
Spatial patterns of recent demographic trends in Serbia (1961–2010)

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ABSTRACT This study considers the spatial and temporal dimensions of demographic trends in Serbia between 1961 and 2010. Using appropriate spatial autocorrelation statistics, spatial patterns of common demographic indicators including changes in population size, the rate of natural increase and infant mortality rate are investigated across municipalities of Serbia. Also, the impact of differential demographic rates according to ethnic origin on forming spatial clusters is implicitly considered. Different stages of demographic transition across municipalities at the start of the analyzed period determined the spatial pattern of clustered subregions; ethnic origin appeared to be a strong factor of differentiation regarding population dynamics. The two opposed areas regarding the transition of rates of natural increase and infant mortality were clustered; the southern included Kosovo and the least developed subregions of Central Serbia. The City of Belgrade and Kosovo have been the two hubs of population growth in Serbia over the past 50 years, while the strongest depopulation refers to the north and east border regions.

KEY WORDS population change – rate of natural increase – infant mortality rate – spatial autocorrelation – Serbia

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1. Introduction

In the past half century, Serbia represented European phenomenon in terms of regional divergence of demographic trends primarily caused by the differential natural growth of the population. Indeed, two opposed reproductive regimes existed in parallel – the one in Kosovo¹ resulted in a population growth rate that was among the highest in the world, while the other induced depopulation trends in the rest of the country (Penev 2002). Differentiated patterns of recent demographic trends have been also noted at the subregional scale as a result of different onset and tempo of demographic transition in natural growth of population caused by different historical, ethnic, cultural and economic factors (Vojkovic 2003), wherein ethnicity is usually singled out as the crucial one (Spasovski, Šantić, Radovanović 2012), similar to the findings for some other ethnically heterogeneous societies (Yücesahin, Ozgur 2008). Yet, if Kosovo is excluded, the period after the dissolution of socialist Yugoslavia is commonly designated as a new post-transitional stage of intensified spatial homogenization of the country in terms of demographic ageing and depopulation (Spasovski, Šantić, Radovanović 2012). In a growing number of post-socialist countries, the period after 1990 is considered from the perspective of the second demographic transition (Sobotka, Krystof, Kantorová 2001; UN 2003) in line with the observation that it is a pan-European, trans-cultural phenomenon that spreads from northwest to southeast of the continent (Van de Kaa 2002). In spite of doubts about applicability of the concept of second demographic transition to Balkan countries due to their specific socio-cultural matrix in relation to that in western societies, macro-level evidence suggests that Serbia excluding Kosovo started to follow the tempo of second demographic transition in southeastern Europe after the stagnation in the 1990s (Bobić, Vukelić 2011). If drivers of second demographic transition, in terms of individual change of value orientations (Lesthaeghe 2010b), are in work, recognized socio-cultural differences among subregions of the country should explain existence of spatial differentiation in demographic development produced by different tempo in accepting ideational changes. Although the analysis in this paper is not based on typical second demographic transition indicators, the general second demographic transition concept regarding the new demographic regime expressed through

¹ Kosovo and Metohija is the official name of the province according to the Serbian Constitution. It is the territory under dispute since 1999 when it was put under administration of UN mission in the framework of the UN Security Council Resolution No. 1244/1999. In February 2008, Kosovo unilaterally proclaimed independence from Serbia. Currently, 108 out of 193 United Nations member states and 23 out of 28 European Union member states (excluding Slovakia, Spain, Greece, Romania and Cyprus) have recognized Kosovo as an independent state.

long-term negative natural increase and transformation from net emigration to net immigration (Van de Kaa 2002) could be useful framework for understanding the direction of recent changes in demographic development of Serbia.

The aim of this paper is to address the use of appropriate spatial statistical indices to assess the role of space in influencing outcomes that have an inherent spatial dimension. In this case, common demographic indicators such as changes in population size, rates of natural increase and infant mortality rates across municipalities of Serbia are analyzed. Further, we want to test if the spatial patterns of observed demographic trends suggest the demographic homogenization of the country excluding Kosovo as was stated in the most recent studies (Spasovski, Šantić, Radovanović 2012). Bearing in mind that ethnic minorities in Serbia, except for Roma, are spatially concentrated across specific municipalities or group of municipalities, the results presented in this paper also reflect, although indirectly, the impact of differential demographic rates according to ethnicity on forming spatial clusters. Consequently, the specific outcome of the analysis highlights the issue of polarization between areas dominantly populated by ethnic Albanians and the rest of the country in terms of analyzed demographic trends.

Special attention in this research is given to evaluation of spatial autocorrelation indices of calculated trends in order to describe the general and local extent of their spatial clustering across the entire study region. They measure the degree to which near and distant things are related concerning their proximity of locations and similarity of the characteristics of these locations, and they are broadly used in various geo-sciences from environmental studies (Dormann et al. 2007), climatology (Balling, Goodrich 2011), etc. to the spatial econometrics (Scrucca 2005). Spatial autocorrelation indices are often used in current demographic research. These indices are very suitable for discovering spatial patterns of various demographic indicators such as fertility rates (Walford, Kurek 2015), mortality rates (Sparks, Sparks 2010), infant mortality rate (Storeygard et al. 2008) or life expectancy (Tsimbos, Kalogirou, Verropoulou 2014). They are also used for the assessment of particular ethnic group clustering at specific locations (Forrest, Poulsen, Johnston 2009) or for identifying high- and low-prevalence orphanhood clusters at the household level (Weinreb, Gerland, Fleming 2008).

The main aims of this paper are:

1. To examine trends in population change, rate of natural increase and infant mortality rate across all municipalities in Serbia from 1961 to 2010 except for the municipalities in Kosovo, where the analysis is limited to the period 1961–1997 due to lack of data.
2. To get detailed insight into spatial distribution of demographic trends using thematic maps.
3. To analyze spatial pattern of demographic trends in Serbia using global and local autocorrelation statistics parameters.

4. To get insight into the spatial distribution of mutual correlation between the series of population change, rate of natural increase and infant mortality rate.

Introducing total fertility rate and life expectancy at birth would certainly calibrate the outcomes of the proposed analysis but these indicators had to be left for future research due to the absence of their time series across municipalities. Similarly, the absence of time series of migration rates at the municipality scale forced us to indirectly estimate the impact of this component, which limited the interpretation of results to some extent. Our goal for this paper was to contribute in recognizing spatial patterns of demographic trends of Serbia in order to better understand the spatial process at work. The findings could be very useful for policy makers given that the last intercensal period 2002–2011 revealed a significant population decrease in small settlements followed by a population increase of the few largest urban centers of the country in terms of intense demographic ageing (SORS 2014).

2. Basic demographic characteristics of Serbia

2.1. Regional demographic differences

Serbia consists of three regions: Central Serbia (including the City of Belgrade) and two autonomous provinces – Vojvodina in the north and the disputed territory of Kosovo in the south (Fig. 1).

In Table 1, general demographic indicators of the three regions are presented for the start and final year of the period analyzed in this paper. Increase in total population of Kosovo between 1961 and 2010 was almost 8 and 14 times the increase recorded in Central Serbia and Vojvodina, respectively. If there were no high intensity emigration comparing to other two regions during the period, the population growth of Kosovo would be significantly higher.

