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DEMOGRAPHIC CHANGES IN RURAL AND SEMI-URBAN AREAS IN POLAND (2003-2016)

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INTRODUCTION

Population ageing is an inevitable process in Europe [Pavelek and Eidenmueller 2014]. According to that, demographic change has become a major policy concern in all the EU Member States [Sojka 2012, Obrębalski 2017, Pastuszka 2017, Serrano-Martínez, García-Marín 2018]. According to Eurostat's demographic projections, the EU's working age population is expected to decline by an average of 0.3% per year by the year 2060. At the same time, the number of elderly people will be increasing by no less than 1% every year [European Commission 2015]. As stated by the Statistics Poland (formerly called: the Central Statistical Office), for almost 30 years trends in demographic processes have indicated the complicated population situation in Poland. What is more, in the nearest future significant changes that would guarantee stable demographic development cannot be expected. A low fertility rate in current years will have a negative impact on the future number of births, due to the much smaller number of women of childbearing age in the future. In addition, this is compounded by the high scale of Polish emigration abroad (especially the temporary emigration of young people). On the one hand, low fertility and births rates, and on the other hand – extending life expectancy, will lead to reduction in labour supply and growing percentage of the oldest age categories [GUS 2018, p. 11].

Rural areas have been ageing rapidly [Rakowska 2016b] as a result of internal and international out-migration of young people [Vullnetari 2012]. There are disproportions in both demographic potential and socio-economic development between rural areas and cities [Poot 2008, Pomianek and Chrzanowska 2016, Kołodziejczyk 2017]. What is more, there are demographic gaps observed even among rural areas (particularly rural municipalities) [Szymańska et. al 2009, Rosner 2012, Biegańska 2013]. The main demographic

and social problem affecting distant regions and peripheral areas is the outflow of people towards large cities (usually major cities in a regional scale) and the capital city – Warsaw. As a consequence, it affects the peripheral areas negatively, causing population ageing, growth of one-person households and disturbances of the gender structure (masculinization in young age categories) [Śleszyński 2012, p. 27]. If not balanced by the immigration of exogenous population, ageing can lead to a significant decrease in the number of inhabitants, and in extreme situations even to depopulation of such areas in a relatively short time [Rakowska 2016c].

AIMS AND METHODS

Demographic potential characterizes the ability of the region's population to reproduce, constant renewal of generations as a result of births, deaths and migration [Niemets et al. 2015, Egorov 2016]. The aim of the paper is to show spatial concentrations of municipalities (communes, gminas, LAU 2 level) with a similar level of demographic potential. The research was based on four variables, describing demographic potential well and being available for the LAU 2 level:

- population density (people per sq. km of a municipality area),
- change in the number of population per 1000 inhabitants (combining natural increase and migrations),
- feminization coefficient (number of females per 100 males),
- dependency rate (number of post-working age people per 100 working age people).

The study was carried out for 2169 municipalities (LAU 2 level), including rural and semi-urban (urban-rural, including small towns) ones. It was based on the data from the Statistics Poland.

The multidimensionality of rural development justifies the use of multivariate analysis methods, including taxonomic ones. Hellwig's synthetic measure of development (SM_i) groups information from a set of diagnostic features and assigns a single (aggregate) measure to an analysed objects using values from 0 to 1 under the assumption that in doing so, a lower value SM_i determines a higher level of the occurrence under analysis [Hellwig 1968]. The formula for determining this measure is as follows:

1. Normalisation of diagnostic variables (x_{ij}),
2. Making all variables homogenous by turning them into stimulants.
3. Constructing the object with the best (highest) values of the diagnostic variables (pattern)

$$z_{0j} = \max\left\{z_{ij}\right\} \tag{1}$$

where: z_{ij} is the normalised values which have been observed in the (whole) data set;

4. Calculating the Euclidean distance (d_i) of each object from the constructed pattern.

$$d_i = \sqrt{\frac{1}{m}\sum_{j=1}^{m}\left(z_{ij} = z_{0j}\right)^2} \tag{r}$$

where i = 1, ..., n is the number of objects j = 1, m is the number of variables, z_{ij} is the normalised value of the variable j for the object i, and z_{0j} is the normalized value of the pattern's variable j.

