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COVID-19 AND INTERNAL MIGRATION IN SERBIA—GEOGRAPHICAL PERSPECTIVE

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Abstract: Internal migration is an essential part of regional population change. Driven by various determinants, internal migration has been unequal across time and space. Migration responses to the changes in societal circumstances make it relevant to investigate the spatial and temporal dimension of internal migration in Serbia before and in the aftermath of the COVID-19 pandemic outbreak. The research aims to identify to what extent and in what way the pandemic has changed the magnitude and geographical patterns of internal migration in Serbia. The study is based on additionally processed official statistics on internal migration for the period 2018–2020, from March to December for each year, at the municipal, district (oblast, plural—oblasti), and regional levels. These are aggregate administrative data on usual residence registration by month. The derived data on the net migration rate is cartographically presented using the classification method natural Breaks (Jenks). Spatial dependence was assessed applying the spatial autocorrelation method, based on the Local Moran statistic. The results revealed that the pandemic affected not only the volume of internal migration but also its spatial patterns. The findings present new insights on the role of internal migration in reallocation of population across Serbia before and during the COVID-19 pandemic while underlying the importance of further research to deepen the understanding of internal migration trends upon the COVID-19 outbreak.

Keywords: COVID-19 outbreak; internal migration; population redistribution; spatial patterns; Serbia

1. Introduction

The worldwide pandemic COVID-19 has affected diverse areas of activity and all the segments of the population. It has disturbed the international and internal mobility of the population in the form of border closures and travel restrictions. According to Piccoli et al. (2021), by the end of April 2020, 27 European countries had introduced limitations to internal mobility of the population while the governments of Germany and Italy adopted territorial-specific measures (at the lower territorial level). Population mobility patterns in Serbia have also faced significant changes since March 6, when the first case of COVID-19 was registered. The government in Serbia did not implement any territorial-specific restrictions on the internal mobility of the population, although

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there were occasional restrictions of movement at certain time intervals during a state of emergency that lasted for 52 days, from March 15 until May 6, 2020. In that period, Serbia closed borders for foreign nationals, but the borders remained open for Serbian citizens returning from abroad, as well as for diplomats and foreign citizens with a residence permit.

The COVID-19 pandemic disrupted labor markets, thus affecting migrant workers as well as migration patterns related to different labor market conditions. Furthermore, individuals' migration decisions were linked to personal experiences, aspirations, and choices affected by the changes wrought by the pandemic and coronavirus threats. The diverse impact of the COVID-19 pandemic on migration volume and geographical patterns, migration challenges, and the negative socio-economic and health consequences faced by migrants and their families after the outbreak of the pandemic have been the subject of interest of researchers in various academic disciplines. They have focused on different types of migration and mobility such as international migration (Bhandari et al., 2021), internal migration (Fielding & Ishikawa, 2021), labor migration (Podra et al., 2021), and daily mobility (Shibayama et al., 2021), some of them from a multi-country perspective. However, when it comes to internal migration, the problems of comparability are related to the key definitions and data harmonization reflected in missing commonly agreed on statistical indicators as well as the related data in the international statistical databases that restrict cross-national comparisons on the internal migration (Bell & Charles-Edwards, 2014). While rethinking migration and systematic resilience associated with the COVID-19 pandemic, Anderson et al. (2021) emphasize that the mobility of internal migrants given their national context can also interact with global supply chains.

Given the official statistics (SORS, n.d.-a), for years before the onset of COVID-19 (in the period 2011–2019), the number of internal migrants in Serbia was between 120,000 and 127,000 annually. According to the same source, during the calendar year 2020, around 110,000 Serbian residents moved within the state, down by 13.9% compared to 2019. Their destinations have been relatively consistent over the years. The predominant internal migration flows in Serbia have had spatial (south–north) and hierarchical (rural–urban) directions for decades following the patterns of socio-economic development, increasing disparities in the mentioned relations (Lukić, 2013). Namely, only the three biggest cities in the country (Belgrade, Novi Sad, and Niš) have had a continuously positive balance of internal migration in this century (Lukić, 2022). Lukić and Anđelković Stoilković (2017) revealed the interaction between migration and the socio-economic development of municipalities in Serbia further suggesting the importance of geographic location for migration. Thus, internal migration affects population redistribution and population decline especially in rural and border areas of Serbia (Lukić & Anđelković-Stoilković, 2017). Recent research on the opinion of the population in rural areas of Serbia on the outcomes of the COVID-19 pandemic on the sustainability of Serbian villages included the relevant aspect of emigration from rural areas (Lukić et al., 2022).

This research aims to identify to what extent and how COVID-19 pandemic has changed the magnitude and geographical patterns of internal migration in Serbia. As far as the authors know, only the studies on the impact of the COVID-19 pandemic on international migration have so far been conducted in Serbia (Lukić et al. 2021; Vesković Anđelković, 2021).

