NICOLAUS COPERNICUS UNIVERSITY IN TORUŃ

Bulletin of Geography. Socio-economic Series, No. 56 (2022): 143-159
http://doi.org/10.12775/bgss-2022-0019

ISSN 1732–4254 quarterly

BULLETIN OF GEOGRAPHY. SOCIO–ECONOMIC SERIES

journal homepages:
https://apcz.umk.pl/BGSS/index
https://www.bulletinofgeography.umk.pl/

Investigating neighbourhood concentration of immigrants in Poland: explorative evidence from Kraków

Marcin Stonawski[1, CDMR], Jan Brzozowski[2, CMR], Konrad Pędziwiatr[3, CMR], Marina Georgati[4, DF]

[1]*Department of Population and Education*, Statistics Denmark, Copenhagen, Denmark; [1,2,3]*Cracow University of Economics*, Center for Advanced Studies of Population and Religion, Krakow, Poland; [4]*Aalborg University*, Department of Planning, Copenhagen, Denmark; [1]e-mail: mstonaw@gmail.com *(corresponding author)*

How to cite:
Stonawski, M., Brzozowski, J., Pędziwiatr, K. & Georgati, M. (2022). Investigating neighbourhood concentration of immigrants in Poland: explorative evidence from Kraków. *Socio-economic Series*, 56(56): 143-159. DOI: http://doi.org/10.12775/bgss-2022-0019

Abstract. *Aim.* This study contributes to research on new immigrant destinations in Central and Eastern Europe by investigating the neighbourhood concentration of immigrants in Poland. We focus on Kraków – Poland's second largest city – for which we have built a unique, register-based dataset containing geocoded, individual-level data. To our knowledge, it is the first high-quality dataset of this type to be prepared and used for research purposes in Poland. We use it to describe the spatial allocation of immigrants at a relatively early stage of immigration using the k-Nearest Neighbours (kNN) approach.
Results and conclusions. We find that, whereas foreigners comprise around 4.2% of the city's population, 50% of city inhabitants live in 200 kNNs that each have less than a 2.2% share of foreigners. The Dissimilarity Index for the immigrants is 0.45. Yet, there is a relatively high concentration among foreigners from Asia and America. However, immigrants from Ukraine and other Eastern European, non-EU countries are much more evenly spread around the city.

Article details:
Received: 15 February 2022
Revised: 15 April 2022
Accepted: 27 May 2022

Key words:
segregation, concentration, immigrants, Dissimilarity Index, Poland

Contents:

1. Introduction

In recent years, most EU member states in Central and Eastern Europe have transformed from "migrant-exporting" economies into important destinations (Okólski 2012; Bilan & Strielkowski 2016). Although this transformation from sending country to host country replicates the experience of Southern European members of the EU such as Spain or Italy (Bonifazi et al., 2009), this transformation is unprecedented in its pace. A striking example in this regard is Poland. Since 2015, it has become a major destination country for third-country nationals in the EU. Before 2015, less than 0.5% of the population was foreign-born. Most recent estimates (2020) mention 2.1 million immigrants residing in Poland in February 2020 (5.8% of the population) – including 1.35 million Ukrainians and several tens of thousands of immigrants in total from other countries combined (i.e. Belarus, Russia, Germany, Moldova and India – to mention those with the largest communities in Poland – GUS, 2020).

Consequently, Poland, with its increasing ethnic diversity, may face similar challenges in integrating migrants and building a cohesive society as do Western European countries (Coenen et al., 2019), including issues of residential segregation and/or concentration of immigrants. For Central and Eastern Europe, the question of migrant ethnic residential concentration is a very novel issue, as migration studies have traditionally emphasised that, in cities of the region, "ethnicity and immigration hardly play a role" (Musterd & Van Kempen, 2009: 599).

Residential concentration involves relatively strong over-representation of immigrants in some areas combined with under-representation in other places (Andersson et al., 2018). It is frequently viewed as a negative effect of immigration, as it may hinder integration (Musterd & Ostendorf, 2009) and lead to socio-economic marginalisation, as well as increasing crime rates in disadvantaged areas (Schönwälder, 2007). Consequently, the process of residential concentration of immigrants attracts a lot of attention of policymakers interested in designing policy measures that favour the spatial dispersion of foreign-born populations (Bolt, 2009). As such, this phenomenon is an object of intense academic debate (see, for instance: Peach, 2002; 2010; Bolt et al., 2010).

Some of the key factors responsible for different patterns of segregation in Europe include migration policy (in particular, a visa regime defining who can enter and under what conditions), character of housing market (in particular, availability of social housing for migrants), welfare-state regime and spatial planning (Arbaci, 2007; Anderson et al., 2018). Studies carried out in Western European cities show that residential segregation is also a result of discrimination on the housing market, differential preferences among different minority and majority groups and so-called cumulative neighbourhood disadvantages, which relate mostly to subsequent generations of immigrants (Peach, 2002; 2010; Costa & De Valk, 2018; Stonawski et al., 2021).

Knowledge of segregation in Europe is based mainly on studies of Western European countries rooted in the broad literature from the United States that focuses mostly on groups of Black and Latino populations (Balakrishnan & Hou, 1999; Fong, 2006; Iceland & Scopilliti, 2008; Crowder et al., 2011; Tammaru et al., 2016; Andersson et al., 2018). This is mostly a result of the duration of immigration processes in these parts of the world, their significance for these societies, as well as data availability. In both cases – Western Europe and the US – focus is put on disadvantaged, low-income and low-educated populations. However, neighbourhood concentration does not necessarily concern only such groups. The processes of immigrant concentration do not necessarily lead in every context to negative outcomes, nor follow similar trajectories as those observed in the past.

There is an obvious research gap in investigating this phenomenon in new migrant destinations in Central and Eastern Europe. Therefore, Poland is a natural candidate for in-depth investigations of residential patterns of immigration. In the case of Poland, there are country-specific factors (N1) that play a role in determining the housing locations of foreigners in major cities (which attract most of the recent immigrants in the country) (Górny & Śleszyński, 2019). Yet, very little is known about their spatial distribution within these agglomerations, the degree of their neighbourhood concentration, or the

possibility of interactions among members of a given national group within their more immediate or wider neighbourhood. One of the rare studies that looks (mainly qualitatively) at various dimensions of the presence of immigrants in urban neighbourhoods concerns Poland's capital, Warsaw, and its larger agglomeration (Górny et al., 2018). In this regard, Kraków is a very interesting case for analysing the residential segregation patterns of immigrants at new destinations. Kraków is the second-largest Polish city, with a registered population of ca. 760,000. Apart from its booming B2B industry and ICT sector, it is the second academic hub in the country, with a student population estimated at 150,000, including over 8,000 foreigners (Mucha & Pędziwiatr, 2019). Kraków is also a booming tourist destination: before the Covid-19 pandemic, the tourism industry accounted for 8% of local GDP and 10% of employment. All of these sectors attract immigrants. Finally, the housing market in Kraków is extremally competitive, as many apartments are offered as short-term via services like Airbnb. Consequently, the pool of apartments available for long-term rental is limited, and migrants have to compete with students for affordable housing. Additionally, one should indicate that most immigrants arrived in Kraków relatively recently (frequently after 2015) so a significant foreign-born population in the city is quite a new phenomenon.

Until recently, no systematic analysis on immigrant residential concentration in Kraków had been performed. The study of Brzozowski & Pędziwiatr (2014), based on a survey of long-term migrants accompanied with interviews and focus groups, revealed that the most highly residentially concentrated groups in Kraków were of Vietnamese people and Armenians. As many as 60% of the surveyed Armenians and 66% of the Vietnamese immigrants stated that their immediate neighbourhood was inhabited mostly by their countrymen. By contrast, the most evenly geographically distributed immigrant communities were those of Ukrainians and citizens of Middle-Eastern and North African (MENA) countries: 36% and 40%, respectively, declared that only Poles lived in their neighbourhood. Of course, the picture of residential segregation and concentration of immigrants in Kraków has changed substantially since 2013: as of 2019, the official statistics show ca. 32,000 foreigners living in the city, accounting for 4.2% of its population.

Consequently, this study aims to contribute to the literature on residential concentration of immigrants by providing a comprehensive analysis of the neighbourhood concentration patterns of foreigners in Poland. It is particularly important to investigate these processes at the current – early – stage of the immigration process with a view to better understanding their dynamics in the future. We focus on Kraków, which is attracting a growing number of immigrants and provides a good example for discussing migration processes affecting large cities in Poland.

