

RESIDENTIAL AXES AND DEMOGRAPHIC DYNAMICS IN MUREȘ COUNTY

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ABSTRACT. – Residential Axes and Demographic Dynamics in Mureș County.

The condition of the human component within a geographical space reflects the functionality of its social system, revealing both existing dysfunctions and favourable elements. At the European level, an accelerated trend of population decline is observed, occurring simultaneously with population ageing. This dual challenge amplifies the pressure on the sustainability of essential societal systems, particularly healthcare and pension systems. Although demographic degradation is a general concern, both its territorial extent and the severity of its effects vary significantly across Europe. Mureș County is part of an increasingly dysfunctional system in terms of its demographic component, and diagnosing the problem is the first step in attempting to mitigate its effects. Within this geographical space, three demographic trajectories can be identified: progress, stagnation, and decline. The relationship between these trajectories and the geographical axes of the county highlights their role in shaping territorial dynamics, a role that can be extrapolated to other geographical contexts.

Keywords: *demographic challenges, demographic trends, geographical axes, residential axes, territorial disparities.*

1. INTRODUCTION

The demographic factor constitutes a fundamental reference element within any geographical space, and its dynamics directly influence the condition and functioning of the system. This system is inherently characterized by temporal variability, while the indicators defining the demographic dimension are highly responsive and sensitive to shifts occurring within the system.

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Until the 1970s, the main problem related to the demographic factor was considered overpopulation (Grunstein, 2023). In the 21st century, the fear of overpopulation has been replaced by that of population aging and decline, driven by increasing life expectancy and decreasing fertility rates. Europe, much of Asia, the Americas, and Australia are experiencing major changes in population composition (Novotný, 2023).

Thus, the development of a strategy targeting the demographic factor requires a dual diagnosis–forecast approach, one that captures both the current state and the potential evolution of the system, and enables the adaptation of interventions in accordance with present and future needs.

In addition to temporary dynamics, the demographic factor records important spatial variations, determined by a series of physical-geographic and/or economic factors. So, although the global population is still growing, and the number of people is increasing, large areas are facing a drastic decrease in the number of inhabitants and an accelerated population aging process.

The global population growth rate is slowing, declining from 1–2% per year to approximately 0.5% per year by 2050. Fertility rates are projected to decrease significantly, from 2.5 in 2020 to around 2.2 in 2050. The median age of the population is expected to rise from 31 years in 2020 to 36 years in 2050. Europe will have the oldest population in terms of median age (47 years), while traditionally younger regions, such as those in Latin America, will experience the largest increase, from 31 years to 41 years by 2050.

Europe is among the continents most affected by population decline and ageing. The effects of this change are more pronounced and will be felt sooner, but it is not the only geographical area facing these challenges. By 2050, due to the decline in natural population growth combined with increasing life expectancy, the global population structure is expected to undergo significant changes (imf.org, 2020).

By 2100, Europe's population, at the current rate, will decrease by approximately 21% (un.org, 2022). Population decline does not only consist of numerical decrease, but also targets the demographic composition, social, cultural and economic characteristics of the population (Franklin, 2020; Bock & Haartsen, 2021).

Figure 1 presents the current and expected evolution of the demographic dependency ratio indicator.

Being a global challenge, numerous studies in the specialized literature examine not only the current situation but also future trends and the measures required to reduce the negative impacts on the social system. In this context, researchers from diverse disciplines, along with local, national, and international authorities, are striving to address this pressing issue—the changing population structure—focusing on three main priority themes:

- Urban agglomeration;
- Dramatic decrease in fertility rate;
- Changing age structure of the population - people over 65 expected to outnumber those under 18 by 2070 (population.un.org, 2017).

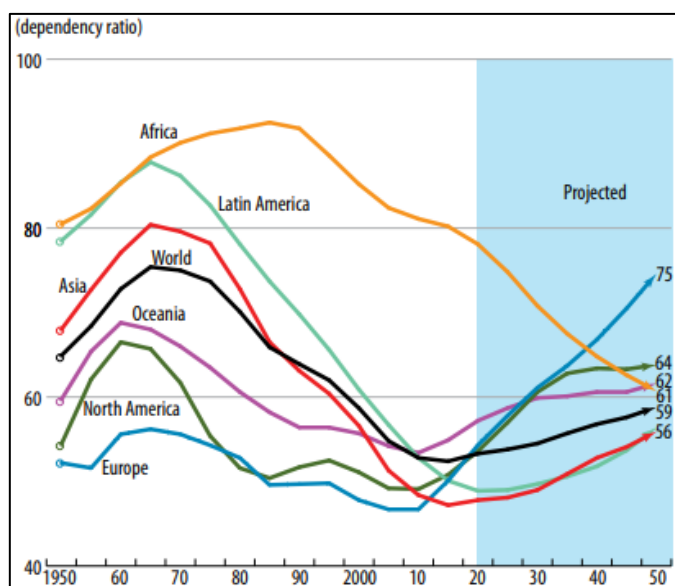


Fig. 1. The evolution of the dependency ratio

Source: <https://www.imf.org/en/-/media/files/publications/fandd/article/2020/march/infographic-global-population-trends-picture.pdf>

At the European level, the threat of demographic decline becomes increasingly pressing. The effects of the changing demographic landscape bring a series of new challenges to the proper functioning of the social system, and in the absence of social and technical reforms, the effects will have irreversible consequences on society (Newsham & Rowe, 2022; 2025).

