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ARE PREFABRICATED PANEL HOUSING ESTATES DIFFERENT? DEMOGRAPHIC TRENDS OF BRNO HOUSING ESTATES IN THE 21ST CENTURY.

JSOU PANELOVÁ SÍDLIŠTĚ JINÁ? DEMOGRAFICKÉ TRENDY BRNĚNSKÝCH SÍDLIŠŤ V 21. STOLETÍ.

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Klíčová slova:
Panelová sídliště, demografické trendy, Brno, vzdělanost, index stáří

Abstract:
The development of housing in Czech cities in the second half of the 20th century was significantly influenced by the period of socialism. Until the end of the 1980s, prefabricated panel housing estates were built, which still form a very distinctive element of the urban structure of cities. What is the real development of the population in these housing estates, what is its potential and what can it mean for the future? The aim of the article is to find answers to these questions based on the analysis of trends in the development of demographic parameters of selected housing estates in the post-industrial city of Brno, which can be a good example of a continuously transforming city without major social upheavals. The analysis of the housing estates is compared with different reference locations (the historic core, the 19th century buildings around Veveří Street and Cejl Street), and then with the whole city of Brno and the Czech Republic. The article works with data obtained from the 2001, 2011 and 2021 censuses, traces the trend in population development, the ageing of the population expressed as a percentage of the population aged 65+ to the population aged 0-14 (the so-called age index) and the trend in the development of education, specifically the proportion of people with more than primary education. Demographic indicators can reflect the attractiveness of housing for different groups of residents in a particular location and can indicate its future development. Most of the monitored housing estates reflect some trends in the development of the demographic structure of the city of Brno – the growth of education and the ageing of the population after 2001 (in the city it lasted until 2011). In this sense, housing estates represent a rather standard residential structure with all its manifestations and needs. The representation of people with higher education than primary education in the settlements in 2021 was also approximately the same as the Brno average and similarly for the other reference locations, but overall, always slightly higher than the national average. A negative phenomenon is that the population in most of the monitored housing estates is steadily decreasing compared to the city of Brno. It confirms the good, different position of the Lesná Housing Estate, which in its demographic development is more similar to two selected locations in the city centre – around Veveří Street and the historical centre.

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Abstrakt:
Vývoj bydlení v českých městech ve 2. polovině 20. století byl výrazně ovlivněn obdobím socialismu. Do konce 80. let vznikala panelová sídliště, která dodnes tvoří velmi výrazný prvek urbanistické struktury měst. Jaký je reálný vývoj populace v těchto sídlištích, jaký je jeho potenciál a co může znamenat pro budoucnost? Cílem článku je nalézt odpovědi na tyto otázky na základě analýzy trendů vývoje demografických parametrů vybraných sídlišť v postindustriálním městě Brna, které může být dobrým příkladem průběžně se transformujícího města bez zásadních sociálních zvratů. Rozbor sídlišť je porovnáván s odlišnými referenčními lokalitami (historické jádro, zástavba z 19. století okolo ulice Veveří a ulice Cejl), dále pak s celým městem Brnem a také Českou republikou. Článek pracuje s údaji získanými ze sčítání obyvatel v letech 2001, 2011 a 2021, sleduje trend vývoje počtu obyvatel, stárnutí populace vyjádřené procentuálním poměrem počtu obyvatel ve věku 65+ vůči počtu obyvatel ve věku 0-14 let (tzv. index stáří) a trend ve vývoji vzdělanosti, konkrétně zastoupení osob s vyšším vzděláním než základním. Indikátory demografického vývoje mohou odrážet atraktivitu bydlení pro různé skupiny obyvatel v konkrétní lokalitě a mohou naznačovat její budoucí vývoj. Ve většině sledovaných sídlištích se odráží některé trendy vývoje demografické struktury města Brna - jedná se o růst vzdělání a stárnutí populace po roce 2001 (ve městě trval do roku 2011). V tomto smyslu sídliště představují spíše standardní rezidenční strukturu se všemi jejími projevy i potřebami. Zastoupení osob s vyšším vzděláním, než základním bylo v sídlištích v roce 2021 také přibližně stejné jako průměr Brna a obdobně i u ostatních referenčních lokalit, celkově ale vždy mírně vyšší jako celostátní průměr. Negativním jevem je, že počet obyvatel ve většině sledovaných sídlištích oproti městu Brnu stabilně klesá. Potvrzuje se dobré, odlišné postavení sídliště Lesná, které se svým demografickým vývojem podobá spíše dvěma vybraným lokalitám v centru města – okolí ul. Veveří a historickému centru.

