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Spatial variability of the socio-economic development in terms of population and settlement at the level of NUTS 4 units. The case study of Poland, Slovakia and Lithuania[1]

Abstract: The aim of the study is to analyze disparities in socio-economic development in terms of population and settlement in supranational dimension. The analysis was carried out on the example of three countries: Poland, Slovakia and Lithuania and refers to units of local level – NUTS 4, with 379, 79, and 60, respectively, units. The time range of research covers the period 2000–2010. The main result of the analysis is identification of three types of areas: areas of growth, transition and stagnation in terms of the population-settlement for these three countries treated together as a single object at a local level (NUTS 4). We also investigate the spatial auto-correlation with the use of the global statistics I – Moran, together with an analysis of the local index of spatial dependence (LISA) and separate determinants that most affect the level of socio-economic development value measured by the synthetic index in terms of population and settlement at the local level.

Key words: population, settlement, NUTS 4, Poland, Slovakia, Lithuania.

[1] The article based on research project for the National Science Centre (N N306 791940) *Socio-economic development and the patterns of economic growth or stagnation areas*, implemented by the staff of the Regional Analysis Department in the Institute of Socio-Economic Geography and Spatial Management, Adam Mickiewicz University, Poznań.

Introduction

Socio-economic development can be studied as a whole or partially, ie. via the system of selected aspects. Population and settlement is one of the aspects that make up the level of socio-economic development (Bagdziński, Maik, Potoczek 1995, Chojnicki 1999). It is often assumed that the characteristic feature of the socio-economic development is its polarization, leading to the presence in the growth areas and areas of stagnation (from economic point of view). Spatial diversity of the level of socio-economic development is also evident in terms of the population and settlement (Churski 2011).

The aspect of population and settlement is described by indicators related to human population and settlement system. Human community is a team of units who represent a separate population for the needs of a particular demographic analysis. A community may be the population of specific area, for example, region, or unit of local level as county or municipality. The level of human population development is determined by indicators related to the size of the population and its dynamics, size and dynamics of natural movement and migration, socio-professional structure of the population and resources of the workforce (Jędrzejczyk 2001, Holzer 2003, Okólski 2005).

Nowadays an important component of population characteristics is the quality of human capital and social capital of inhabitants of the area (Węcławowicz 2000, Trutkowski, Mandes 2005, Chojnicki, Czyż 2005, Janc 2009). The settlement system is a collection of settlements units being its elements. Settlement systems occur in a twofold form: elementary, i.e. towns and villages, and complex, i.e. at the local, regional or national level (Maik 1992, Chojnicki 1999). Properly crystallized settlement system whose basic nodes are cities, plays an important role in the socio-economic development of the area. In particular, this is due to the special role of functions of cities and the links between them. Cities are the most important elements of the settlement system integrates various socio-economic activities, define the location of economic activity, form the housing situation of the population, crystallize economic ties in the form of local and regional markets, trade, services and labor markets. Socio-economic development is integrally linked with the processes of spatial concentration of economic activity and an increase in the level of urbanization, including resulting in increasing coverage of urban agglomerations (Chojnicki, Czyż, 2005, 2006, Czyż 2012).

The aim of this paper is to analyze disparities in socio-economic development in terms of population and settlement in supranational dimension. The analysis carried out on the example of three countries: Poland, Slovakia, and Lithuania and refers to units of local level NUTS 4, which counts respectively of 379, 79 and 60 units. The spatial range of the analysis results from the desire to extend the research beyond Poland with regard to its neighbors (it was accepted within the framework of realized grant)[1]. The time range of research covers the period 2000–2010. The main result of the analysis is to separate in the system of three countries at local level (NUTS 4) areas of growth, transition areas, and stagnation areas in terms of the population-settlement.

Examination procedure and research methods

Examination procedure related to the development analysis of growth areas and areas of stagnation at local level (NUTS 4) in Poland, Slovakia and Lithuania in terms of population and settlement consists of two stages:

S1. Classification of local units (NUTS 4) in terms of population and settlement based on the value of the synthetic Perkal index (Ws) and the analysis of class size of growth areas, transitional areas and stagnation areas as well as its variation over time, together with the characteristics of the impact of these changes on the image of differentiation of the population-settlement processes in the local area. At this stage, also carried out an analysis of spatial auto-correlation used to identify the spatial relationships and their consequences of the population-settlement processes at the local level.

