Journal of Agribusiness and Rural Development

DIFFERENTIATION OF DISTRICTS OF THE MAŁOPOLSKIE VOIVODESHIP WITH RESPECT TO CHOSEN SOCIAL PROBLEMS

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Abstract. The phenomenon of unemployment and exacerbating demographic situation can be seen as major social problem of nowadays in Poland. The paper is an attempt to compare districts of the Małopolskie voivodeship with respect to chosen features characterizing these phenomena. On the basis of the data from the Central Statistical Office and with the help of taxonomic methods, grouping of districts has been carried out with respect to the level of features under investigation. The procedure allowed for distinguishing 5 groups of significant inter-group differentiation. The application of taxonomic methods resulted in obtaining a general and, at the same time, accurate picture of differentiation of the Małopolskie voivodeship with respect to social problems being analysed and distinction of districts with the most difficult situation in this area.

Key words: unemployment, demography, taxonomy, districts

INTRODUCTION

Demography and unemployment are the two topics that arise in the research within the social situation in Poland at present. Apart from social consequences, the phenomenon of unemployment has many negative economic and political results (Kwiatkowski, 2002). The most dangerous seems to be the long-term unemployment. The deficiency of income – especially in long term – caused rapid decrease of the quality of life and in long term leads to poverty. On the other hand, the inequalities in living standard may bring about protests and civil unrest. Alcoholism, drug addiction, an increase of crime level and other social pathologies can also be treated as further consequences of unemployment.

Unemployment is a very severe experience, no matter how old the person is. Unemployment of the youth needs particular attention. Ready to work young people with no possibility to realize their plans for life leave Poland and look for some occupation abroad. On the other hand, for people close to retirement age, unemployment means low income after retirement and therefore life on the edge of poverty.

Another important social problem – not only in our country – is aging of society, which is expressed in an increasing number of post-working age people and decreasing number of those at pre-working age. This process has been observed in Poland since the 90-ties of the XX century (Szymańczak, 2012). Low level of births in Poland – in 2014 reached nearly 1,3, while the minimum level needed for simple generation replacement should fit in the interval 2,10–2,15. Such low level of births results in aging and dying out of a society.

The intensity of the phenomena discussed in the paper is different in each region of the country. Therefore the important issue is to carry out the research on the level of voivodeships and districts. In the Małopolskie voivodeship the level of unemployment differs from year to year, but is constantly lower than the country

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Table 1. Unemployment in Poland and in the Małopolskie voivodeship in 2008–2014
Tabela 1. Bezrobocie w Polsce i województwie małopolskim w latach 2008–2014

Coefficient Wskaźnik	Administrative unit Jednostka administracyjna	Years – Lata						
		2008	2009	2010	2011	2012	2013	2014
Level of unemployment (%) Stopa bezrobocia (%)	Poland Polska	9,5	12,1	12,4	12,5	13,4	13,4	11,5
	Małopolskie voivodeship woj. małopolskie	7,5	9,7	10,4	10,5	11,4	11,5	9,9
Level of unemployment (thous.) Liczba bezrobotnych (tys.)	Małopolskie voivodeship woj. małopolskie	97,8	130,0	142,2	145,1	161,2	164,4	139,0

Source: BDL (n.d.), GUS (n.d.).
Źródło: BDL (b.d.), GUS (b.d.).

average. In the period of 2008–2013 this coefficient had been systematically increasing from the level of 7.5% up to the level of 11.5% (Table 1). In absolute numbers this means the increase of the level of the unemployed from 97.8 thousand in 2008 up to 164.4 thousand in 2013. In 2014 the level of unemployment dropped down to 9.9%, which means 139,0 thousand of the unemployed.