For this study, we have built a unique dataset containing geocoded, individual-level data on immigrants with several characteristics, using information from registers for Kraków. This allows us to study patterns using geographic coordinates and individualised scalable neighbourhoods instead of areal and administrative units of various sizes. To our knowledge, it is the first dataset of this type to be prepared and used for research purposes in Poland, and it has similar qualities as those used, for example, in studies in the Netherlands, Denmark, Norway or Sweden (Bolt et al., 2008; Marcińczak et al., 2015; Wessel et al., 2016; Musterd et al., 2017; Andersson et al., 2018; Stonawski et al., 2021). With this innovative data and approach, in this article we address the following important questions:

1. Is there any evidence of residential concentration of immigrants in Kraków?
2. What are the characteristics of immigrants residing in the city?
3. Are there variations in residential concentration between national or multi-national foreigner groups in the city?
4. What residential contact do native Krakovians have with immigrants?

In the first section of the article, we describe our methods and discuss data availability and its limitations. The second part of the article is devoted to the analysis and presentation of the results and comparisons against recent research on ethnic & immigrant concentration. Finally, we present conclusions from the analysis.

2. Data and methods

Our analysis focuses on foreigners residing in the Kraków Municipality. We define immigrants as persons with a foreign citizenship [N2]. Thus, naturalised immigrants who received Polish citizenship are treated as natives in our analysis, which is a limitation, but, as the phenomenon of a large influx of immigrants is recent, a very small number of foreigners follow the procedure (in 2019 around 7% of all cases on legalisation of stay in Kraków). Our research team, in collaboration with the Municipality of Kraków and the Lesser Poland (Małopolskie) Voivodship Office, has created an individual-level dataset that is unique in Poland; it contains several characteristics of immigrants residing in the city derived from data contained in the registers of these institutions. We combined data on immigrants from the register of people legalising their stay in Poland and from the register of inhabitants of Kraków in 2019. We added geographical coordinates to other characteristics of all residents of the city. For computational purposes, we use data aggregated into 100×100-metre grid cells. The created dataset enables us to study spatial patterns of settlement in Kraków at the lowest possible level of geographic aggregation for 759,379 persons, comprising 31,803 foreign citizens and 727,576 Polish citizens.

The main challenge for studies on settlements and mobility patterns is to define size of neighbourhood (Stonawski et al., 2021; Malmberg et al., 2018; Musterd, 2005). Usually, in the literature on segregation, there appear city districts, census tracts or other administrative divisions that in many cases are arbitrary from the perspective of the conducted studies, as local neighbourhoods do not necessarily stop at administrative borders. Additionally, the scale-dependent nature of mobility patterns, e.g., segregation effects, reduces the reliability of comparison in space and in time (van der Wusten & Musterd, 1998; Musterd, 2005), which is referred to as the Modifiable Areal Unit Problem (MAUP) (Nielsen & Hennerdal, 2017; Andersson et al., 2018). Thus, the segregation levels and patterns are hardly comparable between areas of different sizes. To avoid the described boundary and scale issues, scalable individualised neighbourhoods (sometimes called "egocentric") can be applied (Malmberg, 2018; Anderson 2018; Osth et al., 2014). For each grid cells, we construct a buffer that contains a predefined k-number of the nearest neighbours around the individual – the so called kNN method (Osth et al., 2015). Then, for the grid cells contained in the buffer, we calculate the number of persons with predefined migrant characteristics and calculate measures for the defined neighbourhood. In our study, we use the following neighbourhood scale levels: 200, 800, 1,600, 12,800, and 25,600 persons for studying characteristics among total population, and for k-foreign neighbourhoods: 200, 400, 800 and 1,000. To construct the buffers and calculate the population composition of the neighbourhoods, we use EquiPop software developed by the population geographer John Östh (Osth, 2014; Osth et al., 2014).

To describe spatial settlement patterns in Kraków, we use percentile plots and dissimilarity indexes. Malmberg (2015: 177) explains that the percentile plots provide a "comprehensive picture of differences in neighbourhood composition by showing the proportion of neighbourhoods above or below certain values for the migrant proportion in the population". In the case of individualised neighbourhoods, number of neighbourhoods equals number of persons in population. In the case of Kraków in 2019, we have created around 759,000 neighbourhoods.

The Dissimilarity Index (DI) measures the evenness of the distribution of two groups across neighbourhoods (Duncan & Duncan, 1955; Massey & Denton, 1988). It is the most widely used aggregate measure of segregation describing over- or underrepresentation of a specific group. We calculated it using the following formula proposed by Malmberg et al. (2018), which is designed for calculations in the case of individualised neighbourhoods:

$$DI = \frac{1}{2} \sum_{i=1}^{P} \left| \frac{m_i}{M} - \frac{o_i}{O} \right|,$$

where: i is an individual, P is the whole population, m_i is the proportion of migrants in the individualised neighbourhood of i, M is the sum of all m_i, o_i is the proportion of others in the individualised neighbourhood of i, and O is the sum of all o_i.

The *DI* is equal to zero if both groups – migrants and non-migrant populations – are equally represented in all neighbourhoods and equals one if migrants have zero representation in neighbourhoods where non-migrants live, while non-migrants are not represented in the neighbourhoods where migrants live. Malmberg et al. (2018) explain that the proposed formula is different from those used for fixed geographical areas but has the same properties, including its interpretation – the proportion of the group that needs to move in order to arrive at an even distribution. Additionally, in the article, we present *DI* calculated in the standard way for a fixed geographical area – grid cells.

In the analysis, we also use the probability that a foreigner from a specific group can find another person from his/her group. This measurement can be used to evaluate the residential isolation of specific foreign groups. A measurement of zero indicates that a particular immigrant has no compatriots in his/her k-level foreign neighbourhood (NBH) while a value of one indicates that all neighbours of the immigrant are from his/her immigrant group.

3. Immigrants and neighbourhoods in Kraków

There were around 760,000 people in Kraków in 2019 (in Autumn 2019). They inhabited 11,288 grid cells of 100×100 metres (Fig. 1), which gives an average density of 67.1 persons per inhabited cell (Table 1). According to our estimates, 31,803 of the inhabitants were immigrants, which is 4.2% of the total population of the city. They were citizens of 150 different countries and were present in 4,471 grid cells (around 40% of all inhabited cells in Kraków). Thus, the average density of immigrants was 7.1 persons per grid cell inhabited by foreigners. The highest level of concentration of immigrants in a grid cell was 234 persons. The biggest group of immigrants is of people who originate from other European, non-EU countries, comprising 18.5 thousand persons, 59% of all foreigners in the city. These are mostly foreigners from Eastern Europe: Ukrainians (15.6 thousand), but also Russians (1.4 thousand) and Belarusians (1.3 thousand). The second largest category is comprised of EU+ immigrants (i.e. from the European Union countries, the United Kingdom and EFTA countries) and consists of 8 thousand persons (25% of foreigners), mostly from Italy (1 thousand), Spain (0.9 thousand), France (0.8 thousand), the UK (0.7

Table 1. Foreign population in Kraków

Region	Item	Number of populated grid squares	Median population	Min population in grid cell	Max population in grid cell	Population	% in Total Population	% in Foreigner Population	Averege no of persons per populated grid
Total		11 288	21	1	1 328	759 400	100,0%	x	67,3
Foreigners		4 471	0	0	234	31 803	4,2%	100,0%	7,1
Europe	EU+	2 445	0	0	122	8 053	1,1%	25,3%	3,3
	Non EU+	3 609	0	0	151	18 532	2,4%	58,3%	5,1
Outside Europe		1 842	0	0	54	5 219	0,7%	16,4%	2,8
Africa	North Africa	290	0	0	11	374	0,0%	1,2%	1,3
	Sub Saharan Africa	180	0	0	7	244	0,0%	0,8%	1,4
Asia	East Asia	222	0	0	8	399	0,1%	1,3%	1,8
	South Asia	419	0	0	27	1 016	0,1%	3,2%	2,4
	Central Asia	220	0	0	6	343	0,0%	1,1%	1,6
	South-East Asia	213	0	0	20	517	0,1%	1,6%	2,4
	West Asia	592	0	0	16	1 101	0,1%	3,5%	1,9
America	North America	341	0	0	7	477	0,1%	1,5%	1,4
	Latin America	402	0	0	17	667	0,1%	2,1%	1,7
Oceania	Oceania	31	0	0	5	44	0,0%	0,1%	1,4
Chosen Groups	Vietnam	126	0	0	20	387	0,1%	1,2%	3,1
	Turkey	228	0	0	5	323	0,0%	1,0%	1,4

