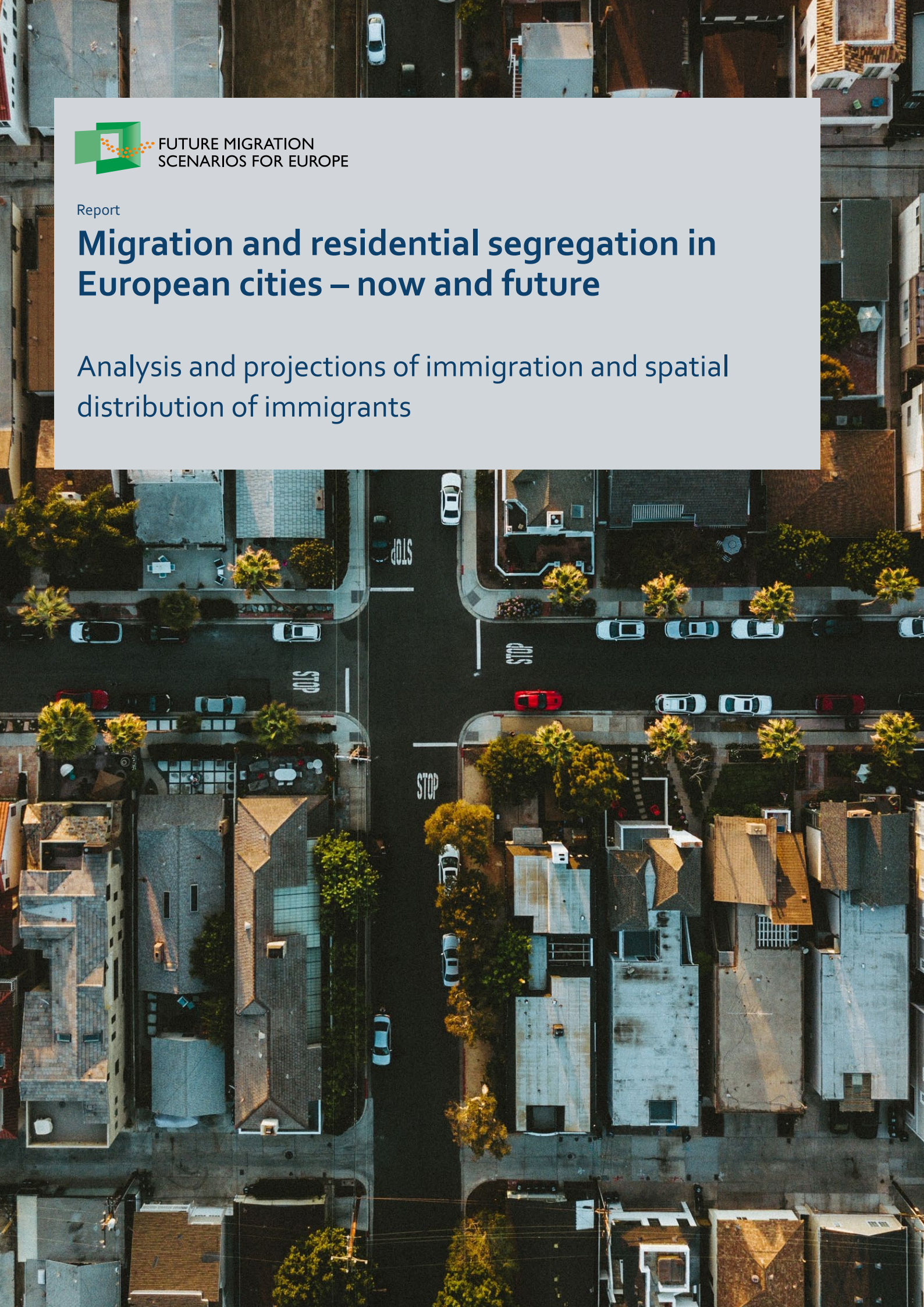
FUTURE MIGRATION SCENARIOS FOR EUROPE

Report

Migration and residential segregation in European cities – now and future

Analysis and projections of immigration and spatial distribution of immigrants



Migration and residential segregation in European cities – now and future
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Report

Krakow University of Economics and Statistics Denmark
Authors: Marcin Stonawski, Marina Georgati, Massimiliano Crisci, Leo van Wissen and Jan Brzozowski
Contributors: Carsten Keßler, Irma Kveladze, Konrad Pędziwiatr, Irma Kveladze and Michele Santurro

ISBN 978-91-8001-077-1
DOI 10.5281/zenodo.8192025

FUME was made possible thanks to funding from the European Union's Horizon 2020 research and innovation programme under Grant ID 870649.

Cover photo:Derek Liang/Unsplash.com
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Contents

Executive summary

The report has been created within Work Package (WP) 6 of the project Future Migration Scenarios for Europe, entitled "*Perspectives of migration – thematic studies*". This WP aimed at improving the understanding of patterns and consequences of migration in selected European cities, namely Amsterdam, Copenhagen, Krakow, and Rome.

The report focuses on patterns of immigration and determinants of settlement patterns of foreigners in the past and possible futures of spatial allocation of this group in these European cities, which each have a different size of foreign population and a different history of migration. To achieve this, we have gathered and harmonised data on foreign population at grid cell level for the period 1990-2020 (where possible). Moreover, we have analysed the spatial allocation and prepared multi variant scenario projections on allocation in the future given national and regional trajectories of change. Historical and projected data has been analysed based on 100m x 100m grid cell information which is a significant advantage over working on administrative level data because, among others, it avoids the Modifiable Areal Unit Problem (MAUP). As Musterd (2005) points out MAUP prevents reliable comparisons of segregation levels and patterns between areas of different sizes, as well as between different countries, while ideally, comparative studies use uniform units of measurement. Thus, in our study we can compare results from different cities. Moreover, we could construct comparable neighbourhoods of similar size (100 meters) around each inhabitant of the cities to provide analysis on different angles that enriches a grid cell level study.

The report consists of an introduction and a description of data and methods used in the study in Section 1. Section 2 presents a city-specific analysis of residential allocation in Amsterdam, Copenhagen, Krakow, and Rome. In Section 3 we present comparative analysis of residential segregation in the cities. Then, we focus on the results of projections for the cities. The report concludes with the main messages from our study.

We hope that our approach will be useful for scientifically-based policy-making (e.g. in the area of interculturalism, integration of migrants, infrastructure).

1. Introduction

The history of European cities is inevitably linked to internal and international migration. In 1650, most of the European population lived in the rural areas, while there were a mere 11 cities with population over 100 thousand, with major Paris reaching only 450 thousand (Moch, 2003). 150 years later in 1800, there were only 6 additional (over 100 thousand) cities, and 21.2% of Europeans lived in the urban areas. The situation has changed dramatically with the industrial revolution: throughout the 19th century a rapid industrialization and urbanization has profoundly reshaped European societies, leading to unprecedented growth of cities. By 1850 there were already 41 cities with a population of 100 thousand and more, while in 1890 – the number had increased to 97 (de Vries, 2007). Needless to say, the bulk of this urbanization process was driven not only by fertility in urban population, but mostly by migration: both within countries, and across international borders. Foreigners constituted a large share of inhabitants of European cities of that time. The foreign population of Paris tripled between 1851 and 1891 from 62 to 219 thousand, reaching 9 per cent of the total. But in mid-size cities their presence was even more pronounced, for instance out of 115 thousand persons living in Roubaix in 1891, 46% were Belgians (Couton, 2003). The most spectacular expansion in this aspect was Vienna, whose population grew tenfold between 1810 and 1910 (Lichtenberger, 1997; Riegler, 2010), while in 1900 around 54% of its population consisted of migrants, mostly coming from other parts of the Austro-Hungarian Empire, but being of a different than Austrian ethnicity (Schloß Schönbrunn, 2023). Therefore, we can clearly see that Europe and particularly Western Europe has a long-lasting tradition when it comes to the role of immigration in expanding and re-shaping European urban areas. Currently (i.e., as of 2021), 38.9 percent of the EU population lives in the cities, and another 35.9 percent in towns and suburbs, while at grid level the share of the population living in Urban clusters is 70.4 percent (Eurostat, 2022).

Turning to immigrant populations, despite their importance in the urbanization process of Europe, their successful integration is becoming a highly political issue. The process of immigrant politicization started mid-20th century, the Western European economies started to witness the process of migration transition from mostly migrant-sending to predominantly migrant-receiving countries (Field, 1989), a trend followed later by Southern European members of the EU (Skeldon, 2012), and finally – in the second decade of 21st century – by Eastern European member states (Okólski, 2021).

In this new framework, immigrants were no longer coming from neighbouring European countries (like Belgians to France, cf. Couton, 2003), but from Middle Eastern and North African (MENA) countries and also from more distant geographical locations in Asia, Africa and even Latin America (Böcker & Havinga, 1998). Moreover, with recent refugee crises caused by the War in Syria and the emergences of the so-called Islamic State in Iraq and Syria, civil immigration became even more politicised (Grande et al., 2019; Krzyżanowski et al., 2018), with much attention paid to management and control of migration, linkage of immigration and refugee inflows to national security concerns and increased emphasis on fast and successful integration of newcomers.

In this last aspect, this new chapter of European immigration history is therefore linked with enhanced interest of ethnic residential segregation. Residential concentration is connected to relatively strong over-representation of immigrants in some areas, combined with their underrepresentation in other places (Andersson et al., 2018). It is frequently viewed as a negative

effect of immigration, as it may hinder the integration process (Musterd & Ostendorf, 2009), and lead to socio-economic marginalisation, as well as increasing crime rates in disadvantaged areas (Schönwälder, 2007). Some of the key factors responsible for different patterns of segregation in Europe include the migration policy (in particular, a visa regime defining who is allowed to enter and under what conditions), character of the housing market (in particular, availability of social housing for migrants), welfare state regime, and spatial planning (Arbaci, 2008, Anderson et al. 2018). Studies carried out in Western European cities showed 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, related mostly to subsequent generations of immigrants (Costa & De Valk 2018, Stonawski et al. 2022).

While immigrants clustering and creation of ethnic districts in major cities at major destination countries is a historical fact and a natural process in their long-term absorption into a receiving society (Grimes, 1993, Peach 1996a and 1996b), a prolonged geographical segregation is – especially in Europe – perceived as a potential threat to social cohesion and a barrier/obstacle in successful integration (Anderson et al., 2018). In some EU member states like Sweden, in spite of substantial inflow of migrants, the residential segregation was kept at reasonable levels (Malmberg et al., 2018), while in Southern Europe this issue remains a source of a great concern, as even immigrants with jobs and good professional skills are exposed to problems of precarious accommodation and limited access to social infrastructure, living in substandard and over-crowded neighbourhoods with large ethnic concentration (Arbaci, 2008). Moreover, the few anti-segregation or desegregation policies towards ethnic minorities led in European cities proved to be mostly ineffective (Bolt, 2009).

Consequently, it is crucial to identify and continuously monitor the patterns of residential segregation among immigrants living in European cities – in order to design sound integration policies, develop urban infrastructure and maintain adequate level of public services in such areas. Our study contributes, at least partially, to that aim by providing the analysis of contemporary patterns of residential segregations in five important European urban destinations for immigrants: Amsterdam, Rome, Copenhagen and Kraków. Moreover, we provide projections of the populations in these cities on grid cell level, taking into account immigrant populations (see also FUME deliverables 4.3, 4.4 and 5.4 on forecasting at the national and city level).

2. Data and methods

The empirical analysis of this report focuses on the population of foreigners residing in four European cities: Amsterdam, Copenhagen, Krakow, and Rome. Our dataset varies in terms of definition of foreign population, source of data, and subgroups used in the analysis for each country. In the following section we describe the data for each city.

2.1 Historical data

Amsterdam

In Amsterdam, we divide the foreign population in 6 subgroups on the basis on country of origin: (1) Eastern EU – Bulgaria, Hungary, Czech Republic, Poland, Romania, Slovakia, Estonia, Latvia, Lithuania, Croatia, and Slovenia, (2) Western EU – the remaining EU countries and the United Kingdom (UK), (3) Middle East and Africa – all countries in the Middle East and Africa (except Turkey and Morocco), (4) Turkey and Morocco – persons of Turkish and Moroccan origin, (5) former colonies – Aruba, Bonaire, Curaçao, Indonesia, Saba, Saint Maarten-Dutch part, Sint Eustatius, and Suriname, (6) Other Europe etc. – non-EU European and European Free Trade Association (EFTA) countries, Asia, Oceania, and the Americas. This is defined as follows:

- For persons born outside of the Netherlands, the country of birth defines country of origin.
- For those born in the Netherlands, country of origin is determined by country of birth of the parents, where country of birth of the mother has precedence over country of birth of the father, unless her country of birth is the Netherlands or unknown, in which case the country of birth of the father is country of origin.

This poses a transformation issue, since the data from the regional model D4.4 are based on the country of birth. See D4.4 for more information how this transformation is performed.

In this study Amsterdam is defined as a territory of the Municipality of Amsterdam. The municipality of Amsterdam was very helpful in providing the dataset. Their data covers the municipality of Amsterdam, subdivided in 100x100m grid cells. The area in the Greater Amsterdam region outside of Amsterdam was treated as one zone. Amsterdam does not have the information for the other municipalities in the Greater Amsterdam region (i.e., the NUTS 3 region) Haarlemmermeer Amstelveen, Aalsmeer, Uithoorn, Ouder-Amstel, Diemen, Zaanstad, Purmerend, Waterland, Oostzaan, Landsmeer, Wormerland, Edam-Volendam, Uitgeest), who in total have about 1.5 million inhabitants, compared to 900 thousand in Amsterdam. It turned out not to be feasible to obtain the grid level data for these other municipalities, without substantial costs.

Copenhagen

We use data from the administrative population registers of Denmark (whose source is the Central Population Register – CPR), administered by Statistics Denmark. The register includes the resident and registered population in the country using the permanent address concept (the permanent address is defined as the place where a person with some regularity sleeps when not abroad because of holidays, business trips, or the place where a person has his/her belongings). Our dataset consists of individual and neighbourhood characteristics for the urban area of Copenhagen in 1990-2020 (age, sex, country of origin) and information about demographic processes (births, deaths, migrations).

For defining foreign population in the study, we use a variable *Country of Origin*. We include immigrants and descendants into this category. Immigrants are persons who are foreign born and who have no native-born parents. If no information exists on the birthplace of the parents, the person should still be considered an immigrant if he/she is foreign-born.

A descendant is a person who is native-born but who has no parents who are native born. If one parent is native-born the person is not a descendant. If no information exists on the birthplace of the parents, the person is considered a descendant if he/she is native-born.

For immigrants the country of origin is the person´s own country of birth. For descendants it is the mother´s country of birth. If no information exists on the mother´s country of births the father´s should be used instead.

In the study we divide the foreign population into 7 subgroups on the basis on country of origin: (1) EU West - persons from 13 EU member states before the 2004 enlargement (we exclude Denmark, natives), Malta and Cyprus, EFTA (Iceland, Lichtenstein, Norway, Switzerland) and the United Kingdom, (2) EU East – persons of origin in EU member states from Eastern and Central Europe which joined the EU in 2004 and after (Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia), (3) Europe NonEU – persons from other European countries than in the groups (1) and (2), (4) MENAP – foreigners from regions of Middle East and North Africa, and Pakistan, (5) Turkey – persons of Turkish origin, (6) Other Western – foreigners from Australia, Canada, United States and New Zealand (7) Other nonWestern – persons from all other countries not included in 1–6.

The residential coordinates for individuals in the population registers were obtained by matching addresses in the population registers with addresses in building or land registers (Den Offentlige Informationsserver [OIS]) in Denmark.

The urban agglomeration area in and around Copenhagen is defined as two NUTS-3 areas: Byen København and Københavns omegn (C), which, in total, consist of 17 municipalities: København, Frederiksberg, Dragør, Tårnby, Albertslund, Ballerup, Brøndby, Gentofte, Gladsaxe, Glostrup, Herlev, Hvidovre, Høje-Taastrup, Ishøj, Lyngby-Taarbæk, Rødovre, and Vallensbæk.

Krakow

For this study, we have built a unique dataset containing geocoded individual level data on immigrants with several characteristics using information from the registers for Krakow. This allows us to study the patterns using geographic coordinates and individualized scalable neighbourhoods instead of areal and administrative units with different sizes. To our knowledge, it is the first dataset of this type, 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 (e.g., Bolt et al., 2008; Marcińczak et al., 2015; Wessel et al., 2016; Musterd et al., 2017; Andersson et al., 2018; Stonawski et al., 2019). Our research team, in collaboration with the Municipality of Krakow (official collaborator of the FUME project) and the Lesser Poland (Małopolskie) Voivodship Office, has created an individual level dataset that is unique in Poland with several characteristics of immigrants residing in the city using registers data from these institutions. We combined the data on immigrants from the register of people legalising their stay on the territory of Poland (2000-2020) and the register of inhabitants of Krakow in (partial data 2000-2012, full detailed data 2013-2020).

The foreign population is defined based on citizenship. Both registers include this characteristic. All individuals are grouped into subcategories using the country of citizenship. In the case of Krakow, the foreign population was divided into 3 groups: (1) citizens of EU countries which includes persons from the EU member states (26 countries, we exclude Poland-natives) and the United Kingdom (abbrev. *Europe EU*), (2) citizens of other European countries (predominantly, Ukrainians, Belarusians, and Russians) (*Europe nonEU*), and (3) citizens of other countries (*Others*).

In this study Krakow is defined as a territory of Municipality of Krakow and does not include any areas which are considered as the Krakow agglomeration area.

Rome

In this study the territory of Rome corresponds to that of the municipality of Rome (2.8 million inhabitants). The rest of the Metropolitan Area of Rome (*the Città Metropolitana*), composed of 120 municipalities with around 1.5 million inhabitants, was not included as recent granular data was not available.

With reference to the period 2015-2020 (1st of January), a unique dataset for individuals was built in close collaboration with the Statistical Office of the Municipality of Rome based on population register (*anagrafe*) data. These data include some demographic characteristics of each resident with reference to the census tracts and the 100 x 100 meters grid cell where each resident lives. The 2001 and 2011 data are from population census and grid cells data have been produced from census tracts data, through an aerial weighting disaggregation method.

Migrants are defined by the country of citizenship with the population of Rome being disaggregated in 9 country of citizenship groups: Italy, Romania, Bangladesh, the Philippines, EU countries, non-EU European countries, Africa, Asia and Oceania, America.

2.2 Data - future projections

The analysis on the future projections is based on data produced by the combination of the regional projections to local spatial modelling. The procedure is described in detail in Deliverable 5.4 (Georgati, 2023). Adjustments in the approach were applied to enhance the quality and consistency of the produced outputs by disaggregating the population differences among the projection years.

2.3 Methods

To describe spatial settlement patterns in Amsterdam, Copenhagen, Krakow, and Rome, we use visual representations of the distributions of the corresponding groups, 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".

The dissimilarity index 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 (1) proposed by Malmberg et al. (2018) which is designed for calculations based on individualised neighbourhoods:

$$DI = 0.5 \cdot \sum_{i=1}^{N_I} \left| \frac{N_{im}}{N_m} - \frac{N_{in}}{N_n} \right|$$

where: *i* is a grid cell; *m* is a minority group; n is the rest of the population; N_I is the number of grid cells/zones; N_{im} is the number of persons of group m in cell i; N_m is the number of persons of group *m* in the examined area; Nin is the number of the rest of the population in cell i; N_n is the number of persons of the rest of the population in the examined area.

The dissimilarity Index is equal to zero if both groups – migrants and non-migrant population are equally represented in all neighbourhoods and equals one if migrants have zero representation in neighbourhoods where there live non-migrants, while non-migrants are not represented in the neighbourhoods where migrants live. In the study we present DI calculated in the standard way for fixed geographical areas – our grid cells.

In the analysis, we also use the probability that a foreigner from a specific group can find another person from his group in the neighbourhood. This measurement can be used to evaluate residential isolation of specific foreign groups. The value zero indicates that a particular immigrant has no compatriots in his/her neighbourhood (NBH) while the value one indicates that all neighbours of the immigrant are from his/her immigrant group. In the study we calculate this measure on the level of neighbours of 100 meters around a residential location.

3. Residential allocation in 4 European cities

3.1. Amsterdam

The population of the Greater Amsterdam region is the largest part of what is called the '*North wing of the Rimcity*'. The Rimcity includes the four largest cities of the Netherlands: Amsterdam, Rotterdam, The Hague and Utrecht, and the smaller cities and suburbs around them, which together form the most densely urbanized region of the Netherlands. Amsterdam makes up 62 percent (2021) of the total Greater Amsterdam region. Although Greater Amsterdam comprises most of the agglomeration Amsterdam, the total Amsterdam agglomeration, also denoted as the 'Metropool region Amsterdam' also includes cities in the NUTS3 regions 'Agglomeration Haarlem' to the west and 'Het Gooi and Vechtstreek' to the south-east, as well as the commuter cities Almere and Lelystad to the north-east. The city of Amsterdam is the core of this region, and the development of this region is highly dependent on the Amsterdam developments. The historical development of the city since 1900 shows how this has developed over time. In the period 1900–1960 the city witnessed a long phase of urbanisation, where the population developed from 510 thousand in 1900 to 872 thousand in 1959. Following this long growth trend, since the sixties a phase of suburbanization started, where inhabitants left the city in large numbers to newly built suburbs, to accommodate a fast-growing population. In this period suburbs such as Purmerend to the north, or Amstelveen, Haarlemmermeer and Uithoorn to the south developed into commuter cities. This largely planned outflow of the urban population was called 'bundled deconcentration' (2nd Memorandum of spatial planning, 1966), and resulted in a net loss of 336 thousand persons due to internal migration in the period 1960-1985 (O&S, Municipality of Amsterdam). As a result, the city decayed, and the urban living environment deteriorated substantially. This development was not restricted to Amsterdam but was the fate of all four large cities in the country. To turn the tide, in 1974 a new policy was launched aimed at regenerating the cities, the so-called Urbanization Memorandum (3rdMemorandum of Spatial Planning). Here, future growth should primarily be concentrated within the cities, by densification of the urban environment. In conjunction with structural changes in the economy, with more emphasis on services, communication, and globalisation, in which the urbanization and agglomeration advantages of larger cities play a key role, this resulted in a renewed growth of Amsterdam since 1985. Since 2008 the city growth on average with 10 thousand inhabitants per year. Interestingly however, the city reached the same size as the all-time maximum in 1959 only again in 2019 (872 thousand). As a result of the annexation of the neighbouring municipality of Weesp in 2021 it now has 883 thousand inhabitants in 2022. Because of the suburbanization trend the population of the Greater Amsterdam region outside Amsterdam has almost doubled since 1970, from 269 to 523 thousand in 2021.

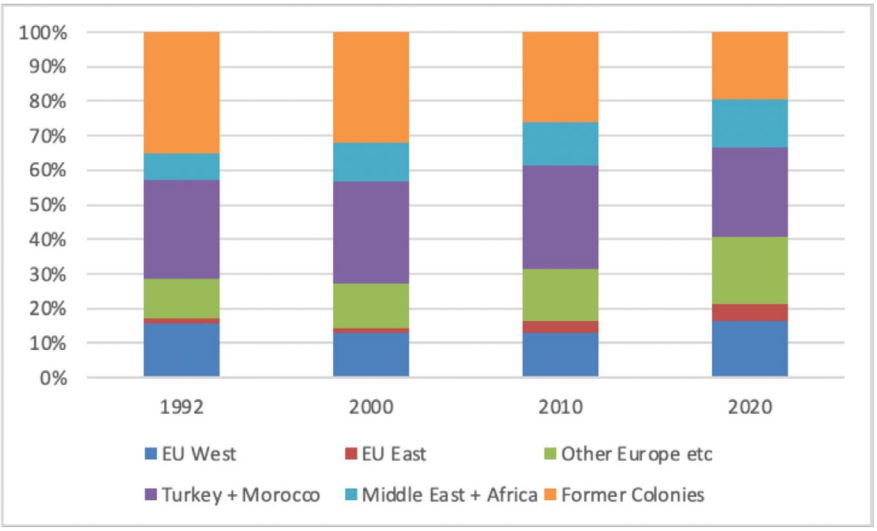
The composition of the Amsterdam population has also changed substantially since the sixties. It followed the national migrant waves that characterised this period (van Wissen, and De Beer, 2000). In the sixties the city received many guest workers from Morocco and Turkey, who were attracted by employers of the large industrial companies searching for cheap labour. Many of these guest workers originated from the poorest regions of their home countries (Lakeman, 1999). This inflow for labour market reasons came to an end in the 1970s, because of the economic recession, and the demise of many of the traditional industrial companies where they had found employ, but that did not mean that the inflow of these migrant groups came to an end (van Kempen & Bolt, 1997). The families of workers from Turkey and Morocco were granted the right for reunification in the Netherlands, and as a consequence a large inflow of Turkish and Moroccan migrants occurred, now for family reunification motives. This policy was abolished in the late nineties.

The seventies were characterised by a large influx of people from Suriname. In 1975 the former colony became independent, and its inhabitants were given the choice to have either Surinamese or Dutch citizenship. Many of these migrants found their way to Amsterdam, where the recently built new high rise city district of the Bijlmermeer provided housing for this migrant group. The inflow largely stopped since the eighties, but it remains one of the largest migrant groups (along with migrants from other former colonies, e.g. the Dutch Antilles and Indonesia). This large inflow of migrants occurred at the same time as the large suburbanisation of the Dutch population to surrounding areas, as a result of which the composition of the city and many neighbourhoods changed substantially.

Migration since the nineties is characterised by on the one hand labour immigration, especially from EU countries and other high-income countries, and on the other hand by refugees, first from former Yugoslavia, later from Middle Eastern countries and Africa. International students also constitute an increasing share of the Amsterdam population.

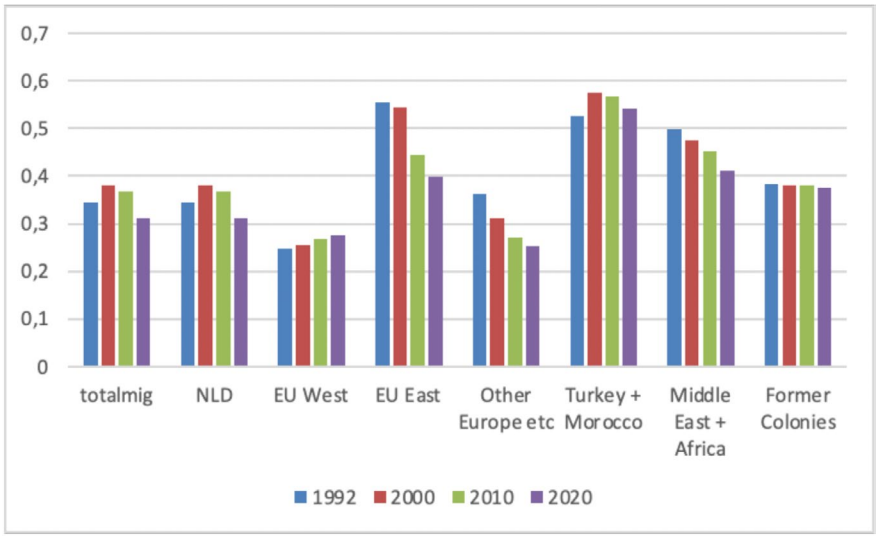
As a result of these developments, Amsterdam has become much more diverse in the last 30 years. The share of the population of foreign origin in Amsterdam has increased substantially, from 22 percent in 1992 to 39 percent in 2020. Of this foreign population, the largest subgroups in 2020 are Turkish and Moroccans (together 26 percent of the foreign population, or 8.6 percent of the total Amsterdam population), down from 29 percent in 1992. (Figure 3.1.1). Migrants from former Dutch colonies comprised the biggest migrant group in Amsterdam in 1992 (35 percent), but this share has decreased to 19 percent in 2020. Migrants from high income countries outside the EU (other European countries, Americas, Australia have doubled in their share in the foreign population: from 7 to 14 percent, whereas the share of EU foreigners increased slightly, from 17 to 21 percent. The share of migrants from the Middle East and Africa has almost doubled in this timespan: from 8 to 14 percent. When looking at the composition of the foreign population of Amsterdam in 2020, 40 percent is from high income countries, 26 percent from Turkey+Morocco, 20 percent from former colonies, and 14 percent from MENA countries.

Figure 3.1.1. Share of chosen groups among foreign origin population in Amsterdam. Source: own calculations.



Despite the growing number and share of the foreign population in Amsterdam, residential segregation has not increased since the nineties (Figure 3.1.2). It was highest for the EU East population in 1992 but has decreased significantly since then. Segregation is highest for the Turkish+Moroccan population, but here as well the trend is downward since 2000. A downward trend is also visible for the MENA population. The only subgroup with an increasing segregation index is the migrant group from the EU West. Interestingly, other research points at increasing segregation by socio-economic status in Amsterdam (e.g. Musterd et al., 2017).

Figure 3.1.2. Segregation index for migrant groups, municipality of Amsterdam 1992-2020
Source: own calculations.



The growing size of the foreign population in Amsterdam is also visible at the grid level. The total number of inhabited cells in the municipality has increased from 5804 in 1992 to 7556 in 2020. Figure 3.1.3. shows that all migrant groups occupy at least 60 percent of these cells in 2020, and all migrant groups have spread out to a larger share of the total number of grids in the city, with the exception of EU West, which was already at almost 100% of occupied cells, and EU East, that has occupied around 80 percent in the whole period. This increased geographical coverage of the city by all groups is in line with the reduced segregation indices discussed above.

Figure 3.1.3. Share of inhabited grid cells occupied by foreigner groups in Amsterdam in 1990, 2000, 2010 and 2020.
Source: own calculations.

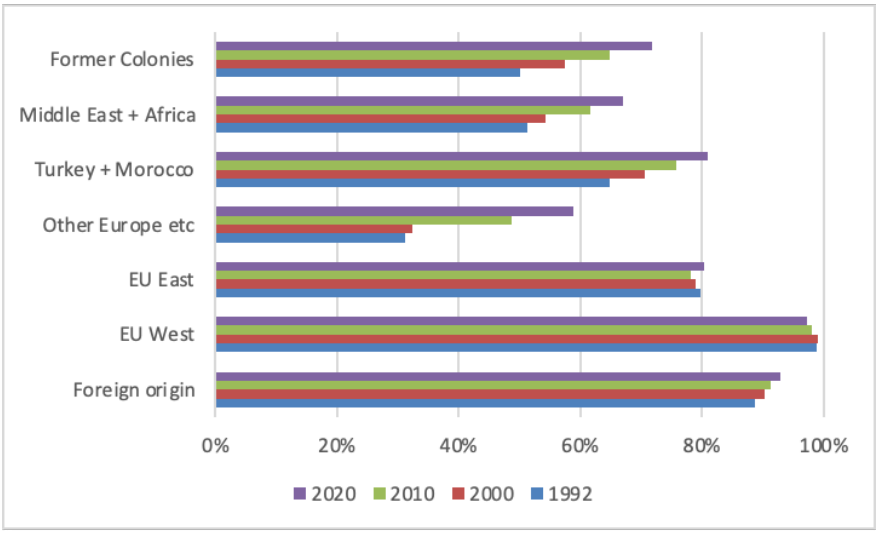
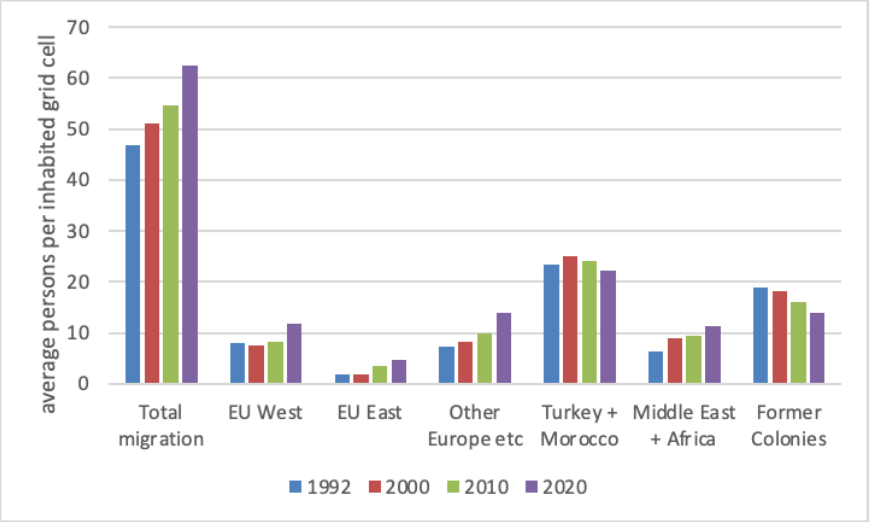


Figure 3.1.4. Average number of persons per inhabited grid cell by foreign group in Amsterdam in 1990, 2000, 2010 and 2020
Source: own calculations.



Taking the analysis one step further, Figure 3.1.5 sheds light on the composition of the individual neighbourhood (defined as a circle of 100 metres around each person) of an Amsterdam citizen. The graph shows the cumulative distribution of the percentage of foreigners in the individual neighbourhoods of Amsterdam citizens. population. Zero percent of the Amsterdam population (P0 on the x-axis) lived in a neighbourhood with no foreigners, in all four years. In 1992 50 percent (P50) lived in a neighbourhood with up to 19 percent foreign population, and this increased to 30 percent foreigners in 2020. And every inhabitant of the city (P100) lived in a neighborhood with more than 80 percent foreigners. The lines go up over time, meaning that each individual neighbourhood became more diverse over time, which is another indicator of reducing segregation over time in Amsterdam.

Figure 3.1.5. Concentration of foreigners in individualised neighbourhoods in Amsterdam in 1992, 2000, 2010 and 2020. Neighbourhoods of 100m radius.
Source: own calculations.

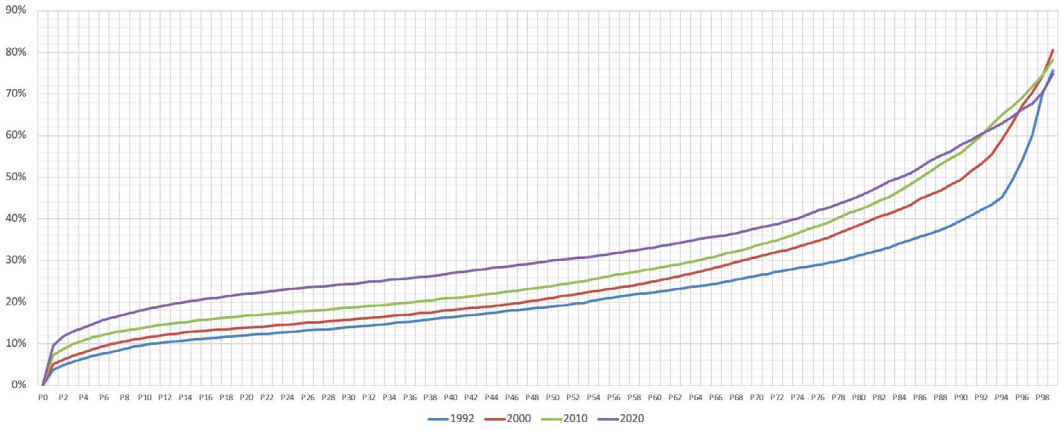


Table 3.1.1. Probability that a foreigner of a specific group finds a random neighbour from his/her own group in a residential neighbourhood in Amsterdam. Individualised neighbourhoods of 100 meters.
Source: own calculations.