The paper is an attempt to compare districts of the Małopolskie voivodeship with respect to the level of chosen features characterizing the phenomenon of unemployment and demographic situation. On the basis of the data from GUS (n.d.) and with the help of taxonomic methods grouping procedure of districts has been carried out with respect to the similarity of the level of features under investigation. Grouping procedure was based on the algorithm constructed on the method of vector (Chomątowski, 1978) with the combination of the method of best choice (Wysocki and Wagner, 1989). The application of taxonomic methods allowed for obtaining general and at the same time accurate picture of differentiation of the Małopolskie voivodeship with respect to the social problems discussed in the paper and determination of districts in this area in which the situation is the most difficult.

RESEARCH METHOD

The investigation procedure was based on the following set of variables (features) describing particular districts:

X_1 – the partition of the number of the unemployed at the age of 24 and less in the total number of the unemployed in the district

X_2 – the partition of the number of the unemployed at the age of 45–54 in the total number of the unemployed in the district

X_3 – the partition of the number of the unemployed at the age of 55 and more in the total number of the unemployed in the district

X_4 – the partition of the unemployed with no occupation for the period of 24 months and more in the total number of the unemployed in the district

X_5 – the unemployment rate in the district

X_6 – births per 1000 people in the district

X_7 – the partition of the number of people in pre-working age in the total number of people in the district.

From the initial set of variables the features for which the coefficient of variability took low values were eliminated, that is the percentage of the unemployed at the age of 25–34 years, 35–44 years and the partition of number of people at working age. The coefficient of variability for these variables takes values from the interval of 0.01–0.08, therefore these variables have no influence on the results of grouping procedure.

The data can be represented in the form of a matrix:

$$A = \begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{22} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{m1} & a_{m2} & \dots & a_{mn} \end{bmatrix} = \left[a_{ij} \right]_{\substack{i=1,\dots m \\ j=1,\dots n}} \quad (1)$$

where a_{ij} denotes the value of feature j (variable) in the object i (district).

The starting point for grouping of objects with respect to the similarity of features under investigation is the determination of differentiation measures (Kukuła, 1989):

$$\varepsilon_{ij} = \frac{\sum_{l=1}^{k} |a_{il} - a_{jl}|}{2} \quad (i, j = 1, ..., n;) \qquad (2)$$

where ε_{ij} – the differentiation measure between the object i and object j.

Differentiation measures computed for each pair of objects (elements ε_{ij}) form the matrix of structural differentiation E_0.

Then the value of average differentiation amongst objects is calculated $\bar{\varepsilon}$:

$$\bar{\varepsilon} = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} \varepsilon_{ij}}{n(n-1)} \qquad (3)$$

that in turn serve as a basis for further calculations – zero – one matrix E, the elements of which – ε_{ij} – are defined as follows:

$$e_{ij} = \begin{cases} 0, & \text{when } \varepsilon_{ij} < \beta \\ 1, & \text{when } \varepsilon_{ij} \geq \beta \end{cases} \quad \beta = \bar{\varepsilon}, \qquad (4)$$

For the matrix E the method of vector elimination is then applied (Chomątowski and Sokołowski, 1978), the results of which homogenous groups of objects are obtained. In the method of vector elimination the result of grouping depends on the value of β.

In the paper the choice of the value of β resulted from the application of the method of best choice (Wysocki and Wagner, 1989), where repeating of the division procedure with different values of $\beta_1 \hat{I} [a,b]$ is demanded, with a $= \bar{\varepsilon} - s_{\bar{\varepsilon}}$, $b = \bar{\varepsilon}$, $\bar{\varepsilon}$ – arithmetic mean of ε_{ij}, $s_{\bar{\varepsilon}}$ – standard deviation of ε_{ij}, $\beta_l = a + (l-1) h$, where $l = 1, 2, ..., L$, $\beta_l = b$, h – step.

For each grouping l the value of the function of quality of classification is determined $F^{(l)}$:

$$F^{(l)} = \sum_{k=1}^{r} F_{lk}, l = 1, ..., L \qquad (5)$$

where F_{lk} – the index of quality of grouping of the variable k:

$$F_{lk} = \frac{s_{k(o)}^2 / (n-1)}{s_{k(w)}^2 / (n-m-1)} \qquad (6)$$

m – the number of groups delimited at a given level of β_l
$s^2_{k(o)}$ – general variance of the variable k
$s^2_{k(w)}$ – inner-group variance for variable k.