S.2. Separation of determinants – indicators that most affect the average value of the synthetic index Ws in terms of population and settlement at the local level.

In these stages of the research, the following mathematical and statistical methods were used:

M1. Classification method

As a method of classification of units used the method of k-means, in which units were interpreted as one-dimensional objects characterized by synthetic indexes Ws, built on the values of standardized baseline indicators. Employing the method for the values of Ws the three clusters (groups) of the test objects were selected. For this propose the averaged boundaries of clusters (the average of the limits specified for each division in 2000–2010) have been established. Designated three concentrations are analyzed in terms of content in order to determine which of the cluster is an area of growth, stagnation area or the area in a state of transition in the field of development of the population-settlement. The idea of such classification underlies an assumption that values of Ws indices properly characterize the level of population and settlement development – the greater the value of is , the better the unit is developed.

M2. The global and local auto-correlation Moran's I statistic

It is natural that changes in the level of population and settlement development of the chosen unit are somehow connected with the changes observed in close units. We could expect positive or negative effect of spillover of such changes. This phenomenon is measured by the coefficients of the spatial auto-correlation defined in two versions. The first one is the global statistic (we use here Moran's I statistic) lets us find a spatial dependence over the studied area. Global statistics are synthetic characteristics of a spatial dependence. But they are not sensitive to local deviations from the global auto-correlation pattern. To identify such deviations, local statistics are more suitable. Their values are calculated for each spatial unit and allow us to determine the similarity of every region to its neighbors. It is also possible to check whether a region is surrounded by neighbors with high or low values of the analyzed variable. We use here the local Moran's statistics based on the Local Indicators of Spatial Association (LISA). Moran's local statistic allows identifying the effects of an agglomeration and

shows clusters of high and low values. The statistic help us to extract so-called hot spots, that is, areas of high values of a test variable surrounded by areas with lower values of the variable. It is also possible find outliers, that is, areas with particularly low values surrounded by regions with high values of the variable, or vice versa.

M3. The method of identification of determinants

In the procedure of the determinants isolation used the method applied directly to the values of components of the synthetic index (without re-standardize them) to avoid the effect of flattening (reducing differences), which may interfere with the analysis of the variation in the test period. The procedure adopted to provide for ranking of standardized individual indicators in each of the analyzed 11 years of observations in the years 2000–2010. The obtained values were divided into three groups: the determinants of the greatest increasing impact on the value (having the largest share in the value) of the synthetic index, the determinants of different impact on the value of the synthetic index (the values of which in some units are above and the other below average, which leads to the condition that once they are determinants of increasing and another times – lowering value of the synthetic index) and the determinants of lowering the value of (having the smallest share in the value) of the synthetic index.

The starting point for the implementation of the first stage of the research was the adoption of a preliminary observation geographical base in terms of population and settlement, the scope of which resulted from the evaluation of data quality. This assessment included an analysis of the suitability, reliability and continuity of data, as well as their comparability.

Table 1. The list of indicators adopted for the analysis in terms POPULATION AND SETTLEMENT of system NUTS 4 units in Poland, Slovakia and Lithuania

No.	Indicators characterizing the population and settlement – the code and name
1	The population density in the total population, pop/km2
2	Females per 100 males
3	The balance of natural increase of total population, in ‰
4	Net migration in the total population, in ‰
5	Actual population increase in the total population, in ‰
6	Live births per 1000 population, in ‰
7	Deaths per 1000 population, in ‰
8	Demographic growth factor(number of births to deaths)
9	Non-working age population per 100 persons of working age
10	Pre–working population, in %
11	Working population, in %
12	Post-working population, in %
13	Marriages contracted per 1000 population, in %
14	Divorces per 1000 population, in %
15	The level of urbanization: the percentage of urban population

Source: own elaboration.

Obtained in this way, the preliminary geographic database of observations were verified and reduced. The verification procedure conducted elimination and reduction of substantive indicators characterizing the least impact on the development of the state and structure of the aspect of population and settlement. An elimination of statistical indicators characterizing a significant level of correlation was also conducted, provided that the indicator had a relatively large impact on the substantive condition and structure of the analyzed aspect.

