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THE EVOLUTION OF THE STRUCTURE BY AGE GROUPS AND THE AGEING OF THE POPULATION IN ROMANIA BETWEEN 1992-2021

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Abstract: The ageing of the population has become a problem of maximum interest, in the context of the completion of the demographic transition, especially in European states. Romania, like all of Eastern Europe, is facing the acceleration of this process, against the background of a strong demographic decline after 1990, generated by the drastic decrease in fertility and the massive migration of labor force abroad. The present study proposes a diachronic analysis of the evolution of the age group structure and, implicitly, of the ageing process, based on the four censuses carried out after 1990. The main objective is to detect territorial disparities, on various levels, with the hypothesis of the differentiated action of of factors that can stimulate or inhibit demographic aging. The double analysis (descriptive, respectively factorial) highlighted a series of regional models of evolution that express various ways of adapting to the socio-economic and political transition. The faster expansion of the process studied in cities is an observation that can be the basis of specific studies. On the other hand, the relative rejuvenation of the population in the metropolitan areas expresses a population transfer generated by the change in lifestyle, the relocation of economic activities and the increase in mobility. At the same time, the isolation, the predominance of agricultural activities and the decline in the exploitation of some resources constitute the motive of an ageing without precedent, illustrating certain trends of depopulation of vast areas.

Key words: demographic ageing, typology, drivers, territorial disparities, Romania

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INTRODUCTION

One of the most problematic trends in the demographic evolution of recent decades is the accelerated ageing of the population, one of most typical features of second demographic transition (van de Kaa, 1987, cited by Káčerová, Ondačková, & Mládek, 2014), a key challenge rooted in past fertility cycles (Reher, 2015). In Europe, this process has been studied and anticipated for a long time (Sauvy, 1948). This unprecedented process is expected to be worldwide, and identifying its causes, patterns of evolution and implications becomes a priority (Davies & James, 2011). Romania, like all European countries, is no exception, with its own evolution, in line with the evolution and duration of the demographic transition. And geography, with its focus on territorial disparities and regional patterns of development, can contribute to a deeper understanding of the ways in which this process manifests itself. From descriptive studies focusing on the distribution of the elderly population in the territory, correlations with environmental problems or well-being, the search for spatial patterns has gradually moved on since the latter part of the last century (Rowles, 1986). At the same time, ideas, concepts and models of approach specific to gerontology have been learned which have strengthened the need for holistic conceptualization with the aim of identifying the historical bases of this process (Warnes, 1990). The impact of the shift from descriptive to analytical studies, based on the manipulation of detailed databases, has been felt with the use of computer processing tools (Harper & Laws, 1995). A true "geography of ageing" has thus developed (Skinner, Cloutier, & Andrews, 2015), overlapping somewhat with health geography, population geography and social geography, sometimes even referred to as "geographical gerontology" in the context of interdisciplinary studies, increasingly oriented towards the relationships between older people and the spaces and places they frequent (Cutchin, 2009). Since the 1990s, three key themes have been developed in this new field: analysis of trends in the evolution of the ageing process in spatial profile, often linked to the mobility of older people; the issue of territorial disparities induced by access to health and social care services; analysis of factors influencing the quality of life for this category of population, often linked to the quality of the environment. They are part of public policies for "healthy (active) ageing", fostering the formation of "age-friendly" communities (Golant, 2014), often imagined according to the principles of sustainable development and inclusive governance (Han, et al., 2021). In this sense, the complex aging active index was created and implemented, with the aim of providing effective policies for monitoring the aging of society. The periodic reports that use this index at the European level indicate an unfavorable position of Romania (1-33, 2019). Society's response to population ageing, identified by international organisations as one of the global "megatrends" shaping this century (alongside population growth, international migration and rapid urbanisation (Messerli, et al., 2019), involves a complete rethinking of how society functions, including from a spatial perspective (MacCarthy, 2022). This is even though, as some authors point out, governments have difficulty perceiving ageing and, above all, anticipating its effects (Thumerelle, 2000).