5. The Hellwig measure is normalised by the following formula:

$$z_i = 1 - \frac{d_i}{d_0} \tag{s-u}$$

where: d_0 – is the value determined by the formula

$$d_0 = \max_i \{d_i\} \tag{4}$$

Two parameters: arithmetic mean and standard deviation, were used in the classification of municipalities by their level of development. Following classes were defined:

- Class 1 (very high level of demographic potential) $d_i > \overline{d_i} + S_{d_i}$ (municipalities at a distance from the pattern exceeding $\overline{d_i} + S_{d_i}$),
- Class 2 (high level of demographic potential) – $\overline{d_i} + \frac{1}{2}S_{d_i} < d_i \leq \overline{d_i} + S_{d_i}$ (municipalities at a distance from the pattern ranging $\left(\overline{d_i} + \frac{1}{2}S_{d_i}, \overline{d_i} + S_{d_i}\right]$),
- Class 3 (medium level of demographic potential) – $\overline{d_i} - \frac{1}{2}S_{d_i} < d_i \leq \overline{d_i} + \frac{1}{2}S_{d_i}$ (municipalities at a distance from the pattern ranging $\left(\overline{d_i} - \frac{1}{2}S_{d_i}, \overline{d_i} + \frac{1}{2}S_{d_i}\right]$),
- Class 4 (low level of demographic potential) – $\overline{d_i} - S_{d_i} < d_i \leq \overline{d_i} - \frac{1}{2}S_{d_i}$ (municipalities at a distance from the pattern ranging $\left(\overline{d_i} - S_{d_i}, \overline{d_i} - \frac{1}{2}S_{d_i}\right]$),
- Class 5 (very low level of demographic potential) – $\overline{d_i} \leq \overline{d_i} - S_{d_i}$ (municipalities at a distance from the pattern not exceeding $\overline{d_i} - S_{d_i}$),

where:
d_i – is the value of synthetic measure calculated by Hellwig's method,
$\overline{d_i}$ – is the arithmetic mean of d_i,
S_{d_i} – is the standard deviation of d_i.
Three rankings were constructed based on the abovementioned method.

RESULTS AND DISCUSSION

According to the adopted method of study, four variables, selected for the research: population density, change in number of population per 1000 inhabitants, feminization coefficient and dependency rate are most important indicators of demographic potential. The results of the grouping of municipalities by their level of demographic potential using Hellwig's method are shown in Tables 1–6 and in Figures 1–3.

TABLE 1. Top 15 municipalities by demographic potential level in 2003

Rank	Municipality	Voivodship	Value of Hellwig's measure
1	Wołomin (s-u)	Mazowieckie	0.9103
2	Czechowice-Dziedzice (s-u)	Śląskie	0.7867
3	Chrzanów (s-u)	Małopolskie	0.7692
4	Łomianki (s-u)	Mazowieckie	0.6802
5	Buczkowice (r)	Śląskie	0.6745
6	Ksawerów (r)	Łódzkie	0.6449
7	Andrespol (r)	Łódzkie	0.6034
8	Jejkowice (r)	Śląskie	0.5931
9	Chełmek (s-u)	Małopolskie	0.5931
10	Wieliczka (s-u)	Małopolskie	0.5926
11	Brzeszcze (s-u)	Małopolskie	0.5908
12	Świerklany (r)	Śląskie	0.5869
13	Piaseczno (s-u)	Mazowieckie	0.5787
14	Raszyn (r)	Mazowieckie	0.5667
15	Kęty (s-u)	Małopolskie	0.5626

r – rural municipalities, s-u – semi-urban municipalities

Source: Authors' research.

