

# Impact of migration and natural reproduction on the development of the Slovak–Hungarian ethnic boundary in eastern Slovakia, 1991–2018

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The study evaluates the spatial development of the Slovak–Hungarian ethnic boundary emphasising the role of migration and natural reproduction at the regional and local levels. Using the case study of eastern Slovakia enables assessment development in relatively stable territories and territories where there are intensive changes in the ethnic structure of the population. It also contains remote rural areas and urban areas, including the city of Košice and its dynamically developing suburban zone. Application of statistical methods to the wide range of data sources, their graphic and cartographic visualization show the shrinking of the Hungarian dominant area. The results suggest that the ethnically Hungarian population is declining, especially in municipalities and areas with migration gains and natural decrease of the population with the increasing significance of migration in this development. This has led to the enlargement of the ethnic boundary to the south and the emergence of ethnic enclaves. However, the area with Slovak dominance has not spatially expanded.

## Introduction

The population is a dynamic spatial entity constantly developing with changes in its size, structure, and distribution. The total population growth of a certain area is determined by natural reproduction and migration of population. These processes are usually interconnected with other structural traits, such as age, sex, educational attainment, social status, ethnicity or religion (KC et al. 2010, Vobecká–Piguet 2012, Káčerová et al. 2014, Novotný–Pregi 2015). Thus, in addition to changes in the size and spatial redistribution of the population, the natural reproduction and migration of population cause changes in the structure of the population according to age (Stockdale 2006, Ouředníček 2007, Stojšavljević–Pantelić 2013, Bernard et al. 2014, Bernard–Bell 2015, Hedberg–Haandrikman 2014, Hochstenbach 2018), education

(Stockdale 2006, Ouředníček 2007, Tammaru–Leetmaa 2007, Šprocha 2011, Faggian et al. 2017, Kooiman et al. 2018) and ethnicity or religion (Novotný–Pregi 2016) at various spatial levels. Especially in areas where there are several ethnicities or nationalities, the differentiation of migration preferences (Kontuly–Tammaru 2006, Bolt et al. 2008, Kährlik–Tammaru, 2009, Coleman 2010, Anniste–Tammaru 2014, Crowder et al. 2015) and patterns of natural reproduction (Gabal 1999, Coleman 2006, 2010, Milewski 2010) influenced by this structure are observed. At the same time, however, migration and natural reproduction cause changes in the structure and spatial distribution of ethnicities (Bolt et al. 2008, Finney–Simpson 2008, Simpson et al. 2009, Andersen 2010, Coleman 2010, Kandylis et al. 2012, Novotný 2012, Andersson 2013, Repaská 2013, Hedberg–Haandrikman 2014, Novotný–Pregi 2015).

Many studies have indicated the strong impact of interregional or intranational migration on changes in the ethnic structure of the population (e.g., Szilágyi 2002, Bolt et al. 2008, Finney–Simpson 2008, Simpson et al. 2009, Andersen 2010, Coleman 2010, Kandylis et al. 2012, Hedberg–Haandrikman 2014, Crowder et al. 2015, Novotný–Pregi 2015, Benedek et al. 2018, Glorius 2018, Farkas–Dövényi 2018). Many authors (e.g., Gabal 1999, Coleman 2006, 2010, Milewski 2010, Daugirdas–Pociute-Sereikiene 2018) also emphasize the strong impact of natural reproduction of the population, stemming from differentiated cultural, social, and reproductive behaviour of particular ethnic population subgroups. However, unlike the population structure according to biological traits (age and sex), it is impossible to explain all changes in the ethnic structure of the population only by migration and natural reproduction. In addition to the differentiated population dynamics of individual ethnic groups, the ethnic structure is also influenced by sociological processes, statistically much more difficult to grasp. It is mainly assimilation (Siwek 1996, Majo 2009), the intensity of which is also influenced by the spatial compactness of ethnic settlement (Majo 2014, Tátrai 2017). The methods of determining ethnicity can also have a significant impact. For example, in the ongoing (2021) census in Slovakia, individuals can state two ethnicities they identify with, while only one ethnicity could be mentioned in the previous census. Although similar changes bring new knowledge, they make it difficult to compare data in longer time series. Therefore, assessing the impact of specific factors on changes in the ethnic structure of the population in space and time is very difficult.

According to Szarka (2003), the current national borders in Central Europe are not the result of ethnic processes but from various political decisions and historical events. In shaping the borders of the new states after the First World War, economic, transport, and military-strategic factors played an important role alongside the ethnic structure of the population (Djurbová 2020). In this part of Europe, several ethnically heterogeneous states emerged, where, in addition to the major ethnic group, several minority ethnic groups live more or less compactly. In

many of the successor states of Austria-Hungary, including Slovakia, Hungarians are the largest ethnic minority, but other larger or smaller ethnic groups are also present. This makes research of changes in the ethnic structure of population in temporal and causal context much needed, especially in this European macro-region.

This study evaluates the spatial development of the Slovak–Hungarian ethnic boundary in eastern Slovakia, emphasising the role of migration and natural reproduction at the regional and local levels.

### **Theoretical background**

In Slovakia, as in other countries in the Carpathian (Pannonian) Basin, a continuous decline in the size of the Hungarian population has been observed in recent decades (Gyurgyík 2003, 2005, 2008, 2009, Kiss 2012, Szarka 2003, Tátrai et al. 2018). Since the 1991 census, the number of people declared as Hungarian nationals have fallen from 567,296 by almost 110,000 to 458,467 in 2011. The significant decline in the share and number of such inhabitants is mainly attributed to three population processes – migration, natural reproduction, and assimilation (Szarka 2003, Gyurgyík 2005, 2008, 2009, Majo 2011, 2014, Tátrai 2017, Megyesi–Péti 2019).