Year	Percentiles	Neighbourhood 100 meters					
		EU West	EU East	Europe NonEU	Former Colonies	Middle East & Africa	Turkey & Morocco
1992	10	2.1%	0.1%	1.6%	4.0%	0.8%	3.9%
	25	2.9%	0.2%	2.1%	5.9%	1.4%	7.6%
	50	3.9%	0.4%	2.9%	9.4%	2.3%	14.3%
	75	4.8%	0.6%	4.5%	28.3%	10.4%	20.2%
	90	6.2%	0.9%	9.1%	40.5%	15.5%	25.2%
	95	7.7%	1.2%	11.2%	43.2%	17.7%	28.3%
	99	13.8%	1.9%	17.7%	47.8%	23.7%	34.1%
2020	10	3.2%	0.9%	4.5%	3.2%	2.3%	4.2%
	25	4.8%	1.3%	5.6%	4.8%	3.5%	9.2%
	50	6.5%	1.8%	6.9%	7.4%	5.9%	18.6%
	75	8.4%	2.9%	9.1%	24.4%	13.1%	32.6%
	90	10.0%	4.6%	12.8%	32.8%	23.9%	41.6%
	95	11.9%	5.6%	17.7%	35.1%	31.7%	47.8%
	99	21.0%	8.8%	29.8%	40.4%	38.4%	54.4%

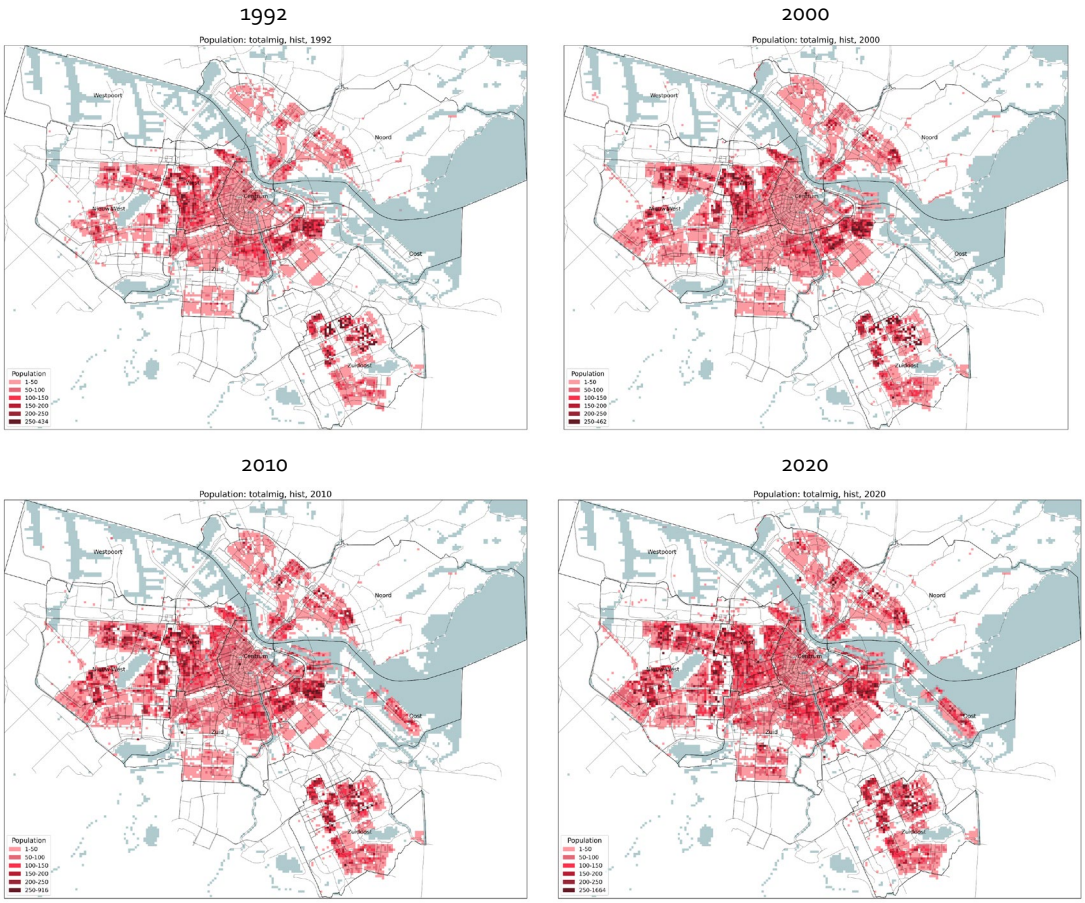
The analysis can be further refined by looking at the same distribution by migrant group. Table 3.1.1. gives the details for specific percentile points. In 1992 10 percent of migrants from the EU West had a probability of 2.1 percent to find a fellow migrant from his/her own group within 100 metres of his/her house. This increased to 3.2 percent in 2020. On the other side of the spectrum, all migrants from EU West had a neighbourhood where he/she had at most a 13.8 percent probability of finding a fellow migrant from the own group, which had increased to 21 percent in 2020. The largest values are to be found among the population of the former colonies, although dropping from 48 to 40 percent, and Turkey and Morocco, with an increase from 34 to 54 percent.

The evolution of the spatial distribution of the foreign population in Amsterdam can be seen in Figure 3.1.6, whereas the Figures 3.1.7 to 3.1.12 depict the change between 1992 and 2020 for each of the migrant groups separately. The observed growth of the foreign population in Amsterdam is not evenly distributed over the city. The distribution of foreign population resembles to a large extent the general shape of the city, with larger concentrations in the West ('Westelijke Tuinsteden') and the Bijlmermeer, and clearly a preference for the central city as well. The expansion of Amsterdam, particularly the new city districts to the West and the East (IJburg) has also given the foreign population the opportunity to find residence there. These are partly the well-paid high income migrant workers who are able to find residence in the expensive city centre.

Figure 7 shows the change in the spatial distribution of the largest foreign subpopulations, the Turkish and Moroccan inhabitants of the city. These migrant groups are typically concentrated in the Western city districts, dominated by single family houses and flats built in the sixties, in the social rental sector, and left by many natives who migrated to suburban cities outside Amsterdam in the seventies and eighties. Another concentration area is the 19th century ring to the south and east of the historical city. In 2020 this pattern is still dominant, but there is also a strong growth in the new city district to the West (Akerpolder), with more expensive housing, and higher percentages of owner-occupiers. The same is true of the new district of IJburg, built in the IJsselmeer, to the East.

The second largest foreign group is the population from non-Eu European countries, the Americas and Australia. Figure 8 shows their spatial distribution in 1992 and 2020.

Figure 3.1.6. Number of foreign-origin population by grid cell in Amsterdam in 1990, 2000, 2010 and 2020. Source: own calculation based on data from Amsterdam Municipality.



The Other European plus Americas plus Australia group shows a preference for more centrally located residences in 1992. In 2020 the distribution is much more evenly distributed over the city, although the centre concentration remains visible.

The Amsterdam population with origins in the former colonies shows a heavy concentration in the Bijlmermeer, both in 1992 and 2020. In 1992 the concentration was also strong in the 19th century ring around the historical centre, but this has been strongly reduced in 2020. Instead at that time we see a much more even distribution across the city, including the new residential areas to the west and the east.

The foreign population from the EU West has increasingly concentrated in the city centre. In 1992 it was already visible to some extent, with lower concentrations in the outer districts, but the map for 2020 shows a major concentration in the centre, as well as in the more expensive district of '*Oud-Zuid*'.

The foreign population from the Middle East and Africa is strongly concentrated in the Bijlmermeer, and in the early 20 century districts West, whereas they are relatively less located in the city centre. In 2020 there is a stronger concentration in Amsterdam-Noord, at the other side of the river IJ.

Figure 3.1.7. Number of Turkish-and Moroccan origin population by grid cell in Amsterdam in 1992 and 2020.
Source: own calculation based on data from Amsterdam Municipality.

1992 2020

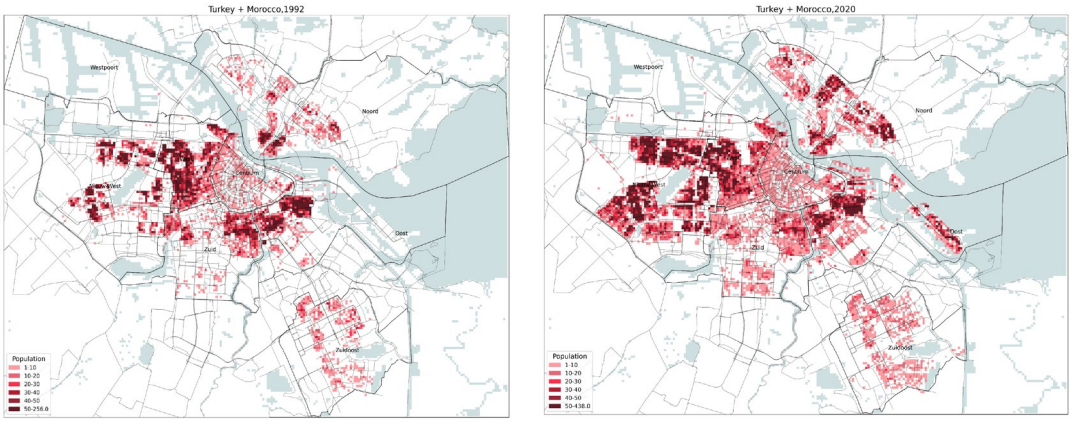


Figure 3.1.8. Number of Other Europe, the Americas and Australia-origin population by grid cell in Amsterdam in 1992 and 2020
Source: own calculation based on data from Amsterdam Municipality.

1992 2020

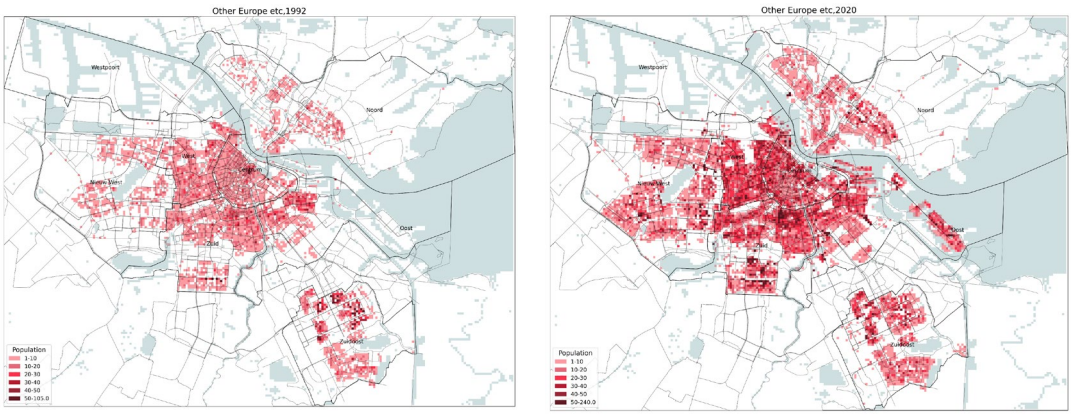


Figure 3.1.9. Number of Former colonies-origin population by grid cell in Amsterdam in 1992 and 2020
Source: own calculation based on data from Amsterdam Municipality.

1992 2020

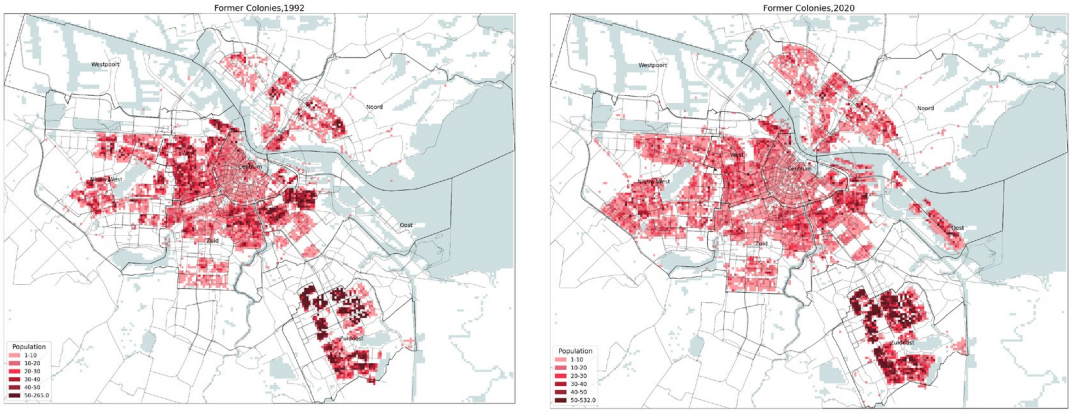
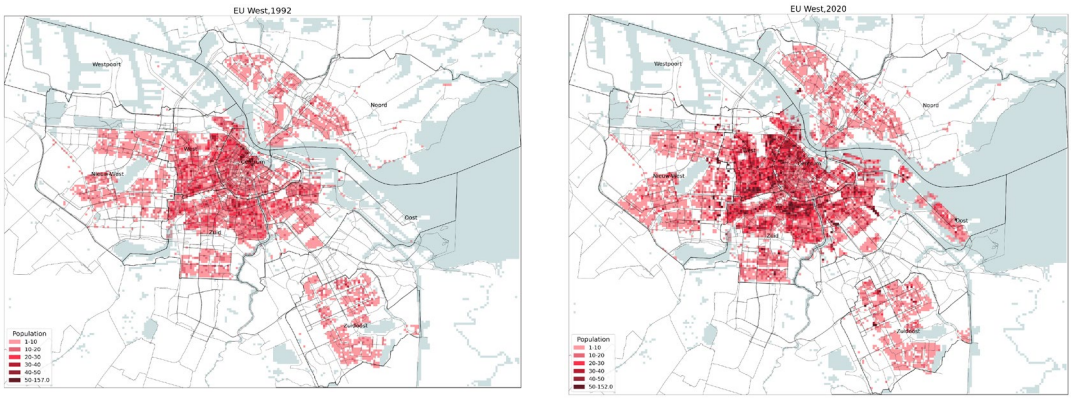


Figure 3.1.10. Number of EU West-origin population by grid cell in Amsterdam in 1992 and 2020
Source: own calculation based on data from Amsterdam Municipality.

1992 2020



Finally, the smallest foreign population in our chosen categories, from the EU East is quite dispersed across the city, both in 1992 and 2020, although a concentration can be seen in the city centre in 2020, and in the western outskirts of the city (Akerpolder and Westelijke Tuinsteden).

Figure 3.1.11. Number of Middle East and African-origin population by grid cell in Amsterdam in 1992 and 2020.
Source: own calculation based on data from Amsterdam Municipality.

1992 2020

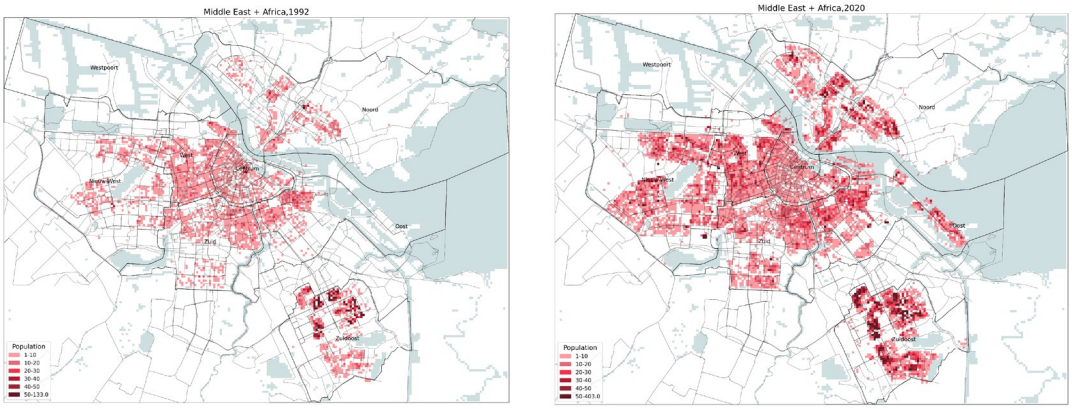
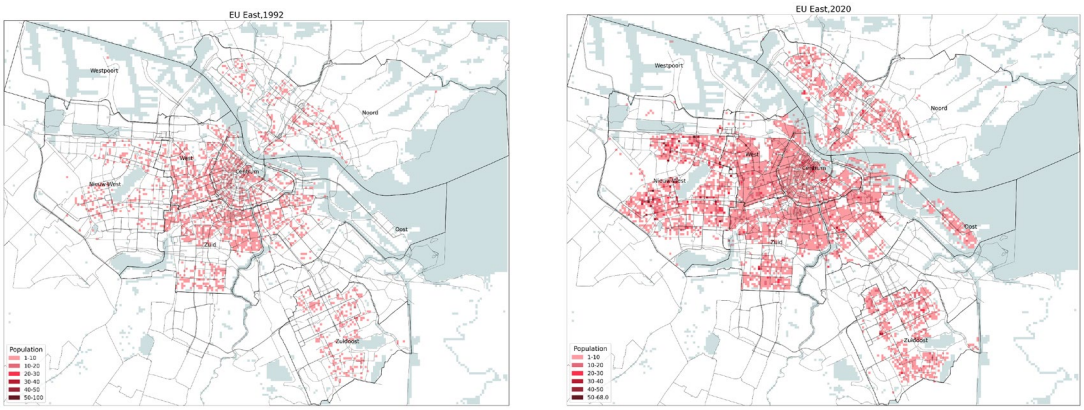


Figure 3.1.12. Number of East-EU-origin population by grid cell in Amsterdam in 1992 and 2020
Source: own calculation based on data from Amsterdam Municipality.

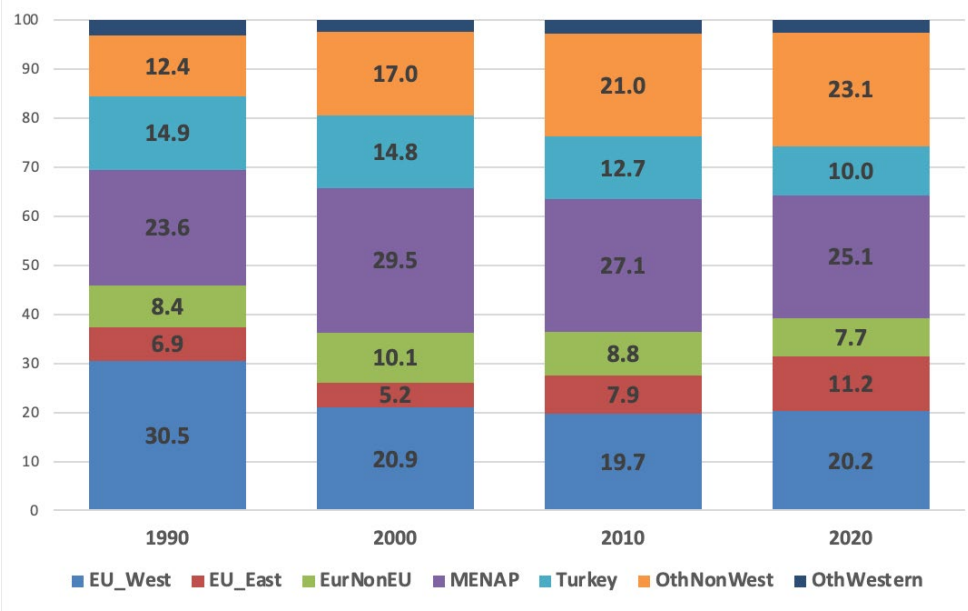
1992 2020



3.2. Copenhagen

The population of the greater Copenhagen area increased from 1.09 to 1.35 million between 1990 and 2020. Over the same period, the share of immigrants and their descendants increased from 8.3 to 23.5 percent of the population.

Figure 3.2.1. Share of chosen groups among foreign origin population in Copenhagen.
Source: own calculations based on DST data.



The country-of-origin composition of the immigrant-origin population also changed significantly in the period 1990–2020. Figure 3.2.1 shows the change in the composition of the foreign population. In Copenhagen in 1990, the largest groups were people from the other Western EU countries (30.5%), predominantly from neighbouring countries like Sweden and Germany, and MENAP countries (23.6%) (predominantly Pakistan, and Morocco). The third and the largest country-specific group was the Turkish diaspora with almost 15% share of the foreign population. The next groups were foreigners from Other non-Western countries (12.4%) (India, Philippines), Europe non-EU (8.4%) (former Yugoslavia), and EU Eastern countries (6.9%) (Poland). During the period of 30 years, the foreign origin population increased by 233% from 92.3 to 317.7 thousand. While all of the above groups grew in numbers over this period, the share of people from Western EU countries fell to 20.2%, and by 2020 this group ranked third behind foreigners from MENAP countries (25.1%) and other non-Western countries (23.1%). The Turkish diaspora was the largest country-specific group in the entire period, but its share decreased to only 10%. The dynamic increase in share was observed for EU Eastern foreigners which reached the level of 11.2%, especially after the EU enragement in 2004.

The current composition of the immigrant-origin population in the Copenhagen area was shaped by migration flows starting around the second half of the 1960s, when workers from Turkey, Pakistan, former Yugoslavia, and Morocco arrived by way of the workforce-immigration program. During the 1980s and 1990s, the main migration streams originated from various conflict regions (Iran, Iraq, Lebanon, Somalia, Bosnia and Herzegovina). The 2000s were dominated by flows of asylum seekers from various regions and immigrants from Eastern Europe, who, following the enlargement of the European Union, had access to the Danish labour market. In 2020, people of Polish origin ranked the fourth largest immigrant origin group in the city.

There is a significant level of residential segregation of minorities in Copenhagen, although there is a weak downward trend (as measured by the dissimilarity index; formula (1)). Housing policies and prices, migration

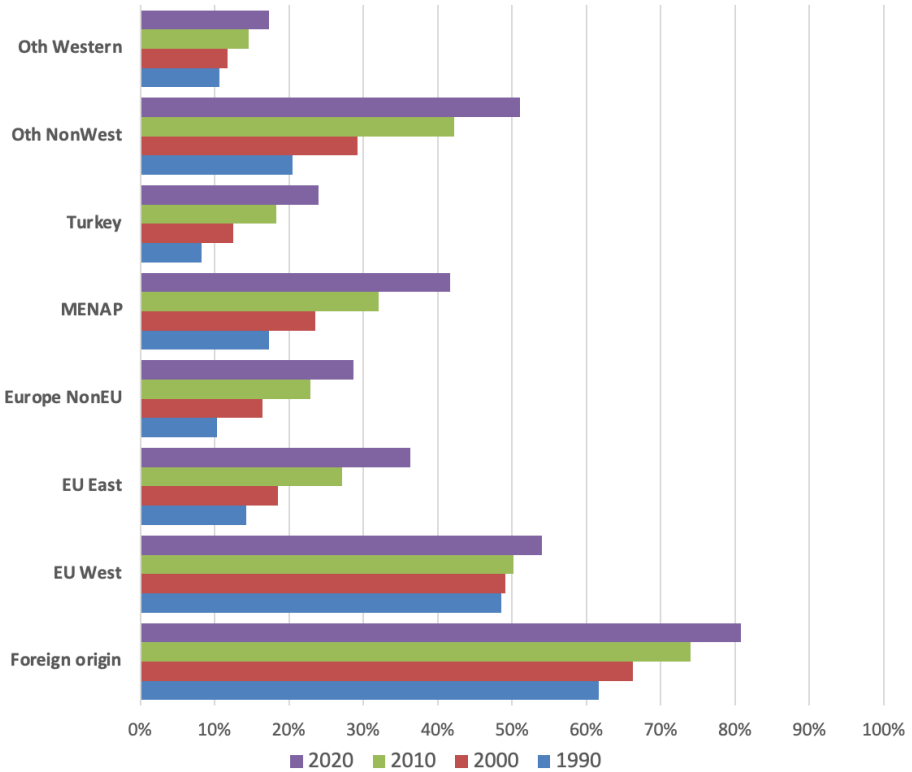
inflows, and labour market developments have contributed to the segregation processes and outcomes in Copenhagen. Comparative research on Nordic cities has shown that the housing market has a fundamental role in structuring segregation patterns (Andersen et al., 2016). It is worth noting that Denmark has historically led an extensive policy aimed at providing affordable housing for all residents through means such as tax deductions for mortgage interest and direct subsidies for rental housing, as well as rent regulation (Kristensen, 2002).

Approximately half of the Danish residential units are owner-occupied. However, the proportion of owner-occupied units is far lower in the Copenhagen area, where approximately two in five and one in five residences are owner-occupied in the regions Københavns omegn (surrounding areas) and Byen København (the city of Copenhagen), respectively (Statistics Denmark). For many immigrants in urban areas, social housing and dwellings in disadvantaged neighbourhoods have been the most easily available housing options (Kristensen, 2002), resulting in political concerns over the concentrations of social problems in such areas (Ministry of Refugees, Immigration and Integration Affairs, 2004). Following the 2001 election, the Ministry of Housing was closed down, and its activities were transferred to several other ministries as the national government took a less active role in housing policy.

The issue of residential segregation is a major political factor in Denmark. Its salience stems from its link to larger, integration-related issues. In the last decade, the country's immigration policy has stood out as being markedly stricter than those of neighbouring countries. Denmark has also had a more intense public debate about immigration, integration, and segregation (Green-Pedersen & Krogstrup, 2008).

In 1990 the population of Copenhagen inhabited 20,294 grid cells (100m x 100m) which gives an average of around 54 persons per cell (Tab. 3.2.1). Foreign origin population was present in 61.6% of them, exactly 12,508 grid cells, which gives an average of 7.6 persons. The highest concentration of foreigners in the grid cell was 286 persons. The highest representation of all groups under consideration had foreigners from EU countries, which were present in 9,857 grid cells – 49% of inhabited grid cells, followed by Other Non-Western group – 4,154 cells (20%) and MENAP – 3,502 cells (17%) (see Fig. 3.2.2). However, the higher concentration was observed among Turkish origin people. They were around 14.1 thousand of them in the city, but they occupied only 1,679 grid cells, which gives an average of 8.4 persons per grid cell (tab. 3.2.1). The next was the MENAP group with an average concentration of 6.4 persons per cell. Much lower average values were observed among Europe non-EU (3.8), EU West (2.95), EU East (2.3) and Other Western (1.6).

Figure 3.2.2. Share of inhabited grid cells occupied by foreigner groups in 1990, 2000, 2010 and 2020. Source: own calculations.



In 1990-2020, the concentration of immigrant origin population increased significantly from 7.6 to 18.3 persons per grid cell, mostly due to a rise in the volume of these groups in Copenhagen (Fig. 3.2.3). However, there is no uniform tendency if we look at changes among chosen groups. Between 1990 and 2000, the average person per occupied group increased in all groups except the EU East population. The biggest growth was observed among the MENAP population. Their concentration increased from 6.4 to 9.7 persons per grid cell, which was the highest among all groups in 2010. After that, while it continued increasing for EU-origin people and *Other Non-Western* and *Other Western* groups, it started decreasing for the most concentrated - *Turkish* and *MENAP*-origin diasporas. For the first, the average decreased from 9.3 in 2010 to 6.2 persons per grid cell. The *MENAP* concentration went down from a record high of 9.7 to 8.9 persons, which was the highest level in 2020.

In 2020, there was a significant increase in the number of foreign-origin residents in grid cells, with 81% of them having at least one foreign-origin person living there (Fig. 3.2.2). The highest growth of representation has also experienced MENAP and Other Non-Western groups. In 2020, MENAP people were represented in 42% of the grid cells, and Other Non-Western in 51%, whereas the representation of Turkish people increased from 8% to 24%.

Figure 3.2.3. Average number of persons per inhabited grid cell by the foreign group in 1990, 2000, 2010 and 2020.
Source: own calculations.

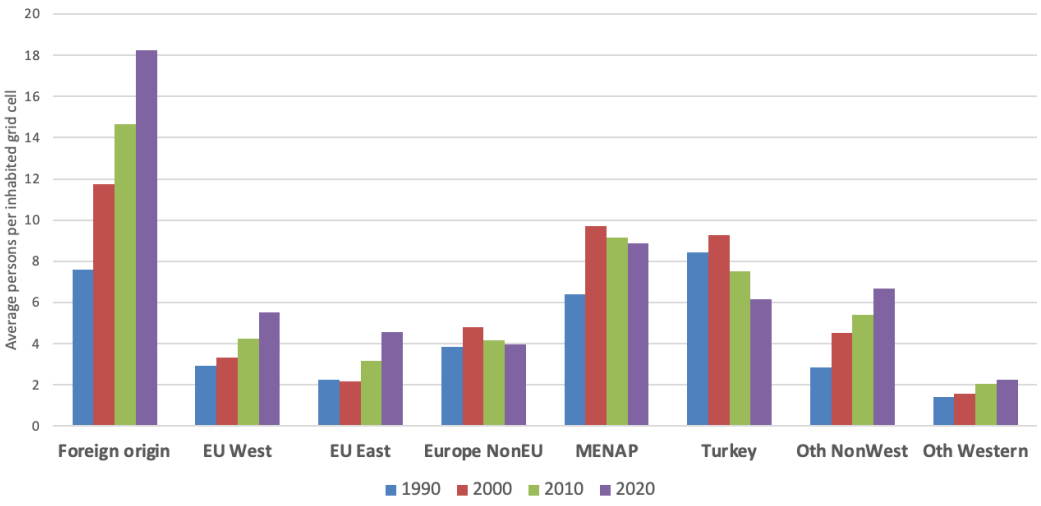
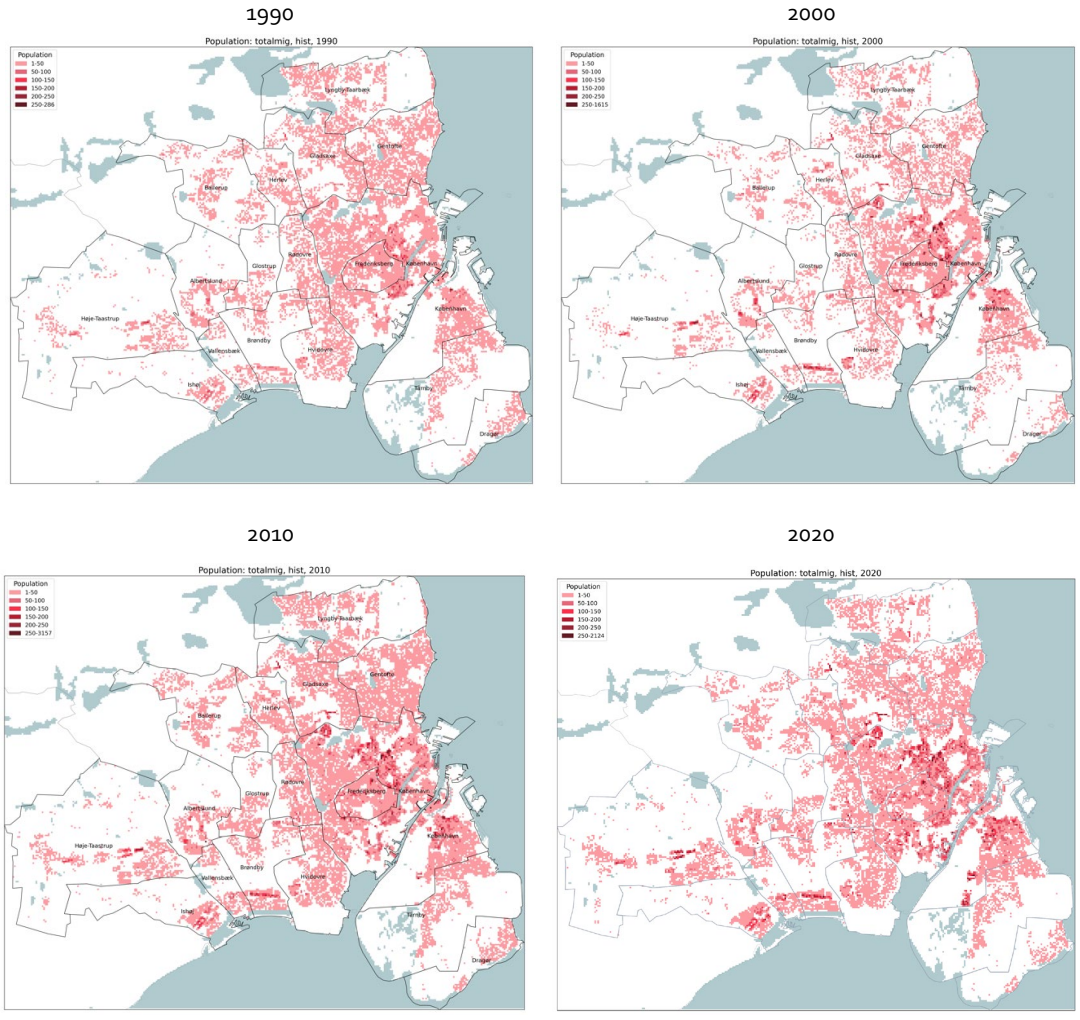


Table 3.2.1. Foreign population in Copenhagen
Source: own calculations.

Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Average no of persons per populated grid
1990	Total	20 294	1.00	1 727	1 091 179	100.00	x	53.77
	Foreign origin	12 508	0.00	286	95 230	8.73	100.00	7.61
	EU West	9 857	0.00	116	29 066	2.66	30.52	2.95
	EU East	2 896	0.00	27	6 576	0.60	6.91	2.27
	Europe NonEU	2 094	0.00	54	8 032	0.74	8.43	3.84
	MENAP	3 502	0.00	137	22 479	2.06	23.60	6.42
	Turkey	1 679	0.00	133	14 190	1.30	14.90	8.45
	Oth NonWest	4 154	0.00	108	11 848	1.09	12.44	2.85
	Oth Western	2 160	0.00	24	3 039	0.28	3.19	1.41
2000	Total	20 491	1.00	3 729	1 142 215	100.00	x	55.74
	Foreign origin	13 573	0.00	1 615	159 292	13.95	100.00	11.74
	EU West	10 059	0.00	390	33 366	2.92	20.95	3.32
	EU East	3 784	0.00	48	8 255	0.72	5.18	2.18
	Europe NonEU	3 360	0.00	73	16 118	1.41	10.12	4.80
	MENAP	4 830	0.00	450	46 995	4.11	29.50	9.73
	Turkey	2 553	0.00	158	23 645	2.07	14.84	9.26
	Oth NonWest	5 987	0.00	517	27 143	2.38	17.04	4.53
	Oth Western	2 400	0.00	66	3 770	0.33	2.37	1.57
2010	Total	20 924	1.00	5 093	1 209 566	100.00	x	57.81
	Foreign origin	15 484	0.00	3 157	227 048	18.77	100.00	14.66
	EU West	10 503	0.00	765	44 706	3.70	19.69	4.26
	EU East	5 669	0.00	382	17 988	1.49	7.92	3.17
	Europe NonEU	4 791	0.00	107	20 004	1.65	8.81	4.18
	MENAP	6 711	0.00	640	61 466	5.08	27.07	9.16
	Turkey	3 833	0.00	126	28 854	2.39	12.71	7.53
	Oth NonWest	8 835	0.00	1 013	47 747	3.95	21.03	5.40
	Oth Western	3 048	0.00	174	6 283	0.52	2.77	2.06
2020	Total	21 529	1.00	3 942	1 348 619	100.00	x	62.64
	Foreign origin	17 400	0.00	2 124	317 695	23.56	100.00	18.26
	EU West	11 618	0.00	636	64 208	4.76	20.21	5.53
	EU East	7 821	0.00	215	35 642	2.64	11.22	4.56
	Europe NonEU	6 176	0.00	69	24 608	1.82	7.75	3.98
	MENAP	8 966	0.00	539	79 725	5.91	25.09	8.89
	Turkey	5 161	0.00	96	31 812	2.36	10.01	6.16
	Oth NonWest	11 005	0.00	557	73 387	5.44	23.10	6.67
	Oth Western	3 717	0.00	86	8 313	0.62	2.62	2.24

The changes in residential allocation of foreign-origin population can be followed on the maps (Figure 3.2.4). It is obvious that the number of foreign residents and their representation in Copenhagen increased, but there are specific areas where a comparatively higher concentration of this population was observed. This is especially visible in the city center, Nørrebro, Amager, Brønby and Ishoj municipalities. The maps also show the development of vulnerable residential areas (socalled "ghettos") in Brøndby and Copenhagen, where the majority of residents are of non-EU origin or their descendants and rely on government assistance. On the other hand, some wealthy immigrants choose to reside in the expensive parts of the city center due to their economic status.

