Prague and Central Bohemia

Current Population Processes and Socio-spatial Differentiation

Martin Ouředníček (ed.)

KAROLINUM

Martin Ouředníček (ed.)

Prague and Central Bohemia
Current Population Processes and Socio-spatial Differentiation

———

Reviewed by:
doc. RNDr. Zdeněk Szczyrba, Ph.D.
Mgr. Ondřej Mulíček, Ph.D.

Authors:
Boris Burcin
Nina Dvořáková
Pavel Frydrych
Marie Horňáková
Jana Jíchová
Adam Klsák
Zuzana Kopecká
Ivana Křížková
Tomáš Kučera
Jiří Nemeškal
Martin Ouředníček
Lucie Pospíšilová
Martin Šimon

This publication was published with the support of the Ministry of Education, Youth and Sports and the Czech Recovery Plan within the project Transformation for Universities at CU (reg. No. NPO_UK_MSMT-16602/2022).

Published by Charles University
Karolinum Press
Prague 2022
Proofreading by Markéta Vašíčková
Layout by Zdeněk Ziegler
Typesed by DTP Karolinum Press
First edition

ISBN 978-80-246-5028-9
ISBN 978-80-246-5144-6 (online : pdf)

Contents

5 / Residential Segregation in Prague and the Central Bohemian Region in 2012–2018: A Multiscalar Approach Using Individualised Neighbourhoods

Martin Šimon, Ivana Křížková, Adam Klsák

5.1 INTRODUCTION

After 1989, and more significantly after joining the European Union in 2004, the number of foreigners in the Czech Republic increased. At present, 590 thousand people with a foreign passport live in the Czech Republic, of which 294 thousand live in Prague and the Central Bohemian Region and 213 thousand live in Prague alone. Roughly every seventh registered inhabitant in Prague and every twentieth of the Czech Republic is a foreigner (MICR, 2020). As the number of foreigners in the country is increasing, the foreign population's diversity is also growing. Therefore, it is of increasing importance to monitor the development and distribution of the foreign population and to create data and inputs for public policies. Without this knowledge, we cannot effectively influence the integration of foreigners into society and mitigate the possible negative consequences of immigration.

The aim of this text is to describe and compare the residential distribution of foreigners in Prague and the Central Bohemian Region and its development in the years between 2012 and 2018. In order to do so, we use detailed data on the foreign population from the records of the Ministry of the Interior. We measure the distribution of foreigners using a new method of individualised scalable neighbourhoods. This method allows us to compare the distribution of minority and majority population on multiple scales and does not depend on the statistical-administrative division of the territory. Particularly, we focus on Slavic and EU migrants and explore the effects of cultural proximity and legal status on residential segregation. In conclusion, we discuss the results and evaluate the merits of the individual scalable neighbourhood method.

The term residential segregation (i.e. the inequality resulting from different conditions in the place of residence) is used in literature to denote social, economic or ethnic inequality present in space. In some localities, neighbourhoods or regions, better-paid job opportunities, better housing stock, more varied educational opportunities and leisure activities are readily available, while other localities, neighbourhoods or regions have low salaries, poor housing, poor schools or public infrastructure. Studies of residential segregation show that the spatial concentrations of the poor, foreigner or ethnic minorities have an effect on the inhabitants' deteriorating life chances in such localities (van Ham et al., 2012; van Ham et al., 2013). The disadvantage resulting from the individual characteristics of a person is thus multiplied by the contextual effect of the disadvantageous locality, district or region. At the same time, segregation studies show that the negative effects of residential segregation are stronger in countries with neoliberal market orientation and weaker in countries with strong welfare policies, where income redistribution or housing policy moderates socio-spatial polarisation of society (Friedrichs, Galster, Musterd, 2003). Therefore, it is vital to explore how segments of immigrant population are spatially segregated in Czechia.

The development of inequalities in spatial distribution of ethnic population groups is a major topic in urban studies. Empirical evidence from established immigration countries led to the formulation of spatial assimilation theory in the second half of the twentieth century. The theory holds that on arrival, immigrants tend to spatially gravitate towards their co-ethnics. Earlier arrivals can provide new immigrants with assistance when searching for jobs and housing. Living in proximity to co-ethnics also allows for sustaining cultural habits acquired in the country of origin and overcoming the language barrier many immigrants face in their destination countries. Later on, when immigrants become more culturally integrated in the host society and improve their socio-economic status, the spatial assimilation theory expects them to spatially disperse, making their spatial distribution more similar to that of the majority population (Park, 1928; Massey, 1985). Spatial assimilation theory is therefore apt to describe the current situation in Czechia as an emerging immigration country (Šimon, Křížková, Klsák, 2020).

Based on the assumptions of the spatial assimilation theory, we can hypothesise that:

$H_{1)}$ immigrant residential segregation will decrease in time;

$H_{2)}$ residential segregation of an immigrant group culturally close to the majority of the population will be smaller than that of a culturally distant group;

$H_{3)}$ immigrant groups socio-economically similar to the majority population will be less segregated than groups whose socio-economic status is more distinct.

When measuring and evaluating residential segregation, it is critical that the spatial assimilation theory does not consider some important aspects of immigrant residential segregation, notably the neighbourhood size. Previous literature reports that the development of segregation in time may occur in opposing directions (towards concentration or deconcentration) based on different scales of analysis (Malmberg et al., 2018). Moreover, the spatial assimilation theory expects changes in segregation to manifest themselves in a longer time period – over the course of immigrant generations. In this text, we use the term 'foreign' or 'population of foreign citizens', as the Czech immigrant population is rather recent, with a low share of second-generation migrants and the data we use is based on state citizenship. We operationalise the segregation decrease through time according to the spatial assimilation theory by evaluating a period of 2012–2018, assuming that a convergence of the minority and the majority occurs gradually over time. Between 2012 and 2018, the foreign population in the country grew by further in-migration , with new foreigners having less time to potentially assimilate.

Research on the development of foreign citizens' residential segregation has been scarce in Czechia due to the rather short history of foreign population in the country as well as the relevant data sources having some important drawbacks. Among the exceptions is the work of Špačková, Pospíšilová and Ouředníček (2016), which documents the increase in the proportion of people with non-Czech ethnicity from 1971 until 2011, suggesting a growing importance of ethnic structure in the differentiation of Prague's urban space. Differences in levels of dissimilarity between selected immigrant groups (Ukrainians, Russians, Vietnamese, and Americans) and tendencies towards spatial dispersal in most groups between 2001 and 2011, were observed by Přidalová and Ouředníček (2017). Similarly, Přidalová and Klsák (2017) detected a stability of spatial patterns of the four above-mentioned immigrant groups in Prague from 2008 until 2015, despite the fact that foreign citizens were among the population groups most affected by the 2008 economic crisis. Although these studies bring primary valuable insights into residential segregation of foreigners, they are based on data for administrative units, making their results dependent on the chosen spatial scale and susceptible to ecological fallacy. As indicated in Robinson's research on segregation already in 1950, ecological correlations cannot validly be used as substitutes for individual ones. Possible invalid transfer of aggregate results to individuals or vice versa points to the critical role of multilevel analysis in achieving more robust and comprehensive results (Subramanian et al., 2009).

The chapter is organised according to its two main aims. Firstly, it strives to introduce the innovative method of individualised neighbourhoods in the Czech context, which allows for the overcoming of some limitations of previous research in residential segregation. Secondly, it seeks to present the basic trends in residential segregation of foreign citizens (1) in the city of Prague and (2) in Central Bohemia on multiple spatial scales, independent of arbitrary administrative boundaries. The results are presented for (i) total foreign population registered to reside in Czechia in 2012 and 2018; (ii) subgroups of Slavic and non-Slavic migrants, which represent culturally closer and culturally more distant foreign citizens; and (iii) subgroups of EU and non-EU migrants, which represent a critical legal difference between migrants. The concluding part evaluates the merits of the novel methodology and discusses implications of current findings.

5.2 MEASURING SEGREGATION

Understanding residential segregation across the globe is subject to three main sets of challenges: those of available data, methods of measurement, and conceptual framing. In the last few years advancements have been made in the three areas of challenges. Firstly, segregation research traditionally relied on primary census data, that typically comes aggregated to administrative units. However, new data sources have recently become available for segregation research, such as geocoded register-based data (Andersson et al., 2018; Šimon, Křížková, Klsák, 2020). These allow for the tailoring of spatial units to the needs of the given research question, in order to evaluate the development of spatial inequalities in-between censuses, and may be linked to other administrative data sources. In this paper, of special interest is the possibility to create user-defined spatial units, which has been increasingly used in research. So-called individualised (or bespoke) neighbourhoods allow for the centering of the research attention on individuals, by looking at the characteristics of the population living in their proximity, instead of making assumptions of individuals' living situation based on the administrative unit they live in. Frontier studies in residential segregation (Andersson, Lyngstad, Sleutjes, 2018) alongside many other research fields, focused on the impact of contextual effects on human behaviour shifted towards a dynamic understanding of spatial exposure (Kwan, 2012; Greenberg Raanan, Shoval, 2014; Farber et al., 2015; Järv et al., 2015; Wissink, Schwanen, van Kempen, 2016; Yip, Forrest, Yian, 2016; Helbich, 2018; Kwan, 2018).

In residential segregation research, individualised neighbourhoods are typically defined by a certain distance threshold, e.g. all people living within a given distance from each

individual (Reardon et al., 2008; Petrović, van Ham, Manley, 2018) or by a certain number of nearest neighbours, e.g. the given number of people nearest to the individual, regardless of the numerical distance from them (Andersson et al., 2018; Sleutjes, Valk, Ooijevaar, 2018). Individualised neighbourhoods therefore can be applied at different scales, allowing us to assess segregation on multiple spatial levels. Individualised neighbourhoods better represent location of individuals' daily life activities, rather than their official residential neighbourhood, and provide information about wider socio-spatial configurations "nested" around (Sampson, 2013). However, even with the application of individualised neighbourhoods for segregation measurement, issues of group classification and taxonomy still matter when producing research outcome (Wright et al., 2020).