TABLE 2. Bottom 15 municipalities by demographic potential level in 2003

Rank	Municipality	Voivodship	Value of Hellwig's measure
2155	Gródek (r)	Podlaskie	0.0810
2156	Jedwabno (r)	Warmińsko-Mazurskie	0.0809
2157	Białowieża (r)	Podlaskie	0.0803
2158	Bytnica (r)	Lubuskie	0.0797
2159	Komańcza (r)	Podkarpackie	0.0796
2160	Szudziałowo (r)	Podlaskie	0.0794
2161	Boleszkowice (r)	Zachodniopomorskie	0.0783
2162	Narewka (r)	Podlaskie	0.0783
2163	Giby (r)	Podlaskie	0.0774
2164	Krempna (r)	Podkarpackie	0.0772
2165	Płaska (r)	Podlaskie	0.0756
2166	Dubicze Cerkiewne (r)	Podlaskie	0.0747
2167	Cisna (r)	Podkarpackie	0.0745
2168	Nowe Warpno (s-u)	Zachodniopomorskie	0.0744
2169	Lutowiska (r)	Podkarpackie	0.0733

r – rural municipalities, s-u – semi-urban municipalities

Source: Authors' research.

TABLE 3. Top 15 municipalities by demographic potential level in 2016

Rank	Municipality	Voivodship	Value of Hellwig's measure
1	Wołomin (s-u)	Mazowieckie	0.9332
2	Czechowice-Dziedzice (s-u)	Śląskie	0.8087
3	Łomianki (s-u)	Mazowieckie	0.8044
4	Piaseczno (s-u)	Mazowieckie	0.7692
5	Chrzanów (s-u)	Małopolskie	0.7250
6	Andrespol (r)	Łódzkie	0.7100
7	Wieliczka (s-u)	Małopolskie	0.7074
8	Buczkowice (r)	Śląskie	0.7014
9	Ksawerów (r)	Łódzkie	0.6924
10	Jejkowice (r)	Śląskie	0.6653
11	Michałowice (r)	Mazowieckie	0.6322
12	Świerklany (r)	Śląskie	0.6313
13	Raszyn (r)	Mazowieckie	0.6129
14	Świątniki Górne (s-u)	Małopolskie	0.6057
15	Gaszowice (r)	Śląskie	0.6056

r – rural municipalities, s-u – semi-urban municipalities

Source: Authors' research.

TABLE 4. Bottom 15 municipalities by demographic potential level in 2016

Rank	Municipality	Voivodship	Value of Hellwig's measure
2155	Czyże (r)	Podlaskie	0.0908
2156	Gródek (r)	Podlaskie	0.0908
2157	Mielnik (r)	Podlaskie	0.0907
2158	Komańcza (r)	Podkarpackie	0.0897
2159	Milejczyce (r)	Podlaskie	0.0894
2160	Narewka (r)	Podlaskie	0.0889
2161	Nowe Warpno (s-u)	Zachodniopomorskie	0.0886
2162	Szudziałowo (r)	Podlaskie	0.0881
2163	Krempna (r)	Podkarpackie	0.0877
2164	Białowieża (r)	Podlaskie	0.0877
2165	Giby (r)	Podlaskie	0.0869
2166	Cisna (r)	Podkarpackie	0.0860
2167	Płaska (r)	Podlaskie	0.0855
2168	Dubicze Cerkiewne (r)	Podlaskie	0.0852
2169	Lutowiska (r)	Podkarpackie	0.0835

r – rural municipalities, s-u – semi-urban municipalities

Source: Authors' research.