Transition in fertility was decisive for the demographic differences among regions during the analyzed period. If Kosovo is excluded as an outlier in European context, below replacement total fertility rate was characteristic of Serbia throughout the whole 1961–2010 period (Kupiszewski, Kupiszewska, Nikitović 2012). The decline was faster and ran deeper than in most European countries in spite of the same general determinants of fertility decline, such as the adoption of new norms and values, growing levels of female labor force participation and birth control. It could be explained by rapid industrialization during the period of socialist Yugoslavia, deep structural changes along with armed conflicts, and institutional crisis during the 1990s (Kupiszewski, Kupiszewska, Nikitović 2012), but also by early liberalization (between 1952 and 1969) of women's right

Fig. 1 – The location of Serbia in Europe

Tab. 1 – General demographic indicators for the three administrative regions of Serbia, 1961 and 2010

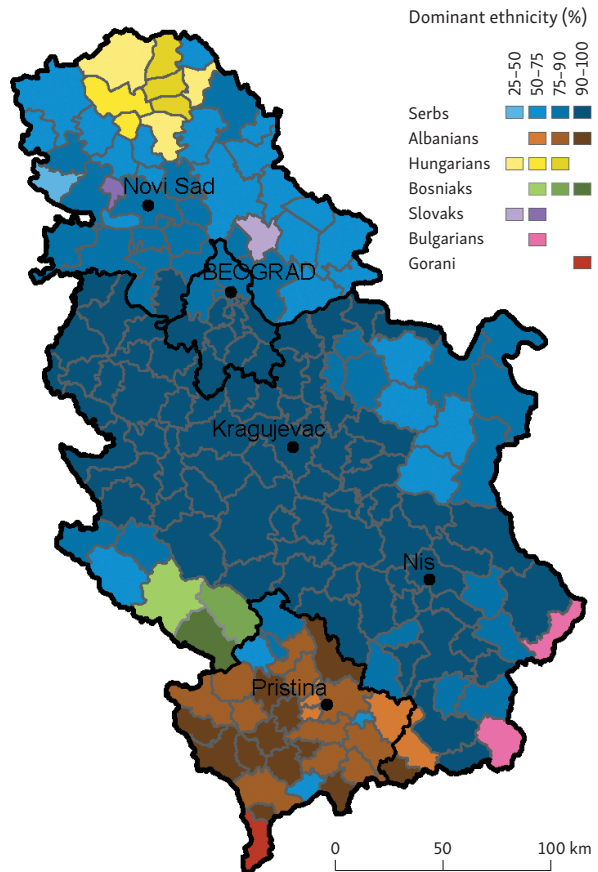
Demographic indicators	Central Serbia		Vojvodina		Kosovo	
	1961	2010	1961	2010	1961	2010
Total population (thousand)	4,823	5,334	1,855	1,958	964	1,740
Rate of natural increase (per 1,000)	8.9	-4.6	7.1	-5.2	29.9	15.3
Total fertility rate	2.1	1.4	2.2	1.4	6.2	2.0
Infant mortality rate (per 1,000 live births)	68.7	7.3	73.4	5.2	132.5	11.6
Life expectancy at birth – females	66.7	76.8	68.5	76.1	55.8	79.4
Life expectancy at birth – males	64.3	72.0	63.6	69.9	57.0	74.1
Net migration rate (per 1,000)	-1.42	-2.06	2.23	-2.04	-5.79	-4.21
Percentage of total population of Serbia	63.1	59.1	24.3	21.7	12.6	19.3
Percentage of total natural growth of Serbia	49.8	0	33.5	0	16.7	100
Population change 2010/1961 (percentage)	10.6		5.6		80.5	
Total natural increase 1961–2010 (thousand)	571		12		1,778	

Sources: Breznik, Sentić (1973); SOK (2008); SORS (2013); KAS (2013); KAS (2014); own calculation for net migration rate.

Note: Officially estimated indicators were not available for Kosovo in 2010 except for the rate of natural increase and total fertility rate. The 2011 figures were used instead.

to abortion (Rašević, Sedlecky 2009, p. 385) similar to former Soviet Union and Romania (Henry, Skilogianis 1999) except for the absence of any efficient measure in the domain of population policy during the socialist period (Rašević 2004, p. 16). The two significant drops in total fertility rate occurred during the 50-year time.

Fig. 2 – Distribution of spatially most homogenous ethnic groups across municipalities of Serbia. Data for Kosovo refer to 1991, the latest available year on ethnic distribution at the municipality scale. If available, the 2011 census data on ethnicity would only demonstrate higher share of Albanians in all municipalities except perhaps in the very north, bearing in mind that the majority of Serbs moved from Kosovo (mostly to Central Serbia) after 1999.



After the first one around 1970, total fertility rate stabilized at the level (about 1.8), which was much closer to northern Europe. Stronger decline in fertility has started after 1990, resembling the trend in post-socialist countries. However, the trends of common second demographic transition indicators in recent period cannot unambiguously suggest if Serbia excluding Kosovo is a typical “late starter” (Bobić, Vukelić 2011) or has its geographically specific tempo in transition to a new demographic regime, particularly in terms of individual level of second demographic transition manifestation (Van de Kaa 1996).

The period observed in this paper is characterized by a slow decline in Kosovo’s fertility rates. It resulted in estimated total fertility rate that was at least twice as high as noted in other two regions of the country and by far the highest in Europe at the end of the 1980s. The population doubling time of 17.5 years in 1991 was two times faster than the world’s peak of 35 years in the 1960s. However, following the stagnation during the 1990s, Kosovo experienced marked decline in total fertility rate since 2003 approaching the replacement level around 2010.

The population in all three regions of Serbia has experienced a marked increase in life expectancy at birth since 1961 due to improvements in the public health care system that helped limit the mortality in the young age groups, particularly that of infants and the under-fives. The most pronounced difference among the regions in 1961 as regards this indicator was significant lagging of life expectancy at birth for females in Kosovo (Table 1). The rationale could be found in exceptionally high total fertility rate at the time. Yet, between 1970 and 1997, life expectancy at birth in Central Serbia and Vojvodina was characterized by small improvements and stagnation as compared to the continuous increase in Kosovo. Consequently, Kosovo achieved higher life expectancy at birth for both sexes in relation to other two regions already in the late 1980s (SORS 2013). On the other side, current life expectancy at birth in Serbia excluding Kosovo is much closer to the post-communist countries than it is to others in Europe (Kupiszewski, Kupiszewska, Nikitović 2012).

The infant mortality rate in Serbia was double the average rate for Europe in the period 1960–1965 (SORS 2006, UN 2013). Despite the outstanding results achieved in the last fifty years, Serbia, regardless of whether it includes Kosovo or not, is still far behind many European countries given the EU-28 average of 3.9 deaths per 1,000 live births in 2011 (Eurostat 2015), implying slower socio-economic development than in most of the post-socialist countries.

In spite of high intensity of forced migration during the 1990s (Nikitović, Lukić 2010), and traditionally voluminous labor outflows initiated by Yugoslav authorities since the mid 1960s (ISS 2013), migration component² was less important for the total population change of Serbia from its natural counterpart during the 1961–2010 period. Its importance can be only evident at subregional level, particularly in the most pronounced emigration area in the north and northeast of Central Serbia. Yet, the whole region of former Yugoslavia (except for Slovenia) along with its neighbors on the east is recognized as an emigrational at the beginning of this century (Fassmann et al. 2014).

2.2. Subregional ethnic distribution

One of the crucial drivers of demographic variations in a society refers to ethnicity and the geographical concentration of ethnic groups (Morrill 1993, Catney 2015). Serbia, and especially Vojvodina region, is characterized by a rich ethno-cultural

² If we disregard the disputed status of Kosovo, the status of current boundaries of Serbia has been changed several times between 1991 and 2006, inducing each time the change of migration type from internal to international, which significantly hampers an analysis of available migration statistics during the 1961–2010 period.

composition of the population due to interplay of historic, geographic, demographic and political factors (Raduški 2003, ISS 2013). Three of the four largest ethnic minorities in the country are concentrated in the border areas, thus forming subregional majorities, close to their homelands (Fig. 2).³ Hungarians are located in the northern, Bosniaks in the southwestern, and Albanians in the southern Serbia. Throughout the period under analysis, both ethnic minorities of Muslim religion, especially Albanians, were characterized by significantly higher rate of natural increase, due to the extremely high total fertility rate, compared to other ethnic groups including Serbs. Moreover, total fertility rate in Kosovo during the whole observed period was by far the highest in Europe, an average of one child higher than in Albania (Penev 2002; Falkingham, Gjonca 2001; KAS 2014). Recent studies substantially grounded on diffusion theory as an explanation for spatial patterns of demographic change suggest that sociocultural heterogeneity prevent the equal diffusion of attitudes and information that support modern reproductive ideas and behavior (Yücesahin, Ozgur 2008). Thus the spatial analysis of demographic trends, as presented in this paper, could provide a general framework for exploring demographic differentials across subregions of Serbia induced by ethnic factor.