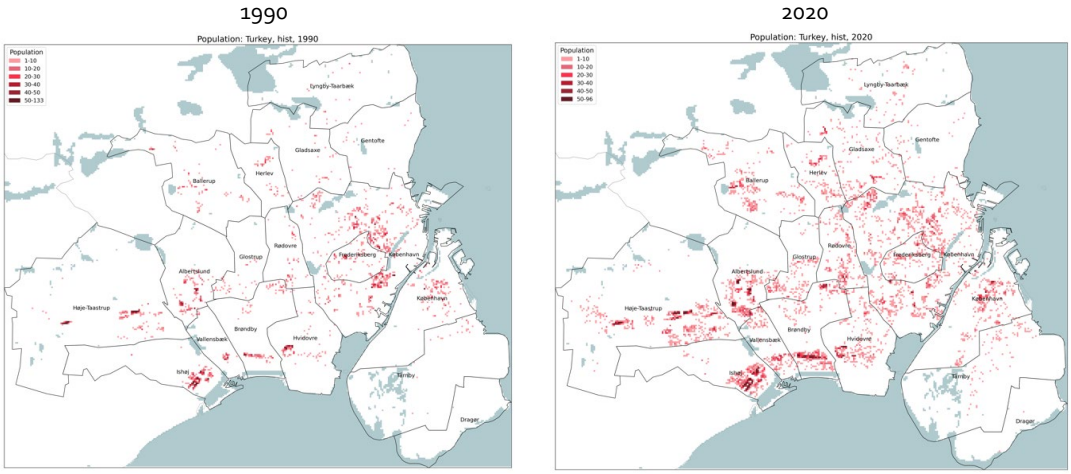
Figure 3.2.4. Number of foreign-origin population by grid cell in Copenhagen in 1990, 2000, 2010 and 2020. Source: own calculation based on data from Statistics Denmark.



In general, our observations show that while the foreign population in Copenhagen is not larger than the local population, a considerable number of foreign populations of EU origin prefer to live in central areas like downtown Copenhagen and Frederiksberg. Meanwhile, foreign populations of non-EU origin tend to reside more widely across the southwestern regions of the Copenhagen metropolitan area. Although it is remarkable that, in general, we observed the rise in total population between 1990 and 2020, with a somewhat steady percentage of the foreign population. This suggests that the foreign population was increasing proportionally to the native population.

The spatial development of the biggest foreign population – Turkish diaspora is shown in Figure 3.2.5. It is clearly visible its change in representation and concentration. Although, generally the Turkish population is well represented in peripheral areas from the centre. There are also areas where the number of people decreased, for example, the Vesterbro area, near the Central Station.

Figure 3.2.5. Number of Turkish-origin population by grid cell in Copenhagen in 1990 and 2020.
Source: own calculation based on data from DST.



As mentioned above, groups with the highest increase of representation were MENAP and Other Non-Western populations. Figures 3.2.6 and 3.2.7 document their rapid increase in the city.

Figure 3.2.6. Number of MENAP-origin population by grid cell in Copenhagen in 1990 and 2020
Source: own calculation based on data from DST.

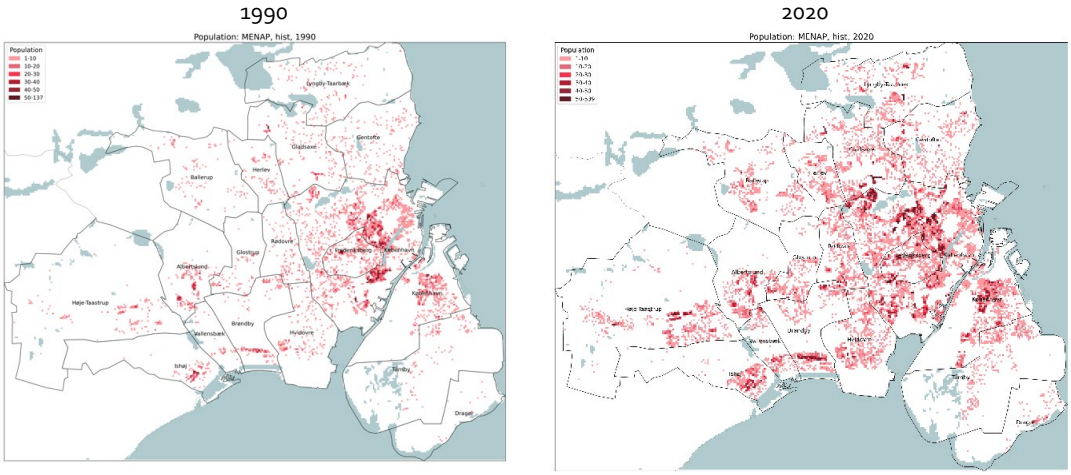
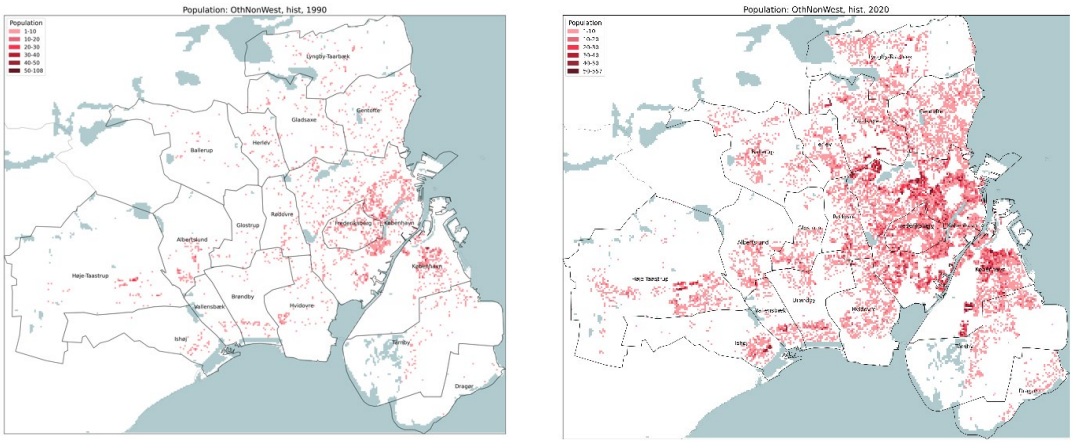


Figure 3.2.7. Number of Other Non-Western-origin population by grid cell in Copenhagen in 1990 and 2020. Source: own calculation based on data from DST.

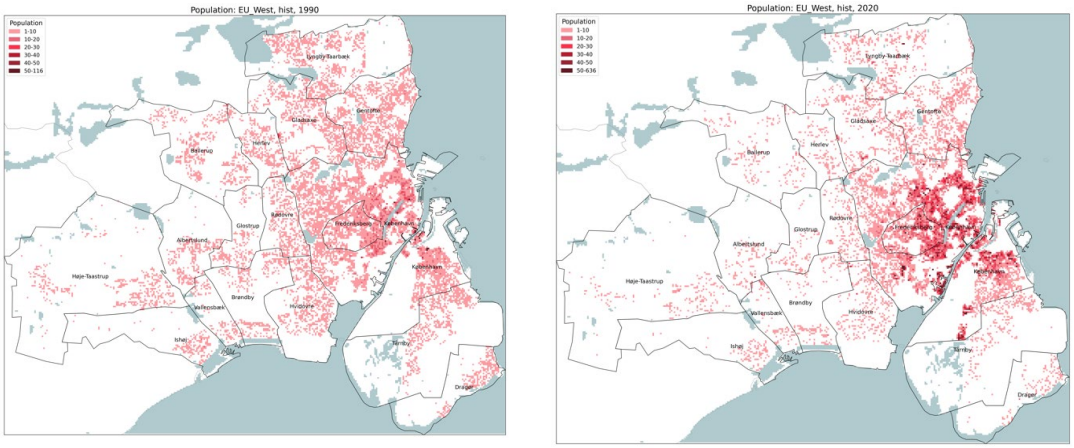
1990 2020



In the case of the EU-West population, we can observe a change in the spatial allocation of the group. There was a reduction of the presence of this group in peripheral areas of the city and an increase in the central areas, like Nørrebro, Østerbro and Indre By.

Figure 3.2.8. Number of EU West-origin population by grid cell in Copenhagen in 1990 and 2020. Source: own calculation based on data from DST.

1990 2020



A similar pattern of spatial allocation can be observed among EU-East and Europe Non-EU population with an increase in population and representation in the central districts (Fig. 3.2.9 and 3.2.10).

Figure 3.2.9. Number of EU East-origin population by grid cell in Copenhagen in 1990 and 2020.
Source: own calculation based on data from DST.

1990 2020

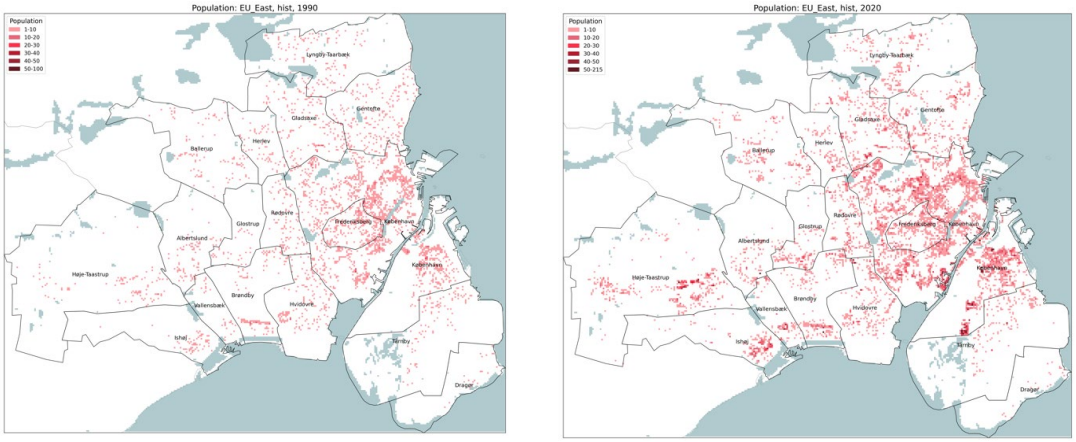
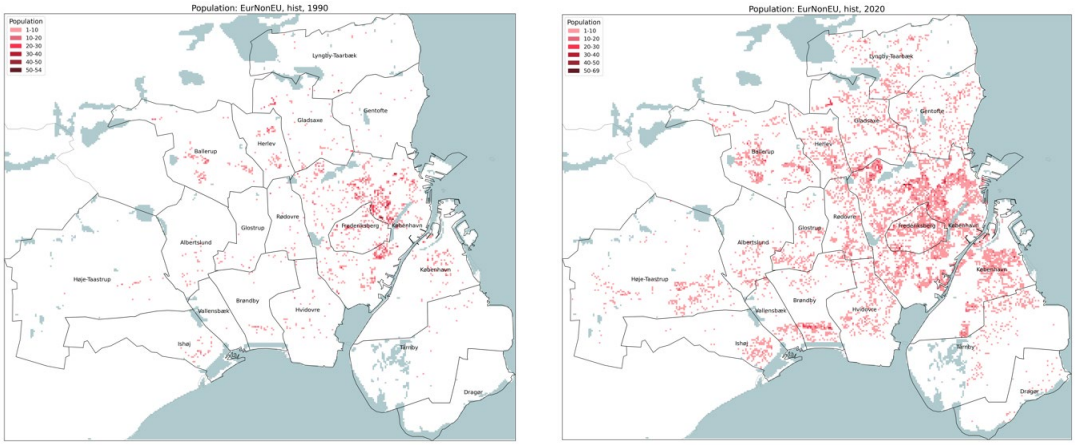


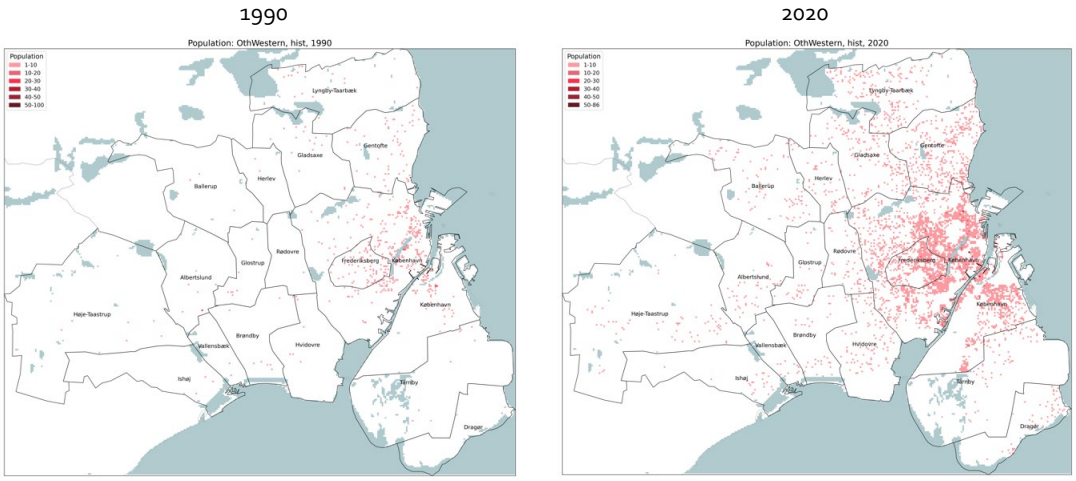
Figure 3.2.10. Number of Europe nonEU-origin population by grid cell in Copenhagen in 1990 and 2020.
Source: own calculation based on data from DST.

1990 2020



The smallest among the analysed group – *Other Western* origin population is predominantly concentrated in the central districts of Copenhagen. Its representation increased significantly in these areas (Fig. 3.2.11).

Figure 3.2.11. Number of Other Western-origin population by grid cell in Copenhagen in 1990,2020.
Source: own calculation based on data from DST.



The analysis reveals that there was a significant increase in the residential concentration of the foreign population in individualised neighbourhoods within 100 meters from an individual. However, even in 1990, there were only less than 1% of inhabitants in Copenhagen with no foreign neighbour (Fig. 3.2.12). In 1990, 50% of the population lived in the neighbourhood with 7% of the foreigner-origin population. During 30 years, this percentage increased to 20%.

At the beginning of the period, only 5% of the inhabitants lived in areas where at least 1 out of 5 neighbours were of foreign origin. In 2020, 50% of the population lived in such neighbourhoods, whereas 5% lived in places where the majority had a non-native origin (Tab. 3.2.2).

Figure 3.2.12. The concentration of foreigners in individualised neighbourhoods in Copenhagen in 1990, 2000, 2010 and 2020. Neighbourhoods of 100m radius.
Source: own calculations.

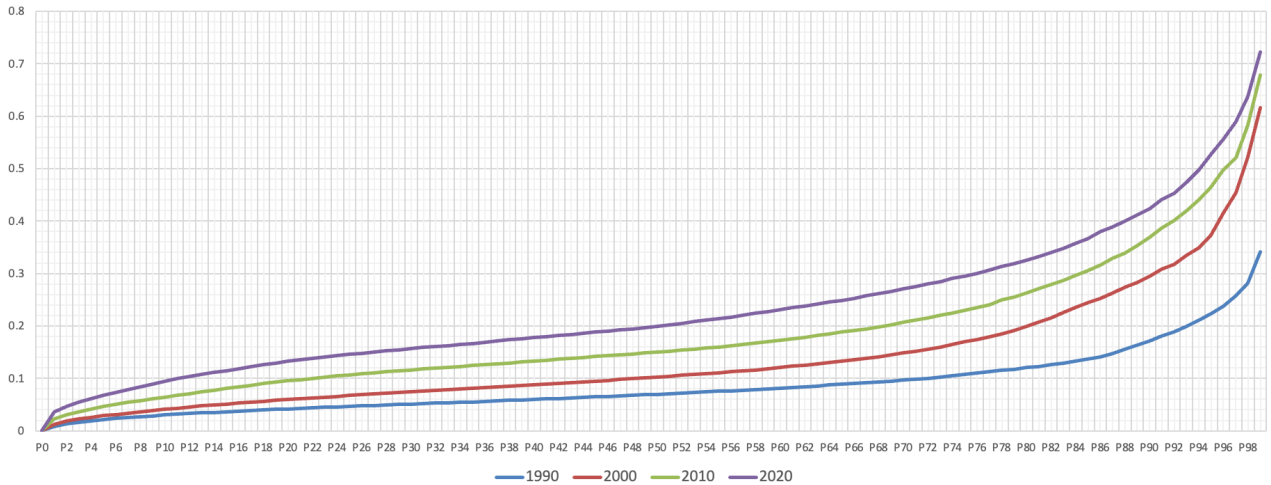


Table 3.2.2. The concentration of foreigners in individualised neighbourhoods in Copenhagen. Chosen Percentile values in 1990, 2000, 2010 and 2020.
Source: own calculations.

Group	Percentiles	Neighbourhood 100meters			
		1990	2000	2010	2020
Foreign origin	10	3.0%	4.1%	6.4%	9.4%
	25	4.6%	6.7%	10.7%	14.6%
	50	7.0%	10.3%	15.0%	20.0%
	75	10.7%	17.0%	22.9%	29.5%
	90	17.1%	29.5%	36.9%	42.4%
	95	22.3%	37.4%	46.5%	52.7%
	99	34.1%	61.7%	67.9%	72.2%

When it comes to the dissimilarity index (DI) calculated on the level of grid cells, segregation of foreign-origin population increased only in the period 1990-2000 from 0.396 to 0.436. It means that in 1990, around 40% of foreigners had to be moved to other grid cells to equal the share of foreigners at the whole city level; by 2000, this number increased to 44%. After that, a downward trend of segregation was observed. DI went to the level of 40% by 2010 and then reached the level of 37.5% in 2020. However, if we analyse each subgroup of foreigners separately, segregation varies significantly. Generally, segregation decreased among all groups. It is worth remembering that some of them were small at the beginning of the period under consideration, and because of that, DI interpretation has to be taken with caution. Thus, we describe segregation only for the biggest groups. The most segregated group was the Turkish-origin population, for which DI equals almost 80% in 1990 and 70% in 2020, and the MENAP population – 66% in 1990 and 55% in 2020. The lowest values were noted for foreigners from Western EU countries, around 40% in 1990 and 2020. Here, the exception was the year 2010 with a temporal increase in segregation. Despite high population growth, segregation of *Other Non-Western* origin population decreased as well and reached 42% in 2020.

Table 3.2.3 Dissimilarity Index for foreigners and its subgroups in Copenhagen in 1990-2020.
Source: own calculations.

Region	1990	2000	2010	2020
Immigrants	0.396	0.436	0.401	0.375
EU West	0.375	0.382	0.524	0.393
EU East	0.669	0.610	0.595	0.489
Europe NonEU	0.742	0.662	0.594	0.538
MENAP	0.661	0.634	0.720	0.545
Turkey	0.792	0.746	0.449	0.695
Other Non-West	0.607	0.525	0.663	0.417
Other Western	0.751	0.719	0.393	0.615

In our study, we analyse the probability of a foreigner from a specific group having a neighbour from the same group in an individualised neighbourhood. The probabilities increased during the period under consideration as the foreign-origin population grew in numbers. The highest probability of meeting a person with the same group had ones from the Turkish diaspora (Fig. 3.2.4). In 1990, 25% of them had a probability of at least 13.5% and after 30 years, 20% probability.

Table 3.2.4. The probability that a foreigner of a specific group finds a random neighbour from his/her own group in a residential neighbourhood in Copenhagen. Individualised neighbourhoods of 100 meters.
Source: own calculations.

Year	Percentiles	Neighbourhood 100meters						
		EU West	EU East	Europe NonEU	MENAP	Turkey	Other Non-West	Other Western
1990	10	1.4%	0.2%	0.4%	1.2%	1.0%	0.5%	0.0%
	25	2.1%	0.5%	0.9%	2.4%	2.2%	0.9%	0.1%
	50	2.9%	0.9%	2.0%	4.9%	4.9%	1.6%	0.4%
	75	3.9%	1.5%	3.7%	8.3%	13.5%	2.7%	0.7%
	90	5.5%	2.6%	5.7%	13.0%	22.4%	4.1%	1.1%
	95	7.6%	3.4%	6.7%	15.4%	27.1%	5.2%	1.5%
	99	16.0%	4.7%	8.0%	21.2%	36.5%	7.8%	4.6%
2020	10	2.3%	1.3%	0.9%	2.9%	1.1%	3.0%	0.2%
	25	4.2%	2.1%	1.5%	5.5%	2.9%	4.4%	0.6%
	50	6.5%	3.6%	2.6%	10.6%	8.1%	6.9%	1.0%
	75	8.8%	5.9%	4.5%	18.3%	19.4%	10.6%	1.5%
	90	12.8%	9.3%	7.2%	25.8%	28.8%	14.9%	2.4%
	95	15.7%	11.7%	8.8%	30.8%	31.7%	19.5%	3.1%
	99	28.3%	20.0%	11.0%	40.5%	36.5%	26.7%	9.9%

3.3. Krakow

In recent years, most of the EU member states from Central and Eastern Europe have undergone transformation from 'migrant-exporting' economies into important migrant destinations (Okólski, 2012; Bilan & Strielkowski, 2016). Although this transformation from a sending into a host country just replicates the experience of South European members of the EU such as Spain or Italy (Bonifazi et al., 2009)., the pace of this transformation is unprecedented. The striking example in this regard is Poland. Since 2015, it has turned into a major destination country for third-country nationals in the EU. Before 2015, less than 0.5 per cent of the population was foreign-born. Most recent (2020) estimates mention ca. 1.35 million Ukrainians living in Poland (3.4 percent of the population) and few dozens of thousands of immigrants from other countries (i.e., Belarus, Russia, Germany, Moldova and India – to mention those with the largest communities in Poland- GUS 2020, cf. Pędziwiatr et al., 2020). Yet, the Russian aggression on Ukraine in February 2022 has driven another wave of migrants – this time forced migrants – to Poland: in total, 8 million Ukrainians crossed the Polish border in 2022 and around 1 million decided to temporarily reside in the country. This implies that the total population of Ukrainians (forced and economic migrants) in Poland at the end of 2022 can be estimated between 2.1 and 2.3 million (Duszczyk et al., 2023). Additionally, the non-Ukrainian immigrant population in major Polish cities is also growing. Some of the fastest growing communities in the last years include those composed of citizens of Belarus (many of them escaping persecution in the country and obtaining some form of protection in Poland), India or Georgia (Pędziwiatr et al., 2022)

Consequently, Poland with its increasing ethnic diversity is due to face similar challenges of migrant integration and building a cohesive society as Western European countries (Coenen et al., 2019), including the question of immigrants' residential segregation and/or concentration. In the case of Central and Eastern Europe the question of migrant ethnic residential concentration is a very novel issue, as traditionally the migration studies have emphasized that in cities of the region: "ethnicity and immigration hardly plays a role" (Musterd and Van Kempen, 2009: 599).

Before we analyse the key patterns of spatial concentration of immigrants in Kraków, it is necessary to briefly discuss the major factors affecting the settlement process of foreigners, including the main features of the Polish migration policy, housing market, welfare state regime, structure of the labour market, discriminatory practices in the housing market as well as residential preferences of migrants. As far as the Polish migration policy is concerned, the country lacks a clear and coherent policy document in this domain. After 1989, policies focused mostly on emigration as immigrant flows into the country were marginal. In this sense, most of attention was paid to facilitating access to foreign labour markets for Polish migrants, either through bilateral agreements, or through EU accession.

The accession of Poland to the European Union in 2004 was one of the major factors shaping the emergence of the migration policy (Matyja et al, 2015). As part of the accession requirements Poland adopted the EU regulation concerning the international and other forms of protection. Thus, the policy concerning forced migrants is relatively well developed (Duszczyk et al., 2020) which is not the case of other types of migration which were not within the main scope of the governments' interest in Poland. Additionally, some members of the academia doubted that foreigners, for instance Ukrainians and Belorussians, could ever want to settle in Poland (Iglicka, 2013). The war in Ukraine and the worsening economic situation of the country, as well as the growing record of human rights abuses of the Belarussian authoritarian regime very quickly contradicted this thesis. Poland with an unprecedentedly low unemployment rate[1] became increasingly attractive for immigrants not only from Ukraine but also other countries. The flexibility of the government with regards to visas and work permits for immigrants resulted in an unprecedented number of employment-related residence permits for third country nationals issued by the authorities. Since 2016 Poland has annually released the highest number of these documents among all European Union countries[2].

The first attempt to formulate the migration and integration policy was made in 2012 with the release by the government of the document "Poland's migration policy – current status and postulated actions". This important document[3], however, was suspended shortly after the government led by the Law and Justice Party came into power in 2015. Although the document was supposed to be replaced by a brand-new immigration policy strategy, this has not happened to this day (Pędziwiatr, 2019).

As far as the housing market is concerned, during the period of centrally planned economy (1945-1989), Poland witnessed a drop in investments in housing and urban infrastructure, which resulted in shortages of affordable housing for the new internal migrant population and severely depressed labour mobility (Mayo & Stein, 1995). As the state was the main investor, the preference in economic reforms was given to industrialization at the expense of urbanization (Okólski, 2012). Such economic transformation resulted in creation of jobs mostly in the industrial sector, with underdeveloped services and shortages in affordable housing in the biggest cities (Szymańska & Matczak, 2002). According to Mayo and Stein (1995), especially in the 1980s, labour markets

[1] Falling below 10% in 2015 and reaching 5% at the beginning of 2020.

[2] For example, Poland with 625 000 permits for non-EU citizens was in 2019 by far the leading destination in the EU-27 for those seeking to obtain a residence permit for employment-related reasons. It also issued the highest number of first residence permits for immigrants in the EU - 724 000 (Eurostat 2020).

[3] The document called "Poland's migration policy – current status and postulated actions" was developed by the government in collaboration with representation of academia and civil society and released in 2012.

were distorted by housing market distortions, which resulted in further penalties in the macroeconomic performance. Despite the economic reforms, which introduced a free-market economy in the 1990s, and the subsequent dynamic and sustained economic growth for almost 30 years, the communist heritage is still visible on the Polish housing market. Poland lags behind Western Europe in the most important indicators of housing market activity, including average living space per person and dwelling stock per one thousand inhabitants (Głuszak, 2015). Another specific feature of the Polish economy is the preference for ownership instead of rent, which can be attributed both to psychological and economic factors, especially the fiscal incentives to own real estate. Yet, such a trend has led to the relative underdevelopment of the rental housing market in Poland. For example, the share of private market tenants in 2016 was just 4.5 per cent (Rubaszek, 2019).

Consequently, the underdevelopment of the rental housing market has a negative influence on contemporary internal migration and international migration in Poland (Hejduková & Kureková, 2020; Maleszyk & Kędra, 2020). Limited availability of flats that could be rented discourages people from moving after a new job. According to experts, there is a shortage of approximately 2,1 million houses in the country. This situation most frequently affects people with medium and low income. They neither have access to cheap mortgages nor cash to buy apartments. The social housing in the country estimated at 150-200 thousand premises is absolutely insufficient for the needs of the population (Chabasiński, 2018). Thus, the difficulty of finding adequate housing by different groups of internal and international migrants in Poland is partially linked with a general shortage of affordable housing. Additionally, there is growing evidence of the discrimination of immigrants in the housing market. For example, according to the recent study of Antfolk and associates (2019), the inquiries for flat advertisements signed with Arabic names have received significantly fewer responses than those signed with English or Polish ones.

As far as the Polish welfare state is concerned, one of the key elements of it is a monthly child allowance (500PLN = 120EUR) introduced in 2016 in the form of the programme "Family 500+". The program aims to boost birth-rates and reduce child poverty by improving living conditions of large families. From the beginning, the 500+ Act assumed that the support would be available for foreigners - mainly EU citizens, but also those whose country had a special agreement with Poland on social security. Ukraine is one of the few non-EU countries with which Poland has such an agreement, and Ukrainians living in Poland are major non-Polish beneficiaries of it. According to the data of the Ministry of Family, Labour and Social Policy, in 2018 the child allowance 500+ was paid monthly to 4,562 children with Ukrainian citizenship. The average monthly cost of the support to Ukrainian families living with children in Poland was approximately 2.2 million PLN (around 500 thousand euro). Belarusians, who are the second largest group of foreigners working in Poland, cannot count on such financial support from the Polish state since Poland has not signed a similar social security agreement with Belarus (Kacprzak, 2019).

When it comes to labour market characteristics, the Polish economy has witnessed a rapid economic growth in the last few years[4]. As a result, the "market of employer" has turned into the "market of employee", where the demand for jobs is much higher in certain sectors than the national supply (Brzozowski, 2018). Consequently, the demand for foreign labour has increased substantially – not only in low-skilled sectors as agriculture and temporary services agencies (which usually secure the simplest occupations in services like cleaning or cashier desk at supermalls), but also in semi-skilled occupations (construction & manufacturing) and in skilled ones (mostly ITC or other B2B services in MNCs). Recent reports confirm that immigrants' participation in the labour market in Poland is increasing in such key sectors as transportation, ICT, construction, catering & hospitality and recently – also education and healthcare (Pędziwiatr et al., 2022).

[4] Even during the Covid-19 pandemic the economic recession due to lockdown measures was milder than in other EU countries.

In the case of Poland, there is a number of country-specific factors[5] that play a role in 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, and possibility of interactions among members of the given national group within their closer or wider neighbourhood. One of the rare studies that looks mainly qualitatively at various dimensions of the presence of immigrants in urban neighbourhoods concerns Polish capital city - Warsaw and its larger agglomeration (Górny et al., 2019). In this regard, Krakow is a very interesting case for analysis of residential segregation patterns of immigrants at new destinations. Krakow is the second largest Polish city, with a registered population at ca. 760 thousand. 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 thousand including over 8 thousand foreigners studying in one of the city's universities (Mucha & Pędziwiatr, 2019). Krakow is also a booming tourist destination: before the covid-19 pandemic, the tourism industry accounted for 8 percent of local GDP and 10% of employment. All of these sectors attract immigrants. Finally, the housing market in Kraków is extremely competitive, as many of the apartments are rented for 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 to get affordable housing. Additionally, one should indicate that most immigrants have arrived in Kraków relatively recently (frequently after 2015) so the significant foreign-born population in the city is quite a new phenomenon.

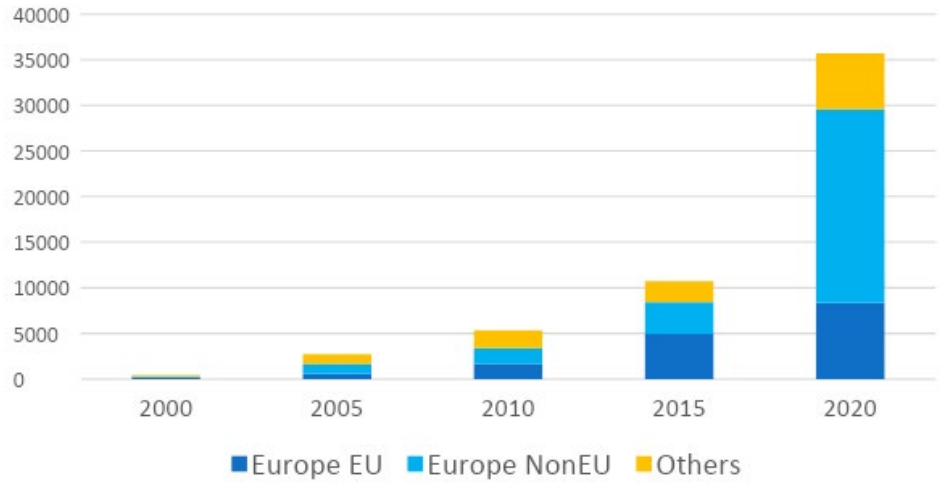
Until recently, no systematic analysis on immigrant residential concentration in Kraków has been performed. The explorative study from 2014 estimated the number of immigrant population in the city at the end of 2013 at 6 thousand persons (Brzozowski & Pędziwiatr, 2014). The study based on the survey of 200 long-term migrants in Lesser Poland from four ethnic groups most represented in the voivodeship: Armenians, citizens of MENA countries (Middle East and North Africa), Ukrainians and Vietnamese people, 40 in-depth interviews (10 with representatives from each group), and 4 focus group interviews also covered the settlement patterns of foreigners. The results clearly indicated that as of 2013, the most highly residentially concentrated groups in Krakow were Vietnamese people and Armenians. As many as 60 percent of the surveyed Armenians and 66 per cent of the Vietnamese immigrants stated that in their immediate neighbourhood lived mostly their countrymen. By contrast, the most evenly geographically distributed immigrant communities were those of the Ukrainians and citizens of MENA countries: 36 percent and 40 percent of them, respectively, declared that only Poles lived in their neighbourhood.

Of course, the picture of residential segregation/concentration of immigrants in Kraków has changed substantially compared to the 2013 situation: as of 2019, the official statistics show ca. 32 thousand foreigners live in the city, which accounts for 4.2 percent of its population. In the following section, we describe in detail the process of data gathering and processing and provide a basic overview of immigrants' population in Kraków.

Figure 3.3.1 and Table 3.3.1 below demonstrate a rapid expansion of the immigrant population in Krakow: while the official statistics show only 413 foreign-born persons living in the city in 2000, in 2005 – 2.7 thousand, in 2010 - 5.3 thousand and in 2015 – 10.7 thousand such individuals. Taking into the account that Poland is a second largest Polish city, these numbers were not impressive, yet the pace of growth was substantial. In 2020, the foreign-born population recorded in the administrative register stood at 35.7 thousand persons, which accounted for almost 4.8 percent of the total city population (746 thousand).