2. Methodology

2.1. Data

The study is based on additionally processed annual national official statistics on internal migration for the period 2018–2020, from March to December for each year, at the municipal, district (oblast, plural—oblasti), and regional levels (Statistical Office of the Republic of Serbia [SORS], n.d.-b, n.d.-c, n.d.-d). These are aggregate administrative data on usual residence registration by month. We decided not to use data for January and February to get data for 2020 after the pandemic started and we harmonized that data set with data sets for previous years. Since 1998, the SORS does not have individual data for the Autonomous Province of Kosovo and Metohija (the territory under United Nations Security Council Resolution, No. 1244; United Nations, 1999), so they are not included in the scope of data. The data on the net migration balance are presented at the regional level. To identify differences at the lower territorial levels, we conducted a more detailed analysis with relative values. The data on the net migration rate per 1,000 population at the oblast level were analyzed. When it comes to municipalities, the data on in-migration, out-migration, and net migration rate per 1,000 population of the municipality are presented. An even more detailed analysis is provided displaying the differences in their values between 2020 (the year of the pandemic) and the previous two years.

Unlike the census where internal migration is recorded based on the statement of the respondent, the annual statistics on internal migration is based on the data on persons who have permanently moved from their previous place (settlement) of usual residence to another place (settlement) within the borders of Serbia. The Ministry of Interior is responsible for collecting data on persons who have changed their place of residence. The usual residence is "the place where a citizen has settled down with the intent to live there permanently or a place where the center of his/her life activities, professional, economic, social, and other ties that prove his/her permanent link with the place where he/she has settled in"[1] (Zakon o prebivalištu i boravištu građana [Law], 2011, Act 3). Adult citizens are obliged to register their usual residence within eight days from the day of settling in at the address. Registration of residence at a new residential address also means deregistration of the previous residence on the territory of Serbia, and citizens submit only a request for the registration of the usual residence and not a request for deregistration of the previous residence. According to the Law (2011), a person will have to pay a fine for non-registration of residence within a period prescribed by law.

2.2. Method

This paper adopted demographic statistics, cartographic method, and spatial analysis. Cartographic visualization of the data on the net migration rate is based on one of the most commonly used classification methods, natural Breaks (Jenks, 1967). Data are classified into groups with similar values, and limits are determined based on relatively large differences between them. Thus, a simplified and sophisticated presentation of research results in the form of thematic maps is enabled.

[1]A place where a citizen temporarily stays outside the place of permanent residence in the Republic of Serbia for more than 90 days is a temporary residence.

The next step involved analyzing spatial patterns. To determine whether a spatial dependence between neighboring municipalities exists, when it comes to the maximum and minimum values of positive and negative net migration rates, the method of local spatial autocorrelation was applied. We chose this method due to its ability to indicate the degree of dependence between two phenomena that are located at a relatively short distance in space (Hafsa et al., 2021). The advantage of this method is reflected in the identification of variations of the studied phenomena at the local level (Lović Obradović et al., 2021). Spatial autocorrelation relies on the first law of geography of Tobler (1970). It is based on the Local Moran statistic to detect clusters and outliers (Anselin, 1995). The statistical significance of spatial grouping is determined using *p*-value and *z*-score. If the *p*-value is less than .05, the null hypothesis (e.g., phenomena are randomly distributed in space) is rejected. *Z*-score determines whether clusters or outliers will be formed. If the *z*-score has high positive values, the spatial similarity is detected and statistically significant High-High (high values are in a high-value neighborhood) and Low-Low (low values are in a low-value neighborhood) clusters emerged. In the case of low negative *z*-score, statistically significant High-Low (high values are surrounded by low ones) and Low-High (low values are surrounded by high ones) outliers are formed. High and low indicate the relative values compared with the mean value of a variable. The category not significant indicates that features are not clustered, but randomly distributed in space (high *p*-value).

Moran Index is calculated using the formula:

$$I_i = \frac{x_i - \overline{X}}{S_i^2} \sum_{j=1, j\neq 1}^{n} w_{i,j}(x_j - \overline{X}) \tag{1}$$

where x_i is an attribute for feature i, $\bar{X}$ is the mean of the corresponding attribute, w_{ij} is the spatial weight between features i and j, and

$$S_i^2 = \frac{\sum_{j=1, j\neq 1}^{n} (x_j - \overline{X})^2}{n-1} \tag{2}$$

with n equating to the total number of municipalities (Mitchell, 2015).

This analysis covered 168 municipalities. Oblast-level data were not included in this analysis, as the recommended sample amount for spatial autocorrelation is greater than 30.

3. Results

The volume of internal migration in Serbia in 2020 at the aggregate level from March to December was significantly reduced compared to the two years preceding the pandemic. Namely, for ten months in the calendar year 2020, around 89,000 Serbian residents moved within the state, which shows a decrease compared to the ten-months' period of 2018 (103,000). The decrease in the volume of internal migration in 2020 is more pronounced compared to 2019 (109,000).