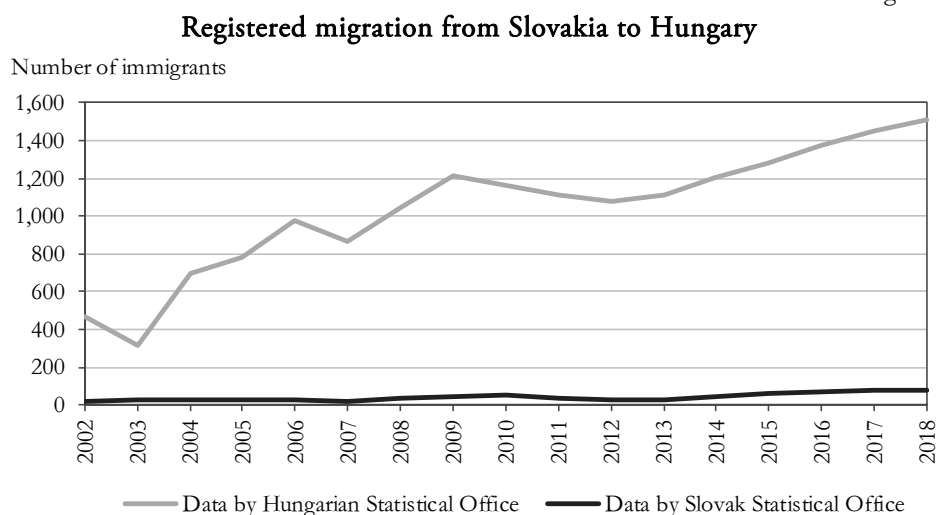
Changes in demographic behaviour with a certain time lag behind Western countries occurred in the second half of the 20th century in Central and Eastern Europe, especially in the reproductive and family behaviour of the population (Mládek 2008, Ubarevičiene et al. 2021). These changes are due to a deep decline in children born in Slovakia since the late 1970s and reduced natural reproduction (Bačík 2014). The transformation process of the economic and social system in the 1990s accelerated these trends (Mládek 2008). Even in the case of the Hungarian minority, the natural increase turned into a decrease (Gyurgyík 2005). The fertility of Hungarian women is slightly lower than the national average, but the mortality of the Hungarian minority is significantly higher than in the general population (Gyurgyík 2005). Furthermore, the lower birth rate has led to a steady increase in the proportion of older age groups. Therefore, the age composition of the Hungarian population is becoming increasingly unfavourable and is aging at a faster pace than on a national scale (Gyurgyík 2008). The differences in natural reproduction of Hungarians and Slovaks in Slovakia are addressed by Gyurgyík (2008).

In the 1990s, a fundamental shift in migration flows between urban and rural communities occurred. The traditional migration from rural to urban areas was replaced by intensive migration in the opposite direction (Bezák 2006). The processes of suburbanization and decentralization cause the ethnic structure of the population in the suburban areas to converge to the ethnic structure of cities and large towns (Novotný 2014, Novotný–Pregi 2015). As the share of the Slovak

population is generally higher in urban communities, migration directly contributes to the decrease of the share of the Hungarian population in many suburban areas. Additionally, migration also affects the birth and death rates, thus significantly affecting the reproductive and family behaviour in particular regions (Gazda–Novotný 2014).

When addressing spatial aspects of internal (Bezák 2006, Šveda–Podolák 2014) and cross-border (Gyurgyík 2005, 2009, Bleha–Popjáková 2007) migration, scholars also highlight the phenomenon of incomplete migration records, resulting from both migration registration methods and inconsistencies between statistically recorded and the real number of inhabitants in spatial units of various levels. Particularly, cross-border migration is more difficult to record, data on it are not accurate and objective (Bleha–Popjáková 2007). Gyurgyík (2009) calls this phenomenon a „hidden migration”. This hidden migration is considered a decisive factor in shrinking the Hungarian minority in Slovakia (Gyurgyík 2009, Tátrai 2017). This is also indicated by a substantial difference in the number of migrants from Slovakia to Hungary recorded by the Slovak and Hungarian Statistical office (Figure 1). However, despite this difference, both data sources indicate an increasing volume of migration. Due to the integration of Slovakia and Hungary into the EU and the Schengen area, the mobility between the two countries has been simplified, and the need for its official documentation has been reduced. Therefore, the number of individuals from Slovakia living in Hungary for a long time is significantly higher than the official statistics.

Figure 1



*Data sources:* HCSO (2019), SOSR (2019).

Majo (2009, 2011) emphasizes the importance of assimilation and the role of migration and natural reproduction of the population when analysing changes in the

ethnic structure of the population. However, monitoring this process statistically is difficult. Gyurgyík (2008) assumes a considerable degree of assimilation in two directions in the case of the Hungarian minority in Slovakia. The more significant is the assimilation towards the majority Slovak ethnicity, which is more intensive intergenerationally while intragenerational changes are less significant. The statistically significant increase in the number and proportion of the Roma population at the expense of the Hungarians, which cannot be explained only by the different intensity of natural reproduction, indicates the ongoing assimilation of the Hungarians towards the Roma. However, in the census before 1989, self-identification was not possible, so the Roma usually declared the ethnicity of the ethnic majority in a given municipality. Declaring Roma ethnicity has been possible since the 1991 census, and Roma has used this opportunity increasingly. Therefore, this phenomenon reflects changes in the census methodology, not necessarily actual assimilation (cf. Gyurgyík 2008).

An important factor influencing the development of the ethnic structure is the spatial distribution of individual ethnic groups, i.e., the spatial compactness of ethnicity. In a more compact and homogeneous ethnic space, it is much easier to maintain ethnic identity than in a diasporic one (Majo 2014). Thus, the higher the homogeneity of ethnic settlement, the lower the degree of assimilation (Tátrai 2017).

According to Szarka (2003), the most important spatial characteristic of Hungarian-Slovak interethnic relations is forming the language boundary. Following Majo–Kusendová (2007), this is understood as the ethnic boundary. Siwek (1996, pp. 11–12) defines an ethnic boundary as „A zone (ideally a line) situated between neighbouring areas inhabited by members of different ethnic groups and in which elements of belonging to those ethnic groups occur in parallel, to such an extent that, according to those elements, it cannot be attributed with certainty in any of the neighbouring areas.” However, Šutaj (2001) highlights that the ethnic boundary cannot be considered a clear line separating the two ethnic groups because it would mean complete segregation. Moreover, municipalities in southern Slovakia are not ethnically homogeneous. Therefore, the ethnic boundary should be understood as a territory or zone where two ethnic groups live together or side by side. Majo–Kusendová (2007) also define the ethnic boundary as a contact zone. They state that the ethnic boundary has a linear character only in exceptional situations. In most cases, it represents a larger or smaller zone, i.e., a transitional zone between territories inhabited by predominantly one ethnic group.

Based on Szarka (2003), Majo–Kusendová (2007) singled out three types of ethnic boundaries between Slovaks and Hungarians in Slovakia. The first type is the *sharp ethnic boundary*, the most common in the past. This type indicates a high degree of social and cultural closure or spatial distribution of ethnics determined by physical-geographical barriers (e.g., river or mountain range). Another type is the *striped ethnical boundary* represents the historical border between the territories

inhabited by Slovaks and Hungarians. This type is more fragmented and occurs in more physically and geographically fragmented areas, where the territories of one ethnic group penetrate deeper into the territory of the other ethnic group. The third type of ethnic boundary is the *blurred ethnic boundary*, forming in Slovakia under various factors (e.g., assimilation, migration) contributing to the formerly homogeneous ethnic structure.

### **Spatial frame, data, and methods**

According to the 2011 census, Hungarians are the largest ethnic minority in Slovakia. They are spatially concentrated in the southern border regions, forming a wider or narrower but mostly spatially compact territory with a predominance of the Hungarian population. In many municipalities in these regions, especially those located in the proximity of the border with Hungary, the dominance of the Hungarian population is very significant. It forms a relatively ethnically homogeneous Hungarian territory. However, its share is gradually declining northwards, creating an ethnic boundary. The Slovak–Hungarian ethnic boundary runs through southern Slovakia, from southeast of Bratislava through Senec, Nitra, Levice, Rimavská Sobota, Rožňava, Košice, Veľké Kapušany to the border with Ukraine. To the north of this boundary, the territory is exclusively ethnically homogeneous Slovak.