TABLE 5. Top 15 municipalities by demographic potential level in 2003–2016

Rank	Municipality	Voivodship	Value of Hellwig's measure
1	Wołomin (s-u)	Mazowieckie	0.9371
2	Czechowice-Dziedzice (s-u)	Śląskie	0.8069
3	Chrzanów (s-u)	Małopolskie	0.7561
4	Łomianki (s-u)	Mazowieckie	0.7531
5	Buczkowice (r)	Śląskie	0.6949
6	Piaseczno (s-u)	Mazowieckie	0.6868
7	Ksawerów (r)	Łódzkie	0.6762
8	Andrespol (r)	Łódzkie	0.6679
9	Wieliczka (s-u)	Małopolskie	0.6555
10	Jejkowice (r)	Śląskie	0.6404
11	Świerklany (r)	Śląskie	0.6111
12	Chełmek (s-u)	Małopolskie	0.6018
13	Michałowice (r)	Mazowieckie	0.6018
14	Brzeszcze (s-u)	Małopolskie	0.5988
15	Raszyn (r)	Mazowieckie	0.5960

r – rural municipalities, s-u – semi-urban municipalities

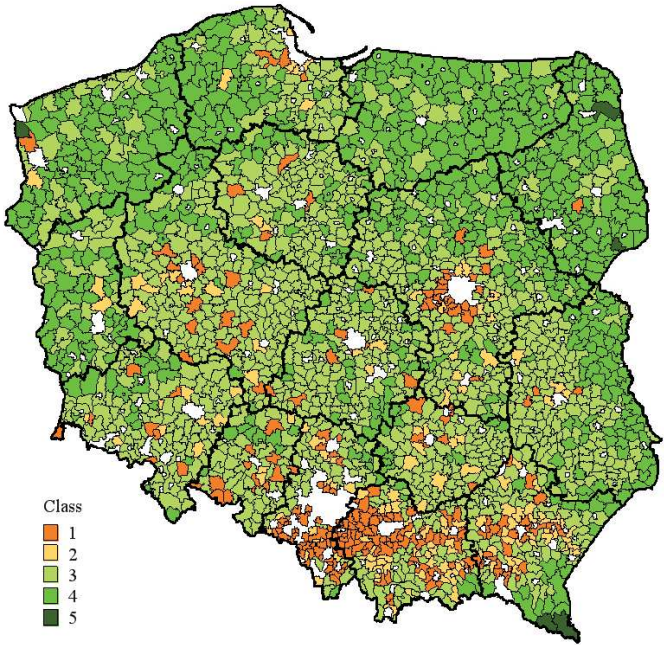
Source: Authors' research.

TABLE 6. Bottom 15 municipalities by demographic potential level in 2003–2016

Rank	Municipality	Voivodship	Value of Hellwig's measure
2155	Wyryki (r)	Lubelskie	0.0867
2156	Jedwabno (r)	Warmińsko-Mazurskie	0.0866
2157	Mielnik (r)	Podlaskie	0.0865
2158	Milejczyce (r)	Podlaskie	0.0856
2159	Komańcza (r)	Podkarpackie	0.0854
2160	Białowieża (r)	Podlaskie	0.0848
2161	Narewka (r)	Podlaskie	0.0848
2162	Szudziałowo (r)	Podlaskie	0.0836
2163	Krempna (r)	Podkarpackie	0.0835
2164	Nowe Warpno (s-u)	Zachodniopomorskie	0.0830
2165	Giby (r)	Podlaskie	0.0826
2166	Płaska (r)	Podlaskie	0.0807
2167	Dubicze Cerkiewne (r)	Podlaskie	0.0806
2168	Cisna (r)	Podkarpackie	0.0802
2169	Lutowiska (r)	Podkarpackie	0.0779