Secondly, improved segregation measurement would not be possible without the recent computational advancements (Fossett, 2017), that make it possible to analyse larger samples, e.g. in replicating the computations for various spatial scales (Piekut, Pryce, van Gent, 2019). Juxtaposing the results obtained through analyses of spatial units of varying definition, enable us to avoid the trap of the Modifiable Area Unit Problem (MAUP). More precisely, we deal with MAUP of spatial units within a region we analyse, but not of a region we analyse. This second MAUP is only partially tackled through the inclusion of two analysed regions: 1) the city of Prague and 2) Central Bohemia.

Thirdly, the advancements in data and methods allow to re-conceptualise segregation. Once understood through the lens of residence and the labour market, it is now being increasingly acknowledged that segregation of social groups occurs in time and in people's free-time activities (Wong, Shaw, 2011; Silm, Ahas, 2014). This creates new avenues for research, such as the use of big data and spatial tracking studies (Goldman, Cornwell, 2021). However, segregation measurement still has to be seen within a broader social and historical context, reflecting the politics of minority – majority relations and power dynamics (Rothstein, 2017; Kaufmann, 2018).

As the data available on Czechia reports on people's residences, we focus primarily on the first two challenges in segregation research and the opportunities for their overcoming, as discussed above: that of using individualised neighbourhoods on several geographical scales. Research on residential segregation and its impacts is conditioned by the availability of data and the methodological questions regarding the measurement of segregation. The contemporary history of international migration to Czechia dates back to the 1990s. However, the intensity of foreigner's immigration increased in speed after the 2004 EU accession and therefore, in recent years, the research on residential segregation of immigrants is gaining more importance. Previously, the available data allowed researchers to use predominantly census data, published once per decade and available for administrative units. This prevented the analyses of developmental trends and resulted in research focusing on the smallest administrative units (basic settlement units), containing data for foreign population that was large enough only for the purposes of analysis of Prague. Studies by Ouředníček and Novák (2007) and by Sýkora (2009) are exceptions which ventured beyond the capital city and employed indicators such as the location quotient and index of segregation. Only recently has research begun to use more detailed data sources and elaborate methods of measurement, see e.g. Šimon, Křížková and Klsák (2020) and Šimon et al. (2020) and Přidalová and Klsák (2017) for studies analysing register-based data aggregated to a population grid.

5.3 METHODS AND DATA

Individualised scalable neighbourhood method

A key added value of the individualised scalable neighbourhood method is that it measures indicators of segregation independently of the existing administrative division. Residential segregation is not measured with data for city

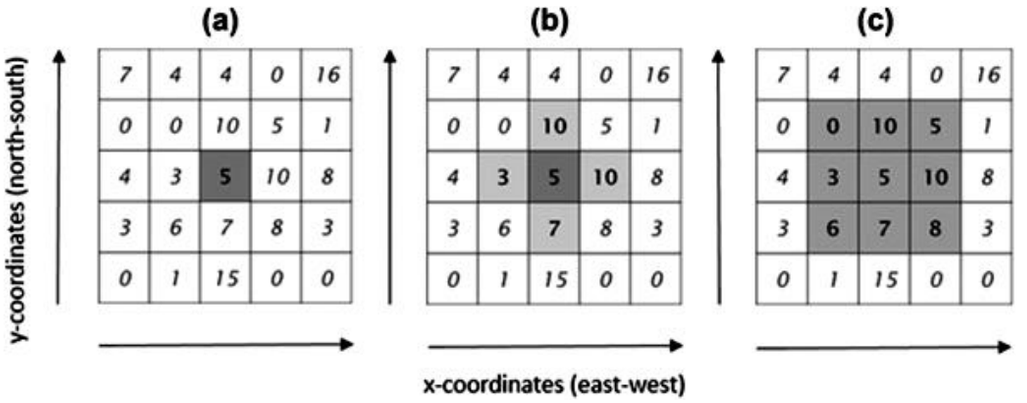

Figure 5.1: Individualised neighbourhoods using population grid. ***Source:*** *Sleutjes, de Valk, Ooijevaar (2018).* **Note:** Constructing an individualised neighbourhood of 50 nearest neighbours (k = 50), using the EquiPop software.

districts or municipalities, but for individuals geocoded in a population grid, taking into account their mutual spatial proximity. The method of individualised scalable neighbourhoods uses user-defined threshold values to delimit neighbourhoods of different sizes. For these individual neighbourhoods, it calculates the proportions of minority and majority population, serving as the basis of segregation indices. Aggregation and clustering of these input values allows for the measurement of segregation across neighbourhood scales and population groups. Figure 5.1 illustrates how individual neighbourhoods are constructed for computation. For each raster cell, the algorithm adds the surrounding raster cells until a specified critical value is reached – the threshold value of k-nearest neighbours.

For instance, if we are interested in the segregation of foreigners at the micro-level, we will set a critical value to the 50 nearest neighbours. The algorithm starts at the first cell of the grid and will add the surrounding cells to it until 50 inhabitants are reached in the current territorial selection. Then the algorithm performs the same calculation sequentially for all the cells of the population raster. As a result, we get two numbers representing the count of minority and majority populations for each individualised neighbourhood. Foreigners living in the same cell of the population grid will therefore have the same resulting values because they share a residential location. As a result, we can determine which of the calculated neighbourhoods has the highest concentration rate of foreigners and what the average concentration rate of foreigners is in the neighbourhoods at k = 50 level. The calculation can be performed for any neighbourhood size in EquiPop software (Östh, 2014). It is possible to perform the calculation for any group which is sufficiently numerous for the subsequent meaningful interpretation of the data.

Data

This chapter is based on data from the Directorate of the Alien Police, which manages data on the complete population of foreigners in the Czech Republic. The study is focused on Prague and the Central Bohemian Region – representing the most important region in the geography of the foreign population in the Czech Republic (Klsák, Křížková, 2022, this book). The data on the citizenship of foreigners in the years 2012 and 2018[19] are analysed to monitor population changes. For the purposes of our case study, we divided the population of foreigners into four groups. In particular, groups of foreigners from Slavic/non-Slavic and European/non-European countries are distinguished. The data contains information on foreigners with permanent or temporary residence, but does not include tourists or undocumented foreigners. We opted for sizes 100–800 to capture segregation at the micro level (housing segregation), 1 600–6 400 at the meso level and 12 800–51 200 at the macro level (labour market segregation). The analysis is computed in parallel for (i) the city of Prague and for (ii) Prague and the Central Bohemian Region.

Foreigners, according to their official citizenships, comprise of many small groups, which are not suitable for the selected computational method of measuring segregation per se (except for a few of the most numerous groups of Ukrainians, Slovaks, Russians and Vietnamese – see Klsák, Křížková, 2022 in this book). Therefore we decided to seperate individual citizenships into groups (Table 5.1). According to spatial assimilation theory, we utilised cultural distance and legal status as two key factors in clustering foreigner groups. Firstly, we differentiate between Slavic and non-Slavic citizens based on cultural distance. Slavic citizens are operationalised as citizens of countries where a Slavic language is either spoken, widely used or considered official language. Foreigners with a similar language are likely to be less different to the Czech majority, their assimilation into the population of destination country is supposedly easier than for non-Slavic citizens. Therefore, the spatial distance between Slavic citizens and the majority is expected to be smaller than the distance between the majority and non-Slavic citizens. Secondly, we differentiate between EU and non-EU citizens based on legal status. The EU group encompasses citizens of EU-28 countries (the UK was a member of the EU during the analysed period) and EFTA. Non-EU group is a residual category. In general, non-EU citizens hold a less advantageous position legally than those migrating from EU countries (Kušniráková, 2014). Although there are other factors in play, notably the individual and country-specific differences between groups (Přidalová, Hasman, 2018), legal status is closely linked to the socio-economic distance. Therefore, the non-EU group is less likely to resemble the Czech majority in terms of spatial distribution than the EU group. The Czech legislation influences rights and duties of foreign citizens and it can in turn affect the ability of those citizens to reside in specific parts of the region.

The data in this study has its limitations. Our approximation of socio-economic position based on legal status is far from ideal as despite having the same legal status, different groups were shown to have a different socio-economic distance from the majority population, probably as a result of individual-level factors, which could not be controlled in this study. As well as that, we noted that the groups consist of a heterogeneous mixture of countries. Thus, we acknowledge that a binary categorisation of groups is rather crude

19 1. 1. 2012 and 1. 1. 2018.

Table 5.1: Delimitation of citizenships into groups.

		Countries with a Slavic language widely spoken	
		Yes	**No**
Member states of European Union	Yes	Slovakia, Bulgaria, Poland, Croatia	Romania, Germany, Great Britain, Italy, Hungary, France, Netherlands, Spain
	No	Ukraine, Russia, Belarus, Moldova, Serbia, Bosnia and Herzegovina, Macedonia	Vietnam, China, USA, Kazakhstan, India, Mongolia, Uzbekistan, Turkey, South Korea, Armenia, Japan

Note: Only countries with over 1 000 citizens in Prague and the Central Bohemian Region as of 2018 are listed, ordered by number of members.

and somewhat arbitrary and does not consider the internal heterogeneity of foreigners' populations. However, this binary categorisation enables us to apply a novel method of segregation measurement and test our hypotheses in a robust way.

Computation of segregation measurement is based on a population grid of 100 m × 100 m, covering the whole territory of Prague and the Central Bohemian Region. This grid is used for aggregation of raw data in geographical information systems and subsequently for calculations of residential segregation indicators using EquiPop software. The analysis of segregation in individualised scalable neighbourhoods does not take administrative borders into account. Therefore, the grid cells near administrative borders of Prague also include in their nearest neighbourhoods units located in the neighbouring administrative unit – the Central Bohemian Region. Table 5.2 overviews the input data for geo-computation.

Table 5.2: Number of foreign citizens by country groups in Prague and the Central Bohemian Region and the city of Prague in 2012 and 2018.