Source: CASPAR dataset of population in Kraków, authors' calculations

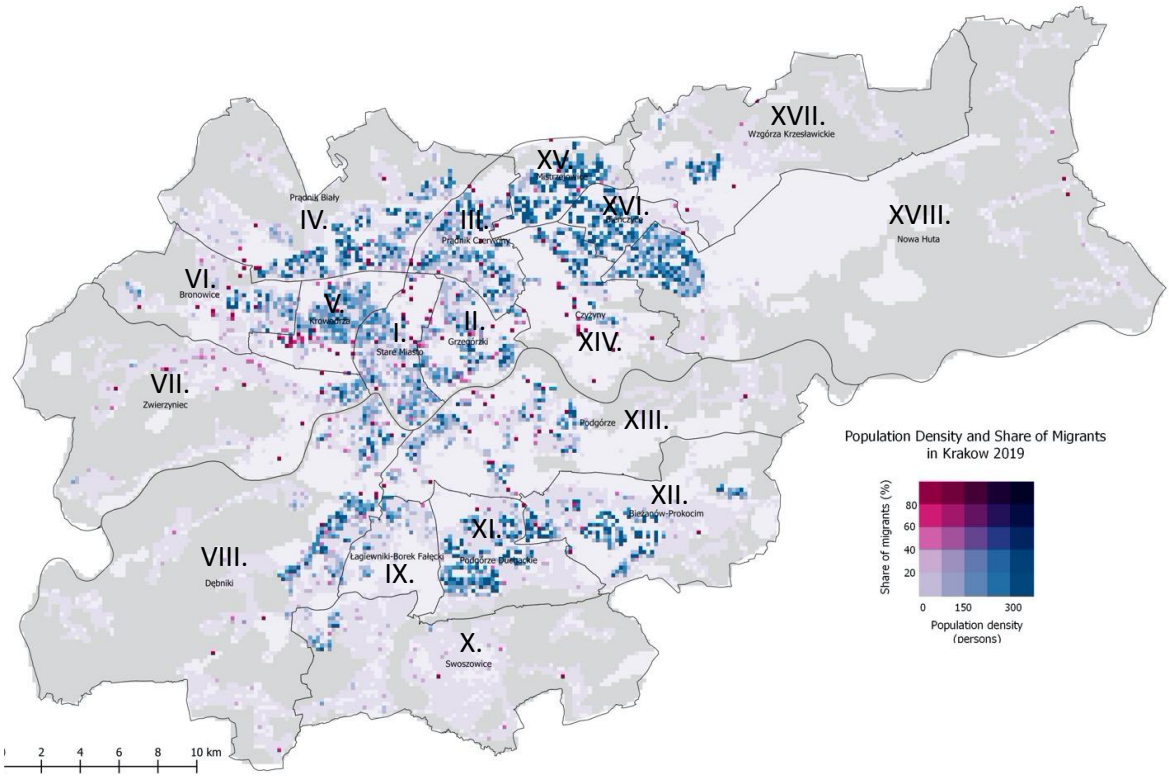

Fig. 1. Share of immigrants and population density by grid cells in Kraków
Source: CASPAR dataset of population in Kraków, authors' calculations

thousand) and Germany (0.6 thousand). Non-EU Europeans have a higher concentration than those from EU countries. The density of the population is 5.1 persons per grid cell, whereas that of EU citizens is 3.3 persons per grid cell. These two groups are followed by less numerous categories of foreigners, namely West Asians – 1.1 thousand people (mostly Turkish – 0.2 thousand), South Asians – 1 thousand (mostly Indians – 0.9 thousand), Latino Americans 0.7 thousand (mostly Brazilians – 0.3 thousand), South-East Asians – 0.5 thousand (the largest single nationality being Vietnamese – 0.1 thousand) and North Americans – 0.5 thousand. Those groups have rather low concentrations – around 1–2 persons per grid cell inhabited by a group.

The population of foreigners in Kraków is balanced in terms of gender. In 2019, around 56% of immigrants were men. However, there are

Table 2. Size of individualised neighbourhoods in Kraków, radius in metres (percentiles based on population counts)

Percentiles	k-NN				
	200	800	1600	12800	25600
10	0	100	141	510	762
25	0	100	141	608	922
50	0	141	224	721	1100
75	100	200	300	985	1393
90	141	361	539	1530	2202
95	224	539	825	2354	3046
99	447	1077	1655	4904	6152

Source: CASPAR dataset of population in Kraków, authors' calculations

differences by region of citizens. For example, in the non-EU immigrant population there are almost equal numbers of men and women, whereas among EU citizens only 30% are women. The population of immigrants is rather young. The biggest group is of people aged 25–34 years and then those who are 35–44 years old. Around 60% of all immigrants defined their civil status as single. However, the most striking result is that foreigners in Kraków are highly educated. In this respect, they are among the elite of the city. Around 70% of persons declared that they had completed tertiary education (N3), which is a much higher level than that of the Poles living in the city. This finding shows that the population of immigrants in Kraków is significantly different from foreign populations in the cities of Western European countries. This is a group of young, highly educated persons that have good labour market opportunities.

According to our dataset, nine out of ten people in Kraków have 200 close neighbours within a 141-metre radius (Table 2). By comparison, in the entire Netherlands, which is a country with a high population density, 90% of inhabitants had 200 surrounding people within a 224-metre radius in 2011. In Belgium, it is a 424-metre radius (Andersson et al., 2018). In Kraków, 90% of inhabitants can find 1,600 of their nearest neighbours within approximately 500 metres. For 90% of Krakovians, 25,600 neighbours live within a 2.2-km radius.

4. Results

In what follows, we analyse the concentration of groups of foreigners in Kraków using the percentile plots and the calculation of dissimilarity index for all the categories of immigrants. Then, we analyse the spatial concentration of foreigners by districts and by individual neighbourhoods. In doing so, we compare our results with the findings from previous studies.

According to the contact hypothesis, direct contact with members of other cultural groups provides direct information about different aspects of their life and creates direct experiences with members of the groups. Information gathered in this way is likely to be more favourable and accurate than information from other sources (e.g. Allport, 1958; Williams, 1947; Ellison et al., 2011). This can lead to more favourable perception of the groups and help in the integration and assimilation of immigrants. The experiences of many countries and cities of Western Europe show that inappropriate immigrant allocation policies or a lack thereof can lead to segregation and deprivation of large areas.

Our data enables us to evaluate what share of Krakovians has potential residential contact with immigrants. Table 4 shows that, when the 200 nearest neighbours are considered, half of the population live in NBHs with a share of immigrants below 2.2%. Seventy percent of Krakovians live in neighbourhoods with an under-represented population of immigrants, which is NBH with a share of immigrants below 4.2% (share in the whole city). Only one in ten persons inhabits a place with 10% or more foreigners. Only 1% of Krakovians live in a place where at least one out of four people is an immigrant. When we look at large NBHs of 25,600 people, half of the population can find 4.1% of immigrants in the surrounding area. This suggests that, in Kraków, only a small fraction of natives can gain direct information on foreigners in their residential area.

However, 7% of the inhabitants of Kraków have no foreigner in a 200-n neighbourhood (Fig. 2a, Table 3). By comparison, in the agglomeration of Copenhagen (called Greater Copenhagen, 1.1 million people, 8.3% of persons with foreign background) only 0.05% of inhabitants had no foreigner in a 250-metre neighbourhood in 1990 and, in 2020, there were no people without a person of immigrant background in the surrounding area (Stonawski et al., 2022). When we increase the size of neighbourhood to 800 people, we do not observe any Krakovian without a foreign neighbour (Fig. 2b, Table 3)

When it comes to the dissimilarity index (DI) of kNN = 200 neighbours, the value for all the foreign population in Kraków is 0.45, which means that 45% of foreigners would need to move to obtain an even distribution (Table 4). The DI falls substantially as a larger level of neighbourhood is applied, which is a normal tendency of this measure of unevenness. The DI among 1,600 neighbours is 0.36, whereas among 25,600 it is 0.28. If we calculate DI for grid cells instead of k-level NBHs, it gives us a level of 0.52 in 2019. For the largest groups of immigrants (those

from Europe) unevenness is much lower among non-EU+ migrants (0.43) in comparison to the EU group (0.58) at the k-level of 200 persons. By comparison, the study of Andersson and associates (2018) found that, for entire countries, the dissimilarity index (albeit for non-European immigrant populations only) varied from 0.475 in Denmark to 0.512 in Belgium for 200-person neighbourhoods. When it comes to Western European cities, the dissimilarity index is traditionally high in Leeds (in the case of Bangladeshi – 0.8, Pakistani – ca. 0.6) and in Barcelona (in the case of Pakistani – 0.8, Moroccan and Chinese – 0.6). Taking into account the values of DI from other "traditional" cities with large immigrant populations in Western Europe, our results indicate a moderate concentration of immigrants in Kraków.