The regions characterized by a negative pre-pandemic migration balance (Južna i Istočna Srbija and Šumadija i Zapadna Srbija) continued to decline, while those that had been attracting residents such as Beogradski and Vojvodina region continued to do so (Figure 1). Beogradski region still has the highest volume of internal migration, but there is a noticeable shift in 2020 compared to the previous two years in terms of volume decrease. However, there is a decrease in the volume of in-migration as well as out-migration in all the four regions of Serbia in 2020, compared to two previous years. This is especially noticeable if we compare these data to 2019 when internal migration was the most intense.

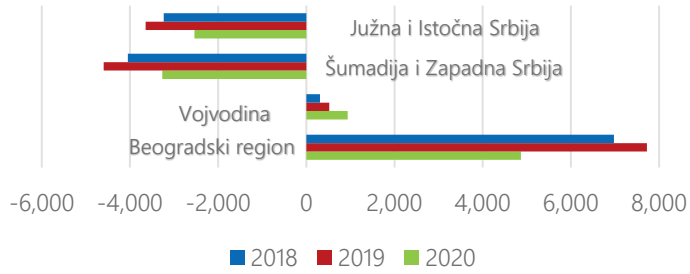

Figure 1. Net migration balance for four Serbian regions in 2018, 2019, and 2020.

Note. Data in figure are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

To assess disparities at lower territorial levels, we have focused on smaller geographic areas such as administrative units of oblast and municipalities. The paper examines shifts in volume, trend, and spatial patterns of internal migration and reveals the changes in population redistribution across the country since the outbreak of COVID-19 when compared to the previous period.

The data on the net migration rate for 2018, 2019, and 2020 (March to December) show interesting patterns at the oblast level. In 2018 and 2019, only two out of 25 oblasti have net migration gains. Those are Beogradska and Severnobačka oblast. In 2020, a positive net migration rate can be noted in even five oblasti—Beogradska, Južnobačka, Nišavska, Severnobanatska, and Zaječarska. Interestingly, there has been a shift in the volume of the net migration rate for Beogradska oblast. In 2018 it was 38.37, while in the following year it was increased to 49.00, and in the year of the pandemic, it was reduced to 34.25.

Figure 2 displays the differences in net migration rates at the level of oblast between 2020 and 2018, and 2020 and 2019 (March–December). Certain similarities, as well as shifts, are noticeable. Perceiving the differences between 2020 and 2018, five oblasti show a negative trend. A negative trend for 2020 minus 2018 is recorded in Severnobačka, Toplička, Moravička, Raška, and Beogradska oblast, while in other a positive migration trend is noted. The highest positive trend is recorded in Južnobačka oblast (16.65).

Comparing the variation between 2020 and 2019, Beogradska and Severnobačka are the only two oblasti that recorded a negative trend. While in Severnobačka oblast negative trends were slightly changed (2020 minus 2019, –2.39; 2020 minus 2018, –2.90), Beogradska recorded

a significant shift of its negative trend—net migration rates 2020 minus 2018 was –4.12, while for 2020 minus 2019 its negative trend is significantly higher and amounts –14.76. Južnobačka oblast still has the highest positive trend, which is slightly lower compared to the previously observed period (12.99). Interestingly, in this period there was a significant shift in Moravička, Raška, and Toplička oblast. In the previously longer observed period (2020 minus 2018), these three oblasti recorded a negative migration trend, while in the shorter observed period (2020 minus 2019) they recorded a positive migration trend due to a smaller volume of out-migration.

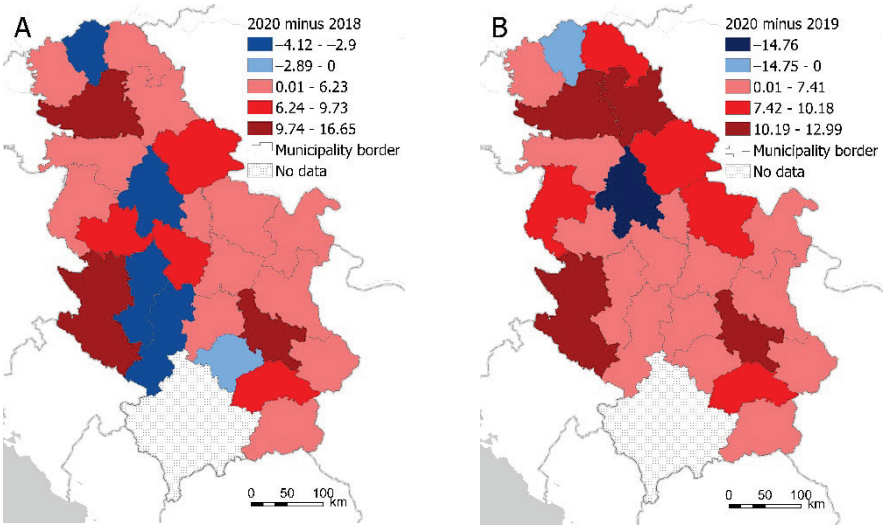

Figure 2. The positive and negative trend of net migration rates 2020 minus 2018 (A) and 2020 minus 2019 (B) by oblast in Serbia from March to December.