3. Data and methods

3.1. Data set

The data set of population change, rate of natural increase and infant mortality rate that was analyzed in this paper has been recently published as the special issue by the SORS titled “Natural changes of population in the Republic of Serbia, 1961–2010” (SORS 2012). It was the first time that national statistical office published a 50-year annual time series of vital events and population change across small spatial units such as municipalities. The time series is not fully consistent in methodological terms because the period 1961–2001 included persons residing abroad for a year or longer unlike the period 2002–2010 that followed the 2002 Census methodology.⁴ Although this inconsistency has implications at the

³ Between 1961 and 2010 there was no substantial difference in terms of the spatial distribution of the subregions specific by the dominance of certain ethnic minorities, but the levels of dominance have changed due to differential natural growth and net migration by ethnicity. In Vojvodina, the proportion of ethnic minorities in the majority of municipalities decreased, while in the rest of the country the share of Bosniaks and Albanians in the subregions of their dominance has increased.

⁴ Since the 2002 Census, persons residing abroad for a year or longer are not included in the total population of the country unlike the case in the earlier censuses.

municipality level, particularly in the distinct emigration subregions, this cannot substantially affect the trend analysis reported in this paper. Also, it should be noted that in the case of Kosovo the series covers the period of 1961–1997 because the statistics on vital events and population change across municipalities is not available between 1998 and 2010, neither by Statistical Office of the Republic of Serbia (SORS), nor by recently established Kosovo Agency of Statistics (KAS). For this reason, all obtained results refer to the period 1961–2010, except for Kosovo's municipalities which are related to the period 1961–1997.

3.2. Trend analysis

Population change, rate of natural increase and infant mortality rate were the subject of trend determination. Preliminary analysis did not reveal any changing epochs i.e. years where time series of these demographic indicators obviously change their slope. This was confirmed by production of so-called cumulative sums (CUSUM) charts, a graphical method of change epoch detection first introduced by Page (1954), with underlying mathematical principles elaborated by Ewan (1963). For that reason, the trend values were simply estimated as a slope of a straight line in the model which for the case of e.g. population changes (*PC*) has the form:

$$PC = a + bt, \quad (1)$$

where *b* denotes the line slope, and with *t* being time in years. Estimation was carried out by method of least squares, which is designed to determine values of unknown model parameters *a* and *b* of a best fitting line in an optimal sense (Koch 1999). In addition, method of least squares provides a standard deviation of parameter estimates which can be employed for statistical testing of trend significance.

The series of population change, rate of natural increase and infant mortality rate were also examined for the presence of mutual relationship. For that purpose, a Pearson product-moment correlation coefficient (sometimes referred to as the PPMCC or PCC or Pearson's *r*) was calculated as a measure of the linear correlation (dependence) between two variables, as well as corresponding statistics for significance testing (Kendall, Stuart 1973).

3.3. Spatial autocorrelation indices

We used global and local analysis methods (i.e., global and local Moran's *I* indices and local Getis-Ord *G_i* statistics) to evaluate spatial patterns of distribution of municipalities by considering both their locations and associate demographic trends values. These methods use measures known as the spatial autocorrelation

coefficients to measure and test how municipalities are clustered/dispersed in space with respect to their trends values.

Moran's I represents the measure of autocorrelation given in spatial context (O'Sullivan, Unwin 2003).

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n w_{ij}(h)(y_i - \bar{y})(y_j - \bar{y})}{\sum_{i=1}^n (y_i - \bar{y})^2 \sum_{i=1}^n \sum_{j=1}^n w_{ij}} \quad (2)$$

Where y_i and y_j are observed or calculated values of the envisaged spatial attribute of entities (municipalities) i and j , \bar{y} is a mean value and $w_{ij}(h)$ is the coefficient that represents proximity of these two entities, often calculated as the inverse of the distance h between them, which accomplishes the postulate of the first law of geography (Tobler 1970): everything is related to everything else, but near things are more related than distant things.

The value of the Moran's I statistic ranges from near +1 indicating clustering of the y values (neighborhood similarity) to near -1 indicating dispersed pattern of the y values or extremely dissimilarity of neighboring areas. In order to evaluate the statistical significance of the Moran's I statistic, a standardized Z score value is calculated.

In the Global Moran's I statistic, the results of the analysis are always interpreted within the context of its null hypothesis, which states that the variable (trends slope in our case) being analyzed is randomly distributed among the municipalities; or better said, the spatial processes promoting the observed pattern of values is random chance. If the obtained p -value is statistically significant, the null hypothesis could be rejected. Otherwise, the observed spatial pattern could be the result of random spatial processes. The results of Moran's I statistic with significant p -values and positive Z -scores indicates spatially clustered datasets. At the same time, negative Z -scores depict that the spatial pattern is more spatially dispersed.

If significantly positive spatial autocorrelation exists in the distribution of observed polygons, municipalities with similar characteristics tend to be near each other. Alternatively, if spatial autocorrelation is weak or non-existent, adjacent polygons in a distribution tend to have different characteristics. Moran's I is global statistic index that summarizes the values of autocorrelation over the entire study region. In the case of statistically immanent spatial autocorrelation, in order to indicate the level of spatial autocorrelation at the local scale, it is necessary to calculate local autocorrelation indices like local Moran's (Anselin 1995) and Getis-Ord G_i statistics (Getis, Ord 1992). These local indicators represent disaggregated measures of autocorrelation that depict the extent to which particular observed locations are similar to or different from neighboring locations.

Local Indicators of Spatial Association (LISA) that are based on the local Moran's I test enable the assessment of significant local spatial clustering around an

individual location; thereby providing details of (1) the degree of spatial clustering; (2) an estimate of detailed variations of clustering in the locally defined area; and (3) identification of the locations of the spatial clusters. The local version of Moran's I for entity i is given by:

$$MI_i = \frac{(y_i - \bar{y})}{S_i^2} \sum_{j=1}^n w_{ij}(h)(y_j - \bar{y}) \quad (3)$$

Where S_i^2 represents sample variance:

$$S_i^2 = \frac{\sum_{j=1, j \neq i}^n w_{ij}(h)}{n-1} - \bar{y}^2 \quad (4)$$

The *Local Moran's I* statistic is used to detect possible non-stationarity of the data - i.e., a clustered pattern - among subregions. A positive local MI_i indicates a cluster of trends values of similar magnitude around i , while a negative MI_i indicates that the value of the trend at municipality i is surrounded by municipalities with dissimilar trend values. If values for y_i and y_j are close to \bar{y} , then local MI_i indicates the absence of spatial autocorrelation.

Local Getis-Ord G_i statistic is given in following form:

$$G_i(h) = \frac{\sum_{j=1}^n w_{ij}(h)y_j - \bar{y}_i \sum_{j=1}^n w_{ij}(h)}{S(i) \sqrt{\frac{(n-1) \sum_{j=1}^n w_{ij}^2(h) - \left(\sum_{j=1}^n w_{ij}(h) \right)^2}{n-2}}}, j \neq i \quad (5)$$

where

$$\bar{y}_i = \frac{\sum_{j=1, i \neq j}^N y_j}{N-1} \quad \text{and} \quad S(i) = \sqrt{\frac{\sum_{j=1, i \neq j}^n y_j^2}{n-1} - (\bar{y}_i)^2}$$

Getis-Ord G_i statistics is used to detect possible non-stationarity of the data i.e. a clustering pattern in specific subregions.

Hot Spot Analysis (Lee, Wong 2005) by calculating Getis-Ord G_i statistics was performed in order to obtain more insight into how the municipalities with high and low levels of calculated trends are clustered. The best way to interpret the Getis-Ord G_i statistic is in the context of the standardized Z-score values. A high positive Z-score of G_i statistics appears when the spatial clustering is formed by similar but high values, the larger the Z score is the more intense the clustering of high values. If the spatial clustering is formed by low values, the Z-score will tend

to be highly negative and the smaller the Z Score is the more intense the clustering of low values. A Z-score around 0 indicates no apparent spatial association pattern.

