the level of income ensuring the conditions of meeting the needs as very good ranged from PLN 5239.48 to PLN 7599.18. These values were indicated respectively by

respondents from the Świętokrzyskie and Mazowieckie voivodeships. The level of income allowing for the standard of living defined on average as very poor was indicated households at the level of PLN 1582.71.

Diagnostic variables and data sources

To obtain the correct result of the cluster analysis, an appropriate set of decision variables should be selected, whose values is to be used as input data for the algorithm. Bearing in mind the purpose of the analysis, the voivodeships were divided into separate concentrations. The variables that were accepted for the analysis to map the above information needs were: assessment of net income level. During the analysis, the concentrations of voivodeships were determined based on the following subjective assessments of the level of income obtained by households: very poor, insufficient, barely sufficient, good and very good. The classification was carried out among three groups of households: employees, farmers and self-employed persons.

Grouping the voivodeships using the Kohonen algorithm

The variables used in the analysis included data on the economic situation of households, which according to the main source of income were classified as households of employees, farmers and the self-employed.

The data illustrating the assessment of the level of income providing specific living conditions according to the subjective assessment of households constituted a set of input data to be used in the self-organizing neural network function, SOM (Tadeusiewicz, 1993). It was assumed that the output layer would consist of 4 nodes (x = 2; y = 2) organized in a square form. The most important result returned by the SOM () function is a juxtaposition (codebook) containing the centroid coordinates around which the grouped units focus. The coordinates of the centroid of the grouped voivodeships for households of employees are presented in Table 3.

Table 3. Centroid coordinates of grouped voivodeships – employee households

Voivodeship	Very bad	Insufficient	Scant	Good	Very good
1	*2*	*3*	*4*	*5*	*6*
Łódzkie	1.550969	-0.75178	-0.01281	0.154288	-0.0567
Małopolskie	-2.05525	-1.05837	0.13801	0.046724	0.035229
Mazowieckie	-3.23657	0.980739	0.225135	0.157238	-0.03405
Podlaskie	3.455582	-1.31839	0.142871	-0.13082	-0.09191
Śląskie	0.923746	1.260701	0.267928	-0.18579	-0.02482
Dolnośląskie	0.016139	0.024306	-0.22974	-0.09199	0.014383
Kujawsko-Pomorskie	0.783176	1.432514	-0.01736	-0.06105	0.033317

1	*2*	*3*	*4*	*5*	*6*
Opolskie	0.497028	-0.75603	-0.00847	-0.08953	0.128929
Pomorskie	-0.38928	-0.01377	-0.14593	-0.11058	-0.03689
Świętokrzyskie	-3.49458	-0.67836	-0.07998	-0.05142	0.097747
Warmińsko-Mazurskie	2.561201	-0.08634	0.443849	0.210173	0.048577
Wielkopolskie	2.06005	0.125136	-0.25937	0.176174	0.077765
Zachodniopomorskie	-1.44927	-0.54351	0.409823	-0.14096	-0.02549
Lubelskie	-2.19642	-0.2268	-0.01725	0.112622	-0.13991
Podkarpackie	0.768956	1.385438	0.186039	0.002156	0.007007
Lubuskie	0.204537	0.224527	-1.04274	0.002767	-0.03319

Source: Author's own work based on CSO data.

As a result of the procedure, four clusters of voivodeships were obtained. The objects they contained were characterized by similarities in terms of the analysed features. The classification of the voivodeships is presented in Table 4.

Table 4. Descriptive statistics of clusters for employee households

Voivode-ship	Segment elements	Subjective assessment	Average level of income (PLN) recognized as:	Standard deviation	Coefficient of variation (%)
Cluster 1	Dolnośląskie Lubuskie	Very bad	1450.633	41.014	2.83
		Insufficient	1989.699	14.568	0.73
		Scant	2646.652	69.217	2.62
		Good	4082.705	4.851	0.12
		Very good	5716.418	26.609	0.47
Cluster 2	Łódzkie Opolskie Warmińsko-Mazurskie Wielkopolskie	Very bad	1603.539	41.325	2.58
		Insufficient	2084.585	41.068	1.97
		Scant	2698.885	53.368	1.98
		Good	4224.404	128.517	3.04
		Very good	5970.084	340.043	5.70
Cluster 3	Małopolskie Mazowieckie Kujawsko-Pomorskie Świętokrzyskie Lubelskie Podkarpackie	Very bad	1410.939	65.134	4.62
		Insufficient	1868.24	89.380	4.78
		Scant	2451.7	121.701	4.96
		Good	3895.226	334.849	8.60
		Very good	5554.924	651.381	11.73
Cluster 4	Podlaskie Śląskie Pomorskie Zachodniopomorskie	Very bad	1542.703	131.953	8.55
		Insufficient	2023.463	151.092	7.47
		Scant	2595.622	159.101	6.13
		Good	4169.285	257.305	6.17
		Very good	5793.213	434.133	7.49

Source: Author's own work based on CSO data.