Note. Data in figure are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

In the first three months of the pandemic, from March to May (when a state of emergency was in force), the volume of internal migration was significantly reduced. The lowest volume of migration was recorded in April, when only 42 migrants were reported, while in the remaining nine months, on average 9,847 migrants per month were reported (SORS, n.d.-d). No case of out-migration was recorded in 145 municipalities, and no case of in-migration in 143 of them.

Table 1 shows the values of gross out-migration rates for five municipalities with the lowest and highest values for 2018, 2019, and 2020 (March–December). The municipalities that are among the first five municipalities with lower values of gross out-migration in all the three years are Novi Pazar and Medijana. Observing the year of the COVID-19 pandemic, two municipalities in which no lower values have been recorded in the previous two years emerged. These are the municipalities of Kragujevac and Opovo. In the municipality of Kovačica, which borders the municipality of Opovo, and the municipality of Bujanovac, the opposite trend can be noted—the minimum value of gross out-migration was in 2018 and 2019, but not in 2020.

Table 1. Gross out-migration rates in 2018, 2019, and 2020 (March–December), minimum and maximum values

Gross out-migration rates – minimum values					
2018		2019		2020	
Bujanovac	7.05	Novi Pazar	7.32	Novi Pazar	4.82
Preševo	7.20	Medijana	8.40	Medijana	6.54
Novi Pazar	7.27	Kovačica	8.82	Kragujevac	7.11
Medijana	7.58	Senta	8.88	Opovo	7.11
Kovačica	8.63	Bujanovac	8.99	Preševo	7.39
Gross out-migration rates – maximum values					
2018		2019		2020	
Palilula (Belgrade)	22.60	Ljubovija	33.90	Vračar	32.26
Zvezdara	24.00	Vračar	37.75	Stari Grad	32.39
Stari Grad	42.43	Crna Trava	38.06	Savski venac	36.55
Savski venac	44.50	Savski venac	42.05	Crna Trava	39.09
Vračar	35.17	Stari Grad	44.14	Ljubovija	40.99

Note. Data in table are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b, *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

Regarding the municipalities with the higher values, three central municipalities of Beogradska oblast stand out for all the three years—Stari Grad, Savski Venac, and Vračar. In all the three municipalities, the volume of gross out-migration in 2020 was reduced compared to the previous two years. Two Belgrade municipalities—Palilula and Zvezdara, in 2018 were among the five municipalities with the highest values. In the next two years, instead of them, border municipalities of Ljubovija and Crna Trava are among the municipalities with the highest values. Even in the year of the pandemic, these two municipalities have the highest values of gross out-migration, respectively.

When it comes to gross in-migration rates (Table 2), the municipality of Bujanovac is the only municipality that is among the five municipalities with the lowest values in all the three analyzed years, with the fact that this value is the lowest in 2020. In the year of the pandemic, the municipality of Vranjska Banja recorded the lowest value (5.11), although in the years before the pandemic it was not among the municipalities with minimum values. Higher values of gross in-migration rates have a pattern similar to higher values of gross out-migration rates. Among the municipalities with the highest values of gross in-migration rates in all the three analyzed years are Stari Grad, Savski Venac, and Vračar. The municipality of Palilula (Belgrade) had a high position in 2018 and 2019, but that position is lost in 2020. Instead, the municipality of Vračar is one of the five municipalities with the highest value. The only municipality that occupies one of the first five places in 2020, and does not belong to Beogradska oblast, is border municipality Ljubovija. In the previous two years, this municipality was not among municipalities with the highest values of gross-in migration rates.

Table 2. Gross in-migration rates in 2018, 2019, and 2020 (March–December), minimum and maximum values

Gross in-migration rates – minimum values					
2018		2019		2020	
Bujanovac	5.67	Bosilegrad	5.82	Vranjska Banja	5.11
Preševo	6.1	Bujanovac	6.18	Bujanovac	5.16
Lapovo	6.1	Tutin	7.25	Bosilegrad	5.2
Vranje	6.53	Smederevo	7.29	Lapovo	5.42
Bač	6.63	Osečina	7.32	Smederevo	5.43

Table 2. Gross in-migration rates in 2018, 2019, and 2020 (March–December), minimum and maximum values (*Continued)*