Although recorded as a general trend at the continental level, the magnitude of the phenomenon differs depending on the geographical location, with significant variations recorded between the 5 macroregions: Northern Europe, Southern Europe, Central Europe, Western Europe and Eastern Europe. Also, significant changes and differences will be recorded at the country level, depending on the economic situation and the demographic policy adopted.

Of the regions presented, the most affected is considered to be Eastern Europe, where the aforementioned problems are combined with a negative migration balance.

At the national level, the situation differs depending on the indicator, but Romania is most often among the nations vulnerable to demographic problems.

Between 2023 and 2050, the population under 20 will experience a sharp decline across Europe, but the most dramatic decline will be recorded in the following countries: Lithuania, Latvia, Greece, Bulgaria, Romania, Portugal, Croatia and Poland. This decline will affect the education system where schools will close or shrink, which will particularly affect students in rural regions, especially those requiring long commutes, but also the workforce in the system (ec.europa.eu, 2025).

In those same countries, the number of active people will decrease by over 20%, which will lead to a steep decrease in the labour force. A reduced workforce leads to a dangerous chain of effects that contribute to reduced economic efficiency, lower GDP, increased economic dependency rates and overburdened pension systems (Darvas et al, 2025).

An increased demographic dependency, whether driven by the young or the elderly, erodes per-capita resources. The rise in the demographic dependency ratio is directly proportional to the growth of the fiscal burden, leading to higher consumption of social resources and a decline in investments and economic performance. When the ratio exceeds 30%, the pressure becomes substantial, necessitating major adjustments in the pension system, natural and migratory population movements, productivity, and other related areas (Hock & Weil, 2006).

The number of immigrants will increase in almost all regions, with the exception of Lithuania, Latvia, Romania, Greece, Poland and Croatia, where the migration balance will be 0 or even negative. Many countries in Eastern Europe will have to raise retirement ages to increase the workforce, this measure being especially necessary in Romania, Croatia and Poland, which have a low labour market integration rate of people aged 55 to 64 (Pinkus & Ruer, 2025).

Population ageing compels governments to seek compensatory solutions to maintain system balance, and these solutions may involve either reducing, maintaining, or increasing expenditures for the young. Whichever solution is chosen, there are a range of benefits and costs, and long-term forecasting of all effects remains limited (Emerson et al., 2024).

For the development of responsible and effective demographic policies, demographic forecasts and demographic theories represent potential tools and solutions.

Geographical axes represent intelligent territorial systems and have as their main characteristic the ability to lead and orient material and immaterial flows, ensuring and facilitating the connection between poles and points, localities and locations (Pop, 2016).

Residential axes or settlement axes represent particular cases of geographical axes and are characterized by the interaction with the human factor as the main relationship. Residential axes present the strengths of a system, the poles and centres of attraction, but also the direction of flows in terms of preferences.

The purpose of this work is to analyse the current and the future situation of the demographic component within Mureș County through specific indicators, in relation to existing geographical axes.

The research question is: what are the demographic trends at the level of residential axes in Mureș County? The answer to this question involves several steps that constitute the objectives of the analysis:

- Analyse the past, present and future situation of the population number and demographic dependency ratio indicators at the level of the study area;
- Examine the role of habitation axes within the studied county;
- Analysis of the state of habitation axes at the county level and their classification into one of the following situations: demographic decline, stagnation, or progress.

2. METHODOLOGY

A review of the specialized literature forms the foundation of this study, serving to identify the core issues and demographic challenges currently facing the European continent. Such a review is an essential component of any research endeavour, as it connects the present work to prior studies and ensures the continuity necessary for original scientific inquiry. In addition to the literature review, the study also employs several well-established research methods: analytical and synthetic approaches, inductive and deductive reasoning, cartographic techniques, comparative analysis, and GIS-based methods.

The basic methods of this research are statistical and mathematical methods. The statistical method represents the primary analytical tool for the diagnostic component of this study, as it provides the necessary instruments for processing data supplied by specialized institutions such as Eurostat, the National Institute of Statistics, the Mureș County Statistics Directorate, and others. Statistical processing requires specific datasets obtained through data-

collection procedures from official national and county sources, public databases, and the activity reports of authorized institutions. Together, these elements form a logical mechanism composed of interrelated and complementary methods that help construct an accurate picture of the situation within the study area.

The mathematical method constitutes the second fundamental approach, used for the forecasting component of this research. It offers an objective perspective on reality and allows the study to be adapted from one spatial context to another, depending on available data and research needs. In this case, the analysis relies on three types of regression models: log-linear regression, exponential regression, and linear regression. Regressions as mathematical-statistical methods are often used in demographic studies (Utomo et al., 2025; Mulugeta et al., 2022; Væth et al., 2018), as they are useful for determining the direction and magnitude of effects, for revealing the importance of certain factors, but are also used for predictions.