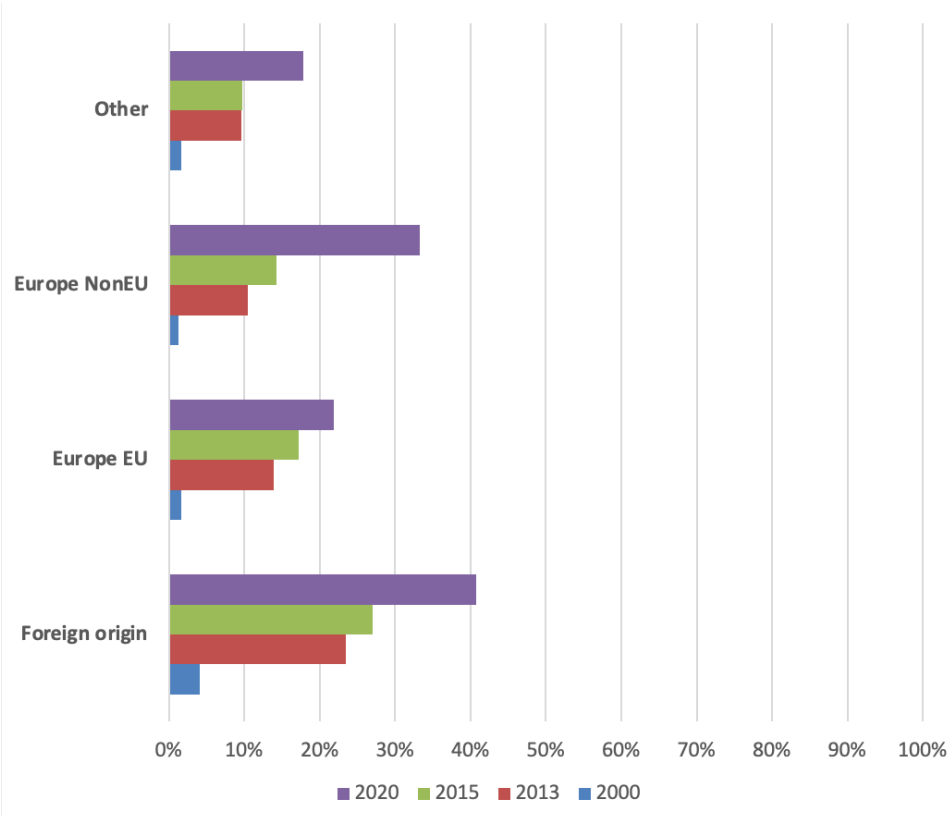
[4] For example, availability of jobs, local transportation infrastructure (roads and local transport), quality of life, availability of cultural infrastructure, educational and health care facilities (Pędziwiatr et al., 2023).

Figure 3.3.1. Number of foreigners in Krakow in 2000-2020.
Source: own calculations.



During the period under consideration, the representation changed rapidly. In 2000 a foreigner population lived only in 273 grid cells, which was only 4% of all inhabited cells in the Krakow Municipality. This share increased to 41% by 2020 (see Figure 3.3.2).

Figure 3.3.2. Share of inhabited grid cells occupied by foreigner groups in Krakow in 1990, 2013, 2015 and 2020.
Source: own calculations.



Together with rising representation the concentration was increasing in grid cells inhabited by foreign populations. In 2000 the average number of immigrants was 1.51 persons per these grid cells, with the highest concentration of people from non-European countries 1.42 persons. The average concentration of European EU and European non-EU countries was on the level of respectively 1.39 and 1.25. By 2015, it increased to 3.65 persons per inhabited grid cell. However, the highest growth was observed in 2015-2020 when the average concentration reached 9.32 persons (Figure 3.3.3). As mentioned before, due to significant migration flow from European non-Eu countries, mostly from Ukraine, the average concentration of this group reached almost 7 persons per grid cell, whereas for other groups it was at level of 3.55 (Others) and 3.37 (Europe EU).

Figure 3.3.3. Average number of persons per inhabited grid cell by foreign group In Krakow in 1990, 2013, 2015 and 2020
Source: own calculations.

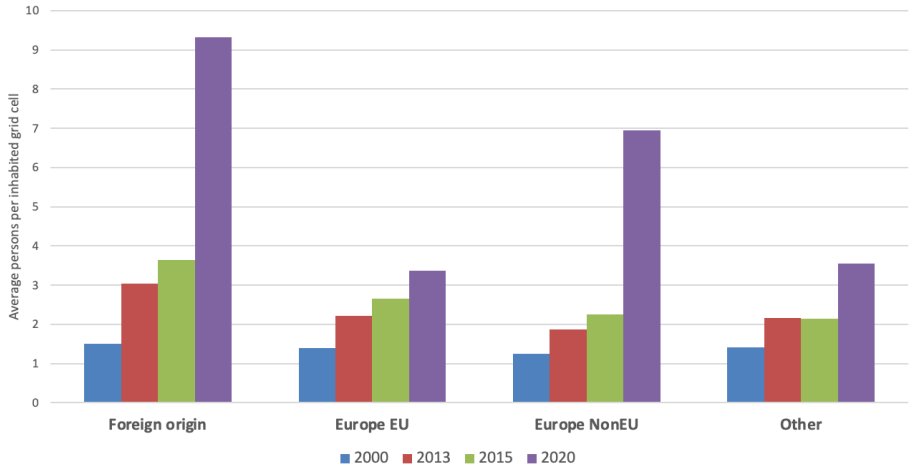


Table 3.3.1. Foreign population in Krakow.
Source: own calculations.

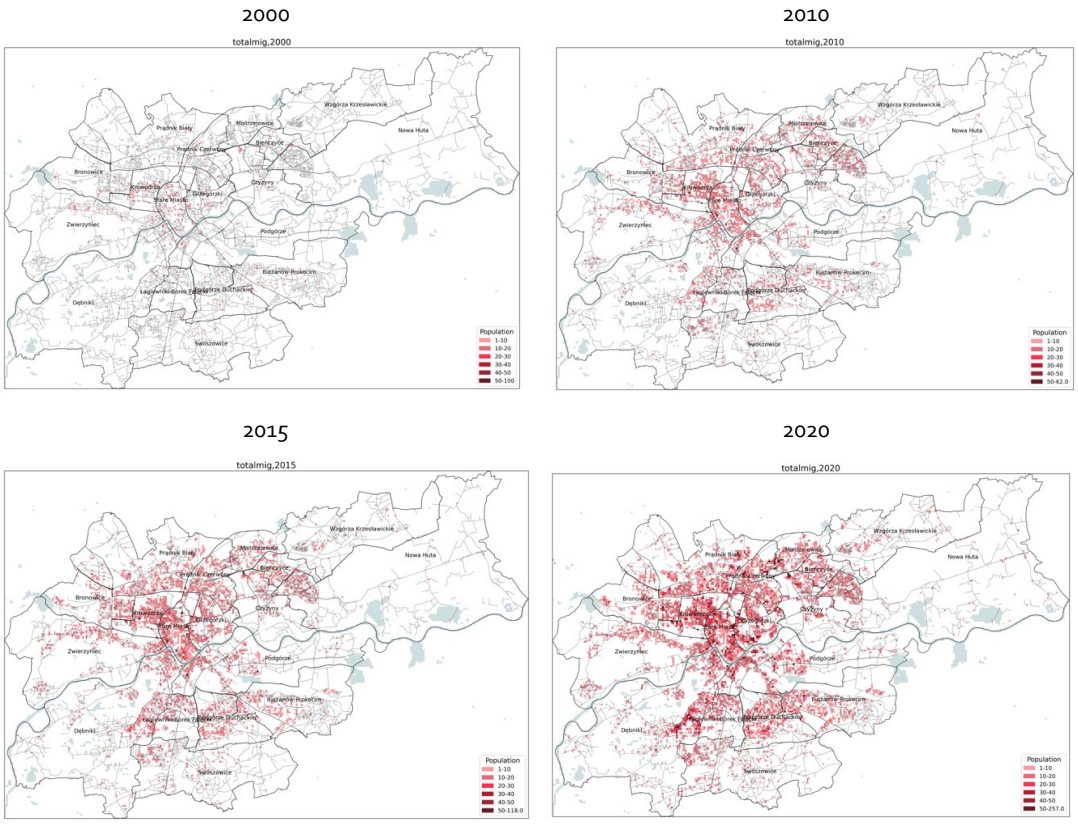
Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Average no of people per grid cell
2000	Total	6 651	1	1 947	709 516	100.00	x	106.68
	Immigrants	273	0	10	413	0.06	100.00	1.51
	Europe EU	110	0	5	153	0.02	37.05	1.39
	Europe NonEU	84	0	3	105	0.01	25.42	1.25
	Other	109	0	10	155	0.02	37.53	1.42
2013	Total	10 637	1	1 451	731 438	100.00	x	68.76
	Immigrants	2 493	0	83	7 592	1.04	100.00	3.05
	Europe EU	1 484	0	64	3 287	0.45	43.30	2.21
	Europe NonEU	1 119	0	57	2 085	0.29	27.46	1.86
	Other	1 027	0	22	2 220	0.30	29.24	2.16
2015	Total	10 866	1	1 425	737 439	100.00	x	67.87
	Immigrants	2 940	0	118	10 728	1.45	100.00	3.65
	Europe EU	1 869	0	93	4 957	0.67	46.21	2.65
	Europe NonEU	1 545	0	70	3 493	0.47	32.56	2.26
	Other	1 061	0	26	2 279	0.31	21.24	2.15
2020	Total	11 517	1	1 254	746 336	100.00	x	64.80
	Immigrants	4 697	0	257	35 734	4.79	100.00	7.61
	Europe EU	2 514	0	116	8 324	1.12	23.29	3.31
	Europe NonEU	3 837	0	134	21 224	2.84	59.39	5.53
	Other	2 051	0	65	6 187	0.83	17.31	3.02

The following set of maps demonstrate the evolution of the city's population by main districts, starting from 2000 (Figure 3.3.4). At the turn of the 21st century, the (very small) immigrant population of the city was relatively dispersed through all the districts, with mildly stronger concentration in Stare Miasto and Krowodrza.

We can then trace some settlement patterns from 2010 onwards with immigrant population moving into such districts as Stare Miasto, Krowodrza, Grzegórzki and Prądnik Czerwony, then – to a lesser extent – also into Mistrzejowice, Bieńczyce, Podgórze Duchackie, Borek Fałęcki, Zwierzyniec and Bronowice. Interestingly, there is a visible aversion to moving into Nowa Huta – a district with relatively cheap rental prices and good public transport infrastructure. This aversion can be partially explained by a (former) bad reputation of the district, which after the economic transformation and limitation of steelworks activity was economically marginalised (Pozniak, 2013)

From 2015 onwards one could observe that immigrants tend to cluster in the central districts of the city, including the old city Stare Miasto and the districts located mostly in the northern and southern part of the city centre. An outlier in this aspect is the increased population of immigrants in northeast districts of Mistrzejowice and Bieńczyce, which have a slightly more peripheral location. This in turn can be attributed to the rental supply: these are the areas in which in recent years the construction of new residential blocks was particularly intense. Much of these new apartments were then rented to foreigners.

Figure 3.3.4. Number of foreign-origin population by grid cell in Krakow in 2000, 2010, 2015 and 2020. Source: own calculations.



Figures 3.3.6-3.3.8 show development of the foreign population by subgroups: Europe EU, Europe nonEU and citizens of non-European countries between 2000 and 2020. The biggest change is observed in Europe nonEU population both in growths in concentration and representation.

Figure 3.3.6. Number of Europe EU foreigners by grid cell in Krakow in 2000 and 2020.
Source: own calculations.

2000 2020

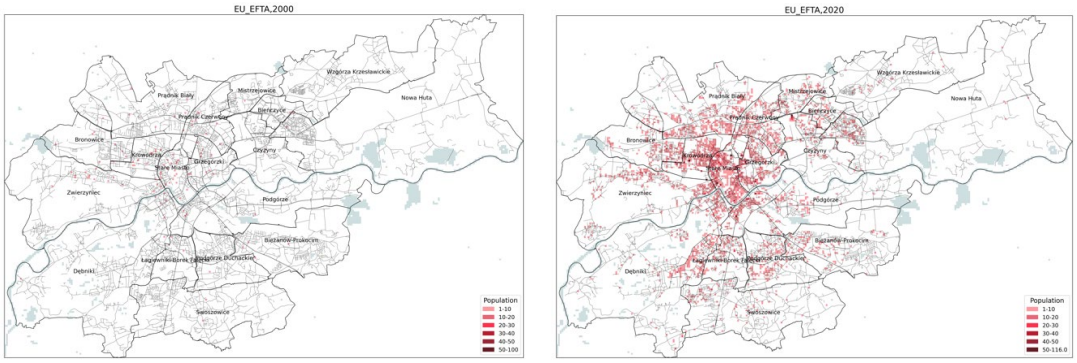


Figure 3.3.7. Number of Europe nonEU foreigners by grid cell in Krakow in 2000 and 2020.
Source: own calculations.

2000 2020

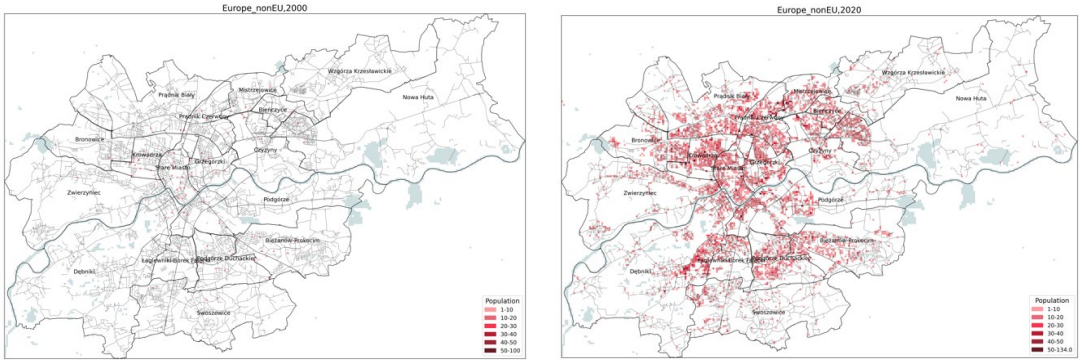
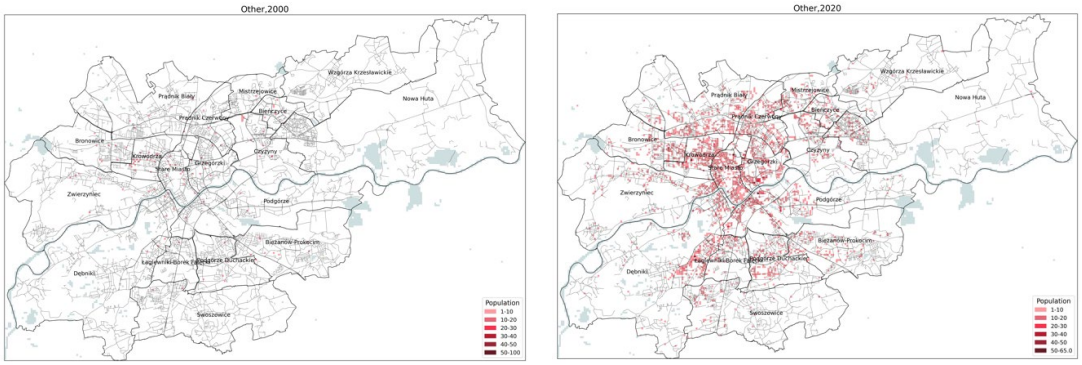


Figure 3.3.8. Number of Other foreigners by grid cell in Krakow in 2000 and 2020.
Source: own calculations.

2000 2020



Our data enables us to evaluate what share of Krakovians has potential residential contact with foreigners. Figure 3.3.5 and Table 3.3.2 show the distribution of inhabitants of Krakow by share of foreigners in their individual 100-meter neighbourhoods in 2000, 2015 and 2020. It is visible that the share increased for all Krakowians. It is worth mentioning that in 2000 almost 75% of residents had no foreign neighbours and no one had their concentration above 1%, whereas in 2020 this share was only 5% and around 10% lived with at least 10% of foreigners in a neighbourhood.

In 2020 the share of foreign citizens was 4.8%. However, around 67% of Krakowians have the concentration below 4.8%. In 2015 nearly 72% lived in NBHs below the average share (1.45% of foreigners in Krakow).

Figure 3.3.5. Concentration of foreigners in individualised neighbourhoods in Krakow in 2000, 2015 and 2020. Neighbourhoods of 100m radius..
Source: own calculations.

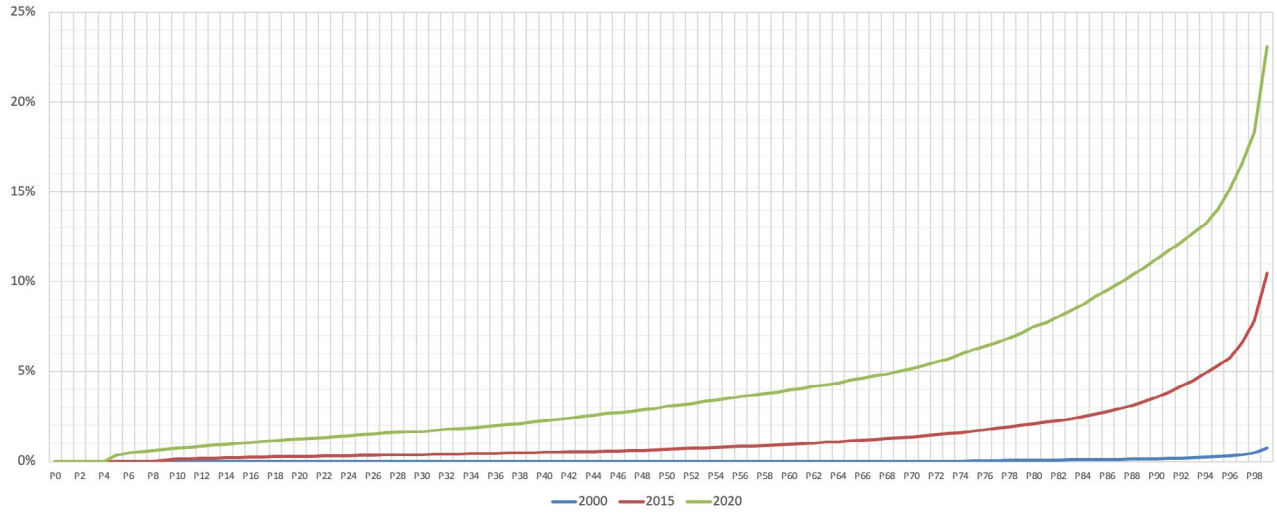


Table 3.3.2. Concentration of foreigners in individualised neighbourhoods in Krakow. Chosen percentile values in 2000, 2015 and 2020.
Source: own calculations.

Group	Percentiles	Neighbourhood 100 meters		
		1990	2015	2020
Foreigners	10	0.0%	0.1%	0.7%
	25	0.0%	0.3%	1.5%
	50	0.0%	0.7%	3.1%
	75	0.0%	1.7%	6.2%
	90	0.1%	3.6%	11.3%
	95	0.3%	5.3%	14.0%
	99	0.7%	10.5%	23.1%

When it comes to dissimilarity index (DI), the value for all the foreign population in Krakow was: 0.949 in 2000, then it started to fall as the result of intensive inflow of immigrants to 0.606 in 2013 and 0.596 in 2015. As for 2020, the dissimilarity index (DI) is 0.51, which means that 51% of foreigners would need to move to get an even distribution (Table X). For the largest groups of immigrants, those from Europe, unevenness is much lower among non-EU+ migrants – 0.504 in comparison to the EU group – 0.66. By comparison, the study of Andersson and associates (2018) has found that for entire countries the dissimilarity index (albeit for non-European immigrant populations only) varied between 0.475 in Denmark to 0.512 in Belgium. 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). Considering

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.

Table 3.3.3 Dissimilarity Index for foreigners and its subgroups in Krakow in 2000-2020.
Source: own calculations.

Region	2000	2013	2015	2020
Immigrants	0.949	0.606	0.596	0.510
Europe EU	0.981	0.714	0.686	0.660
Europe NonEU	0.982	0.720	0.674	0.504
Other	0.980	0.762	0.760	0.666

We analyse the probability of a foreigner from a specific group having a neighbour from the same group in a 100-meter neighbourhood (Table 3.2.4). This probability is, of course, the highest for European nonEU immigrants (mostly Ukrainians, but also other Eastern Europeans) – half of the population of this group has at least a 4.2% chance to find another person from their own group within a 100-meter NBH. In the case of EU citizens, half of them live in NBHs where the probability of finding another citizen is at least 3.1%. Among immigrants from outside Europe 50% live the probability at least 1.8%.

Table 3.2.4. Probability that a foreigner of a specific group finds a random neighbour from his/her own group in residential neighbourhood in Krakow. Individualised neighbourhoods of 100 meters.
Source: author's calculations.

Percentiles	Europe EU			Europe NonEU			Other		
	1990	2015	2020	1990	2015	2020	1990	2015	2020
10	0.0%	0.2%	0.4%	0.0%	0.1%	1.3%	0.0%	0.1%	0.3%
25	0.0%	0.7%	1.2%	0.0%	0.4%	2.4%	0.0%	0.3%	0.8%
50	0.1%	1.7%	3.1%	0.0%	0.8%	4.2%	0.1%	0.7%	1.8%
75	0.5%	4.0%	6.2%	0.1%	1.8%	7.2%	0.8%	1.6%	3.4%
90	0.8%	7.4%	10.3%	0.2%	3.6%	11.6%	1.1%	2.8%	6.9%
95	50.0%	11.8%	16.3%	0.3%	8.8%	17.0%	100.0%	4.6%	10.1%
99	100.0%	21.2%	29.4%	0.7%	17.5%	39.3%	100.0%	14.5%	15.6%

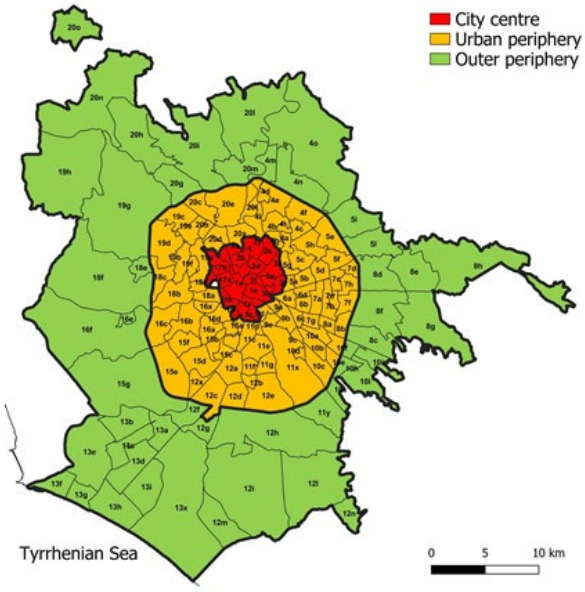
3.4. Rome

After being a country of emigration for over a century, starting from the 1970s Italy gradually transformed into one of the main destination for immigrants in Europe, showing a sharp increase in the number of foreign residents, from 350,000 in the early 1990s to over 5 million to date. The metropolitan areas of Central-Northern Italy are traditionally the magnets of attraction for both national and international migratory flows. In particular, Rome has always played a pivotal role in the Italian migratory landscape and is the Italian municipality with the highest number of foreign residents.

Before dealing with the evolution and characteristics of migration in the area, this paragraph presents a summary picture of the geographical setting and socio-economic specificities of the Roman context, which affect the settlement patterns and the residential concentration processes.

Rome is the municipality with the largest surface in Italy (1,285 km2) and one of the largest in the European Union. In order to characterize the territory of Rome it is useful to refer to three sub-areas determined on the basis of the aggregation of the 155 urban areas (zone urbanistiche): *City centre, Urban periphery and Outer periphery*. The *City centre* and the *Urban periphery* represent the "urban core" of Rome, the most densely populated area located within the Great Ring Road (Grande Raccordo Anulare, henceforth the GRA), the large freeway that surrounds the city, and includes the districts of the "consolidated" city built in the Twentieth century, which in the last 50 years have undergone only minor urban changes (Figure 3.4.1). More specifically, the *City centre* includes the historic centre, within the ancient Aurelian walls, and has a very high concentration of managerial services, public administration offices and tourist accommodations. In the *Urban periphery* the neighbourhoods more distant from the City centre are mainly residential and also include wide areas of public housing. The third sub-area, the *Outer periphery*, includes very vast portions of farmland (Agro romano) and sparsely inhabited districts located outside the GRA. It contains the more recently built districts that became populated especially from the 1970s onwards with the urban sprawl from the neighbourhoods of the urban core (Crisci et al. 2014), and include many settlements that used to be illegal, because built without the necessary permits (Clementi, Perego 1983), and still lack services and public infrastructure.

Figure 3.4.1 – Municipality of Rome by urban areas (zone urbanistiche) and urban belts.



1a	Centro Storico	5h	Casal de' Pazzi	11a	Ostiense	16a	Colli Portuensi
1b	Trastevere	5i	Sant'Alessandro	11b	Valco San Paolo	16b	Buon Pastore
1c	Aventino	5l	Settecamini	11c	Garbatella	16c	Pisana
1d	Testaccio	6a	Torpignattara	11d	Navigatori	16d	Gianicolense
1e	Esquilino	6b	Casilino	11e	Tormarancia	16e	Massimina
1f	XX Settembre	6c	Quadraro	11f	Tre fontane	16f	Pantano di Grano
1g	Celio	6d	Gordiani	11g	Grottaperfetta	16x	Villa Pamphili
1x	Zona Archeologica	7a	Centocelle	11x	Appia Antica Nord	17a	Prati
2a	Villaggio Olimpico	7b	Alessandrina	11y	Appia Antica Sud	17b	Della Vittoria
2b	Parioli	7c	Tor Sapienza	12a	Eur	17c	Eroi
2c	Flaminio	7d	La Rustica	12b	Villaggio Giuliano	18a	Aurelio Sud
2d	Salario	7e	Tor Tre Teste	12c	Torrino	18b	Val Cannuta
2e	Trieste	7f	Casetta Mistica	12d	Laurentino	18c	Fogaccia
2x	Villa Borghese	7g	Centro Direzionale Centocelle	12e	Cecchignola	18d	Aurelio Nord
2y	Villa Ada	7h	Omo	12f	Mezzocamino	18e	Casalotti di Boccea
3a	Nomentano	8a	Torrespaccata	12g	Spinaceto	18f	Boccea
3b	San Lorenzo	8b	Torre Maura	12h	Vallerano Castel di Leva	19a	Medaglie d'Oro
3x	Università	8c	Giardinetti	12i	Decima	19b	Primavalle
3y	Verano	8d	Acqua Vergine	12l	Porta Medaglia	19c	Ottavia
4a	Monte Sacro	8e	Lunghezza	12m	Castel Romano	19d	Santa Maria della Pietà
4b	Val Melaina	8f	Torre Angela	12n	Santa Palomba	19e	Trionfale
4c	Monte Sacro Alto	8g	Borghesiana	12x	Tor di Valle	19f	Pineto
4d	Fidene	8h	San Vittorino	13a	Malafede	19g	Castelluccia
4e	Serpentara	9a	Tuscolano Nord	13b	Acilia Nord	19h	Santa Maria di Galeria
4f	Casal Boccone	9b	Tuscolano Sud	13c	Acilia Sud	20a	Tor di Quinto
4g	Conca d'Oro	9c	Tor Fiscale	13d	Palocco	20b	Acquatraversa
4h	Sacco Pastore	9d	Appio	13e	Ostia Antica	20c	Tomba di Nerone
4i	Tufello	9e	Latino	13f	Ostia Nord	20d	Farnesina
4l	Aeroporto dell'Urbe	10a	Don Bosco	13g	Ostia Sud	20e	Grottarossa Ovest
4m	Settebagni	10b	Appio - Claudio	13h	Castel Fusano	20f	Grottarossa Est
4n	Bufalotta	10c	Quarto Miglio	13i	Infernetto	20g	Giustiniana
4o	Tor San Giovanni	10d	Pignatelli	13x	Castel Porziano	20h	La Storta
5a	Casal Bertone	10e	Lucrezia Romana	15a	Marconi	20i	Santa Cornelia
5b	Casal Bruciato	10f	Osteria del Curato	15b	Portuense	20l	Prima Porta
5c	Tiburtino Nord	10g	Romanina	15c	Pian Due Torri	20m	Labaro
5d	Tiburtino Sud	10h	Gregna	15d	Trullo	20n	Cesano
5e	San Basilio	10i	Barcaccia	15e	Magliana	20o	Martignano
5f	Tor Cervara	10l	Morena	15f	Corviale	20x	Foro Italico
5g	Pietralata	10x	Ciampino	15g	Ponte Galeria		

Rome is the centre of a metropolitan area that reaches about 4.3 million inhabitants and is monocentric in terms of production, with a few functional hubs outside the city, such as Fiumicino with its airport. Rome is the first municipality in Italy regarding gross domestic product, seat of the headquarters of numerous national and multinational companies and important employment hub in the sectors of information, communication, commerce and professional activities, with a high share of employees in the public service sector. The role of the tourism industry with its satellite activities is very important, as Rome is one of the most visited cities in the world with 15 million arrivals and 35 million presences in 2022.

The average income in Rome is higher than the national average, €17,300 against €13,800. The welloff neighbourhoods are concentrated in the City centre and in some areas of the *Urban periphery*, along the north-west axis, i.e. the via Cassia, and the south-east axis of the city, in the EUR district and in the Appia Antica area. The less affluent neighbourhoods are concentrated in the eastern quadrant, where there are many public housing units, and in the western periphery near the GRA.

After the 2008 and 2011 economic and financial crises that hit Italy, the real estate values in Rome fell on average by 20% from 3,400€/m2 to 2,800 €/m2 in 2019, while in the municipalities of the hinterland in the same period they decreased from 1,700€/m2 to 1,500 €/m2. Real estate and rental prices differ greatly between central and peripheral districts, also affected by the high concentration of peer-to-peer accommodation and short-term rentals in the areas closest to the main tourist attractions (Crisci et al. 2022). The highest real estate values are in the historic centre (on average, 5,700 €/m2) and in some other neighbourhoods of the City centre, such as Parioli-Flaminio (5,200 €/m2). In the Urban periphery the prices go from 3,400 €/m2 in the Appia-Tuscolana area to 2,300 €/m2 in the Casilina-Prenestina area, while in the Outer periphery the average values drop to around 1,800 €/m2.

Between the 1970s and the beginning of the 2000s the urban core of Rome gradually depopulated by 700,000 residents, also due to strong peri-urbanization. The urban sprawl was mainly motivated by the cost of housing and was selective, involving mostly native and foreign young adults and families with children. After the 2008 and 2011 crises the urban core stopped its depopulation and first signals of re-urbanization emerged, thanks to the sharp decrease of the real estate prices, which allowed many families, with the same budget, to find a home at a much shorter distance from the centre than just a few years earlier (Crisci 2022).

Some features of the housing system distinguish the Italian urban contexts from the rest of Europe. In Italy the intervention of the state in the housing sector is very limited and the social housing is organized as residual and stigmatised. There is a housing tenure polarization with predominance of owner occupation, which in Rome is almost 70%. The housing opportunities in the private market for migrants with limited financial resources are scarce and of low quality, and local housing policies are often non-inclusive.

The Italian welfare state regime itself is familistic and attributes a central role to the family in providing basic assistance, rather than to the state or the market (Arbaci 2019), still relying heavily on the commitment of women in care and in domestic work within the family. This model is under increasing pressure due to the growing female participation in the labour market and population ageing (Ferrera 1996). As a result, there is a strong demand for domestic work and care services for the elderly and children, which is often met by immigrant women, especially in large urban areas such as Rome and Milan (Mingione 2009). Despite the structural nature of the migratory phenomenon, Italian immigration policies are often based on an emergency approach and alternate opening and closure, also due to the high politicization of the issue (Bonifazi 2013).

The population of Rome in the 2000s reached the highest peak in its history, nearly 2.9 million residents, mainly due to international migrations that gained importance from the 1980s, gradually transforming the city in a multicultural direction. At January 1st 2020, 361,000 foreigners reside in the city (556,000 in the metropolitan area), corresponding to 13% of the total residents.

The city is also an important place of transit for those with a temporary or transnational migratory project

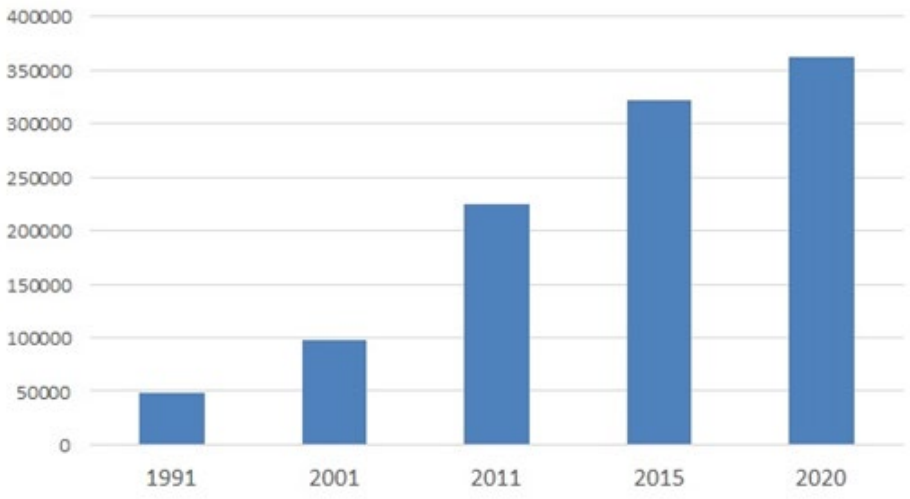
and hosts many migrants with high socio-economic vulnerability, such as asylum seekers, refugees and unaccompanied foreign minors. However, these categories are present in much lower numbers than economic migrants. Rome is at the centre of a long-lasting and heterogeneous migratory dynamic that has produced a very composite foreign presence as for the places of origin. As of 2020 there were 186 different nationalities represented among the residents of Rome.

Rome offers various appealing aspects that have always made it an important destination for immigrants. As Italy's capital, it hosts the diplomatic and consular missions of all the countries of the world, which makes it a necessary transit point for administrative reasons. Furthermore, its role as the centre of Catholicism, linked to the presence of the Vatican City, makes the local Catholic Church the promoter and coordinator of a wide and well-structured territorial network of assistance and support for immigrants. The presence of a vast historical and cultural heritage, many state, private and pontifical universities, seats of headquarters of international organizations and multinational companies represent further attractive elements for a high-skilled migration coming not only from Western countries. Nonetheless, in the area of Rome, the majority of immigrants is concentrated in the low-skilled segments of the labour market, less desirable to locals, mainly in the service sector, tourism, construction and domestic work. In these segments, immigrants often perform precarious and low-paid jobs, but with a high level of labour market integration, as highlighted by employment rates much higher than in all the other Italian metropolitan areas. Occupational specializations emerged based on gender and country of origin, for instance, with women very often engaged in domestic work (mainly when from the Philippines, Ukraine, South America and Eastern Europe), or Romanian and Polish men in the construction business, and Bangladeshis and Chinese in retail and restaurant sector (Benassi et al. 2022).