The optimum division is the division l_0, at which the function $F^{(l)}$ takes its highest value $F^{(l0)} = \max \{F^{(1)}, ..., F^{(L)}\}$. The value of $\beta = \beta_{l0}$ corresponding with this division is the sought step value.

INVESTIGATION RESULTS

The research has been carried out on the basis of the data from Local Data Base of the Central Statistical Office that represented realization of variables mentioned in the previous section for districts of the Małopolskie voivodeship in 2014. For each feature the arithmetic mean was computed, as well as standard deviation and the coefficient of variability. In addition the minimum and maximum values for these variables were given (Table 2).

From the data presented in the table 2 it follows that the districts of the Małopolskie voivodeship are differentiated significantly with respect to the level of the features chosen for the analysis. The partition of the number of people unemployed in the age of 24 and less in the total number of the unemployed oscillates from 9.4% in the Kraków district to 33.3% in Proszowicki district. The rate of unemployment takes values from 5.2% in the Kraków district to 17.1% in Dąbrowski district. These values are significantly different from average values for the voivodeship, that reach the level of 20.7 and 9.9% respectively. Similar differentiation can be observed in case of other features participating in the analysis.

On the basis of the method presented in previous sections, grouping of districts was carried out with respect to the level of the features under investigation, which led to distinction of 3 groups of many elements and 2 groups with one element only (Fig. 1):

Group I consists of 10 districts: Bocheński, Myślenicki, Gorlicki, Nowosądecki, Nowotarski, Tatrzański, Suski, Wadowicki, Brzeski, Tarnowski.

Group II comprises 7 districts: Krakowski, Wielicki, Nowy Sącz, Chrzanowski, Olkuski, Oświęcimski, Tarnów.

Group III has 3 districts: Miechowski, Proszowicki, Dąbrowski.

Table 2. Values of individual characteristics and their characteristics in the districts of the Małopolskie voivodeship in 2014
Tabela 2. Wartości poszczególnych zmiennych i ich charakterystyki w powiatach województwa małopolskiego w roku 2014

Districts Powiaty	Number of the unemployed Liczba bezrobotnych	Feature – Cecha (%)						
		X_1	X_2	X_3	X_4	X_5	X_6	X_7
Bocheński	3 698	26,5	15,1	11,7	26,5	9,5	12	21,1
Krakowski	8 045	20,1	18,0	15,8	20,0	8,5	10	19,8
Miechowski	2 010	28,6	13,4	10,7	26,3	9,5	9,9	17,2
Myślenicki	4 879	24,4	16,8	11,3	20,7	10,7	11,3	21,8
Proszowicki	2 064	33,3	11,4	9,2	26,3	11,2	9,4	18,1
Wielicki	3 764	17,0	17,9	17,6	19,8	9,7	10,5	20,8
Kraków	21 948	9,4	20,8	20,5	22,6	5,2	9,9	15,7
Gorlicki	5 749	22,1	17,2	9,6	23,0	12,5	10,6	20,1
Limanowski	8 815	26,3	16,4	8,5	31,2	16,0	12,9	24,1
Nowosądecki	10 920	25,0	17,3	9,3	21,2	14,9	12,3	23,6
Nowotarski	8 752	27,7	16,3	11,6	25,7	13,3	10,2	21,1
Tatrzański	3 679	23,3	17,0	14,1	30,1	13,0	10,2	19,5
Nowy Sącz	3 987	15,4	20,2	12,7	20,4	8,9	10	18,9
Chrzanowski	5 700	15,9	19,4	14,9	18,3	13,7	8,8	16,3
Olkuski	6 465	17,0	17,7	14,5	29,4	13,8	8,7	16,8
Oświęcimski	5 768	15,7	21,4	14,2	20,1	11,5	9,3	17,7
Suski	3 215	27,8	16,9	11,8	19,1	10,2	9,6	20,6
Wadowicki	6 429	20,7	18,1	15,1	22,8	11,2	11	20,1
Brzeski	4 071	26,1	15,6	11,8	23,6	11,6	9,9	20,4
Dąbrowski	4 114	27,2	15,0	8,1	27,1	17,1	9,2	18,5
Tarnowski	9 592	28,1	16,4	9,9	20,3	13,6	10	20,5
Miasto Tarnów	5 363	14,4	20,4	14,7	24,2	9,6	8,3	16,1
Total – Ogółem	139 027	20,7	17,9	13,4	23,3	9,9	10,2	19
max. (x)	21 948	33	21	21	31	17	12,9	24,1
min. (x)	2 010	9	11	8	18	5	8,3	15,7
average – średnio		22	17	13	24	12	10,18	19,49
s(x)		5,89	2,33	3,07	3,69	2,67	1,13	2,23
V(x)		0,26	0,14	0,24	0,16	0,23	0,11	0,11