3. DATA/MATERIALS USED

The number of people residing in Mureș County is decreasing. Figure 2 shows the downward evolution of the number of people residing in Mureș County for the period 2005-2025.

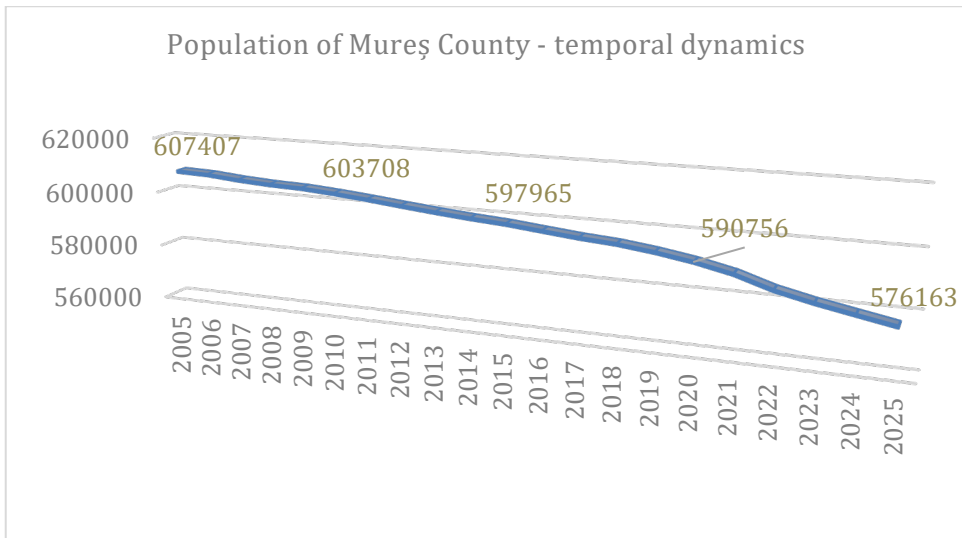


Fig. 2. The downward demographic trend recorded in Mureș County. Source: the author, based on data provided by the NIS (2026)

The percentage of decrease differs from one interval to another, being calculated according to the formula:

$$P_{\%} = \frac{A_{n2} - A_{n1}}{A_{n1}} \times 100, \text{ where:}$$

$P_{\%}$ =percentage of change, A_{n2} = last year of the interval, and A_{n1} =first year of the interval.

The percentage decrease for each interval is as follows: the 2005–2010 period shows a decline of approximately 0.6%, the 2010–2015 period records a decrease of about 0.95%, the 2015–2020 interval shows a decrease of roughly 1.2%, and in the most recent interval, 2020–2025, the decrease reaches 2.5%. The downward trend is accelerating, as the rate of decline increases noticeably over time, becoming four times higher in 2025 compared to 2005.

To determine the future trend, the mathematical method is applied, based on a combined adaptation of exponential regression and log-linear regression. The formula used is:

$$P_n = P_0 - e^{r \cdot n}, \text{ where:}$$

P_n = population in year n , P_0 = baseline population ($n=0$), r = annual percentage rate, and e = Euler's number (2.71828).

The next step involves estimating the annual rate, i.e. the variable r . The formula used is based on logarithms, with the variable t indicating the number of years elapsed from P_0 to P_n :

$$r = \frac{\ln(P_n) - \ln(P_0)}{t} = \frac{\ln(2025) - \ln(2005)}{20} = \frac{\ln(576.163) - \ln(607.407)}{20} = -0,0026/an$$

Thus, the prediction for the year 2030 is outlined according to the formula:

$$P_{2030} = P_{2025} \cdot e^{5 \cdot r} = 576,163 \cdot e^{5 \cdot (-0,0026)} \approx \mathbf{568,730}$$

The percentage of decrease for the 2025-2030 interval is about -1.3%. Figure 3 presents the real and estimated differences in the population residing in Mureş County for the previously analysed intervals.

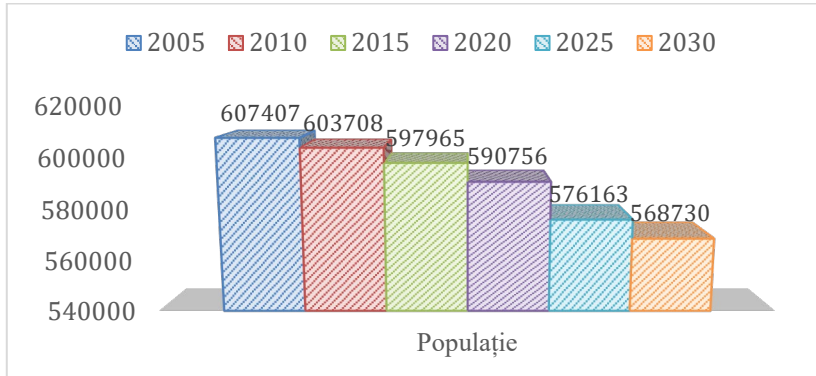


Fig. 3. County demographic trends. *Source: the author, based on data provided by the NIS (2026)*

The population decline trend is determined at the county level by a series of factors, based on the decrease in birth rate, but also the strongly negative balance of internal and external migration (cjmures.ro, 2021).

