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The Use of Methods of Multidimensional Comparative Analysis in Evaluation of the Standard of Living of Poland's Population in Comparison with Other Countries of the European Union

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Abstract: *The comparative analysis of the standard of living of the population is significant from the viewpoint of evaluation of economic changes as well as determination of the distance between countries with regard to social development. The goal of the article was to compare, using the methods of multidimensional comparative analysis (MCA), the standard of living in the countries of the European Union using a single indicator. This indicator, as an aggregated value, synthesizes the information from all variables defining a complex phenomenon, enabling a comparison of countries with regard to the standard of living. The point of departure for the research was a creation of a set of variables, divided into 8 sub-*

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groups: health care, labour market, salaries, housing conditions, education, culture and recreation, communication, environmental protection, and social benefits. On the basis of this group of variables, a comparison of the European Union countries between 2006 and 2011 was made, specifying the position of Poland, with regard to the standard of living of inhabitants and evaluation of the extent of Poland's similarity to other EU countries. The source base of the articles was information from secondary sources: Internet sites, publications on European statistics, as well as data published by the GUS (Central Statistical Office of Poland).

Introduction

The concept of living conditions of the population is often used synonymously with the concept of the standard of living of the population. However, it is worth stressing that the terms connected with these issues differ from each other. Living conditions usually describe the entirety of factors determining the satisfaction of human needs impacting the standard of living as well as the possibilities to satisfy them, while the standard of living refers to the extent of satisfaction of human needs itself (Luszniewicz, 1972). The issue of standard of living of the population currently becomes one of the key concepts in strategies of social development.

In the statistical, economical and sociological literature, the concepts connected with the term "living conditions" and others have not been standardized so far. The living conditions, however, are usually defined as the entirety of relations a society, a household or an individual lives in. They are often determined by four basic elements:

- the level of economic welfare (income of the population), guaranteeing a specific level of satisfaction of material needs;
- the extent of endowment of housing and municipal infrastructure;
- the extent of endowment of social infrastructure;
- conditions of a human's natural environment (Markowski, 1987).

Within these groups, further disaggregating of component characteristics connected with specific needs of a human becomes necessary to describe the living conditions.

According to the UN commission of experts (of 1954), the standard of living includes the entirety of actual conditions of living of people, as well as the extent of their material and cultural satisfaction of needs through a flow of goods and services, both payable and allocated from social funds.

The main goal of the article was to compare the standard of living of the population of Poland and of the populations of countries of the European Union. For the evaluation of the standard of living of the population, taxonomic synthetic development measures have been used. The evaluation of

the standard of living of the population of Poland and determination of Poland's place in comparison with other countries was enabled by an aggregate indicator, obtained during analysis, which included a wide extent of issues. 53 socioeconomic indicators were initially distinguished and grouped into eight basic fields characterizing the researched phenomenon:

1. Health care
2. Labour market
3. Social expenditures and benefits
4. Housing conditions
5. Education
6. Culture and recreation
7. Communication
8. Environmental protection

The next step was to build an optimal set of statistical features describing a complex phenomenon, and to use them as a basis to determine the development indicator for each EU country. The source basis of the article was information from secondary sources: Internet sites, publications on European statistics, and data published by the GUS.

Due to the limited number of pages of the article, the study does not include data and the majority of results of individual calculations

Methodology of the research

Multidimensional comparative analysis (MCA) is a comparison of objects defined with many diverse features. The methods to perform such analysis include taxonomic methods, based on comparisons made using the distance matrix (Pluta, 1977). Among the taxonomic methods, methods of grouping and linear ordering can be distinguished. The former method allows to examine objects. In this group, discriminative and classification methods can be distinguished. Discrimination is understood as assignment of objects to known classes which can be determined using characteristics (such as measure of location) or representatives (teaching sample). Classification is understood as distribution of objects into previously unknown classes in such a way as to obtain the highest similarity of objects belonging to one class, and the lowest similarity of objects from different classes (Dziechciarz, 2003).