	Prague and Central Bohemian Region		**Prague**	
	2012	**2018**	**2012**	**2018**
All foreign citizens (in thousands)	203	271	149	197
EU countries	67	100	44	67
Non-EU countries	135	170	104	129
Slavic countries	140	176	99	121
Non-Slavic countries	49	94	49	75

Data source: *MICR (2020), own elaboration.*

Index of dissimilarity for individualised neighbourhoods

The dissimilarity index (D) is employed to capture the changing distribution of foreigners in individualised multi-scalar neighbourhoods. The dissimilarity index measures the similarity of the spatial distribution of two populations in space on the basis of their mutual share in individual territorial units. The index is calculated according to the formula below.

$$D = 0{,}5 * \sum \left| \frac{N_{ia}}{N_a} - \frac{N_{ib}}{N_b} \right|$$

In the formula, N_a denotes the number of inhabitants of the majority in the whole grid and N_{ia} the number of inhabitants of the majority in the individualised neighbourhood. Furthermore, N_b represents the number of inhabitants of the minority in the whole grid and N_{ib} the number of inhabitants of the selected minority in the individualised neighbourhood.

Compared to the standard calculation of the dissimilarity index, this formula uses individualised neighbourhoods instead of administrative units as it takes into account the spatial proximity of the population. It is therefore a more appropriate indicator for capturing residential segregation, compared to other traditional indicators. The factual interpretation of the dissimilarity index is the same as in the standard calculation. The value 0 expresses an even distribution of both populations in all territorial units and the value 100 expresses an extremely uneven distribution. The value of the dissimilarity index indicates the proportion of the minority population which would have to move in order for an even distribution across spatial units to be achieved. As the indicator is sensitive to population size, its trend (decrease or increase of dissimilarity) should be evaluated, rather than the actual numerical values (Šimon, Křížková, Klsák, 2020).

5.4 RESIDENTIAL SEGREGATION OF FOREIGN CITIZENS IN PRAGUE AND THE CENTRAL BOHEMIAN REGION

This section presents an analysis of foreign groups' distribution in Prague and the Central Bohemian Region between 2012 and 2018. Firstly, general segregation trends of foreign citizens are introduced. Secondly, we focus on Slavic/non-Slavic and EU/non-EU groups of foreigners. These two distinctions represent major cultural, legal, and socio-economic differences when contrasted with the majority population. Therefore, the two binary groups are likely to show dissimilar patterns in spatial distribution.

General segregation trends between 2012 and 2018

The dissimilarity in foreign citizens' spatial distribution range from 37 (k = 100) to 10 (k = 51 200) for the city of Prague. The values of dissimilarity index are higher for the whole metropolitan region (Central Bohemia), where it ranges from 50 (k = 100) to 27 (k = 51 200). Only 10–37 percent of the minority population would have to move in order to achieve an equal spatial distribution in the capital city compared to 27–50 percent in Central Bohemia (Figure 5.2). Residential segregation of foreigners is thus very low. Moreover, the dissimilarity is greater at the micro scale and smaller at the macro scale. The results suggest that there are virtually no large areas in Central Bohemia, where there would be an absence of the foreign population, whereas on the level of small-scale neighbourhood (k = nearest 100 neighbours), more areas remain predominantly Czech.

The overall trend is a decrease in dissimilarity in the spatial distribution of foreign citizens, both in Prague and its metropolitan region, between 2012 and 2018 (Figure 5.2). This suggests that the spatial distributions of foreign citizens and Czech citizens converge towards each other in time. However, contrasting trends for different scales of dissimilarity index do emerge. While for small-scale neighbourhoods, the dissimilarity index decreases, at the macro-scale stagnation or a moderate increase of the dissimilarity index can be observed. At the micro-level, the spatial distribution of foreign citizens is becoming increasingly similar to that of the majority population, while at the macro-level the two groups tend to gravitate towards different regions. We can thus observe a concentration supposedly in some macro-regions which provide job opportunities for foreigners (Figure 5.3), and a dispersal in micro-level spatial distribution.

The concentration trend at the macro-level can be explained by the growing attractiveness of the Central Bohemia for foreigners in the past few years. The number of foreigners is increasing in most areas of Prague and some parts of Prague's metropolitan hinterland. The deconcentration trend at micro level invites several possible and complementary explanations. Firstly, as expected by the assimilation theory, this may be due to foreigners' gradual assimilation into Czech society, providing immigrants with more resources to find residence of their choice. The second and third possible explanations relate to the recent situation of the housing market. Prague has been experiencing a housing shortage since 2016, due to limited housing construction and increases in housing prices. This resulted in an increased suburbanisation from Prague to Prague's metropolitan hinterland (Hudeček et al., 2019). The second explanation we propose is that due to the limited offer of available housing, foreigners may also either have to search for available housing in areas which would otherwise not be suitable for them or opt for sub-standard housing arrangements. For instance, foreigners might share an apartment with others to decrease housing cost per unit. So far, we have sparse evidence to support this residential strategy and we are not aware of any scientific literature that would confirm this hypothesis. Our third proposition is that the micro-level dispersal of foreigners is driven by wealthier parts of the foreign population that can overpay the majority population on the housing market, e.g. by buying

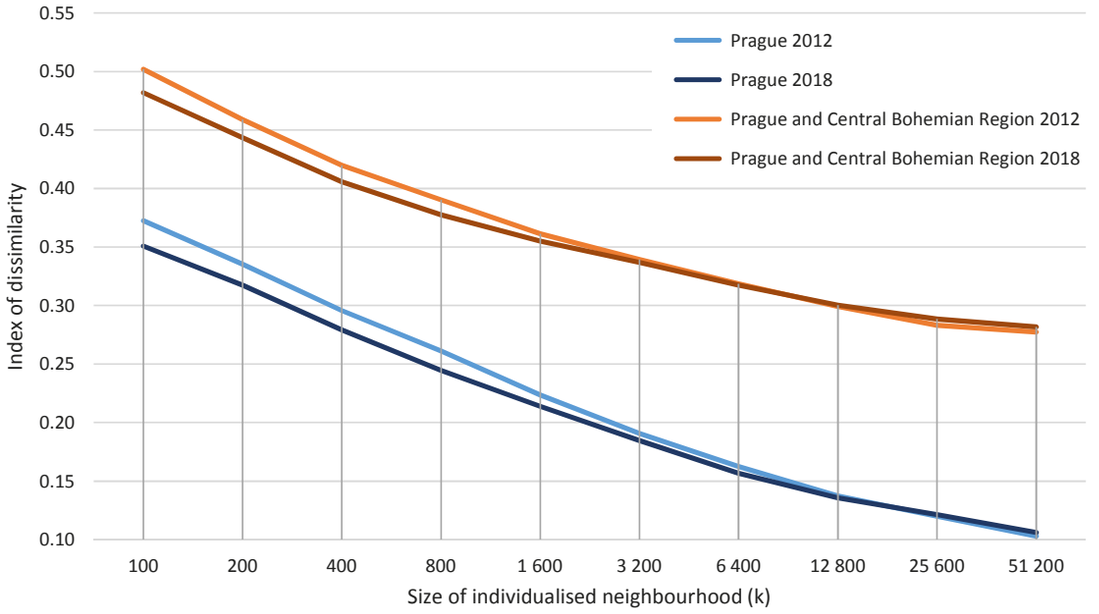

Figure 5.2: Change in dissimilarity index for individualised scalable neighbourhoods of foreigners in the Central Bohemian Region and Prague in 2012 and 2018.
Data source: *MICR (2019), own elaboration.*

or renting newly built properties, many of which are unaffordable for the majority population (Figure 5.3; Křížková, Ouředníček, 2020).

The multi-scalar nature of segregation is highlighted by our methodological approach presenting the observed extent of foreigners' dissimilarity at multiple scales of individualised neighbourhoods. For instance, slightly different patterns of concentration and deconcentration can be measured by using different k-levels. We document this by comparing the maps of changes in foreign citizens' count on the level of 200 nearest neighbours (Figures 5.3 and 5.4) and 3 200 nearest neighbours in Central Bohemia (Figures 5.5 and 5.6). The larger the scale (k-value), the higher number of areas that have experienced an increase in foreign residents. Our further analyses show that such increase is due to relatively small numbers, only exceptionally reaching above