Source: BDL (n.d.), GUS (n.d.), own calculations.
Źródło: BDL (b.d.), GUS (b.d.), obliczenia własne.

2 districts: Limanowski and Kraków are totally different from all of the distinguished groups and therefore they form two groups of one element each (IV and V respectively).

The average values, standard deviation and the coefficient of variability for each typological group are presented in Table 3.
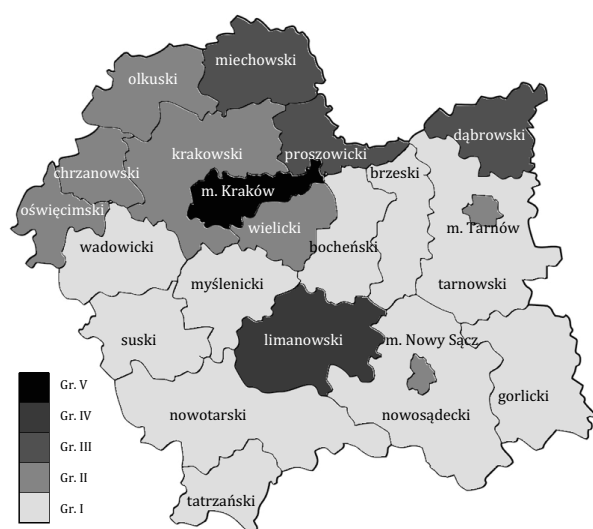
Fig. 1. Distinguished groups of similar districts in Małopolskie voivodeship
Source: own elaboration.
Rys. 1. Wyodrębnione grupy powiatów podobnych województwa małopolskiego
Źródło: opracowanie własne.

Districts of group I cover south and middle zone of the voivodeship and constitute more than a half of its total area. In this group 25.2% of the unemployed population are young people – at the age of 24 and less, 16.7% – people at the age of 45–54 and 11.6% – people at the age close to retirement. High percentage is observed for people unemployed for a long time – 23.3%, the rate of unemployment in these districts reach the average value of 12.1%. The highest (in comparison with other groups of many elements) is the percentage of people at pre-working age (20.9%) and the average level of births (10.7 per 1000 of people). People at post-working age constitute 16.3% on average. Characteristics for this group are the closest to average values for the whole voivodeship.

Group II consists of districts that cover west side of the voivodeship, districts in the neighbourhood of Kraków and two urban districts: Tarnów and Nowy Sącz. In this group the situation of unemployment in the population of young people is better – the unemployed from the group at the age of 24 and less constitute 16.5%

Table 3. Characteristics of groups of districts of the Małopolskie voivodeship (average, standard deviation, coefficient of variability)
Tabela 3. Charakterystyki grup powiatów województwa małopolskiego (średnia arytmetyczna, odchylenie standardowe, współczynnik zmienności)