Incremental Spatial Autocorrelation (ISA), which uses Moran's I measure to test for spatial autocorrelation across a series of distances throughout a study area (ESRI 2012), was conducted to determine the distance associated with peak clustering for all demographic indicators. The value obtained from ISA was then used as distance threshold or radius h for determining w_{ij} proximity weights for calculating Moran's I (eq. 2) and in Hot Spot analysis (eq. 5) as well. Municipalities' polygons within the specified h distance threshold of a target municipality receive a weight of 1. Once the threshold distance is exceeded, weights w_{ij} diminish with inverse squared distance.

4. Results

4.1. Rate of natural increase

The negative rate of natural increase trend over the period 1961–2010 is characteristic of all municipalities in the country. Global Moran's $I = 0.053$ ($Z = 10.746$, $p < 0.001$) for the trends of rate of natural increase (threshold radius $h = 120$ km) indicate moderate clustered spatial patterns with high statistical significance. The largest reductions in rate of natural increase occurred in areas with very high levels at the beginning of the period (southeastern and southwestern Central Serbia, northern Kosovo) and vice versa, the smallest decrease is registered across municipalities where rate of natural increase was fairly low or negative already in the 1960s (northeastern Central Serbia). Local Moran's I statistics clustered precisely these subregions (Fig. 3a). The largest part of Kosovo entered the first phase of first demographic transition not before 1985 (Spasovski, Šantić, Radovanović 2012), which could explain to some extent why most of this region is not in a cluster of large reduction in rate of natural increase. Nevertheless, the hot spot analysis resulted in two large opposing clusters (Fig. 3b), which almost sharply split the country into the northeast (smaller reductions in rate of natural increase) and the south (larger reductions in rate of natural increase) implying quite distant dates between them in terms of the first demographic transition onset.

4.2. Infant mortality rate

Infant mortality rate was very high throughout the country in 1961, but especially in Kosovo, where, consequently, the strongest decrease of the trend is observed over the period. Global Moran's I (threshold radius $h = 120$ km) for the trends of

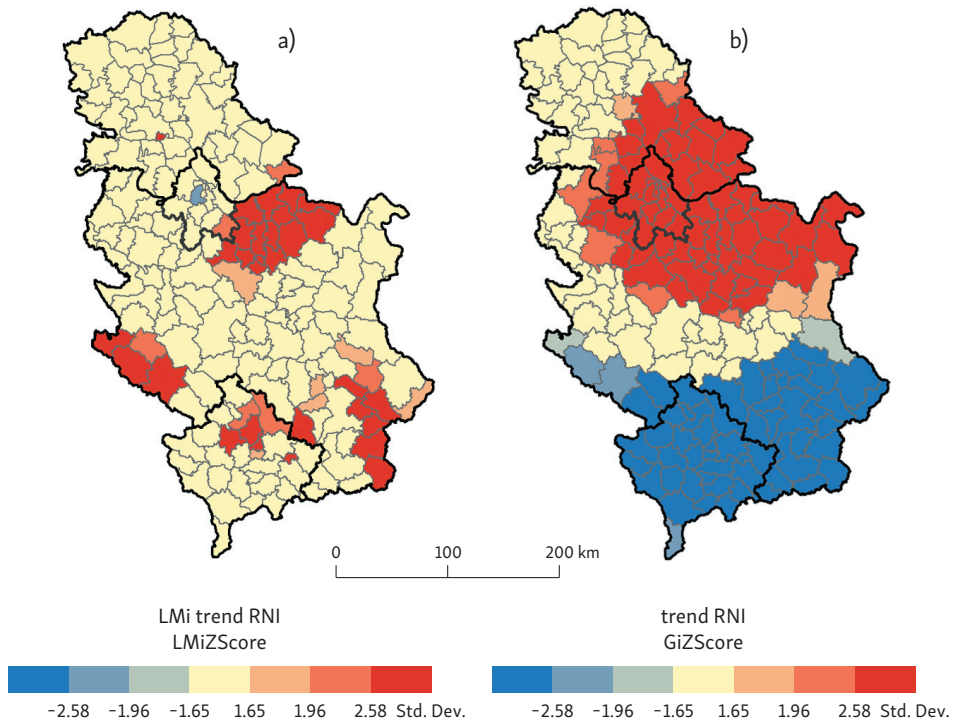


Fig. 3 – Spatial distribution of trends in rate of natural increase across municipalities of Serbia

infant mortality rate $I = 0.112$ ($Z = 21.727$, $p < 0.001$) support moderate clustered spatial patterns with high statistical significance. Local Moran's statistics (Fig. 4a) clearly depicted the outstanding pole of decrease in infant mortality rate (Kosovo and two adjacent municipalities in the south of Central Serbia mostly inhabited with ethnic Albanians). This index also clustered two smaller subregions in Central Serbia (including urban nucleus of the Belgrade City) that have experienced the lowest decrease of trend in infant mortality rate given relatively low starting values. Yet, the hot spot analysis of trends in infant mortality rate (Fig. 4b), similarly to the trends in rate of natural increase, revealed even sharper distinction between the north and the south (Kosovo and adjacent subregions of large reductions in infant mortality rate).

4.3. Population change

Spatial distribution of calculated population change trends across municipalities of Serbia (Fig. 5a) shows a positive trend of high scale over the 1961–2010 period

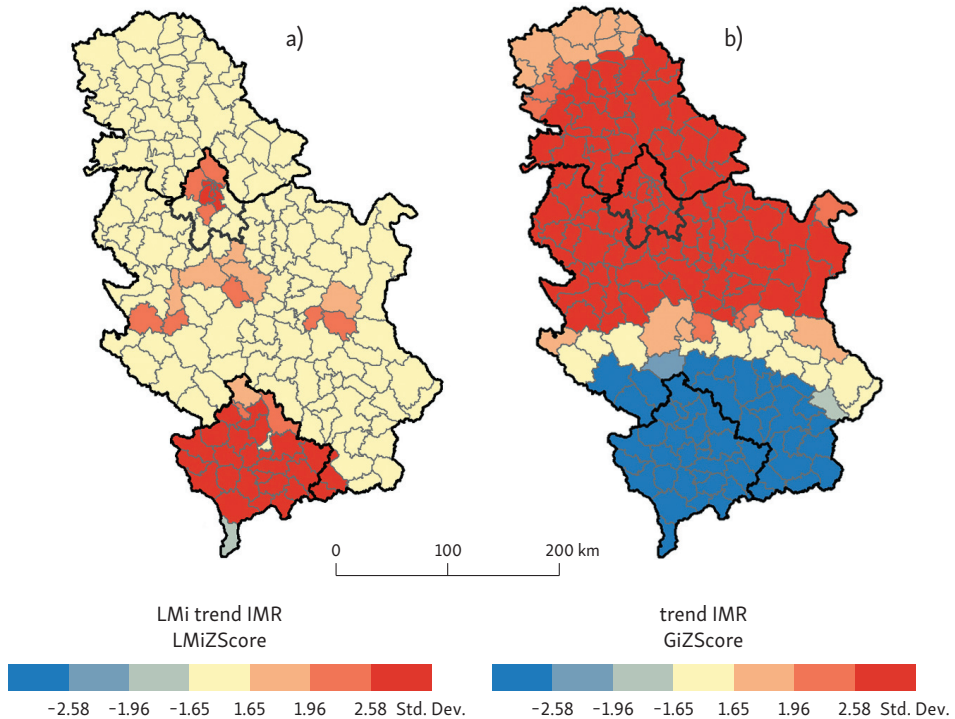


Fig. 4 – Spatial distribution of trends in infant mortality rate across municipalities of Serbia

exclusively in the largest urban centers of Central Serbia (central urban area of the Belgrade City, Kragujevac and Niš), and Vojvodina (Novi Sad), and in most of municipalities of Kosovo (predominantly populated by ethnic Albanians). The decreasing trend is typical for the vast majority of municipalities, mainly located in rural and/or peripheral areas. Global Moran's $I = -0.008$ ($Z = -0.462$, $p = 0.644$) calculated with threshold radius $h = 80$ km for the trends of population change indicates that they are not spatially clustered neither dispersed over the whole territory of Serbia. Local Moran's I statistics clustered only municipalities that have experienced extensive population growth. Positive (red polygons) and negative (blue) Z-scores of Gi statistics presented by hot spot analysis (Fig. 5b) respectively indicate clusters of increasing and decreasing trend in population change. The most intensive clustering is observed in the region of Kosovo indicating population explosion of the province during the 50-year period. The lower intensity clustering formed the subregion consisted of the high density part of the Belgrade City along with adjacent commuting area. The similar intensity clustering of the opposite population change trend revealed two subregions – eastern part of Central Serbia, and northern border belt of Vojvodina region, which includes most of Hungarians