At the beginning of the 1970s, foreign residents in Rome numbered just over 25,000 and until the beginning of the 1980s, 60% were from Western Europe and North America, employed in prestigious professional positions, ecclesiastics or married to Italians. Non-Western immigrants were mostly students, political refugees, and women who worked as domestic servants in households, often from the Philippines or the Cape Verde Islands (Bortot 1980, Birindelli et al. 1993). Between the 1970s and 1980s Italy completed the transition from emigration to immigration country (Bonifazi 2013) and Rome was one of the cities that most absorbed the flows of economic migrants from non-Western countries. In 1991 the foreigners registered as residents were still only 48,000, but after the fall of the Berlin wall there was a first rapid growth which in 2001 brought the number of foreign resident population to 98,000, corresponding to 3.9% of the total residents (Casacchia, Crisci 2006).

In 2000s the number of foreign residents grew rapidly and in 2015 exceeded 300,000 units (Fig. 3.4.2). This increase was linked to the regularization of many migrant workers following the introduction of the "Bossi – Fini" law (Law n. 189 of 30 July 2002), which produced over 100,000 applications only in the province of Rome (Sonnino 2006), and the strong immigration following Romania's entry into the European Union in 2007. The 2008 and 2011 crises, although it has strengthened the socio-economic imbalances already present in the area of Rome, did not initially slow the growth in the number of foreign residents. The migrants continued to enter sectors of the labour market not directly affected, such as tourism and domestic work. After 2015 restrictive national migration policies helped to reduce the increase of the foreign population that reached 361,000 units in 2020.

Figure 3.4.2. Number of foreigners in Rome in 1991, 2001, 2011, 2015 and 2020.
Source: 1991, 2001 and 2011 data are from population censuses (ISTAT); 2015 and 2020 data (1st of January) are from the population register (Municipality of Rome).



Overall, between 2001 and 2020 the number of foreign residents more than tripled and the composition by citizenship groups also showed some substantial changes (Fig. 3.4.3. and Tab. 3.4.1.). In 2001 the largest groups were foreigners from EU countries (20.8%, mainly France and Spain), America (16.5%, mainly Peru and United States) and Africa (14.5%, mainly Egypt and Morocco). Filipinos were the largest single country group (13.3%), followed by Romanians (9.2%). Other relevant groups were Asia (13.0%, mainly Bangladesh, China and Sri Lanka) and non-EU Europe (9.3%, mainly Poland and Albania). In 2011 all groups grew in absolute terms. In particular, Romanians increased by more than five times becoming the largest group (22.2%) and overtaking the Filipinos who decreased in relative terms (12.3%) despite having doubled in absolute values. Bangladeshis also increased more than five times to become the third largest citizenship group (7.8%). The EU countries group had only a slight growth and more than halved in relative terms (9.9%). In 2020 the distribution between the groups remained similar to 10 years earlier, with Romanians still largely in the majority (23.9%) with about 90 thousand residents, followed by Filipinos with 41 thousand residents (11.4%) and the Bangladeshis with 31 thousand residents (8.7%). In the group of the non-EU Europeans the strong growth of the Ukrainians should be noted: with less than thousand in 2001, they were 15 thousand in 2020.

Figure 3.4.3. Share of chosen groups among foreign origin population in Rome in 2001, 2011, 2015 and 2020
Source: own calculations based on data from ISTAT and the Municipality of Rome.

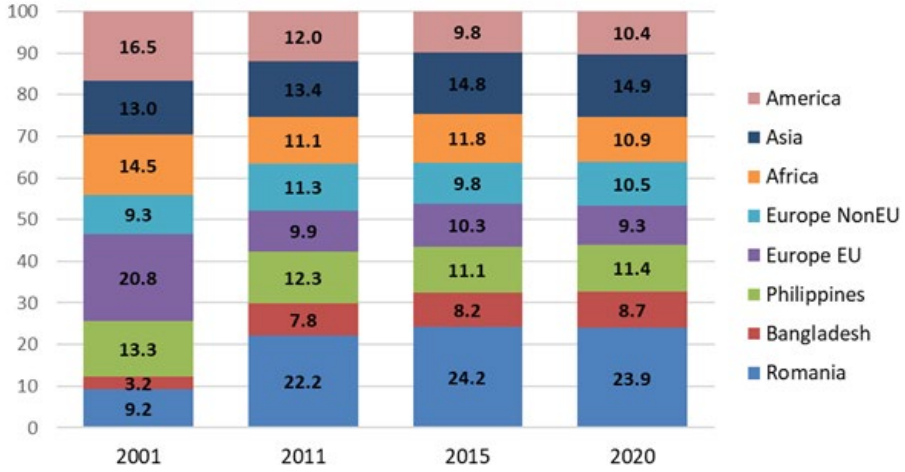


Table 3.4.1. Foreign population in Rome in 2001, 2011, 2015 and 2020.
Note: 2001 and 2011 census data underestimate the total population by around 150,000-200,000 units; 2015 and 2020 population register data by grid cells underestimate the total population by around 80,000 units, due to records missing regarding the country of citizenship.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Average no of persons per populated grid
2001	Total	47 535	0.01	1 331	2 546 802	100.00	x	53.58
	Foreign origin	18 539	0.01	758	98 414	3.86	100.00	5.31
	Romania	2 138	0.01	15	9 076	0.36	9.22	4.25
	Bangladesh	749	0.01	86	3 123	0.12	3.17	4.17
	Philippines	3 529	0.01	37	13 102	0.51	13.31	3.71
	Europe EU	5 917	0.01	30	20 487	0.80	20.82	3.46
	Europe NonEU	2 031	0.01	108	9 184	0.36	9.33	4.52
	Africa	3 529	0.01	217	14 282	0.56	14.51	4.05
	Asia	3 030	0.01	375	12 781	0.50	12.99	4.22
	America	4 637	0.01	37	16 280	0.64	16.54	3.51
2011	Total	49 861	0.01	5 035	2 616 032	100.00	x	52.47
	Foreign origin	28 029	0.01	4 228	224 341	8.58	100.00	8.00
	Romania	12 501	0.01	725	49 763	1.90	22.18	3.98
	Bangladesh	2 690	0.01	1 570	17 453	0.67	7.78	6.49
	Philippines	6 813	0.01	52	27 610	1.06	12.31	4.05
	Europe EU	6 241	0.01	53	22 212	0.85	9.90	3.56
	Europe NonEU	6 773	0.01	256	25 300	0.97	11.28	3.74
	Africa	4 393	0.01	2 384	24 921	0.95	11.11	5.67
	Asia	6 196	0.01	1 288	30 011	1.15	13.38	4.84
	America	7 654	0.01	83	26 945	1.03	12.01	3.52
2015	Total	49 606	0.01	6 604	2 714 940	100.00	x	54.73
	Foreign origin	32 917	0.01	6 519	321 625	11.85	100.00	9.77
	Romania	16 712	0.01	675	77 962	2.87	24.24	4.67
	Bangladesh	3 367	0.01	2 288	26 388	0.97	8.20	7.84
	Philippines	7 655	0.01	99	35 701	1.31	11.10	4.66
	Europe EU	8 815	0.01	88	33 117	1.22	10.30	3.76
	Europe NonEU	8 517	0.01	442	31 412	1.16	9.77	3.69
	Africa	6 240	0.01	4 296	37 951	1.40	11.80	6.08
	Asia	9 389	0.01	1 896	47 491	1.75	14.77	5.06
	America	8 314	0.01	113	31 603	1.16	9.83	3.80
2020	Total	51 696	0.01	1 188	2 765 362	100.00	x	53.49
	Foreign origin	34 427	0.01	831	361 677	13.08	100.00	10.51
	Romania	16 072	0.01	46	86 613	3.13	23.95	5.39
	Bangladesh	4 402	0.01	75	31 498	1.14	8.71	7.16
	Philippines	7 275	0.01	47	41 184	1.49	11.39	5.66
	Europe EU	13 491	0.01	268	33 595	1.21	9.29	2.49
	Europe NonEU	9 457	0.01	79	38 034	1.38	10.52	4.02
	Africa	7 919	0.01	546	39 289	1.42	10.86	4.96
	Asia	12 975	0.01	233	53 936	1.95	14.91	4.16
	America	8 394	0.01	34	37 528	1.36	10.38	4.47

In 2001 the population of Rome resided in 47,535 grid cells (100m x 100m) which gives an average of about 53 persons per grid (Table 3.4.1). Foreigners were present in 18,539 grids of them (39.0%) which gives an average of 4.8 persons (Fig. 3.4.4 and Fig. 3.4.5). The highest number of foreigners in a single grid cell was 758 persons. The most represented of all groups here considered was EU countries which were present in 5,917 grid cells, 12.4% of the inhabited grid cells, followed by American group, with 4,637 cells (9.8%), and the African group and the Philippines, both with 3,529 cells (7.4%) (Fig. 3.4.4). The higher concentration was observed in the non-EU European group, which was present in 2,031 cells with a population of 9 thousand (4.5 persons per grid cell on average). The next were the Romanian and the Asian group with an average concentration of 4.2 persons per cell. Lower average values are observed for the EU group (3.46), the American group (3.51) and the Philippines (3.71). The concentration of foreign population in 2020 is considerably higher and increased from 5.31 in 2001 to 10.51 persons per grid cell. Looking at the selected groups there is no uniform tendency. In the period 2001-2020 the highest growth is showed by Bangladeshis, from 4.17 to 7.16 persons per grid cell, and Filipinos, from 3.71 to 5.66. On the contrary, the EU group (from 3.46 to 2.49) and non-EU European group (from 4.52 to 4.02) highlight a decrease of their concentration. In 2020 the percentage of populated grid cells with at least a foreign resident increased significantly (to 66.6%) (Fig. 3.4.5). The highest values of representation are showed by Romanians (31.1%), the EU group (26.1%) and the Asian group (25.1%). Much lower are the values of Bangladesh (8.5%), the Philippines (14.1%) and the African group (15.3%).

Figure 3.4.4. Share of inhabited grid cells occupied by foreigner groups in Rome in 2001, 2011, 2015 and 2020. Source: own calculations based on data from ISTAT and the Municipality of Rome.

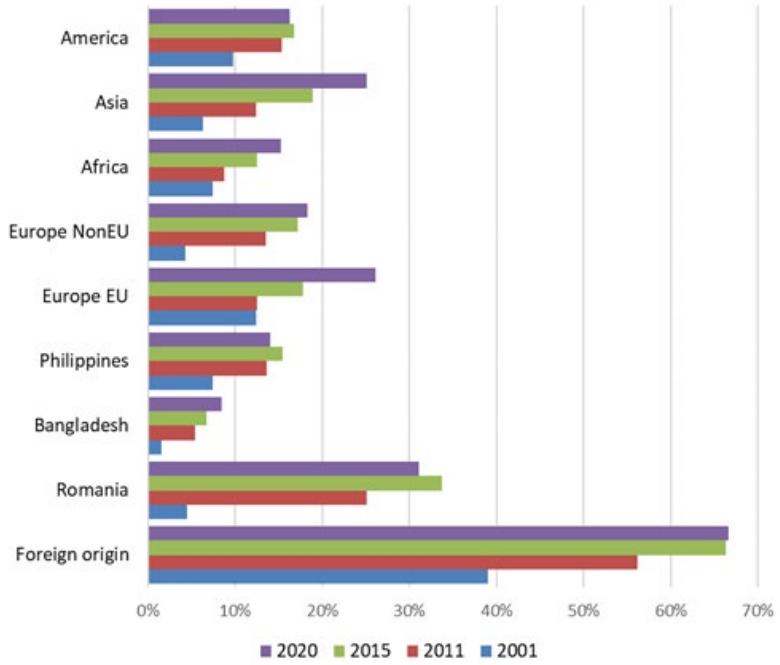


Figure 3.4.5. Average number of persons per inhabited grid cell by foreign group in Rome in 2001, 2011, 2015 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

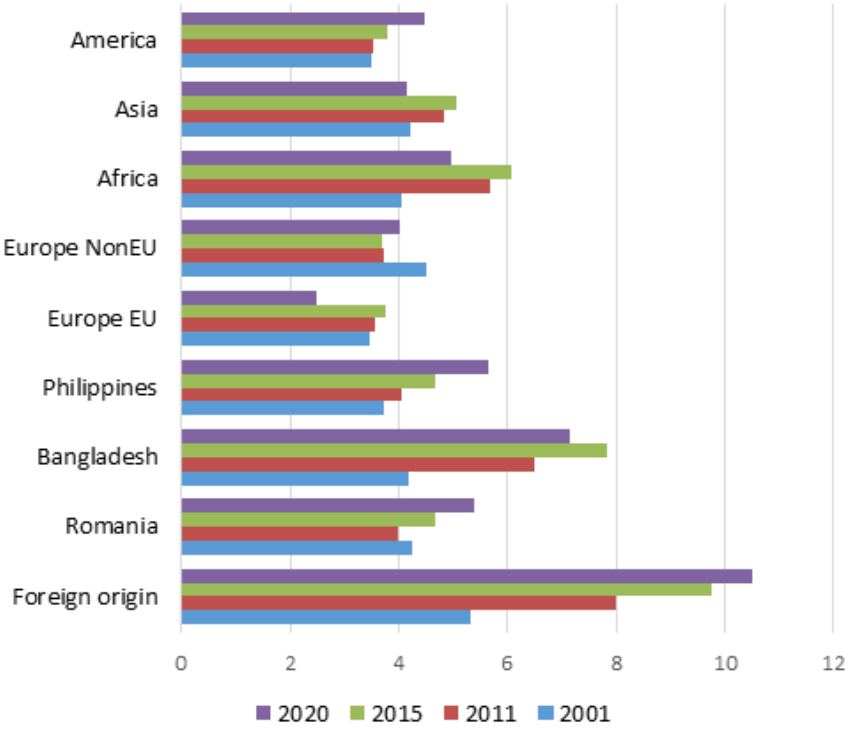
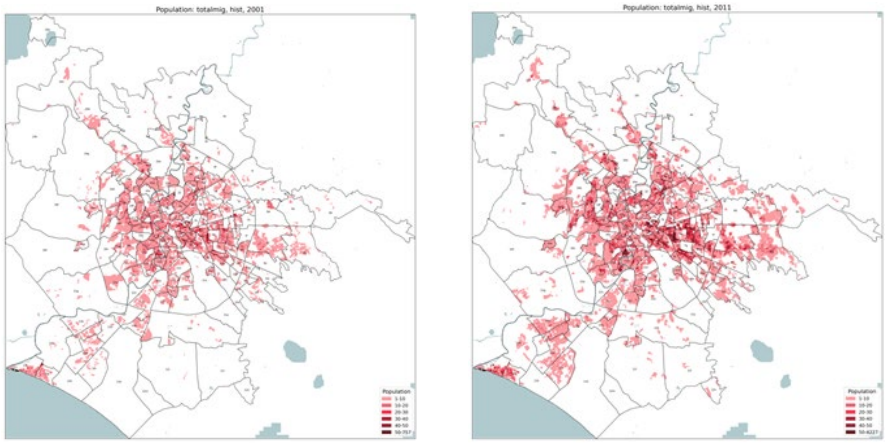


Figure 3.4.6 shows the gradual diffusion of the foreign residents between 2001 and 2020 over a large part of the urbanized territory. In fact, most of the areas in white on the map are occupied by urban villas, parks and agricultural zones, especially in the Outer periphery. The highest concentration is seen in the eastern Urban periphery, where rental and real estate values are lower (Torpignattara, Quadraro, Centocelle). Other neighbourhoods with relevant levels of concentration are in the western (Primavalle), northern (Tomba di Nerone) and southern (Marconi and Pian Due Torri) Urban periphery. In some cases, the concentration also reflects the presence of intensive constructed neighbourhoods with buildings of 8 and more floors (Marconi, Don Bosco and Tuscolana Sud). In fact, in Rome the most widespread type of residential building is the 4 or 5-storey palazzina in the urban core and the 1 or 2-storey villa in the Outer periphery.

Figure 3.4.6. Number of foreign residents by grid cell in Rome in 2001, 2011, 2015 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

2001 2011



2015 2020

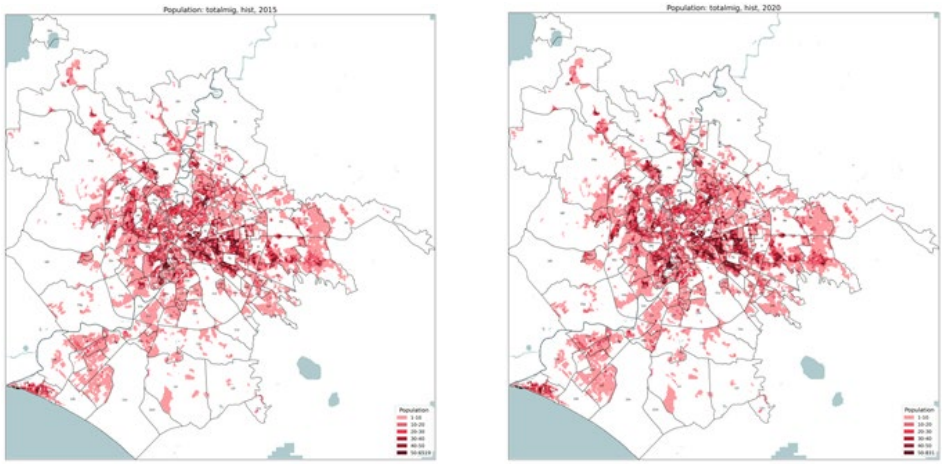
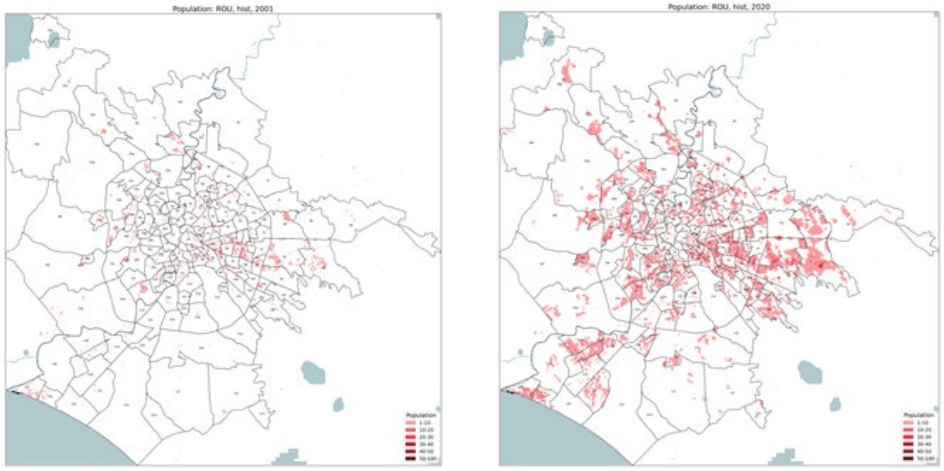


Figure 3.4.7 clearly shows the very strong increase of Romanians, which went from 9,000 to 86,000 residents in 20 years. Compared to other groups, they have a marked peri-urban settlement pattern and are mainly concentrated in the less affluent eastern neighbourhoods and in the areas outside the GRA, where many Italians of lower middle class live. Their more flexible residential localisation between urban core and outer periphery is also due to the widespread ownership of a car, essential for commuting towards the rest of the huge territory of the city and for maintaining transnational ties with the country of origin (Crisci 2010).

Figure 3.4.7. Number of Romanian population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

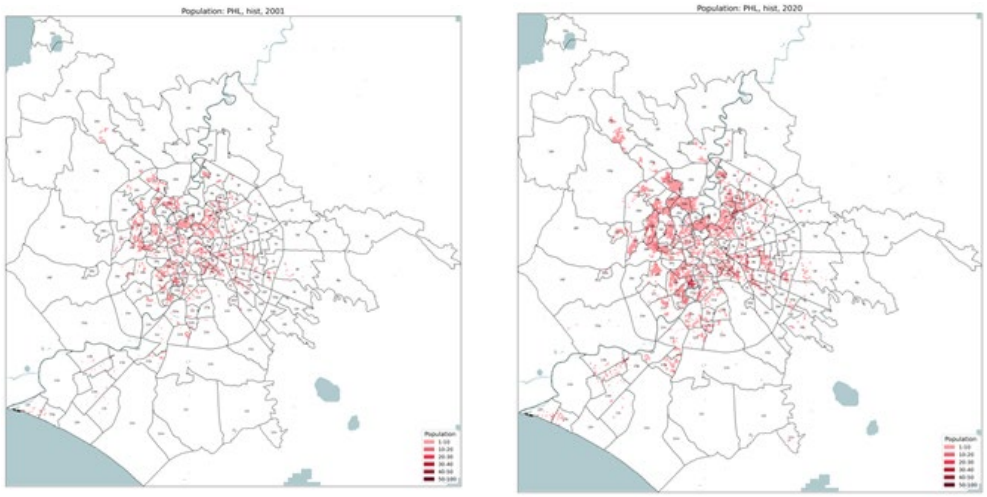
2001 2020



Filipino migration started in Rome in the 1970s. They are traditionally concentrated in the most affluent neighbourhoods of the City centre (Parioli and the historic centre) and the north-western Urban periphery (Tomba di Nerone), where they live often with their employer's families. In the last decades they spread across many low-middle class districts in the Urban Periphery (Marconi and Primavalle), often close to the areas where their domestic work activities are concentrated (Fig. 3.4.8).

Figure 3.4.8. Number of Filipino population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

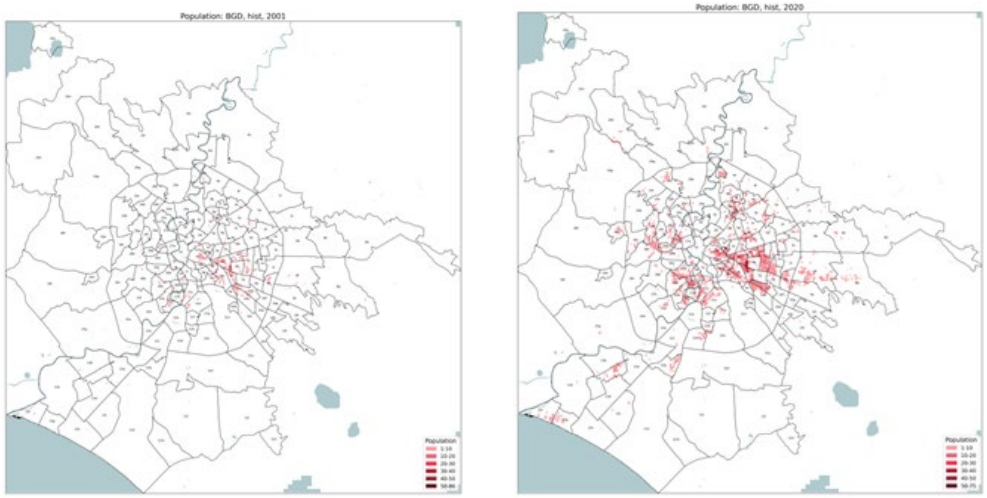
2001 2020



Bangladeshis in Rome traditionally prefer a central location in the less affluent eastern quadrant of the *Urban periphery* and are concentrated in the neighbourhoods Esquilino and Torpignattara, the latter nicknamed today Banglatown for it (Pompeo 2011) (Fig. 3.4.9). Over the last decades they have also spread their presence in other semi-central districts (Marconi) where they often work in small shops (i.e. mini-markets).

Figure 3.4.9. Number of Bangladeshi population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

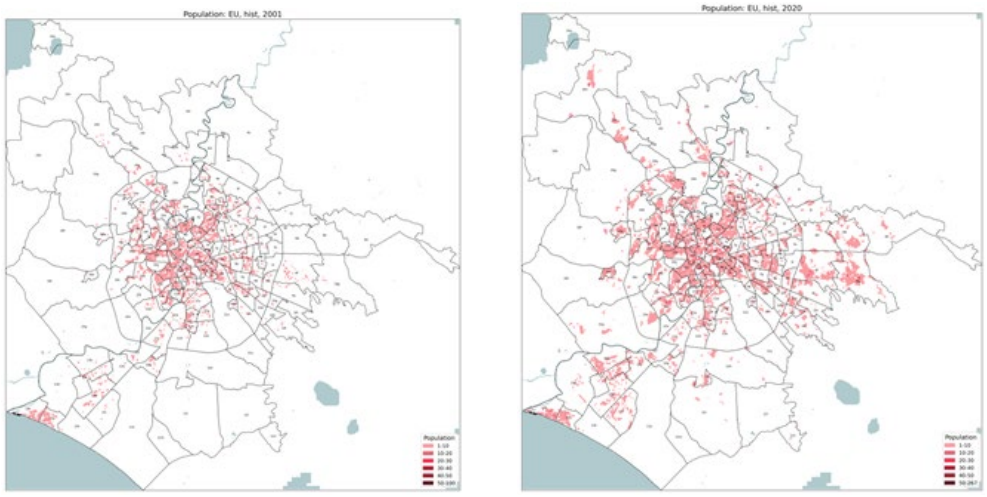
2001 2020



The EU group is, as already mentioned, the one that had the least growth over the last two decades, but it still shows a quite strong residential dispersion also in the *Outer periphery* (Fig. 3.4.10). Among the most numerous nationalities in this group are migrants from France and Spain, who prefer to reside close to the *City centre*, and from Poland, who are more likely to live in suburban neighbourhoods.

Figure 3.4.10. Number of EU population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

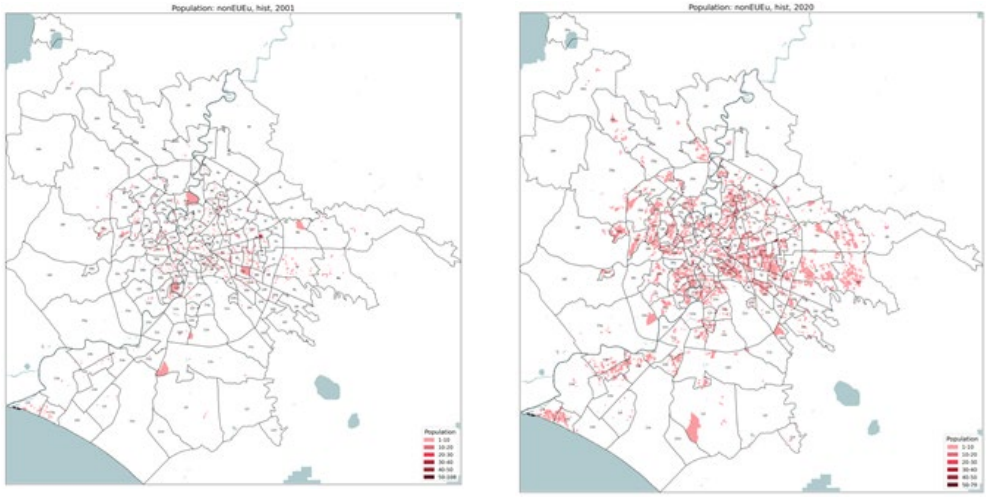
2001 2020



The non-EU European group had a strong growth between 2001 and 2020. The group includes nationalities with diverse settlement patterns, such as migrants from Ukraine, who often live in the urban core with the elderly persons they care for, and from Albania, who are more likely to live in the *Outer periphery* (Fig. 3.4.11).

Figure 3.4.11. Number of European non-EU population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

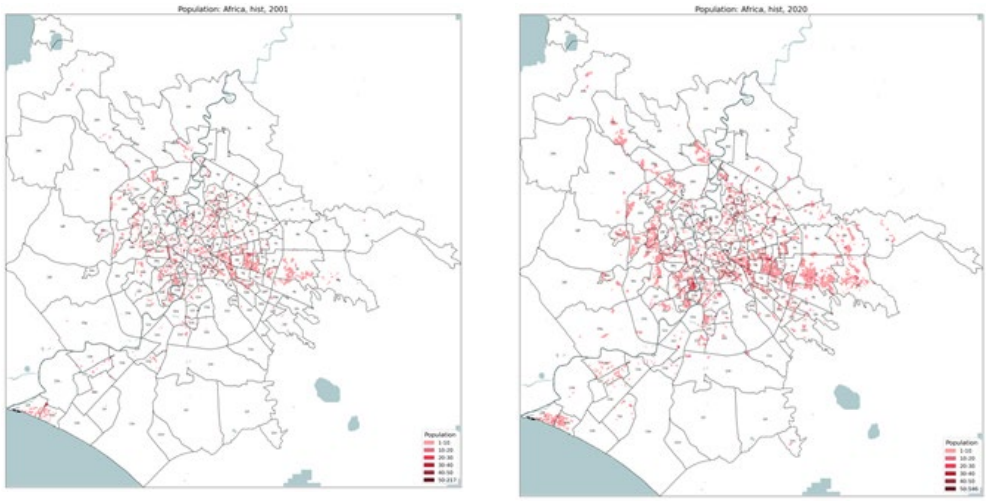
2001 2020



The African group includes mainly migrants from Egypt, Morocco, Nigeria and Senegal, who are concentrated in the less affluent neighbourhoods of the *Urban periphery*, especially in the eastern (Centocelle), but also in some southern (Marconi) and western (Primavalle) districts (Fig. 3.4.12).

Figure 3.4.12. Number of African population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

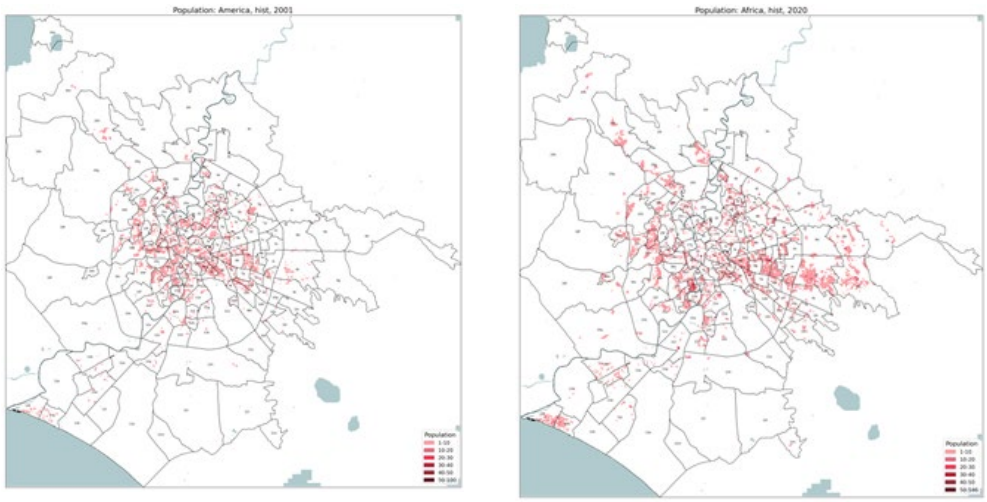
2001 2020



The American group is concentrated in the urban core and its settlement pattern is the result of different types of propensity: North Americans prefers to live in well-off neighbourhoods of the City centre and South Americans (mainly from Peru and Ecuador) reside in less affluent districts, often in the western and eastern *Urban periphery* (Fig. 3.4.13).

Figure 3.4.13. Number of American population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

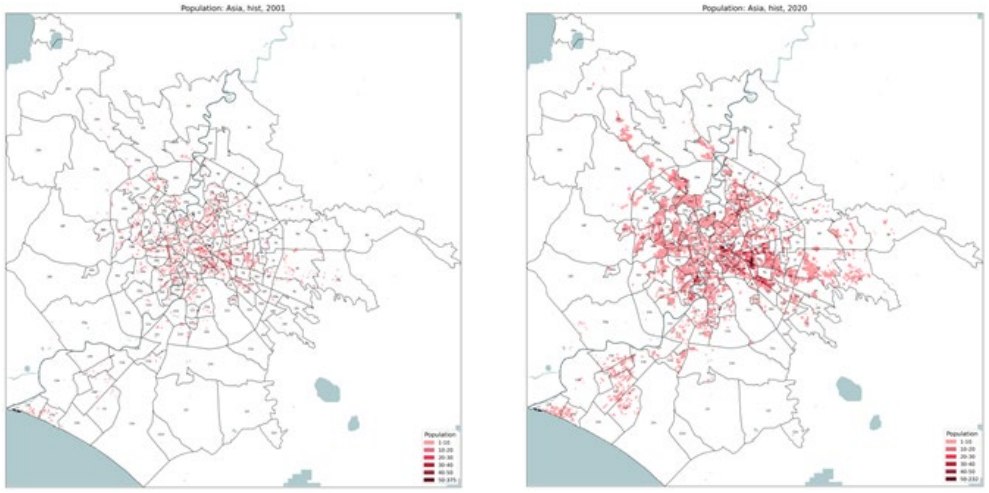
2001 2020



The Asian group is one of those that have shown the strongest growth in the last two decades and dispersion in many districts of the *Urban* and *Outer periphery* (Fig. 3.4.14). This group includes mainly migrants from China and India, who are more likely to live in the eastern *Urban periphery*, and from Sri Lanka, which live often with the families they work for.

Figure 3.4.14. Number of Asian population by grid cell in Rome in 2001 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

2001 2020



Residential concentration of foreigners in individualised neighbourhoods within a distance of 100 meters from an individual shows a strong growth over the last two decades (Fig. 3.4.15 and Tab. 3.4.2). In 2001 50% of the population resided in a neighbourhood with 2% of foreigners and in 2020 the percentage rose to 11.3%. In 2001 only the 1% of the inhabitants lived in a neighbourhood with at least 1 out of 6 foreign neighbours, in 2020 this percentage has grown to 25%. In 2011 and 2015 the very high values at the 99th percentile are probably linked to the fake registrations as resident of thousands of immigrants (for example homeless immigrants, with no fixed address or living in an apartment without an official contract) at the address of the offices of some institution that helps immigrants. The observed strong decrease in 2020 might be caused by the change in policy of the municipality of Rome that has stopped accepting this practice.

Figure 3.4.15. Concentration of foreigners in individualised neighbourhoods in Rome in 2001, 2011, 2015 and 2020. Neighbourhoods of 100m radius
Source: own calculations based on data from ISTAT and the Municipality of Rome.