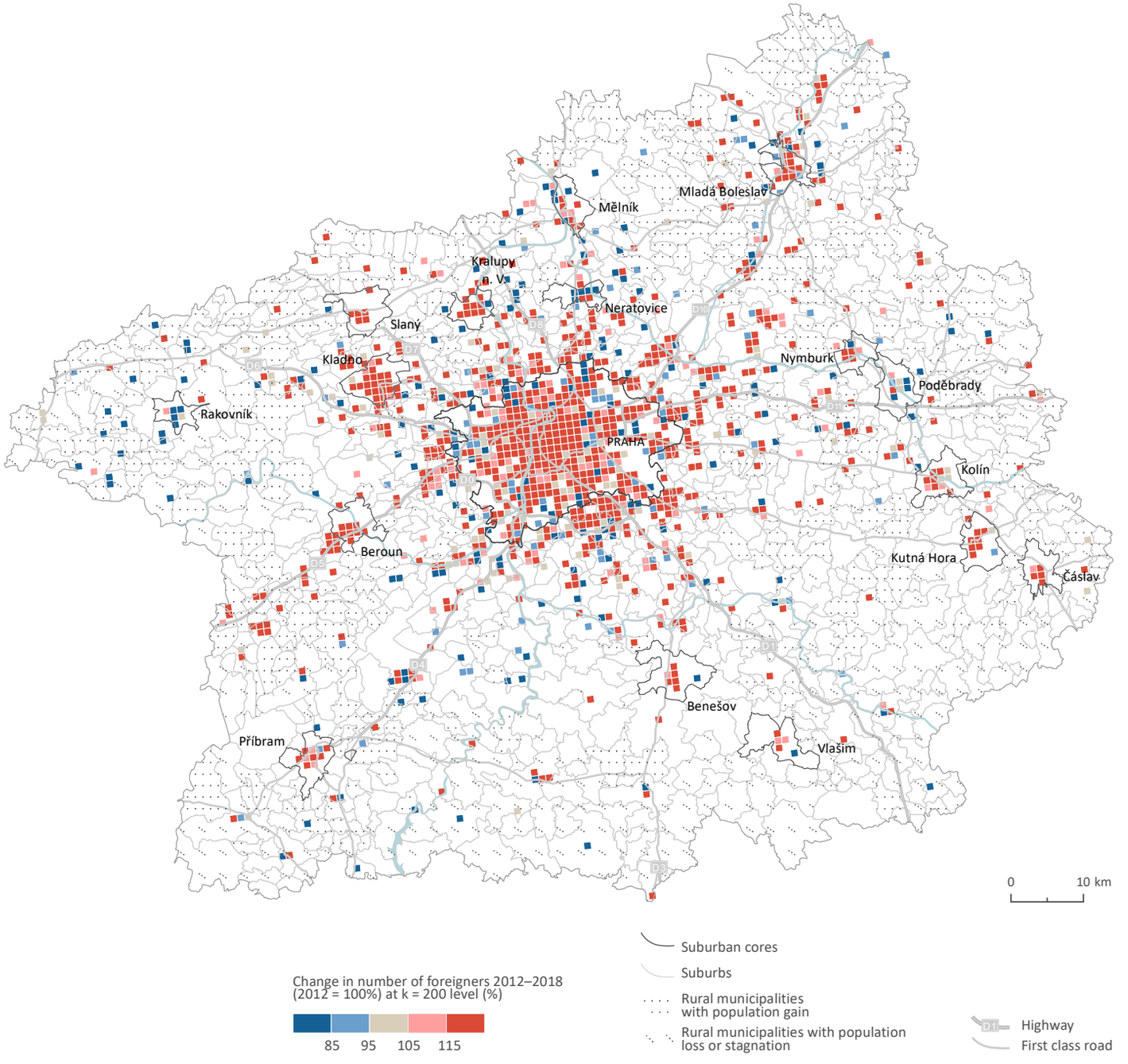

Figure 5.3: Change in number of foreigners in individualised scalable neighbourhoods at k = 200 level in Central Bohemia 2012–2018.
Data source: *MICR (2019), own elaboration.*
Note: Values above 105 percent (red) indicate an increase in the number of foreign citizens in the given grid cell between 2012 and 2018, values below 95 percent (blue) indicate their decrease. Grid cells with at least 10 foreigners are visualised. Grid size is 1 000 m.

20 people in one grid cell. However, all the individualised neighbourhoods are computed for k-nearest neighbours, but the resulting value is visualised only in one grid cell each time. Therefore, an increase in number of foreigners in grid cell is reflected in all other neighbouring cells, whose k-nearest neighbourhood reach this cell. Moreover, relevant changes in spatial patterns of change in foreign citizens' numbers are visible when different grid sizes are visualised (compare e.g. Figure 5.2 using 1 000 m grid to visualize Central Bohemia and Figure 5.3 using 100 m grid to visualise city of Prague). Although the grid square size used for comparison in our study is constant (100 m × 100 m), we highlight this to steer our readers' attention to the fact that the size of spatial units matters for visualisation of outcomes. However, our additional analyses (not presented here) indicate that trends in segregation in the Central Bohemia, achieved through the analysis of larger grid squares, are like those commented on in this chapter.

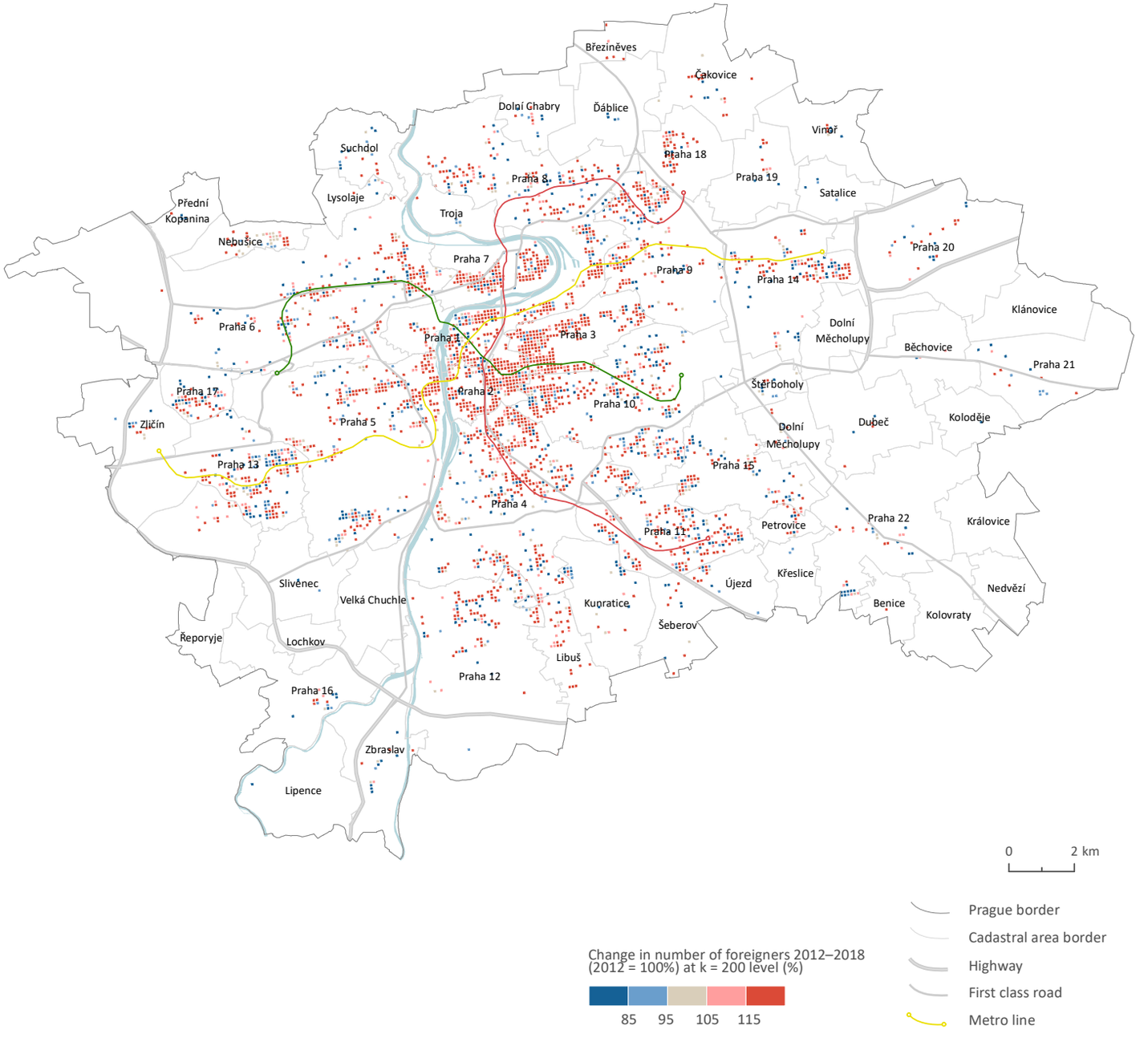

Figure 5.4: Change in number of foreigners in individualised scalable neighbourhoods at k = 200 level in Prague in 2012–2018.
Data source: *MICR (2020), own elaboration.*
Note: Values above 105 percent (red) indicate an increase in the number of foreign citizens in the given grid cell between 2012 and 2018, values below 95 percent (blue) indicate their decrease. Grid cells with at least 10 foreigners are visualised. Grid size is 100 m.

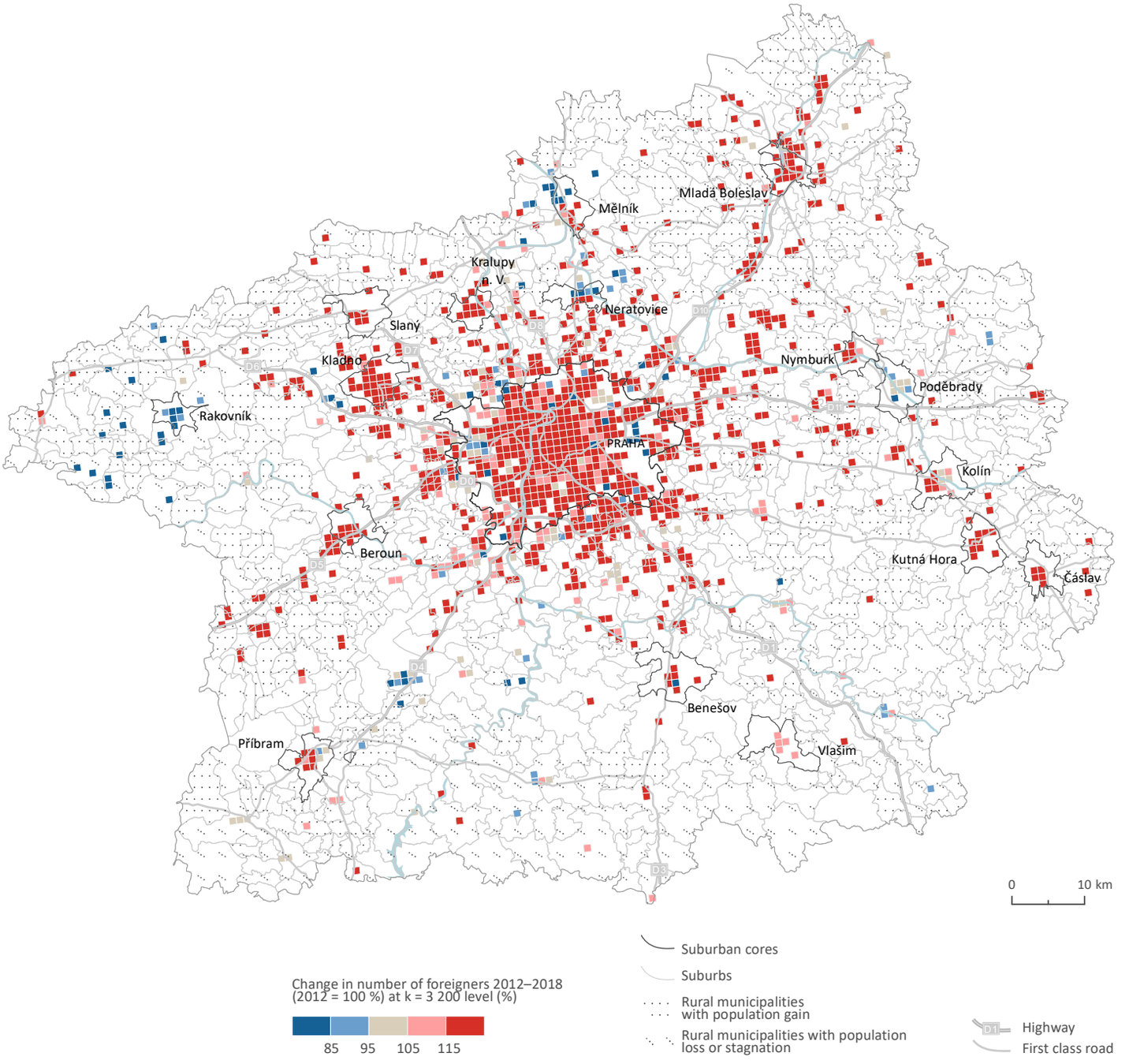

Figure 5.5: Change in number of foreigners in individualised scalable neighbourhoods at k = 3 200 level in Central Bohemia in 2012–2018.
Data source: *MICR (2019), own elaboration.*
Note: Values above 105 percent (red) indicate an increase in the number of foreign citizens in the given grid cell between 2012 and 2018, values below 95 percent (blue) indicate their decrease. Grid cells with at least 10 foreigners are visualised. Grid size is 1 000 m.