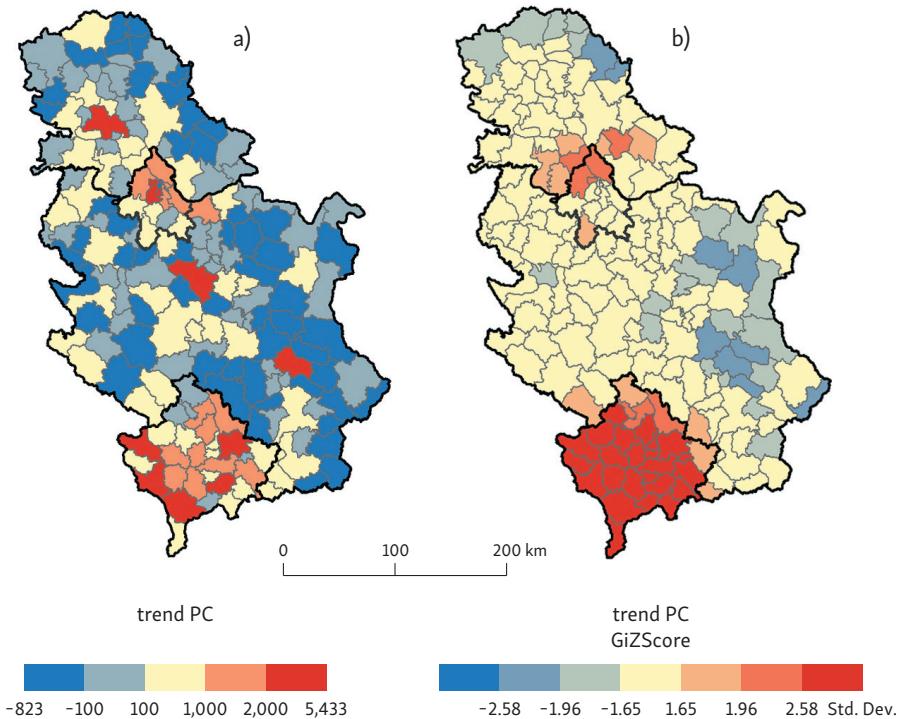


Fig. 5 – Spatial distribution of trends in population change across municipalities of Serbia

and Croats in terms of ethnicity. The former is recognized in the literature as the first depopulation subregional entity in Serbia while the latter could be explained by the resultant of emigration and long-lasting negative rate of natural increase of ethnic Hungarians if compared to the total population (Penev, ed. 2006; Gábrity Molnár 2011; Spasovski, Šantić, Radovanović 2012).

4.4. Correlation between demographic variables

The spatial distribution of correlation coefficients between the series of population change and rate of natural increase shows that municipalities are strongly polarized as regards the direction of correlation (Fig. 6a). PPMCC regardless of the sign is lower than 0.5 and 0.7 for 10% and 20% of municipalities, respectively. Strong positive correlation refers to the municipalities where both population size and rate of natural increase were decreasing during the period (mainly peripheral and/or backward rural areas), while strong negative correlation resulted in all cases from an increase in population size and a decrease in rate of natural

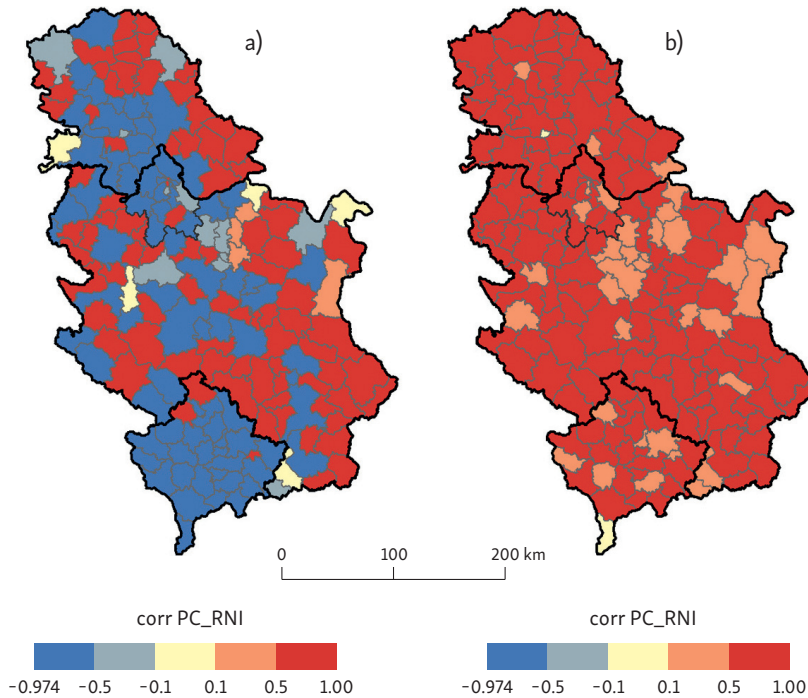


Fig. 6 – Spatial distribution of correlation coefficients between series of population size, rate of natural increase and infant mortality rate

increase (higher intensity trends in Kosovo and lower intensity trends in larger urban centers of Central Serbia and Vojvodina). Spatial distribution of correlation coefficients between the series of population change and infant mortality rate resembles Figure 6a, given the similar trend of infant mortality rate comparing to rate of natural increase during the observed period. Finally, no negative correlation is calculated between the series of rate of natural increase and infant mortality rate as both trends were decreasing during the 1961–2010 period. Furthermore, the PPMCC higher than 0.5 and 0.7 is characteristic of 80% and almost 50% of municipalities in Serbia, respectively (Fig. 6b).

5. Discussion and conclusions

Previous studies indicate a clear distinction between Kosovo and the other two regions of Serbia when it comes to the start of demographic transition and its course, the prevalent reproductive regime, the age pattern of mortality and the consequences of these processes on the development of the population (Penev

2002; Rašević 2004; Spasovski, Šantić, Radovanović 2012). In spite of its limitations, this paper went further in depicting the statistical significance of spatial autocorrelation trends in population change, rate of natural increase and infant mortality rate across small territorial units such as municipalities of Serbia.