If the general trend shows a decline in population, at the level of administrative-territorial units there are clear differences in demographic patterns. Figure 4 illustrates the percentage change in the resident population at the UAT level, based on a comparison between the years 2015 and 2025.

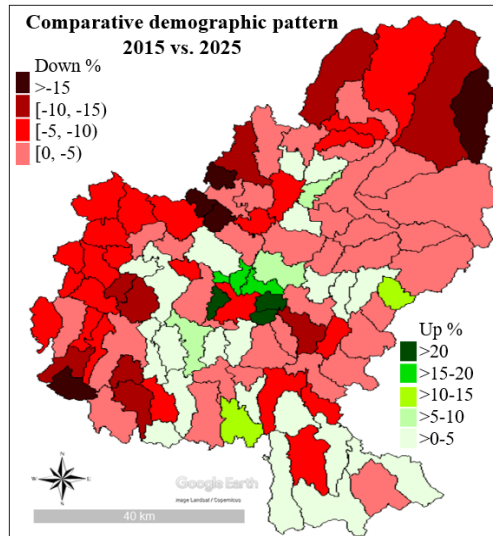


Fig. 4. Demographic trends at the administrative-territorial unit (ATUs) level in Mureș County. *Source: the author, based on data provided by the NIS (2026)*

In 2025, almost 70% of the communes in Mureș County show demographic decline, with the highest decrease recorded in the commune of Băla, which registers a reduction of approximately -23.3% compared to 2015. With the exception of the town of Ungheni, all other towns display a negative trend, the most significant decline—exceeding -10% —being noticed in the city of Târnăveni. For the cities of Târgu Mureș, Sighișoara, and Reghin, this decrease can also be attributed to the phenomenon of “relocation,” while in the remaining towns the trend aligns with the regional and national pattern of population decline and ageing. The metropolitan and peri-urban area of Târgu Mureș stands out, comprising over 35% of all communes that exhibit population growth, including the communes with the highest increases at county level: Corunca (over 57.5%) and Livezeni (nearly 48.7%).

At the axial level, the situation varies depending on the position and extent of axis. Figure 5 illustrates the status of the axes according to demographic trends, based on a comparison between the 2015 and 2025 situations for each ATUs.

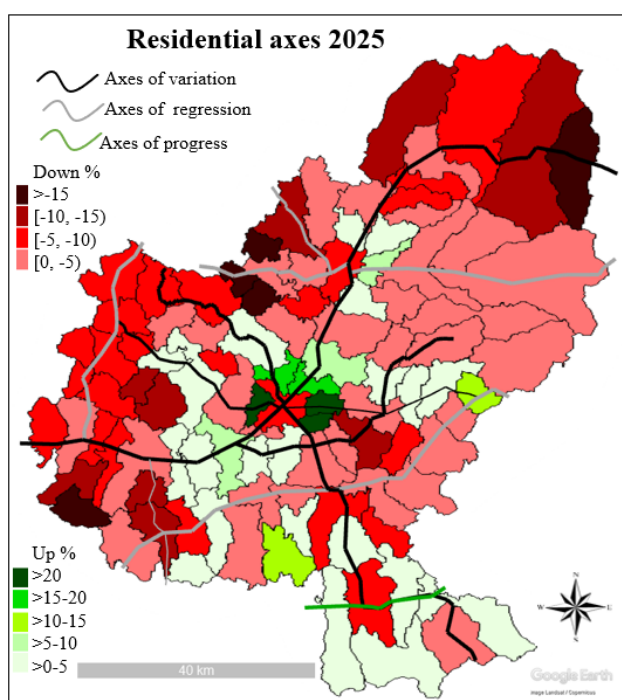


Fig. 5. Residential axes - current situation. *Source: the author, based on data provided by the NIS (2026)*

The population size and its evolution are conditioned by several variables: the age structure of the population, the natural and migratory movement of the population etc. The population pyramid represents an easy-to-interpret visual form of the demographic situation of a space, being the result of the demographic indicators interaction.

The shape of the population pyramid provides important information about a geographical area. Less developed countries tend to have a wider base, reflecting a younger population, whereas in developed countries the pyramid increasingly takes on a columnar shape. Romania, depending on the model used—either the classical four-stage model or the extended five-stage model—is in the final stage in terms of age structure. In the classical interpretation, this stage indicates population stabilization, although this stabilization is associated with low fertility rates, which are nonetheless balanced by low mortality rates. In the extended interpretation, and in accordance with statistical reality, Romania is also in the final stage—the post-post-transition stage—characterized by an aging and declining population. (populationpyramids.org, 2025).

Figure 6 shows the evolution of the population pyramid within Mureș County, an evolution that leads to the pyramid changing towards an increasingly typical column shape.