r – rural municipalities, s-u – semi-urban municipalities

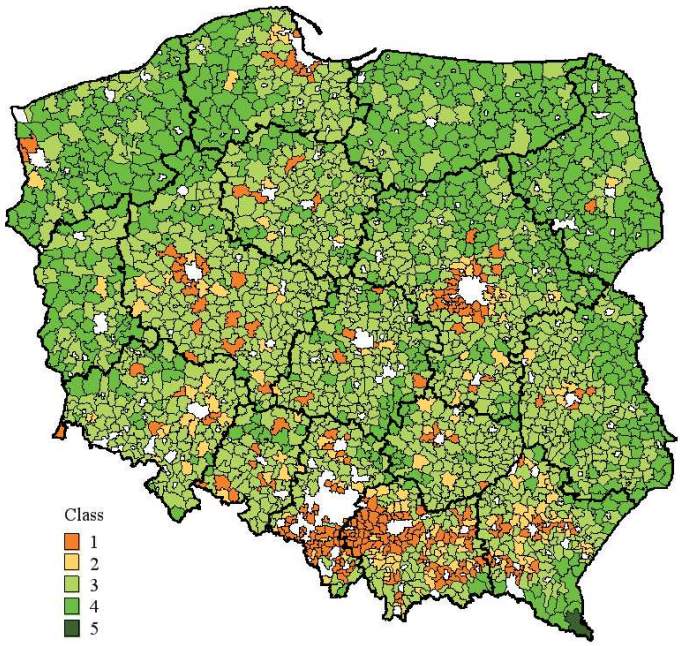
Source: Authors' research.



white areas – urban municipalities, not included in the research

FIG. 1. Municipalities of similar level of demographic potential in 2003

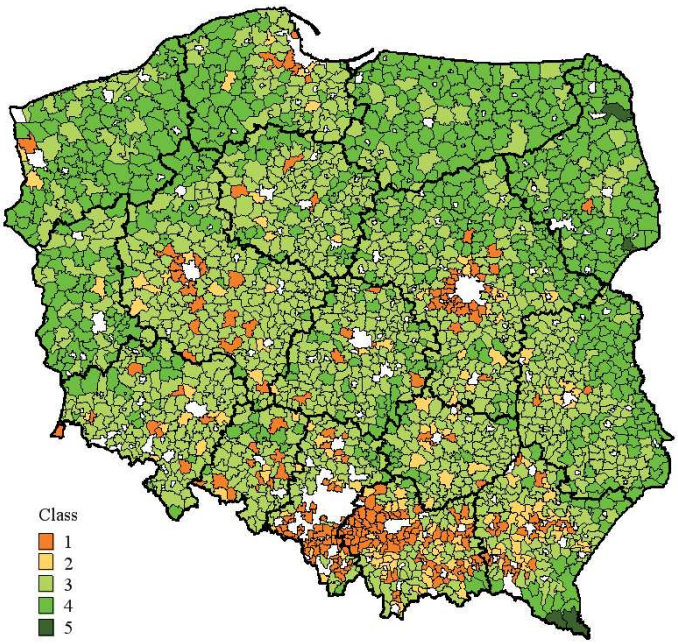
Source: Authors' research.



white areas – urban municipalities, not included in the research

FIG. 2. Municipalities of similar level of demographic potential in 2016

Source: Authors' research.



white areas – urban municipalities, not included in the research

FIG. 3. Municipalities of similar level of demographic potential in 2003–2016

Source: Authors' research.

In top 15 of the rankings occurred municipalities representing only 4 out of 16 voivodships: Mazowieckie, Śląskie, Małopolskie and Łódzkie (Tables 1, 3 and 5). The maps show that the municipalities of the best demographic potential were concentrated around cities (Mazowieckie, Łódzkie, Śląskie). Małopolskie Voivodship dominated with the percentage of municipalities with high and very high level of demographic potential.

In bottom 15 of the rankings occurred municipalities representing three voivodships of the Eastern Poland (known as under-developed region): Podlaskie, Podkarpackie and Warmińsko-Mazurskie as well as two western voivodships: Lubuskie and Zachodniopomorskie.

In the ranking combining years 2003–2016 one municipality from Lubelskie Voivodship (the 4th voivodship of the Eastern Poland) was included in the bottom group by demographic potential level.

The maps show that the municipalities of the best demographic potential were concentrated around cities: Warsaw in Mazowieckie, Rzeszów in Podkarpackie or Gdańsk in Pomorskie. Moreover, in Śląskie Voivodship high and very high demographic potential characterised municipalities surrounding numerous cities, whereas in Małopolskie Voivodships these municipalities formed a wide ring around Kraków.