Over the last decades, the relatively homogeneous territory with a strong majority of the Hungarian population has shrunk considerably. The decrease of the ethnic Hungarian population is significant even in the Hungarian homogeneous areas. According to Gyurgyík (2008), the most significant changes in the ethnic structure of the population occur along the ethnic boundary. These manifestations are most visible in Bratislava and its surroundings, in the triangle of towns Levice–Nitra–Nové Zámky, in the Košice region, and the area between Košice and the towns of Kráľovský Chlmec and Veľké Kapušany. Nevertheless, south of more than 650 km long Slovak–Hungarian boundary, there are still territories characterized by considerable internal homogeneity, both in ethnic composition and in the demographic process.

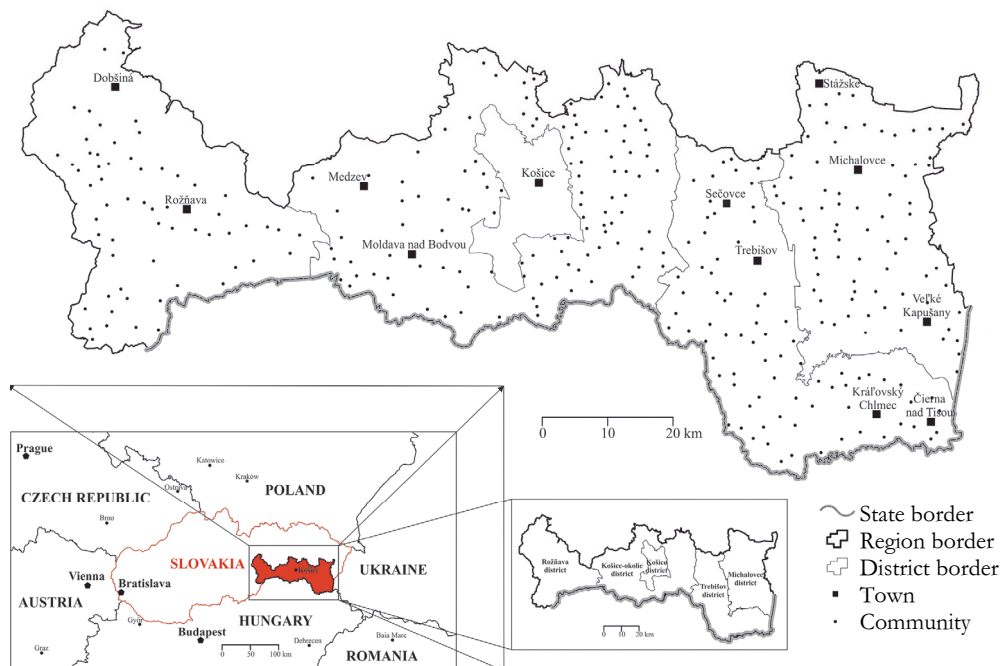
This study focuses on the ethnic boundary in eastern Slovakia (Figure 2), as this region, according to Gyurgyík (2008), contains both relatively stable territories and territories where there are intense changes in the ethnic structure of population and where the development of ethnic boundary dynamic changes have occurred. It also contains remote rural and urban areas, including the city of Košice and its dynamically developing suburban zone. Although Košice is among the most important economic centres in Slovakia, eastern Slovakia is economically the most lagging Nomenclature of territorial units for statistics2 (NUTS2) in the country suffering from migration loss from internal migration. However, it shows relatively

good economic performance than the NUTS2 of the surrounding countries (Koroutchev–Novotný 2020).

In this model region, we evaluate the impact of spatial redistribution processes (migration and natural reproduction) on the development of ethnic boundary in the districts of the Košice region (Rožňava, Košice-okolie, Trebišov and Michalovce) adjacent to Slovak–Hungarian state border, and the city of Košice. Municipalities, where neither Slovak nor Hungarian ethnicity reached at least 75% of the total population, are considered as the *ethnic boundary*. If the proportion of Slovak or Hungarian ethnicity was 75% or more, it was included in the territory with a relatively homogeneous representation of the given ethnic group (hereafter referred to as *Slovak homogeneous areas* and *Hungarian homogeneous areas*).

Figure 2

### Location of the researched region



We also pay special attention to the population of the Roma ethnic group due to its specific reproductive behaviours (Veselovská–Pirová 2014), differing significantly from the reproductive behaviours of Slovak or Hungarian ethnic populations. This subsequently affects the development of population structure according to age, natural increase, and even migration patterns in individual municipalities (Novotný 2014, Novotný–Pregi 2015). However, most Roma declare themselves Slovak or Hungarian ethnicity in population census – depending on whether they live in municipalities or areas with a predominance of Slovak or Hungarian population.

Therefore, determining the real number and share of the Roma minority in Slovakia is very difficult. A much more detailed picture of the number and spatial distribution of Roma in Slovakia is provided by the Atlas of Roma Communities (Radičová et al. 2004, Mušíňka et al. 2014, SGPRC 2019). Due to the inconsistency between external classification and self-identification of Roma, reproductive behaviours and migration trends of the Roma ethnic group are attributed to the Slovak and Hungarian ethnicities. Following previous studies (Novotný 2014, Novotný–Pregi 2015), we observe the relationship between ethnic structure and selected indicators of population redistribution individually in groups of municipalities where the share of Roma in the total population according to the Atlas of Roma Communities (Radičová et al. 2004, Mušíňka et al. 2014, SGPRC 2019) exceeded or did not exceed 20% in each of three defined kinds of areas (Slovak homogeneous, Hungarian homogeneous and ethnic boundary).

This study evaluates the period 1991–2018. This period covers key development trends of migration and natural reproduction of population in various stages of post-socialist transformation, accompanied by the break-up of previous migration patterns and natural reproduction of population (Bezák 2006, Mládek 2008) and the emergence and establishment of new ones (Novotný 2016). To capture various trends under changing circumstances of the post-socialist development, we divided the observation period into three intervals 1991–2000, 2001–2010, and 2011–2018. The beginning of each period is the same as the year of the census.

The research is based on three basic sources of statistical data. First, data on mid-year population and population dynamics (number of immigrants and emigrants, number of births and deaths) for each year are drawn from the Balance of Population Movement (SOSR 1991–2018). Second, when analysing the development and changes in the population structure according to ethnicity, for 1991, 2001, and 2011 we use data from the last three population census (SOSR 1991, 2001, 2011), and for 2018 the data from the Balance of Population Movement by Ethnicity (SOSR 2018). All these data were obtained at the individual municipalities. After harmonisation, it was aggregated into three main categories of areas (Slovak homogeneous, Hungarian homogeneous, and ethnic boundary), and within each category, separately for municipalities with a larger representation of the Roma population and without it. Third, the data from 2018 are based on the 2011 census and consider the number of births and deaths, immigration and emigration by ethnicity until 2018. This means that, unlike intercensal periods, the period 2011–2018 does not capture possible intragenerational assimilation or changes in perception of one's ethnic identity.