Preliminary observations geographic database made up of 26 indicators, including 24 indicators describing the population, and 2 describing the settlement. With the use of technical and statistical reduction 11 indicators were eliminated. Thus, the analysis of spatial differentiation level of socio-economic development in three countries: Poland, Slovakia and Lithuania in 2000–2010 in terms of population and settlements was carried out on the basis of 15 indicators relating to the local level of spatial units (NUTS 4), including 14 indicators describing the population, and one indicator describing the settlement. Finally selected indicators describe the size of the population, the size of natural movement and migration, the economic structure (social and professional) and level of urbanization in the system of units the local level (see Table 1).

Spatial distributions of growth areas and stagnation areas in Poland, Slovakia and Lithuania in terms of the population and settlement

The resulting spatial distributions of growth areas and stagnation areas in terms of population and settlement for 11 time observations in the period 2000–2010 on the basis of 15 indicators made it possible to identify significant patterns that lead to the following conclusions.

The spatial distribution of the areas of growth and areas of stagnation at the local level (NUTS 4) in terms of population and settlement were characterized during the observed period relatively high volatility, i.e. occurred significant changes in the size of each class. The most numerous class of units of the NUTS 4 in the entire analyzed period were transitional areas (cf. Table 2, 3). It should be emphasized that the share of units belonging to this class varied and ranged from 42.5% (220 units) in 2009 to 55.9% (290 units) in 2002. The second largest class was a class bringing together areas of stagnation. The share of this class in the total size of units analyzed at the local level varied and ranged from 28.2% (146 units) in 2000 to 35.9% (186 units) in 2009. Class of growth areas was the least numerous, but also undergoes fluctuations. It gathered from15.4% of the total units in 2002 (79 units) to 21.6% (112 units) in 2009. On the basis of the analysis of changes in class size of growth areas, transition areas and areas of stagnation in the system NUTS 4 units for jointly treated super region consisting of Poland, Slovakia and Lithuania is observed a clear downward trend in the number of units belonging to the class of transition regions (see Tables 4–6),

while increasing the number of units in the areas growth and areas of stagnation. However, the larger dynamics of change are observed for areas of stagnation (cf. Table 2, 3).

The noticed trend shows increasing polarization of socio-economic development in terms of the population-settlement at the local level NUTS 4 in the system of three countries: Poland, Slovakia and Lithuania. However, specificities of each country should highlighted. The increase in the share of units belonging to the class of growth areas is visible in Poland and Slovakia. In Poland, this class ranges from 12.4% in 2004 to 24.0% in 2009, and in Slovakia from 6.3% in 2000 to 13.9% in 2009 (see tab. 4.5). However, in contrast to above in Lithuania is clearly marked increased share of units forming of the class areas of stagnation at the end of the reporting period, which in 2010 represent 45.0% of the total units, at 6.7% in 2001 (cf. Table 6). Nevertheless, in all three countries there is decline in the share of individuals belonging to the class of transitional areas (cf. Tables 4–6). In Poland, the share of a transitional areas ranges from 61.5% in 2002 to 46.4% in 2009, in Slovakia from 29.1% in 2003 to 17.7% in 2008, and in Lithuania from 60.0% in 2001 to 38.3% in 2010. (see Tables 4–6).

Through analyzing the obtained distributions it can be concluded that the growth areas at the local level in all three countries consist mainly from spatial units that have the status of cities (large and medium cities) and units being their neighbors, which together often create urban agglomerations. NUTS 4 units belonging to the class of growth areas are characterized by a positive flow phenomena of the population-settlement, which are mostly described by such indicators

Table 2. Class size of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Poland, Slovakia and Lithuania

Class	Number of NUTS 4 units in 2000–2010										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth areas	94	91	79	83	86	89	94	101	103	112	109
Transition areas	278	274	290	270	266	262	245	247	238	220	231
Stagnation areas	146	153	149	165	166	167	179	170	177	186	178

Source: own elaboration.