This study proposes a diachronic analysis of the evolution of the ageing process of the Romanian population after the fall of the communist regime. Closely linked to the completion of the demographic transition, postponed by the pro-natalist demographic policy until 1989, this process has been pushed forward rapidly, stimulated by the massive emigration of a significant part of the young working population or by the significant increase in life expectancy, particularly after 2000 (Rotariu, 2014). This development is in line with the general trends observed in Central and Eastern Europe, marked by significant gaps compared to Western Europe, especially in terms of active ageing (Olivera, 2020) or determinants, first of all the importance of the contribution of international migration which helps to reduce the share of the elderly population in attractive countries (Długosz & Kurek, 2006; Lewandowska-Gwarda & Antczak, 2020) or the incomplete epidemiological transition (Kinsella, 2000). The specific context of Eastern Europe imposes in Romania a combination of the three established forms of ageing: at the bottom, through declining fertility; at the middle, through significant emigration of the young adult population; at the top,

through increasing life expectancy at birth (Sardon & Calot, 1999). There are a number of similarities with the development of this process in Southern Europe (Marcaletti, Iñiguez-Berrozpe, & Caravaglia, 2020). In contrast, in the western part of the continent there has been a succession between ageing at the bottom and ageing at the top, with a significant time lag. This combination coincided with profound political, economic and social transformations brought about by the shock of the fall of communism, with the older generation often seen as the main losers of the transition (Botev, 2012). The rapid pace of ageing, affecting both rural and urban areas, has generated increased attention among social scientists, particularly in recent decades, especially on the effects on public welfare services, which are ill-equipped for coping (Asandului, 2013; Bodogai & Cutler, 2014). Special attention was also paid to the analysis of Romania's specific situation in the European context, in order to identify solutions for the implementation of EU policies (Gabor et al., 2022). There are also studies that have focused on the factors favouring the rise of this process, such as international migration (Nemenyi, 2011), transformations generated by widening economic and social gaps (Jemna & David, 2021) or the capacity of territorial structures to adapt to this process (Istrate, Muntele, & Bănică, 2015). A review of the literature shows that most studies have been limited to the national or regional scale or to comparisons with other European countries. The option for a more detailed analysis using the basic administrative structure (the 3181 communes, towns and municipalities) is indicated in order to identify the manifestation of regional patterns in the evolution of the ageing process, including the extent to which they express the influence of socio-economic, cultural or geographical factors. In this respect, a number of questions have been formulated which require a response:

- Can we talk about the generalization of the demographic ageing process in Romania?
- Are there regional differences in the timing and pace of this process?
- Do regional patterns express particularities derived from the differentiated evolution of the demographic transition?
- Have profound transformations of the transition such as urban population decline (shrinking) or the formation of metropolitan agglomerations influenced the pace of evolution of this process?
- Is there local or regional resistance to this process? What factors are at play?

The working hypothesis arising from these questions is based on the observation that, beyond the general trends observed in various works, there are significant territorial disparities generated by the differentiated action of factors that stimulate or slow down the ageing process. As a result, the study comprises two mutually complementary approaches: one descriptive, focusing on the typology of ageing evolution, and the other based on a multivariate analysis testing a number of explanatory variables.

MATERIALS AND METHODS

In order to answer the questions raised and to test the hypothesis put forward, two separate databases were created. The first of these contains primary information on the age structure of the population as recorded in censuses after 1990 (in 1992, 2002, 2011 and 2021). The second database consisted in the selection of variables with an explanatory role for the evolution of indicators expressing demographic ageing. The ageing index (*Ai*=+65 years/0-14 years) was preferred as the dependent variable, after previously testing its correlation with mean age, which was found to be very strong.

For the descriptive analysis, three distinct classifications were made: on the evolution of the structure by major age groups (0-14 years, 15-64 years, over 65 years), expressed as a percentage of the total population; on the evolution of the ageing index, as formulated above; on the evolution of the average age : $X=(\sum(x+0.5)Px)/(\sum Px)$, where X is the average age, Px is the number of the population of age x and 0.5, the average equivalent of the variation of deviations from the exact date of attainment of a given age.

