Migration Flows through the Lens of Human Resource Ageing

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Abstract

Background: Ageing and shrinking of the European population influence the shrinking of central places and the hinterland of cities in a spatial structure. Migration also influences the shrinking or growing of spatial units. Various factors influence migration and, thus, spatial units' demographic, social and economic stability. The age structure of citizens in a spatial unit may change not only due to population ageing but also because these factors influence the migration flows of different cohorts differently, which has not been studied so far. **Objectives:** We used data on internal migration between Slovenian municipalities in 2018 and 2019 to develop a cohort-based spatial interaction model to estimate future inter-municipal migration. **Approach:** In a spatial interaction model, we analyzed differences in the attractiveness and stickiness of municipalities for different cohorts, focusing on those over 65 who may wish to prolong their working status. We also tried to answer the question of how to mitigate shrinkage processes in spatial units by investigating the potential to contribute to the social value of communities. **Results:** The study's results show that the 65+ cohorts do not have the same preferences regarding the attractiveness and stickiness factors as younger migrants. **Conclusions:** The results of our study could contribute to better decisions at the national, regional, and/or local level when designing strategies for regional, urban, and/or rural development, exploring the best solutions for long-term care, and investing in appropriate networks, or considering the revitalization of rural municipalities.

Keywords: attractiveness, stickiness, ageing, gerontology, social value, migration, gravity model, shrinking regions, human resources

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Introduction

Ageing Europe and shrinking regions

European cities and regions are depopulating (ESPON, 2017). The change in population density in regions is not only an important issue in terms of land consumption, the environment, and related health problems but also has an impact on the economy, as shrinking areas have fewer human resources and consume less production output, which also brings the challenge of creating social value from the activities in a region. Therefore, it also influences changes in urban and regional planning. The decline in residential density in cities is often seen as a consequence of urban sprawl as part of urbanization. However, if we look at the whole region in which an urban area occupies its central place, we see that urban shrinkage is not only the result of urban sprawl and that, in many cases, as the city shrinks, the whole region shrinks.

ESPON (2017) confirmed the thesis of Angel et al. (2010) that shrinkage dynamics are lower for larger cities (> 100,000 residents) than for small and medium-sized cities. Older studies have shown that urban sprawl is closely related to increasing land consumption per capita, i.e., higher spatial standards driven by GDP and income growth (Patacchini and Zenou, 2009), which are assumed to increase more than land prices (Angel et al., 2011). But urban sprawl is not the only case where urban areas are shrinking. The industrial transition to I4.0 and I5.0, lower fertility, and ageing human resources are also changing demographic trends (Bogataj et al., 2019a, 2019b, 2020a, 2020b; Calzavara et al., 2020). The relative number of shrinking Local Administrative Units at the LAU2 level in the EU Member States and other European Economic Area (EEA) countries over the period 2001–2011 is shown in Figure 1.

From Figure 1, we can conclude that there are nearly 41% (thirteen of the thirty-two) EU and other EEA countries where more than 40% of urban LAUs are shrinking in population, 25% (eight of the thirty-two) countries where 40% and more of medium LAUs are shrinking in demographic data. There are more than 62% (twenty of the thirty-two) EU and other EEA countries where 40% and more of rural areas are losing population. From Figure 1, we can see that the percentage of depopulated LAUs is increasing from west to east. The detailed data is aslo presented in Table 1.

In the journals indexed by the Web of Science, the keyword "shrinking city" is relatively new and was first mentioned in 2005. In the first decade of this millennium, there were only six articles with this keyword; in the second decade, another 159. The authors focus more on the renewal of industrial areas and the increase in residential areas, which is developing much faster than the demographic dynamics (Rienow et al., 2014). As pointed out in these articles, the trend towards lower population density for small, medium, and larger urban LAUs is noteworthy, considering that urban sprawl and the expansion of low-density settlements are costly for municipalities to provide public transport and other services, including care for the elderly, to affect the increase of the carbon footprint and to develop more and more land and other natural resources (Nuissl et al., 2009; Wolff et al., 2018). Wolff et al. (ibid.) also pointed out that the population has been shrinking faster in the last two decades in the post-socialist countries of Eastern Europe and the post-industrial states of Western Europe due to falling birth rates and negative net immigration, while ageing is expected to continue in the coming decades in both East and West (European Commission, 2020, 2021).

Figure 1
The relative number of shrinking Local Administrative Units on LAU 2 level in European countries (EU) and other European Economic Area (EEA) countries, 2001–2011.