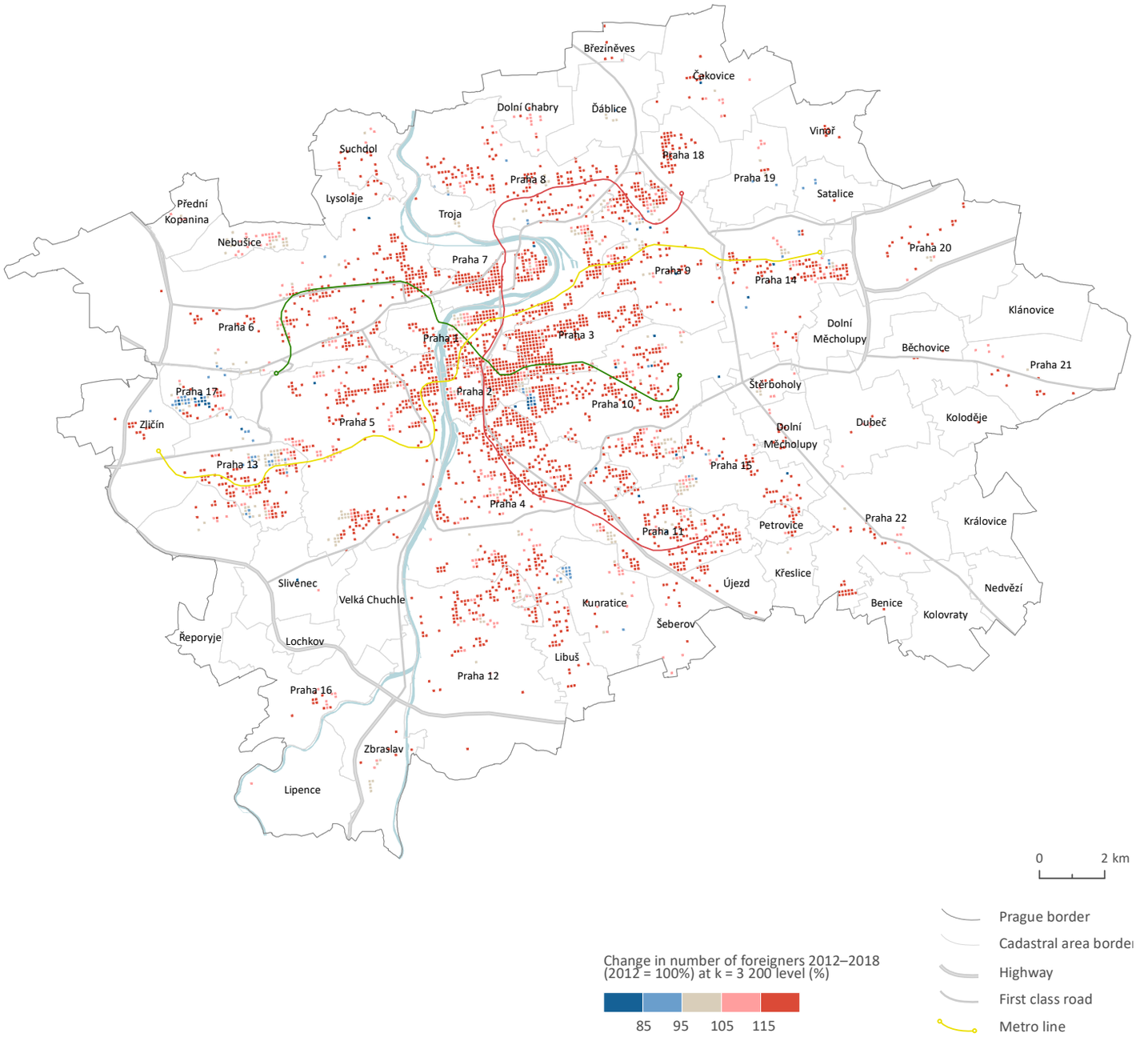

Figure 5.6: Change in number of foreigners in individualised scalable neighbourhoods at k = 3 200 level in Prague in 2012–2018.
Data source: *MICR (2019), own elaboration.*
Note: Values above 105 percent (red) indicate an increase in the number of foreign citizens in the given grid cell between 2012 ad 2018, values below 95 percent (blue) indicate their decrease. Grid cells with at least 10 foreigners are visualised. Grid size is 100 m.

Segregation of European and non-European immigrants

European and non-European citizens[20] are subject to different rights in and obligations towards the Czech society, with the non-European citizens being in a more disadvantageous position. Non-EU migrants have different socio-economic distance to the Czech society, which may translate into residential segregation. In line with our hypothesis, EU citizens are more equally distributed in space in both Prague and in the Central Bohemia, in comparison to non-EU citizens (Figures 5.7 and 5.8, respectively). While the difference in dissimilarity index among groups is kept stable across k-levels in the metropolitan region (Figure 5.8), it decreases with larger k-values in Prague (Figure 5.7). This marginal difference for large spatial levels in Prague results from the fact that among the 50 thousand nearest neighbours of all Prague residents, there is a similar mix of EU and non-EU population. This underlines earlier observations of non-existence of larger spatially-bounded communities where only one specific group of foreign citizens would predominate (Přidalová, Ouředníček, 2017). Although micro-concentrations of foreigners exist in certain parts of the city (expensive areas in the city centre, gated communities and newly built residential properties; Temelová et al., 2011), they are not clearly pronounced when individualised neighbourhoods are taken into account.

Dissimilarity index for non-EU foreigners is around 0.2 lower in Prague than in Central Bohemia. This confirms larger inequalities in this group's representation in the metropolitan region. While parts of Central Bohemia have only a few non-EU residents, their population is more concentrated in other areas of the region. Non-EU citizens tend to reside predominantly in larger towns and areas with a good accessibility to Prague, while their population is sparse in rural areas. The proximity to job opportunities thus emerges as the key localisation factor in non-EU foreigners' settlement in Prague and the Central Bohemian Region. Work opportunities for non-EU population (where Ukrainians predominate, making up over 40 percent of non-EU foreigners in Central Bohemia in 2018) are more concentrated in Central Bohemia, than those for Europeans (where Slovaks predominate, representing 51 percent of EU foreigners in Central Bohemia in 2018), whereas they are equally accessible for both groups in Prague.

For the EU and non-EU groups in both Prague and metropolitan region between 2012 and 2018 (Figures 5.7 and 5.8), the values of the dissimilarity index observed a general decrease. The most pronounced decline in the dissimilarity index was found for smallest neighbourhood levels across all groups. Some exceptions to the overall decrease were the largest scales (k-values), where moderate increases of dissimilarity index could be observed for non-EU citizens in both Prague and Central Bohemia. As our data indicates

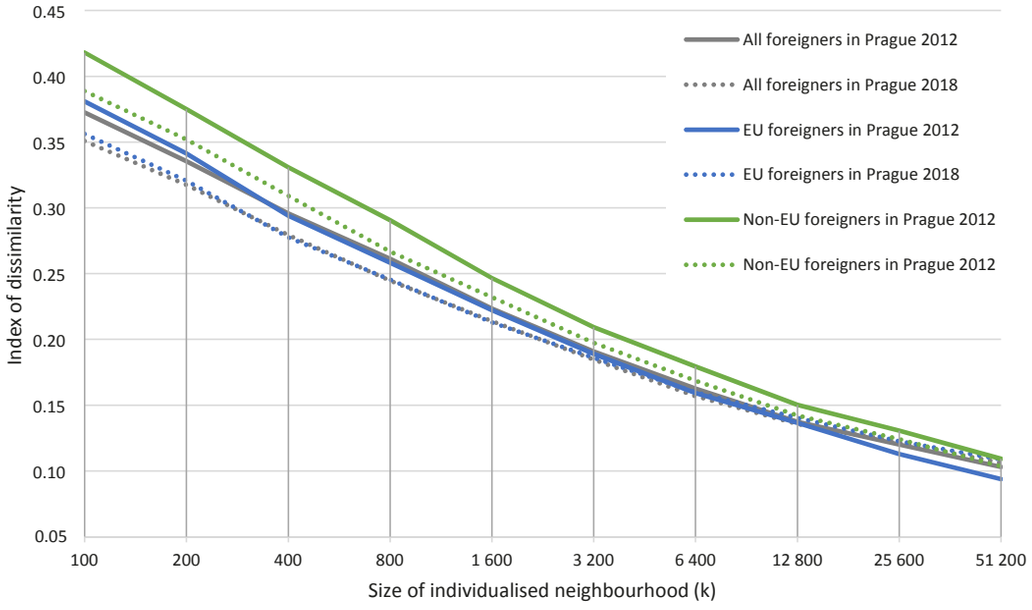

Figure 5.7: Change in dissimilarity index for individualised scalable neighbourhoods for European and non-European foreigners in the city of Prague between 2012 and 2018. ***Data source:*** *MICR (2019), own elaboration.*

20 European citizens, further referred to as EU-citizens, were operationalised as citizens of EU-28 and EFTA countries. The group consists of citizens of the following countries (in thousands): Slovakia (114), Poland (21), Germany (21), Bulgaria (15), Romania (14), United Kingdom (7), Hungary (6), Italy (5), France (4), Austria (4), the Netherlands (3), Croatia (3), Greece (2), Spain (2), and Sweden (1). Non-European citizens were operationalised as citizens of all countries outside EU-28 and EFTA. The group consists of the following countries' citizens: Ukraine (126), Vietnam (60), Russia (37), Mongolia (9), China (7), USA (7), Belarus (6), Kazakhstan (6), Moldova (6), India (4), Serbia (4), Turkey (2), Uzbekistan (2), Korea (2), Bosnia and Herzegovina (2), Macedonia (2), Armenia (2), Japan (2), Philippines (1), Syria (1), Thailand (1), Azerbaijan (1), Nepal (1), Israel (1), Egypt (1), and Tunisia (1). Only countries with over 1 000 citizens in Prague and the Central Bohemian Region as of 2018 are listed.