Gross in-migration rates – maximum values					
2018		2019		2020	
Palilula (Belgrade)	30.89	Palilula (Belgrade)	30.02	Zvezdara	29.53
Zvezdara	34.8	Stari Grad	35.71	Stari Grad	32.73
Stari Grad	35.31	Zvezdara	38.15	Ljubovija	32.95
Savski venac	37	Savski venac	38.26	Vračar	34.68
Vračar	37.58	Vračar	46.63	Savski venac	34.89

Note. Data in table are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

To see the effect of the COVID-19 pandemic on the trend of out-migration and in-migration, a deeper analysis is conducted (Table 3). When it comes to the difference between 2020 and 2018, the municipality of Stari Grad records the most significant difference in the number of out-migrants per 1,000 inhabitants (–10.04). The same municipality ranks first in terms of the difference in the number of out-migrants per 1,000 inhabitants in the shorter period 2020–2019, too. On the other hand, an increase in the number of out-migrants per 1,000 inhabitants in the longer period 2020–2018 was recorded in the municipality of Ljubovija (19.05). The same trend is observed when comparing 2020 and 2019, with the volume of increase significantly reduced (7.09). In both this period and the previous one, the municipality of Vladimirci ranks second with the largest difference in the rate of out-migration with a reduced volume, too.

Table 3. Municipalities in Serbia with the highest and the lowest positive and negative shifts of gross in- and out-migration rates 2020 minus 2018 and 2020 minus 2019 (March–December)

Gross out-migration – negative				Gross in-migration – negative			
2020–2018		2020–2019		2020–2018		2020–2019	
Stari Grad	–10.04	Stari Grad	–11.75	Palilula (Belgrade)	–8.95	Vračar	–11.96
Opovo	–8.12	Niška Banja	–10.63	Niška Banja	–7.63	Zvezdara	–8.61
Savski Venac	–7.95	Bojnik	–9.11	Golubac	–6.65	Palilula	–8.08
Gadžin Han	–7.28	Svilajnac	–7.91	Voždovac	–6.59	Zemun	–7.97
Žabari	–6.95	Opovo	–7.77	Novi Beograd	–6.35	Niška Banja	–6.6
Gross out-migration – positive				Gross in-migration – positive			
2020–2018		2020–2019		2020–2018		2020–2019	
Medveđa	3.62	Surdulica	1.45	Ljig	4.48	Rača	2.09
Beočin	3.7	Novi Sad	2.03	Crna Trava	4.86	Batočina	3.36
Mali Zvornik	6.42	Batočina	2.38	Beočin	5.17	Surdulica	3.43
Vladimirci	7.38	Vladimirci	4.83	Mali Zvornik	9.33	Mali Zvornik	4.83
Ljubovija	19.05	Ljubovija	7.09	Ljubovija	20.38	Ljubovija	8.69

Note. Data in table are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

In 2020 compared to 2018, the lower volume of in-migration was in the municipalities of Beogradska oblast: Palilula, Voždovac, and Novi Beograd, as well as in the municipalities of Niška Banja and Golubac. When comparing in-migration rates in 2020 and 2019, the municipalities of Beogradska oblast (Vračar, Zvezdara, Palilula, and Zemun) also record the most significant in-migration loss. It is interesting that in the municipality of Ljubovija, the

volume of in-migration increased in 2020 compared to 2018 and 2019, but the net in-migration gain was reduced slightly more than twice. The municipality of Mali Zvornik had the second largest net in-migration gain in 2020 compared to both previous years.

The certain shift of the volume and trend of internal migration in the period from March to December is evident if we analyze net migration rates (Figure 3). Some municipalities experienced net migration gain in 2020 after the two years of net migration loss and vice versa. Only two municipalities (Mladenovac and Ruma) excelled by a positive pre-pandemic net migration rate, and in 2020 they had a negative migration rate. Equal rates of in-migration and out-migration in 2020 were recorded in the municipalities of Veliko Gradište and Senta. These two municipalities had had a negative net migration rate in the previous two years. Most municipalities characterized by shifts had negative migration rates in 2018 and 2019, while in 2020 they recorded net migration gains. These are Topola, Stari Grad, Kladovo, Novi Kneževac, Doljevac, Alibunar, Beočin, Bačka Palanka, Bajina Bašta, Žitište, Gadžin Han, Merošina, Sokobanja, Srbobran, Sremski Karlovci, and Opovo.

However, most municipalities have not experienced a change in trend. Ninety-nine municipalities that recorded negative net migration rates in the previous two years, continued this trend in the year of the pandemic. The same, pre-pandemic positive trend was continued by 26 municipalities in 2020. Although the trend remained the same, there is a noticeable difference in the volume. A higher value of positive net migration rate in 2020 compared to 2018 and 2019 was recorded in the municipalities of Kanjiža, Obrenovac, Stara Pazova, Temerin, and Knić. The municipality of Knić records the highest net migration gain (2018–0.77, 2019–0.78, and 2020–5.00).