The goal of methods of linear ordering is to arrange the objects from the best to the worst according to the criterion of level of the complex phenomenon. The methods of linear ordering include the standardized sums and development pattern methods (Dziechciarz, 2003). In the linear

ordering (ranking), the objects, the goal of ranking, as well as features serving as the evaluation criteria should be determined. The basis for ranking is the matrix:

$$X = \begin{bmatrix} x_{11} & x_{12} & x_{13} & \cdots & x_{1m} \\ x_{21} & x_{22} & x_{23} & \cdots & x_{2m} \\ x_{31} & x_{32} & x_{33} & \cdots & x_{3m} \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ x_{n1} & x_{n2} & x_{n3} & \cdots & x_{nm} \end{bmatrix}$$

where x_{ij} the value of the j variable in the i object.

The first stage of ranking is the selection of statistical features. In an analysis of research of the standard of living of population, the research results are significantly impacted by the appropriate selection of diagnostic features characterizing the described phenomenon. Well selected diagnostic variables should:

- play a significant role in the description of the analyzed phenomenon;
- be complete and available;
- be expressed in an interval scale or a ratio scale;
- be weakly correlated with each other in order to avoid duplication of data;
- be characterized with a high variability level (Gibas & Heffner, 2007).

The selection of these features should be based on substantive and formal premises. When the substantive criteria are taken into consideration, the variables should be reduced again by those characterized by low variability (this study assumes a threshold of 10%).

The following stage of ranking is determination of the character of individual variables as:

- stimulants: an increase in value causes an increase in the level of the complex phenomenon;
- destimulants: an increase in value causes a decrease in the level of the complex phenomenon;
- nominants: a specific value (N) evidences the highest level of the complex phenomenon;
- neutral: neither increases nor decreases impact the level of the complex phenomenon.

The variables with the neutral character are not desired in the set of diagnostic variables.

The next step is to change the destimulant variables to stimulants (through multiplying their value by -1) and the nominant variables to stimulants through the formula:

$$w_{ij} = \begin{cases} 1 & \text{for } x_{ij} = N_j \\ \frac{-1}{x_{ij} - N_j - 1} & \text{for } x_{ij} < N_j \\ \frac{1}{x_{ij} - N_j + 1} & \text{for } x_{ij} > N_j \end{cases}$$

where:

w_{ij} – value of the j variable after being changed to a stimulant in the i object,

N_j – nominal value for the i variable,

x_{ij} – value of the j variable in the i object (see Dziechciarz, 2003).

Having determined the character of diagnostic features and changed them to stimulants, variables should be standardized according to the formula:

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j}$$

where:

z_{ij} – standardized value of the j variable in the i object,

\bar{x}_j – arithmetic mean of the j variable,

s_j – standard deviation of the j variable (Dziechciarz, 2003).

After such standardization, variables become standardized with regard to variability and location.

The final step of the stage of selection of features for ranking is elimination of the variables which duplicate information. The variables are selected through analysis of potential connections of features. The extent of similarity is determined on the basis of correlation coefficient matrices. On the basis of such reduction, the so-called optimal set of diagnostic features is obtained.

The following stage of ranking is to determine the so-called pattern and anti-pattern for abstract objects. The pattern z_{0j} is a vector whose coordinates are the highest values of variables, and the anti-pattern z_{-0j} is a vector whose coordinates are determined by the lowest values of each variable. Subsequently, the similarity of objects to the abstract best object is examined by calculation of distance (e.g. Euclidean) of each object from the development pattern. The lower the object's distance from the pattern, the higher the level of the complex phenomenon.

Since the analysis applies to a comparison of a synthetic indicator over time, the pattern was assumed to be a vector with coordinates which had been the highest values of variables over the years under examination, and the anti-pattern became a vector with coordinates which had been the lowest values of features in the research period.

The last stage of ranking is determination of the so-called development measure for each object:

$$m_i = 1 - \frac{d_{i0}}{d_0} \quad (i = 1, 2, \dots, n)$$

where:

m_i – development measure for the i object,

d_{i0} – distance of the i object from the pattern,

d_0 – distance between the pattern and the anti-pattern.

The measure is constructed in such way that its values are within the interval $[0,1]$, and the higher its value, the higher the level of the complex phenomenon.

Research results

The standard of living of the population of countries of the European Union has been characterized using indicators determining various areas of social life. Initially, 53 indicators had been suggested, which were further divided into 8 groups (Table 7, Appendix). During further research, those among the presented variables which, according to the formal and substantive criteria, significantly impact the level of the examined phenomenon, were selected (Kubicka, 2001). A main limitation in the selection of variables

was the lack of complete data. Therefore, the set of potential variables did not include: X_{12} , X_{78} , X_{79} . Subsequently, the variables for which the variability coefficient was lower than 10% were removed from the set of data, since these variables did not bring any significant information in the phenomenon under discussion. The quasi-permanent variables included the variables: X_{19} , X_{110} , X_{111} , X_{21} .