Table 1. Variables used in factor analysis - description and source of information

Variable type	Variable	Acronym	Description	Source of information	Standardisation
Dependent variable	Ageing index	AI	Ratio of population aged 65+ to 0-14 years	Romanian population censuses of 1992, 2002, 2011, 2022	Z-scores, with elimination of outliers
Variabilele explicative	Bottom ageing	BA	Ratio of the average birth rate of the last intercensal period to that of previous period	INS Tempo Online Database (1966-2021)	
	Middle ageing	MA	Average net migration in recent intercensal periods	INS Tempo Online Database (1966-2021)	
	Top ageing	TA	Ratio of age groups 50-64 years and +65 years	Romanian population censuses of 1992, 2002, 2011, 2022	
	Oldest old	OO	Share of the population aged +80 in the total population aged +65	Romanian population censuses of 1992, 2002, 2011, 2022	
	Average altitude of settlements	ALT	Considered for main localities	Topographical map 1:100 000 Military Topographical Directorate	
	Fragmentation of settlement areas	FS	Ratio of population to number of localities	Romanian population censuses of 1992, 2002, 2011, 2022	
	Location to major cities	LMC	Distance in km on the shortest route to cities with more than 50 000 inhabitants	România. Marele atlas rutier 1:200000	
	Access to the major transport network	AMT	Factor scores according to the importance of transport routes. Maximum value (1) given for railways & European roads, minimum value given for local roads	România. Mare atlas rutier 1:200000	Factor scores
	Share of population employed in agriculture	PEA	Percentage of employed labour force	Romanian population censuses of 1992, 2002, 2011. INS Tempo Online Database (2021)	Z-scores, with elimination of outliers
	New houses built	NHB	Number of new dwellings completed as a share of total population in each intercensal period	INS Tempo Online Database (1966-2021)	
	Building index	BI	Average share of households with access to water supply, sewerage and central heating out of all households	Romanian population censuses of 1992, 2002, 2011, 2022	
	Education index	EI	Share of population with secondary and tertiary education	Romanian population censuses of 1992, 2002, 2011, 2022	
	Income	INC	Wages, social benefits average income (lei/person), extra-polated on population socio-professional structure basis	INS Tempo Online Database (1966-2021)	
	Roma weight	RR	Share of ethnic Roma population (% of total)	Romanian population censuses of 1992, 2002, 2011, 2022	

Although seemingly redundant, the three typological analyses were conducted precisely to observe the inconsistencies between them. The statistical processing of the information used the XLSTAT function of Excel (Addinsoft, version 2015), opting for agglomerative hierarchical clustering that uses Euclidean distance and groups statistical individuals by degree of similarity (Ward's method of clustering), aiming to keep the intra-class dispersion coefficient values as low as possible for a higher quality of classification. Adobe Illustrator CS12 was used for the graphic processing of the results. A total of 15 variables were used for the factor analysis, four of which were constant for the entire analysis period, the rest were calculated for each of the four time series (Table 1).

Standardised data sets for each of the four time sequences (1992, 2002, 2011 and 2021) were subjected to multivariate analysis. The PLS (partial least square regression) model was chosen, using XLSTAT functions. It is based on covariance analysis, recommended for series with a large number of explanatory variables with a high probability of multicollinearity. The main results sought were correlation matrices, factor axis distributions and regression quality coefficients (R_2, standard deviation).

RESULTS AND DISCUSSIONS

Descriptive analysis

The first AHC (agglomerative hierarchical clustering) analysis, according to the methodology presented, aimed at tracking changes in the specific weighting of each age category. The first and last of these correspond to the accepted divisions (young, 0-14 years, and old, 65+ respectively). The median category, the adult population (15-64 years), has been divided into three broad subgroups: 15-29 years, 30-49 and 50-64 years). The use of 5-year age groups at this scale of detail proved to be inconclusive, with too much dispersion of values within classes. The gender structure has not been taken into account as the last census did not provide this information at a detailed scale. The relative diversity of the resulting patterns is due to time lags in the incidence of determinants ranging from declining fertility to increasing life expectancy or various social, economic or cultural factors (figure 1, table 1).