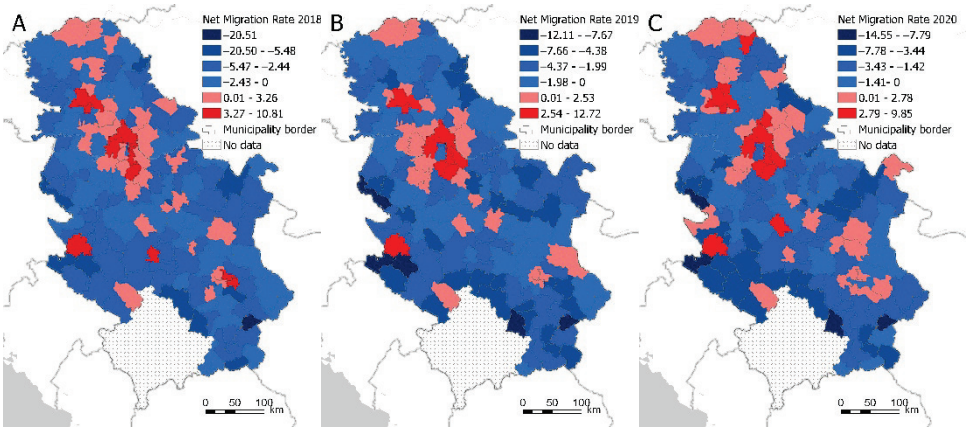

Figure 3. Net migration rate by municipalities in Serbia 2018 (A), 2019 (B), and 2020 (C) from March to December. *Note.* Data in figure are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

Analyzing the shift of net migration rate between 2020 and 2018, it can be concluded that 66 municipalities showed a negative trend, while 162 showed a positive trend. Comparing the net migration loss and gain in a shorter period (between 2020 and 2019), a negative trend can be noted in a slightly smaller number of municipalities compared to

the previously analyzed period (53). Consequently, the number of municipalities characterized by a positive trend has increased (116). The municipalities that are characterized by the highest shifts of net migration rates in 2020 (March–December) compared to the previous two years are shown in Table 4.

Table 4. Municipalities in Serbia with the highest and the lowest positive and negative shifts, net migration rates 2020 minus 2018 and 2020 minus 2019 (March–December)

2020–2018		2020–2019	
Negative values			
Vladimirci	–5.01	Vračar	–6.47
Niška Banja	–4.87	Zemun	–4.83
Palilula (Belgrade)	–4.78	Vladimirci	–3.64
Plandište	–4.77	Majdanpek	–3.07
Surčin	–4.29	Palilula (Belgrade)	–3.04
Positive values			
Savski venac	5.85	Bela Palanka	5.44
Crna Trava	5.96	Čoka	5.57
Stari Grad	7.46	Opovo	7.72
Opovo	8.41	Žitište	7.79
Gadžin Han	9.24	Stari Grad	8.77

Note. Data in table are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

3.1. Local spatial autocorrelation analysis

The spatial grouping of positive net migration rates in 2018, 2019, and 2020 show unusual patterns that record certain changes in the year of the pandemic compared with the previous two years. Spatial grouping of the highest positive values of the net migration rate, or cluster High-High (red color) for all the three years is noticeable in Beogradski region and its immediate vicinity. The number of municipalities belonging to this cluster has increased over the years. Thus, in 2018 it consisted of the municipalities Palilula, Zemun, Voždovac, Grocka, and Vračar. In 2019, in addition to the above five, the municipalities of Surčin, Barajevo, Sopot, and Zvezdara are joined. In 2020, the municipality of Stara Pazova joined this cluster, but the municipality of Zvezdara no longer belongs to it (Figure 4A, 4B, and 4C).

Two clusters of the lowest positive values or Low-Low (orange color), both in south-eastern Serbia are noticeable only in 2020. One was formed by the municipalities of Boljevac and Soko Banja. The second is in its vicinity and is created by municipalities of Merošina, Doljevac, Gadžin Han, Bela Palanka, Crveni Krst, and Medijana.

Figure 4D, 4E, and 4F displays the spatial grouping of the highest negative net migration rate. High-High cluster (dark blue color) can be observed in the northern part of the country for all the three years. Its position has not remained constant but is moved from the northeast to the northwest of the country. The cluster, which was formed by the municipalities of Senta, Ada, Novi Bečej, and Žabalj in 2018, included two more municipalities in 2019: Novi Kneževac and Bačka Topola. In 2020, none of these municipalities belonged to the High-High cluster. The High-High cluster was formed by the municipalities of Sremska Mitrovica, Bogatić, Irig, Ruma, and Inđija.