In the case of smaller ethnic groups and a smaller unit of neighbourhood, the value of DI is much higher, and these results confirm the existence of an obvious weakness of this instrument (Musterd & Van Kempen, 2009). DI tends to be high for very small immigrant populations, as it is easier for smaller populations to become unevenly distributed in an area. Therefore, for a better picture of the ethnic concentration of immigrants, it is also important to consider the absolute numbers and the distribution of each immigrant group population over the city districts. The largest number of foreign population (4,000 persons) can be found in District I (Stare Miasto [the Old City]) district, where immigrants comprise 10.6% of the population. Yet, this result should be considered with caution. First, as one of the most popular tourist destinations in Europe (Matoga & Pawłowska, 2018), Kraków experiences most of the negative effects of rapid tourism-industry expansion on local population (Lambea

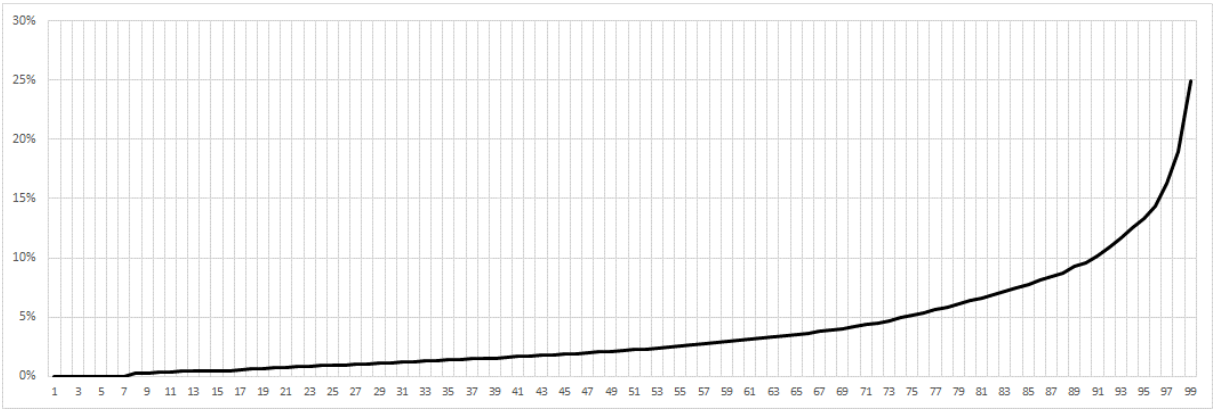

Fig. 2a. Concentration of foreigners in individualised neighbourhoods in Kraków. Percentile values for k-level 200
Source: CASPAR dataset, authors' calculations

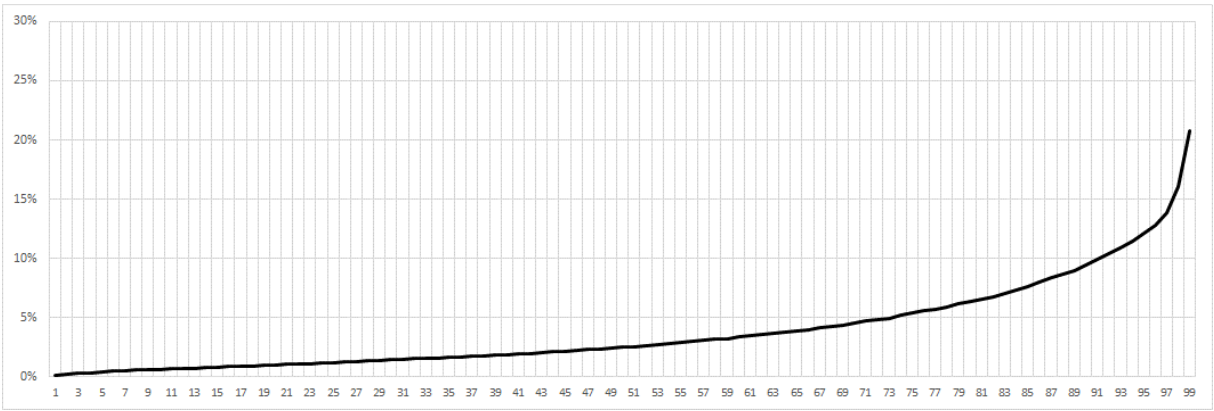

Fig. 2b. Concentration of foreigners in individualised neighbourhoods in Kraków. Percentile values for k-level 800
Source: CASPAR dataset, authors' calculations

Table 3. Concentration of foreigners in individualised neighbourhoods in Kraków. Percentile values for k-level 200, 800, 1,600, 12,800 and 25,600

Group	Percentiles	k-NN				
		200	800	1600	12800	25600
Foreigners	10	0,3%	0,7%	0,8%	1,1%	1,1%
	25	0,9%	1,2%	1,3%	1,5%	1,6%
	50	2,2%	2,5%	2,8%	3,6%	4,1%
	75	5,1%	5,4%	5,3%	5,8%	6,1%
	90	9,6%	9,4%	9,1%	8,6%	8,1%
	95	13,3%	12,1%	11,0%	9,6%	9,2%
	99	24,9%	20,8%	17,8%	11,0%	10,3%

Source: CASPAR dataset of population in Kraków, authors' calculations

Table 4. Dissimilarity Index for foreigners and its subgroups in Kraków

Region	k-level NBH					GRIDS
	200	800	1600	12800	25600	
Foreigners	0,45	0,39	0,36	0,30	0,28	0,52
Europe EU+	0,58	0,52	0,49	0,42	0,40	0,66
Europe non-EU+	0,43	0,35	0,31	0,24	0,23	0,53
Outside Europe	0,58	0,48	0,43	0,36	0,35	0,68
North Africa	0,89	0,72	0,55	0,33	0,30	0,92
Sub Saharan Africa	0,93	0,82	0,70	0,38	0,34	0,95
East Asia	0,92	0,81	0,70	0,48	0,45	0,95
South Asia	0,86	0,69	0,61	0,45	0,42	0,90
Central Asia	0,91	0,79	0,66	0,33	0,28	0,94
South-East Asia	0,92	0,81	0,69	0,48	0,44	0,95
West Asia	0,79	0,61	0,52	0,36	0,34	0,86
North America	0,88	0,73	0,62	0,49	0,48	0,92
Latin America	0,86	0,68	0,58	0,41	0,38	0,90
Oceania	0,99	0,97	0,94	0,72	0,63	0,99
Vietnam	0,95	0,88	0,80	0,54	0,49	0,97
Turkey	0,91	0,80	0,68	0,44	0,41	0,94

Source: CASPAR dataset, authors' calculations

Llop, 2017). As a consequence, the Old City centre experiences depopulation of local inhabitants, who are being substituted by users of short-term rental apartments, hostels, discos and restaurants. Second, some of these hostels and discos that employ migrants might also register them as residents, but the residence declaration does not imply that a given migrant actually lives in this area. Third, the foreign population in District I is dominated by the Europe EU+ category; these are thus, in fact, wealthier migrants from Western Europe, who could be investors in, or proprietors of real estate, but not necessarily inhabitants in this area.