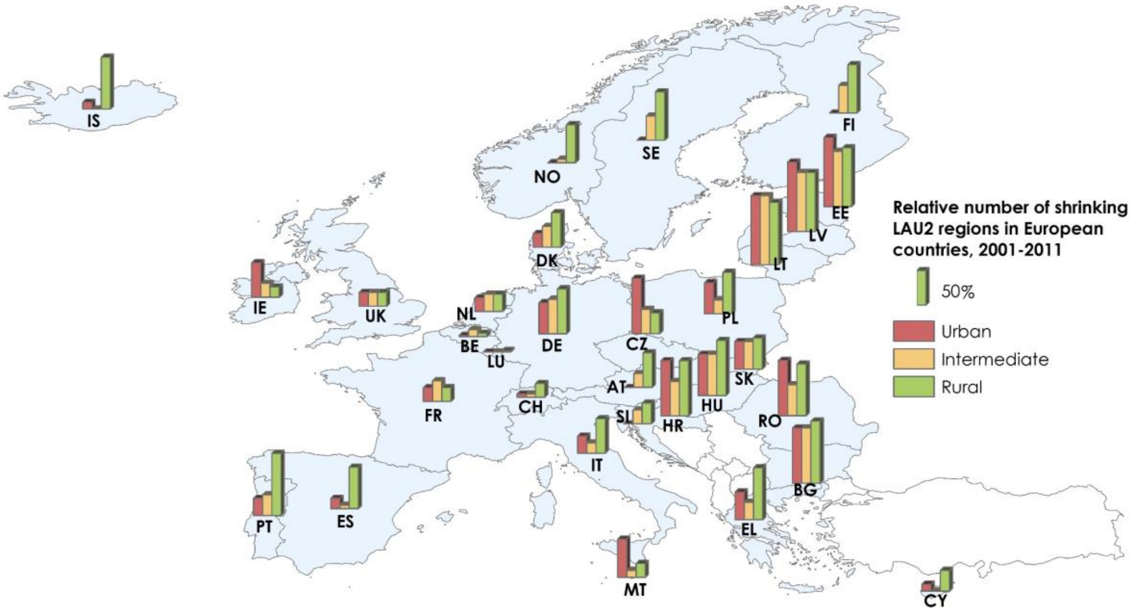


Table 1
Classification of Local Administrative Units on LAU 2 level in European countries (EU) and other European Economic Area (EEA) countries, 2001–2011

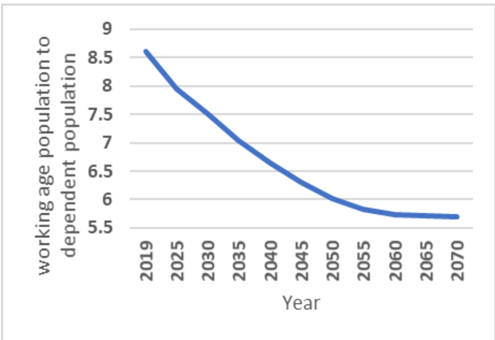
Classification	Under 20%	[20%–40%)	[40%–60%)	[60%–80%)	[80%–100%]
Urban	FI, SE, NO, AT, SI, CY, CH, BE, LU, LI IS, ES, NL	EL, PT, DK, IT, UK, FR	HU, DE, PL, SK, MT, IE	BG, RO	HR, LT, EE, LV, CZ
Number	13	6	6	2	5
%	40.6	18.8	18.8	6.3	15.6
Intermediate	IS, ES, NO, CY, CH, BE, LU, LI, IT, MT	EL, FI, PT, SE, AT, DK, SK, CZ, SI, NL, UK, FR, IE, PL	HR, RO, DE	BG, HU,	LT, EE, LV
Number	10	14	3	2	3
%	31.3	34.7	9.4	6.2	9.4
Rural	BE, LU, LI, IE	MT, CZ, SI, CY, NL, UK, FR, CH	PL, ES, NO, AT, DK, SK, IT	RO, EL, FI, DE, IS, SE	LT, EE, BG, LV, HU, HR, PT
Number	4	8	7	6	7
%	12.5	25	21.9	18.7	21.9

Source: Authors' calculation, ESPON (2017), Eurostat (2020b).

According to the baseline (BSL) of the EU population projection, the number of people in employment in Europe will fall from more than 288 million to 242 million - or even below 200 million if the no migration scenario is adopted - over the next 40 years; see Figure 2b. But it is not only the working population that is shrinking; other cohorts are shrinking too. Urban Audit - a European database for the comparative analysis of EU cities (Eurostat, 2020b) - shows that between 1996 and 2001, we lost 57% of the population of 220 large and medium-sized European cities. In addition to the almost 81% of cities in Central and Eastern European countries, many German, Italian and Spanish cities, among others, are also on the list of shrinking cities. Moreover, this dynamic has increased in the second decade of the 21st century. As Wiechmann and Pallagst (2012) noted, urban shrinkage was, for years, considered a phenomenon of suburbanization. But as already mentioned, this phenomenon should not be seen primarily as a consequence of suburbanization.