Table 3. Class structure of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Poland, Slovakia and Lithuania

Class	Share (%) of the NUTS 4 units in 2000–2010										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth areas	18.1	17.6	15.4	16.0	16.6	17.2	18.1	19.5	19.9	21.6	21.1
Transition areas	53.7	52.9	55.9	52.1	51.4	50.6	47.3	47.7	45.9	42.5	44.6
Stagnation areas	28.2	29.5	28.7	31.9	32.0	32.2	34.6	32.8	34.2	35.9	34.3

Source: own elaboration.

as high population density, a positive real growth, a high proportion of the working age population and consequently by low economic dependency ratio, and a high level of urbanization measured by the percentage of the urban population.

In Poland, the above coincidence is well illustrated by the examples of the Warsaw agglomeration, Krakow agglomeration, Tri-City agglomeration, Poznań agglomeration and Toruń–Bydgoszcz agglomeration. In the case of the selected urban areas (eg, Poznan, Warsaw, Tri-City) is shown the process of expansion of the areas of high population growth and settlement. This can be explained by the positive impact of a large urban center for the surrounding units and overlapping processes of suburbanisation (Śleszyński 2006, Parysek 2008, Jakóbczyk-Gryszkiewicz 2011).

High concentration of growth areas in terms of population and settlement is evident in the selected NUTS 4 units (e.g. districts of Gdańsk, Kartuzy, and Kościerzyna) in the Pomeranian voivodeship in the area of the so-called Kashubian (cultural region in northern Poland), where is maintained the traditional

Table 4. Class structure of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Poland

Class	Share (%) of the NUTS 4 units in 2000–2010										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth areas	19.3	17.2	12.9	12.7	12.4	16.4	17.4	19.8	20.8	24.0	23.7
Transition areas	59.1	57.8	61.5	58.3	56.2	55.1	53.0	52.8	50.7	46.2	50.4
Stagnation areas	21.6	25.1	25.6	29.0	31.4	28.5	29.6	27.4	28.5	29.8	25.9

Source: own elaboration.

Table 5. Class structure of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Slovakia

Class	Share (%) of the NUTS 4 units in 2000–2010										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth areas	6.3	7.6	16.5	13.9	20.3	13.9	12.7	8.9	10.1	13.9	11.4
Transition areas	24.1	24.1	27.8	29.1	26.6	25.3	19.0	21.5	17.7	20.3	21.5
Stagnation areas	69.6	68.4	55.7	57.0	53.2	60.8	68.4	69.6	72.2	65.8	67.1

Source: own elaboration.

Table 6. Class structure of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Lithuania

Class	Share (%) of the NUTS 4 units in 2000–2010										
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Growth areas	26.7	33.3	28.3	40.0	38.3	26.7	30.0	31.7	26.7	16.7	16.7
Transition areas	58.3	60.0	58.3	43.3	53.3	55.0	48.3	50.0	53.3	48.3	38.3
Stagnation areas	15.0	6.7	13.3	16.7	8.3	18.3	21.7	18.3	20.0	35.0	45.0

Source: own elaboration.

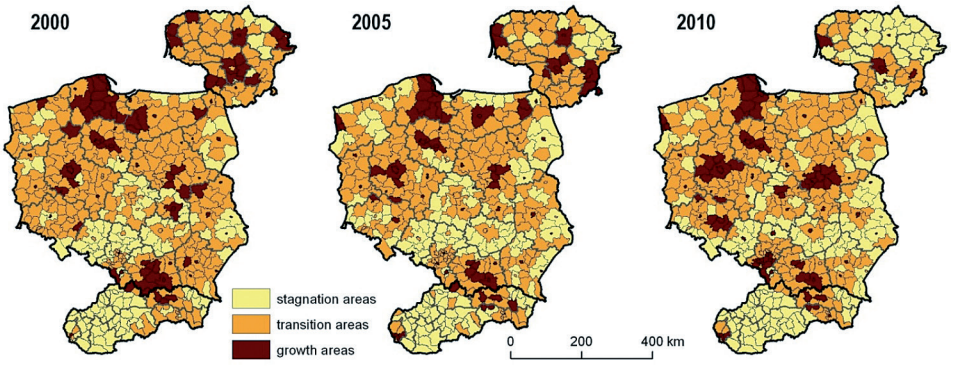

Fig. 1. The distribution of growth areas and areas of economic stagnation in terms of POPULATION AND SETTLEMENT of system NUTS 4 units in 2000–2010 in Poland, Slovakia and Lithuania
Source: own elaboration.

pro-family behavior expressed, among others, by high birth rate and low rate of divorce (Gawryszewski 2005).