As it is discussed in theory (Morrill 1993; Reed, Briere, Casterline 1999), and empirically supported in various studies (Lesthaeghe, Neels 2002; Lesthaeghe 2010a; Walford, Kurek 2015), changes in demographic trends within a country are usually spread with certain lags in relation to a center of diffusion. The analysis in this paper questioned the homogenization of Serbia excluding Kosovo in terms of population change and natural increase rate as suggested in recent research (Spasovski, Šantić, Radovanović 2012). In spite of very low/negative rate of natural increase and decreasing population trends throughout Serbia excluding Kosovo, induced by persistent, long-lasting bellow replacement total fertility rate, the spatial autocorrelation indices indicate that the lags are still relevant in forming demographically distinct spatial clusters. Local Moran *I* statistics distinguished between the subregions that significantly differ from each other as regards the onset of intensive birth rate decline in accordance with the third phase of demographic transition, as is commonly perceived (Lee 2003). Growing empirical basis entitles claims that the second demographic transition in the post-socialist countries has taking place since 1990, wherein certain regions at subnational level can be designated as points of diffusion in terms of the new demographic regime implying uneven spatial dispersal of changes linked with the second demographic transition (Sobotka, Krystof, Kantorová 2001; Walford, Kurek 2015). Thus, the results in this paper could be interpreted as suggesting that the subregions that were the first to experience negative natural growth of population (northeast of the Central Serbia) actually constitute a center of the second demographic transition in Serbia. Moreover, the hot spot analysis highlighted the large area around that nucleus pointing to the directions of the diffusion. It also suggests that both southwest and southeast subregion of Central Serbia are much closer to Kosovo than to the northern areas of the country, which is not surprising if considered as the lag in the onset and tempo of first demographic transition, implying possible issues and lags in future diffusion of the new demographic regime to the south. Similarly, as infant mortality rate can be interpreted as a specific synthetic indicator of socio-economic conditions, it seems that the analysis reasonably put the least developed subregions of Central Serbia into the same cluster with Kosovo.

Unsurprisingly, spatial autocorrelation analysis concerning population change highlighted two parallel demographic processes of opposite direction – extreme population growth (Kosovo) and depopulation (the rest of the country). Yet, hot spot analysis shows that homogenization of Serbia excluding Kosovo in terms of depopulation is not so straightforward as suggested in recent studies. It is obvious that the most densely populated part of the City of Belgrade, including its

gravitational sphere in terms of daily commuters, is confronted with distinctive border subregions of depopulation in the north and east, implying the development of a mono-centric demographic model similar to neighboring post-socialist countries (Madzevic, Apostolovska Toshevska, Iliev 2013; Fassmann et al. 2014). This is supported by the spatial distribution of correlation coefficients between the series of population change and rate of natural increase, which indirectly assessed migration impact. Namely, if we set border and/or mountain subregions aside, it is evident that smaller urban hubs in the heart of the country, that boomed during the rapid industrialization in the 1960–70s, were not able to keep pace with larger industrial centers in terms of attracting labor force. Therefore, it is reasonable to expect that the depopulation process will continue to spread around the capital even on account of the few remaining large regional centers in the forthcoming period.

Although the differential rate of natural increase by ethnicity was not available for the analysis, municipalities dominantly populated by ethnic Albanians were clearly singled out by the spatial analysis of population dynamics. However, the analysis regarding the rate of natural increase and infant mortality rate (except Local Moran's *I* in the case of Albanians) did not show any pronounced ethnic clustering. It rather indicates to the grouping as a result of different stages of the demographic transition between the subregions during the period, particularly in the case of rate of natural increase. Thus, Kosovo represents a centre of a wider area spreading over the south of Serbia, which was the last to enter the final stage of demographic transition, including all subregional ethnic majorities of high fertility regime (Albanians, Bosniaks, Muslims).

Finally, given observed spatial clusters that reflect different onset and tempo of change in reproductive regimes, it could be valuable if further analysis of this type explicitly include common indicators of second demographic transition in Serbia. Thus, it will provide information about the spatial distribution of more specific phenomena relevant for current regional and subregional differences in demographic development of the country, which could be valuable knowing that country borders do not limit diffusion of demographic patterns. However, the time series of these indicators at the municipality scale have to be previously derived, which appears to be the biggest obstacle for a research now.

References

- ANSELIN, L. (1995): Local indicators of spatial association - LISA. *Geographical Analysis*, 27, 93–115.
- BALLING, JR, R.C., GOODRICH, G.B. (2011): Spatial analysis of variations in precipitation intensity in the USA. *Theoretical and applied climatology*, 104, 3–4, 415–421.
- BOBIĆ, M., VUKELIĆ, J. (2011): Second Demographic Transition De-blocked? *Sociologija*, 53, 2, 149–176.

- BREZNIK, D., SENTIĆ, M. (1973): Projekcije ukupnog i aktivnog stanovništva Jugoslavije sa migracionom komponentom. *Stanovništvo*, 10–11, 3–4; 1–2, 137–176.
- CATNEY, G. (2015): The Changing Geographies of Ethnic Diversity in England and Wales, 1991–2011. *Population Space and Place*, Published online in Wiley Online Library, DOI: 10.1002/psp.1954.
- DORMANN, C., MCPHERSON, J., ARAÚJO, M., BIVAND, R., BOLLIGER, J., CARL, G., WILSON, R. (2007): Methods to account for spatial autocorrelation in the analysis of species distributional data: a review. *Ecography*, 30, 5, 609–628.
- ESRI (2012): Spatial Statistics Tools, ArcMap 10.1. ESRI, Redlands.
- EUROSTAT (2015): Eurostat on-line database, <http://epp.eurostat.ec.europa.eu/portal/page/portal/population/data/database> (15.6.2016).
- EWAN, W.D. (1963): When and how to use CUSUM charts. *Technometrics*, 5, 1–32.
- FALKINGHAM, J., GJONCA, A. (2001): Fertility transition in Communist Albania, 1950–90. *Population Studies*, 55, 309–318.
- FASSMANN, H., MUSIL, E., BAUER, R., MELEGH, A., GRUBER, K. (2014): Longer-Term Demographic Dynamics in South-East Europe: Convergent, Divergent and Delayed Development Paths. *Central and Eastern European Migration Review*, 3, 2, 150–172.
- FORREST, J., POULSEN, M., JOHNSTON, R. (2009): Temporary and Disadvantaged? The Economic and Spatial Assimilation of New Zealand Maori in Sydney. *Population Space and Place*, 15, 475–492.
- GÁBRITY MOLNÁR, I. (2011): The motives for Emigration of Hungarians in Vojvodina Minderheitendasein. In: Gerner, Z., Kupa, L. (eds.): *Mittel- und Osteuropa – interdisziplinär betrachtet*, Socialia, Studienreihe Soziologische Forschungsergebnisse, Band 113. Verlag Dr. Kovač, Hamburg, Germany, 103–114.
- GETIS, A., ORD, J.K. (1992): The Analysis of Spatial Association by Use of Distance Statistics. *Geographical Analysis*, 24, 3, 189–206.
- HENRY, D., SKILOGIANIS, J. (1999): *From Abortion to Contraception: A Resource to Public Policies and Reproductive Behavior in Central and Eastern Europe from 1917 to the Present*. Transnational Family Research Institute, Greenwood Press, London.
- ISS (2013): Dynamic Historical Analysis of Longer Term Migratory, Labour Market and Human Capital Processes in Serbia. SEEMIG project, Work Package 3: Conceptual Framework for modelling longer term migratory, labour market and human capital processes. SEEMIG Country report. Institute of Social sciences, Belgrade, <http://seemig.eu/downloads/outputs/SEEMIGHistoricalAnalysisSerbia.pdf>, (3. 2. 2014).
- KAS (2013): Kosovo Population Projection 2011–2061. Kosovo Agency of Statistics, Pristina, http://ask.rks-gov.net/ENG/publikimet/doc_download/1126-kosovo-population-projection-2011-2061, (4. 12. 2014).
- KAS (2014): Statistical Yearbook of the Republic of Kosovo 2014. Kosovo Agency of Statistics, Pristina, http://ask.rks-gov.net/ENG/publikimet/doc_download/1192-statistical-yearbook-of-the-republic-of-kosovo-2014, (10. 11. 2014).
- KENDALL, M.G., STUART, A. (1973): *The Advanced Theory of Statistics*, Volume 2. Inference and Relationship, Griffin.
- KOCH, K.R. (1999): *Parameter Estimation and Hypothesis Testing in Linear Models*. Springer, New York.
- KUPISZEWSKI, M., KUPISZEWSKA, D., NIKITVIĆ, V. (2012): The Impact of Demographic and Migration Flows on Serbia. International Organization for Migration – Mission to Serbia, Belgrade, http://www.kirs.gov.rs/docs/migracije/The_Impact_of_Demographic_and_Migration_Flows_on_Serbia.pdf, (12. 12. 2012).