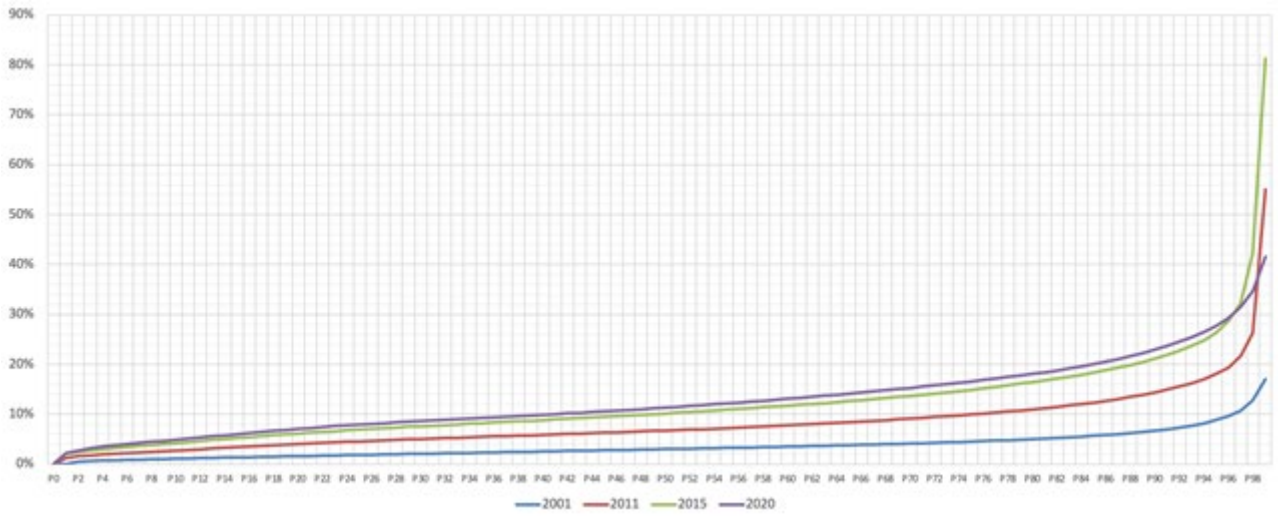


Table 3.4.2. Concentration of foreigners in individualised neighbourhoods in Rome. Chosen percentile values in 2001, 2011, 2015 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

Group	Percentiles	Neighbourhood 100 meters			
		2001	2011	2015	2020
Foreigners	10	1.1%	2.7%	4.2%	4.9%
	25	1.8%	4.6%	6.9%	7.9%
	50	3.0%	6.7%	10.1%	11.3%
	75	4.5%	9.9%	14.9%	16.6%
	90	6.7%	14.4%	21.1%	22.9%
	95	8.8%	18.1%	26.3%	27.8%
	99	17.1%	55.0%	81.3%	41.5%

Between 2001 and 2020 the level of segregation of foreigners in Rome, measured by the dissimilarity index (DI), has steadily decreased (Tab. 3.4.3). More precisely, the DI went from 0.350 in 2001 to 0.294 in 2020. This means that the percentage of foreigners who would have to move to another grid cell to equalise the share of foreigners in each grid cell decreased from 35.0% to 29.4%. The trend of segregation was different between the groups. Three groups showed a strong decrease: Romanians, from 0.617 to 0.423; non-EU Europeans, from 0.612 to 0.402; Bangladeshis, from 0.831 to 0.624. The DI of Filipinos and the EU group had a very slight decline, while the segregation of African and American groups slightly increased.

Table 3.4.3. Dissimilarity Index for foreigners and its subgroups in Rome in 2001, 2011, 2015 and 2020.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

Groups	2001	2011	2015	2020
Immigrants	0.350	0.330	0.326	0.294
Romania	0.617	0.461	0.478	0.423
Bangladesh	0.831	0.711	0.711	0.624
Philippines	0.587	0.520	0.547	0.536
Europe	0.394	0.368	0.379	0.368
Europe NonEU	0.612	0.385	0.431	0.402
Africa	0.498	0.579	0.616	0.537
Asia	0.546	0.506	0.466	0.417
America	0.432	0.387	0.461	0.457

During the period 2001-2020 the probability that a foreigner of a specific group finds a random neighbour from his/her own group increased with the growth of the foreign population (Table 3.4.4). For the Romanian and Asian groups this probability grew particularly: 25% of their residents in 2001 had a probability around 2% that in 2020 increased to more than 6%.

Table 3.4.4. Probability that a foreigner of a specific group finds a random neighbour from his/her own group in residential neighbourhood in Rome in 2001 and 2020. Individualised neighbourhoods of 100 meters.
Source: own calculations based on data from ISTAT and the Municipality of Rome.

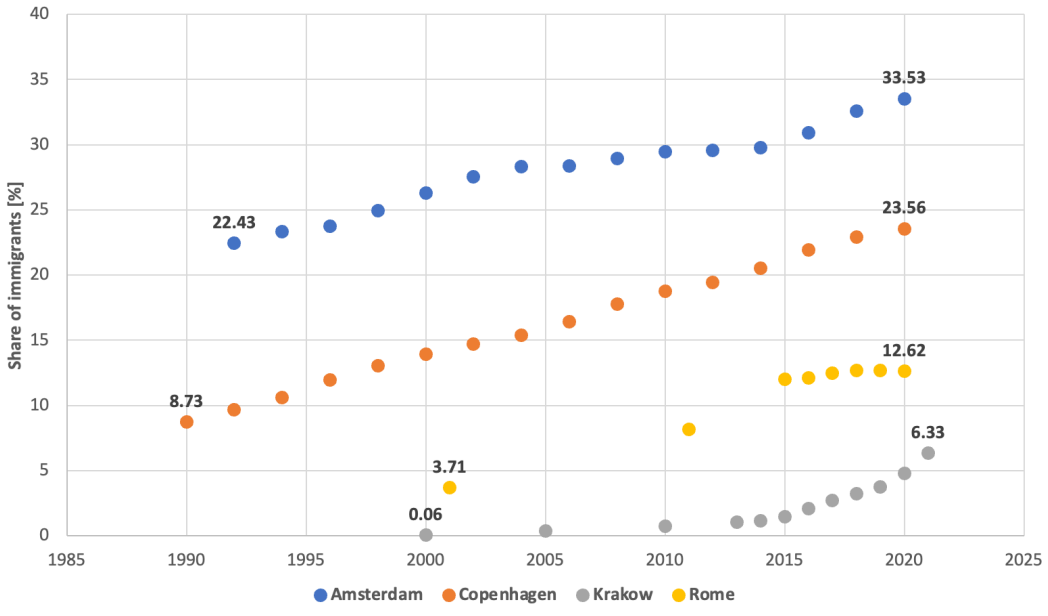
Year	Percentiles	Neighbourhood 100 meters							
		Europe EU	Europe NonEU	Rou	Phil	BGD	Asia	Africa	America
2001	10	0.4%	0.2%	0.2%	0.4%	0.2%	0.3%	0.3%	0.4%
	25	0.7%	0.4%	0.4%	0.7%	0.4%	0.5%	0.5%	0.6%
	50	1.1%	1.1%	1.1%	1.2%	0.7%	0.9%	1.0%	0.9%
	75	2.1%	30.8%	2.6%	2.1%	1.7%	2.0%	1.9%	1.5%
	90	4.1%	68.2%	50.0%	3.1%	4.4%	5.5%	4.3%	2.8%
	95	5.9%	92.3%	53.8%	4.3%	7.4%	37.4%	12.5%	4.3%
	99	19.3%	100.0%	94.2%	11.3%	10.1%	37.9%	37.5%	19.4%
2020	10	0.9%	0.7%	1.1%	0.9%	0.7%	1.5%	0.7%	0.7%
	25	1.4%	1.0%	1.8%	1.5%	1.4%	2.3%	1.3%	1.1%
	50	2.4%	1.5%	3.8%	2.4%	2.3%	3.8%	2.4%	1.8%
	75	4.4%	2.4%	6.9%	3.8%	3.7%	6.4%	4.6%	2.9%
	90	7.4%	4.3%	10.0%	5.3%	5.8%	15.5%	12.9%	5.0%
	95	12.0%	27.3%	12.5%	6.4%	6.9%	22.0%	29.3%	7.2%
	99	44.8%	62.5%	18.8%	8.1%	8.2%	33.1%	54.1%	24.6%

4. Comparison of segregation patterns in 4 European cities

The spatial segregation of foreigners is a topic of great concern among academicians and policy makers in many countries in Europe. However, the level of segregation and their patterns vary significantly between countries, regions, and cities. These differences can be explained by variation in size of immigrant population, historical trajectories, and structural factors, like for example welfare regime, housing system, educational and occupational policies. The comparison of the residential segregation of cities can contribute to the analysis of causes and consequences of the process and in shaping policy measures in relation to residential allocation of foreign origin populations. In our study we focus on cities with different levels of migrants, different history of migration and different geographic location. It is clearly visible when we compare the share of foreigners residing in the cities.

In figure 4.1, we can observe the historical evolution of immigrant populations in 4 analysed cities. At the beginning of the period under consideration, in Amsterdam around two people out of ten were foreigners. A significantly lower share can be observed in Copenhagen with around 8% of foreigners. We do not have precise data about Krakow and Rome at this time point but we know that the share was very low there. Around the year of 2000, in Krakow there were still almost no foreigners - only around 0.06% of total resident population, whereas in Rome the share was 3.7%. In Copenhagen during the 1990s the share of foreign origin population doubled and was at the level of 14%. At the same time Amsterdam reached 26%. The next 20 years brought the continuation of an upward trend in the size of foreign population in all places. While Amsterdam has a quite steady increase reaching 33.5% in 2020, the growth in other cities was much steeper. In Krakow, the share in the 5 last years alone increased from 1.5% to 6.3%. In Rome the proportion almost tripled from 3.7% to 12.6%. In 2020 Copenhagen had 10 percentage point lower share than Amsterdam, on the level of 23.5%.

Figure 4.1. Share of foreigners in Amsterdam, Copenhagen, Krakow and Rome in 1990-2021. Source: own calculations.



In 1990-2020 the representation of foreigners in the grid cells did not change significantly, except for Amsterdam, where this group was present in around 90% of inhabited grid cells (Figure 4.2). Due to development of the city, the number of inhabited grid cells increased by 30% whereas the number of foreigners grew by 81.5%. Thus, growth of this group was accompanied by an increase of concentration in the city. In other places representation rose significantly in the period under consideration. It is worth mentioning that in all these cities the number of inhabited cells grew, but the smallest change was noted in the case of Copenhagen - only by 6%. At the same time representation increased from 62% to 81% of grid cells. The most dramatic change occurred in Krakow where in 2000 foreigners were present only in 4% of grid cells and in 2020 in 41% of cells. At the beginning of 2000s, foreigners lived in almost 50% of grid cells in Rome, but in 2020 they were present in 70% of them.

Figure 4.2. Share of inhabited grid cells (100x100m) with presence of immigrants in 1990-2021. Source: own calculations.

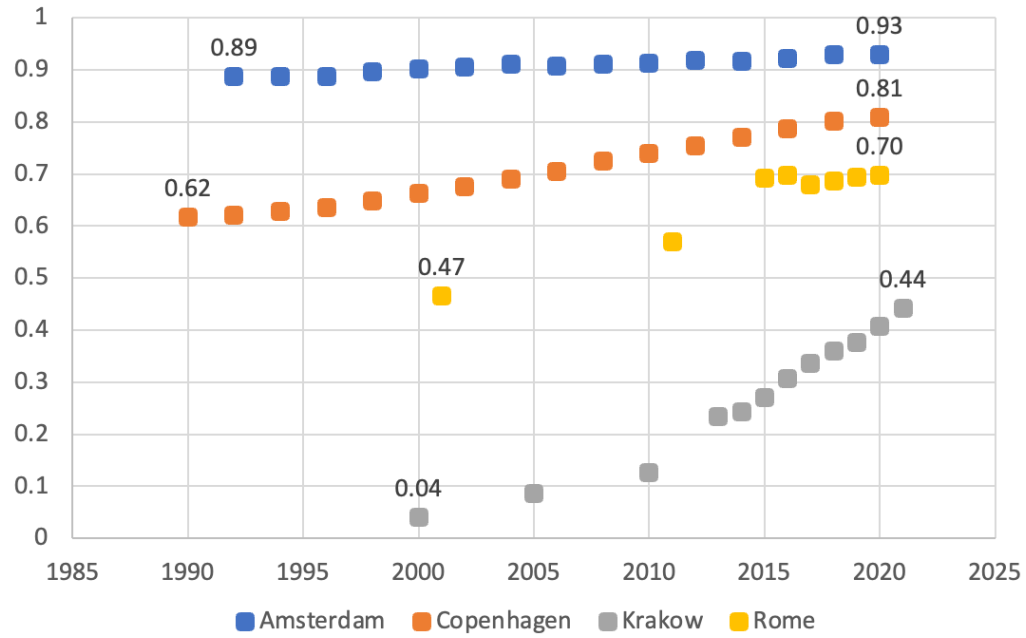


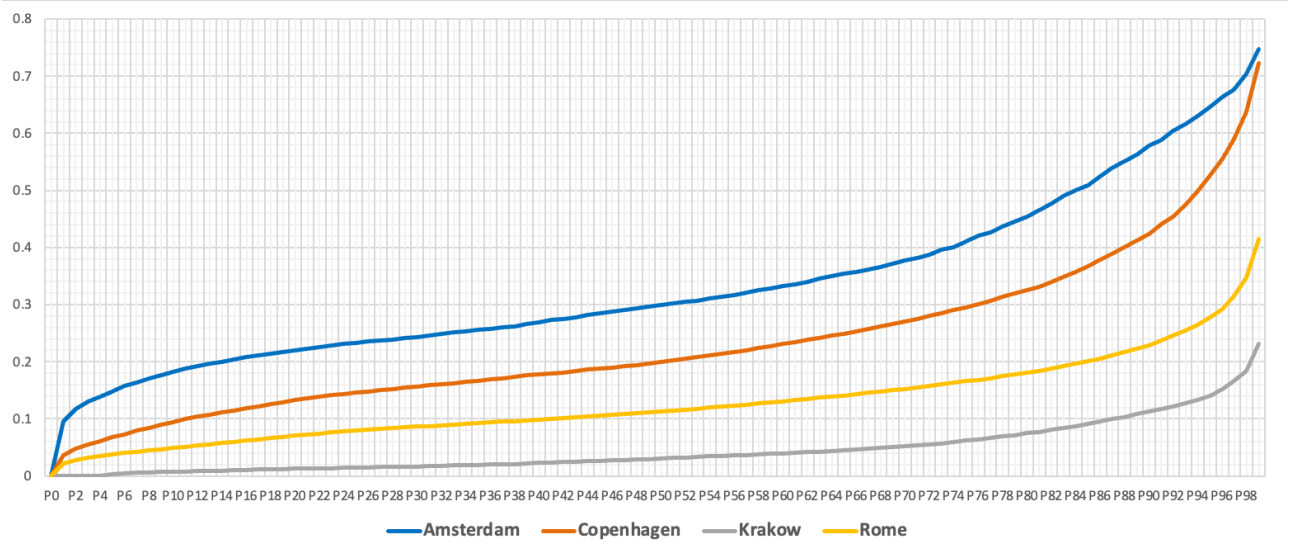
Figure 4.3. shows a percentile plot of the concentration of foreign origin populations varies between neighbourhoods across cities under consideration in 2020. If we compare the lowest shares of this group in the cities, 10% of inhabitants of Amsterdam live in NBHs with less than 18.3% of foreigners, whereas in Copenhagen the 10th percentile equals 9.3% in Rome 4.9%, and in Krakow 0.7%. It is also interesting to compare how many people in each city live with 5% or lower share of foreigners. In Amsterdam below 1% of population reside in such neighbourhoods, in Copenhagen - around 2.5%, in Rome - 10.5% and in Krakow almost 70% of Krakovians have 5% or less foreigners in 100-meter neighbourhoods. Thus, there are huge differences in this respect.

The other important issue is how many inhabitants live in NBHs with a majority of foreign population. Here, there is also a large variation. In 2020 16% of residents of Amsterdam lived in these kinds of surroundings, in Copenhagen only 5%. But in Krakow and Rome there were no 100-meter egocentric neighbourhoods with the majority of foreign population.

We can also notice quite significant variation in highly foreign dense neighbourhoods. In Amsterdam, in 10% dense neighbourhoods the proportions vary between 57.8% to 74.8% for the 90th to 99th percentiles. The range among 10% is much higher in Copenhagen where the variation is between 42.4% to 72.2%. In Rome 10% of the population lives with concentration between 23% and 41.5%. In Krakow this concentration is very low - the highest 10% of NBHs has a share from 11.3% to 23.1%.

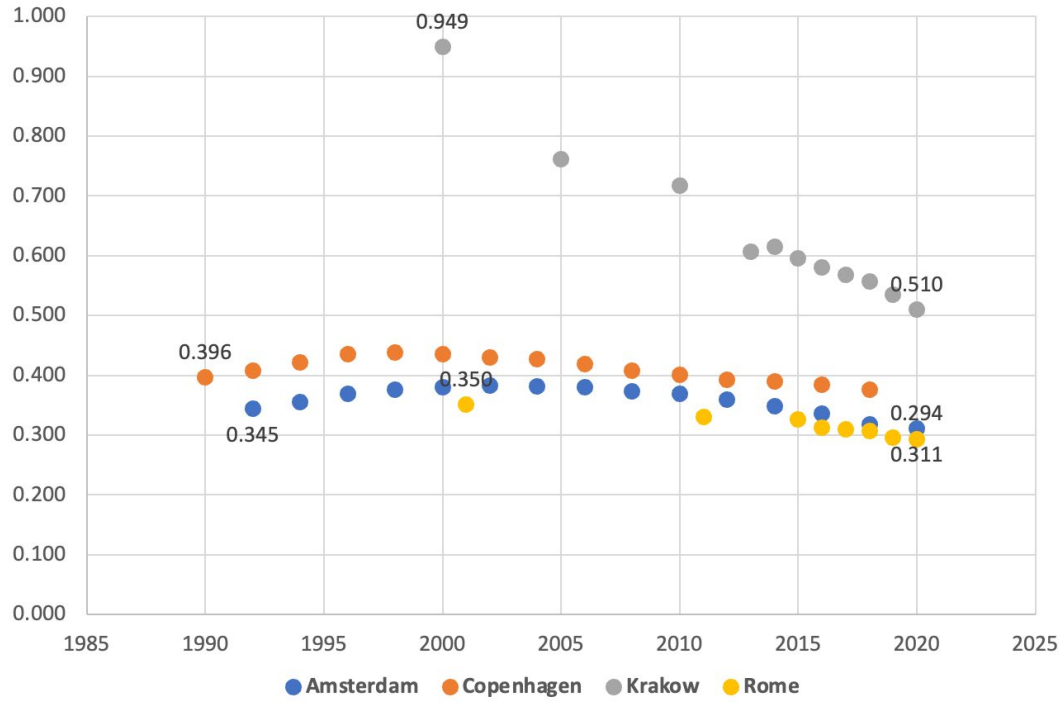
The main reason for the differences mentioned above is mostly because of large differences in size of foreign population between the cities. When we look at the patterns of concentration (Figure 4.X), they are similar across the cities. It is predominantly the difference between the proportions of foreigners that makes the difference between lines of Figure 4.3.

Figure 4.3. Concentration of foreigners in individualised neighbourhoods in Amsterdam, Copenhagen, Krakow and Rome in 2020. Neighbourhoods of 100m radius..
Source: own calculations.



We measure residential segregation on a grid cell level using dissimilarity index. It enables us to find where the spatial sorting of foreign population is stronger among cities in the study. Figure 4.4. shows changes in this index in 1990-2020. In the case of Amsterdam and Copenhagen, we observe similar levels and the trajectory of change. In 1992 it would be necessary to move around 40% of foreigners to achieve even spatial distribution in Amsterdam and 34.5% in Copenhagen. The segregation was increasing slowly during the 1990s and reached the highest level in Amsterdam in 1998 - 43.8% and in Copenhagen in 2002 - 38.3%. Then the levels were decreasing and reached in 2018 levels of, respectively, 37.6% and 31.8%. In Rome at the beginning of 2000s DI was 35%, but it dropped and between 2015-2019 had similar levels to those observed in Amsterdam. Krakow is an outlier in this group of cities because of a very small number of foreign population residing in its territory. It is clearly visible in 2000 when DI was at the level of 95%. Together with the rapid increase of immigrants in the city, segregation decreased significantly and reached a level of 51% in 2020. According to available data, the downward trajectory is continued in Krakow. In 2021 DI was 49.5%.

Figure 4.4. Dissimilarity Index for foreign population in 1990-2020.
Source: own calculations.



5. Future of residential segregation in the cities according to the FUME model

At the global level a number of scenarios were formulated following narratives, as described in Deliverable 3.4 (Yildiz, 2020). The basis of these scenarios is the framework of the Shared Socioeconomic Pathways (SSP) scenarios. These are projected socioeconomic global changes up to 2100 and used to derive greenhouse gas emissions scenarios with different climate policies. These scenarios have gained widespread acknowledgement as the basis for future policies on climate change. An important dimension of these scenarios is demography, and the demographic scenarios underlying the SSP scenarios were produced by the *Wittgenstein Centre for Demography and Human Capital*. The FUME scenarios take as the starting point the SSP2 'Middle of the Road' scenario, extend on variations on GDP projections and apply further assumptions at regional level, as mentioned in Deliverable 4.4 (van Wissen, 2022). In this report, we choose to present the results of the *benchmark* and the *baseline* scenario.

The *benchmark* scenario is identical to SSP2 including the effects of the COVID-19 pandemic at global level where internal and international migration follows observed trends between 2015 and 2019 at regional level for each country. On the other hand, the *baseline scenario* assumes no international migration and zero net internal migration at regional level. The following subsections present visualisations for each case study and the corresponding segregation analysis as performed in the previous sections highlighting worth-mentioning observations in the comparison of the effects of the two different scenarios at city level.

5.1. Amsterdam

In this subsection the results for the city of Amsterdam will be presented in the form of maps and tables, of the *benchmark scenario*, which can be interpreted as the trend scenario, and the *baseline scenario*, to show the impact of migration on the spatial development of the foreign population of the city until 2050. Compared to the 2020 distribution (Figure 3.1.6), the benchmark scenario results in a less densely populated city, in 2050, with a number of hotspots visible in the western and eastern districts (Figure 5.1.1.). In the baseline scenario the size of the foreign population is clearly much smaller, and the spatial distribution much more scattered, compared to the benchmark.

Figure 5.1.1. Distribution of foreign-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.

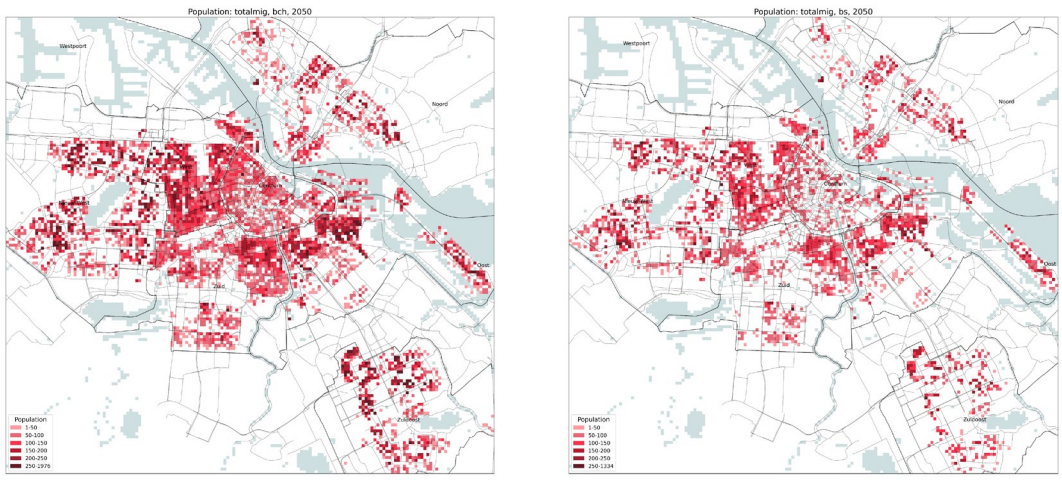
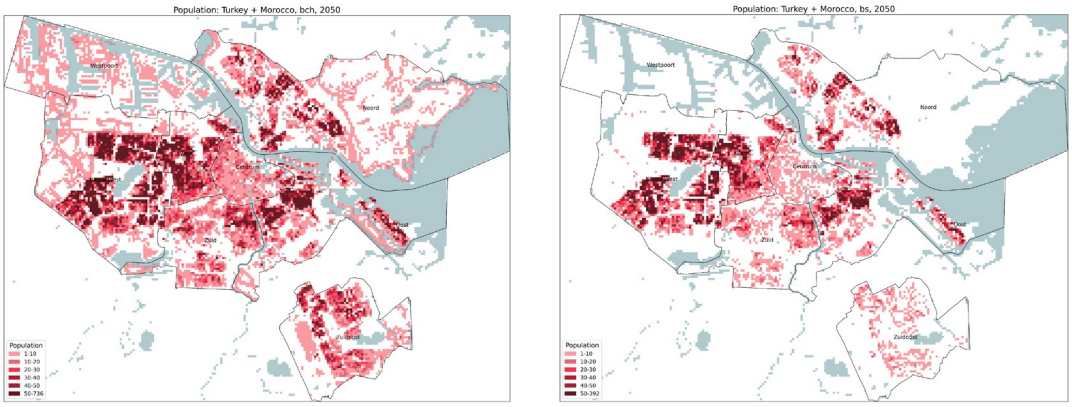
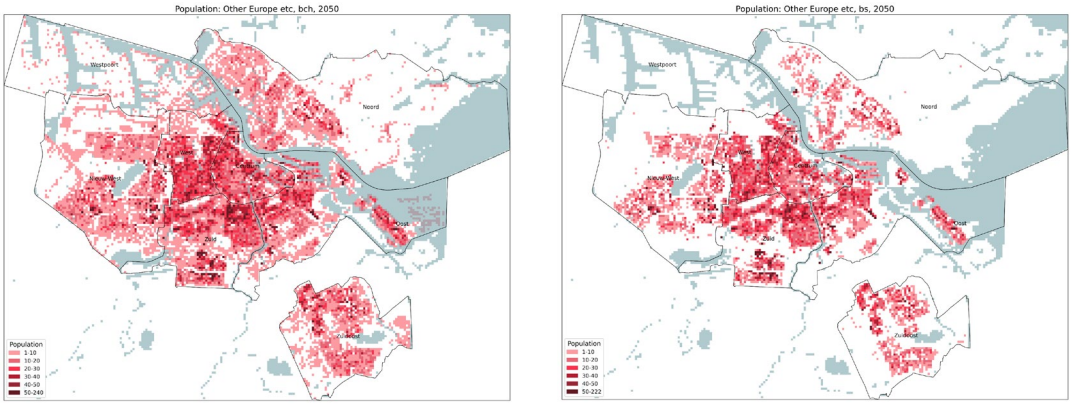


Figure 5.1.2. Distribution of Turkish and Moroccan population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



According to the *benchmark scenario*, in 2050 the Turkish and Moroccan population in Amsterdam will be strongly concentrated in the Western districts of the city, including the district of the "Western Garden cities" (Westelijke Tuinsteden), built in the sixties, as well as in the more recent and more expensive Akerpolder to the southwest. This was already apparent in 2020, but the concentration has increased since then. The sizable impact of immigration is clearly seen by comparing the two maps.

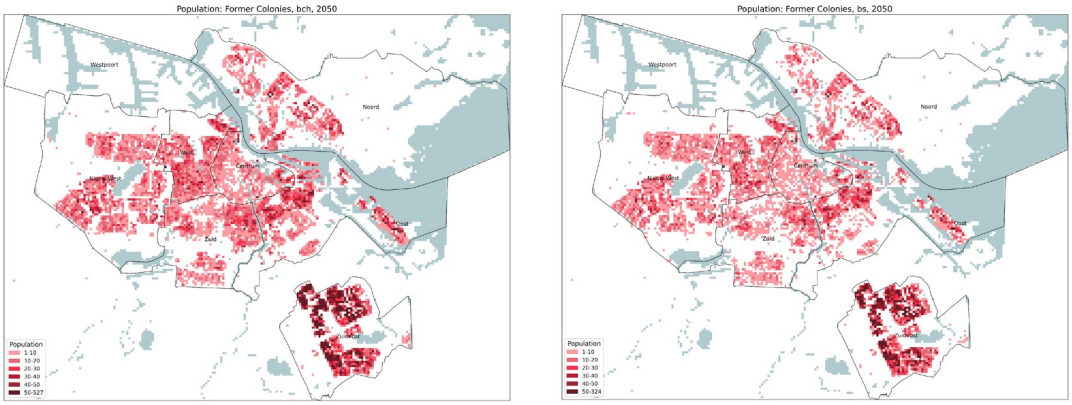
Figure 5.1.3. Distribution of other European countries plus Americas and Australia-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



The foreign population from non-EU Europe, plus the America and Australia in the *benchmark scenario* is more dispersed in 2050 compared to 2020. The population has grown substantially (see regional projections D4.3) and the comparison with the *baseline scenario*, which shows a significant reduction in the size of the foreign population, shows that migration has a sizable effect on the spatial distribution.

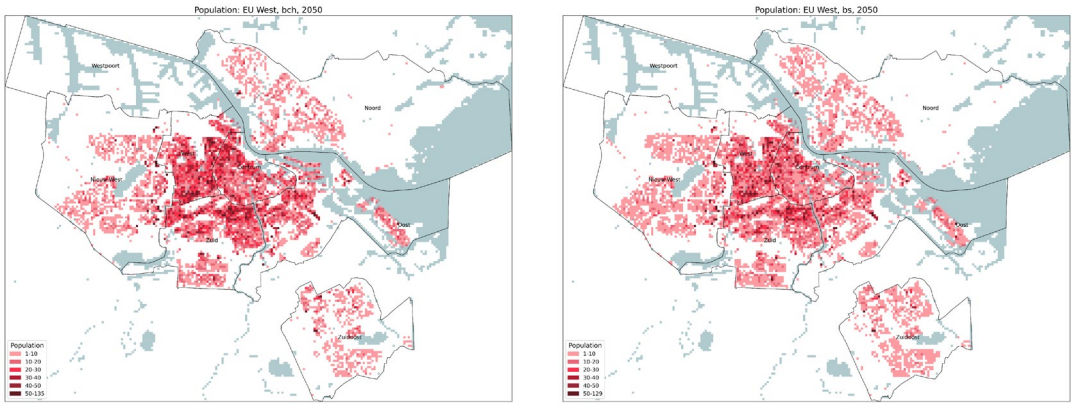
Figure 5.1.4. shows the results for the population of the former colonies. From the regional projections it was clear that this population decreases in size for both benchmark and baseline scenarios. A striking difference between 2020 and 2050 is that the density in the city of Amsterdam has decreased, but that the concentration in the South-eastern district of the Bijlmermeer has remained.

Figure 5.1.4. Distribution of former colonies-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



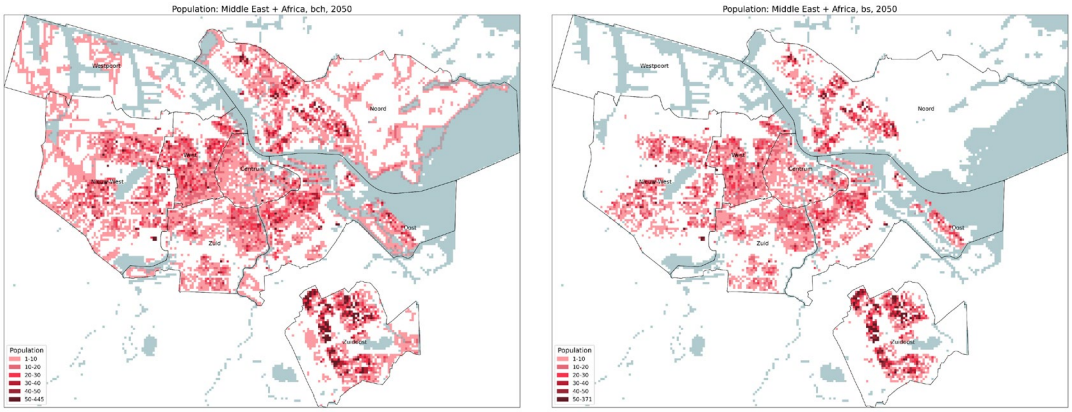
According to the regional projection the foreign population of EU West will decrease in the *benchmark* and *baseline* scenarios. This is shown in the maps in Figure 5.1.5, where the density of this population is much lower than in the 2020 map (Figure 4.2.10). The concentration has decreased relatively more in the outer districts of the city, whereas the 2020 hotspots are still there in 2050, even in the *baseline scenario*.

Figure 5.1.5. Distribution of EU West-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



The results for the foreign population from the Middle East and Africa are presented in figure 5.1.6. From the regional projections we have that in the *benchmark* this population will grow about 25 percent, whereas the *baseline* shows a decrease of about 15 percent. The benchmark distribution shows that the concentration has increased especially in the 19th and early 20th century ring around the historical centre, whereas it has decreased in the centre itself. This tendency is even stronger in the baseline scenario.

Figure 5.1.6. Distribution of Middle Eastern and Africa-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



Finally, Figure 5.1.7 shows the results for the EU_East foreign population. In both scenarios this population will decrease, as is visible in the reduced density of both maps compared to the 2020 map. Both 2050 maps are quite comparable, since the difference between both scenarios for this population group is not very large.

Figure 5.1.7. Distribution of EU_East-origin population by grid cell in Amsterdam in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.

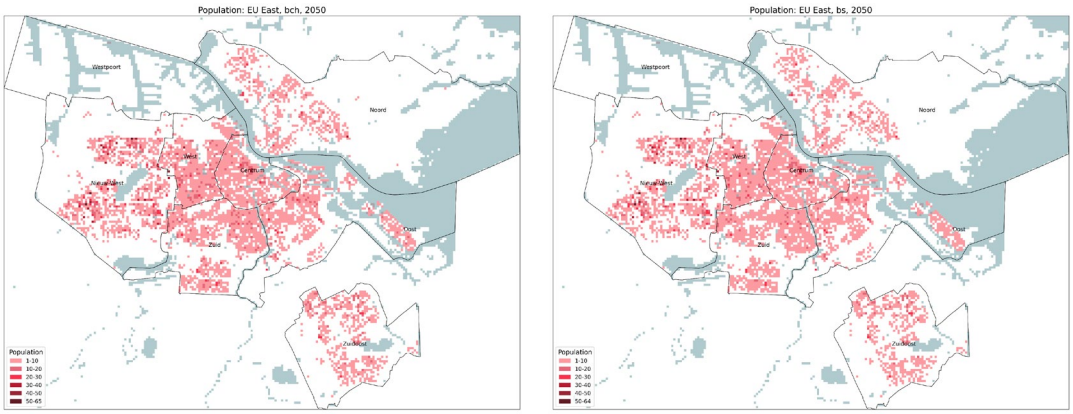


Table 5.1.1. below shows that the dissimilarity indices for almost all population groups stay constant, or decrease (Turkey+Morocco, Middle-East+Africa). This means that the reduction in dissimilarity observed in the period 1992-2020 is not reversed. In both scenarios in 2050 dissimilarity is lower than in 2000, for most foreign populations in Amsterdam.

Table 5.1.1 Dissimilarity Index for foreigners and its subgroups in Amsterdam in 2030-2050 by scenario
Source: own calculations.