To analyse the development of the ethnic structure of the population, we used a simple indicator – the percentage of a particular ethnic group in the total population of a given spatial unit. However, the results of the 2011 census show a certain degree of inaccuracy (cf. Novotný–Pregi 2015, 2016), resulting in relatively high



proportions of the population with undetected ethnicity. Particularly, based on data for 2011 and 2018, the analysis could statistically reduce the percentage of the population of any specific ethnic group and, thus, artificially increase the extent of the ethnic boundary. Therefore, we did not consider the population with unknown ethnicity, and we deducted the number of such citizens from the size of the mid-year population.

We evaluated the population's migration trends and natural reproduction by the net migration and natural increase rates. We chose relative values for better comparability of developments in spatial units with various sizes of the population. The influence of the process of spatial redistribution of the population on the development of the ethnic boundary (i.e., the degree of intensity of the linear correlation between changes in the ethnic structure of the population and migration or natural reproduction of the population) is expressed using Pearson's correlation coefficient (Cohen 1977). For cartographic visualisation, inverse weighted distance (cf. Novotný–Pregl 2018) was employed. Geographical centres of municipalities form entry point fields, and proportions of analysed ethnic groups are interpolated values.

### **Trends of natural reproduction and migration**

Considerable spatial differentiation is a general feature of natural reproduction in Slovakia (Podolák 2006). While many regions in western and central Slovakia show long-term natural decrease and northern and eastern Slovakia experience natural increase, the balance of natural reproduction in south-eastern Slovakia is nearing equilibrium that results from above-average natality and mortality (Marenčáková 2006). However, significant differences are observed in the different areas by ethnicity identified in this study (Table 1). The net rate of natural increase value is significantly influenced by ethnicity, most pronounced in municipalities with a higher share of the Roma population. In municipalities with a Roma population of over 20% (regardless of whether it is an ethnic boundary, Slovak, or Hungarian homogeneous area), the net rate of natural increase is considerably higher than in municipalities with a lower proportion of Roma. The group of municipalities with a higher proportion of Roma in all three categories of areas by ethnicity and all three time intervals of research recorded a positive balance of natural reproduction (except areas with a relatively homogeneous Hungarian population in 2011–2018).

The three territories, defined based on the percentage of Slovaks and Hungarians, in which the Roma population does not represent a significant minority, also show a certain differentiation of natural reproduction processes. The development of the net rate of natural increase in the Slovak homogeneous territory and the territory of the ethnic boundary is similar. However, while both areas show a natural increase during the entire observation period, the population in the Hungarian homogeneous territory shows a natural decrease. The growing intensity

of the natural decrease of the Hungarian minority can be attributed to the constant decline in natality and the increase in mortality.

Table 1

**Development of balance of natural reproduction and migration  
in the areas delimited according to ethnicity**

| Period                          | Slovak homogeneous areas |       | Ethnic boundary |       | Hungarian homogeneous areas |       |
|---------------------------------|--------------------------|-------|-----------------|-------|-----------------------------|-------|
|                                 | 1                        | 2     | 1               | 2     | 1                           | 2     |
| Net rate of natural increase, ‰ |                          |       |                 |       |                             |       |
| 1991–2000                       | –3.53                    | –3.55 | –3.06           | 12,61 | –1,55                       |       |
|                                 | <b>–3.53</b>             |       | <b>–4.44</b>    |       | <b>–1.55</b>                |       |
| 2001–2010                       | –1.28                    | –6.28 | –0.19           | –5,37 | –4,74                       | –1,40 |
|                                 | <b>–1.98</b>             |       | <b>–3.15</b>    |       | <b>–2.76</b>                |       |
| 2011–2018                       | –0.53                    | –5.18 | –0.50           | 10,23 | –5,70                       | –0,60 |
|                                 | <b>–1.39</b>             |       | <b>–3.65</b>    |       | <b>–3.34</b>                |       |
| Net migration rate, ‰           |                          |       |                 |       |                             |       |
| 1991–2000                       | –0.06                    | –9.44 | –2.27           | –1,80 | –1,26                       |       |
|                                 | <b>–0.07</b>             |       | <b>–2.20</b>    |       | <b>–1.26</b>                |       |
| 2001–2010                       | –0.85                    | –1.98 | –0.30           | –1.12 | –3.78                       | –1.26 |
|                                 | <b>–0.47</b>             |       | <b>–0.10</b>    |       | <b>–2.16</b>                |       |
| 2011–2018                       | –0.17                    | –0.95 | –2.06           | –0.28 | –1.75                       | –2.14 |
|                                 | <b>–0.04</b>             |       | <b>–1.15</b>    |       | <b>–0.05</b>                |       |

*Notes:* 1 – Municipalities with a proportion of Roma people below 20%, and 2 – Municipalities with a proportion of Roma people over 20% according to Results of the 1991 population and housing census (SOSR 1991) in 1991–2000, Atlas of Roma communities (Radičová et al. 2004) in 2001–2010, and Atlas of Roma communities in Slovakia 2013 (Mušínska et al. 2014) in 2011–2018.

*Data sources:* SOSR (1991–2018).

Individual ethnic areas have specific reproductive behaviour patterns, with more significant differences manifested in municipalities with a higher proportion of Roma (according to the Atlases of Roma Communities). While we observe a decrease in the net rate of natural increase in municipalities without a larger share of the Roma minority, the natural increase slows down in municipalities with a Roma population above 20%. In some areas, it is even increasing. These trends suggest that the Roma ethnic group is the dominant carrier of natural growth in the entire region. This means that the proportion of the Roma population is growing at the expense of the non-Roma population at an increasing pace. However, during the census, Roma tend to declare themselves Slovak or Hungarian, so the change in their share may not be reflected in the development of the Slovak–Hungarian ethnic boundary according to the data of the SOSR.