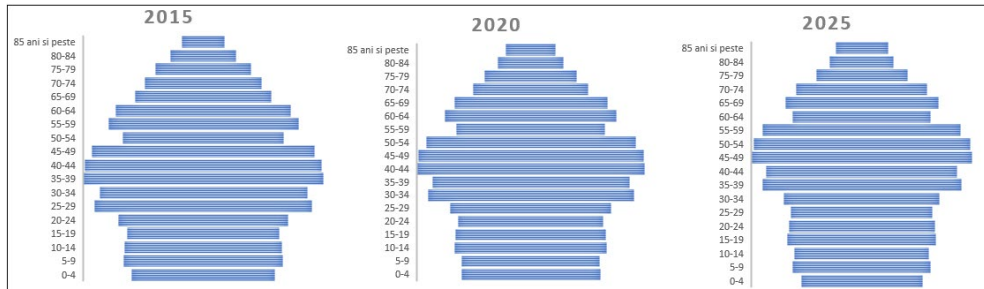


Fig. 6. Population pyramid – Mureș County, *Source: the author, based on data provided by the NIS (2026)*

In addition to the decline in population, the aging of the human factor represents a second threat to the social system. This aging has multiple and negative consequences on society, but the most easily anticipated ones are the increased pressure on the pension and healthcare systems, which leads to the destabilization of the social system.

The assessment of population stability by age cohorts in Mureș County is carried out using the ‘Demographic Dependency Ratio’ indicator.

The dependency ratio has improved over the last 30 years, from 52% to 49%, but is expected to reach 71% in 2050.

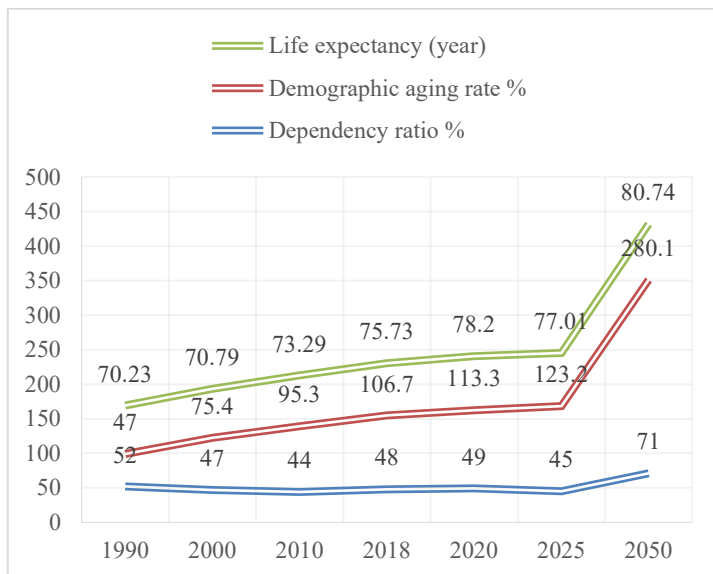


Fig. 7. Evolution of demographic indicators. *Source: cjmures.ro, 2021*

This is due to the increase in the percentage of the elderly population, correlated with the increase in life expectancy. Mureş County is among the counties in Romania projected to experience a comparatively lower rate of demographic aging. However, this rate has nonetheless risen, and by 2050 it is expected to triple, posing significant challenges to the social system and necessitating timely intervention (cjmures.ro, 2021). Figure 7 presents the recorded and expected evolution for three relevant demographic indicators in the demographic analysis of Mureş County. The Demographic Dependency Ratio remains the indicator that most accurately reflects changes in the age structure of the population at the level of the studied county. The formula used to calculate demographic dependency is:

$$\text{Dependency ratio} = \frac{\text{Dependent population (0 – 14 and 65+)}}{\text{Active population (15 – 64)}} \times 100$$

Figure 8 presents the results of the comparison of demographic dependency ratio values at the ATUs level between 2015 and 2025.

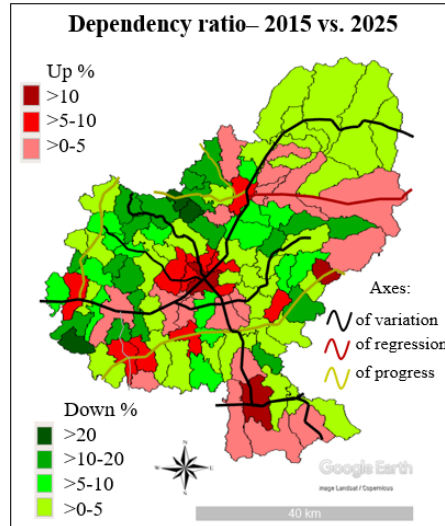


Fig. 8. Comparison of demographic dependency ratio 2015 vs. 2025.

Source: the author, based on data provided by the NIS (2026)

Figure 9 shows the residential axes outlined according to the dependency ratio values in 2025, compared to 2015.

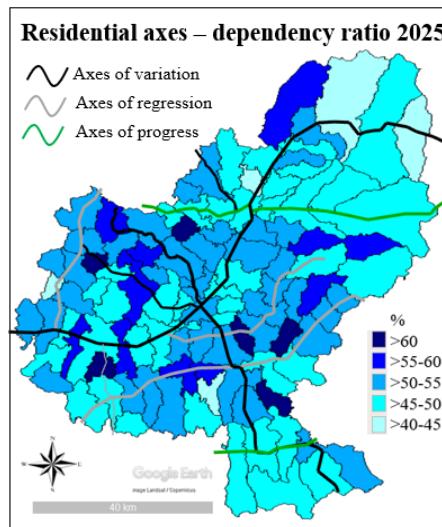


Fig. 9. The "demographic dependency ratio" indicator in relation to residential axes.