The mean density of migrants per district ranges from 1% to 13% of the total population residing in the district (Table 5). Figure 3 displays the average share of migrants in comparison to the average population density in Kraków at the boundaries of statistical regions and census enumeration areas (BREC 2011), where a moderate concentration of migrants becomes apparent. The map shows in dark blue the more densely inhabited areas with the lowest concentrations of migrants in the peripheral districts of the north-eastern part of the city (Districts XV and XVI). The average population density in these districts reaches or

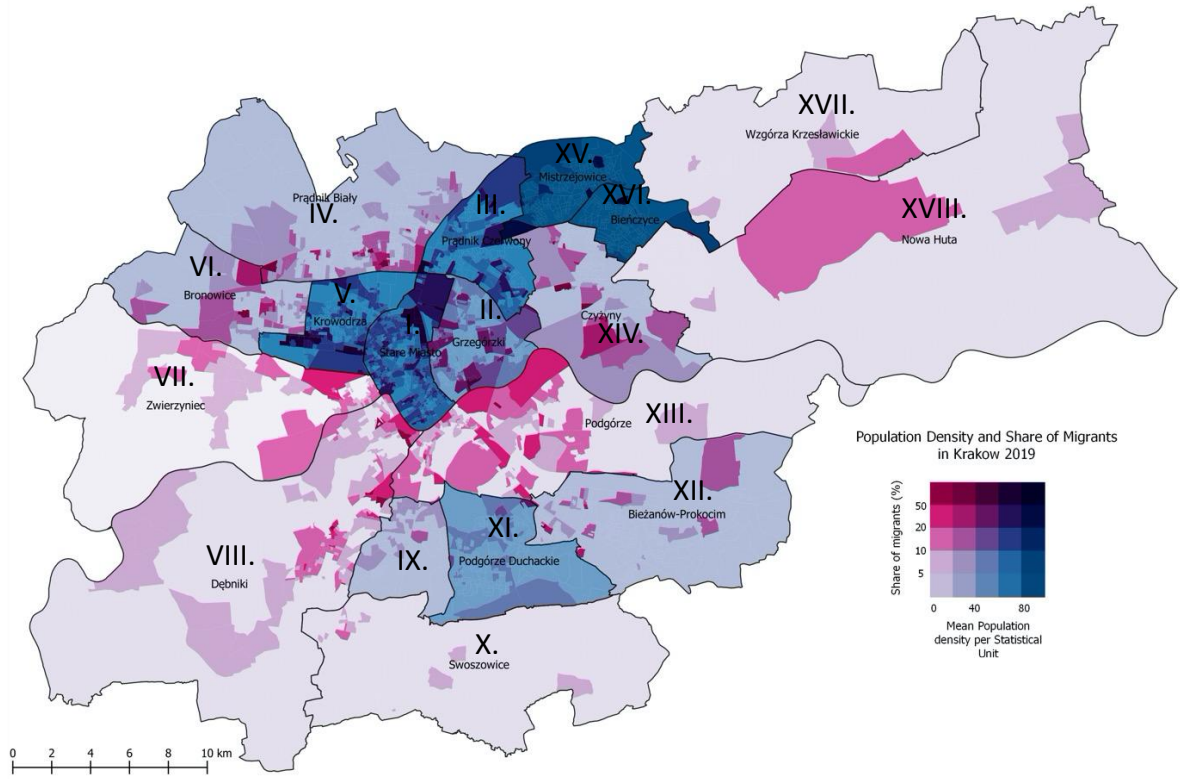

Fig. 3. Average share of migrants and average population density in Kraków at the boundaries of statistical regions and census enumeration areas
Source: CASPAR dataset of population in Kraków, authors' calculations

Table 5. Mean density of migrants and of total population per district in Kraków in 2019

District	District Name	Mean Migrants Density (as % of total population)	Mean Population Density (persons per grid cel)
XVIII.	Nowa Huta	1,12	8,19
XVII.	Wzgórza Krzesławickie	1,54	8,67
X.	Swoszowice	1,78	11,1
XII.	Bieżanów-Prokocim	2,61	35,37
XVI.	Bieńczyce	2,86	114,4
IX.	Łagiewniki-Borek Fałęcki	3,37	29,51
XI.	Podgórze Duchackie	3,47	58,45
XV.	Mistrzejowice	3,75	95,63
VIII.	Dębniki	4,24	14,53
IV.	Prądnik Biały	4,9	31,9
VII.	Zwierzyniec	5,52	8,02
XIII.	Podgórze	7,17	16,24
VI.	Bronowice	7,3	26,4
III.	Prądnik Czerwony	7,85	78,01
XIV.	Czyżyny	8,46	26,65
II.	Grzegórzki	10,7	58,1
V.	Krowodrza	12,39	64,95
I.	Stare Miasto	12,95	69,45

Source: CASPAR dataset, authors' calculations

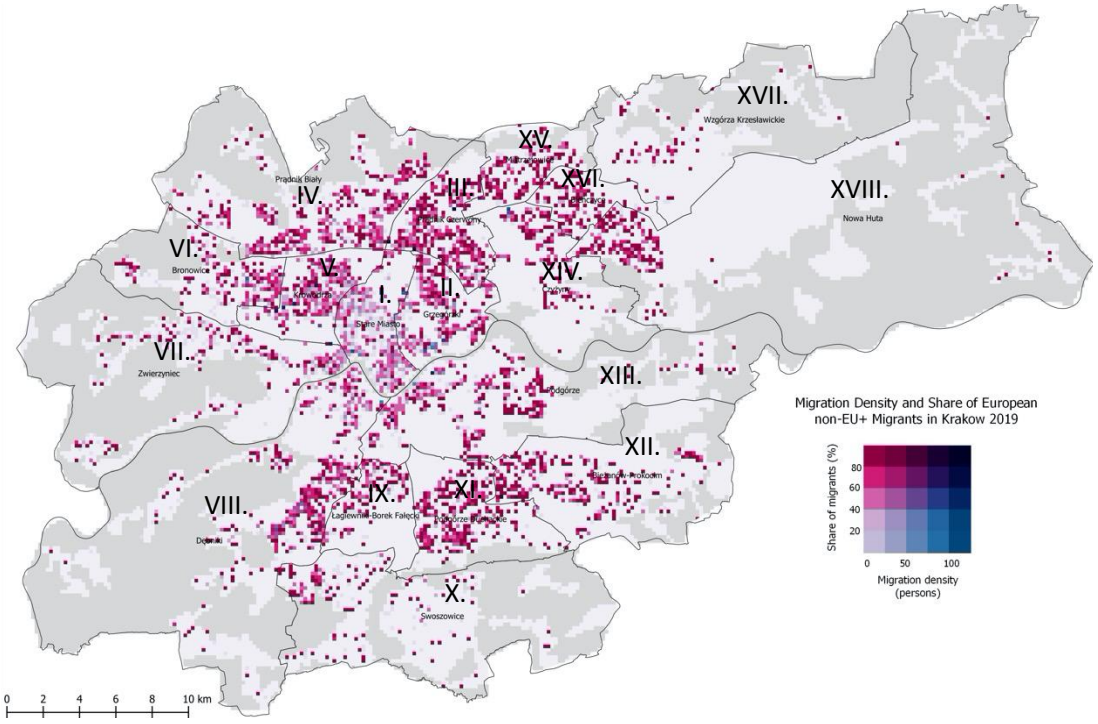

Fig. 4. Share of European non-EU+ migrants and migration density in Kraków
Source: CASPAR dataset, authors' calculations