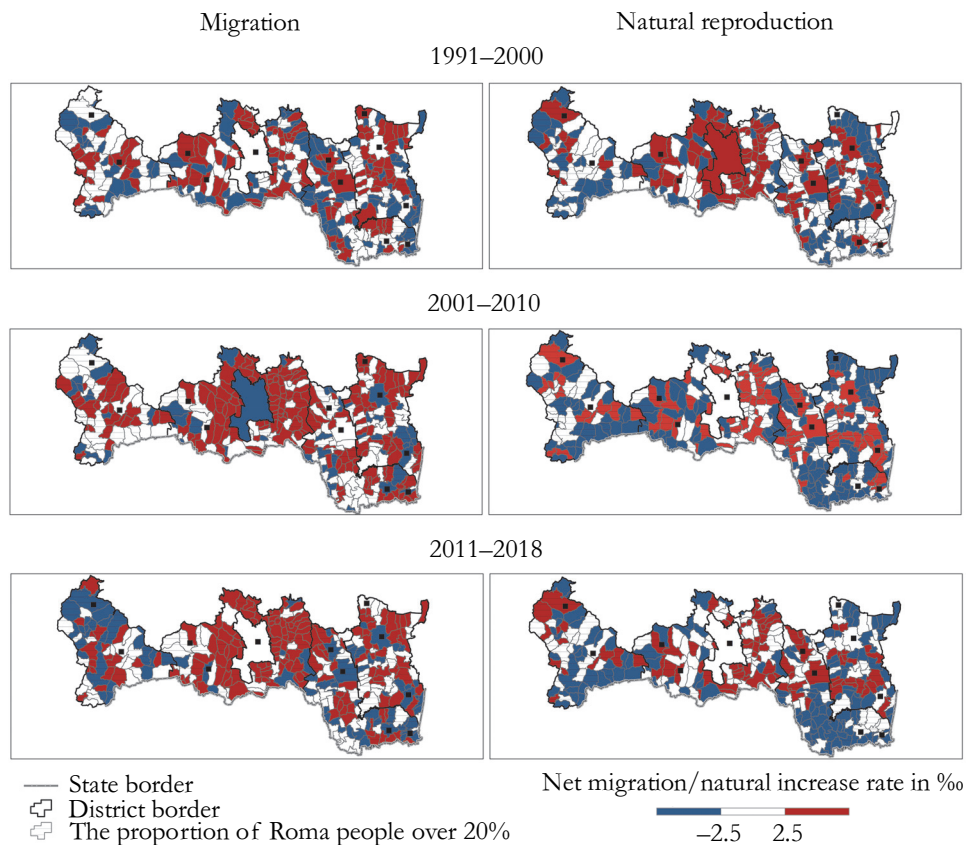
Southern districts of eastern Slovakia have been losing population by migration, except for the district of Košice-okolie, experiencing migration increase, mainly due to intensive suburbanisation of the population from Košice (Novotný 2014). In all areas by ethnicity, migration processes have a smaller impact on the overall development of the population than natural reproduction (Table 1). The differentiation of migration trends in the entire area by Slovak–Hungarian ethnicity is much smaller than in the natural reproduction of the population.

The development of migration at the individual municipalities provides a much more telling picture, especially in the last two monitored periods (Figure 3). The transformation of internal migration trends has resulted in decentralization, i.e. the dispersion of the population within the region from the core to its suburban area is observable in the individually assessed districts. The decentralization process is most intensive and visible in the Košice region, where the region's core (the city of Košice) records a negative migration balance. In contrast, municipalities in its proximity have recorded rapid migration growth. A similar development, but with lesser intensity and smaller spatial extent, can be observed in the vicinity of other towns (Rožňava, Michalovce, Trebišov). Therefore, the share of the Slovak ethnic population in these towns is higher than in many municipalities in their hinterland. The Slovak population in municipalities that have experienced migration increases comprising a share of the Hungarian ethnic population higher than the source of migration record an increase in the share of the Slovak population at the expense of the Hungarians.

Additionally, several studies highlight that younger age groups are largely involved in the decentralization process and suburbanisation (Kok 1999, Bernard 2017, Rees et al. 2017), and the average age of suburbanisers is usually lower than the average age of the population of the target municipality (Novotný 2014, Pregi–Novotný 2017). Migration from the town to the municipalities in its proximity can indirectly increase the birth rate in the given municipalities (Gazda–Novotný 2014), the ethnic structure of new-borns converging with the ethnic structure of immigrants. Therefore, migration has a significant direct and indirect impact on the development of the ethnic boundary. In eastern Slovakia, it applies particularly to the areas in the proximity of Košice and Rožňava.

Figure 3

### Development of balance of natural reproduction and migration at the level of municipalities

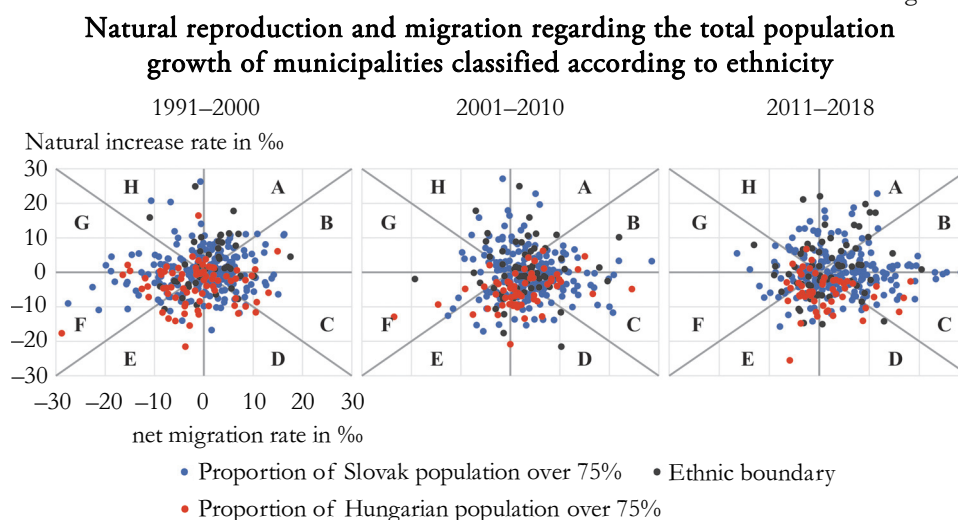


Data sources: SOSR (1991–2018).

Additionally, international migration contributes to the development of ethnic boundaries. Significant emigration of Hungarians from Slovakia to Hungary was recorded in the researched region (Kincses–Bálint 2016a, Kincses–Bálint 2016b, Bálint et al. 2017, Péti et al. 2017, Kincses 2020). However, in the case of both internal and international migration, a significant proportion of flows remain hidden under various forms of unrecorded migration that official statistics do not capture (e.g. residents who study or work elsewhere than in their place of residence for a long time). Several studies point to the hidden migration of citizens of the Slovak Republic with permanent residence in Slovakia but living or studying in Hungary (Takács–Kincses 2013, Kincses 2014a, Kincses 2014b, Pregi 2018).

The natural reproduction of the population also shows clear regularities in the spatial arrangement of municipalities. Most municipalities in the Hungarian homogeneous area show negative values of the net rate of natural increase, especially in the last two intervals, a spatially continuous strip of municipalities with natural decrease formed along the border with Hungary. The development at the level of municipalities, thus, largely corresponds to the development of the entire Hungarian homogeneous area, where there is a significant decrease in the net rate of natural increase at the end of the observed period. While in 1991–2000, a natural increase was recorded mainly by towns and municipalities in their immediate vicinity, only municipalities with a higher share of Roma show statistically significant positive values in the next two intervals.

Figure 4



Data sources: SOSR (1991–2018).