1. Introduction

In many Czech cities in the modern period of history, similar urban development took place, differing more in the extent than in the originality of building interventions. This is one of the reasons why we can find several recurring types of urban structures used for housing. In addition to the growing structure of historic cores, these are mainly 19th century block housing, 20th and 21st century apartment buildings of various spatial forms, neighbourhoods consisting of single-family houses, and also numerous loosely arranged prefabricated housing estates from the socialist period of the second half of the 20th century (Kopáčik et al., 2021). The advantages, disadvantages and evolution of different urban structures and concepts at the scale of entire cities have been discussed in many studies (Neuman, 2005; Hirt, 2007; Sýkora et al., 2000).
This article focuses on a specific urban structure – the prefabricated panel housing estates, which are home to approximately 30% of the total population in the Czech Republic (Czech Statistical Office, 2024), a very large group of people. Panel housing estates also form a distinctive spatial type of urban structure, sometimes dominating the outskirts of cities. In the socialist period, housing construction within the framework of the centrally planned economy was concentrated in the intensive construction of housing estates, whose capacity fulfilled the basic requirement of the then society to offer housing to the growing number of urban residents. From an urban planning point of view, these are residential complexes based on modernist concepts of free-standing development.

After 1989, there was an intense debate about the future of prefabricated panel housing estates, reflecting the fear that housing estates would become socially excluded localities (Medková,

2019), mainly due to the assumption that housing estates would not be able to compete with the supply of diverse, high-quality housing in new flats and family houses. However, what is the current social situation in housing estates, if we base the answer on real demographic data from the 21st century? This article examines the situation using the example of the post-industrial city of Brno, which may be an example of a well-transforming city without major social upheavals affecting its development.

Like many authors, we assume that the quality and affordability of housing is reflected in the demographic structure of the population and its development trends. The analysis of population structure in the context of urban development is the focus of a number of recent studies focusing on Europe (Terama et al., 2019), foreign cities (Salvati et al., 2019) or Czech regions more broadly (Burian et al., 2020). This article analyses demographic data at the level of individual, selected prefabricated panel housing estates.

Its objective was to analyse demographic trends in Brno's prefabricated panel housing estates in the 21st century. The objective of the analysis is to identify trends that may indicate past and suggest future development of the housing estate. Demographic trends in housing estates are compared with other residential areas—namely, the Veveří district around the street of the same name, the historical center, the area around Cejl Street, as well as with the city of Brno and the Czech Republic. The demographic structure of prefabricated panel housing estates was originally the result of one massive migration wave implemented in a short period of time decades ago and in this sense was not the result of natural development. The question is whether the structure has stabilised and diversified and is therefore a standard, socially sustainable urban structure with all its manifestations and needs. According to some of our previous research, the level of satisfaction of residents in Brno housing estates is at a relatively good level, comparable to other residential areas in Brno (Kopáčik, 2021; Wittmann et al., 2017). We can check whether this satisfaction corresponds to the demographic structure of the population. The ambition of this article is not to analyse demographic parameters from a sociological perspective.

2. Research methods, data and analysed areas

2.1. Methodology and data

The article analyses data obtained from the database of the Czech Statistical Office (the data was obtained in 2024), specifically information from the population censuses conducted in 2001, 2011 and 2021. It concerns the population, population ageing expressed as a percentage of the population aged 65+ in relation to the population aged 0-14 (the so-called age index) and education, specifically the representation of people with higher education than primary education. The data collected from individual locations, the city of Brno, and the state have been transformed into graphs that clearly display development trends and are compared with each other.

The evolution of the population can indicate the attractiveness or decline in the attractiveness of a given area (unless changes are caused by some external factors, such as the redevelopment of the housing stock). The age structure of the population is also analysed, where the balance of the age structure is considered positive (Kopáčik et al., 2019). If the number of permanent residents decreases and children are not sufficiently represented in the locality, the attractiveness of housing for a specific population group (families with children) is low. The predominant number of seniors indicates an aging neighbourhood. Such a location will become depopulated over time and may be used for temporary rental housing (Šmídová et al., 2023).