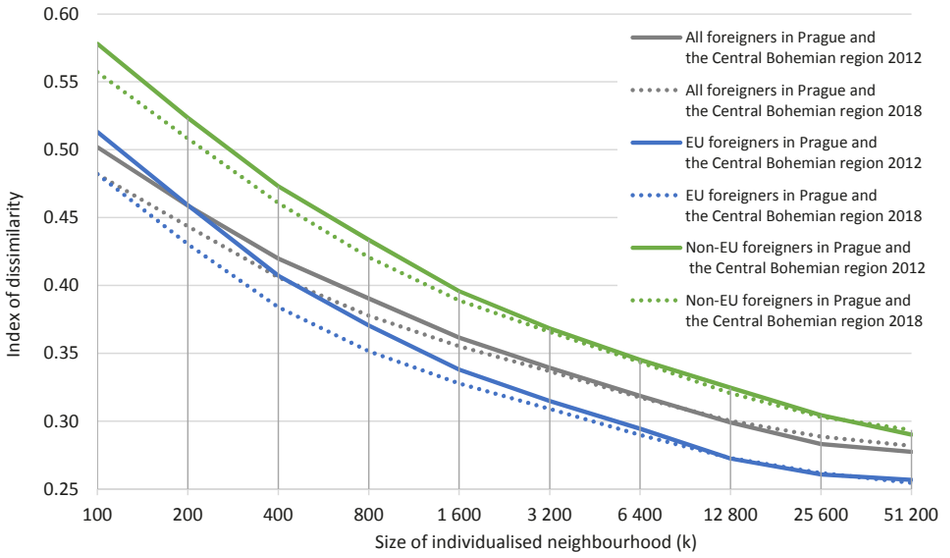

Figure 5.8: Change in dissimilarity index for individualised scalable neighbourhoods for European and Non-European foreigners in Central Bohemia between 2012 and 2018.
Data source: *MICR (2019), own elaboration.*

an almost uniform increase in the numbers of foreign citizens across the studied area, the slight increase in non-EU citizens' spatial unevenness is likely to stem from residential behaviour of the majority population, which tends to suburbanise and thus vacate housing stock for incoming foreigners, as documented by Křížková, Klsák and Šimon (2022).

Segregation of Slavic and non-Slavic foreigners

Distinguishing between Slavic and non-Slavic foreigners[21] allows us to examine the relationship between the ability to speak a language similar to that of the majority population and the subsequent outcomes in residential segregation. Language advantage presumably increases foreigners' chances to assimilate into the majority, thus leading to a lower residential segregation. In line with our expectations, Slavic citizens are indeed more equally distributed in space than non-Slavic citizens in both Prague and the metropolitan region (Figures 5.9 and 5.10). This confirms our hypothesis that Slavic citizens are more prone to spatial dispersal than linguistically more distant foreigners.

Citizens of Slavic countries are more equally distributed than all foreigners in Central Bohemia (Figure 5.9). The comparison of 2012 and 2018 data indicates that spatial distribution of Slavic group is becoming increasingly similar to that of the majority population. This is due to an overall dispersal of Slavic foreign population across the whole region in time. This micro-scale dispersal is evidenced by the decreasing dissimilarity values for the two groups and accompanied by a stagnation of dissimilarity index on larger scales in time. Dissimilarity index for non-Slavic group decreased throughout the period of 2012–2018 for all scales except the largest one. These developments were similar both in Prague and in the Central Bohemia.

Contrasting cultural and legal perspective in segregation outcomes

We have provided evidence that suggests that segregation of foreign citizens in the city of Prague and in Central Bohemia depends on scale, i.e. the number of nearest neighbours. A comparison of binary delimited groups of foreigners provides an insight on how differences in linguistic ability and in rights derived from foreign state citizenship affect residential segregation. These distinctions use country citizenship, due to the fact that other relevant indicators, such as the country of birth, are not available. If we compare all four groups, non-Slavic citizens are more segregated than non-EU citizens in both regions. Slavic citizens, however, are more segregated on smaller scales, while slightly less segregated on larger scales, compared to the EU citizens in Central Bohemia. The likely higher cultural distance between the majority and non-Slavic citizens as

21 Slavic citizens were operationalised as citizens of countries where a Slavic language is spoken, widely used or considered official language. The group consists of citizens of the following countries (in thousands): Ukraine (126), Slovakia (114), Russia (37), Poland (21), Bulgaria (15), Belarus (6), Moldova (6), Serbia (4), Croatia (3), Bosnia and Herzegovina (2), and Macedonia (2). Non-Slavic citizens were operationalised as citizens of all countries where a Slavic language is not spoken, widely used or considered official language. The group consists of the following countries' citizens: Vietnam (60), Germany (21), Romania (14), Mongolia (9), China (7), USA (7), United Kingdom (7), Hungary (6), Kazakhstan (6), Italy (5), France (4), India (4), Austria (4), the Netherlands (3), Turkey (2), Uzbekistan (2), Korea (2), Armenia (2), Japan (2), Greece (2), Spain (2), Philippines (1), Syria (1), Thailand (1), Azerbaijan (1), Nepal (1), Israel (1), Egypt (1), Tunisia (1), and Sweden (1). Only countries with over 1 000 citizens in Prague and the Central Bohemian Region as of 2018 are listed.

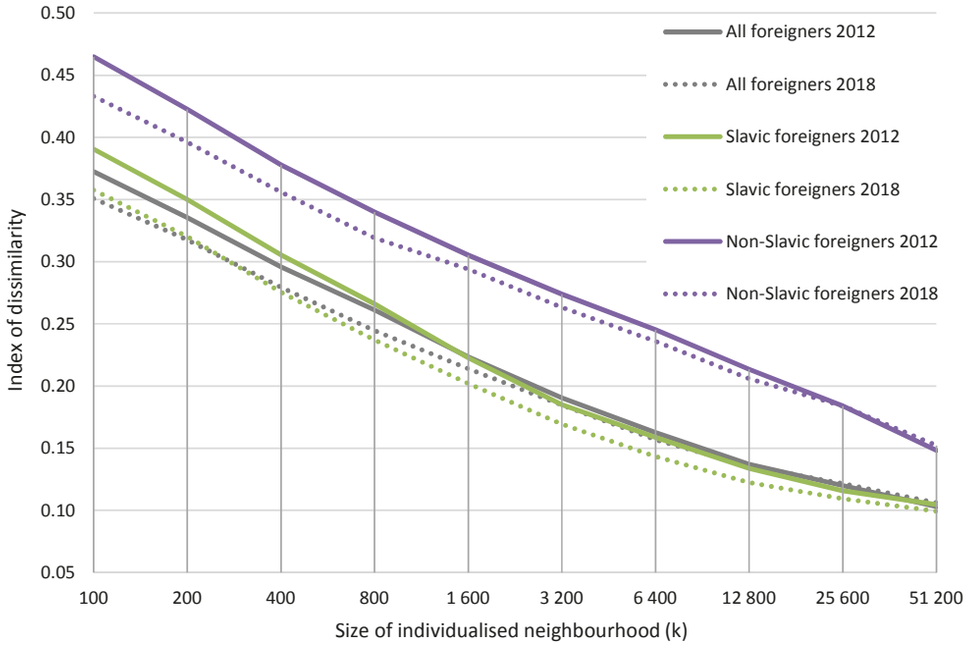

Figure 5.9: Change in dissimilarity index for individualised scalable neighbourhoods for Slavic and non-Slavic foreigners in the city of Prague between 2012 and 2018.
Data source: *MICR (2019), own elaboration.*

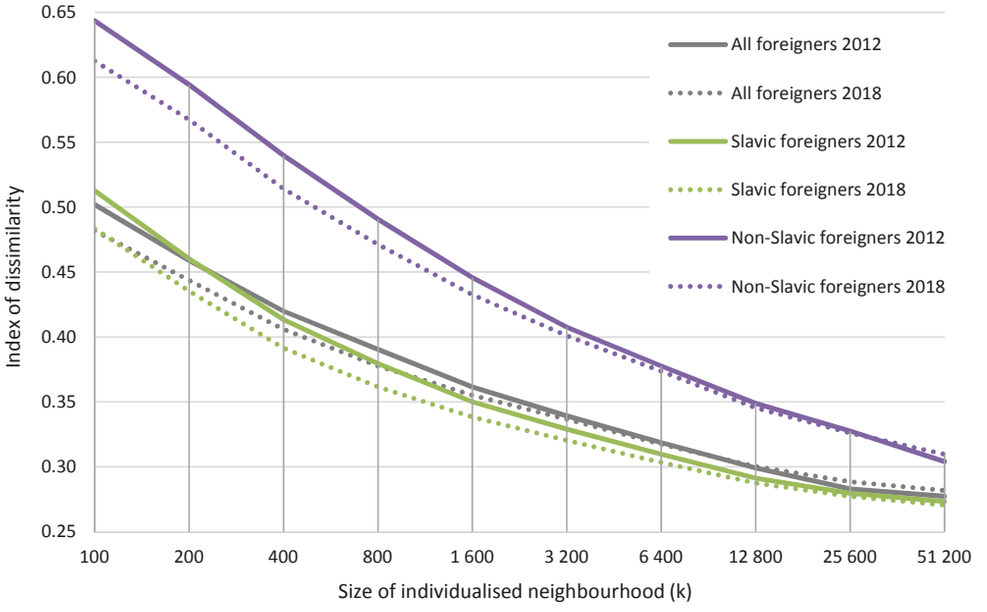

Figure 5.10: Change in dissimilarity index for individualised scalable neighbourhoods for Slavic and non-Slavic foreigners in Central Bohemia between 2012 and 2018.
Data source: *MICR (2019), own elaboration.*

opposed to between the majority and EU citizens as well as the selective and more spatially concentrated labour market opportunities, are the probable causes of the higher dissimilarity of non-Slavic compared to non-EU group.