The smallest variation in the assessments of household income participating in the survey can be observed in the first segment, comprising the Dolnośląskie and Lubuskie voivodeships. Coefficients of variation ranged from 0.12% to 2.83%. The respondents of these voivodeships also indicated the lowest amount (PLN 4082.70) that ensures, according to their subjective assessment, that the household needs are met at a good level.

The first and second focus is the concentration of the western and southern parts of Poland, namely, the following voivodeships: Dolnośląskie, Lubuskie, Łódzkie, Opolskie, Warmińsko-Mazurskie and Wielkopolskie. The obtained values of standard deviation and the level of variation coefficient for households in these groups indicated a slight regional differentiation among these voivodeships.

The greatest variation in the variables accepted for analysis can be observed in the third cluster. This is indicated by the values of standard deviation and the coefficient of variation. The coordinates of the centroid of grouped voivodeships for farmer households are presented in Table 5.

Table 5. Centroid coordinates of grouped voivodeships – farms whose main source of income is agricultural work

Voivodeship	Very bad	Insufficient	Scant	Good	Very good
Dolnośląskie	0.320827	-0.07301	0.257728	0.021375	0.047013
Kujawsko-Pomorskie	0.421323	-0.44105	0.035375	0.033264	0.01912
Lubelskie	-2.6926	0.02901	0.074729	0.106491	0.006721
Lubuskie	3.586097	-0.76188	-0.02545	-0.12256	0.05328
Łódzkie	0.586021	0.852334	-0.19041	-0.32394	0.004866
Małopolskie	-2.31442	-0.27293	-0.14177	-0.0381	0.022884
Mazowieckie	-0.41872	1.044963	-0.01604	0.100204	0.027596
Opolskie	1.003391	-0.26112	0.180979	-0.04743	-0.08903
Podkarpackie	-2.79034	-0.86769	-0.04621	0.101698	-0.06227
Podlaskie	-1.97751	0.265496	-0.30103	0.096954	0.003151
Pomorskie	0.971217	-0.15335	0.114808	-0.24535	-0.04013
Śląskie	0.162827	1.02469	0.318202	0.108224	-0.0145
Świętokrzyskie	-2.3974	-0.21054	-0.06064	-0.13469	0.011502
Warmińsko-Mazurskie	4.817295	0.062442	-0.26459	0.255361	-0.0342
Wielkopolskie	0.302252	0.272957	-0.0403	-0.02141	-0.02156
Zachodniopomorskie	0.419731	-0.51032	0.104615	0.109917	0.06555

Source: Author's own work based on CSO data.

On the basis of centroid measures, the voivodeships were classified by the corresponding value of this measure (Table 5). Four classes of voivodeships were defined for the needs of the analysis based on centroid values (Table 6).

Table 6. Descriptive statistics for clusters of households whose main source of income is work in agriculture

Voivode-ship	Segment elements	Subjective assessment	Average level of income (PLN) recognized as:	Standard deviation	Coefficient of variation (%)
Cluster 1	Łódzkie Pomorskie Świętokrzyskie Wielkopolskie	Very bad	1636.211	250.949	15.34
		Insufficient	2181.964	318.532	14.60
		Scant	2865.866	414.948	14.48
		Good	4867.75	684.989	14.07
		Very good	6864.838	999.765	14.56
Cluster 2	Kujawsko-Pomorskie Lubuskie Małopolskie Zachodniopomorskie	Very bad	1819.485	444.190	24.41
		Insufficient	2518.429	614.099	24.38
		Scant	3185.329	706.729	22.19
		Good	4868.273	895.975	18.40
		Very good	6634.888	1007.412	15.18
Cluster 3	Dolnośląskie Lubelskie Mazowieckie Podlaskie Śląskie	Very bad	1437.71	242.764	16.89
		Insufficient	1982.774	289.834	14.62
		Scant	2680.189	336.707	12.56
		Good	4433.505	521.162	11.76
		Very good	6842.5	1027.194	15.01
Cluster 4	Opolskie Podkarpackie Warmińsko-Mazurskie	Very bad	1861.473	524.784	28.19
		Insufficient	2578.728	834.389	32.36
		Scant	3395.076	1109.458	32.68
		Good	5059.291	1615.384	31.93
		Very good	6988.36	2227.955	31.88

Source: Author's own work based on CSO data.