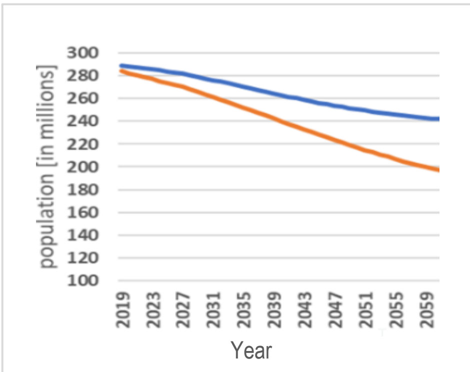
This shrinking city and region phenomenon should be analyzed in a wider spatial scope that considers migration between regions and countries and between central places and their surrounding areas. The basic idea of our approach is thus that we should look at the total number of municipalities in the analyzed area when we examine the shrinkage of their central places (see Figure 1, which shows the shrinkage of LAU2 regions, i.e., municipalities in %). As a result of the shrinkage of urban and rural areas, the EU should also consider the population outside the Schengen borders; otherwise, the difference between the blue and the orange line in Figure 2b could look like it does. The ratio between the working-age population and the dependent population in the EU is shown in Figure 2a. Figure 2b shows the projected working-age population in the EU according to two scenarios.

Figure 2a
Projection of the ratio between the working-age and cared-for populations in the EU.



Baseline scenario:
Source: Eurostat (2020a)

Figure 2b
EU Projection of the working-age population.



No Migration Scenario:
Base Line Scenario:
Source: Eurostat (2020a)

The law of spatial gravity

To consider how to curb the shrinkage of LAUs, the methodology of our research relies on the gravitational modelling approach. Initial attempts to understand regularities and patterns of spatial population flows began with the observation that this flow of people between central places and the hinterland, and at a higher level of spatial units, is analogous to the gravitational attraction between solid bodies. More migrants move between larger urban areas than smaller rural settlements. This movement is more intense between areas closer together than between areas further apart, ceteris paribus, which led to a simple mathematical model for predicting migration flows based on Newton's gravitational approach. Based on this idea, Wilson (1967, 1969) derived the family of spatial interaction formulae from entropy maximizing principles, followed by many studies.

The law of social gravity is widely applicable in population migration and commuting. However, this simple law is still being studied in many other and more complex social systems. Recently, for example, Wang et al. (2021) presented a model of free utility that helps us understand the spatial interaction patterns in complex social systems and provides a new perspective for understanding the potential function also from the perspective of spatial games where regions compete for human resources and other inhabitants. The fact is that cities and settlements increasingly have to compete for new immigrants, new human resources, and consumers of their services. Therefore, they also try to retain the old population to whom they offer services and care and expand their silver economy. Residents are looking for prospects in the municipalities they want to move to, and municipalities can compete for them to avoid unwanted shrinkage. Among the values of factors as decision variables that influence attractiveness and stickiness, the level of wages and taxes, the availability and cost of housing units, amenities, and other social infrastructure are often cited as factors that make communities more attractive (Janež et al., 2016; et al., 2019b). But recently, these have not been the most important factors in Slovenia.

Our study focuses on town centres and their retail cores to understand their role as places of consumption and employment and their ability to attract residents to come and stay in their LAU2 (community) area. As the proportion of older adults is rapidly increasing, we should consider the potential multiple roles of older people in revitalizing and rejuvenating town centres and their surrounding areas, as places are central to health and safe living for all generations (Phillips et al., 2021). Age-friendly cities as community environments also for older adults is a concept often used in gerontological studies and strategies to describe the extent to which cities and their centres, as well as their surroundings, are suitable places to grow old, i.e., 'ageing in place. The findings are increasingly stimulating debate about the silver economy of a city or region. Our research assumes that more care and investment in housing and public spaces are needed to support community and social participation for 'ageing in place, as social and environmental gerontology puts it, and that the social value of such a focus on the silver economy also needs to be assessed (Rogelj and Bogataj, 2018a, 2018b, 2020a, 2020b). For these purposes, we need to distinguish between the needs of younger and older cohorts.

Objective

We should introduce the methods to study the attractiveness and stickiness of municipalities and evaluate the strong enough factors to attract residents of different ages to the shrinking areas to achieve the desired population dynamics. It is particularly important to study the factors that significantly influence the flows of missing human resources.