Małopolskie Voivodship has a significant percentage of municipalities with high and very high level of demographic potential. The worst demographic situation is observed in

northern and eastern municipalities (most of the Eastern Poland area) as well as in some mountain areas.

Migration and low number of births cause depopulation and have negative impact on demographic structure, in particular that these migrations refer to a large extent to young people [Szafraniec 2012], people of mobile working age and women of childbearing age. Therefore the problem is deepening, creating a spiral of negative development.

Research of the Institute of Geography and Spatial Organization of Polish Academy of Sciences shows that depopulation is a long-term process, conditioned historically and still intensifying. In the 1950s and 1960s, 15 to 30% of the country was becoming depopulated. At present, about 70% of Poland is depopulating while forecasts indicate that by 2050 the population will decline at around 85–90% of the territory [Śleszyński et. al. 2017, p. 93]. At present, mostly eastern and north-eastern voivodships as well as some mountain and foothill areas are depopulating.

The main reason of depopulation is migration, both internal (interregional and intra-regional) and international. The most problem municipalities were situated in borderlines of Warmińsko-Mazurskie Voivodship as well as Podlaskie Voivodship in which almost half of the inhabitants emigrated (regarding the registered internal movement) in the last two decades [Wilczyński 2016, p 209; Śleszyński et. al. 2017, p. 93]. Moreover, rural areas and small towns of the Eastern Poland (especially concerning voivodships: Warmińsko-Mazurskie, Podlaskie, Lubelskie, Podkarpackie) and the northern part of Mazowieckie Voivodship experienced foreign emigration. The main direction of migration in 2004–2017 was the European Union (especially Germany, Great Britain, Ireland and the Netherlands) [GUS 2017]. As Figure 4 shows, Germany was the main destination of Polish migration in 1966–2014 [GUS 2015]. During this period, the level of migration to the USA was also maintained. There was a visible increase of migration to Great Britain after the accession of Poland to the EU.

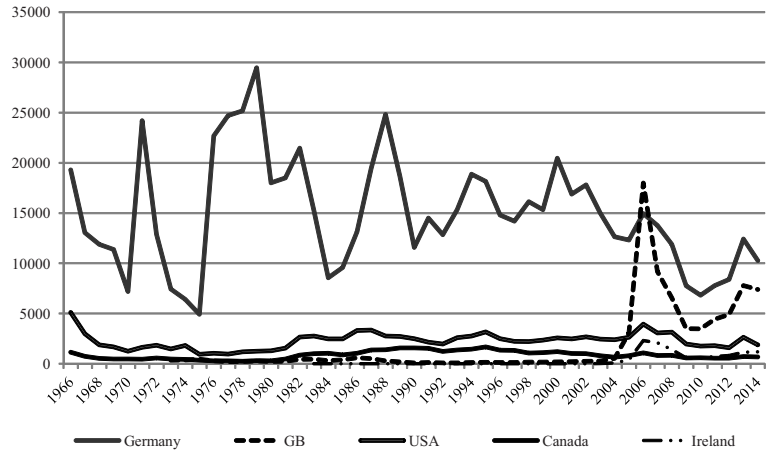


FIG. 4. Main directions of emigration for permanent residence from Poland in 1966–2014 by country

Source: [GUS 2015]