Scenario	Benchmark			Baseline		
Region	2030	2040	2050	2030	2040	2050
Immigrants	0.2805	0.2816	0.2862	0.2813	0.2766	0.2615
EU West	0.2407	0.2428	0.2486	0.2399	0.2413	0.2524
EU East	0.3245	0.3215	0.3191	0.3238	0.3193	0.3145
Europe Non EU+ Americas +AU	0.2094	0.2022	0.1967	0.2193	0.2180	0.2199
Turkey+Morocco	0.4919	0.4559	0.4155	0.4966	0.4931	0.4661
ME+Africa	0.3568	0.3376	0.3223	0.3728	0.3647	0.3420
Former colonies	0.3466	0.3423	0.3361	0.3402	0.3342	0.3453

5.2. Copenhagen

As far Amsterdam, we make projections on the future changes of the immigrant-origin population in Copenhagen for the years 2030, 2040, and 2050, based on the benchmark and baseline potential migration scenarios. From the information provided in Table 5.2.1, according to the benchmark scenario, in 2030, the population of Copenhagen will inhabit 31 308 grid cells (100m x 100m), which will give an average 52,65 persons per populated grid cell. Interestingly, a foreign-origin population will be present in 20 890 grid cells by representing on average 16,54 persons per populated grid, with the highest concentration of foreigners - 2 116 persons in the cell. The highest representation of all groups under consideration will have foreigners from Other Non-Western countries with 12 595 grid cells with an average population of 6,76. This will be followed by the EU West group – 10 967 cells with an average population of 5,53, MENAP – 9 938 grid cells with an average population of 8,43, EU East – 7 804 with 4,58 average population, non-EU Europe - 6 513 populated grid cells with an average population of 4,01 and Turkey – 6 260 grid cells with 5,55 average population. The lowest values are predicted for Other Western groups with 3 218 grid cells and average 2,42 persons per populated grid.

The number of populated grid cells in the future keeps increasing, and in 2040 it will reach 32 288 cells with average 56,37 person per populated grid, while in 2050 it will rise to 32 659 grid cells with a 57,57 average population. This indicates the increase of the populated cells for other foreignorigin groups, including an average population with it. Thus, the foreign-origin population by 2040 will be present in 25 450 grid cells representing on average 14,92 persons per populated cell, while in 2050, it will become 27 756 grid cells with 14,73 average population in it. Unlike 2030, in 2040, the highest representation of all groups under consideration will have foreigners from *MENAP* (17 130 grid cells), *Other Non-Western* (15 948 grid cells) and EU West (10 304 grid cells) groups with an average population of 5,74 (MENAP), 6,67 (*Other Non-Western*) and 5,37 (*EU West*). Slightly lower values can be observed for *EU East* (7 789 cells – 4,56 avg. pop.), *non-EU Europe* (6 723 cells – 3,99 avg. pop.), *Turkey* (6 669 cells – 5,47 avg. pop.) and *Other Western* groups (3 653 cells – 2,23 avg. pop.). As we already mentioned, the number of populated grid cells will continue to increase even in 2050. In the 2050s benchmark scenario, foreigners from *MENAP* and *Other Non-Wester* groups will continue to have the highest representation of populated grid cells compare to other groups. The MENAP group will have 20 797 populated grid cells with a 5,39 average person concentration per cell, while the Other Non-Wester group will have 20 421 grid cells and a 6,75 average population. These two groups are followed by *EU West* (9 553 grid cells – 4,99 avg. pop.), *EU East* (7 376 grid cells – 4,47 avg. pop.), Turkey (6 565 grid cells – 5,49 avg. pop.), and *Other Western* (3 319 grid cells – 2.15 avg. pop.) groups respectively with lower concentration values in the grid cells. According to Table 5.2.1, the number of foreign-origin population projected in cells, will decrease over time. By 2030,

it will be 2,116 people per cell. By 2040, it will decrease to 2,101 people per cell. And by 2050, it will be 1,976 people per cell. In the future, this trend is also reflected in the average number of people per populated area.

As per the baseline scenario, the population is expected to occupy 29 753 grid cells by 2030, with an average of 50,78 individuals per populated cell. However, the foreign-origin population will be distributed across 17 235 grid cells, with an average of 18,45 persons per populated cell. The highest concentration of foreigners will be 2 113 individuals in a cell. According to the baseline 2030 scenario, the *EU West* and Other *Non-Western* groups of foreign-origin people will have the highest number of populated grid cells. Specifically, there will be 11 188 grid cells in the *EU West* with an average population of 5,53 people per cell, and 10 486 cells in *Other Non-Western* groups with an average of 6,94 people per populated cell. Those groups are followed by *MENAP* (8 952 grid cells with 8,97 avg. pop.), *EU East* (7 796 cells with 4,56 avg. pop.), *non-EU Europe* (6 169 cells with 3,99 avg. pop.), *Turkey* (5 339 cells with 6,07 avg. pop.) and Other Western (3 218 cells with 2,42 avg. pop.) groups. In 2040, the population will occupy 29 731 grid cells with an average of 50,63 people per cell. Only 16 778 cells will have foreign populations, with an average of 18,35 people per cell, and the highest concentration of foreigners will reach 2 082 individuals in a cell. In terms of the most densely populated grid cells by foreign population, the 2040 scenario will be similar to the previous one. *The EU West* group, with an average population of 5,45 in 10 529 grid cells, and the *Other Non-Western* group, with an average population of 6,69 in 10 761 cells, are still the leading groups in this scenario. The groups with comparatively lower numbers of cells and average population are *MENAP* with 8 729 cells and 9,11 average population, followed by *EU East* with 7 634 cells and 4,54 average population.

Table 5.2.1 Foreign population in Copenhagen in 2030-2050 by scenario.
Source: own calculations.

Scenario	Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Median population	Average population
Benchmark	2030	Total	31308	1	3938	1650709	100.00	x	32.56	52.65
		Foreign origin	20890	0	2116	351201	21.28	100.00	6.26	16.54
		EU West	10967	1	627	60689	3.68	17.28	2.00	5.53
		EU East	7804	0	215	36017	2.18	10.26	3.00	4.58
		Non EU Europe	6513	0	69	27872	1.69	7.94	2.59	4.01
		MENAP	9938	0	539	92249	5.59	26.27	4.10	8.43
		Turkey	6260	0	96	36578	2.22	10.42	3.00	5.55
		)ther Non Western	12595	0	557	89664	5.43	25.53	3.72	6.75
		Other Western	3218	1	86	8249	0.50	2.35	1.00	2.42
	2040	Total	32288	1	3923	1822749	100.00	x	38.09	56.37
		Foreign origin	25450	0	2101	384798	21.11	100.00	5.65	14.92
		EU West	10304	1	611	55307	3.03	14.37	2.00	5.37
		EU East	7789	1	215	35511	1.95	9.23	3.00	4.56
		Non EU Europe	6723	0	69	28850	1.58	7.50	2.49	3.99
		MENAP	17130	0	539	105560	5.79	27.43	2.05	5.74
		Turkey	6669	0	96	38631	2.12	10.04	3.00	5.47
		)ther Non Western	15948	0	557	112808	6.19	29.32	3.60	6.67
		Other Western	3653	1	86	8131	0.45	2.11	1.00	2.23

	2050	Total	32659	1	3801	1883064	100.00	x	40.09	57.57
		Foreign origin	27796	0	1979	413890	21.98	100.00	6.04	14.73
		EU West	9553	1	507	47704	2.53	11.53	2.00	4.99
		EU East	7376	1	203	32960	1.75	7.96	3.00	4.47
		Non EU Europe	7140	1	69	26223	1.39	6.34	2.00	3.67
		MENAP	20797	0	539	118445	6.29	28.62	2.43	5.39
		Turkey	6565	0	96	38090	2.02	9.20	3.00	5.49
		Other Non Western	20421	0	557	143346	7.61	34.63	3.24	6.75
		Other Western	3319	1	81	7124	0.38	1.72	1.00	2.15
Baseline	2030	Total	29753	1	3933	1512701	100.00	x	30.31	50.78
		Foreign origin	17235	0	2113	319713	21.14	100.00	7.04	18.45
		EU West	11188	1	625	61887	4.09	19.36	2.00	5.53
		EU East	7796	1	215	35570	2.35	11.13	3.00	4.56
		Non EU Europe	6169	0	69	24640	1.63	7.71	3.00	3.99
		MENAP	8952	0	539	82474	5.45	25.80	4.26	8.97
		Turkey	5339	0	96	33732	2.23	10.55	3.00	6.07
		Other Non Western	10486	1	557	73323	4.85	22.93	4.00	6.94
		Other Western	3218	1	86	8242	0.54	2.58	1.00	2.42
	2040	Total	29731	0	3902	1506874	100.00	x	30.26	50.63
		Foreign origin	16778	0	2082	308287	20.46	100.00	7.00	18.35
		EU West	10529	1	609	57359	3.81	18.61	2.00	5.45
		EU East	7634	1	207	34669	2.30	11.25	3.00	4.54
		Non EU Europe	6135	1	69	24305	1.61	7.88	3.00	3.96
		MENAP	8729	0	539	79877	5.30	25.91	5.00	9.11
		Turkey	5406	1	96	32102	2.13	10.41	3.00	5.94
		Other Non Western	10761	1	551	71940	4.77	23.34	3.00	6.69
		Other Western	3624	1	85	8058	0.53	2.61	1.00	2.22
	2050	Total	30444	1	3851	1426174	100.00	x	27.00	46.85
		Foreign origin	16661	1	2031	290003	20.33	100.00	6.00	17.41
		EU West	9818	1	580	51027	3.58	17.60	2.00	5.20
		EU East	7327	1	205	32547	2.28	11.22	3.00	4.44
		Non EU Europe	5881	1	65	22491	1.58	7.76	2.00	3.82
		MENAP	8825	1	535	78489	5.50	27.06	4.00	8.89
		Turkey	5068	1	94	30937	2.17	10.67	3.00	6.10
		Other Non Western	10158	1	542	67407	4.73	23.24	3.00	6.64
		Other Western	3313	1	72	7105	0.50	2.45	1.00	2.14

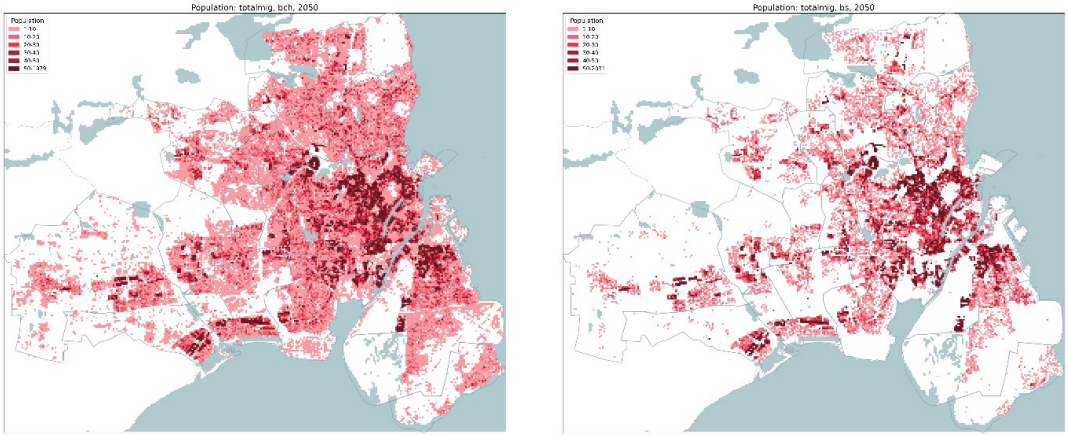
The groups with the lower number of cells and average population are *Non-EU Europe* with 6 135 cells with a 3,96 average population, and *Turkey* with 5 406 cells and average 5,94 persons per populated cell, and the *Other Western* group has 3 624 cells with a 2,22 average population.

By the 2050 baseline scenario, there will be 30 444 grid cells with a population density of approximately 50,63 people per cell. Of those cells, 16 661 will be occupied by people of foreign origin with an average population of 17,41. The foreign population will be distributed differently in grid cells compared to the previous two scenarios, with a maximum concentration of 2,031 individuals in a cell. While the *Other Non-Western* group with 10 158 cells with an average of 6,64 people, and the *EU West* group with 9 818 cells with an average of 5,20 people of foreign origin will have the highest number of populated grid cells. Those leading groups with the highest number of populated grid cells are followed by ones with lower numbers. The groups with the highest number of populated grid cells are followed by those with a lower number: *MENAP* has 8 825 cells with an average population of 8,89, *EU East* has 7 327 cells with an average population of 4,44, *Non-EU Europe* has 5 881 cells with an average population of 3,82, *Turkey* has 5 068 cells with an average population of 6,10, and *Other Western* group has 3 313 cells with an average population of 2,14.

The spatial distribution of total migration of foreign-origin populations in the urban fabric of Copenhagen will keep expanding by 2050 according to both baseline and benchmark scenarios presented in Figure 5.2.1.

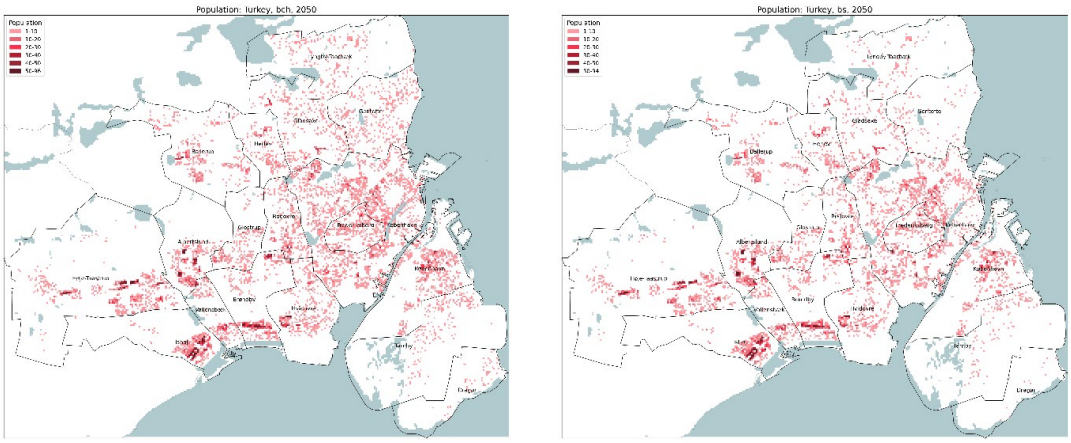
The benchmark scenario reveals an increased spread of foreign population towards north, south, and west. Besides, it is vivid that the central part of the Copenhagen will become more densely populated then it is today. Interestingly, municipalities such as Frederiksberg, Brøndby, Vallensbæk, Ishøj and Høje-Taastrup that are somewhat populated by foreigners, will keep increasing in the future and in some areas will result on very densely populated places. Such densely populated parts of the Copenhagen can also be seen form baseline scenario. Although the distribution of foreign-origin populations will not be as intensive as in the benchmark scenario, some central parts of the municipalities, as mentioned above, will still be densely populated.

Figure 5.2.1. Distribution of foreign-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



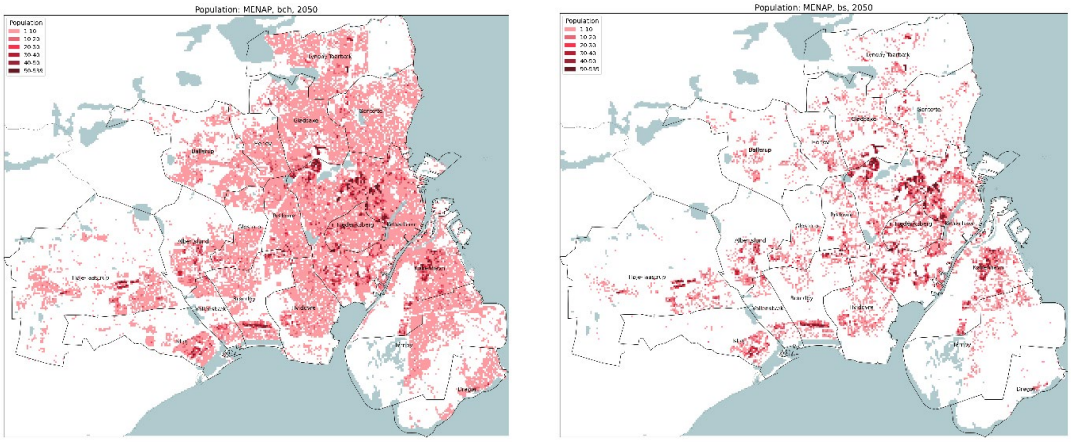
The *benchmark scenario* on figure 5.2.2. indicates that the foreigners of Turkish origin will be somewhat spread all over the Copenhagen metropolitan area. However, their higher concentration will be in certain parts of Ishøj, Vallensbæk, Brøndby, Albertslund and Høje-Taastrup. Not very high concentration but still vivid presence of this foreign group can be seen in downtown and central parts of Copenhagen. Interestingly, the analogous distribution patterns and high concentration configurations in the above-mentioned municipalities can be observed in the baseline scenario for 2050.

Figure 5.2.2. Distribution of Turkish-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



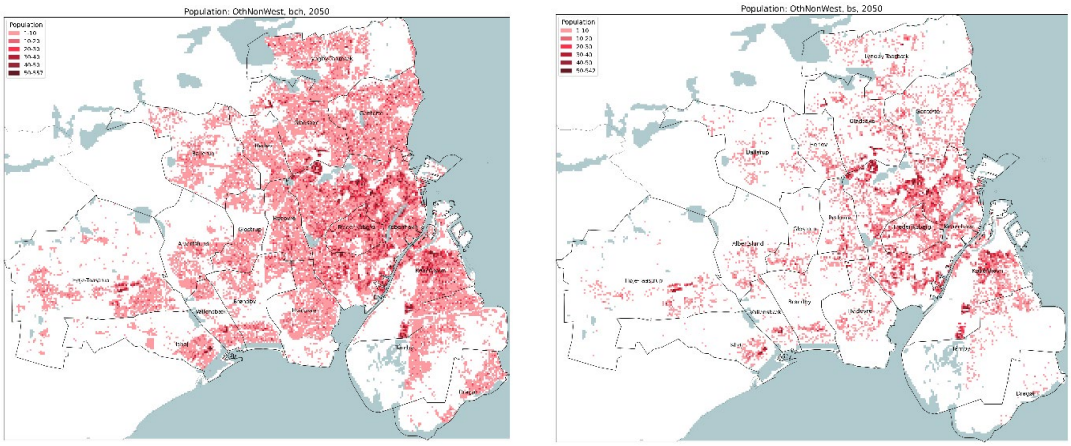
The *benchmark scenario*, MENAP groups will be more dispersed throughout Copenhagen's urban area by 2050 than groups of Turkish origin (Figure 5.2.3.). It is remarkable that there will be some densely populated areas in the MENAP group, such as those similar to the Turkish population in central Copenhagen, as well as in Ishøj, Brøndby, Albertslund, and Høje-Taastrup. However, differing from the Turkish group, their presence will significantly increase in the municipalities of Frederiksberg and Gladsaxe. On the other hand, in the baseline scenario, this foreign group is not distributed extensively throughout the urban space of Copenhagen as in the benchmark scenario. Nevertheless, the most noticeable patterns of increased population density in the observed municipalities still will remain actual.

Figure 5.2.3. Distribution of MENAP-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



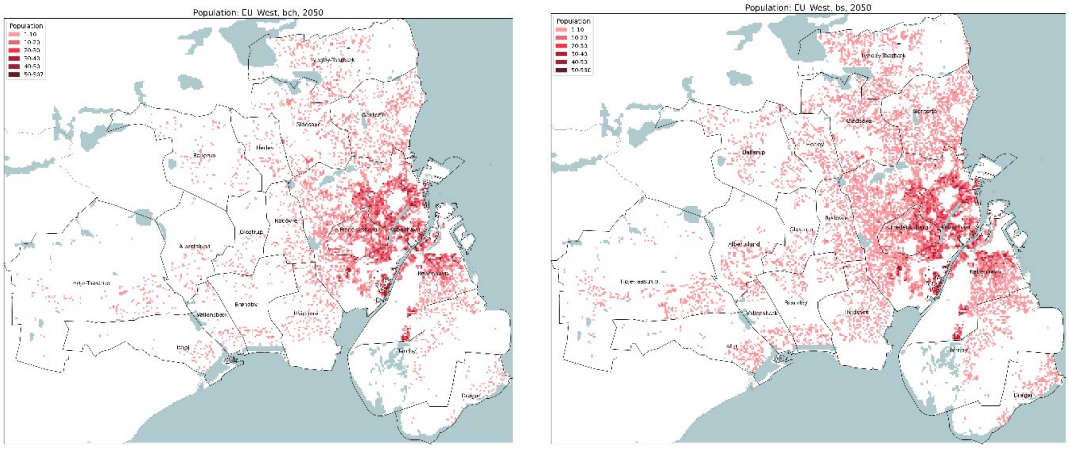
In Copenhagen's urban area, the presence of Other Non-Western-origin population is comparable to that of the MENAP group, as indicated by the benchmark scenario in Figure 5.2.4. Although, Other NonWest group will have a comparatively higher concentration in the city center of Copenhagen than MENAP. When comparing the baseline scenario to the 2020 map, there appears to be a decrease in population density for the Other Non-Western-origin population in the year 2050. Besides, the distribution of this group throughout the city is still not very widespread. However, the areas with the highest population density in the *baseline scenario* are still similar to those identified in the benchmark scenario.

Figure 5.2.4. Distribution of Other Non-Western-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



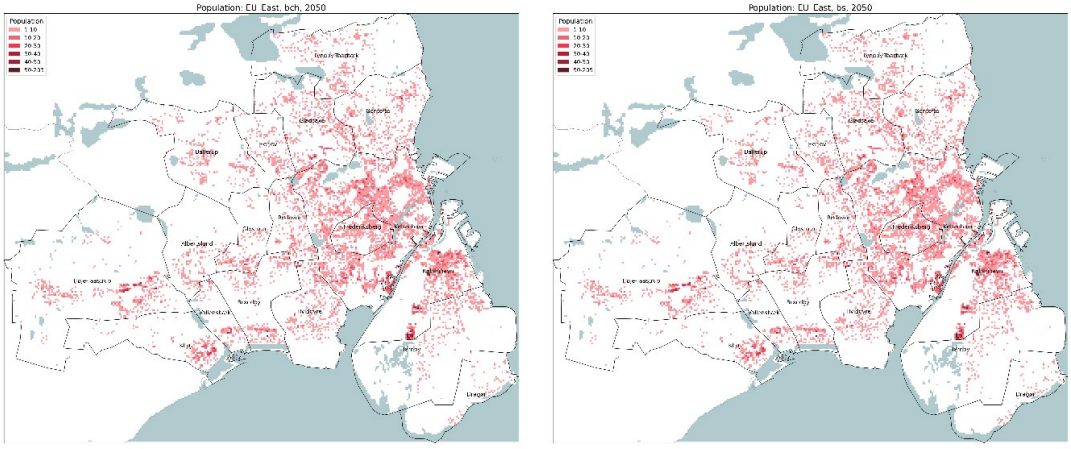
When comparing the *benchmark* and *baseline* scenarios on Figure 5.2.5, the population distribution of EU West-origin individuals follows a different trend than what was observed with Turkish, MENAP, and Other Non-Western-origin populations. It is evident that the *baseline scenario* exhibits a rise in the EU West-origin population throughout Copenhagen's urban space compared to the *benchmark scenario*. Additionally, noteworthy is the higher population density increase in the city center in the *baseline scenario* than in the *benchmark scenario*.

Figure 5.2.5. Distribution of EU West-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



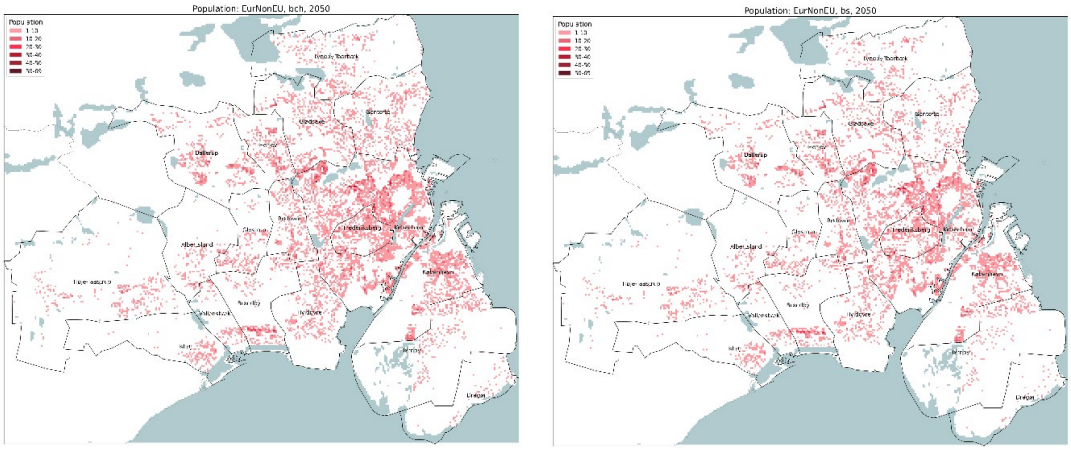
The distribution patterns observed for the EU East-origin population in Figure 5.2.6. is slightly different from the EU West-origin population. Here, the population of the EU East-origin group does not show any dense population concentration in the city center neither on the *benchmark* nor the *baseline* scenarios. Besides, in the case of both scenarios, they display somewhat similar distribution in the urban fabric of the Copenhagen metropolitan area.

Figure 5.2.6. Distribution of EU East-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



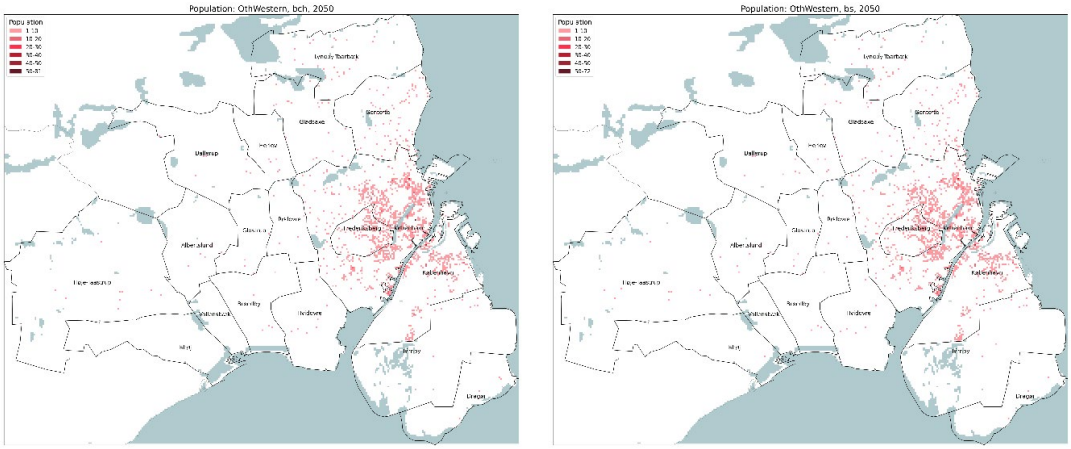
Based on the *benchmark scenario*, the population of non-EU origin in Europe is spread throughout Copenhagen's urban area, without any distinct patterns of high-density population (Figure 5.2.7.). However, it is clear that this group of foreign origin would likely prefer to settle in the city area of Copenhagen. However, in the *baseline scenario*, the population distribution has decreased and is now concentrated in the city center. There are no noticeable patterns in density.

Figure 5.2.7. Distribution of Europe nonEU-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



Out of all the foreign-origin groups, the Western-origin population group is the smallest. When compared to the 2020 maps, their *benchmark* and *baseline* scenarios clearly show a decrease in their population by 2050. According to the two scenarios presented in Figure 5.2.8, the population of this group will be spread out sporadically throughout the urban area of Copenhagen. However, a significant portion of the population will still prefer to live in the city center, leading to a concentration of residents in that area.

Figure 5.2.8. Distribution of Other Western-origin population by grid cell in Copenhagen in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



We have assessed the level of segregation for foreign-origin groups in Copenhagen using the dissimilarity index (DI) at the grid cell level. The resulting values are presented in Table 5.2.2, which shows the DI values for all discussed foreign-origin groups under benchmark and baseline scenarios for 2030, 2040, and 2050. Each cell in the table represents the level of dissimilarity or segregation within a subgroup for a specific year and scenario. The Dissimilarity Index (DI) ranges from 0 to 1, where 0 means no difference or complete integration, and 1 complete difference or segregation. Based on the table values, for the benchmark scenario in 2030, the foreign-origin population's segregation will be 0.3653, which will decrease to 0.3335 by 2050. This indicates that around 35% of foreigners will need to relocate to other grid cells to level the foreign population's share at the city level. Compared to the benchmark scenario, the baseline scenario shows slightly different numbers. By 2030, the foreign-origin population's segregation will be 0.3927, which will increase to 0.4078 by 2050. This means that approximately 41% of the foreign-origin population should be moved out of the cell to match the foreigners' share at the city level. It is noteworthy that these numbers are lower than the DI calculated for the year 2020. It is also remarkable that in the benchmark scenario, population segregation only increased for EU East, Europe Non-EU, and Other Western groups. However, in the baseline scenario, only the MENAP group showed a decrease in population segregation, while other foreign-origin groups showed a tendency to increase.

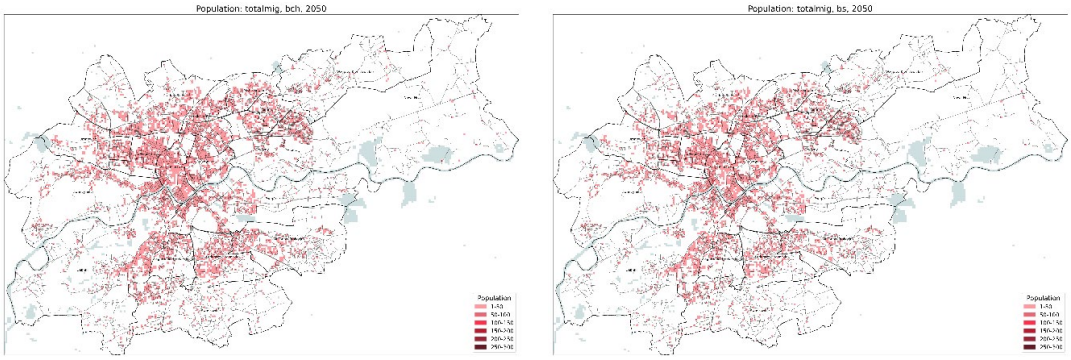
Table 5.2.2 Dissimilarity Index for foreigners and its subgroups in Copenhagen in 2030-2050 by scenario. Source: own calculations.

Scenario	Benchmark			Baseline		
Region	2030	2040	2050	2030	2040	2050
Immigrants	0.3653	0.3502	0.3335	0.3927	0.4054	0.4078
EU West	0.4514	0.4913	0.519	0.4286	0.4441	0.457
EU East	0.5182	0.5452	0.5679	0.5107	0.5165	0.5214
Europe Non-EU	0.516	0.5212	0.5702	0.5589	0.5635	0.5691
MENAP	0.4826	0.4299	0.396	0.5385	0.5602	0.5577
Turkey	0.631	0.6209	0.6282	0.6631	0.6984	0.7048
Other Non-Western	0.3814	0.3643	0.3564	0.44	0.4455	0.4504
Other Western	0.6727	0.6826	0.7103	0.6575	0.6461	0.6578

5.3. Krakow

In this subsection, we present the projected results for the city of Krakow with visual representations of the distributions of the examined migrant groups for the two selected scenarios, along with the corresponding summary statistics and the estimated dissimilarity index. In contrast to the 2020 distribution (Figure 3.3.4), we notice that the density of migrants concentration has declined, especially in the central part of the city, in both scenarios (Figure 5.3.1). The trend is more intense in the baseline scenario where the foreign population is declining by more than 11 000 persons.

Figure 5.3.1. Distribution of foreign-origin population by grid cell in Krakow in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



The central part of the municipality with the historical district of Stare Miasto seems to be still the most attractive area for the European EU foreigners, as shown in Figure 5.3.2 , while their total population does not present significant changes between 2020 and 2050. On the other hand, non-EU Europeans are dispersed in the peripheral districts with their population declining significantly in both scenarios (Figure 5.3.2). Similar trends are noticed for the population deriving from the rest of the world (Figure 5.3.3).

Figure 5.3.2. Distribution of Europe+ foreigners by grid cell in Krakow in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.

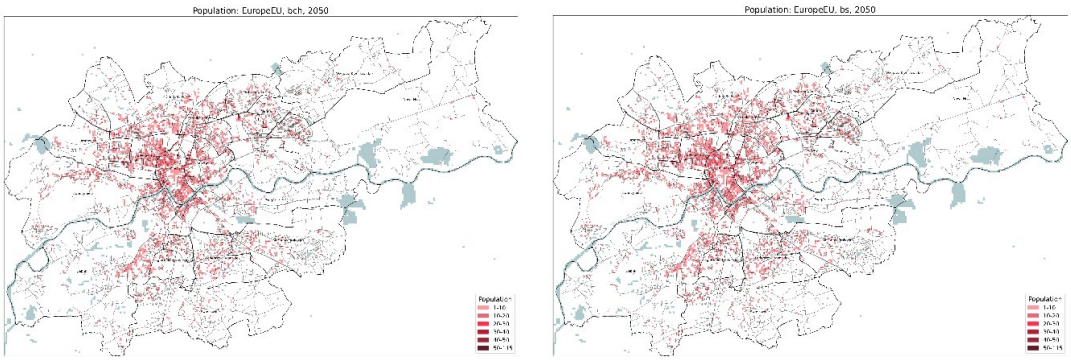


Figure 5.3.1. Distribution of Europe nonEU+ foreigners by grid cell in Krakow in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.

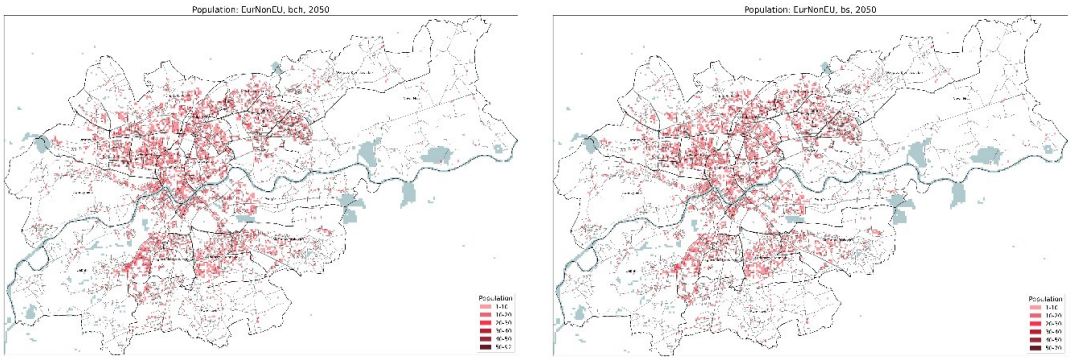


Figure 5.3.2. Distribution of Other foreigners by grid cell in Krakow in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.