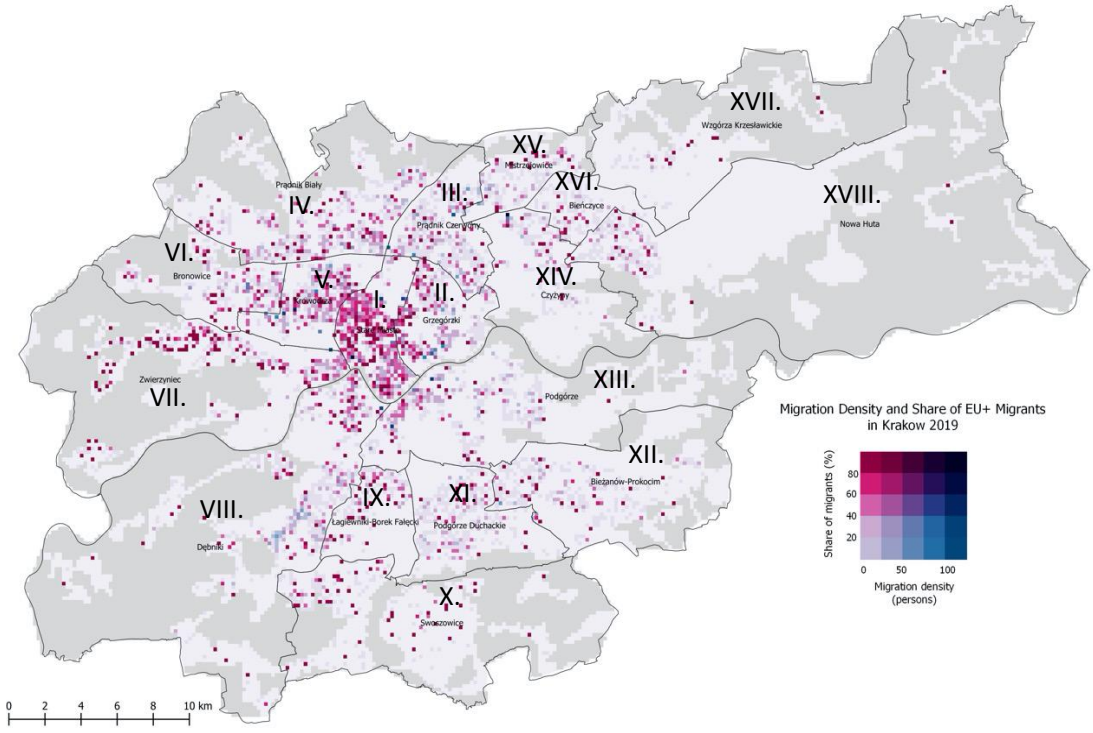

Fig. 5. Share of EU+ migrants and migration density in Kraków
Source: CASPAR dataset, authors' calculations

even exceeds the 100 persons per cell, with fewer than 4% of them coming from a foreign country. On the other hand, Districts II, V and I show the highest average density of migrants in Kraków (10–13%) with a moderate total population density of approximately 65 persons per cell.

Focusing on the distribution of the European migration in Kraków, a pattern can be easily recognised, where European EU+ migrants are mainly gathered in the Old City (District I) and non-EU migrants are mostly distributed in the peripheral districts. The following two maps illustrate this pattern, showing the share of European non-EU (Fig. 4) and EU+ (Fig. 5) migrants in comparison to the total migration density in the corresponding areas.

Yet, when investigating other districts, some interesting patterns arise. First, there are very few foreigners in the most peripheral districts, such as IX, X, XVI, XVII and XVIII (see also Table A1 in appendix). In these neighbourhoods, the rental price is relatively low, but so too the pool of apartments for rent, especially in old buildings, is limited. On the other hand, immigrants tend to choose locations in which there are new residential areas and the pool of apartments for rent is higher, although the price is also (relatively) high. These are districts II, III, IV, V, VIII and XIII.

Turning to specific group concentrations, there are some clear patterns for a few ethnicities. One fifth of South Asians (predominately Indians) live in District VIII, while 38.5% of South-East Asians and 45.2% of Vietnamese immigrants live in District XIII (Fig. 7). Consequently, our study confirms the existence of an ethnic concentration of Vietnamese nationals. Yet, those 175 Vietnamese people mostly living in District XIII do not constitute any "critical mass" – they are too few to form an ethnic district. Moreover, the number of Vietnamese immigrants in Poland and Kraków is gradually falling.

In the last step of our empirical exercise, we analyse the probability of a foreigner from a specific group having a neighbour from the same group among the closest 200, 400, 800 and 1,000 foreign neighbours. This probability is of course highest for European Non-EU+ immigrants (mostly Ukrainians, but also other Eastern Europeans) – half of the population of this group has at least

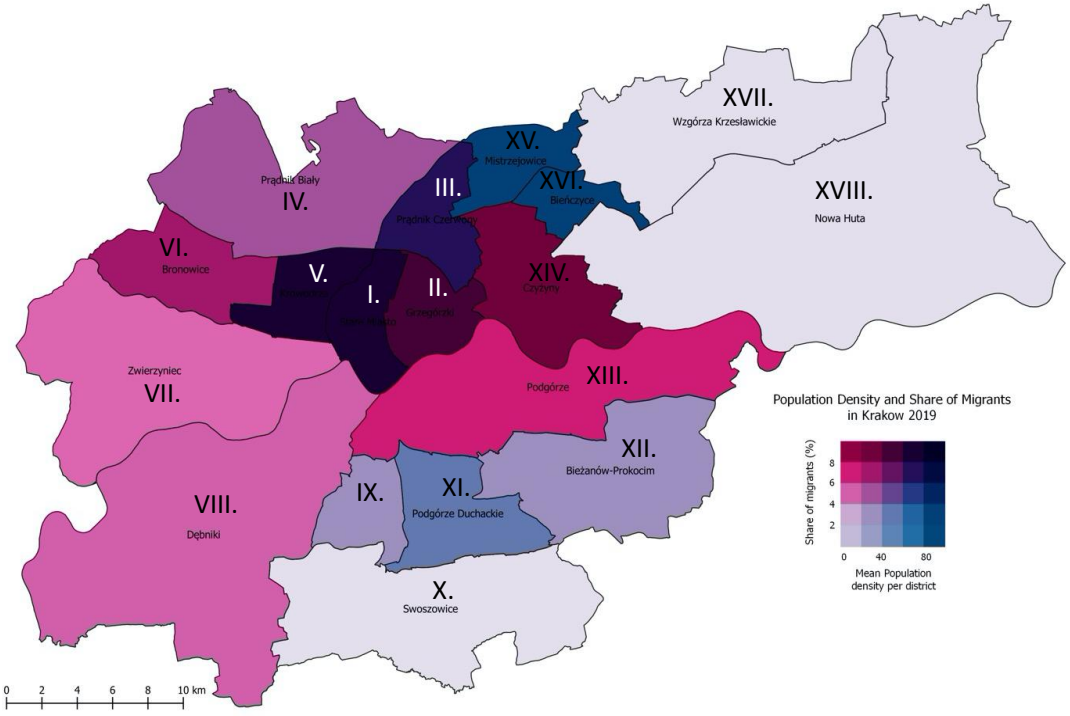

Fig. 6. Share of EU+ migrants and migration density in Kraków
Source: CASPAR dataset, authors' calculations

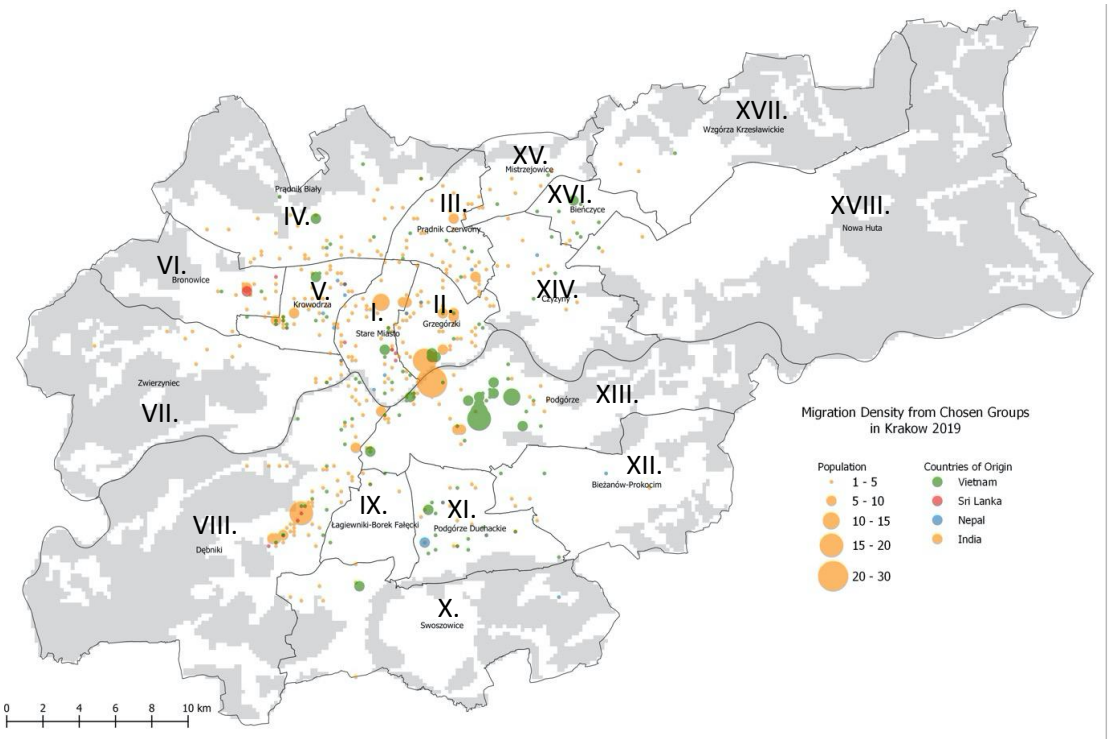

Fig. 7. Migration density of persons from India, Vietnam, Sri Lanka and Nepal in Kraków
Source: CASPAR dataset, authors' calculations