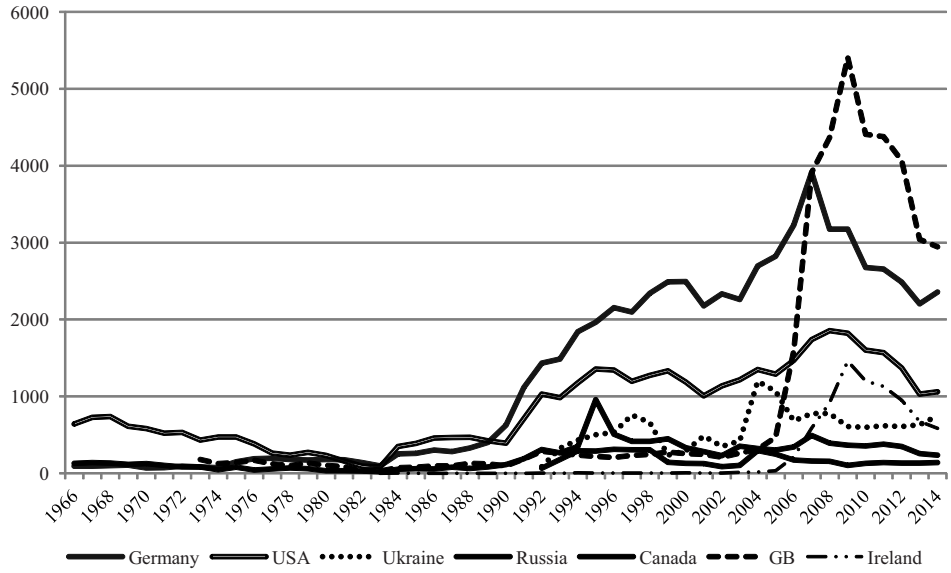


FIG. 5. Main directions of immigration for permanent residence to Poland in 1966–2014 by country

Source: [GUS 2015]

Germany and the USA were also the main directions of immigration for permanent residence to Poland in 1966–2014 (Fig. 5).

At the same time, in Poland there is a number of unregistered citizens of other countries (including Ukraine), but they do not compensate for unregistered foreign emigration [Śleszyński et. al. 2017, p. 96]. And it is not sure whether Ukrainian immigrants will stay here for long or rather treat Poland as transit on their way to more attractive in terms of job, salaries, social care, living conditions etc. western countries.

CONCLUSIONS

The demographic potential, especially in the peripheral and remote areas, has been deteriorating. Negative natural increase, low or negative migration balances, unfavourable values of the feminisation index and growing relation of the number of people at post--working age to the number of people at working age have been threatening rural development. The abovementioned results confirm analyses of Statistics Poland and research carried by Biegańska [2013], Rakowska [2016a,b], Wilczyński [2016] and Śleszyński et al. [2017]. The most favourable and promising situation according to demographic potential is observed in central and southern Poland, especially in semi-urban and suburban areas of large cities. The worst demographic potential level and at the same time the least favourable demographic forecasts concern mostly the Eastern Poland, already known as problem area. The spiral of negative conditions accelerates, causing more disadvantages,

making young people looking for new places to work and live, deepening current demographic problems and leading to socio-economic development pathologies. Perhaps it would be not so much a solution but a way to mitigate the disadvantageous situation to form some government actions encouraging young people to stay in depopulating areas and showing prospects of finding jobs and/ or, starting their own economic activities.

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Summary. The demographic potential, especially in the peripheral and remote areas, has been deteriorating. Negative natural increase, low or negative migration balances, unfavourable values of the feminisation index and growing relation of the number of people at post-working age to the number of people at working age have been threatening rural development. The aim of the research was to show spatial concentrations of municipalities (LAU 2 level) with a similar level of demographic potential. The study was carried out for 2169 municipalities (LAU 2 level), including rural and semi-urban (urban-rural, including small towns) ones. It was based on the data from the Statistics Poland. The municipalities were are ranked by the level of demographic potential (by 4 variables) and put into 5 groups by the potential level using the taxonomic development measure of Hellwig. The results were presented in maps using cartogram method. The most favourable and promising situation according to demographic potential is observed in central and southern Poland, especially in semi-urban and suburban areas of large cities. The worst demographic potential level and at the same time the least favourable demographic forecasts concern mostly the Eastern Poland, already known as problem area. The spiral of negative conditions accelerates, causing more disadvantages, making young people looking for new places to work and live, deepening current demographic problems and leading to socio-economic development pathologies.

Key words: demographic potential, sustainable development, problem areas

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