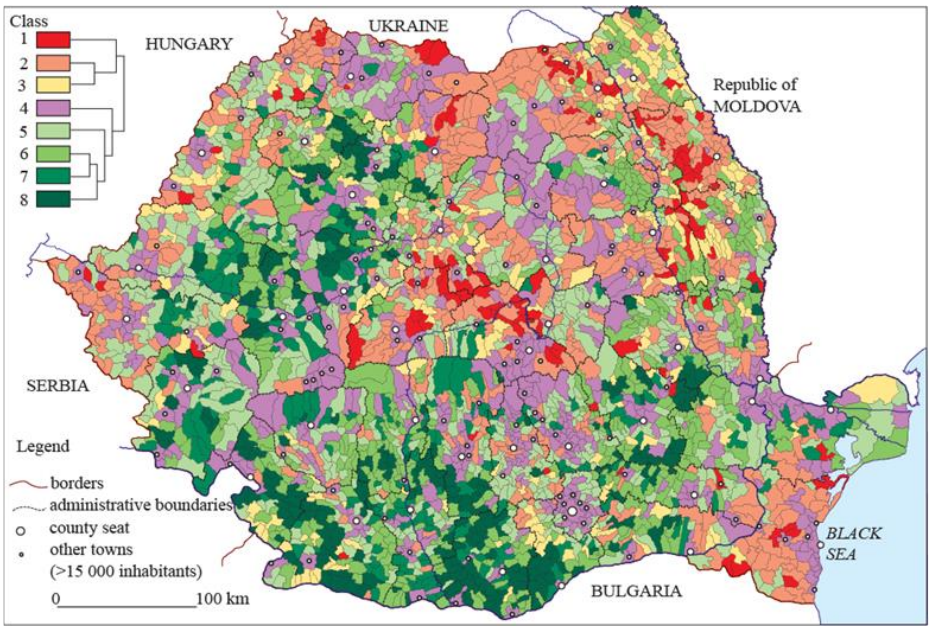

Figure 1. Typology of population structure by large age groups
(Source: RPL 1992, 2002, 2011, 2021, INS)

Table 1. Profile of classes

Age group	*Year\Class*	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***
		in % from total population							
0-14 years	1992	**29,1**	24,8	19,4	22,9	19,8	17,0	17,1	13,0
	2002	**27,8**	22,7	20,3	18,5	18,8	16,8	16,2	13,2
	2011	**27,2**	20,5	20,0	15,9	16,9	15,3	13,7	12,4
	2021	**26,1**	18,8	18,9	15,2	15,4	13,5	12,3	11,1
15-29 years	1992	**25,2**	24,9	22,1	23,8	22,6	21,7	21,3	18,3
	2002	**24,4**	23,5	19,9	22,9	20,9	18,3	19,0	14,6
	2011	**21,6**	20,0	17,5	18,2	17,8	15,2	16,0	12,5
	2021	**21,3**	18,6	18,3	15,3	16,8	15,5	14,6	13,0
30-49 years	1992	19,6	21,5	18,8	**25,6**	21,4	19,7	22,0	18,3
	2002	22,4	24,7	21,0	**28,6**	24,1	21,2	24,0	18,5
	2011	25,0	27,9	25,0	**30,0**	27,5	24,8	26,8	21,9
	2021	25,8	28,2	25,9	**28,6**	27,6	24,8	26,2	22,3
50-64 years	1992	15,6	17,3	22,0	17,2	20,6	23,6	22,4	**27,0**
	2002	12,9	15,2	17,7	16,7	17,8	20,2	20,0	**23,2**
	2011	13,9	16,7	16,5	20,3	18,4	18,8	**20,6**	20,2
	2021	14,8	18,5	17,6	21,6	20,2	20,4	**22,3**	20,9
over 65 years	1992	10,6	11,6	17,6	10,5	15,5	17,8	17,2	**23,3**
	2002	12,5	14,0	21,2	13,3	18,3	23,5	20,7	**30,5**
	2011	12,3	14,9	21,1	15,6	19,4	25,9	22,8	**33,1**
	2021	12,0	15,9	19,3	19,4	20,1	25,7	24,6	**32,6**

The eight classes retained from this analysis are well highlighted both in terms of geographical distribution, which is significantly regionalised, and in terms of the profile of changes.

A first cluster concerns classes 1-3, grouped mainly in the north-east, centre and south-east of the country. The first class, with a very high proportion of young people (0-14 years) and young adults (15-29 years) is also distinguished by a relatively stable structure, with a slow advance of the elderly population (over 65 years) and a stagnation of the 50-64 age group. They form relatively coherent areas in the regions mentioned, being closely linked to the preservation of a relatively high female fertility, partly explained by belonging to certain ethnic (Roma) and confessional (neo-Protestant) communities (Muntele, 2022). Class 2, located in continuity with the previous one, shows a more advanced pattern of evolution, with a significant decline of the young population and a clear advance of the elderly, without having crossed the threshold of chronic ageing. Class 3 is often located in the extension of the first two, with significant areas also in the south or south-west of the country, with a stable share of young and old, at an average level, with a relatively equal distribution of the share of the five population categories. It can be considered the more advanced, mature version of the other two classes.