Voivodeships belonging to the same classes can be considered similar due to the numerical values of the analysed variables. In the case of households, whose main source of income is agricultural income, the third segment is the largest. The focus characterised by the highest values of the coefficient of variation were the Opolskie, Podkarpackie and Warmińsko-Mazurskie voivodeships, characterized by the relatively highest levels of the variables studied.

The coordinates of the centroid of grouped voivodeships of households whose main source of income was self-employment are presented in Table 7.

Table 7. Centroid coordinates of grouped voivodeships – households whose main source of income is self-employment

Voivodeship	Very bad	Insufficient	Scant	Good	Very good
1	*2*	*3*	*4*	*5*	*6*
Dolnośląskie	0.572139	-0.47133	-0.11762	-0.0874	-0.00559
Kujawsko-Pomorskie	0.190088	-0.83843	0.013486	-0.02095	0.095912
Lubelskie	-2.76342	0.406997	-0.09767	0.10628	-0.02831

1	*2*	*3*	*4*	*5*	*6*
Lubuskie	0.713677	-0.51773	0.406442	-0.05187	-0.0147
Łódzkie	0.074148	0.696655	-0.12199	-0.17167	-0.01531
Małopolskie	-0.55599	0.0187	-0.13874	0.030389	0.011218
Mazowieckie	5.765698	0.145957	-0.0823	0.13272	0.003595
Opolskie	-0.87953	-0.09784	0.105448	0.007162	-0.05672
Podkarpackie	-2.45031	-0.15252	-0.02992	-0.04899	0.03681
Podlaskie	-2.50568	0.20719	-0.04086	-0.02503	0.030589
Pomorskie	3.371231	0.080352	0.022489	-0.02897	-0.01807
Śląskie	0.269435	0.499237	0.020026	-0.10162	-0.01692
Świętokrzyskie	-1.55251	-0.19006	0.214883	0.063481	-0.04548
Warmińsko-Mazurskie	-1.11601	0.09684	-0.02188	0.253659	0.013574
Wielkopolskie	0.702293	0.9084	0.144982	-0.02092	0.054522
Zachodniopomorskie	0.164746	-0.79242	-0.27677	-0.0363	-0.04512

Source: Author's own work based on CSO data.

The classification of voivodeships is presented in Table 8.

Table 8. Descriptive statistics for clusters of households whose main source of income is self-employment

Voivode-ship	Segment elements	Subjective assessment	Average level of income (PLN) recognized as:	Standard deviation	Coefficient of variation (%)
1	*2*	*3*	*4*	*5*	*6*
Cluster 1	Mazowieckie Pomorskie	Very bad	2402.247	181.907	7.57
		Insufficient	3235.745	260.775	8.06
		Scant	4227.751	366.510	8.67
		Good	6891.31	549.058	7.97
		Very good	10494.58	1186.175	11.30
Cluster 2	Dolnośląskie Kujawsko-Pomorskie Podkarpackie	Very bad	1896.863	219.615	11.58
		Insufficient	2484.584	286.507	11.53
		Scant	3246.915	375.037	11.55
		Good	4875.628	525.956	10.79
		Very good	6677.149	772.755	11.57
Cluster 3	Lubelskie Łódzkie Małopolskie Opolskie Podlaskie Śląskie Warmińsko-Mazurskie Wielkopolskie Zachodniopomorskie	Very bad	1787.488	141.133	7.90
		Insufficient	2397.628	194.946	8.13
		Scant	3126.934	260.974	8.35
		Good	4996.499	540.304	10.81
		Very good	7293.372	879.273	12.06

1	*2*	*3*	*4*	*5*	*6*
Cluster 4	Lubuskie Świętokrzyskie	Very bad	1949.184	226.755	11.63
		Insufficient	2492.783	259.378	10.41
		Scant	3129.579	321.824	10.28
		Good	5025.397	601.602	11.97
		Very good	6924.306	688.447	9.94

Source: Author's own work based on CSO data.

The least numerous of the isolated clusters were clusters 1 and 4, containing the Mazowieckie and Pomorskie voivodeships, as well as the Lubuskie and Świętokrzyskie voivodeships. In cluster 1 we can see the reflection of the most economically developing voivodeships, which results in higher incomes for the inhabited population.