The fact is that cities and other settlements are increasingly competing for new immigrants from other regions of EU countries. They must try to retain old residents and their tax revenues to invest in these municipalities' social infrastructure to increase their social value areas. While municipalities compete for the younger cohorts with better jobs and schools, better health and social services are key influencing factors for the older ones. Since these factors vary in strength for different cohorts, we should examine each separately and consider their interrelationships. This is not the case in the long list of articles dealing with the law of social gravity in academic journals. It is advisable to examine these flows and make a comparative analysis. For this purpose, we will use the same model of socio-economic gravity separately for different cohorts.

Further, since the attractiveness and stickiness factors have different values for different cohorts, we wanted to study and compare the migration flows of the three main resident cohorts separately, which is also not the case in the long list of articles dealing with the law of social gravity in academic journals. In this study, we will use inter-municipal internal migration data in Slovenia for 2018-2019 to develop a cohort-based spatial interaction model to estimate future migration between municipalities and consider policies to change trends by introducing public investment, wage, housing, and tax policies (Janež et al., 2016) and new education programs at the required levels (Grah et al., 2019, 2021; Colnar et al., 2019, 2020). To this end, it is recommended to use one of the social gravity models based on previous research findings as described in Drobne (2014), Drobne and Bogataj (2014), and Bogataj et al. (2019b), as well as in some other papers of this research group.

The spatial interaction models work empirically quite well. Many authors (Fotheringham and O'Kelly, 1989; Sen and Smith, 1995; etc.) have shown that they provide reasonable conclusions about the spatial behaviour of commuting or migration flows. They have been developed to provide a generally accepted theoretical derivation of spatial interactions and bases for local, regional, or national decision-making. Thus, by studying the variation of factors affecting migration intensity, we can find measures to mitigate the depopulation of regions and cities, which is our main objective.

In this paper, we specifically address the following research questions: How can municipal revenues, which are largely invested in the social infrastructure of the municipality, retain and/or attract human resources across different cohorts?

Methodology

The extended spatial interaction model

We study the gravitational characteristics, attractiveness, and stickiness of Slovenian municipalities separately, based on the general spatial interaction model (SIM) previously developed by Cesario (1973, 1974) and later extended by many authors, e.g., Drobne and Bogataj (2014), Drobne et al. (2019). The model is extended to include economic, housing, ageing, and municipal revenue factors, mainly used to finance social infrastructure. These factors influence the flow of three cohorts: residents under 65, between 65 and 74, and the 75+ cohort. The model helps us to answer the question of how to evaluate the influence of these factors on the shrinkage of LAU2 regions. Finally, the measures that need to be taken to achieve population sustainability in LAU2 regions are presented.

As suggested by Drobne (2014), we have introduced the normalized spatial interaction model, NSIM, (1) to estimate the influence of the factors analyzed:

$$M_{ij}^{(t)} = k\, K(d_{ij})^{\beta} \prod_r K(r)_i^{\gamma(r)}\, K(r)_j^{\alpha(r)}, \tag{1}$$

where $M_{ij}^{(t)}$ is the number of migrants in age cohort t from an origin municipality i to a destination municipality j; the age cohorts are defined as follows: t = 0–65, 66–74, 75+ is the cohort of *t-year*-old residents; k is the constant of proportionality; $K(d_{ij})$ is the coefficient of the fastest time distance over the state road network between the centre of origin municipality i and the centre of destination municipality j; $K(r)_i$ and $K(r)_j$ are coefficients of factors r in origin municipality i and destination municipality j, respectively, defined as the value of the factor in municipality i and municipality j, divided by the average value of this factor in Slovenia, as explained in Table 2; β, $\gamma(r)$ and $\alpha(r)$ are regression coefficients defined in the regression analysis.

Table 2
Migration and factors are analyzed in the normalized spatial interaction model (definitions, descriptions, and sources).