Another important indicator is the representation of the population with higher education than primary education, the so-called ISCED3 (Eurostat, 2016), which influences the economic potential of the population. The latter can to some extent indicate the overall quality of housing in the urban population. It is assumed that more educated (potentially wealthier) residents have more choice in their housing choice and would not stay in a locality in the long term if it was unsafe or otherwise socially, economically or environmentally unacceptable.

2.2. Analysed areas

The areas in question are defined by the boundary of the prefabricated panel housing estates. The boundary is defined on the basis of the so-called statistical districts defined by the Czech Statistical Office. Only those statistical districts containing only prefabricated panel houses were included. Thus, there is no distortion in the form of new construction. The analysed housing estates were built at different times and therefore the first residents moved in at different times. This may affect the comparative basis of the age structure. Therefore, the article is based mainly on trends in the development of demographic parameters.

These are the following prefabricated panel housing estates: Komárov, Vinohrady, Kohoutovice, Starý and Nový Lískovec and Lesná. The exact boundary is defined on the Brno city plan below: Lesná Housnig Estate Construction between 1962-1970, population at last census: 11,890. Urban designers/architects: František Zounsek, Viktor Rudiš, Miroslav Dufek, Ladislav Volák (Stavoprojekt)

Lesná is a unique housing estate with a unique urban concept of living in green areas and a long-established good image. The composition of the urban structure is located on gentle southern slopes. The park arrangement “Devil’s Gorge” complements the housing estate and functions as a pedestrian path and element connecting almost all adjacent streets. Traffic is served by a ring road that creates a large, quiet pedestrian zone. A complementary network of streets serves individual houses. Civic amenities are in low-rise prefabricated panel buildings in the 6 x 7.2m module. The area of the Lesná Housing Estate is approximately 1.539 km² - of which the built-up area of the houses is 0.153 km², i.e., 9.9% of the area is built up with buildings.

Figure 1: *Boundary of the Lesná Housing Estate*

Source: Google Maps, ČUZK

Kohoutovice Housing Estate Construction between 1970-1981 and 1985-1986, population at last census: 9,215. Urban designers/architects: František Kočí, Jaroslav Černý, Jaromír Kurfürst (9)
The housing estate is built mainly around the backbone road "Libušina třída", which bypasses the original development. The houses are always in the T06B construction system and have 5 to 13 storeys. The civic amenities are located in the lower part of the development (the exception is the Grand Prix restaurant). The area of the Kohoutovice Housing Estate is approximately 1.102 km² - of which the built-up area of the houses is 0.09 km², i.e., 8.2% of the area is built up with buildings.

Figure 2: *Boundary of the Kohoutovice Housing Estate*

Source: Google Maps, ČUZK

Starý Lískovec Housing Estate Construction between: 1974-1981, population at last census: 10,256. Urban designers/architects: Jaroslav Ryška, Pavel Krchňák, Mečislav Borecký, Antonín Mikulec, Jaroslav Pípa, Ladislav Volák, Roman Zajíc Starý Lískovec is connected to the nearby Bohunice Housing Estate. In the past, these housing estates even shared the name "Czechoslovak-Soviet Friendship Housing Estate". The housing estate is located between very busy stretches of roads (the D1 motorway and the Bítešská expressway, but these roads do not serve the housing estate). The area of the Starý Lískovec Housing Estate is approximately 0.924 km² - of which the built-up area of the houses is 0.089 km², i.e., 9.6% of the area is built-up with buildings.

Figure 3: *Boundary of the Starý Lískovec Housing Estate*

Source: Google Maps, ČUZK

Nový Lískovec Housing Estate Construction between: 1980-1985, population at last census: 8,869.Urban designers/architects: František Kočí, Miroslav Kolofík The housing estate is divided by a four-lane road which is lined predominantly with B70 houses (4 and 8 storeys) and supplemented by T06B local houses (also 4 to 8 storeys). This road is the backbone road from which other parts of the housing estate are subsequently served. The population of Nový Lískovec is characterised by a larger number of people in the youngest age group (under 29) and in the 45-59 age group. At the same time, there is a higher proportion of families with children. The part of Nový Lískovec called "Stone Hill" is characterised by a higher proportion of cooperative flats than most parts of the city. The area of the Nový Lískovec Housing Estate is approximately 0.631 km² - of which the built-up area of the houses is 0.070 km², i.e., 11.1% of the area is built-up with buildings.