Characteristics Charakterystyki	Variables – Zmienne						
	X_1	X_2	X_3	X_4	X_5	X_6	X_7
Group I – Grupa I	In %						
Average – Średnio	25,2	16,7	11,6	23,3	12,1	10,7	20,9
$s(x)$	2,41	0,81	1,74	3,17	1,61	0,87	1,09
$V(x)$	0,10	0,05	0,15	0,14	0,13	0,08	0,05
Group II – Grupa II							
Average – Średnio	16,5	19,3	14,9	21,7	10,8	9,4	18,1
$s(x)$	1,70	1,34	1,40	3,55	2,05	0,76	1,69
$V(x)$	0,10	0,07	0,09	0,16	0,19	0,08	0,09
Group III – Grupa III							
Average – Średnio	29,7	13,3	9,3	26,6	12,6	9,5	17,9
$s(x)$	2,61	1,50	1,09	0,36	3,26	0,29	0,54
$V(x)$	0,09	0,11	0,12	0,01	0,26	0,03	0,03
Group IV – Grupa IV							
Limanowski district – Powiat limanowski	26,3	16,4	8,5	31,2	16,0	12,9	24,1
Group V – Grupa V							
Kraków	9,4	20,8	20,5	22,6	5,2	9,9	15,7

Source: own calculations.
Źródło: obliczenia własne.

of the total number of the unemployed, while people in the age close to retirement have higher partition in the total population of the unemployed – 14.9%. The percentage of the people unemployed for a long time and the rate of unemployment are lower than the relevant characteristics in previous group – 21.7% and 10.8%. The demographic situation in this group, on the other hand, seems worse than in the previous group – 9.4 live births and 18.1% pre-working age people.

Districts of group III cover the north part of the voivodeship. In these districts most (comparing groups with many elements) young people – almost 30% have no occupation, while the percentage of the unemployed at the age of 45–54 is the lowest. The relative number of people unemployed for a long time is also highest (26.6%), while the demographic situation is similar to the one observed in previous group: 9.5 live births per 1000 people and 17.9% people in pre-working age.

In the Limanowski district the situation is totally different from other groups. The features that distinguish this district from others are the highest relative number of live births – 12.9% and the best age structure (24.1% of people in pre-working age) with high level of unemployment amongst young people (26.3%),

highest percentage of people unemployed for a long time (31.2%) and the highest level of the rate of unemployment (16%). At the same time the partition of people unemployed in the age close to retirement is the lowest for this district – 8.5%.

The features under investigation have still another distribution in the Kraków district. The level of unemployment amongst the young is the lowest here (9.4%), which is the consequence of a high percentage of students. The percentage of the unemployed in the age close to retirement is the highest (20.5%). The rate of unemployment has the lowest level here – 5.2%, anyway, with such a large population it means nearly 22000 people unemployed in 2014, therefore the phenomenon of unemployment is a severe problem. The coefficient of live births takes values similar to the ones of other groups (except for Limanowski district) and is equal to 9.9%, while the percentage of people at pre-working age is the lowest and equals 15.7%, which means the highest percentage of people at post-working age, i.e. about 21.5% (the partition of people in working age equalls to 62.8% on average in the districts of the voivodeship under investigation).

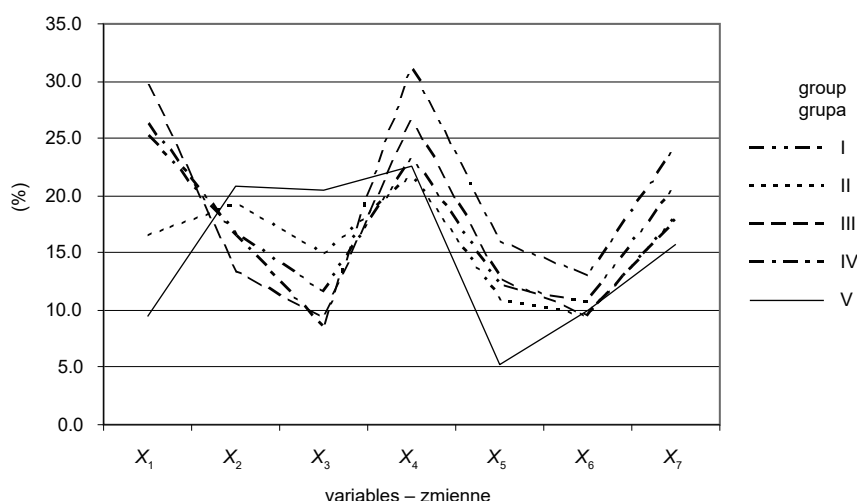The complementation of the description of particular groups presented above are the values of coefficients