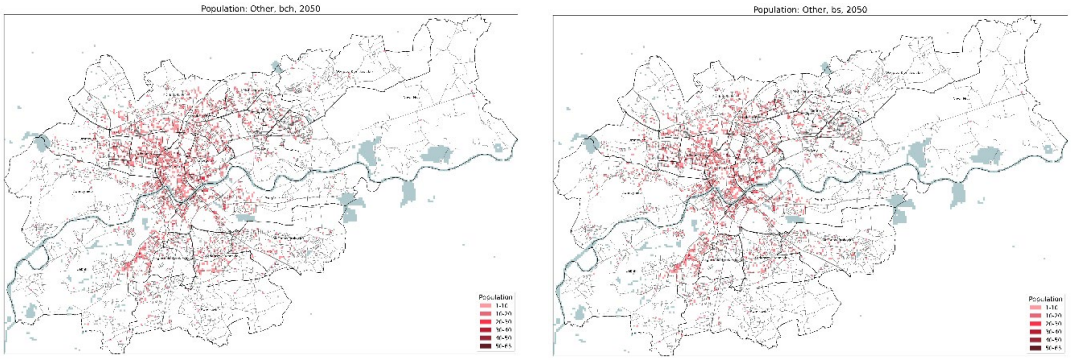


Table 5.3.1 presents a summary of the projected distribution of each of the examined groups where the share of the total migration is gradually shrinking from approximately 4.50 in 2030 to 4.05 in both scenarios. This estimation might hide caveats when we consider the recent developments with the on-going war in Ukraine, but reveals a risk of increasing segregation especially when all total populations decline. Foreigners that already inhabit specific regions are less likely to move in new locations, while they might attract the concentration of co-ethnics and not of native population.

Table 5.3.1 Foreign population in Krakow in 2030-2050 by scenario

Scenario	Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Median population	Average population
Benchmark	2030	Total	11395	1	1249	741535	100.00	x	21.07	64.94
		Foreign origin	4388	0	236	33273	4.49	100.00	4.00	7.17
		Europe EU	2514	0	117	10435	1.41	31.36	2.00	3.38
		Non EU Europe	3394	0	119	16822	2.27	50.56	3.00	4.96
		Other	1761	0	65	6176	0.83	18.56	2.00	3.35
	2040	Total	11202	1	1229	723308	100.00	x	21.08	64.45
		Foreign origin	4416	0	227	32400	4.48	100.00	4.00	6.99
		Europe EU	2463	0	117	9594	1.33	29.61	2.00	3.40
		Non EU Europe	3318	0	113	16211	2.24	50.03	3.00	4.89
		Other	2039	0	65	6598	0.91	20.36	2.00	3.04
	2050	Total	10955	1	1221	703092	100.00	x	22.00	64.06
		Foreign origin	4261	0	222	28421	4.04	100.00	3.09	6.32
		Europe EU	2331	0	116	8564	1.22	30.13	2.00	3.50
		Non EU Europe	2971	0	92	12307	1.75	43.30	3.00	4.14
		Other	2040	0	65	7569	1.08	26.63	2.00	3.05
Baseline	2030	Total	10957	1	1230	714782	100.00	x	22.00	65.15
		Foreign origin	4254	0	236	31589	4.42	100.00	4.00	7.16
		Europe EU	2514	0	117	10186	1.43	32.25	2.00	3.37
		Non EU Europe	3265	0	117	15929	2.23	50.44	3.00	4.88
		Other	1649	0	65	6157	0.86	19.50	2.00	3.50
	2040	Total	10015	1	1207	657900	100.00	x	22.00	65.67
		Foreign origin	3769	0	210	26795	4.07	100.00	4.00	6.98
		Europe EU	2369	0	116	8484	1.29	31.73	2.00	3.48
		Non EU Europe	2966	0	86	12302	1.87	46.01	2.00	4.15
		Other	1568	0	65	6141	0.93	22.97	2.00	3.63
	2050	Total	9470	1	1208	604773	100.00	x	22.00	63.83
		Foreign origin	3563	0	207	24783	4.10	100.00	3.99	6.79
		Europe EU	2511	0	115	8319	1.38	33.79	2.00	3.31
		Non EU Europe	2724	0	70	10425	1.72	42.35	2.00	3.83
		Other	1533	0	65	6121	1.01	24.87	2.00	3.68

Table 5.3.2 shows the dissimilarity indices for the 3 main migrant groups investigated in the case of Krakow, where an increasing trend is noticed in both scenarios compared to the corresponding 2020 indices.

Scenario	Benchmark			Baseline		
Region	2030	2040	2050	2030	2040	2050
Immigrants	0.5317	0.5336	0.545	0.5409	0.5567	0.5814
Europe EU	0.6664	0.6638	0.6638	0.6692	0.6645	0.6807
Europe Non EU	0.5302	0.5338	0.5568	0.543	0.5657	0.5922
Other	0.692	0.6634	0.6658	0.7855	0.7056	0.7283

5.4. Rome

In this paragraph the results of the projections of foreign population in Rome are presented with reference to the *benchmark* and the *baseline* scenarios for the years 2030, 2040 and 2050.

The *benchmark scenario* assumes that in the next 30 years internal and international migration dynamics will continue the trends observed at regional level for each country in the period 2015-2019. According to the *benchmark scenario*, in 2030 the population of Rome will reside in 55,904 grid cells (100m x 100m), on average 55,72 persons per populated grid cell (Tab. 5.4.1). The foreign population is expected to increase strongly and foreign residents will be present in 42,608 grid cells (76.2% of the inhabited cells), on average 11,64 persons per populated grid, with the highest concentration of foreigners in cell equals to 1065 persons. In 2030 the most represented of all groups here considered will be Romania, which will be present in 25,311 grid cells, 45.3% of the inhabited cells, followed by Asian group, with 14,083 cells (25.2%) and the EU group with 13,509 cells (24.2%). The higher concentration will be observed in the Asian group, which will be present with 6.02 persons per grid cell on average, followed by the African and Bangladesh group with an average concentration of 5.6 persons per populated cell. The lowest level of concentration is predicted for the EU group with 2.17 persons on average per inhabited cell.

In 2050 according to the *benchmark scenario* the number of populated cells will keep increasing, reaching the figure of 126,502 cells with an average population of 27.35 persons per inhabited cell. Foreign residents will be present in 125,489 grid cells (99,2% of the inhabited cells), on average 5.91 persons per populated grid, with the highest concentration of foreigners in the cell equals to 1765 persons. The most represented group will be Romania, which will be present in 26,736 grid cells, 21.1% of the inhabited cells, followed by the African group, with 19,475 cells (15.4%) and the Bangladesh group with 18,914 cells (15.0%). The higher concentration will be observed in the Asian group, which will be present with 7.47 persons per grid cell on average, followed by the Bangladesh group with an average concentration of 6.63 persons per populated cell and the African group with 6.16 persons per inhabited cell. The group with the lowest values of concentration will be the EU with 2.19 persons on average per inhabited cell.

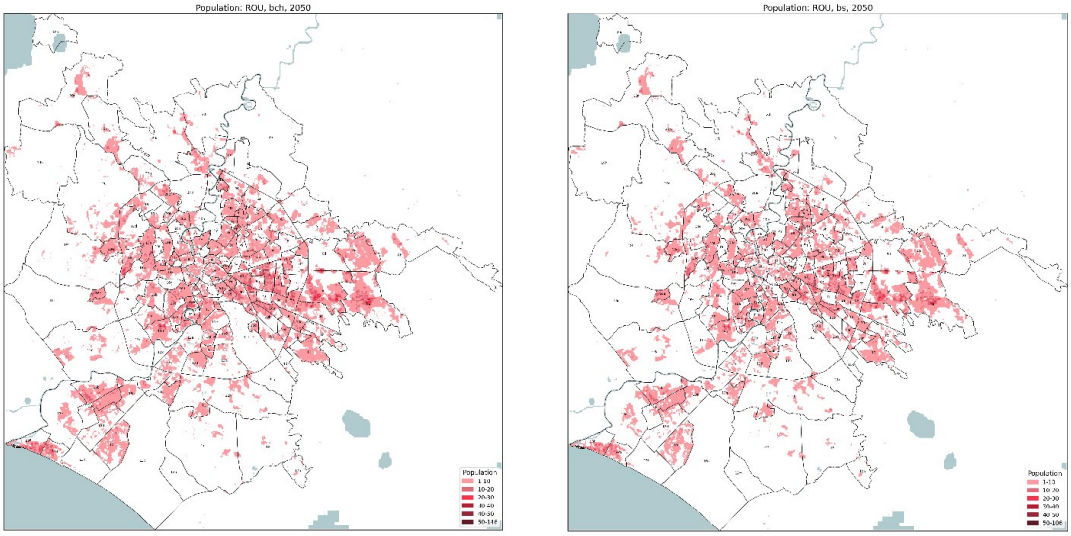
Assuming no international migration and zero net internal migration at regional level, the *baseline scenario* presents a much less dynamic future picture than the *benchmark scenario*. According to the *baseline scenario*, in the period 2030-2050 the number of populated cells will be similar to what was observed in 2020 for both total and foreign residents, that is to say respectively around 50,000 and 34,000, with only minor changes. In 2030-2050 the most represented group will be Romania with around 23,000 inhabited grid cells, followed by Asian group (around 15,000 populated cells) and EU group (around 12,000 inhabited cells). As in 2020, in the period 2030-2050 the Bangladeshis group will show the higher concentration with around 5,70 persons per populated cell, followed by Romanian and Filipino groups, both with around 4.60 persons per inhabited cell.

Table 5.4.1. Foreign population in Rome in 2030-2050 by scenario

Scenario	Year	Item	Number of populated grid cells	Min population in grid cell	Max population in grid cell	Population	% in total population	% in foreigner population	Median population	Average population
Benchmark	2030	Total	55904	1	1285	3115072	100.00	x	16.40	55.72
		Foreign origin	42608	0	1065	495962	15.92	100.00	4.74	11.64
		ROU	25311	0	132	120791	3.88	24.35	2.66	4.77
		BGD	10872	0	110	61121	1.96	12.32	2.53	5.62
		PHL	12103	0	60	56322	1.81	11.36	2.43	4.65
		EU	13509	1	268	29249	0.94	5.90	1.00	2.17
		Non EU Europe	10822	0	82	45929	1.47	9.26	1.99	4.24
		Africa	10632	0	729	60073	1.93	12.11	2.26	5.65
		Asia	14083	0	238	84731	2.72	17.08	2.59	6.02
		America	9238	0	34	37746	1.21	7.61	2.17	4.09
	2040	Total	69016	0	1413	3312647	100.00	x	8.62	48.00
		Foreign origin	54032	0	1381	619791	18.71	100.00	3.97	11.47
		ROU	26217	0	144	129676	3.91	20.92	2.70	4.95
		BGD	14717	0	142	90320	2.73	14.57	2.70	6.14
		PHL	14450	0	69	66085	1.99	10.66	2.41	4.57
		EU	14378	1	119	31611	0.95	5.10	1.00	2.20
		Non EU Europe	12245	0	82	54652	1.65	8.82	1.95	4.46
		Africa	14554	0	960	87900	2.65	14.18	2.11	6.04
		Asia	16062	0	277	112008	3.38	18.07	2.67	6.97
		America	12455	0	34	47539	1.44	7.67	1.91	3.82
	2050	Total	126502	1	1797	3459881	100.00	x	1.52	27.35
		Foreign origin	125489	1	1765	741802	21.44	100.00	1.17	5.91
		ROU	26736	0	147	133161	3.85	17.95	2.70	4.98
		BGD	18914	0	202	125398	3.62	16.90	2.67	6.63
		PHL	17110	0	77	77113	2.23	10.40	2.43	4.51
		EU	14587	1	157	31881	0.92	4.30	1.00	2.19
		Non EU Europe	13059	0	82	59543	1.72	8.03	1.98	4.56
		Africa	19475	0	1261	119996	3.47	16.18	2.01	6.16
		Asia	18639	0	321	139209	4.02	18.77	2.58	7.47
		America	15398	0	34	55502	1.60	7.48	1.92	3.60
Baseline	2030	Total	50456	0	1267	2975171	100.00	x	20.76	58.97
		Foreign origin	34553	0	834	368377	12.38	100.00	4.79	10.66
		ROU	23281	0	107	105325	3.54	28.59	2.52	4.52
		BGD	6272	0	85	35754	1.20	9.71	2.51	5.70
		PHL	10318	0	51	48113	1.62	13.06	2.43	4.66
		EU	12459	1	111	23377	0.79	6.35	1.00	1.88
		Non EU Europe	9556	0	80	33884	1.14	9.20	2.00	3.55
		Africa	7976	0	546	34998	1.18	9.50	2.25	4.39
		Asia	15375	1	233	60921	2.05	16.54	2.00	3.96
		America	10955	1	34	26005	0.87	7.06	1.00	2.37
	2040	Total	51511	0	1283	3013018	100.00	x	20.00	58.49
		Foreign origin	34420	0	829	366809	12.17	100.00	4.79	10.66
		ROU	23231	0	107	105054	3.49	28.64	2.52	4.52
		BGD	6265	0	85	35704	1.19	9.73	2.51	5.70
		PHL	10251	0	51	47829	1.59	13.04	2.43	4.67
		EU	12343	1	54	22931	0.76	6.25	1.00	1.86
		Non EU Europe	9523	0	80	33734	1.12	9.20	2.00	3.54
		Africa	7973	0	546	34914	1.16	9.52	2.25	4.38
		Asia	15345	1	233	60815	2.02	16.58	2.00	3.96
		America	10887	1	34	25856	0.86	7.05	1.00	2.37
	2050	Total	50982	0	1283	2966471	100.00	x	19.69	58.19
		Foreign origin	33214	0	830	357538	12.05	100.00	4.92	10.76
		ROU	22801	0	107	103303	3.48	28.89	2.53	4.53
		BGD	6228	0	85	35348	1.19	9.89	2.51	5.68
		PHL	9908	0	51	46556	1.57	13.02	2.47	4.70
		EU	12000	1	79	21945	0.74	6.14	1.00	1.83
		Non EU Europe	9431	0	80	32623	1.10	9.12	2.00	3.46
		Africa	12105	1	546	32280	1.09	9.03	1.00	2.67
		Asia	15215	1	232	60430	2.04	16.90	2.00	3.97
		America	10614	1	34	25215	0.85	7.05	1.00	2.38

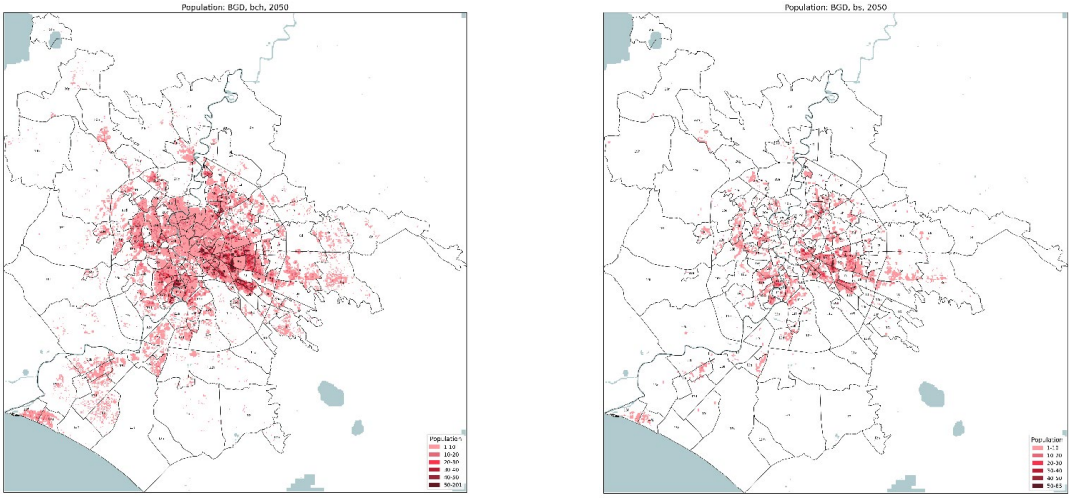
According to the *benchmark scenario*, by 2050 the number of foreigners from Romania will increase strongly and spread in many areas of Rome, mainly in the City centre and in the Urban periphery (Fig. 5.4.1). Particularly, they will be concentrated in some neighbourhoods of the eastern periphery, such as *Torpignattara, Centocelle, Quadraro, Alessandrino* and *Torre Maura*, but also in southern (*Marconi and Trullo*) and western (*Fogaccia*) district of the Urban periphery. According to the baseline scenario, Romanians will continue to have a peri-urban settlement pattern, being largely present in the Outer periphery, more specifically in the eastern neighbourhoods *Torre Angela* and *Borghesiana*.

Figure 5.4.1. Distribution of foreigners from Romania by grid cell in Rome 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



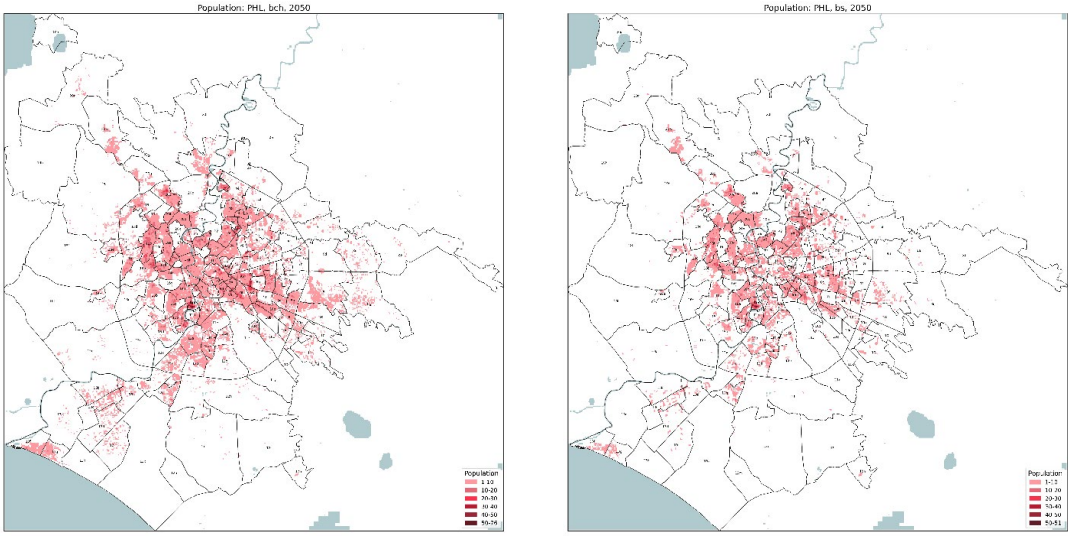
According to the *benchmark scenario* (Fig. 5.4.2), by 2050 the Bangladesh group will be surprisingly diffused also in many affluent areas of the City centre and Urban periphery (*Eroi* and *Colli Portuensi*). The level of concentration in the neighbourhoods *Esquilino, Torpignattara* and *Marconi* will continue to be very consistent, but other highly concentrated districts will emerge in the eastern Urban periphery, such as *Gordiani, Centocelle, Don Bosco* and *Appio Claudio*. In the *baseline scenario*, the main areas of concentration of Bangladeshis will continue to be limited to the so-called "Banglatown" (Pompeo 2011).

Figure 5.4.2. Distribution of foreigners from Bangladesh by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



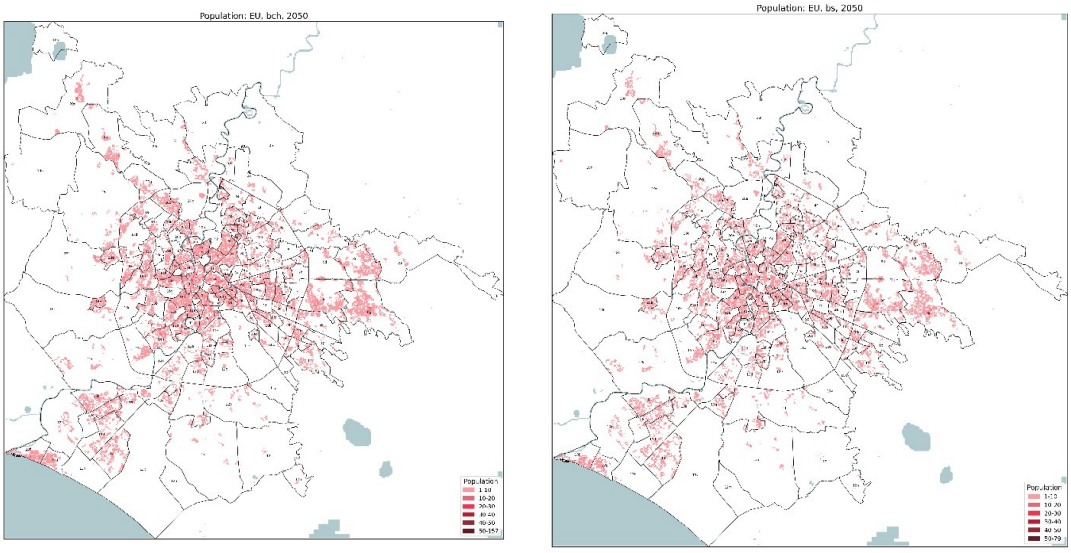
According to the *benchmark scenario* (Fig. 5.4.3), by 2050 the Filipinos group will be more spread than in 2020 in the City centre (Centro Storico and Esquilino), the Urban periphery and also in the Outer periphery (Torre Maura and Ostia). Some neighbourhoods of the Urban periphery (Parioli, Tomba di Nerone, Marconi and Primavalle) will continue to be those with the highest concentration. Also in this case, the baseline provides a future perspective with little change compared to 2020.

Figure 5.4.3. Distribution of foreigners from the Philippines by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



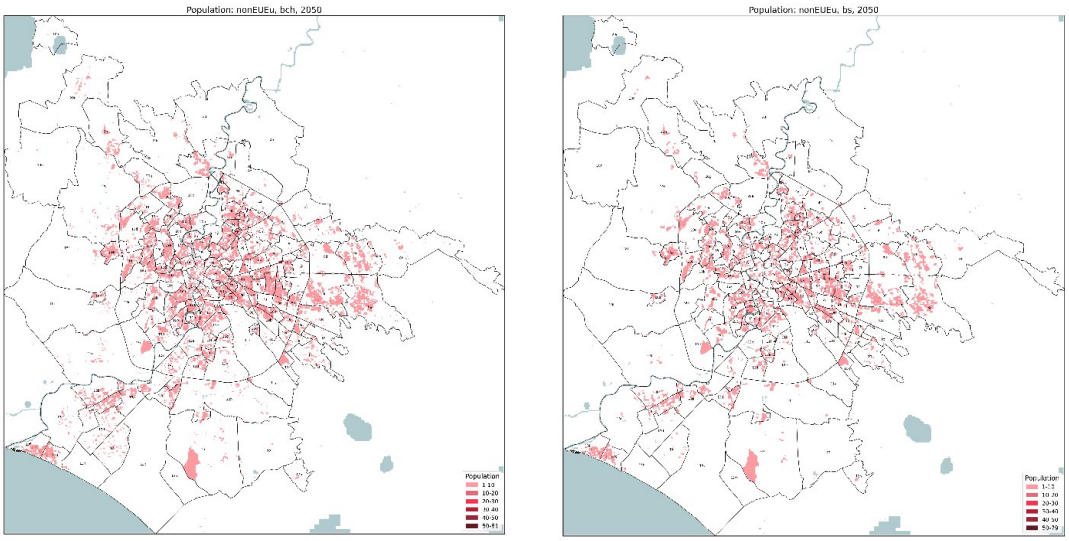
Among the selected groups, the EU group will continue to show the least growth according both the *benchmark* and the *baseline* scenarios (Fig. 5.4.4). The two scenarios agree in predicting a distribution similar to today's by 2050, without large levels of concentration and with a marked dispersion also in the Outer periphery.

Figure 5.4.4. Distribution of EU foreigners by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



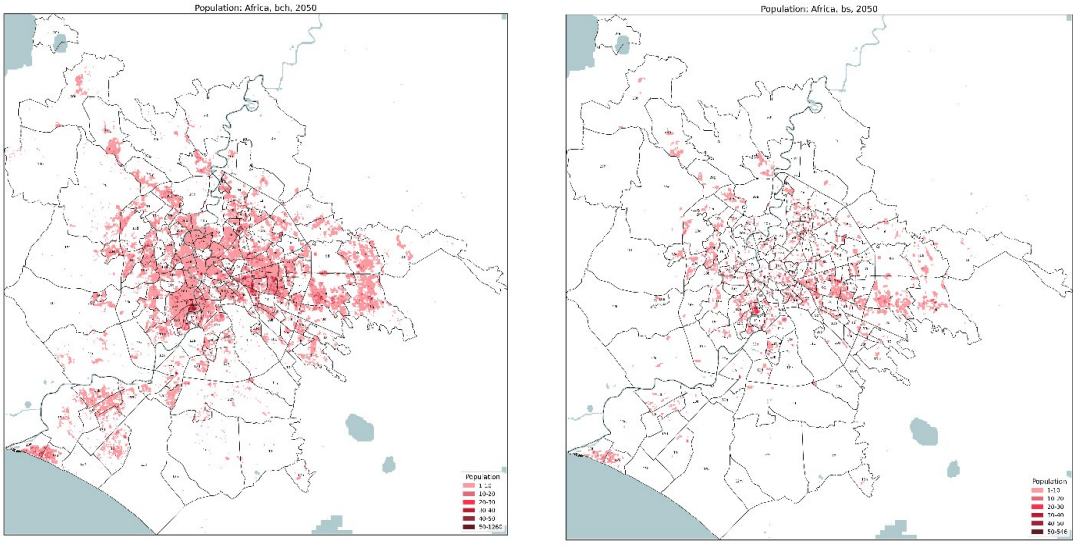
The non-EU European foreigners will increase slightly in the benchmark scenario. According to both the scenarios, they do not show particular concentration in any districts of Rome by 2050 and seem to maintain the current settlement pattern with a high level of peri-urban distribution (Fig. 5.4.5).

Figure 5.4.5. Distribution of Non-EU European foreigners by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



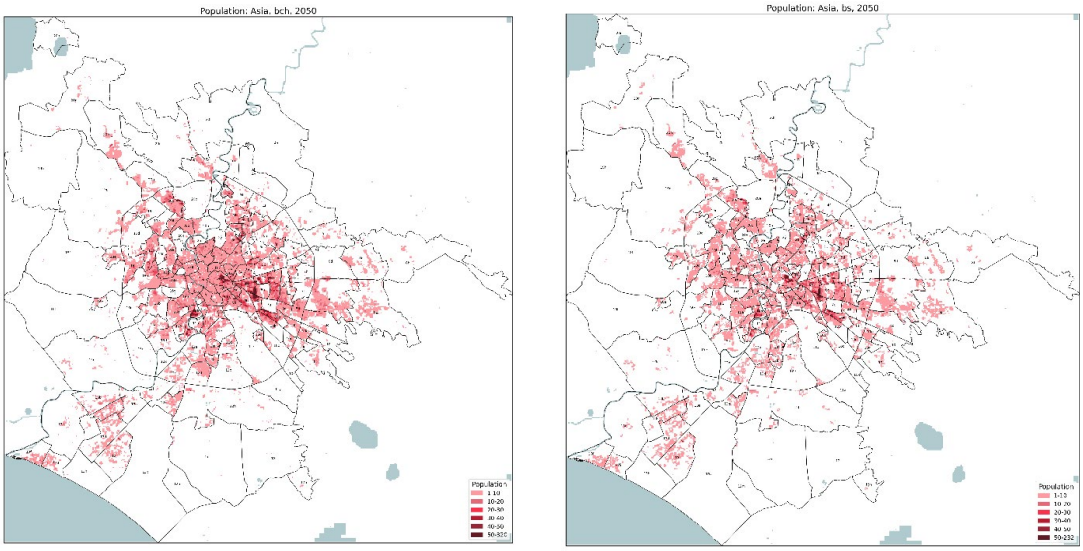
The future distribution of the African group in Rome will be very different according to the two scenarios (Fig. 5.4.6). The *baseline scenario* presents a settlement model by 2050 very similar to the current one, with a concentration in some less affluent neighbourhood of the Urban periphery (*Centocelle, Marconi* and *Primavalle*) and a very limited presence in the rest of the city. According to the benchmark scenario the African group will increase significantly and spread surprisingly in many affluent neighbourhoods of the City centre and Urban periphery, maintaining the high concentration levels in the eastern Urban periphery.

Figure 5.4.6. Distribution of foreigners from Africa by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



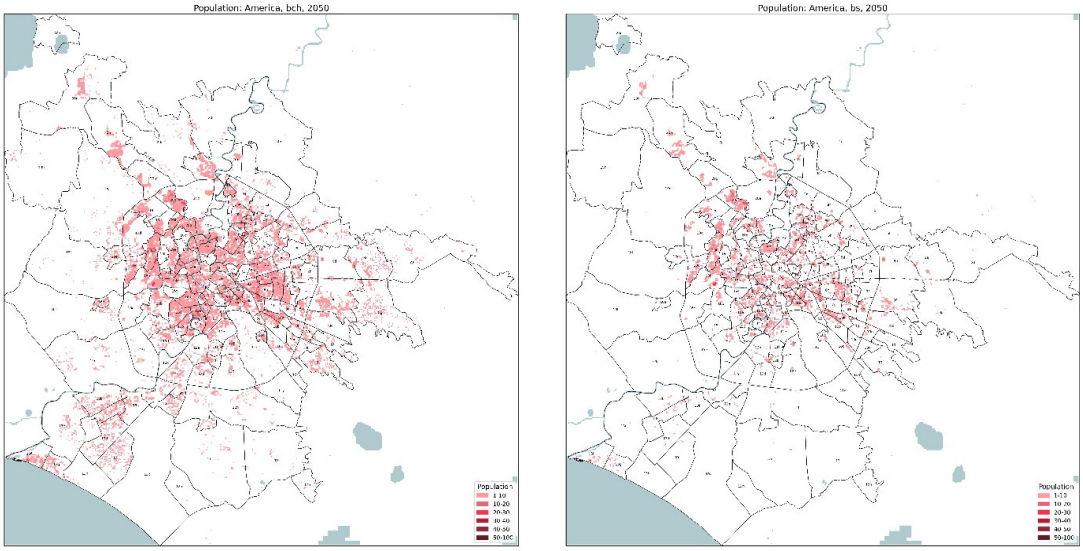
According to the *benchmark scenario*, the Asian group will continue to be highly concentrated in the eastern periphery (*Torpignattara, Centocelle* and *Don Bosco*) and at the same time it will spread to many neighbourhoods of the City centre and Urban periphery (Fig. 5.4.7). The settlement pattern of the Asians will be characterized by a strong presence in the urban core and by a low concentration in the Outer periphery. According to the baseline scenario the Asian group will maintain its high concentration in the eastern Urban periphery.

Figure 5.4.7. Distribution of foreigners from Asia and Oceania by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



According to the *benchmark scenario*, by 2050 the American group will be more diffused in the City centre and in the Urban periphery (Fig. 5.4.8). There will be a particularly high concentration in the western neighbourhoods Val Cannuta and in the southern districts Marconi and Ostiense. According to both scenarios, the Americans will continue to be present above all in the urban core of Rome.

Figure 5.4.8. Distribution of foreigners from the Americas by grid cell in Rome in 2050 by the benchmark (left) and baseline (right) scenario.
Source: own calculations.



In the *benchmark scenario* (Tab. 5.4.2), compared to what was observed in 2020, the dissimilarity index will decrease sharply for Bangladesh and Filipino groups, more slightly for Romanian, African and American, while it will increase surprisingly for the EU group. According to the *baseline scenario*, the reduction in dissimilarity will be observed only for Bangladesh and Filipino groups. The EU and American groups will increase in dissimilarity over the period 2030-2050, while the values of the other groups will remain basically unchanged.

Table 5.4.2. Dissimilarity Index for foreigners and its subgroups in Rome in 2030-2050 by scenario
Source: own calculations.

Scenario	Benchmark			Baseline		
Region	2030	2040	2050	2030	2040	2050
Immigrants	0.3298	0.3388	0.3478	0.3307	0.3292	0.3344
ROU	0.3798	0.3712	0.3634	0.393	0.3915	0.3961
BGD	0.3808	0.3718	0.3744	0.4677	0.4682	0.4717
PHL	0.3809	0.3604	0.3465	0.4171	0.418	0.4269
EU	0.5475	0.5329	0.5298	0.572	0.5706	0.5793
Non EU Europe	0.4168	0.4311	0.437	0.4107	0.4122	0.4173
Africa	0.4897	0.4825	0.4794	0.5423	0.543	0.5882
Asia	0.4123	0.4099	0.41	0.4757	0.477	0.4774
America	0.414	0.3765	0.3689	0.5526	0.5554	0.5622

6. Conclusion

One of the main objectives of the FUME project was to develop three-level demographic projections that would allow the impact of migration on the size and structure of Europe's population to be examined at national, regional and urban levels. The country level projections were produced for each EU Member State (see report "National level population and migration projections" – Deliverable 4.3). We then produced regional models consistent with the national models for Denmark, Italy, the Netherlands and Poland (see the report "Regional migration and population scenarios" – Deliverable 4.4). The results of these projections formed the basis for city level projections for Amsterdam, Copenhagen, Krakow and Rome. In the course of this scientific endeavour, we were able to create a set of projection models and tools that can be used in decisionmaking at different levels of administrative division.

One of the key achievements is the production of population estimates and projections by foreign status for cities, not aggregated at city level, but at a much more disaggregated level – in our case 100 x 100 meter grid cells – which allows decision-makers to use the data in a very flexible way (e.g. by aggregating to any administrative level, or by creating individual neighbourhoods for each city resident). To achieve this, we have used cutting-edge methods such as machine learning. We have collected the most spatially detailed data currently available. The harmonised set of historical data and results of multi-scenario demographic projections allows researchers to study not only past spatial distribution, but also possible futures of spatial processes in cities under different national and regional scenarios; not only those related to population and migration (e.g., changes in the size and structure of mobility flows), but also scenarios of urban development (e.g., investments in infrastructure, housing, transport). To our knowledge, this is the first such detailed and complex approach.

In this report we have focused on one of the possible applications of this approach, namely the analysis of residential segregation at the city level. We carried out an in-depth study of historical data for Amsterdam, Copenhagen, Krakow and Rome, using a range of measures at grid cell and neighbourhood level. A similar approach was used to analyse projected data from two scenarios.

The important first conclusion is that despite significant differences in size, foreign population structure and migration history, residential segregation measured using grid cell level data is very similar in the three cities considered – Amsterdam, Copenhagen and Rome. The outlier here is Krakow, with a very short period of recent immigrant influx and a small number of migrants. But even in this case, residential allocation of migrants is relatively even across the city, with a downward trend in the dissimilarity index.

Second, our projections show a rather moderate impact of national and regional migration trajectories on residential segregation in cities. Even very extreme scenarios – such as the baseline and benchmark – do not have a significant impact on long-term residential segregation. Regarding the analysis of future segregation patterns, it should be noted that this analysis is based on model outputs that represent only one possible realisation of the future distribution of migrants for a given scenario and city. As discussed in Deliverable 5.4, the model cannot consider all factors affecting migrants' residential choices. Moreover, training the model on data from the last few decades where some of the migrant groups are only represented with very low numbers can have a sideeffect of producing very even distributions of these groups across the city. While this continues a trend of decreasing dissimilarities in our case study cities, these initially small migrant communities might also concentrate in specific neighbourhoods as they grow in numbers, thereby increasing segregation.

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