- LEE, R. (2003): The Demographic Transition: Three Centuries of Fundamental Change. *Journal of Economic Perspectives*, 17, 4, 167–190.
- LEE, J., WONG, D.W.S. (2005): *Statistical Analysis of Geographic Information with ArcView GIS and ArcGIS*. John Wiley and Sons, New York.
- LESTHAEGHE, R. (2010a): Long term spatial continuities in demographic innovations – Insights from the Belgian example, 1846–2000. Population Studies Center Research Report 10–695. Population Studies Center, University of Michigan, Institute for Social Research.
- LESTHAEGHE, R. (2010b): The Unfolding Story of the Second Demographic Transition. Population Studies Center Research Report 10–696. Population Studies Center, University of Michigan, Institute for Social Research.
- LESTHAEGHE, R., NEELS, K. (2002): From the First to the Second Demographic Transition: An Interpretation of the Spatial Continuity of Demographic Innovation in France, Belgium and Switzerland. *European Journal of Population*, 18, 4, 325–360.
- MADZEVIC, M., APOSTOLOVSKA TOSHEVSKA, B., ILIEV, D. (2013): A Process of Demographic and Economic Polarization in the Republic of Macedonia. *Geographica Pannonica*, 17, 2, 37–45.
- MORRILL, R. (1993): Development, Diversity, and Regional Demographic Variability in the U.S. *Annals of the Association of American Geographers*, 83, 3, 406–433.
- NIKITOVIĆ, V., LUKIĆ, V. (2010): Could Refugees Have a Significant Impact on the Future Demographic Change of Serbia? *International Migration*, 48, 1, 106–128.
- O’SULLIVAN, D., UNWIN, D. (2003): *Geographical Information Analysis*. John Wiley & Sons, New Jersey.
- PAGE, E.S. (1954): Continuous inspection schemes. *Biometrika*, 41, 100–115.
- PENEV, G. (2002): The Replacement of Generations in Serbia in the Period 1950–2000. *Stanovništvo*, 40, 1–4, 45–71.
- PENEV, G., ed. (2006): Population and households in Serbia – Census 2002. Statistical Office of the Republic of Serbia, Belgrade, <http://pod2.stat.gov.rs/ObjavljenePublikacije/G2006/pdf/G20066005.pdf> (28. 12. 2012).
- RADUŠKI, N. (2003): The Ethnic Make Up of the Population of Serbia – Census 2002. *Migracijske i etničke teme*, 19, 2–3, 253–267.
- RAŠEVIĆ, M. (2004): Fertility Trends in Serbia during the 1990s. *Stanovništvo*, 42, 1–4, 7–27.
- RAŠEVIĆ, M., SEDLECKY, K. (2009): The abortion issue in Serbia. *The European Journal of Contraception and Reproductive Health Care*, 14, 6, 385–390.
- REED, H., BRIERE, R., CASTERLINE, J. (1999). *The Role of Diffusion Processes in Fertility Change in Developing Countries: Report of a Workshop*. National Academy Press, Washington, DC.
- SCRUCCA, L. (2005): Clustering multivariate spatial data based on local measures of spatial autocorrelation. *Quaderni del Dipartimento di Economia, Finanza e Statistica*, 20, 1–11.
- SOBOTKA, T., KRYSSTOF, Z., KANTOROVÁ, V. (2001): Second demographic transition in the Czech Republic: Stages, specific features and underlying factors. Paper presented at the EURESICO Conference “The second demographic transition in Europe”. Bad Herrenalb, Germany, 23–28 June 2001.
- SOK (2008): Demographic changes of the Kosovo Population 1948–2006. Series 4, Population Statistics. Statistical Office of Kosovo, Pristina, http://ask.rks-gov.net/ENG/publikimet/doc_download/521-demographic-changes-of-the-kosovo-population-1948-2006, (4. 12. 2014).
- SORS (2006): Demografska statistika 2002–2003. Statistical Office of the Republic of Serbia, Belgrade, <http://webzrs.stat.gov.rs/WebSite/repository/documents/00/00/16/58/Dem2002-2003.zip>, (20. 12. 2012).

- SORS (2012): Natural changes of population in the Republic of Serbia. Statistical Office of the Republic of Serbia, Belgrade, <http://pod2.stat.gov.rs/ObjavljenPublikacije/G2012/pdf/G20126011.pdf>, (31. 10. 2012).
- SORS (2013): Demographic Yearbook in the Republic of Serbia, 2012. Statistical Office of the Republic of Serbia, Belgrade, http://webrzs.stat.gov.rs/WebSite/repository/documents/00/01/26/50/DEMOGRAFSKA_STATISTIKA-2012.zip, (18. 11. 2013).
- SORS (2014): Comparative overview of the number of population in 1948, 1953, 1961, 1971, 1981, 1991, 2002 and 2011. Data by settlements. Statistical Office of the Republic of Serbia, Belgrade. <http://pod2.stat.gov.rs/overakorisnika/ok.aspx?knjigaId=45&jezik=sr-cir> (15. 10. 2014).
- SPARKS, P.J., SPARKS, C.S. (2010): An Application of Spatially Autoregressive Models to the Study of US County Mortality Rates. *Population Space and Place*, 16, 6, 465–481.
- SPASOVSKI, M., ŠANTIĆ, D., RADOVANOVIĆ, O. (2012): Historical stages in transition of natural replacement of the Serbian population. *Glasnik Srpskog geografskog društva*, 92, 2, 23–60.
- STOREYGARD, A., BALK, D., LEVY, M., DEANE, G. (2008): The Global Distribution of Infant Mortality: A Subnational Spatial View. *Population Space and Place*, 14, 3, 209–229.
- TOBLER, W. (1970): A computer movie simulating urban growth in the Detroit region. *Economic Geography*, 46, 2, 234–240.
- TSIMBOS, C., KALOGIROU, S., VERROPOULOU, G. (2014): Estimating Spatial Differentials in Life Expectancy in Greece at Local Authority Level. *Population Space and Place*, 20, 7, 646–663.
- UN (2003): Partnership and Reproductive Behaviour in Low-Fertility Countries. United Nations, Department of Economic and Social Affairs, Population Division, New York.
- UN (2013): World Population Prospects, the 2012 Revision, Volume II: Demographic Profiles. United Nations, Department of Economic and Social Affairs, Population Division, New York.
- VAN DE KAA, D.J. (1996): Anchored Narratives: The Story and Findings of Half a Century of Research into the Determinants of Fertility. *Population Studies*, 50, 3, 389–432.
- VAN DE KAA, D.J. (2002): The Idea of a Second Demographic Transition in Industrialized Countries. Paper presented at the Sixth Welfare Policy Seminar of the National Institute of Population and Social Security, Tokyo, Japan, 29 January 2002.
- VOJKOVIĆ, G. (2003): Population as an Element of Regionalization of Serbia. *Stanovništvo*, 41, 1–4, 7–42.
- WALFORD, N., KUREK, S. (2015): Outworking of the Second Demographic Transition: National Trends and Regional Patterns of Fertility Change in Poland, and England and Wales, 2002–2012. *Population Space and Place*, Published online in Wiley Online Library, DOI: 10.1002/psp.1936.
- WEINREB, A., GERLAND, P., FLEMING, P. (2008): Hotspots and Coldspots: Household and village-level variation in orphanhood prevalence in rural Malawi. *Demographic Research*, 19, 32, 1217–1248.
- YÜCESAHİN, M.M., ÖZGÜR, E.M. (2008): Regional Fertility Differences in Turkey: Persistent High Fertility in the Southeast. *Population Space and Place*, 14, 2, 135–158.