A second cluster joins five distinct classes that stand out for the rapidity of their transformations, either among the young (classes 4-7) or the old (all five) population. Class 4, groups most urban centres and their peri-urban areas but is also well represented in the Carpathian area. It is marked by the most profound transformations, with a massive decline in the share of the first two groups (0-29 years) and a strong increase in those aged over 50, leaving room for a very strong accumulation in the middle ages (30-49 years). This trend reflects the profound demographic changes experienced after the fall of communism, primarily the decline in fertility but also the massive accumulation of an older population from the generations that migrated following the policy of forced industrialisation (Sobotka, 2011). Class 5, which is particularly common in rural areas with relatively easy access to urban centres, is the more advanced version of the previous one, in which the accumulation of the elderly population was earlier, resulting in

relatively strong ageing. Classes 6, 7 and 8 form distinct, coherent areas, particularly in the south and west of the country, without being absent in the rest (especially class 6), and are distinguished by the massive reduction in the proportion of young people (both 0-14 and 15-29 years), while in contrast there is a massive accumulation of older people, more evident in the case of class 8, the ratio between the extreme groups being clearly favourable to it. The high and relatively increasing share of the 50-64 age group favours a trend towards a deepening of the ageing process, in parallel with the massive shrinkage of the adult population (30-49 years).

The picture of spatial distribution described above holds for the other two typological analyses that tested the ratio of extreme ages (ageing index) to mean age. Taking into account only extreme ages or average age, these classifications are simpler, with a stronger homogeneity within the 6 classes retained (average dispersion within classes being below 20%).

In the case of the ageing index, the first class, the only one that has maintained clearly subunit values throughout the period, is dispersed in the north-east and centre of the territory, in those conservative areas mentioned in the first typological analysis (figure 2). Class 2, comprising mainly urban centres, with no hierarchical differentiation, in which the ageing process, although absent in 1992, became a certainty in the 2011-2022 period, showing a strongly accelerated evolution, attributable to inevitable phenomena during the transition to a market economy, primarily deindustrialisation and the migration of a large part of the young population either to their rural areas of origin or, especially after 2000, when European integration became certain, abroad. Class 3 is characterised by stability at relatively high values of the index, close to 1, and is more characteristic in the west and centre of the country, around the capital and other large cities, closely linked to processes such as peri-urbanisation, relocation or decentralisation of certain economic activities which have favoured well-positioned rural areas over major transport axes (particularly those oriented towards the west) or over more dynamic cities. Class 4 represents the degraded version of the previous one, particularly characteristic of mountain areas which, during the communist period, had experienced a certain stability in the overall demographic development due to the exploitation of mineral or forest resources. Some agricultural areas in the south-east (Dobrogea, Bărăgan), where the agro-industrial economic model dominates, are also close to this pattern (Sandu, 2010). The reduction of previous advantages after 1990 has led to a rapid deterioration of the age structure in these areas, particularly through the migration of young people abroad, resulting in extremely rapid ageing, especially after 2002. Class 5 includes localities located mainly in the western mountainous area (Western Carpathians) and in the south-west of the country, areas where the ageing process was already advanced during the communist period but after 1990 it did not advance so much, even levelling off in the last period. Class 6, with a similar starting point to the previous one, has experienced, on the contrary, a critical degradation, inevitably accompanied by depopulation tendencies, especially in the mountainous areas of the western part of the country (Muntele, Istrate, Athes, & Bănică, 2023). The areas most affected by ageing form a circular arc, starting in northern Transylvania along the Western Carpathians and descending south and south-east into the Danube Plain.