In general, natural reproduction played a decisive role in the total population increase in this region in the first interval of observation. Later, migration became a dominant component. Natural reproduction has retained a key role in the municipalities of the ethnic boundary, as in most of the surveyed municipalities, the natural increase exceeded the migration loss. Thus, the direct impact of migration on population growth in the ethnic boundary is secondary but not negligible. For a graphic representation of the total increase of the population and its basic components at the municipality level according to the Slovak–Hungarian ethnicity, we used Webb's graph (Figure 4). Based on the relationship between migration and natural increase, we classified individual municipalities into eight octants, where octants A to D present total increase and octants E to H total decrease. Octants B, C, F, and G represent municipalities where migration plays a key role, and octants

A, D, E, and H represent municipalities dominated by natural reproduction. Despite the considerable dispersion of municipalities in the graph, the visualization indicates a gradual increase in the importance of migration in all categories of municipalities according to ethnicity.

### **Development of the Slovak–Hungarian ethnic boundary in East Slovakia**

Slovaks dominated the region throughout the whole period of observation. According to the population census from 1991, the share of the Slovak ethnic population in the total population was 79.3%. This share was relatively stable until 2018, when it increased very slightly to 80.3%. In the 1991 census, 15.9% of the population declared Hungarian ethnicity. By 2018, this share decreased to 12.5%, i.e. by 3.5 percentage points. According to the Slovak Statistical Office, the share of the Roma population was 2.9% in 1991, increased to 3.6% in 2001 and 5.2% by 2018. Atlas of Roma communities from 2004 (Radičová et al. 2004), 2013 (Mušínska et al. 2014), and 2019 (SGPRC 2019) offer a completely different picture of its distribution in the region. According to these databases, the share of the Roma population was over 16% in 2004 and 2013, and almost 16.5% in 2019, confirming that a significant part of the Roma population declared themselves Slovak or Hungarian ethnicity in the population census.

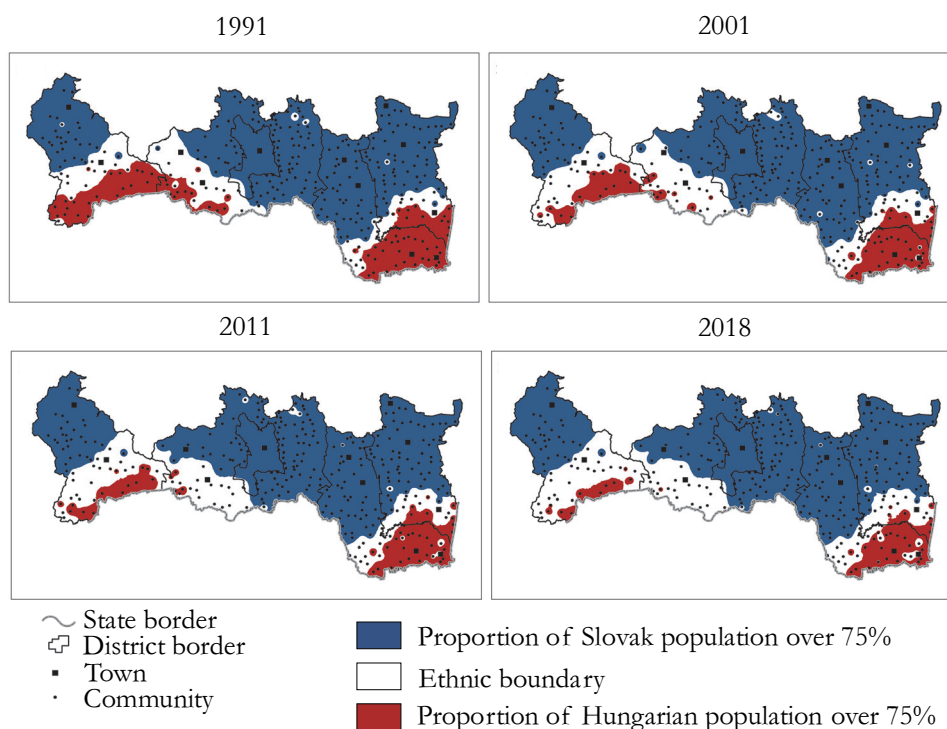
From a spatial perspective, Slovaks dominate mainly in the central and northern parts of the region. In the southern part of the region, municipalities with a relatively homogeneous representation of the Hungarian population are concentrated. The almost continuous territory of municipalities with a homogeneous Hungarian population along the boundary, and the area of the ethnic boundary, are observed in the area south and east of the city of Košice within a few dozen kilometres.

The decrease in the share of the population of Hungarian ethnicity in 1991–2018 reflects the development of the Slovak–Hungarian ethnic boundary in eastern Slovakia (Figure 5). The ethnic boundary widened in the region towards the south at the expense of the Hungarian homogeneous area. The most significant spatial shift of the ethnic boundary at the expense of the Hungarian population was recorded in the western part of the region, in the districts of Rožňava and Košice-okolie. There, the striped ethnic boundary changed into a blurred ethnic boundary. In the Košice-okolie district, by 2018, Hungarian homogeneous areas had almost disappeared favouring ethnic boundaries, primarily a consequence of migration from Košice.

The ethnic boundary in the eastern part of the region, in the districts of Trebišov and Michalovce, was still relatively sharp in 1991. However, unfavourable demographic development of the Hungarian minority, migration and the process of assimilation led to the expansion of the ethnic boundary southward at the expense of the Hungarian homogeneous area.

Figure 5

**Spatial development of Slovak–Hungarian ethnic boundary and Slovak and Hungarian homogeneous areas**



Data sources: SOSR (1991, 2001, 2011, 2018).

Another effect of these processes is the disruption of the spatial integrity of the Hungarian homogeneous area. Several municipalities (e.g. the transport hub Čierna and Tisou) did not reach a 75% share of either Slovak or Hungarian ethnic population. These municipalities can be considered ethnic enclaves, which Majo–Kusendová (2007) define municipalities with a population structure by ethnicity significantly different from the surrounding municipalities. In addition to the Hungarian homogeneous region, such ethnic enclaves also appeared in the ethnic boundary. However, these municipalities, with a dominant Slovak or Hungarian population, are not part of it. We also find ethnic enclaves in the Slovak homogeneous area, but these are usually municipalities with a high proportion of Roma.

The widening of the ethnic boundary to the south is thus accompanied by a reduction in municipalities with at least a three-quarters predominance of Hungarians. Their number decreased from 74 in 1991 to 41 in 2018 (Table 2). However, there was no significant transfer of municipalities from the Hungarian to

the Slovak homogeneous area, rather an increase in municipalities forming an ethnic boundary or ethnic enclaves (46 municipalities in 1991, 72 in 2018).