Source: the author, based on data provided by the NIS (2026)

To establish the trend of the demographic dependency ratio, linear regression and data for 2015, 2020 and 2025 were used. The formula used for linear regression is:

$$y = m \cdot x + b, \text{ where:}$$

Y=dependency ratio, m=slope, x=year and b=intercept.

To calculate the regression slope, the following formula is used:

$$m = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2}$$

The dependency ratio values for the reference years are: 2015=46.6%, 2020=49%, 2025=45%. According to these values, the x and y averages are:

$$\bar{x} = \frac{2015 + 2020 + 2025}{3} = 2020$$

$$\bar{y} = \frac{46.6 + 49 + 45}{3} \approx 46.87$$

The calculation of the derivatives x1=1, x2=2 and x3=3 is the next step (see table 1).

Table 1. The calculation of the derivatives

X ₁ = 1	X ₂ = 2	X ₃ = 3
$x_1 - \bar{x} = 2015 - 2020 = -5$	$x_2 - \bar{x} = 2020 - 2020 = 0$	$x_3 - \bar{x} = 2025 - 2020 = 5$
$y_1 - \bar{y} = 46.6 - 48.87 = -2.27$	$y_2 - \bar{y} = 49 - 48.87 = 0.13$	$y_3 - \bar{y} = 45 - 48.87 = -3.87$
$(x_1 - \bar{x})(y_1 - \bar{y}) = (-5) \times (-2.27) \approx 1.34$	$(x_2 - \bar{x})(y_2 - \bar{y}) = 0 \times 0.13 = 0$	$(x_3 - \bar{x})(y_3 - \bar{y}) = 5 \times (-3.87) \approx -19.34$
$(x_1 - \bar{x})^2 = 25$	$(x_2 - \bar{x})^2 = 0$	$(x_3 - \bar{x})^2 = 25$

Source: the author

Thus, after finding the amounts required for the slope, its value is calculated:

$$m = \frac{\sum(x_i - \bar{x})(y_i - \bar{y})}{\sum(x_i - \bar{x})^2} = \frac{1.34 + 0 + (-19.34)}{25 + 0 + 25} = \frac{-18}{50} = -0.36$$

The penultimate step is the calculation of the b-intercept:

$$b = \bar{y} - m\bar{x} = 46.87 - (-0.36) \times 2020 \approx 770.07$$

The regression or the prediction for the year 2030 is calculated according to the formula:

$$Y_{(2030)} = m \cdot x + b = -0.36 \times 2030 + 770.07 \approx 45.27$$

The difference between 2025 and 2030 is 0.27%, with the average demographic dependency rate at county level set to increase by the same percentage.

4. RESULTS AND DISCUSSION

The population structure will register considerable changes in the study area in the coming years, and the forecasts made at the European level show that these will not have favorable effects on the functionality of the county social system. Although inevitable, these changes can be controlled to some extent through targeted demographic policies at the territorial level.

The first problem that the study area is facing is the drastic decrease in population. Figure 10 shows the hypothetical and expected situation for the "population number" indicator in 2030. This comparison is based on the result obtained through mathematical analysis and targets the average decrease of -1.3% at the county level, which is subsequently applied at the level of each ATU.

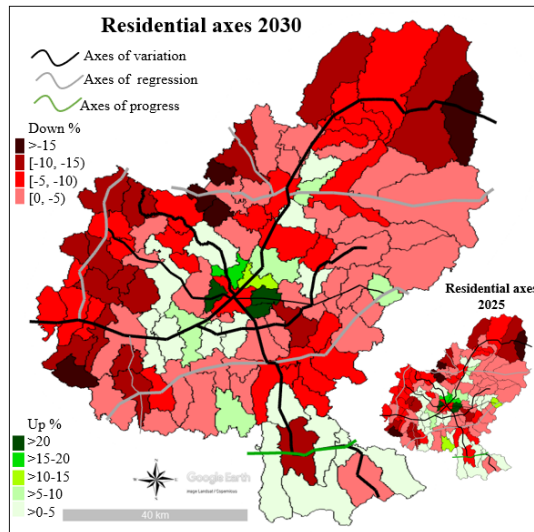


Fig. 10. Expected population growth in 2030, compared to 2025.

Source: the author

In the case of the "Population number" indicator, the county axes that align with the national and European demographic trends of population decline are: Târnava Mică Axis, Gurghiu Axis and Pârâul de Câmpie Axis. The magnitude of the phenomenon differs for the three regressive axes. The most obvious decrease is recorded by the Pârâul de Câmpie Axis, where forecasts for 2030 show an average decrease of 10-15% compared to the situation in 2025. A more favourable situation, described by the current study in the form of variation axes, is recorded by the axes: Mureș Axis, Longitudinal Axis, Niraj Axis, but also by the ramifications that diverge from the city of Târgu Mureș.