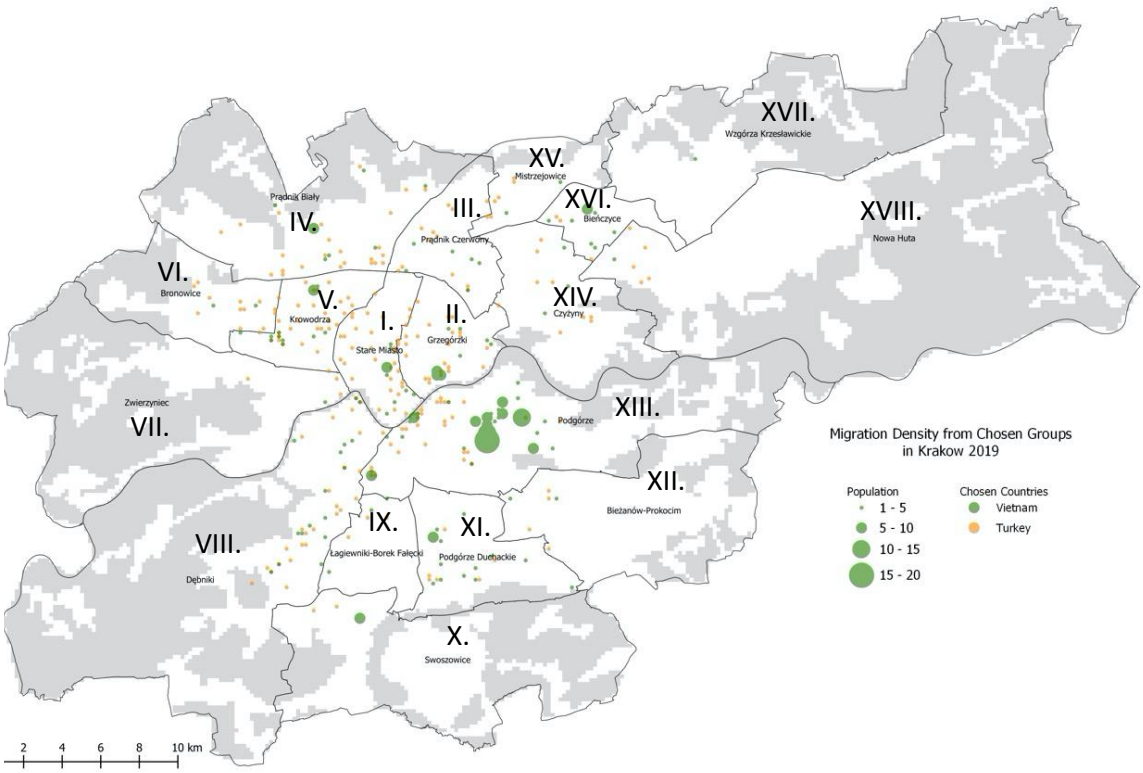

Fig. 8. Migration density of persons from Vietnam and Turkey in Kraków
Source: CASPAR dataset, authors' calculations

Table 6. Probability that a foreigner of a specific group finds a neighbour from his/her own group among k-foreign neighbours

Group	Percentiles	k-NN			
		200	400	800	1000
Non Europe	10	10,5%	11,2%	11,4%	11,3%
	25	13,6%	14,4%	15,1%	15,1%
	50	17,6%	17,6%	17,6%	17,7%
	75	22,9%	20,7%	20,1%	20,4%
	90	29,9%	28,1%	26,0%	25,1%
	95	35,9%	33,4%	29,6%	29,1%
	99	41,7%	37,6%	31,0%	30,2%
Europe EU+	10	13,2%	13,7%	13,8%	13,9%
	25	19,8%	19,4%	19,8%	19,8%
	50	31,0%	30,7%	29,7%	30,1%
	75	46,6%	46,1%	43,6%	43,2%
	90	58,1%	54,9%	51,6%	51,2%
	95	62,3%	57,3%	54,6%	53,6%
	99	66,7%	60,5%	58,2%	57,3%
Europe NON-EU+	10	39,7%	40,6%	40,8%	40,9%
	25	53,5%	54,0%	52,3%	52,1%
	50	65,5%	64,6%	64,8%	64,8%
	75	74,6%	74,3%	72,5%	72,5%
	90	78,2%	76,8%	75,8%	75,7%
	95	79,8%	77,9%	76,9%	76,6%
	99	83,9%	80,5%	78,8%	78,5%

Source: CASPAR dataset, authors' calculations

Table 7. Probability that a foreigner of a specific group finds a neighbour from his/her own group among k-foreign neighbours

Group	Percentiles	k-NN			
		200	400	800	1000
Vietnam	10	0,5%	0,7%	0,5%	0,6%
	25	1,5%	1,5%	1,0%	1,0%
	50	4,3%	2,8%	2,5%	2,1%
	75	15,4%	16,5%	13,1%	13,1%
	90	35,6%	23,1%	15,9%	13,8%
	95	38,3%	24,0%	16,2%	14,0%
	99	38,4%	27,6%	16,2%	14,2%
Turkey	10	0,3%	0,2%	0,4%	0,6%
	25	0,5%	0,7%	0,8%	0,8%
	50	1,1%	1,2%	1,1%	1,2%
	75	2,0%	1,8%	1,7%	1,7%
	90	3,0%	2,2%	2,2%	2,1%
	95	4,3%	2,7%	2,5%	2,4%
	99	5,3%	3,7%	3,0%	2,8%

Source: CASPAR dataset, authors' calculations

a 65.5% chance of finding another person from their own group among their 200 nearest foreign neighbours (Table 6). In the case of EU+ citizens, half of them live in NBHs where the probability of finding another citizen is at least 31%. Among immigrants from outside Europe, only about 10% live in foreign neighbourhoods with a probability higher than 30%.

It is very interesting to compare the concentration of two groups of a similar size living in Kraków – Vietnamese and Turkish immigrants (Fig. 8), who are very concentrated in Western European cities. Both groups have a population size of approximately 350 people (Table 1). However, they are significantly different in terms of concentration. The population from Vietnam was present in 126 grid cells, whereas the Turks were spread over almost twice the number of grid cells – 228. The highest number of Vietnamese people in a grid cell was 20, and the highest number of Turks was only 5. This gives an average concentration in the grid of 3.1 for Vietnamese people and just 1.4 for Turks. These differences are also highly visible when the probabilities are compared (Table 7). Half of Vietnamese population reside in foreign NBHs where the probability of finding other members of this group is below 4.3%, but half of Turks live in NBHs where the probability is below 1.1%. Ten percent of Vietnamese people live in NBHs where there is at least a 35.6% probability, whereas the top 10% of the Turkish population has the probability is at least 3%.

5. Conclusions

We have prepared an analysis of urban residential segregation in Poland using an individualised neighbourhood approach with a unique dataset of geocoded data on population by citizenship status. Our main results show that the current segregation of immigrants in Kraków is rather low in comparison to Western European cities with long histories of immigration. Whereas foreigners comprise around 4.2% of the city's population, 50% of inhabitants live in a place where the share of foreigners among their 200 nearest neighbours is below 2.2%. The dissimilarity index shows that around 45% of immigrants would have to be moved from their current residence to achieve an even distribution of foreigners in Kraków. Yet, among the immigrant population, a relative concentration could be seen among foreigners from Southeast Asia and South Asia, as well as North and Latin America. These populations are very small and are particularly strongly concentrated in certain districts of the city, while almost completely absent in others. On the other hand, immigrants from Ukraine and other Eastern European, non-EU countries – who constitute the largest group in the immigrant population – are much more evenly spread around the city.

The striking result of our analysis is that the foreigners are much better educated than the overall population of Kraków, and they can be considered an elite in this respect. This is in sharp contrast to the educational attainment of immigrants in Western European cities, which is much lower than that of the native populations. Another difference is that foreigners in Kraków live in central and more prestigious residential areas, while immigrants in the Western European countries tend to not reside in the worst and cheapest locations in the city.