The values of dissimilarity index for Slavic and all foreign citizens are very similar both in the city of Prague and in Central Bohemia, while the values for EU citizens were only similar to those of all foreigners in Prague (compare Figures 5.9 and 5.10 to Figures 5.7 and 5.8). This suggests that there are larger regional differences between EU citizens and all citizens than between Slavic citizens and all foreign citizens in the whole of the metropolitan region. Therefore, EU foreigners are less equally distributed than Slavic ones in Central Bohemia. The groups of foreigners from Slavic and EU countries overlap in the cases of Slovakia, Bulgaria, Poland, and Croatia, making most of the remaining EU population consist of the citizens of EU-15 and EFTA countries. These groups generally possess higher socio-economic status than other migrants in Czechia and can therefore afford to reside in more attractive localities, which leads to the clustering of their population in parts of Prague and some suburbs (see Klsák, Křížková, 2022, this book).

5.5 MERITS OF MEASURING SEGREGATION BY THE METHOD OF INDIVIDUALISED SCALABLE NEIGHBOURHOODS

The results of our study present a rather complex picture of segregation that combines several research objectives, neighbourhoods, and geographical scales. Although this intricacy may present a minor challenge to the readers' and policymakers' understanding of segregation, it has undeniable benefits.

Firstly, the method of individualised scalable neighbourhoods applied to geocoded data allows us to move beyond census-based research. Earlier studies of residential segregation were sparse due to the recentness of international migration and the limited availability and reliability of data on foreign citizens in Czechia. The present research thus allowed us to look beyond the administrative border of Prague which has traditionally been regarded as the only area where a population of foreigners is large enough to be subjected to a quantitative analysis of residential segregation. Nevertheless, our study provided evidence for the overall decreasing trend of residential segregation of foreign citizens in Prague observed by earlier studies, e.g. Přidalová, Ouředníček (2017). The method of individualised neighbourhoods emphasises the spatiality of segregation as opposed to previous research into segregation that employed administratively defined areas as units of analysis. It does so by considering the actual distances between individuals rather than the mere residential belonging within a container of an administrative unit and by assessing segregation simultaneously on multiple scales, each of which can be relevant to a different feature of segregation (Fowler, 2016; Costa, de Valk, 2018).

Secondly, the method of individualised scalable neighbourhoods provides us with an opportunity to compare the extent of residential segregation in Czechia with results using the same methodology achieved in other European countries. While some comparisons could be drawn using census data on administrative units, such as those used by Jaczewska and Grzegorczyk (2016) in the study of Paris and Berlin metropolitan regions, the dependency on census data prevented us from evaluating the more recent changes in the spatial distribution of population. For instance, comparing our results to the recent Swedish study (Malmberg et al., 2018) shows that the index of dissimilarity for non-European migrants at k = 100 is slightly larger in Central Bohemia (0.56–0.58) than in Sweden (0.51–0.54). This suggests that there is similar level of residential segregation of non-European population in Central Bohemia when compared to the whole country of Sweden. Although the two studies look at differently defined populations (based on country of birth in the Swedish case and on state citizenship in the Czech case) and research areas (the whole country and the metropolitan region of the capital city), both observed a gradual decrease of segregation indexes in time. Similar results were reported in the Netherlands (Sleutjes, Ooijevaar, de Valk, 2019). This finding appears contradictory to much of the public concern about increasing residential segregation, which is not always evidence-based (Catney, 2016; Malmberg et al., 2018).

Thirdly, geocoded data, together with the method of individualised scalable neighbourhoods, open new possibilities for research that can bring valuable insights into trends and mechanisms of residential segregation. One example is cohort studies that track segregation of people who were born in the same year or who experienced a key life event such as immigration to a new country in the same period. Such research would step beyond the initial exploratory analyses, highlighting the age aspect of segregation by comparing ethnic groups further divided to subgroups of age (Sabater, Catney, 2019). Further linking to other register data or contextual variables extends the options of this research method and makes it possible to study the relationships between people's residential and workplace segregation (Strömgren et al., 2014), residential and school segregation (Östh, Malmberg, Andersson, 2015), and the spatial and temporal patterns of economic segregation (Östh, Shuttleworth, Niedomysl, 2018) in the Czech context.

Finally, the interconnectedness between different aspects of segregation and the multi-scalarity of the phenomenon can yield rich results that require nuanced interpretation, rather than one straightforward message about decrease or increase of segregation. There is no single map of segregation. Instead, by using our data, we can produce a map of residential segregation for each of the five groups multiplied by ten neighbourhood scales and two sizes of grid units resulting in a hundred different maps. Residential segregation can be both increasing and decreasing at the same time, but at different spatial scales. For example, we have seen that segregation of foreign citizens has generally decreased from 2012 until 2018, but there were differences between population subgroups based on country of citizenship as well as between geographical scales. Though more difficult to grasp, we believe that this complexity is an opportunity for those who want to understand the underlying mechanisms and to formulate policy recommendations aimed at countering the possible negative effects of segregation.

5.6 DISCUSSION AND CONCLUSION

Despite being one of the central issues in urban studies, the understanding of segregation was compromised by a number of factors, particularly the (un)availability of data and unsuitable reporting on the spatial distribution of people and their activities. This chapter introduced the method of

individualised scalable neighbourhoods as a promising avenue for future research in segregation. The method was applied to the newly available geocoded data on foreign citizens residing (1) in the city of Prague and (2) in Central Bohemia to show a truly complex picture of residential segregation in a cross-sectional analysis of multiple scales and groups.

In general, the study provided a clear evidence of decreasing segregation in Prague and Central Bohemia between 2012 and 2018. Two different population classifications were used to explore the effects of cultural and legal differences on residential segregation. Reflecting on our hypotheses, we argue that spatial assimilation does occur in Central Bohemia. Firstly, it was shown that residential segregation decreases in time for most groups and most neighbourhood sizes. Contrary to this, a moderate rise in residential segregation was measured at the macro scale where the increase is likely to stem from the spatial distribution of jobs available to foreigners. Secondly, residential segregation of the culturally close group (citizens of Slavic countries) is indeed generally lower than the culturally more distant group (citizens of non-Slavic countries). Thirdly, the legally and socio-economically closer group to the Czech majority (EU citizens) proved to be more equally distributed as opposed to the more dissimilar group (non-EU citizens). All three hypotheses were thus supported by the data. While the merits and shortcomings of this research have to be acknowledged, we believe that our study brings important insights into residential segregation, that have not yet been presented in Czechia. As the numbers of foreigners increase, it will be crucial for research and policy makers to ensure that evidence is scrutinised and interpreted using appropriate techniques, one of which was presented here.

Acknowledgements

This research was supported by the Czech Science Foundation within the project No. 19-03211S "Residential Segregation and Mobility of Foreign Citizens: Analysis of Neighbourhoods, Housing Trajectories, and Neighbourhood Context".

References

ANDERSSON, E. K., MALMBERG, B., COSTA, R., SLEUTJES, B., STONAWSKI, M. J., DE VALK, H. A. G. (2018): A Comparative Study of Segregation Patterns in Belgium, Denmark, the Netherlands and Sweden: Neighbourhood Concentration and Representation of Non-European Migrants. *European Journal of Population*, 34, 251–275.

ANDERSSON, E. K., LYNGSTAD, T. H., SLEUTJES, B. (2018): Comparing Patterns of Segregation in North-Western Europe: A Multiscalar Approach. *European Journal of Population*, 34, 151–168.

CATNEY, G. (2016): Exploring a Decade of Small Area Ethnic (de-)Segregation in England and Wales. *Urban Studies,* 53 (8), 1691–1709.

COSTA, R., DE VALK, H. A. G. (2018): Ethnic and Socioeconomic Segregation in Belgium: A Multiscalar Approach Using Individualised Neighbourhoods. *European Journal of Population*, 34, 225–250.

FARBER, S., O'KELLY, M., MILLER, H. J., NEUTENS, T. (2015): Measuring segregation using patterns of daily travel behavior: A social interaction based model of exposure. Journal of Transport Geography, 49, 26–38.

FOSSETT, M. (2017): *New methods for measuring and analyzing segregation*. Springer Nature, Cham.

FOWLER, C. S. (2016): Segregation as a Multiscalar Phenomenon and Its Implications for Neighborhood-Scale Research: The Case of South Seattle 1990–2010. *Urban Geography*, 37 (1), 1–25.

FRIEDRICHS, J., GALSTER, G., MUSTERD, S. (2003): Neighbourhood Effects on Social Opportunities: The European and American Research and Policy Context. *Housing Studies*, 18 (6), 797–806.

GREENBERG RAANAN, M., SHOVAL, N., (2014): Mental maps compared to actual spatial behavior using GPS data: A new method for investigating segregation in cities. Cities, 36, 28–40.

GOLDMAN, A. CORNWELL, E.Y., (2021): *Racial/Ethnic Differences in Real-Time Social Contact and Health: Findings from the Chicago Health and Activity Space in Real-Time (CHART) Study*. Paper presented at Population Association of America 2021 conference, online, 5-8 May 2021.

HELBICH, M. (2018): Toward dynamic urban environmental exposure assessments in mental health research. *Environmental Research*, 161, 129–135.