In the following step, the remaining features were assigned the character of stimulants and destimulants. The destimulant features were changed into stimulants. The set of features did not include nominants and neutral variables.

The further stage of the study was normalization of values of diagnostic variables for each year. From the group of these variables, using an algorithm of extraction of central and isolated features, the information-duplicating features (satellite features) were discarded (Strzała & Przechlewski, 1994). The remaining features in each year were weakly correlated with each other. In the final effect, the diagnostic variables were assumed as the variables included in Table 1:

Table 1. Diagnostic variables and their character

1. Health care		Character of a diagnostic variable
X_{13}	number of hospital beds per 100 thousand inhabitants	S
X_{14}	number of deaths due to alcohol per 100 thousand inhabitants	D
X_{15}	number of deaths due to pneumonia per 100 thousand inhabitants	D
X_{18}	number of deaths per 100 thousand inhabitants	D
2. Labour market		
X_{22}	long-term unemployment rate (%)	D
X_{25}	children in households in which neither of parents is employed (%)	D
3. Social expenditures and benefits		
social benefits for family and children (% of all benefits)		S
state expenditures for research development (% of the GNP)		S
social contribution of employers (% of the GNP)		S

Table 1 Continued

4. Housing conditions		Character of a diagnostic variable
X_{41}	% of persons living in difficult housing conditions	D
X_{44}	% of households complaining about noise at the place of residence	D
X_{48}	household expenditures connected with dwelling maintenance and equipment (% of household expenditures)	S
5. Education		
X_{52}	number of schoolchildren per one teacher	D
X_{55}	% of children benefitting from kindergarten care	S
6. Culture and recreation		
X_{63}	household expenditures for hotels and restaurants (% of household expenditures)	S
7. Communication		
X_{76}	mobile telephony subscribers per 1000 inhabitants	S
X_{77}	size of passenger transport in relation to the GNP	S
8. Environmental protection		
X_{81}	carbon dioxide emission (tons/inhabitant)	D
X_{82}	share of energy from renewable sources in the final consumption of energy (%)	S

Source: own study on the basis of data from EUROSTAT and GUS.

A fixed weight (equal to 1) was assigned to all diagnostic indicators, which has given them identical significance. Having selected the optimal set of diagnostic features, abstract objects were determined, namely, a development pattern and anti-pattern for the standard of living in the EU countries. Later, a development pattern and anti-pattern was selected for the research period. The results are shown in Table 2.

Table 2. Pattern and anti-pattern for 2006-2011 for the variables determining the standard of living of the population of the European Union

Feature	X_{13}	X_{14}	X_{15}	X_{18}	X_{22}	X_{25}	X_{31}
Pattern	1,7611	0,9617	1,4947	1,1797	1,4915	1,7622	2,9437
Anti-pattern	-1,7493	-3,4949	-2,7659	-1,9982	-3,2766	-2,4753	-1,6550
Feature	X_{32}	X_{34}	X_{41}	X_{44}	X_{48}	X_{52}	X_{55}
Pattern	2,4919	1,9818	1,7859	1,7661	1,8546	1,5838	1,2777
Anti-pattern	-1,1992	-1,9483	-2,5787	-2,5321	-2,2130	-1,9403	-2,1596
Feature	X_{63}	X_{76}	X_{77}	X_{81}	X_{82}		
Pattern	2,6160	2,6207	3,7364	1,3117	2,9556		
Anti-pattern	-1,4299	-1,7837	-2,6345	-4,0290	-1,2518		

Source: own study.

In the next step, the values of synthetic indicators determined for each of 27 examined countries of the European Union in 2006-2011 were calculated and the countries were ordered linearly according to this value. The highest indicator value shows the country with the highest standard of living of population. The results are shown in Table 4 and 5.