According to the applied methodology, measurable progress is remarked only in the rural area of the Târnava Mare Hills region, served by the Târnava Mare Axis. Although modest, this progress encompasses all rural localities along the axis.

The development poles, Târgu Mureș and Sighișoara, play a contrasting role in terms of converging socio-economic flows. Demographically, these poles function as centres of residential divergence, with migration trends expected to intensify, while dependence on the poles remains, as surrounding and metropolitan areas continue to grow.

The 2030 forecast indicates that the axes experiencing decline in 2025 will face increasingly severe reductions, with the Pârâul de Câmpie Axis being the most vulnerable.

The demographic dependency ratio, the second indicator analysed, provides a comprehensive assessment of demographic challenges and, through the applied methodology, their spatial distribution and intensity across Mureș County.

Figure 11 presents the projected values of this indicator for 2030 at the level of the county's administrative-territorial units (ATUs).

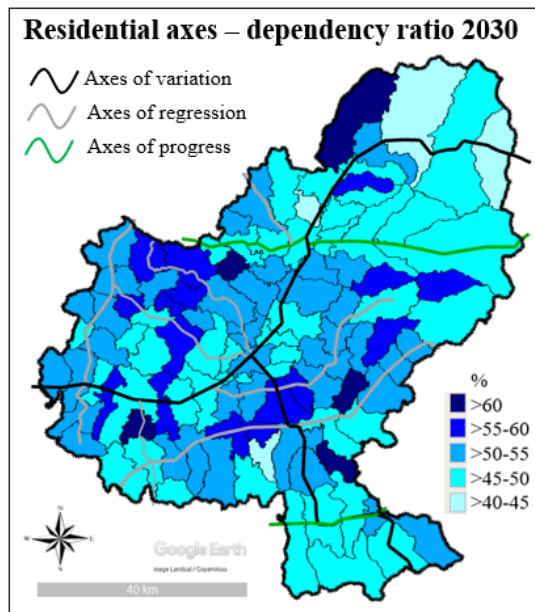


Fig. 11. Expected evolution of the demographic dependency indicator.

Source: the author

The antithetical situation present in the previous indicator is also present here, but this is not surprising, given the logical and indissoluble link between the demographic components.

At the county level, there is a constant trend of uniformity in the demographic dependency rate. However, the stabilization trend is not uniform, with some areas exceeding the previous threshold. This apparent balance is, however, unstable over time, given the correlation with the current and forecasted significant population decline in this area (see previous figures), determined by a combination of factors (low birth rate, negative natural growth, increased migration) that directly affect the dependency rate. However, the vast majority of the county is expected to be above the average European rate.

At the level of physical-geographic regions, it is found that the mountainous area is the one that is most vulnerable to demographic challenges.

At the axial level, it is noted that the main axes, the Mureș Axis and the Longitudinal Axis, have a situation of variation, the first registering a better placement, supported by urban areas which most often constitute a support point. The capacity of the poles is seen through the size of the area of influence, with the cities of Târgu Mureș, Sighișoara, and Reghin standing out from this perspective. Areas of progress are stable, while areas of regression are in continuous decline.

5. CONCLUSIONS

The situation of the demographic component in Mureș County shows significant differences at the territorial level. These differences, through location and extension, indicate the strong and vulnerable areas of the county, being in direct relation to the geographical axes. These geographical axes represent the lines of force of the territory in terms of the demographic component, and their importance is directly reflected in the state of demographic indicators.

The importance of poles is determined both by their condition, but especially by their role in the territory. The main cities in the county are experiencing population decline, while their adjacent areas are growing. Consequently, these cities function as development poles, playing an increasingly significant role in the spatial dispersion of development. Such development can be beneficial if it is guided in line with sustainable development objectives, facilitating interaction among all socio-economic actors and providing necessary infrastructure. Understanding the geographical directions of influence of development poles is crucial for resource management and infrastructure planning, helping to prevent congestion and its negative environmental effects.

Development poles support the territory and attract demographic resources, which may lead to instability in more remote areas that fall outside their sphere of influence. The strength of the poles is determined by the strength of the axes, and from a demographic perspective, the Mureș Axis and the Târnava Mare Axis are underpinned by a favourable physical-geographical substrate.

In conclusion, at the level of Mureș County, the demographic component is in decline from all points of view, but the territorial extension and intensity of this issue vary. The role of geographical axes as lines of force of the territory is argued by the stability or even timid evolution of the demographic component at their level and of their adjacent areas. These axes are emerging as development axes, namely the Mureș Axis and the Târnava Mare Axis, which support and boost the development of the county. Enhancing territorial connectivity between these areas could stabilize the county and extend the reach of their spheres of influence. Simultaneously, the vulnerability of regions beyond direct influence underscores the need for improved connectivity. The geographical axes thus serve as valuable tools for demographic diagnosis and forecasting, providing a basis for targeted interventions.