Figure 4: *Boundary of the Nový Lískovec Housing Estate*

Source: Google Maps, ČUZK

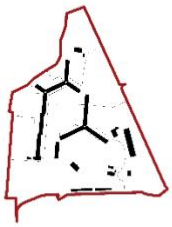
Vinohrady Housing Estate Construction between: 1983-1988, population at last census: 11,666. Urban designers/architects: Miroslav Dufek, Aleš Jenček, Jan Doležal, Pavel Plšek, Vít.Vaněk The population of Vinohrady has a higher proportion of people in the youngest age group (under 29) and a higher number of multi-person households (more than three people in an apartment). Within the so-called "basic settlement units" defined by the CSU, Vinohrady is the largest settlement unit with almost 12,000 inhabitants. The shape of Vinohrady is to some extent determined by the collectors – it is an orthogonal network of streets, following the model of Lesná, where the housing estate is complemented by a ring road. The area of the Vinohrady Housing Estate is approximately 0.717 km² - of which the built-up area of the houses is 0.106 km², i.e., 14.8% of the area is built-up with buildings which is the most densely built-up of all the housing estates analysed.

Picture 5: *Boundary of the Vinohrady Housing Estate*

Source: Google Maps, ČUZK

Komárov Housing Estate Construction between: 1985-1987, population at last census: 2,004. Urban designers/architects: Jana Lakomá The development in Komárov is one of the last prefabricated panel developments in Brno. The housing estate was built on the land of the original low-rise development in an unusual layout. See the maps below. The complex consists of only one type of house – an eight-storey panel house type T06B. The public space is arranged in semi-enclosed squares and there is minimal traffic within the housing estate. However, the development is close to a busy road and industrial facilities, causing higher noise and air pollution. The population of Komárov is more than 80% adults (15-64 years), which is above average both among the housing estates and in the statistical areas of Brno. The majority of residents (74%) live in rented housing. The area of the Komárov Housing Estate is approximately 0.135 km² - of which the built-up area of the houses is 0.011 km², i.e., 8.1% of the area is built-up with buildings. At the same time, it can be noted that this housing estate has a very small area and is not suitable for comparing the density of development with others.

Picture 6: *Boundary of the Komárov Housing Estate*



Source: Google Maps, ČUZK

It can also be stated that the housing estates offer good amenities with services, kindergartens and primary schools, basic health care, good transport connections for individual and public transport, are not burdened by high crime rates (POLICE OF THE CZECH REPUBLIC, 2024) and are more affordable compared to newly offered housing.

For comparison and to complete the context, the data for the locality around Cejl Street with a significant Roma population, the locality near Veveří Street in the broader city center (both with apartment buildings from the second half of the 20th century), the historical core of Brno (the cadastral area of "Brno City" outside the surroundings of Špilberk Castle), the average for the city as a whole and the average data for the Czech Republic were also analysed.