The measures of location and dispersion for individual years are shown in Table 3. In the research period, no clear trend of increase or decrease of the indicator determining the standard of living of the population of EU countries was apparent. The average indicator value did not change since 2006 (just as the standard deviation value). However, it is worth noticing that the median in 2007-2011 decreased in relation to 2006, which may evidence the fact that the standard of living of population in some EU countries has worsened. The right-sided asymmetry of distribution of the indicator in the years under examination aggravated as well. Therefore, it means that most countries had results below the EU average. In 2011, the skewness of distribution of the synthetic indicator doubled with regard to the base year. A lower concentration of value of the synthetic indicator of EU countries around the average is also evidenced by the value of kurtosis. Since 2006, the value of this indicator had also increased more than twice.

Table 3. Basic statistic measures for the synthetic indicator in 2006-2011

	2006	2007	2008	2009	2010	2011
Average	0,4657	0,4652	0,4653	0,4655	0,4654	0,4657
Median	0,4773	0,4682	0,4715	0,4508	0,4514	0,4545
Standard deviation	0,0676	0,0635	0,0642	0,0658	0,0653	0,0674
Q1	0,4369	0,4322	0,4254	0,4292	0,4317	0,4244
Q3	0,4894	0,4910	0,4948	0,4949	0,4972	0,5000
Minimum	0,3562	0,3536	0,3243	0,3334	0,3442	0,3415
Maximum	0,6260	0,6277	0,6285	0,6276	0,6290	0,6395
Kurtosis	0,4871	0,9072	1,1525	1,3219	1,2300	1,0672
Slant	0,4138	0,5704	0,4992	0,8364	0,9635	0,8997

Source: own study.

When analyzing the standard of living in individual countries of the Community, it can be noticed that since 2007, Austria and Finland had been characterized with the highest synthetic indicator values. Moreover, since 2006, their synthetic indicators had been increasing, which evidences the fact that these countries were continuously developing in the area of increasing of the standard of living of their inhabitants. A country which had also been at the top of the ranking each year was Sweden. From the second position in 2006, it fell to the third in 2007 and did not change its position until the end of the research period. However, it should be observed that in case of this country (in comparison with the base year), the synthetic indicator value was slightly decreasing.

Until 2009, France had been declining in the ranking of European countries (its synthetic indicator had also been decreasing). In 2010, this country had the first increase in the indicator value, and in the following year, France found itself at the 5th place among the countries of the Community, experiencing only a slight decline in the indicator value in comparison with the base year. Italy was in a similar situation: despite the fact it had declined by two places in the ranking, its indicator had virtually not changed.

In 2006, Denmark was at the 6th place in the ranking. In 2007, its position significantly worsened, putting this country at the 13th place with regard to the standard of living of the population. In 2011, Denmark only came 12th among the EU countries (the indicator of standard of living for this country declined by 6% in comparison with the base year).

The group of countries which had not changed their ranking position significantly included Luxembourg (7th place in 2006, 5th place in 2011).

Table 4. Development measures of the standard of living of the EU population in 2006-2008

No.	2006		2007		2008	
	Country	Dev. measure	Country	Dev. measure	Country	Dev. measure
1	Austria	0,6260	Austria	0,6277	Austria	0,6285
2	Sweden	0,5910	Finland	0,5821	Finland	0,5889
3	Finland	0,5890	Sweden	0,5770	Sweden	0,5715
4	France	0,5129	Italy	0,5131	Italy	0,5024
5	Italy	0,5086	France	0,4993	Germany	0,5018
6	Denmark	0,4922	Germany	0,4968	France	0,4993
7	Luxembourg	0,4915	Luxembourg	0,4930	Luxembourg	0,4981
8	Spain	0,4873	Spain	0,4890	Spain	0,4915
9	Lithuania	0,4860	Belgium	0,4848	Denmark	0,4865
10	Belgium	0,4858	Czech Republic	0,4825	Lithuania	0,4816
11	Germany	0,4827	Lithuania	0,4790	Greece	0,4804
12	Portugal	0,4807	Greece	0,4771	Belgium	0,4796
13	Greece	0,4791	Denmark	0,4697	Czech Republic	0,4758
14	Czech Republic	0,4773	Portugal	0,4682	Portugal	0,4715
15	Slovenia	0,4626	Slovenia	0,4581	Ireland	0,4660
16	Malta	0,4618	Malta	0,4518	Malta	0,4451
17	Estonia	0,4492	Estonia	0,4500	Netherlands	0,4437
18	Hungary	0,4471	Hungary	0,4413	Slovenia	0,4355
19	Netherlands	0,4370	Netherlands	0,4370	Estonia	0,4281
20	Latvia	0,4370	Latvia	0,4325	Hungary	0,4263
21	Ireland	0,4368	Ireland	0,4318	Latvia	0,4245
22	United Kingdom	0,4096	Bulgaria	0,4240	Poland	0,4157
23	Bulgaria	0,3871	United Kingdom	0,4124	Cyprus	0,4147
24	Cyprus	0,3854	Cyprus	0,3980	United Kingdom	0,4028
25	Slovakia	0,3571	Poland	0,3656	Bulgaria	0,4025
26	Poland	0,3569	Romania	0,3656	Romania	0,3766
27	Romania	0,3562	Slovakia	0,3536	Slovakia	0,3243