Table 2

### Number of municipalities in areas delimited according to ethnicity

| Period | Slovak homogeneous areas |    | Ethnic boundary |    | Hungarian homogeneous areas |    |
|--------|--------------------------|----|-----------------|----|-----------------------------|----|
|        | 1                        | 2  | 1               | 2  | 1                           | 2  |
| 1991   | 205                      | 10 | 42              | 4  | 74                          | 0  |
|        | <b>215</b>               |    | <b>46</b>       |    | <b>74</b>                   |    |
| 2001   | 156                      | 64 | 33              | 28 | 49                          | 9  |
|        | <b>217</b>               |    | <b>61</b>       |    | <b>58</b>                   |    |
| 2011   | 147                      | 75 | 36              | 28 | 38                          | 13 |
|        | <b>222</b>               |    | <b>64</b>       |    | <b>51</b>                   |    |
| 2018   | 145                      | 79 | 40              | 32 | 31                          | 10 |
|        | <b>224</b>               |    | <b>72</b>       |    | <b>41</b>                   |    |

*Notes:* 1 – Municipalities with a proportion of Roma people below 20%, and 2 – Municipalities with a proportion of Roma people over 20% according to Results of the 1991 population and housing census (SOSR 1991) in 1991–2000, Atlas of Roma communities (Radičová et al. 2004) in 2001–2010, and Atlas of Roma communities in Slovakia 2013 (Mušínska et al. 2014) in 2011–2018.

*Data sources:* SOSR (1991, 2001, 2011, 2018).

In addition to a decrease of Hungarian municipalities and an increase of municipalities within the ethnic boundary, the results also show a significant increase in the number of municipalities where the share of Roma exceeded 20%, according to the Atlas of Roma Communities. It is mainly a case of the Slovak homogeneous area. According to the latest available data from 2019, 121 municipalities with a significant share of the Roma minority in the analysed region exist. As the Roma population is featured by rapid demographic growth compared to Central European conditions (Podolák 2000), the increase in the share of Roma in the region may continue to contribute to the transformation of the Slovak–Hungarian ethnic boundary.

### Relation of changes in ethnic boundary with natural reproduction of population and migration

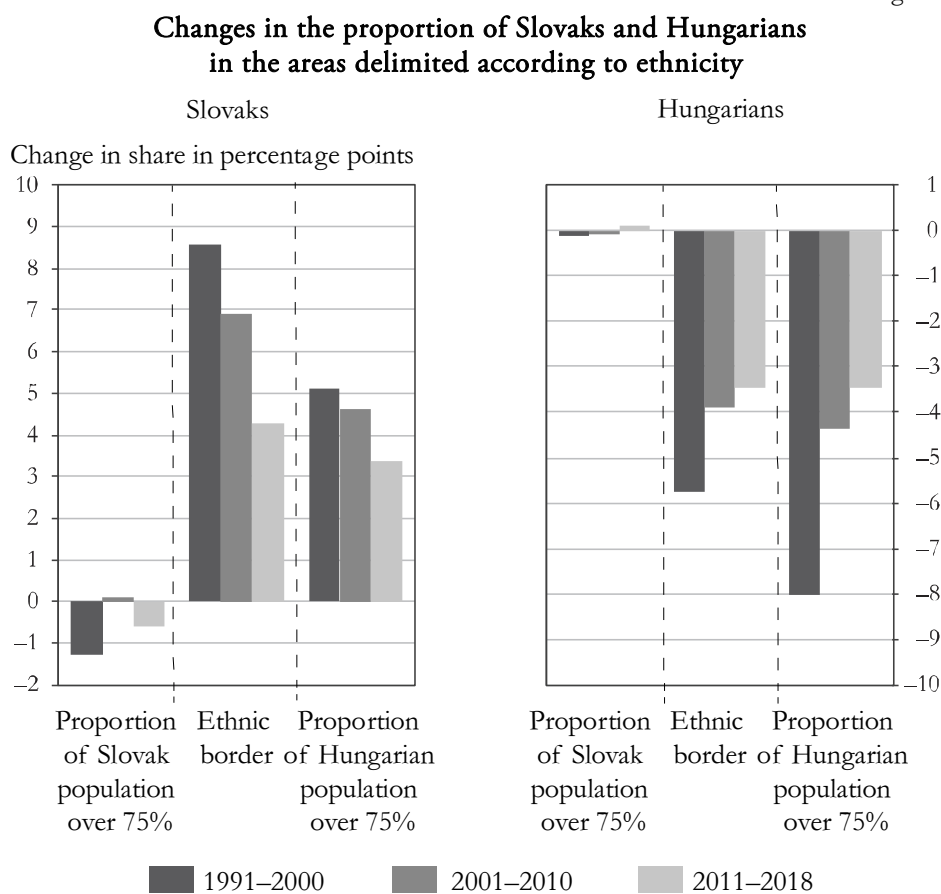
According to ethnicity changes in the Slovak and Hungarian population percentage, three areas delimited as shown in Figure 6. In the Slovak homogeneous area, we observe only an insignificant decrease in the share of Slovaks. However, in the Hungarian homogeneous region and the ethnic boundary, their share has increased significantly, although at a decreasing pace. The largest change occurred in the intercensal period 1991–2001 when the share of Slovaks in the Hungarian



homogeneous territory increased by more than five percentage points, and in the ethnic boundary, even by almost nine percentage points.

In the case of the Hungarian minority, we observe the opposite trend during the entire researched period and in all researched areas, i.e., a decrease in the share of Hungarians (except for the Slovak homogeneous area in the period 2011–2018). The decrease is most significant between 1991 and 2001, especially in the Hungarian homogeneous region (around eight percentage points). In the next two time intervals, the decline was almost the same at the ethnic level.

Figure 6



Data sources: SOSR (1991, 2001, 2011, 2018).

Given that the most significant changes in the ethnic structure of the population occurred in the ethnic boundary and the Hungarian homogeneous region, we assess the strength of the relationship between changes in the share of Slovaks and Hungarians and migration and natural population reproduction processes only in these two areas. Pearson's coefficient of a simple linear correlation was employed to

express the strength of the relationship. To reveal the potential impact of the specific demographic behaviour of the Roma population, we also applied this procedure separately to a group of municipalities where the share of Roma in the total population according to the Atlas of Roma Communities (Radičová et al. 2004, Mušíňka et al. 2014, SGPRC 2019) exceeded and did not exceed 20%.

In the first intercensal period (1991–2000), the correlation between the change in the share of Slovaks and the values of the net migration rate and the net rate of natural increase in the set of municipalities of the ethnic boundary (from which municipalities with Roma population over 20% were excluded), was trivial when evaluated following Cohen (1977). In the following two intervals, the correlation coefficient values with the net rate of natural increase indicate a moderately strong negative correlation; a strong positive correlation was recorded (Table 3) in migration. In the Hungarian homogeneous region municipalities, there is significant variability of values between the monitored indicators, reflected in lower values of the degree of correlation. In natural reproduction, values close to zero were recorded in the first and last intervals. In the intercensal period 2001–2010, a weak negative but not negligible correlation was demonstrated (–0.245). The observed phenomenon shows a stronger relationship with the values of the net migration rate, especially in the first intercensal period, when it reached a positive relationship (correlation coefficient 0.301).