3. Results

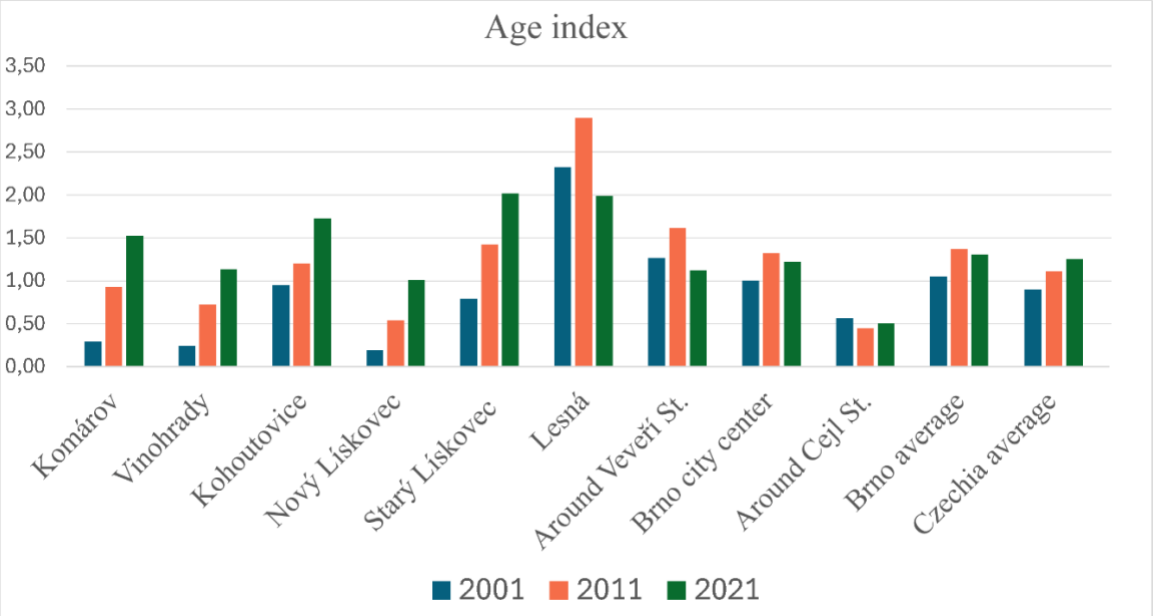
3.1 Graphs and commentar

Statistical data (Czech Statistical Office, 2024) were converted into the form of the following graphs and maps.

The number of inhabitants is decreasing in the monitored housing estates. The exception is the Lesná Housing Estate, where the population is more or less stable.

The population in the housing estates is ageing, in some places the age index even reaches 2 (Starý Lískovec). Compared to the Brno and Czech averages in 2021 (1.31 and 1.27), however, some housing estates show better parameters (Vinohrady, Nový Lískovec). In the Lesná Housing Estate, where the age index was high in 2011 (about 2.8!), the trend has been reversed - i.e., a positive development.

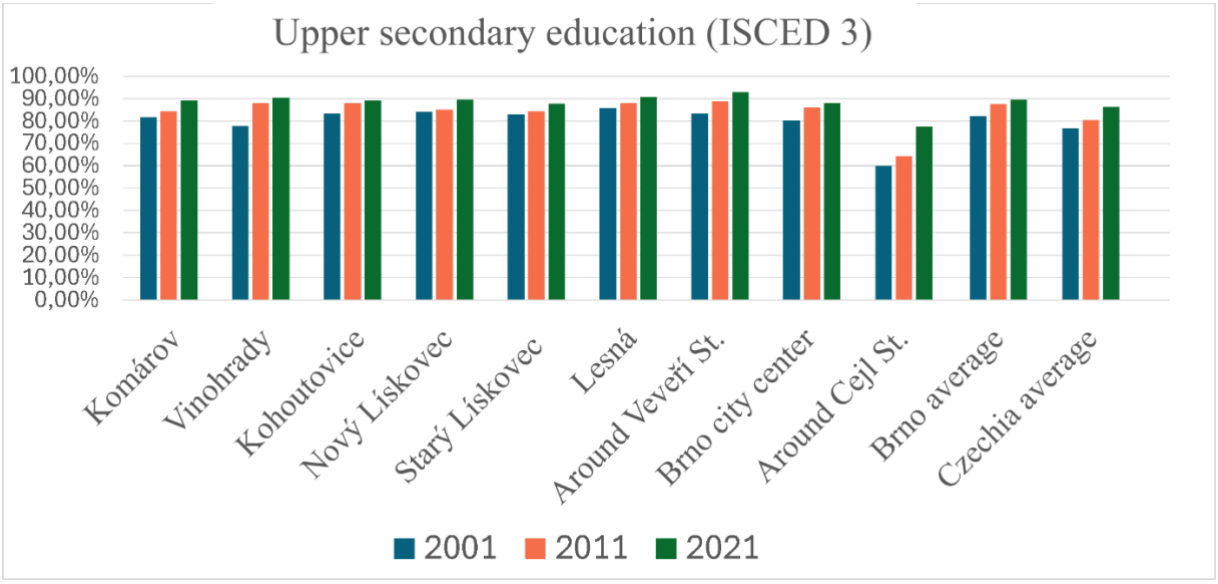
Chart 1: *Age Index Chart - Comparison of Localities*



Source: author's analysis

In the analysed housing estates, the rate of representation of residents with higher education than primary education (the average for the surveyed housing estates is 89.48%) is approximately the same compared to the city of Brno (89.28% in 2021) and slightly higher compared to the national average (86.09% in 2021).