HUDEČEK, T., HLAVÁČEK, P., HAINC, J., ČERVINKA, M. (2019): Statistics and Governance. Current Issues of Affordable Housing: The Case of Prague. IOP Conference Series: Earth and Environmental Science, 290, 1–6.

JACZEWSKA, B., GRZEGORCZYK, A. (2016): Residential Segregation of Metropolitan Areas of Warsaw, Berlin and Paris. *Geographia Polonica*, 89 (2), 141–68.

JÄRV, O., MÜÜRISEPP, K., AHAS, R., DERUDDER, B., WITLOX, F. (2015): Ethnic differences in activity spaces as a characteristic of segregation: A study based on mobile phone usage in Tallinn, Estonia. *Urban Studies*, 52 (14), 2680–2698.

KAUFMANN, E. (2018): Whiteshift: Populism, immigration and the future of white majorities. Penguin Random House, UK.

KLSÁK, A., KŘÍŽKOVÁ, I. (2022): Spatial Patterns of the Foreign Population in Prague and the Central Bohemian Region: The State 10 Years After the Financial Crisis. In: Ouředníček, M. (ed.): *Prague and Central Bohemia: Current Population*

Processes and Socio-spatial Differentiation. Karolinum Press, Prague, 35–57.

KŘÍŽKOVÁ, I., KLSÁK, A., ŠIMON, M. (2022): Migration and Residential Mobility of Foreign Citizens in Prague and the Central Bohemian Region. In: Ouředníček, M. (ed.): *Prague and Central Bohemia: Current Population Processes and Socio-spatial Differentiation*. Karolinum Press, Prague, 59–72.

KŘÍŽKOVÁ, I., OUŘEDNÍČEK, M. (2020): Minority internal migration in a new immigration country: Do immigrants suburbanise in Czechia and why? *Population, Space and Place*, 26, e2326.

KUŠNIRÁKOVÁ, T. (2014): Is There an Integration Policy Being Formed in Czechia? *Identities*, 21 (6), 738–54.

KWAN, M. P. (2012): The uncertain geographic context problem. *Annals of the Association of American Geographers*, 102 (5), 958–968.

KWAN, M. P. (2018): The limits of the neighborhood effect: Contextual uncertainties in geographic, environmental health, and social science research. *Annals of the American Association of Geographers*, 108 (6), 1482–1490.

MALMBERG, B., ANDERSSON, E. K., NIELSEN, M. M., HAANDRIKMAN, K. (2018): Residential Segregation of European and Non-European Migrants in Sweden: 1990–2012. *European Journal of Population*, 34, 169–193.

MASSEY, D. S. (1985): Ethnic Residential Segregation: A Theoretical Synthesis and Empirical Review. *Sociology and Social Research*, 69 (3), 315–350.

ÖSTH, J. (2014): *Introducing the EquiPop software an application for the calculation of k-nearest neighbour contexts/neighbourhoods*. Uppsala University, Department of Social and Economic Geography.

ÖSTH, J., MALMBERG, B., ANDERSSON, E. K. (2015): Analysing Segregation Using Individualised Neighbourhoods. In: Lloyd, C. D., Shuttleworth, I., Wong, D. W. (eds.): *Social-Spatial Segregation: Concepts, Processes and Outcomes*. Policy Press, Bristol, 135–161.

ÖSTH, J., SHUTTLEWORTH, I., NIEDOMYSL, T. (2018): Spatial and Temporal Patterns of Economic Segregation in Swedens Metropolitan Areas: A Mobility Approach. *Environment and Planning A*, 50 (4), 809–825.

OUŘEDNÍČEK, M., NOVÁK, J. (2007): *Kvantitativní analýza stavu a vývoje segregace/separace obyvatelstva. In: Segregace v České republice: Stav a vývoj, příčiny a důsledky, prevence a náprava*. Závěrečná editovaná zpráva projektu WA-014-05-Z01. Charles University in Prague, Prague, 9–28.

PARK, R. E. 1928. Human Migration and the Marginal Man. American Journal of Sociology, 33 (6), 881–893.

PETROVIĆ, A., VAN HAM, M., MANLEY, D. (2018): Multiscale Measures of Population: Within- and between-City Variation in Exposure to the Sociospatial Context. *Annals of the American Association of Geographers*, 108 (4), 1057–1074.

PIEKUT, A., PRYCE, G., VAN GENT, W. (2019): Segregation in the Twenty First Century: Processes, Complexities and Future Directions. *Tijdschrift voor Economische en Sociale Geografie*, 110 (3), 225–234.

PŘIDALOVÁ, I., KLSÁK, A. (2017): Rozmístění cizinců v Praze: vývoj a současnost (2008–2015). Specialised map. Charles University in Prague, Faculty of Science, Prague.

PŘIDALOVÁ, I., HASMAN, J. (2018): Immigrant groups and the local environment: socio-spatial differentiation in Czech metropolitan areas. *Geografisk Tidsskrift-Danish Journal of Geography*, 118 (1), 72–87.

PŘIDALOVÁ, I., OUŘEDNÍČEK, M. (2017): Role zahraniční migrace v měnící se sociálně-prostorové diferenciaci Prahy. *Sociologický časopis/Czech Sociological Review*, 53 (5), 659–692.

REARDON, S. F., MATTHEWS, S. A., OSULLIVAN, D., LEE, B. A., FIREBAUGH, G., FARRELL, C. R. (2008): The Geographical Scale of Metropolitan Racial Segregation. Demography, 45 (3), 489–514.

ROBINSON, W.S. (1950): Ecological Correlations and the Behavior of Individuals. *American Sociological Review*, 15 (3), 351–357.

ROTHSTEIN, R. (2017): *The color of law: A forgotten history of how our government segregated America*. Liveright Publishing, New York, London.

SABATER, A., CATNEY, G. (2019): Unpacking Summary Measures of Ethnic Residential Segregation Using an Age Group and Age Cohort Perspective. *European Journal of Population*, 35, 161–189.

SAMPSON, R. J. (2013): The place of context: a theory and strategy for criminology's hard problems. *Criminology*, 51 (1), 1–31.

SILM, S., AHAS, R. (2014): The Temporal Variation of Ethnic Segregation in a City: Evidence from a Mobile Phone Use Dataset. *Social Science Research*, 47, 30–43.

SLEUTJES, B., DE VALK, H. A. G., OIJEVAAR, J. (2018): The Measurement of Ethnic Segregation in the Netherlands: Differences Between Administrative and Individualized Neighbourhoods. *European Journal of Population*, 34, 195–224.

SLEUTJES, B., OIJEVAAR, J., DE VALK, H. A. G. (2019): Residential Segregation in the Amsterdam Metropolitan Region: A Longitudinal Analysis Using Scalable Individualised Neighbourhoods. *Tijdschrift voor Economische en Sociale Geografie*, 110 (3), 359–377.

STRÖMGREN, M., TAMMARU, T., DANZER, A. M., VAN HAM, M., MARCIŃCZAK, S., STJERNSTRÖM, O., LINDGREN, U. (2014): Factors Shaping Workplace Segregation Between Natives and Immigrants. *Demography*, 51 (2), 645–671.

SUBRAMANIAN, S.V., JONES, K., KADDOUR, A., KRIEGER, N. (2009): Revisiting Robinson: The perils of individualistic and ecologic fallacy. International Journal of Epidemiology, 38 (2), 342–360.

SÝKORA, L. (2009): New Socio-Spatial Formations: Places of Residential Segregation and Separation in Czechia. *Tijdschrift voor Economische en Sociale Geografie*, 100 (4), 417–435.

ŠIMON, M., KŘÍŽKOVÁ, I., KLSÁK, A. (2020): Migranti ve vybraných městech Česka 2008–2015: Analýza změny prostorového rozmístění s využitím populačního rastru. *Geografie*, 125 (3), 343–374.

ŠIMON, M., KŘÍŽKOVÁ, I., KLSÁK, A., MIKEŠOVÁ, R., LEONTIEVA, Y. (2020): Základní trendy rozmístění cizinců v Česku 2008–2015: Rezidenční segregace perspektivou různě

velkých individualizovaných sousedství. *Urbanismus a územní rozvoj*, 23 (3), 9–17.

ŠPAČKOVÁ, P., POSPÍŠILOVÁ, L., OUŘEDNÍČEK, M. (2016): The Long-Term Development of Socio-Spatial Differentiation in Socialist and Post-Socialist Prague. *Sociologický časopis/Czech Sociological Review*, 52 (6), 821–860.

TEMELOVÁ, J., OUŘEDNÍČEK, M., NETRDOVÁ, P., NOVÁK, J., NOVÝ, V., JÍCHOVÁ, J., PULDOVÁ, P., POSPÍŠILOVÁ, L., DVOŘÁKOVÁ, N. (2011): *Analýza nových lokalit bydlení v Pražském městském regionu*. Univerzita Karlova, Praha.

VAN HAM, M., MANLEY, D., BAILEY, N., SIMPSON, L., MACLENNAN, D. (Eds.) (2013): *Understanding Neighbourhood Dynamics: New Insights for Neighbourhood Effects Research*. Springer, Dordrecht.

VAN HAM, M., MANLEY, D., BAILEY, N., SIMPSON, L., MACLENNAN, D. (Eds.) (2012): *Neighbourhood Effects Research: New Perspectives*. Springer, Dordrecht.

WISSINK, B., SCHWANEN, T., VAN KEMPEN, R., (2016): Beyond residential segregation: Introduction. *Cities*, 59, 126–130.

WONG, D. W. S., SHAW, S. L. (2011): Measuring Segregation: An Activity Space Approach. *Journal of Geographical Systems*, 13 (2), 127–145.

WRIGHT, R., ELLIS, M., HOLLOWAY, S., GOLRIZ, M. (2020): Mixed measures: different definitions of racially diverse neighborhoods compared. *Urban Geography*, 42 (8), 1147–1169.

YIP, N. M., FORREST, R., XIAN, S. (2016): Exploring segregation and mobilities: Application of an activity tracking app on mobile phone. *Cities*, 59, 156–163.

Data sources

MICR (2019): Anonymised geocoded dataset on foreign citizens in Czechia, 2013–2018. *Ministry of the Interior of the Czech Republic*, Prague.