Notation	Definition	Description	Source
$M_{ij}^{(t)}$	The number of migrants of age cohort t from the municipality of origin i to the municipality of destination j.	The number of migrants of age cohort t for 2018 and 2019.	SORS (2021a)
$K(d_{ij})$	Coefficient of the fastest time-spending distance between the origin municipal centre i and the destination municipal centre j.	The ratio between the time distance for a pair of municipal centres i and j and the average time distance for all pairs of municipal centres in Slovenia for the year 2019.	SIA (2021) and authors' calculation
$K(POP_{\circ})$	Coefficient of the number of residents of the municipality.	The ratio of the number of residents in the municipality to the average factor value for Slovenia for the year 2019.	SORS (2021b) and authors' calculation
$K(UEMP_{\circ})$	Coefficient of registered unemployment rate in the municipality.	The municipality's unemployment ratio to the average factor value for Slovenia for the year 2019.	SORS (2021c) and authors' calculation
$K(GEAR_{\circ})$	Coefficient of gross earnings per capita in the municipality.	The municipality's gross earnings per capita ratio to the average factor value for Slovenia for the year 2019.	SORS (2021d) and authors' calculation
$K(NDWE_{\circ})$	Coefficient of the number of dwellings per number of residents in the municipality.	The ratio of the number of dwellings per number of residents in the municipality to the average factor value for Slovenia for 2018.	SORS (2021e) and authors' calculation
$K(PDM2_{\circ})$	Coefficient of the average price per m^2 of the dwelling in the municipality.	The ratio of the average price per m^2 of the dwelling in the municipality to the average factor value for Slovenia for the years 2018 and 2019.	SMARS (2021) and authors' calculation
$K(MREV_{\circ})$	Coefficient of the municipal revenue per capita.	The municipal revenue per capita ratio to the average factor value for Slovenia for the year 2019.	MFRS (2021) and authors' calculation
$K(AGEI_{\circ})$	Coefficient of the ageing index of the municipality.	The ratio of the ageing index of the municipality to the average factor value for Slovenia for the year 2019.	SORS (2021f) and authors' calculation
$K(HELD_{\circ})$	Coefficient of the capacity of older people's homes in the municipality.	The ratio between the capacity of nursing homes in the municipality and the average factor value for Slovenia for 2019.	Breznik et al. (2019) and the authors' calculation

Source: Author's elaboration.
Note: $_{\circ}$ *denotes the separate consideration of the variable in the municipality of origin* i *and the municipality of destination* j.

Considering the factors analyzed in the NSIM for three cohorts of migrants, model (1) can be formulated in detail as in (2).

$$M_{ij}^{(t)} = k\,K(d_{ij})^{\beta} K(POP)_i^{\gamma(POP)}\, K(POP)_j^{\alpha(POP)}\, K(GUEMP)_i^{\gamma(UEMP)}\, K(UEMP)_j^{\alpha(UEMP)} \cdot \\ \cdot K(GEAR)_i^{\gamma(GEAR)}\, K(GEAR)_j^{\alpha(GEAR)}\, K(NDWE)_i^{\gamma(NDWE)}\, K(NDWE)_j^{\alpha(NDWE)} \cdot \\ \cdot K(PDM2)_i^{\gamma(PDM2)}\, K(PDM2)_j^{\alpha(PDM2)}\, K(MREV)_i^{\gamma(MREV)}\, K(MREV)_j^{\alpha(MREV)} \cdot \\ \cdot K(AGEI)_i^{\gamma(AGEI)}\, K(AGEI)_j^{\alpha(AGEI)}\, K(HELD)_i^{\gamma(HELD)}\, K(HELD)_j^{\alpha(HELD)} \quad (2)$$

The notations in model (2) are described in Table 2. Model (2) was linearized and solved by IBM SPSS using ordinary least squares (OLS) regression analysis.

Empirical study

In Slovenia, the migration of residents between LAU2, i.e., municipalities, was studied, and data was collected for 2018 and 2019. The description and sources of the factors can be found in Table 2.

We considered three main cohorts of residents: age cohorts 0-65, 66-74, and 75+ years, wherein the first group (0-65) is employed. In the second group, their children who migrate with their parents are mainly retired but whose retirement age may increase if a new pension system is introduced, and in the 75+ group are retired persons. Many of them also need the help of others due to physical or mental functional impairment. Data on migration between Slovenian municipalities were collected by the Statistical Office of the Republic of Slovenia (SORS, 2021a) based on the Central Population Register. The SORS also provided us with data on the number of residents (SORS, 2021b), the registered unemployment rate (SORS, 2021c), gross earnings per capita (SORS, 2021d), the number of dwellings (SORS, 2021e) and also the ageing index (SORS, 2021f). Data on the delimitation of municipalities were obtained from the Surveying and Mapping Authority of the Republic of Slovenia (SMARS, 2021). Data on the revenues of municipalities that can be invested in social infrastructure, which can increase the attractiveness and social value of these investments, were provided by the Ministry of Finance (MFRS, 2021).