Chart 2: *Upper Secondary Education Chart - Comparison of Localities*



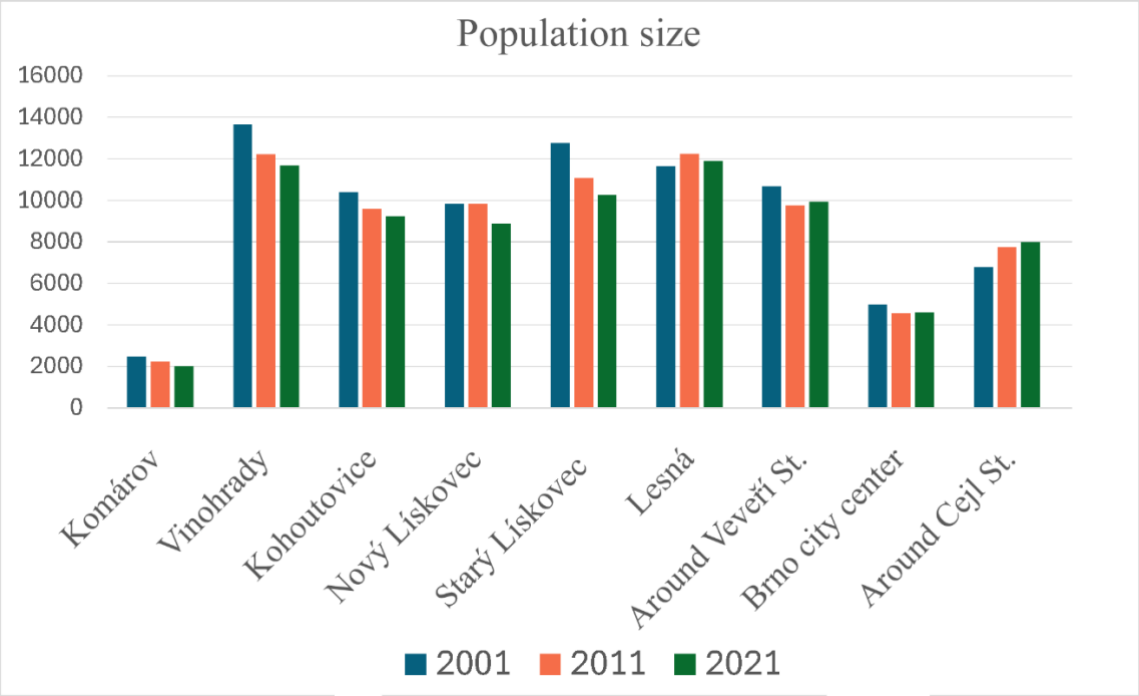
Source: author's analysis

For the housing estates (with the exception of Lesná), the city and the state, the trend of growth of both indicators is common – the age index and education are growing (respectively, there is a slight decrease in the age index in the case of Brno between 2011 and 2021).
The Cejl area is quite different in two parameters, it is characterized by a more or less stable, very low age index (about 0.5!) indicating a large representation of children and a lower educational attainment of the local population (ISCED 3: about 77% in 2021) compared to the city and the state, although the latter has an increasing tendency.

The historic core and the Veveří area are similar in many ways. Apart from their geographical location (city centre), they are characterised by an increasing trend in education since 2001 and a decreasing age index towards 1 since 2011, which indicates a positive development. Another positive phenomenon is the fact that the population in the localities has stabilised after 2011 (the historic core) or slightly increased (Veveří).

The population of Brno has been growing steadily over the last 20 years. Between 2001 and 2021, the population increased by about 6% to 398,510 in 2021 (Czech Statistical Office, 2024). In the city of Brno, the age index increased until 2011, after which it slightly decreased. The age index was 1.31 in 2021 – this is roughly the national average in that year. At the level of the Czech Republic, there was a continuous increase in the age index from 2001 to 2021, up to a level of 1.27 in 2021.

Chart 3: *Population Size Chart - Comparison of Localities*



Source: author's analysis

3.2 Discussion

The attractiveness of a particular urban structure, a prefabricated panel housing estate, is indicated in this article by the demographic parameters of the area. These are the resultant reflection of many other factors that have not been consistently discussed in the article, even

though they are at a good or acceptable level. These include safety, transport accessibility and the level of amenities. Other potential factors also need to be considered for a more rigorous analysis of the attractiveness of housing estates. One of these is the city's support for housing, which may be the subject of further detailed investigation. Various forms of housing ownership, including municipal ownership, can be analysed (Šmídová, 2023). The effect of real estate prices and the privatization of apartments also needs to be analysed. This will be the aim of another follow-up study.