It should be emphasized the specificity of the spatial distribution of growth areas in Slovakia. This class is represented by NUTS 4 units located in the western part of the country, which correspond to local units included in the area of capital city of Bratislava (Korec, Ondoš 2009), but also concentrated in the eastern part of Slovakia. Examples of units with a high level of development in terms of population and settlement, and with relatively low levels of economic development, are Kežmarok, Levoča, Spišská Nová Ves, Stara Lubovna, which are characterized by high shares of Roma communities, affecting the occurrence of high values of selected indicators and in consequence the favorable trends in the population development. Traditionally, Roma communities are characterized by a high birth rate, which in turn affects the high population growth, and a high proportion of the population in the pre-productive age or a high rate of marriages (Szyszak 2011, Balvin, Kwadrans, Kowalczyk 2011).

In Lithuania, the growth areas correspond to municipal entities and units adjacent to them. These include the country's capital Vilnius and the Vilnius district municipality, Kaunas and Kaunas district municipality, and the coastal region in western part of the country: Klaipèda and Klaipèda district municipality and the cites Palanga and Neringa and centers in northern Lithuania: Šiauliai and Panévežys. These units are usually characterized by high population density, relatively high population growth rate and low rate of economic burden. It should be noted, however, that most of these units throughout the analyzed period show a negative real growth, resulting from a negative balance of migration and the evolution of adverse demographic dynamics values. At the end of the period, i.e. in 2009–2010 dropped sharply in Lithuania the share of units characterized by a positive flow phenomena of the population-settlement, mainly due to unfavorable changes in population occurring in areas surrounding urban centers, which are the areas of growth.

In the system of three analyzed countries it can be observed a concentration of areas of high intensity negative effects of population and settlement patterns that correspond to areas of stagnation.

Within the area of Poland units focus of the regions: Opole voivodeship and Łódź voivodeship, and in the eastern Polish regions: Świętokrzyskie voivodeship, Lublin voivodeship and Podlaskie voivodeship with a relatively low level of socio-economic development. A special case is the Opole voivodeship, in which is observed a significant process of depopulation of the region, due to the outflow of the population of German origin, which in turn is causing the high share of the population at retirement age and low birth rates (Solga 2009, Długosz, Biały 2014).

Analysis of distribution of stagnant units in 2000–2010 revealed an additional system referring to the relict borders (the political boundaries of the years 1815 to 1919), which till today clearly divide the socio-economic space of Poland in many aspects, including in terms of population and settlement (Gawryszewski 2005).

In Slovakia it is visible permanent large concentration of areas of stagnation in the western and central parts of the country and in a less scale in the eastern peripheral parts. These units are characterized by high intensity of the negative phenomena of the population-settlement, which express among others relatively low values of real growth of population, unfavorable demographic dynamics values or a significant part of the population being in the retirement age.

In Lithuania there is marked by a high concentration of stagnant areas of population-settlement in the north-eastern parts of the country. A disturbing is the trend of the increasing number of these areas during the period. As shown by other studies Lithuania is characterized by above-average index of feminisation, a high proportion of working population of people in retirement age and is one of the European countries with advanced depopulation processes, resulting from very strong emigration (Krupickaitė 2007, Michalski 2012).

An important reason for the increasing depopulation of Lithuania and expansion of the areas of stagnation in terms of the population and settlement is a financial and economic crisis of 2008–2009, which had a significant impact on the economic migrations in many European countries. In Lithuania, which was particularly affected by the recession, observed an increased outflow of population, mainly of people in working age (Migration Bulletin, 2012). In 2009–2010, the population of Lithuania decreased by 82,000. Almost 40% of immigrants are people aged 20 to 49 years. Children up to 14 years of age who are leaving with their parents constitute 10% of all immigrants. In addition, it is worth noting that there was an increase of migration for family reasons and educational migration (Lithuanian Department of Statistics). It is estimated that if the current trend continues, the 2035r. Lithuania will be less than 3 million inhabitants (at 3,249,000 in 2010), and more than 30% of them will be in the age over 60 years. Places of the highest concentration of units representing the class of the transition areas at the local level are in the north-western Poland, eastern Slovakia, and western and south-western Lithuania.