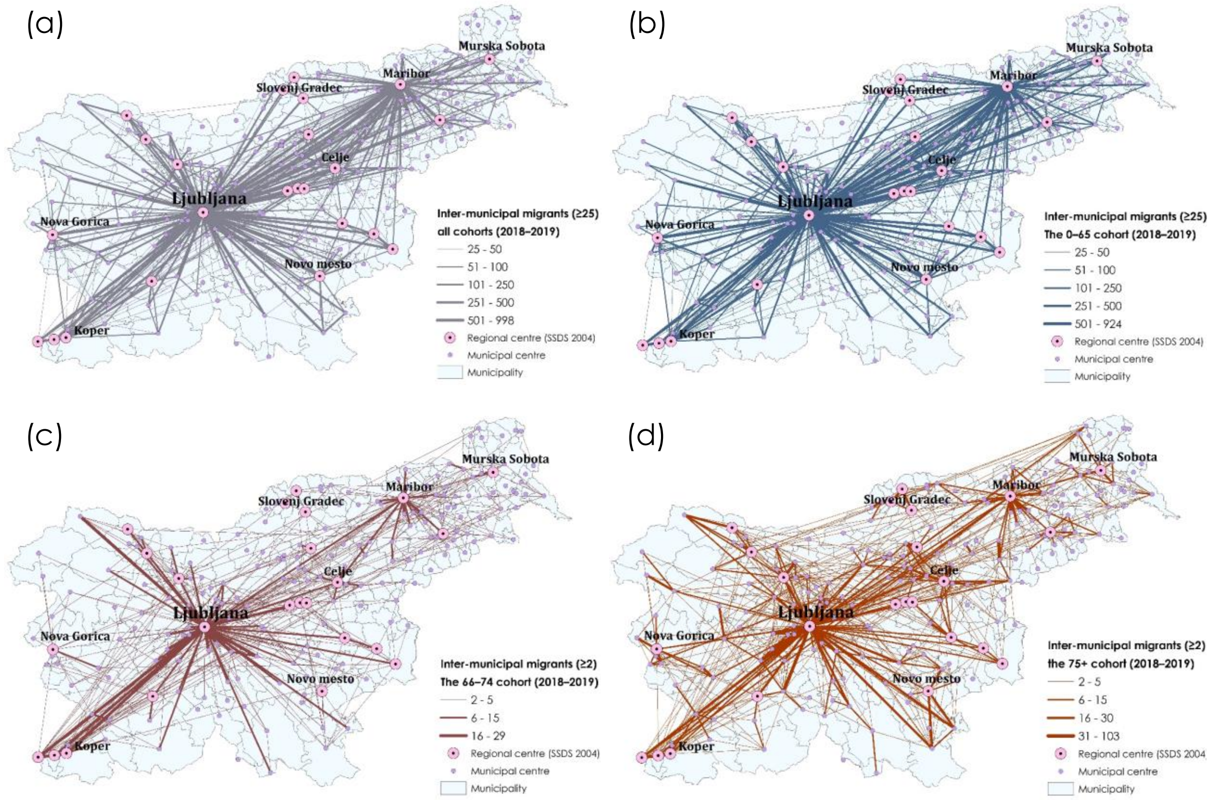
Results

In 2018-2019, 162,222 migrants changed their permanent residence between Slovenian municipalities. Broken by age cohorts, there were 150,670 inter-municipal migrants in the 0-65 cohort, 3951 migrants in the 66-74 cohort, and 7601 migrants in the 75+ cohort. Figure 3 shows the migration interactions for all migrants and the three cohorts analyzed (note that not all interactions are shown for better readability).

The results of the regression analysis can be found in Table 3, which shows the values of the regression coefficients of the linearized models for three age cohorts (0–65, 66–74, and 75+ years) that are significant for the change in migration flows between municipalities in Slovenia for at least one age cohort. Where the p-value is greater than 0.05, the values are in parentheses (detailed statistics are available from the authors upon request).

In the right part of Table 3, we see how the flows change when a factor increases by 10%. Let us take an example to understand the right side of the table. Let us calculate what the net migration would be for municipality j were previously the annual inflow of cohort 0–65, IF(0–65), was 30% less than the outflow, $OF(0\text{–}65) = a = 2000, IF(0\text{–}65) = 0.7a = 1400$; therefore the net migration for the cohort is negative, $NM(0\text{–}65) = IF(0\text{–}65) - OF(0\text{–}65) = -600$, therefore the municipality shrinks.

Figure 3
Internal migrants between Slovenian municipalities in 2018–2019: (a) all cohorts, (b) the 0–65 cohort, (c) the 66–74 cohort, (d) the 75+ cohort.



Source: Authors' work, SORS (2020), SMARS (2020).
Note: Only flows with 25 or more migrants are shown for all cohorts and the 0–65 cohort, and only two or more migrants for the 66–74 and 75+ cohorts.