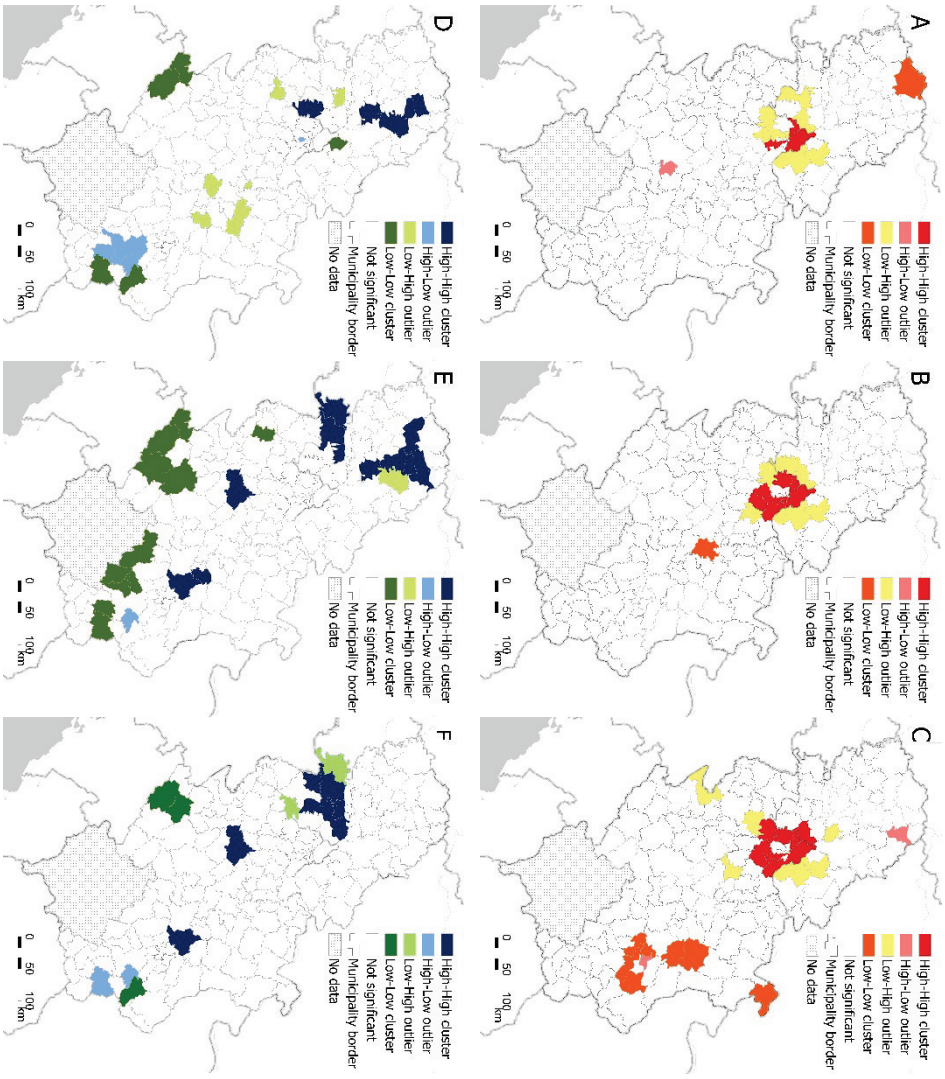

Figure 4. Local Moran cluster and outlier map for positive migration rates by municipalities in Serbia in 2018 (A), 2019 (B), and 2020 (C) and negative migration rates in 2018 (D), 2019 (E), and 2020 (F).

Note. Data in figure are calculated based on *Internal migration in the Republic of Serbia in 2018* [Unpublished raw data], by SORS, n.d.-b; *Internal migration in the Republic of Serbia in 2019* [Unpublished raw data], by SORS, n.d.-c; *Internal migration in the Republic of Serbia in 2020* [Unpublished raw data], by SORS, n.d.-d.

The Low-Low cluster (green color) is formed by the municipalities with the lowest negative values of the net migration rate. One, smaller cluster, can be noticed in the southwestern part of the country. In 2018 and 2020, this cluster was formed from two municipalities—Priboj and Prijepolje, respectively, Prijepolje and Nova Varoš. In 2019, the municipalities of Sjenica, Ivanjica, and Lučani joined this cluster. The second, also a smaller cluster was identified in the south-eastern part of Serbia in 2018 and 2019. In the year of the pandemic, only one

municipality stands out as the municipality with the lowest negative value of the net migration rate—Babušnica.

4. Discussion and conclusion

The focus of this study was to assess the effect of the COVID-19 pandemic on the volume and geographical patterns of internal migration in Serbia throughout the analysis of out-migration, in-migration, and net migration rate at the different territorial levels. We have found a decrease in the volume and certain spatial patterns shifts of internal migration in Serbia upon the COVID-19 outbreak.