Acknowledgements

The work was supported within the framework of the European Union Horizon 2020 programme – project Future Migration Scenarios for Europe (FUME) [grant no. 870649]

Notes

- (N1) For example, availability of jobs, local transportation infrastructure (roads and local transport), quality of life, availability of cultural infrastructure, educational and healthcare facilities (Pędziwiatr et al., 2021).
- (N2) This is a limitation of the available dataset, which contains only information on citizenship.
- (N3) There is no information on educational attainment for 30% of the immigrant population. This is due to the data on EU citizens, who do not state education using UE rights for residency – for the EU group, lack of data is around 95%. For other

immigrants it varies at 3–10%. We estimate that EU migrants are also very well educated.

References

Allport, G.W. (1958). *The nature of prejudice*. New York: Garden City.

Andersson, E.K., Malmberg, B., Costa, R., Sleutjes, B., Stonawski, M.J. & De Valk, H.A. (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(2): 251-275.

Balakrishnan, T.R. & Hou, F. (1999). Socioeconomic integration and spatial residential patterns of immigrant groups in Canada. *Population Research and Policy Review*, 18(3): 201-217.

Bilan, Y. & Strielkowski, W. (2016). Migration in post-transition economies: immigration surplus in Visegrad group countries. *International Journal of Trade and Global Markets*, 9(2): 182-196.

Bolt, G. (2009). Combating residential segregation of ethnic minorities in European cities. *Journal of Housing and the Built Environment*, 24(4): 397.

Bolt, G., Özüekren, A.S. & Phillips, D. (2010). Linking integration and residential segregation. *Journal of Ethnic and Migration Studies*, 36(2): 169-186.

Bonifazi, C., Heinz, F., Strozza, S. & Vitiello, M. (2009). The Italian transition from emigration to immigration country. *IRPPS WPs*, 24, Istituto di Ricerchesulla Popolazione e le Politiche Sociali, 1-104.

Brzozowski, J. & Pędziwiatr, K. (2014). Analiza procesu integracji imigrantów w Małopolsce (Analysis of integration of immigrants in Malopolska – in Polish). In: E. Pindel (red.) *Imigranci w Małopolsce. Między integracją, asymilacją, separacją, marginalizacją, 117-240,* Akademia Ignatianum, Kraków.

Coenen, A., Verhaeghe, P.P. & Van de Putte, B. (2019). Ethnic residential segregation: A family matter? An integration of household composition characteristics into the residential segregation literature. *European Journal of Population*, 35(5): 1023-1052.

Costa, R. & De Valk, H.A. (2018). Ethnic and socioeconomic segregation in Belgium: A multiscalar approach using individualised neighbourhoods. *European Journal of Population*, 34(2): 225-250.

Crowder, K., Hall, M. & Tolnay, S.E. (2011). Neighborhood immigration and native out-migration. *American Sociological Review*, 76(1): 25-47.

Duncan, O.D. & Duncan, B. (1955). Residential distribution and occupational stratification. In: C. Peach (Ed.) *Urban Social Segregation*, 51-67, London: Longman.

Ellison, C.G., Shin, H. & Leal, D.L. (2011). The Contact Hypothesis and Attitudes Toward Latinos in the United States. *Social Science Quarterly*, 92(4): 938-958.

Eurostat (2020). Residence permits - statistics on first permits issued during the year. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Residence_permits_-_statistics_on_first_permits_issued_during_the_year#First_residence_permits_by_reason (17.10.2021)

Fong, E. (2006). Residential segregation of visible minority groups in Toronto. In: Fong E (ed). Inside the mosaic, 51–75. University of Toronto Press, Toronto.

Górny, A. & Śleszyński, P. (2019). Exploring the spatial concentration of foreign employment in Poland under the simplified procedure. *Geographia Polonica*, 92(3): 331-345.

GUS (2020a). Populacja cudzoziemców w Polsce w czasie COVID-19, Available at: https://stat.gov.pl/download/gfx/portalinformacyjny/pl/defaultaktualnosci/6329/12/1/1/populacja_cudzoziemcow_w_polsce_w_czasie_covid-19.pdf (13.12.2021).

Hennerdal, P. & Nielsen, M.M. (2017). A multiscalar approach for identifying clusters and segregation patterns that avoids the modifiable areal unit problem. *Annals of the American Association of Geographers*, 107(3): 555-574.

Iceland, J. & Scopilliti, M. (2008). Immigrant residential segregation in US metropolitan areas, 1990–2000. *Demography*, 45(1): 79-94.

Lambea Llop, N. (2017). A policy approach to the impact of tourist dwellings in condominiums and neighbourhoods in Barcelona. *Urban Research & Practice*, 10(1): 120-129.

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(2): 169-193.

Massey, D.S. & Denton, N.A. (1988). The dimensions of residential segregation. *Social Forces*, 67(2): 281-315.

Marcińczak, S., Tammaru, T., Strömgren, M. & Lindgren, U. (2015). Changing patterns of residential and workplace segregation in the Stockholm metropolitan area. *Urban Geography*, 36(7): 969-992.

Matoga, Ł. & Pawłowska, A. (2018). Off-the-beaten-track tourism: a new trend in the tourism development in historical European cities. A case study of the city of Krakow, Poland. *Current Issues in Tourism*, 21(14): 1644-1669.

Musterd, S. & Van Kempen, R. (2009). Segregation and housing of minority ethnic groups in Western European cities. *Tijdschrift voor economische en sociale geografie*, 100(4): 559-566.

Musterd, S. (2005). Social and ethnic segregation in Europe: Levels, causes, and effects. *Journal of Urban Affairs*, 27(3): 331-348.

Musterd, S., Marcińczak, S., Van Ham, M. & Tammaru, T. (2017). Socioeconomic segregation in European capital cities. Increasing separation between poor and rich. *Urban Geography*, 38(7): 1062-1083.

Okólski, M. (2012). Transition from emigration to immigration. In: M. Okólski (ed.) *Europe, the Continent of Immigrants: Trends, Structures and Policy Implications*, 23-44, Amsterdam University Press, .

Östh, J. (2014). Introducing the EquiPop software: An application for the calculation of k-nearest neighbour contexts/ neighbourhoods. Available at: http://equipop.kultgeog.uu.se/Tutorial/Introducing%20EquiPop.pdf (10.09.2021).

Östh, J., Malmberg, B. & Andersson, E. (2014). Analysing segregation with individualized neighbourhoods defined by population size. In: Lloyd, C. D., Shuttleworth, I.G. & Wong, D.W. (Eds.), *Social-Spatial Segregation: Concepts, Processes and Outcomes*, 135-161, Policy Press.

Östh, J., Clark, W.A. & Malmberg, B. (2015). Measuring the scale of segregation using k-nearest neighbor aggregates. *Geographical analysis*, 47(1): 34-49.

Pędziwiatr, K., Stonawski, M. & Brzozowski, J. (2019). Imigranci w Krakowie w świetle danych rejestrowych (Immigrants in Kraków in administrative registers – in Polish). *Multiculturalism & Migration Observatory Report: Center for Advanced Studies of Population and Religion (CASPAR)*, 1-72 , Cracow University of Economics.

Schönwälder, K. (2007). Residential segregation and the integration of immigrants: Britain, the Netherlands and Sweden, WZB Discussion Paper, No. SPIV 2007-602, Wissenschaftszentrum Berlin für Sozialforschung (WZB), Berlin.

Stonawski, M., Rogne, A.F., Christiansen, H., Bang, H. & Lyngstad, T.H. (2021). Ethnic segregation and native out-migration in Copenhagen. *European Urban and Regional Studies*, 29(2): 168-188. DOI: https://doi.org/10.1177/09697764211039183.

Stonawski, M., Christiansen, H. & Hakhverdyan, S. (2022). Udviklingen i multinationale nabolag fra 1990 til 2020 (Developments in multinational neighborhoods from 1990 to 2020 – in Danish), DST Analyse, 2022(3), Statistics Denmark.

Tammaru, T., Strömgren, M., van Ham, M. & Danzer, A. M. (2016). Relations between residential and workplace segregation among newly arrived immigrant men and women. *Cities*, 59: 131-138.

Williams Jr, R.M. (1947). The reduction of intergroup tensions: a survey of research on problems of ethnic, racial, and religious group relations. *Social Science Research Council Bulletin*, 57(11): 153.