The local government plans to invest in social housing to increase the availability of housing units per capita by 10%. How would the new flows - IFN is the new inflow, OFN the new outflow - and the new net migration, NMN, change? From Table 3, we can see the values of the factors for inflows and outflows. Suppose there are 500 residents of the 66-74 cohort in the inflow and 400 residents of this cohort in the outflow, while there are 300 residents in the outflow and 100 residents in the inflow in the 75+ cohort. What is the expected net migration, NMN, in the next two years?

Table 3 shows that the values of the standardized regression coefficients of the linearized model, which assess the strength of the impact of individual factors on migration flows, vary between cohorts. Older people aged 66–74 are more likely to opt for longer migration distances than 75+ ($\beta = -0.475 > -0.56$) and also more likely than the youngest population group (0-65), where $\beta = -0.649$. At the 10% longer time distance, the proportion of those willing to migrate is 6% lower if they belong to the 0–65 cohort, 4.4% lower if they belong to the 66–74 cohort, and 5.2% lower for the oldest population group (75+).

Table 3
Regression coefficients of the linearised model and their statistics for the age cohorts 0–65, 66–74, and 75+ years (inter-municipal migration in Slovenia in 2018–2019).

Regression coefficient	Value of standardized regression coefficient			Expected change of flow intensity in %, if the value of factor increases by 10%		
β	-0.649	-0.475	-0.56	-6.0	-4.4	-5.2
$\gamma(POP)$	0.464	0.401	0.445	4.5	3.9	4.3
$\alpha(POP)$	0.448	0.181	-0.03	4.4	1.7	-0.3
$\gamma\ (UEMP)$	0.016	-0.001	-0.054	0.2	0.0	-0.5
$\alpha(UEMP)$	0.025	0.056	-0.022	0.2	0.5	-0.2
$\gamma\ (GEAR)$	0.057	-0.011	-0.003	0.5	-0.1	0.0
$\alpha(GEAR)$	0.043	-0.026	-0.036	0.4	-0.2	-0.3
$\gamma(NDWE)$	0.13	0.122	0.068	1.2	1.2	0.65
$\alpha(NDWE)$	0.147	0.128	0.06	1.4	1.2	0.57
$\gamma\ (PDM2)$	-0.027	-0.012	(-.027)	-0.3	-0.1	NA
$\alpha(PDM2)$	(-.007)	-0.049	(-.003)	NA	-0.5	NA
$\gamma(MREV)$	0.037	0.054	0.074	0.4	0.5	0.7
$\alpha(MREV)$	0.016	(-.002)	-0.02	0.2	NA	-0.2
$\gamma(AGEI)$	0.029	-0.023	0.086	0.3	-0.2	0.8
$\alpha(AGEI)$	-0.015	-0.017	-0.038	-0.1	-0.2	-0.4
$\gamma\ (HELD)$	-0.015	-0.005	-0.06	-0.1	0.0	-0.6
$\alpha(HELD)$	0.018	0.131	0.282	0.2	1.3	2.7
R	0.786	0.6	0.622			
R^2	0.617	0.36	0.387			
Adjusted R^2	0.617	0.354	0.383			
Standard error	0.776	0.531	0.666			
No. of observations	14,096	1920	2481			
ANOVA stat. F	1336.89	62.84	91.46			
ANOVA p-value	0.0000	0.0000	0.0000			

Source: Authors' work.
Note: γ-factors are for the origin, and α-factors are for the destination.

The size of the municipality influences the out-migration of the 66–74 cohort less than that of the older and/or younger cohorts ($\gamma(POP) = 0.401 < 0.445 < 0.464$ in Table 4). In comparison, the size of the municipality attracts them less than younger cohorts. For those 75 or more, this factor is almost insignificant when choosing a municipality to emigrate to ($\alpha(POP) = -0.03$). It is interesting to see how unemployment affects emigration. While it has a positive effect on out-migration for cohorts 0–65 ($\gamma\ (UEMP) = 0.016$), where young families live, older persons tend to stay in municipalities with higher unemployment, $\gamma(UEMP)$ is even negative. We can also easily explain that the influence of salary level is positive for the youngest cohort, while it is not positive for the older ones. Still, for detailed conclusions, we need to perform the same operations as in Table 4. In the same way, as in Table 4, we can calculate each factor whose values are given in Table 3 and conclude.

Table 4 shows the response in new net migration if the availability of housing units per capita is increased by 10% ($K(NDWE_j) = 1.1$): total net new migration, NMN, will increase by 6.69% over the next two years.