It is also important to note that the analysis works with statistical data that are based on the number of permanent or usual residents. There are also people residing in the housing estaes who are reported to reside elsewhere. These are students, people travelling for work, foreigners without permanent residence, including refugees, and so on. Therefore, the real situation may be slightly different and the number of people present in the locality is slightly higher (this difference is greatest in the historic core). This is also shown by the results of earlier surveys based on mobile phone movements (Kopáčik et al., 2021).

Therefore, the results obtained rather suggest certain trends and principles that should be verified in further case studies. The number of inhabitants of the housing estates is decreasing, with the exception of Lesná, where we observe a rather balanced tendency, which may reflect its urban and especially environmental quality (living in green areas) and the resulting good image. This location is popular among residents, as some of our recent satisfaction surveys suggest (Wittmann et al., 2017). In terms of the development of the age index between 2001 and 2011, the analysed housing estates uniformly followed the trend of the city – i.e., an ageing population. Unlike the city, their ageing, with the exception of Lesná, continues to occur after 2011. Here, the trend in the index reversed in 2011, but based on a higher base. The age index does not have a comparable level in 2021, in some housing estates it is higher (up to about 1.5 – 2.0), in some lower (up to about 1.0) than the average for the whole city (1.31). A clearly positive phenomenon is the steadily increasing trend of the level of education of the residents of the analysed housing estates in 2021 even slightly exceeding the citywide average.

The other analysed areas (Veveří, the historic core, Cejl) also provide interesting comparisons. The historic core and the Veveří area are similar to the Lesná Housing Estate in many ways, which confirms its exceptional position. Between 2011 and 2021, the age index has decreased in these localities and the population is stable or slightly increasing. The Cejl area cannot be well compared with the others due to a completely different social structure.

In contrast to these findings, international studies express general warnings about the unfavourable development of housing estates. However, they do not rely on detailed analysis of data at the level of individual localities and cannot be considered as clearly relevant to our results. (Haase et al., 2009) predict a change in trends of inner-city development in Central Eastern Europe from long-term decline to repopulation, rejuvenation and increasing housing mobility. Indeed, there are some indications that housing in revitalised parts of inner cities may become prestigious, and conversely it will be the poorer classes that will be pushed to the margins (Hochstenbach and Musterd, 2018). On the other hand, it should be acknowledged that our results also suggest such a possible future development; prestigious housing in the inner city may only be rivalled by the Lesná Housing Estate.

It should also be added that the demographic structure of the urban population is currently significantly affected by migrants and war refugees, especially from Ukraine. Only when the

social and economic situation has stabilised will it be possible to carry out a further analysis of developments in hindsight, which will certainly be very desirable.

4. Conclusion

In the analysed prefabricated panel housing estates in Brno, a similar trend of demographic development can be observed in the 21st century, with population decline. This is probably due to the supply of other quality housing, which is, however, not so financially and capaciously available as to cause a drastic depopulation of the housing estates.

Demographic trends in most localities show that the population is also ageing. However, not yet on such a scale that housing estates are becoming socially unsustainable. This is due, among other things, to the low starting base of the age index. Most of the monitored housing estates reflect some long-term trends in the development of the demographic structure of the city – the aforementioned ageing of the population, but also a positive trend in the growth of the educational level of the population (in Brno these trends occurred between 2001 and 2011, after which they are rather stable). Compared to the city, the comparable share of residents with more than primary education, i.e., those who have a common choice in choosing housing, may indicate that Brno's housing estates still offer an environmentally, socially and economically good environment for living.

Brno's housing estates represent a rather standard residential structure with all its manifestations and needs. It is therefore necessary to adapt the character of housing estates to the local community and to further direct it, to support the social development of all generations, to support private and public investment, to offer modern amenities for all age groups, quality public spaces and, for example, parking facilities. It is desirable to reverse the problematic trend of ageing. However, other drastic approaches do not seem to be needed at present (e.g., gentrification interventions). Housing estates already offer good amenities, good transport accessibility and are not burdened by high crime rates and are affordable compared to new buildings. They therefore have development potential that can be built upon.

Some housing estates may have good environmental quality and a long-lasting image, such as the Lesná Housing Estate. These factors may manifest themselves in a different, positive demographic development, which in many ways may resemble some prestigious city centre locations.

The advantage of living in Brno is still good accessibility to cultural institutions, health and educational facilities and many other city activities. The image of the city remains at a good level, it is perceived as rather attractive and this potential should be exploited. This also applies to Brno's prefabricated panel housing estates.

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