Fig. 2. Average values of features in groups of districts in the Małopolskie voivodeship in 2014
Source: own elaboration.
Rys. 2. Średnie wartości cech w grupach powiatów województwa małopolskiego w roku 2014
Źródło: opracowanie własne.

of variability that were not mentioned because of their low levels. The unemployed at the age of 25–34 constitute 28.6% of the total number of the unemployed in the districts of Małopolskie voivodeship on average, with standard deviation S(X) equalled to 1,3 and the coefficient of variability V(X) at the level of 0.04. Similar situation occurs in case of the unemployed at the age of 35–44. Their average share in the total number of the unemployed in 2014 is equal to 19.2% while the coefficient of variability takes the value of 0,08. The partition of people at working age has the average level of 62.8% in districts, the standard deviation S(X) = 0.73 and the coefficient of variability V(X) = 0.01. These variables, displaying such low variation level, have no noticeable influence on the results of grouping.

Graphical image of differentiation of the distinguished groups is shown in the Figure 2.

The factor that has the highest impact on the differentiation of groups in the variable X_1 – the share of the number of the unemployed at the age of 24 and less in the total number of the unemployed and the partition of the number of the unemployed from the oldest age category.

RECAPITULATION

Districts of the Małopolskie voivodeship are differentiated significantly with respect to the structure and rate of unemployment, number of live births per 1000 people and the structure of population according to economic age groups. On the basis of taxonomic methods 5 groups of districts were distinguished with significant inter-group differentiation.

Group I consists of 10 districts covering south part of the voivodeship, where every fourth of the unemployed is younger than 25 and every fourth of the unemployed has remained unoccupied for 2 years. The percentage of people at pre-working age is relatively high (21% on average).

Group II comprises districts of the west side of the voivodeship, districts in the neighbourhood of Kraków and districts: Tarnów and Nowy Sącz. In these districts the level of unemployment amongst the young is the lowest, as well as the rate of unemployment.

Group III has districts that cover the area of the north part of the voivodeship, where the level of unemployment is the highest amongst the young, as well as the percentage of the people unemployed for a long time. With respect to demographic structure the situation is best in the Limanowski district and in the districts of group I.

The application of taxonomic methods allowed for obtaining general and at the same time accurate picture of the differentiation of the Małopolskie voivodeship with respect to the social problems being analyzed here. The results of the investigation may be the starting point for feedback analyses and the foundation for decision making in the economic field.

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ZRÓŻNICOWANIE POWIATÓW WOJEWÓDZTWA MAŁOPOLSKIEGO POD WZGLĘDEM WYBRANYCH PROBLEMÓW SPOŁECZNYCH

Streszczenie. Zjawisko bezrobocia oraz pogarszająca się sytuacja demograficzna należą do najważniejszych współczesnych problemów społecznych w Polsce. W pracy podjęto próbę porównania powiatów województwa małopolskiego pod względem wybranych cech charakteryzujących powyższe zjawiska. Na podstawie danych Głównego Urzędu Statystycznego, w oparciu o metody taksonomiczne przeprowadzono grupowanie powiatów podobnych pod względem poziomu badanych cech. Otrzymano pięć grup o wyraźnym zróżnicowaniu międzygrupowym. Zastosowanie metod taksonomicznych pozwoliło otrzymać uogólniony, a jednocześnie dokładny obraz zróżnicowania województwa małopolskiego ze względu na analizowane problemy społeczne oraz ustalenie powiatów, w których sytuacja pod tym względem jest najtrudniejsza.

Słowa kluczowe: bezrobocie, demografia, taksonomia, powiaty