Table 4
A numerical example of the change in the coefficient for the number of dwellings per resident in a municipality, $NDWE_j$

$NDWE_j$	0–65 years		66–74 years		75+ years		
$K(NDWE_j)$=1.1	**Initial flow**	**RC**	**Initial flow**	**RC**	**Initial flow**	**RC**	**Sum of flows**
Outflow (OF)	2000	1.2	400	1.2	300	0.65	2600
Inflow (IF)	1400	1.4	500	1.2	100	0.57	2200
Net migration (NM)	-600		100		-200		-700
Next year	**Final flow**	**Growth in %**	**Final flow**	**Growth in %**	**Final flow**	**Growth in %**	**Sum of new flows**
New outflow (OFN)	2024	1.2	404.8	1.2	210	0.65	2638.8
New inflow (IFN)	1419.6	1.4	506	1.2	60	0.57	1985.6
New net migration (NMN)	-604.4	-0.73	101.2	1.2	-150	-25	-653.2

Note: RC – regression coefficient.
Source: Authors' work.

Discussion

Why is it important to know the orientation values in the chapter "Results"? To stop the shrinkage of cities and regions, the European Long-Term Investors Association in Europe has launched the "Investing in Social Infrastructures" initiative, which could encourage residents to stay in city centres (Fransen et al., 2018). The European Commission, the European Investment Bank, the Council of Europe Development Bank, and many national development banks support the initiative. It emphasizes the importance of focusing policy attention on the role of education, social infrastructure, and related services, intending to increase investment in education (Grah et al., 2019, 2021), health and affordable housing, smart solutions, as well as other social infrastructures that are essential for Member States' economic growth and people's well-being and could bring social added value to the community (Rogelj and Bogataj, 2018b, 2019, 2020b; Rogelj et al., 2019) and mitigate shrinkage. In the final report by Fransen et al. (2018), in this association, a comprehensive collection of facts and figures on social infrastructure and social services and related funding opportunities and needs are considered, and many recommendations are made on current funding instruments and future programmes, including for municipalities.

We have therefore examined how municipal revenues, most of which are invested in the social infrastructure of the municipality, can increase the attractiveness and retention power of municipalities. This answer can also be derived from the gravity model results, as in Tables 3 and 4. We have thus answered the research question of how municipalities can retain and/or attract human resources across different cohorts. According to our results in Table 3, municipal revenue retains the older people, the 75+ cohort, and the least young people, the 0-65 cohort, but significantly attracts only younger people between 0 and 65.

Conclusion

Using data on 150,670 migrants of cohort 0-65 in 14,097 inter-municipal interactions in Slovenia, 3,951 migrants of cohort 66-74 in 1,921 inter-municipal interactions, and 7,601 migrants of the oldest residents of cohort 75+ in 2,482 inter-municipal interactions in Slovenia in 2018-2019, we found that the coefficient of determination is much higher for cohort 0-65 than for the oldest residents. In addition to the influence of the distance between municipalities on migration and the influence of the size of the municipalities themselves, the availability of nursing homes was found to be a very strong factor for the 75+ population. From this, we can conclude that the decisive influence on population growth in the municipalities is an investment in housing for the oldest cohorts. Such investments also impact new jobs for nurses, social workers, and other workers involved in services and care for older adults (Grah et al., 2019, 2021), which can significantly reduce area shrinkage. Such investments could have a significant impact on stopping the shrinkage of communities and their central places by ensuring a better quality of life for older people and jobs for young people.

The initiative to activate investments in European social infrastructure, which could encourage residents to stay in their municipalities, is crucial to mitigate the shrinkage of municipalities in Member States and increase the population's prosperity. Based on the gravity model developed and implemented for Slovenian municipalities, we can conclude that infrastructure for older adults, especially investments in their better housing, can contribute to the sustainability of population growth and the silver economy, which can also be seen in Table 4.

Municipal revenues have not had a sufficient impact on the attractiveness and stickiness of territories in the past, and their influence on sustainability is even negative. Therefore, we should know better what was done with these revenues in the past and what we should do in the future. We should find a better municipal investment policy, especially now that the new law on long-term care, which has just been improved in the Slovenian Parliament, puts more responsibility on Slovenian municipalities.

National authorities and local governments could use the findings of this study when devising strategies for regional and urban development, when exploring the best solutions for long-term care and investing in appropriate networks, or when considering the revitalization of rural communities. We propose to incorporate our findings and new extended models into future strategies, such as the SI4CARE project (the details can be found at https://socialinterreg.eu/projects/si4care) or to rethink educational programmes and infrastructures for what would answer the question of when to raise the retirement age and how to attract older workers in a region that is the subject of the MAIA - European Academy (Cordis, 2022). The answers should be considered at the regional level (NUTS2 or NUTS3) and municipal level (LAU2).

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