REFERENCES

1. Bock, B., & Haartsen, T. (2021), *Who is afraid of population decline? The struggle of keeping rural depopulation on the Dutch agenda*, Journal of Depopulation and Rural Development Studies, vol. 33, pp. 35–56. DOI: 10.4422/ager.2021.22.
2. cjmures.ro (2021), Planul de dezvoltare a județului Mureș 2021 - 2027. https://www.cjmures.ro/Programe_actiuni/PSDJ_Mures2021-2027_cu%20anexe_rev10.02.2022.pdf (last accessed on 28.11.2025).
3. Darvas, Z., Welslau L., & Zettelmeyer J. (2025), *Demographic change will hit public debt sustainability in European Union countries*, Journal of Policy Modeling, vol. 47, pp. 1131-1157. DOI: <https://doi.org/10.1016/j.jpolmod.2025.09.004>.
4. ec.europa.eu (2025). Population structure indicators at national level. On line: https://ec.europa.eu/eurostat/databrowser/view/demo_pjanind/default/table (last accessed on 20.11.2025).
5. Emerson, P., Knabb S., & Sirbu A., I. (2024), *Does the old-age dependency ratio place a drag on secular growth?*, Economic Analysis and Policy, vol. 82, pp. 1056-1070. DOI: <https://doi.org/10.1016/j.eap.2024.04.026>.
6. Franklin, R., S. (2020), *I come to bury (population) growth, not to praise it*, Spatial Economic Analysis, 15(4), pp. 359–373. DOI: 10.1080/17421772.2020.1802056.
7. Grunstein, J. (2023), *Our future is a graying planet, not an overcrowded one*, World Politics Review, Online at: <https://www.worldpoliticsreview.com/population-aging-retirement-reforms-birthrate-overpopulation/> (last accessed on 23.11.2025).

8. Hock, H., & Weil D., N. (2006), *The dynamics of the age structure, dependency, and consumption*, Nber Working Paper Series, No. 12140, 36 pages. Online: https://www.nber.org/system/files/working_papers/w12140/w12140.pdf.
9. imf.org (2020), *Coming of age*. Online: <https://www.imf.org/en//media/files/publications/fandd/article/2020/march/infographic-global-population-trends-picture.pdf> (last accessed on 15.11.2025).
10. Mulugeta, S., S., Muluneh, M., W., Belay, A., T., Moyehodie Y., A., Agegn S., B., Masresha B., M., & Wassihun S., G. (2022), *Multilevel log linear model to estimate the risk factors associated with infant mortality in Ethiopia: further analysis of 2016 EDHS*, BMC Pregnancy Childbirth, vol. 22, 597.
DOI: <https://doi.org/10.1186/s12884-022-04868-9>.
11. Newsham, N., & Rowe, F. (2022), *Understanding trajectories of population decline across rural and urban Europe: A sequence analysis*, Population, Space and Place, 29(3), e2630. <https://doi.org/10.1002/psp.2630>.
12. Newsham N., & Rowe F. (2025), *The Demographic Causes of European Sub-National Population Declines*, Eur J Population vol. 41.
DOI: <https://doi.org/10.1007/s10680-025-09730-0>.
13. NIS (2026), National Institute of Statistics – TEMPO ONLINE Platform. Online: <http://statistici.insse.ro:8077/tempo-online/#/pages/tables/insse-table> (last accessed on 15.01.2026).
14. Novotný, V. (2023), *Europe's demography and what to do about it. European View*, 22(2), pp. 205-212. DOI: <https://doi.org/10.1177/17816858231205403>.
15. Pinkus, D., & Ruer N. (2025), *The demographic divide: inequalities in ageing across the European Union*, Policy Brief vol. 13, Bruegel, pp. 1-22. Online: <https://www.bruegel.org/sites/default/files/2025-03/PB%2013%202025.pdf>.
16. Pop, C., C. (2016), *Geographic Axes. Intelligent Territorial Structures* (in Romanian), Casa Cărții de Știință Publishing House, Cluj-Napoca, Romania, 138 pages.
17. population.un.org (2017). *World Urbanisation Prospects 2018*. Online: <https://population.un.org/wup/> (last accessed on 16.11.2025).
18. populationpyramids.org (2025). *Romania Population Pyramid (2025)*. Online: <https://populationpyramids.org/romania> (last accessed on 16.11.2025).
19. un.org (2022). *World Population prospects 2022: Summary of Results*. Online: https://www.un.org/development/desa/pd/sites/www.un.org.development.desa.pd/files/wpp2022_summary_of_results.pdf (last accessed on 15.11.2025).
20. Utomo, B., Romadlona, N., A., Naviandi, U., BaharuddinNur, R., J, Makalew, R., Liyanto E., Nanwani S., Dibley M., J., & Hull T., H. (2025), *Census block based loglinear regression analysis of health and social determinants of maternal mortality in Indonesia 2010–2021*, Sci Rep 15, 9397. DOI: <https://doi.org/10.1038/s41598-025-91942-9>.
21. Væth, M., Skriver M. V., & Støvring H. (2018), *The impact of proportional changes in age specific mortality on life expectancy when the mortality rate is a log-linear function of age*, Demographic Research, 58, pp. 671-684.
DOI: 10.4054/DemRes.2018.39.23.