Observed at the level of regions, a decrease in volume of in-migration as well as a decrease in the volume of out-migration is observed. This suggests that overall population mobility was constrained. Analyzing the data at the oblast level, we found that the most attractive for internal migrants is still Beogradska oblast, but with reduced intensity since the outbreak of the pandemic. Other oblasti, except for Beogradska, Severnobačka, Nišavska, Severnobanatska, and Zaječarska had a negative net migration rate but show a more favorable values in 2020 compared to 2019 indicating mitigation of the negative trend, but due to smaller volume of out-migration. A recent study, conducted in Japan, also confirms that there has been a positive trend of internal migration in certain prefectures since the pandemic (Fielding & Ishikawa, 2021). The authors believe that the gains are not the result of a positive rate of internal migration, but smaller net losses. Južnobačka oblast records the highest positive migration trends for both observed periods owing to the city of Novi Sad, the seat of the oblast and the second-largest city in Serbia. Due to its favorable geographical position on the Danube Corridor, Novi Sad has developed into the university, cultural, political, and health center of Vojvodina region. As such, it has been attracting people from other parts of Serbia for years.

If we focus on municipalities rather than oblast, the drop in net migration gains in 2020 compared with 2019 and 2018 is observed. Analyzing the trend, it can be concluded that most municipalities in 2020 maintained the pre-pandemic trend. The municipalities with the highest values of in-migration rate are also those that have the highest out-migration rate values. The evidence confirms that those overall migratory municipalities are the central Belgrade municipalities Vračar, Stari Grad, Savski Venac, and the border municipality of Ljubovija. On the other hand, the municipality of Bujanovac is one of the municipalities with the lowest values of both out-migrants and in-migrants for all the three years. The results also suggest that the effect of the increased number of municipalities characterized by a positive trend regarding migration rate 2020 minus 2019 is mainly driven by reduced out-migration.

In the year of the pandemic, there were not only shifts in the trend and volume of internal migration but also its spatial patterns. Namely, the spatial grouping of lower and higher values of net migration rates recorded certain changes. When it comes to the spatial grouping of positive values of the net migration rate, changes in the patterns of both lower and higher values have been noticed. The capital city area (Beogradska oblast) has recorded the highest volume of internal migration for years. Spatial grouping of the highest positive values is also noticeable in the analyzed years. Comparing the outcomes in the year of the pandemic with the previous two years, the expansion of the cluster, in the form of the number of municipalities, can be observed. The expansion of the cluster did not include the central Belgrade municipalities, but the municipalities from the wider city area of Belgrade (Barajevo,

Grocka, Obrenovac, and Sopot). It confirms that during the pandemic, central Belgrade municipalities were losing their attractive potential for internal migrants. Also, the expansion of the cluster to the north-west occurred, so that municipalities of Pećinci and Stara Pazova are included. This cluster encompasses one part of the international Danube corridor and the most important development axis and the center of population concentration, i.e., Belgrade metropolitan area with Novi Sad (Lović Obradović, 2019; Živanović, Tošić, & Đorđević, 2010).

Assessing the spatial grouping of the lower positive values of the net migration rate, statistically significant clusters in 2018 or 2019 are not indicated. In the year of the pandemic, the formation of two smaller clusters in southeastern Serbia is noticeable. The core of one cluster is the municipality of Soko Banja, with its dominant tourist function. This municipality is one that recorded a positive net migration rate in 2020, while in the previous two years it had had a negative one. The second cluster was formed around the municipalities of the city of Niš. In 2020, the municipality of Kladovo stood out as a municipality that recorded a lower positive rate of net migration rate in 2020 compared to the mean value (in the previous two years, this trend was negative). The municipality of Kladovo is also tourist-oriented.

The spatial grouping of the negative values of the net migration rates shows a tendency of high north–low south, that is the north of Serbia is characterized by the highest negative values of net migration rate, while in the south-western part the lower negative values are grouped. The highest negative values show the northeast–northwest tendency, bypassing the municipality of Novi Sad. On the other hand, certain municipalities in southwestern Serbia have the lowest negative net migration rates. Given the larger volume of internal migration in 2019 spatial shifts, in 2020 they are significantly higher compared to 2018 than compared to 2019.

4.1. Limitations and future research

This research is one of the first studies in Serbia that reveals and highlights the important changes in the volume and spatial patterns of internal migration before and in the aftermath of the COVID-19 pandemic outbreak, thus affecting the redistribution of the population across the country. A potential limitation of our study is related to the data that we have used. Namely, it is well-known that not all citizens in Serbia register their usual residence address on time, which affects the coverage and the quality of the data on internal migration. The societal effects of the pandemic further contributed to untimely registration. Therefore, it can be assumed that the number of internal migrants is underestimated. According to Lukić et al. (2022), the opinion of the respondents from rural areas in Southern and Eastern Serbia is that the pandemic did not cease the emigration from rural settlements. Accordingly, further research that would include a longer series of data, as well as settlement type, is needed to deepen the understanding of internal migration dynamics and patterns evolving over years since the COVID-19 outbreak in Serbia and their implications for spatial population distribution.

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