Source: own study on the basis of data from EUROSTAT and GUS.

Spain was one of the countries in which the economic crisis had visibly impacted the standard of living of population. Until 2008, it had occupied the 8th place in the ranking. In 2009, its position among the Community countries significantly declined (12th place). This country was also much weaker with regard to the calculated indicator. Moreover, it should be noticed that despite the fact that Spain had come 9th in 2010, its synthetic

indicator was lower than in the previous year. It was only in 2011 when the value of this indicator increased, giving Spain the 10th place in the ranking.

Table 5. Development measures of the standard of living of the EU population in 2006-2008

No.	2009		2010		2011	
	Country	Dev. measure	Country	Dev. measure	Country	Dev. measure
1	Austria	0,6276	Austria	0,629	Austria	0,6395
2	Finland	0,6179	Finland	0,6161	Finland	0,6083
3	Sweden	0,5793	Sweden	0,5787	Sweden	0,5826
4	Germany	0,5188	Germany	0,5271	Germany	0,5316
5	Luxembourg	0,4959	Italy	0,5071	Luxembourg	0,5075
6	Italy	0,4952	France	0,5016	France	0,5041
7	Lithuania	0,4951	Luxembourg	0,5014	Italy	0,5035
8	France	0,4946	Belgium	0,4929	Estonia	0,4966
9	Belgium	0,486	Spain	0,4667	Belgium	0,4849
10	Denmark	0,4744	Denmark	0,4663	Spain	0,4724
11	Greece	0,4733	Greece	0,4646	Lithuania	0,4679
12	Spain	0,4701	Lithuania	0,4645	Denmark	0,4624
13	Czech Republic	0,4657	Estonia	0,4633	Portugal	0,4558
14	Netherlands	0,4508	Portugal	0,4514	Poland	0,4545
15	Hungary	0,4478	Netherlands	0,4446	Netherlands	0,4467
16	Portugal	0,4465	Czech Republic	0,4422	Czech Republic	0,4436
17	Estonia	0,443	Poland	0,4407	Greece	0,4368
18	Slovenia	0,4404	Slovenia	0,4406	Hungary	0,4365
19	Ireland	0,4355	Hungary	0,4383	Slovenia	0,4352
20	Malta	0,4332	Bulgaria	0,4353	Malta	0,4251
21	Poland	0,4252	Malta	0,4282	Cyprus	0,4237
22	Bulgaria	0,422	United Kingdom	0,4193	Ireland	0,4165
23	United Kingdom	0,4121	Ireland	0,4132	United Kingdom	0,4155
24	Cyprus	0,4032	Cyprus	0,4109	Bulgaria	0,4113
25	Latvia	0,3991	Romania	0,3913	Romania	0,3877
26	Romania	0,3824	Latvia	0,3872	Latvia	0,3818
27	Slovakia	0,3334	Slovakia	0,3442	Slovakia	0,3415

Source: own study on the basis of data from EUROSTAT and GUS.

Lithuania, in 2006, was at the 9th place among the EU countries with regard to the standard of living of inhabitants. The highest indicator level for this country was observed in 2007 (which gave the 7th place to Lithuania). However, after this year, only a decline in the calculated indicator was apparent and in 2011, its value was lower than at the beginning of the research period. Belgium, ranking 10th in 2006, did not change its position