SUMMARY

Prostorové vzorce nedávných demografických trendů v Srbsku (1961–2010)

Srbsko představovalo v průběhu posledních padesáti let celoevropský fenomén, pokud jde o regionální divergenci demografických trendů, způsobenou odlišným přirozeným přírůstkem obyvatelstva. Vlastně tu souběžně fungovaly dva opačné reprodukční režimy – ten kosovský vedl k jednomu z nejvyšších populačních přírůstků na světě, kdežto ten druhý probíhal ve zbytku země ve znamení depopulačních trendů. Rozdílné vzorce nedávných demografických trendů byly zřetelné též na subregionální úrovni v důsledku rozdílného počátku a tempa demografického přechodu u přirozeného přírůstků obyvatelstva. To bylo dáno odlišnými historickými, národnostními, kulturními a ekonomickými faktory, přičemž národnost je zpravidla pokládána za ten klíčový, jak to odpovídá poznatkům z jiných národnostně heterogenních společností.

V této studii byly použity náležitě prostorové statistické ukazatele ke zjištění časoprostorové dimenze změn velikosti populace, míry přirozeného přírůstků a kojenecké úmrtnosti v Srbsku v letech 1961 až 2010. Také bylo zkoumáno prostorové rozmístění vzájemné korelace u časových řad údajů o velikosti populace, míře přirozeného přírůstků a kojenecké úmrtnosti. Aplikované metody nám umožnily ověřit, zda prostorové vzorce pozorovaných demografických trendů poukazují na demografickou homogenizaci země (s vyloučením Kosova) ve sféře depopulace, jak bylo naznačeno v nedávných studiích. Máme-li na zřeteli, že kromě Romů jsou národnostní menšiny v Srbsku prostorově soustředěny v konkrétních obcích nebo jejich skupinách, výsledky uvedené v tomto příspěvku také odrážejí vliv odlišných demografických měř podle národnosti na vznik prostorových shluků.

Byl použit globální Moranův index I , místní Moranův index I a metoda Getis-Ord G_i^* z oboru statistiky prostorové autokorelace ke změření a zjištění, jak se obce v Srbsku shlukují, nebo naopak rozptylují, pokud jde o hodnoty trendů, vypočítané za padesátileté časové řady u velikosti populace, míry přirozeného přírůstků a míry kojenecké úmrtnosti.

V případě demografických odlišností během analyzovaného období byl rozhodující přechod u plodnosti. Pokud se vyloučí Kosovo jakožto výjimečný případ v evropském kontextu, pro Srbsko byla po celé období 1961 až 2010 charakteristická úhrnná míra plodnosti pod úroveň prosté reprodukce. Tento pokles byl rychlejší i hlubší než ve většině evropských zemí, i když tu působily tytéž obecné determinanty poklesu plodnosti, jako například osvojení nových norem a hodnot, rostoucí úroveň zapojení žen do pracovního procesu a antikoncepce. Kosovo je současně charakterizováno pomalým snižováním výjimečně vysoké úhrnné míry plodnosti, jež se posléze kolem roku 2010 přiblížila úrovni prosté reprodukce. Statistický úřad Srbska nedávno vydal v padesátileté časové řadě za úroveň obcí Srbska soubor údajů o velikosti populace, míře přirozeného přírůstků a kojenecké úmrtnosti, jenž byl zkoumán v tomto příspěvku. V případě Kosova zahrnovala časová řada období 1961–1997, protože statistika přirozené změny a pohybu obyvatel za obce není k dispozici za období 1998 až 2010, ať již ve Statistickém úřadu Srbska či v nedávno založeném Statistickém úřadu Kosova.

I při velice nízké míře přirozeného přírůstků a někdy i úbytku a dále snižujícím se populačním trendům v celém Srbsku vyjma Kosova, způsobených stálou, dlouhodobou mírou plodnosti pod úroveň prosté reprodukce, vyplývá z ukazatelů prostorové autokorelace, že se takové zaostávání nadále uplatňuje při vytváření demograficky výrazných prostorových shluků.

Díky místnímu Moranově indexu I lze vydělit subregiony, které se vzájemně velice liší, pokud jde o nástup intenzivního poklesu míry porodnosti v souladu s třetí fází demografického

přechodu, jak je to běžně konstatováno. Navíc lze výsledky vykládat tak, že z nich plyne, že tyto subregiony, kde nastal úbytek přirozené měny obyvatelstva jako první (severovýchod středního Srbska), vlastně představují centrum druhého demografického přechodu v Srbsku. Analýza „zárodečných míst“ odhalila rozsáhlou oblast kolem jádra, odkud se šíří různými směry. Také z ní plyne, že jak jihozápadní, tak jihovýchodní subregion středního Srbska jsou mnohem bližší Kosovu než severním oblastem země. To ovšem neudivuje, bereme-li v úvahu zpožděný počátek a tempo prvního demografického přechodu, což se může projevit v nástupu a zpoždění budoucí difuze nového demografického režimu na jihu.

Podobně jako míra přirozeného přírůstku, i obě opačné oblasti u přechodu kojenecké úmrtnosti byly podrobeny shlukové analýze. Jelikož lze kojeneckou úmrtnost pojímat jako specifický syntetický ukazatel socioekonomických poměrů, zdá se, že rozbor právem umístil nejméně rozvinuté subregiony středního Srbska do téhož shluku s Kosovem.

Konkrétní výsledek analýzy týkající se pohybu obyvatel ukazuje, že homogenizace Srbska vyjma Kosova v případě depopulace není tak jednoznačná, jak bývá v současné literatuře běžně přijímána. Nejhustěji zalidněná oblast města Bělehradu, do níž lze zahrnout i gravitační sféru každodenně dojíždějících lidí, je konfrontována s výraznými hraničními subregiony s depopulací na severu a východu, z čehož lze odvodit vývoj monocentrického demografického modelu, podobného sousedním postkomunistickým zemím. To je podpořeno prostorovým rozmístěním korelačních koeficientů mezi údaji o velikosti populace a mírou přirozeného přírůstku. Lze proto právem očekávat, že se bude depopulační proces v nadcházejícím období nadále šířit kolem hlavního města i na účet hrstky zbývajících větších regionálních center.

Třebaže u této analýzy nebyla dostupná rozdílná míra přirozeného přírůstku podle národnosti, na základě prostorové analýzy populačního vývoje se jasně vyčlenily obce, kde naprosto převažuje albánská národnostní menšina. Avšak analýza se zaměřením na míru přirozeného přírůstku a kojenecké úmrtnosti (až na místní Moranův index I v případě Albánců) neukázala žádné výrazné shluky podle národností. Spíše poukázala na seskupování v důsledku rozdílných stadií demografického přechodu mezi subregiony v daném období, zejména v případě míry přirozeného přírůstku. Kosovo tudíž představuje střed širší oblasti šířící se po jihu Srbsku, jež jako poslední vstoupila do posledního stadia demografického přechodu. Týkalo se to všech subregionálních národnostních menšin, které vynikají vysokou plodností (Albánců, Bosňáků, Muslimů). Konečně máme-li na zřeteli uvedené prostorové shluky, jež odrážejí rozdílný nástup a tempo změny reprodukčního režimu, mohlo by být cenné, kdyby příští analýza tohoto typu výslovně zahrнула běžné ukazatele druhého demografického přechodu v Srbsku.

Obr. 1 Poloha Srbska v Evropě

Obr. 2 Rozložení prostorově nejhomogennějších národnostních menšin podle obcí Srbska. Údaje za Kosovo se vztahují k roku 1991, poslední dostupný rok za národnostní složení na úrovni obcí. Pokud by byly k dispozici i údaje ze sčítání z roku 2011 o národnosti, ukázaly by vyšší podíl Albánců ve všech obcích, snad až na nejsevernější oblast, máme-li na zřeteli, že se po roce 1999 většina Srbů z Kosova vystěhovala (většinou do středního Srbska).

Obr. 3 Prostorové rozmístění trendů u míry přirozeného přírůstku na úrovni obcí Srbska

Obr. 4 Prostorové rozmístění trendů u kojenecké úmrtnosti na úrovni obcí Srbska

Obr. 5 Prostorové rozmístění trendů u pohybu obyvatel na úrovni obcí Srbska

Obr. 6 Prostorové rozmístění korelačního koeficientu u časové řady velikosti populace, míry přirozeného přírůstku a míry kojenecké úmrtnosti