Complementary and essential element of analysis of the development of growth areas and areas of stagnation in terms of the population-settlement is the

study of global and local Moran's I-statistics. The analysis of the global Moran's I-statistics, along with an analysis of the local index of spatial dependence (LISA) based on this statistics, allow to identify the spatial relationships and the consequences of the population-settlement processes at the local level in the system of units NUTS 4 in Poland, Slovakia and Lithuania. The value of the global Moran's I-statistics in terms of population and settlements in 2000–2010 for NUTS 4 units in Poland, Slovakia and Lithuania is positive, which indicates the presence of positive spatial auto-correlation, and a tendency to develop (in the analysed period) centered spatial systems in the form of aggregates or clusters (see Table 7). In the period 2000–2010, the value of Moran's I-statistics variable varied and reaches the minimum value I = 0.348 in 2005 and the maximum value I = 0.465 in 2008. At the end of analysed period the value of Moran's I-statistics increases, which may indicate the growing strength of spatial relationships throughout the analyzed system. On the one hand, the growing spatial concentration of NUTS 4 units with a similar level of development (high or low), and on the other – with rising power of influence situation in some units on the situation in other units.

More detailed description of above problem is provided by the analysis of the local index of spatial dependence (LISA) based on local statistics I-Moran. For the analysis was selected first and the last time point, and the years in which there was obtained the minimum and maximum value of the global Moran's I-statistics. Hence analyzed are years 2000, 2005, 2008 and 2010. In the analyzed period the spatial distribution of clusters is close to be stable (see Fig. 2). However, it is clearly marked by a concentration of units with high values surrounded by individuals with high values (so-called hot spots) in the Polish north-central area of Poland (Pomeranian voivodeship). In addition to this clear (bigger) cluster of a high level of development there are also smaller clusters. During analysed periods clusters of this type occurred in Poland – in the southern part of the country and in the agglomeration of Warsaw and Poznan, in the north-eastern Slovakia, and Lithuania in Kaunas region. In turn, a clear tendency to form clusters of the low level of development (the so-called cold spots) in terms of population and settlement occurred in the area of south-eastern Polish, in the western part of Slovakia and in the north-eastern Lithuania (in 2010).

It should be emphasized that the results of analyzes of the distribution LISA largely confirm the earlier results of the obtained distribution for growth areas

Table 7. The values of the global Moran's I-statistics and their statistical significance level (p) in terms of POPULATION AND SETTLEMENT in 2000–2010

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Moran's I-statistics	0.386	0.420	0.390	0.369	0.361	0.348	0.396	0.457	0.465	0.409	0.425
p	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Explanation:
0.386, 0.348 – the boundary and minimum values of Moran's I-statistics
0.425, 0.465 – the boundary and maximum values of Moran's I-statistics
Source: own elaboration.