significantly. Moreover, its synthetic indicator in the period under examination did not change. Germany (11th place in 2006) was a country for which an enormous increase of the indicator describing the standard of living of inhabitants was apparent (in comparison with the base year, the indicator value had increased by 10%). Since 2009, Germany had become the fourth country in the ranking. After 2008, Portugal (12th place in 2006), just as Spain, had undergone the greatest decline in value of the synthetic indicator describing the standard of living of its population, which only gave it the 16th place among the EU countries. However, after this year, Portugal had begun to increase its position in the ranking and in 2011 it already ranked 13th (a 5% decline of the synthetic indicator in comparison with the base year). Greece had also suffered the effects of the 2008 crisis. Despite the fact that until 2010 it used to maintain the 11th place in the ranking of states, the value of its synthetic indicator after 2008 began to decline. In 2011, both the indicator value and Greece's place in the ranking significantly declined (a 8% decrease in the indicator value in comparison with the base year). In the case of the Czech Republic and Slovenia, which had been 14th and 15th respectively in 2006, a slight decline in value of their indicator of standard of living of population was apparent. In 2011, these countries came only 16th and 19th respectively among the Community countries.

Malta, although the value of its indicator had been declining until 2008, remained at the 16th place among the EU countries. However, the value of the indicator under discussion was still decreasing year by year, which had a negative impact on Malta's position among the European countries. In 2011, Malta came only 20th (a 8% decline in the indicator in comparison with 2006). Estonia had been a country for which the lowest indicator was observed in 2008, although after that year, the standard of living in Estonia, as measured by the synthetic indicator, began to increase, which gave it finally the 8th place in the 2011 ranking. It is worth noticing that in case of this country, a more than 10% increase in value of the synthetic indicator by was observed.

In the case of Hungary, although the value of its indicator in 2009 had been at the same level as in 2006, this country shifted by three places upwards. Unfortunately, after that year, Hungary's rank began to decline, which gave it the 18th place in the ranking of the Community countries (the value of the synthetic indicator for this country was also lower in 2011 in comparison with the base year). The Netherlands, despite a small increase of the calculated indicator, shifted from the 19th place, occupied in 2006, to the 15th place in 2011. Latvia was one of the countries whose position among the EU countries was declining year by year. Moreover, the stand-

ard of living of the population, as measured by the synthetic indicator, was worsening year by year as well (a decline by as much as 13%). In 2011, this country was already at the 26th place among the Community countries. In case of Ireland (21st place in 2006), the highest increase of the calculated indicator was noticed in 2008 (from 0,437 to 0,466). After that year, this country fell from its position and finally came 22nd in the ranking. Great Britain did not significantly change its place among the Community countries (from the 22nd place in 2006, it had fallen to the 23rd place in 2011). However, it is worth noticing that since 2006 this country had undergone a slight increase in the value of the calculated indicator. Despite a decline by one position in the ranking (just as Great Britain), Bulgaria also experienced an increase in value of the indicator describing the standard of living of the population. Cyprus, although it was only at the 21st place in 2011, had significantly increased the value of the synthetic indicator (by 10% in comparison with the base year). This evidences the development of this country with regard to the improvement of conditions of its inhabitants. Slovakia, from the 25th place in 2006, fell to the last place in the ranking, although since 2009 its synthetic indicator had been increasing. In 2011, however, the value of this indicator dropped again.

Poland in 2006 was at the penultimate place in the ranking. However, it should be noticed that in that year, Poland was a very young member of the Community as well. After 2006, a tremendous increase in value of the synthetic indicator (the highest among the EU countries) was visible. Moreover, this indicator was increasing year by year. In 2011, Poland had already ranked 14th among the Community countries (indicator increase by as much as 27%). Such a situation evidences a reduction of distance between Poland and the top of the EU countries. However, it should be stressed that in terms of standard of living of Poland's population, there are still many problems left to be corrected and improved.

Romania in 2006 was at the last position of the ranking. However, after that year, an increase in the value of the indicator had been noticed for this country until 2010. In 2011, Romania was already at the 25th place, out-running Slovakia and Latvia.

All countries of the Community in the research period could be divided into three groups. Namely, a group of countries for which the synthetic indicator describing the standard of living of the population had declined in comparison with 2006. This group included: Sweden, Denmark, Spain, Lithuania, Portugal, Greece, the Czech Republic, Slovenia, Malta, Hungary, Latvia, Ireland and Slovakia. The second group (the least numerous) consisted of countries for which the synthetic indicator had not undergone any major changes. Those countries were: France, Italy and Belgium. The last

group were the countries which had improved their position in the ranking (due to an increase of the indicator). This group of countries included: Austria, Finland, Luxembourg, Germany, Estonia, the Netherlands, Great Britain, Bulgaria, Cyprus, Poland and Romania. Among all the countries of the European Union, it was Poland which had achieved the greatest growth of the synthetic indicator in 2006-2011.