Table 3

**Relationship between the changes in the proportion of Slovaks at the total population of selected communities and the values of selected indicators of spatial redistribution of population**

| Period    | Indicators of spatial redistribution of population, ‰ | Ethnic boundary |        | Hungarian homogeneous area |        |
|-----------|---|-----------------|--------|----------------------------|--------|
|           |   | 1               | 2      | 1                          | 2      |
| 1991–2000 | Net rate of natural increase                          | 0.099           | –0.172 | –0.060                     |        |
|           | Net migration rate                                    | –0.042          | 0.739  | 0.301                      |        |
| 2001–2010 | Net rate of natural increase                          | –0.330          | –0.193 | –0.245                     | –0.465 |
|           | Net migration rate                                    | 0.541           | –0.105 | –0.177                     | 0.260  |
| 2011–2018 | Net rate of natural increase                          | –0.349          | 0.240  | 0.047                      | –0.176 |
|           | Net migration rate                                    | 0.563           | –0.285 | 0.225                      | 0.421  |

*Notes:* 1 – Municipalities with a proportion of Roma people below 20%, and 2 – Municipalities with a proportion of Roma people over 20% according to Results of the 1991 population and housing census (SOSR 1991) in 1991–2000, Atlas of Roma communities (Radičová et al. 2004) in 2001–2010, and Atlas of Roma communities in Slovakia 2013 (Mušíňka et al. 2014) in 2011–2018.

*Data sources:* SOSR (1991–2018).

The correlation coefficient values indicate that the decentralization of the population, i.e. migration from towns to municipalities in their vicinity, has a significant effect on increasing the share of Slovaks and developing the Slovak–Hungarian ethnic boundary. It is so intensive that it can also affect the natural

reproduction of the population. Following Novotný (2014) and Novotný–Pregi (2015), who show on the example of three functional urban regions in the Hungarian border (Bratislava, Lučenec, and Košice) that migrants involved usually have a lower average age and have Slovak ethnicity, it is possible to expect the migration also causes a shift of reproductive potential. Additionally, Slovak families have more children than Hungarian on average (Majo 2009). Thus, it can be assumed that in municipalities that have experienced more significant migration gains, the increase in the Slovak population associated with the natural increase will be more dynamic than in the case of Hungarian ethnicity.

In municipalities with a share of the Roma population over 20%, the strength of the linear correlation between changes in the share of Slovaks and migration and natural reproduction is weak in almost all monitored intervals. However, we observe a strong direct dependence with migration values between 1991 and 2000 in municipalities on the ethnic boundary, a moderate negative net rate of natural increase in the period 2001–2010, and with the net migration rate in the period 2011–2018 in municipalities of the Hungarian homogeneous area.

Compared to Slovaks, changes in the share of Hungarians have a significantly different nature of relationship with the values of selected indicators of population redistribution, both in the area of the ethnic boundary and in the municipalities of the Hungarian homogeneous area (Table 4).

Table 4

**Relationship between the changes in the proportion of Hungarians at the total population of selected communities and the values of selected indicators of spatial redistribution of population**

| Period    | Indicators of spatial redistribution of population, ‰ | Ethnic boundary |        | Hungarian homogeneous area |        |
|-----------|---|-----------------|--------|----------------------------|--------|
|           |   | 1               | 2      | 1                          | 2      |
| 1991–2000 | Net rate of natural increase                          | –0.215          | –0.187 | –0.301                     |        |
|           | Net migration rate                                    | 0.006           | 0.034  | –0.140                     |        |
| 2001–2010 | Net rate of natural increase                          | –0.121          | –0.077 | 0.194                      | –0.010 |
|           | Net migration rate                                    | –0.167          | –0.432 | 0.115                      | –0.728 |
| 2011–2018 | Net rate of natural increase                          | 0.393           | 0.332  | –0.054                     | 0.072  |
|           | Net migration rate                                    | –0.460          | 0.045  | –0.202                     | –0.397 |

*Notes:* 1 – Municipalities with a proportion of Roma people below 20%, and 2 – Municipalities with a proportion of Roma people over 20% according to Results of the 1991 population and housing census (SOSR 1991) in 1991–2000, Atlas of Roma communities (Radičová et al. 2004) in 2001–2010, and Atlas of Roma communities in Slovakia 2013 (Mušínska et al. 2014) in 2011–2018.

*Data sources:* SOSR (1991–2018).

In the first period, this relationship is strongest with a net rate of natural increase, explained by the different reproductive behaviours of Slovak and

Hungarian ethnicity (Majo 2009). While the correlation with both indicators is weak between 2001 and 2010, it is significantly stronger in the last time interval. A moderate-strong negative correlation was recorded in the municipalities of the ethnic boundary in migration, and a moderate-strong positive correlation in natural reproduction. In municipalities with a higher proportion of Roma, the correlation with migration is stronger. The values of the net migration rate show a negative correlation, a moderate-strong correlation.

Specific patterns of reproductive behaviour of Slovaks and Hungarians, and significant differentiation of the net rate of natural increase in the areas delimited according to ethnicity, indicate a significant impact of natural reproduction on the development of the ethnic population. However, changes in the percentage of Slovaks and Hungarians at the municipalities show a stronger relationship with migration, especially in the municipalities of the ethnic boundary.

This suggests that the decisive process in expanding the ethnic boundary southward is due to the intensive decentralization of the population. Therefore, in general, the ethnic structure of the population in municipalities of the ethnic boundary tends to converge with the ethnic structure of the population in towns that are sources of migration flows. This is significant in the municipalities that recorded high migration gains and a lower Slovak percentage than nearby urban cores. These findings largely correspond to the results of other studies that evaluated the impact of spatial redistribution processes on changes in the ethnic structure of the population in selected functional urban regions located on the Slovak–Hungarian ethnic boundary (Novotný 2014, Novotný–Pregi 2015).

## Conclusion

The study confirms the decline of the ethnically Hungarian population and the shrinking of the Hungarian-dominated areas. The ethnically differentiated age structure of the population and the intensity of natural reproduction, internal and international migration, and assimilation, contribute to this development. All these factors work to the detriment of the Hungarian ethnic group and favour the Slovak or Roma ethnic group.

The results suggest that the percentage of the ethnically Hungarian population is declining, especially in municipalities and areas with migration gains and a natural population decrease. After 2001, migration became the dominant factor in this development. From a spatial perspective, these processes lead to the enlargement of the ethnic boundary to the south, at the expense of the Hungarian homogeneous area and the emergence of ethnic enclaves. However, there is no statistically significant spatial expansion of the Slovak homogeneous area.

It is clear that current migration, reproduction, and assimilation trends significantly impact the development of the ethnic boundary in the future.

Therefore, this study is an important basis for future research. Furthermore, the emergence and development of ethnic enclaves, together with the expansion of the territory with a statistically significant but not homogeneous representation of Hungarians, is particularly a research challenge.

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