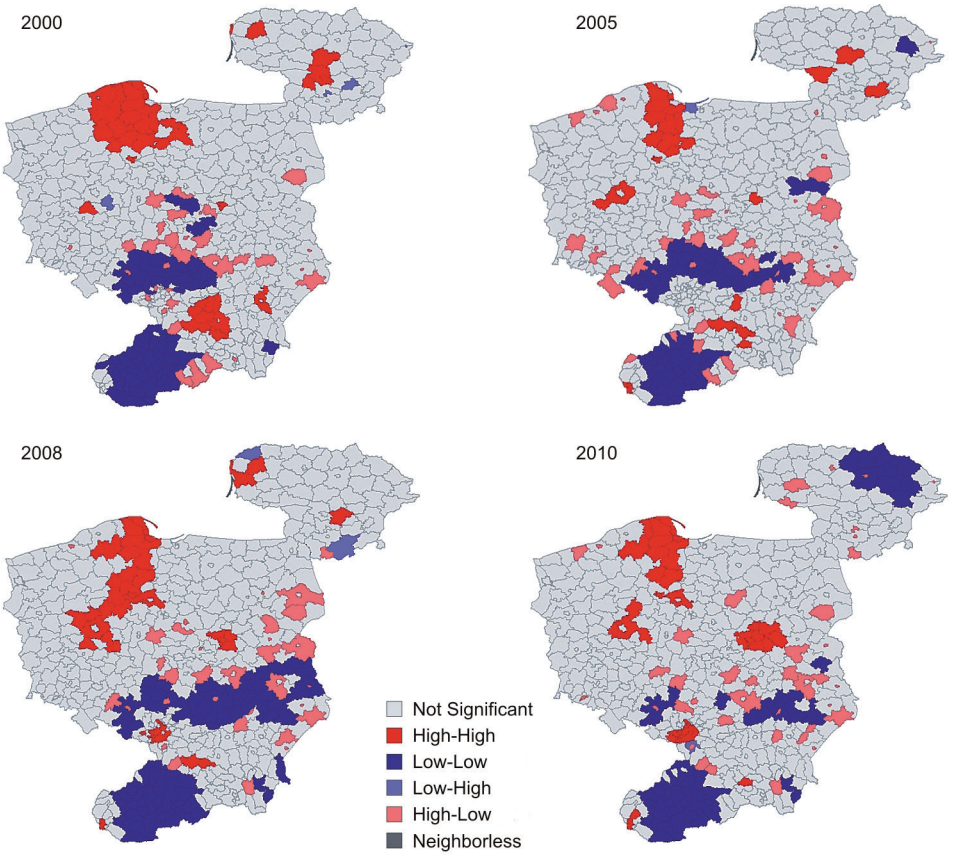

Fig. 2. The distribution of clusters of spatially autocorrelated units designated by LISA (local Moran's I-statistics) in terms of POPULATION and SETTLEMENT
Source: own elaboration.

and areas of stagnation in terms of the population-settlement system of the countries studied. In the case of Poland and Slovak Republic in the analyzed years in the vicinity of clusters of low level of population-settlement development appear units with relatively much higher level of development (co called "outliers"). This situation informs of the growing diversity within areas with a relatively low level of development and is the result of faster growth in the level of development of these units with respect to their neighbors.

Determinants of the population-settlement level of development

An analysis of ranking of standardized values for 15 indicators describing the aspect of population and settlement in 2000–2010, allows the designation of these

determinants of positive impact (G), i.e. those indicators whose standardized values to the greatest extent shaped the high values of the synthetic index Ws, and determinants of negative impact (S), i.e. indicators, whose standardized values to the greatest extent shaped the low values of the synthetic index Ws.

Indicators with varying impact on the values of synthetic index (the values of which are above the average for some units and are below the average for the other units) there are not taken into account in the analysis.

In the period 2000–2010, differentiation of level of development in terms of population and settlement in the sub-regional scale in Poland, Slovakia and Lithuania expressed by the values of the synthetic Perkal index, was essentially determined by six indicators, which can be considered as determinants of positive impact or negative impact determinants (see Table 8). Among them there were five most often and with the greatest impact on increasing values of the synthetic index within the analyzed period of 11 years of NUTS 4 units. The determinant of positive impact throughout whole the period considered was the participation of the population in the pre-productive age (in %).

For other indicators, which most shaped the high values of the synthetic Perkal index included the balance of natural increase (in ‰), except for 2000, and the period 2009–2010, and the rate of marriages (in ‰), occurring at the beginning and at the end of the reporting period (except for the period 2003–2009). In contrast, among the three indicators that to the greatest extent determined the reduction in the value of the synthetic index two occurred in the entire period, i.e. the ratio of deaths (in ‰), and the divorce rate (in ‰). The other indicator that the greatest extent shaped the low value of the synthetic index was the rate of feminization.