Table 6. Countries located closest to each other according to the criterion of Euclidean distance

Country	Closest "neighbour"	Country	Closest "neighbour"	Country	Closest "neighbour"
Austria	Germany	Grecja	Słowenia	Poland	Belgium
Belgium	Germany	Hiszpania	Italy	Portugalia	Greece
Bulgaria	Romania	Netherlands	Belgium	Romania	Bulgaria
Cyprus	Malta	Ireland	Hiszpania	Slovakia	Czech Republic
Czech Republic	Netherlands	Lithuania	Poland	Slovenia	Belgium
Denmark	Slovenia	Luxembourg	Austria	Sweden	Finland
Estonia	Slovenia	Latvia	Hungary	Hungary	Latvia
Finland	Austria	Malta	Cyprus	United Kingdom	Netherlands
Francja	Germany	Germany	Austria	Italy	Hiszpania

Source: own study.

In the further part of research, the similarity of the 2011 standard of living of the population in the European countries under examination was determined. In the analysis, 4 groups of countries, similar to each other with regard to the examined diagnostic features, were distinguished. The analysis was performed on the basis of the distance matrix (Dziechciarz, 2003). "Pairs" of countries which are closest to each other with regard to the living conditions of the population were distinguished (Table 6). On the basis of the distance matrix, a connected graph was created, from which the longest connections were removed naturally. As a result, the countries were grouped with regard to "similarities" in the standard of living of the inhabitants. The first group consisted of Hungary, Latvia, Romania and Bulgaria. They are also countries with a relatively low level of the synthetic indicator. The following group were Malta and Cyprus. The third group included Luxembourg. As a particular country with its living conditions, it was rela-

tively far from other countries (the distance to the closest “neighbour” was greatest of all distances). It is worth noticing that the data published for this country significantly differ from the general trends characterizing the economic and social phenomena in the EU countries. The remaining countries (including Poland) made up the last group of similar objects. However, it should be stressed that the living conditions in Poland are most similar to the conditions in Belgium and Lithuania.

Conclusions

The conducted analysis shows that there is no apparent trend in the development of the standard of living of the European Union inhabitants. The 2008 crisis caused some countries to feel its effects exactly in the form of a decline in the standard of living of the population. As for other countries, not only did they not feel any adverse effects in this area, but also the research period turned out to be a period of growth for them with regard to the phenomenon under discussion. Poland was also one of those countries.

In the research period, Poland experienced a large increase in value of the synthetic indicator. Moreover, it was one of the countries which had significantly increased their position in the ranking (an increase by 12 places). It should be added that this was the largest increase among all countries of the European Union. Therefore, it can be assumed that the standard of living of the Poles had significantly increased in the years under discussion, which is connected with a positive economic growth of our country. An apparent growth of the indicator was also experienced by Germany and Estonia. Such a high level of the calculated indicator for those countries allowed them to occupy top positions in the ranking under discussion in 2011. Among countries which had the highest development indicator were Austria and the Scandinavian countries, Finland and Sweden. At the same time, other European countries experienced a serious decline. They included Spain, Portugal or Greece, which had felt the effect of crisis after 2008 and for which the synthetic indicator value declined quite sharply. In such countries as Great Britain and Ireland, a decline in the standard of living was apparent as well, despite the fact that as much as several years earlier these countries used to be perceived as those in which the standard of living of the population had been high.

To sum up the performed analysis, it should be stressed that with regard to the standard of living, the distance of Poland from the top countries of the European Union has decreased, although Poland, with regard to the phenomenon under discussion, still differs significantly from these countries. However, it should be remembered that reduction of development disproportions requires time, therefore, in order to follow the process of changes, research in this area should be continued.