Based on the analysis, it can be assumed that the results may be derived from the diversity of living costs within voivodships. One measure of these costs is the expenditure incurred by households for the use of a home and energy carriers. These expenses (per person) in the analysed period ranged from PLN 160.58 (Podkarpackie) to PLN 253.50 (Śląskie). The high costs of housing maintenance were also incurred by employees' households in the voivodships of Lubuskie and Dolnośląskie (respectively PLN 241.12 and PLN 253.40 per person in the household). As a result of the grouping, households of employees from these voivodships were located in the same cluster. A similar relationship can be observed in clusters concerning households whose main source of income was self-employment. For example: Pomorskie and Mazowieckie, located in the same cluster.

CONCLUSION

Persistent regional disparities in Poland can be determined by many economic and social factors. This translates into the living conditions of the residents of individual voivodeships. When discussing the income situation in Polish households under the regional (voivodeship) approach, one can analyse changes, indicators of the level of regional development and the degree of satisfying needs. The literature on the subject emphasizes that the existing differences in the level of macro- and microeconomic indicators are reflected in the income level of the population (Księżyk, 2012).

The obtained results of grouping voivodeships in terms of a subjective assessment of their inhabitants – in the case considered in this article because of their needs – indicate that neural networks (particularly the Kohonen network) may be useful for this type of analysis. An interesting issue is also the comparison of the grouping results obtained by SOM and with the use of other previously developed methods, especially k-means, so often used in economic analyses. Based on the re-

sults of the analysis and presented in the article, further research into the economic situation of households is required. An analysis of the conditions that determine the situation related to differentiating subjective assessments of Polish households may indicate directions of changes and increase the chances of improving the living conditions of the inhabitants of individual voivodeships. In summing up, it can be stated that in terms of the level of household financial resources and their subjective evaluation, voivodeships exist in which the pursued policy should attempt to level their chances of better satisfying the inhabitants' needs.

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Summary

One of the factors affecting the stratification and diversity of living conditions of the population is the level of income of the population. Income levels indicate inequalities that are inevitable and even necessary to some extent. They are part of the incentive mechanisms in consumer behaviour. The aim of the article was to show, by grouping voivodships, the differences in the assessment of the subjective level of household income. Households participating in the *Household Budget Survey* conducted by the Polish Central Statistical Office reported the amount of income (in PLN) allowing (in their assessment) to recognize the given income as: very weak, insufficient, barely sufficient, good and very good. The specified values of the centroids made it possible to organize voivodships in Poland due to the level of analysed features and identification of groups in which there are households with similar expectations and a subjective assessment of the economic situation. Based on the analysis, it can be concluded that in terms of subjective assessments of the level of income obtained by households there are stratifications in the individual groups of voivodships. The analysis of the diversity of income level assessments was conducted in a spatial section (diversification of the phenomenon by voivodships). The SOM-Kohonen method was used for the analysis.

Keywords: household, subjective assessment, material situation, SOM, Kohonen.

Regionalne zróżnicowanie gospodarstw domowych w kontekście subiektywnej oceny poziomu dochodów

Streszczenie

Jednym z czynników wpływających na rozwarstwienie i różnorodność warunków życia społeczeństwa jest poziom dochodu ludności. Poziom dochodu wskazuje na nierówności, które są nieuniknione, a nawet w pewnym stopniu niezbędne. Są elementem mechanizmów motywacyjnych w zachowaniach konsumentów. Celem artykułu jest wykazanie, za pomocą grupowania województw, zróżnicowania w ocenie subiektywnego poziomu dochodów gospodarstw domowych. Go-

spodarstwa uczestniczące w *Badaniu budżetów gospodarstw domowych* przeprowadzonym przez Główny Urząd Statystyczny podawały wysokość dochodów (w złotych) pozwalających (w ich ocenie) uznać dane dochody, jako: bardzo słabe, niewystarczające, ledwo wystarczające, dobre i bardzo dobre. Określone wartości centroidów umożliwiły uporządkowanie województw w Polsce ze względu na poziom analizowanych cech oraz identyfikację grup, w których są gospodarstwa domowe o podobnych oczekiwaniach i subiektywnej ocenie sytuacji gospodarczej. Na podstawie analizy można stwierdzić, że pod względem subiektywnych ocen poziomu dochodów uzyskiwanych przez gospodarstwa domowe istnieją stratyfikacje w poszczególnych grupach województw. Analiza różnorodności ocen poziomu dochodów została przeprowadzona w przekroju przestrzennym (zróżnicowanie zjawiska według województw). Do analizy zastosowano metodę SOM-Kohonen.

Słowa kluczowe: gospodarstwo domowe, subiektywna ocena, sytuacja materialna, SOM, Kohonen.

JEL: C10, D12, D14, D31, C38.