Featured indicators to the greatest extent influenced the values of the synthetic index of the level of development and population settlement NUTS 4 units during the period, and thus determined the greatest extent the resulting distribution of growth areas and areas of stagnation in the reporting aspect. To a large

Table 8. Determinants of the level of development in terms of POPULATION AND SETTLEMENT in Poland, Slovakia and Lithuania in 2000–2010

No.	Indicator	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
2	1.1.N4.6. Females per 100 males	S	–	–	S	S	S	S	S	S	S	S	S
3	1.1.N4.7. The balance of natural increase of total population, in ‰	–	G	G	G	G	G	G	G	G	G	–	G
7	1.1.N4.16. Deaths per 1000 population, in ‰	S	S	S	S	S	S	S	S	S	S	S	S
10	1.1.N4.20. Pre–working population, in %	G	G	G	G	G	G	G	G	G	G	G	G
13	1.1.N4.23. Marriages contracted per 1000 population, in %	G	G	G	–	–	–	–	–	–	–	G	G
14	1.1.N4.24. Divorces per 1000 population, in %	S	S	S	S	S	S	S	S	S	S	S	S

Source: own elaboration.

extent, this situation is due to high level of spatial variability of these indicators, and thus with a high degree of differentiation of the units in this respect.

Conclusions

An analysis of disparities in socio-economic development in terms of population and settlement at the level of NUTS 4 units in Poland, Slovakia and Lithuania allows to draw the following conclusions:

1. The resulting spatial distributions of growth areas and areas of stagnation in terms of population and settlement, obtained on the basis of 15 indicators were characterized in 2000–2010 by relatively high volatility.
2. Throughout the reporting period the largest class of NUTS 4 units was the class with transition areas, and least numerous class was class of growth areas. It should be emphasized that according to the particular country, this structure has been mixed. Clear dominance of transitional areas can be observed in Poland and in Lithuania (except for 2010), while in Slovakia the entire period occurred largest share areas of stagnation.
3. The analysis of changes in class size of growth areas, transition areas and stagnation areas in the system of NUTS 4 units in Poland, Slovakia and Lithuania show a clear downward trend in the number of units belonging to the class of transition regions, while increasing the number of units in the class of areas of stagnation as well as in the class of growth areas.
4. The observed trend change confirms that the characteristic feature of the socio-economic development is its polarization, leading to the presence in the economic areas of growth and stagnation areas. Spatial diversity of the level of socio-economic development can also be seen in terms of the population-settlement. Additionally and in the system of studied three countries the degree of the polarization is increasing in the analysed period.
5. The results of the analysis of the distribution of locally auto-correlated units (LISA graph) largely confirm earlier obtained results of distribution analysis of growth areas and areas of stagnation in terms of the population-settlement system of the countries studied and allow for separation of clusters of high (so-called hot spots) and low (so-called cold spots) level of development in the analyzed aspect.
6. In the period 2000–2010, differentiation of level of development in terms of population and settlement in the sub-regional scale in Poland, Slovakia and Lithuania expressed by the values of the synthetic Perkal index, was essentially determined by six indicators. The determinant of positive impact throughout whole the period considered was the participation of the population in the pre-productive age (in %). For other indicators, which most shaped the high values of the synthetic Perkal index were: the balance of natural increase (in ‰), the rate of marriages (in ‰), the ratio of deaths (in ‰), and the divorce rate (in ‰). The other indicator that the greatest extent shaped the low value of the synthetic index was the rate of feminization.

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Zróżnicowanie poziomu rozwoju społeczno-gospodarczego w aspekcie ludność i osadnictwo na poziomie jednostek NUTS 4. Przykład Polski, Słowacji i Litwy

Zarys treści: Celem opracowania jest analiza zróżnicowania poziomu rozwoju społeczno-gospodarczego w aspekcie ludność i osadnictwo w wymiarze ponadkrajowym. Analiza prowadzona na przykładzie trzech państw: Polski, Słowacji i Litwy i odnosi się do jednostek poziomu lokalnego NUTS 4, które liczą odpowiednio 379, 79 i 60 jednostek. Zakres czasowy badań obejmuje lata 2000–2010. Podstawowym wynikiem przeprowadzonej analizy jest wydzielenie w układzie trzech państw na poziomie lokalnym (NUTS 4) obszarów wzrostu, przejściowych i stagnacji w aspekcie ludnościowo-osadniczym. Ponadto obliczono wartości lokalnej statystyki I – Morana wraz z analizą lokalnych współczynników zależności przestrzennej (LISA) i wydzielono determinanty, które najbardziej wpływają na wartości wskaźnika syntetycznego Ws w aspekcie ludność i osadnictwo na poziomie lokalnym.

Słowa kluczowe: ludność, osadnictwo, jednostki NUTS 4, Polska, Słowacja, Litwa