References

- Gibas P., Heffner K. (2007), *Analiza ekonomiczno przestrzenna*, Wydawnictwo AE Katowice, Katowice.
- Ekonometria. Metody, przykłady, zadania* (2003), Dziechciarz J. (ed.), Wydawnictwo Akademii Ekonomicznej im. Oskara Langego we Wrocławiu, Wrocław.
- Kubicka J. (2001), *Procesy integracji europejskiej a poziom życia ludności*, Wydawnictwo AE Katowice, Katowice.
- Luszniewicz A. (1972), *Statystyka poziomu życia ludności*, PWN, Warszawa.
- Markowski T. (1987), *Lokalna polityka kształtowania warunków bytowych w świetle teorii efektów zewnętrznych*, „Acta Universitatis Lodzies”.
- Pluta W. (1977), *Wielowymiarowa analiza porównawcza w badaniach ekonomicznych*, PWN, Warszawa.
- Strzała K., Przechlewski T. (1994), *Ekonometria inaczej*, Wydawnictwo Uniwersytetu Gdańskiego, Gdańsk.
- http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database
http://www.stat.gov.pl/cps/rde/xbcr/gus/dzial-16_Metadane_pl.pdf
www.stat.gov.pl

Appendix

1. Health care	
X_{11}	infant mortality rate (%)
X_{12}	number of doctors per 100 thousand inhabitants
X_{13}	number of hospital beds per 100 thousand inhabitants
X_{14}	number of deaths due to alcohol per 100 thousand inhabitants
X_{15}	number of deaths due to pneumonia per 100 thousand inhabitants
X_{16}	number of deaths due to cardiovascular diseases per 100 thousand inhabitants
X_{17}	number of deaths due to cancer per 100 thousand inhabitants

Appendix Continued

X_{18}	number of deaths per 100 thousand inhabitants
X_{19}	life expectancy
X_{110}	average men's life expectancy
X_{111}	average women's life expectancy
2. Labour market	
X_{21}	professional activity rate (%)
X_{22}	long-term unemployment rate (%)
X_{23}	unemployed persons aged 15-24 (%)
X_{24}	very low intensity work rate in a household
X_{25}	children in households in which neither of parents is employed (%)
3. Social expenditures and benefits	
X_{31}	social benefits for family and children (% of all benefits)
X_{32}	expenditures for research and development (% of GNP)
X_{33}	state expenditures for elderly people care (% of GNP)
X_{34}	social contribution of employers (% of GNP)
X_{35}	state social expenditures per one person
X_{36}	expenditures for pensions (% of GNP)
X_{37}	prices of electric power (EUR/kWh)
4. Housing conditions	
X_{41}	% of persons living in difficult housing conditions
X_{42}	% of persons without their own toilet in their dwelling
X_{43}	% of persons without their own bathroom or shower in their dwelling
X_{44}	% of households complaining about noise at their place of residence
X_{45}	% of persons without their own household
X_{46}	severe deprivation rate (%)

Appendix Continued

X_{47}	at-risk-of poverty and social exclusion rate (%)
X_{48}	household expenditures connected with dwelling maintenance and equipment (% of household expenditures)
5. Education	
X_{51}	scholarization rate for young people aged 19-24 years (%)
X_{52}	number of schoolchildren per one teacher
X_{53}	persons with secondary or higher education (% in the group aged 15-24 years)
X_{54}	% of persons in the group aged 25 to 65 years with low education level
X_{55}	% of children benefitting from kindergarten care
X_{56}	household expenditures for education (% of household expenditures)
6. Culture and recreation	
X_{61}	hotel occupancy (%)
X_{62}	number of hotels per 1000 inhabitants
X_{63}	household expenditures for hotels and restaurants (% of household expenditures)
X_{64}	household expenditures for recreation and tourism (% of household expenditures)
7. Communication	
X_{71}	households with access to a computer (%)
X_{72}	households with access to the Internet (%)
X_{73}	households with broadband Internet (%)
X_{74}	Internet users per 1000 inhabitants
X_{75}	fixed telephony subscribers per 1000 inhabitants
X_{76}	mobile telephony subscribers per 1000 inhabitants
X_{77}	size of passenger transport in relation to the GDP
X_{78}	length of motorways (in km) per km ²
X_{79}	newly registered cars and lorries per 1000 inhabitants
8. Environmental protection	
X_{81}	carbon dioxide emissions (tons/inhabitant)
X_{82}	share of energy from renewable sources in the final consumption of energy (%)

Appendix Continued

8. Environmental protection	
X_{81}	carbon dioxide emissions (tons/inhabitant)
X_{82}	share of energy from renewable sources in the final consumption of energy (%)

Source: own study based on the data from EUROSTAT and GUS.