The distribution and dynamics of average age values are similar, with differences stemming from the evolution of life expectancy, traditionally lower in the north-west and south-east of the country and higher in the cities (figure 3). The six classes are grouped in pairs, with the first representing the slower and the other the faster evolving variant. The first class coincides with the north-eastern and central areas of the country which still have a very favourable age structure of the population, with a high share of young people and young adults and, consequently, a relatively low average age compared to the national average. Class 2 is mainly characteristic of urban centres, reflecting a rapid transformation of the age structure as already mentioned. It is likely that this rapid increase in average age also reflects greater progress in extending life expectancy, with access to health services more efficient than in rural areas. Class 3, marked by slow growth, while maintaining average values in relation to the national profile, is particularly characteristic of dynamic, attractive areas (western part of the country, capital region). Class 4, with values already

higher than the national average in 1992, has seen a fairly strong increase and is characteristic of mountainous and sub-mountainous areas and the south-east of the country. Classes 5 and 6 stand out for being well above average since 1992, corresponding to the vast areas strongly affected by ageing in the south of the country and in the Western Carpathians. However, they are distinguished by a relative stability (class 5) and a sharp increase (class 6), which in 2021 will reach an average of 50 years, indicating a drastic reduction in the potential labour force in the affected areas.

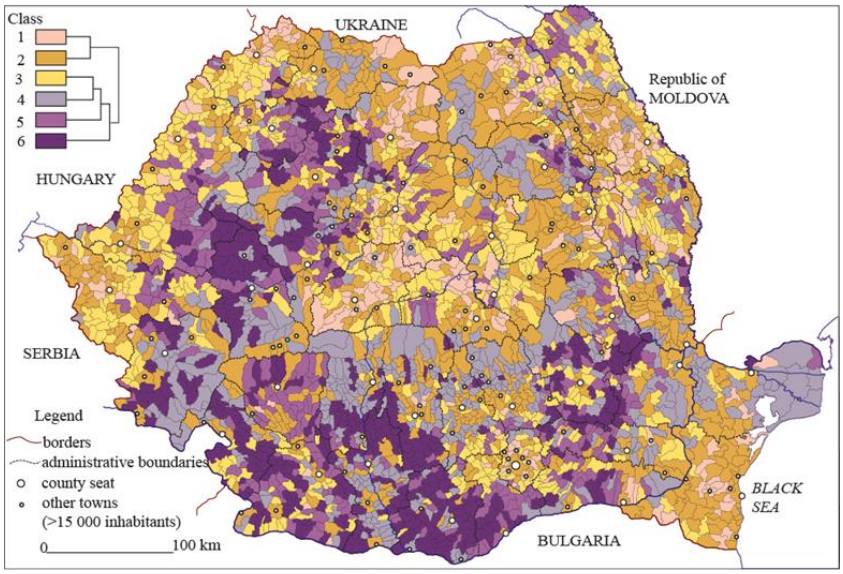

Figure 2. Typology of Ageing Index
(Source: RPL 1992, 2002, 2011, 2021, INS)

Table 2. Profile of classes

Class	1992	2002	2011	2021
	over 65 years / 0-14 years			
1	0,38	0,49	0,53	0,58
2	0,45	0,66	0,89	1,14
3	0,81	0,92	0,96	0,98
4	0,73	1,04	1,40	1,80
5	1,25	1,45	1,56	1,56
6	1,56	2,01	2,49	2,90
National Average	**0,48**	**0,80**	**1,02**	**1,21**

It can be concluded from the descriptive analysis that there are strong regional differences in Romania in terms of the evolution of the population structure by major age groups, expressing well-defined regional patterns, closely linked to the differentiated diffusion of economic and social modernization processes, despite the trend towards homogenization manifested during the communist period. The post-communist transition has disrupted previous trends, marked by a strong gap between urban and rural areas, introducing new disparities corresponding to the more rapid integration into the market economy of some regions favoured by their geographical position (the west of the country, metropolitan areas) and the decline of activities which previously provided stability, especially in mountainous and agricultural areas (Mitrică, et al., 2020). With the notable exception of the Western Carpathians, the intra-Carpathian regions seem to correspond rather to patterns marked by a relative stability of the indicators monitored, while the extra-Carpathian regions (except for the metropolitan areas, especially the capital) are strongly marked

by the speed of the ageing process (Nancu, Guran-Nica, & Perșu, 2010). From a certain perspective, Romania is in an intermediate position between Hungary and Bulgaria. For example, in terms of average age, Romania's increase between 1992-2021 was 21% from 34.9 to 42.4 years, lower than Bulgaria's (24% from 36.3 to 44.8 years) but higher than Hungary's (18% from 36 to 42.7 years). The intra-Carpathian regions developed at a pace closer to that of Hungary and the south of the country to that of Bulgaria, with the north-east in an intermediate position, also due to the somewhat higher fertility rate.

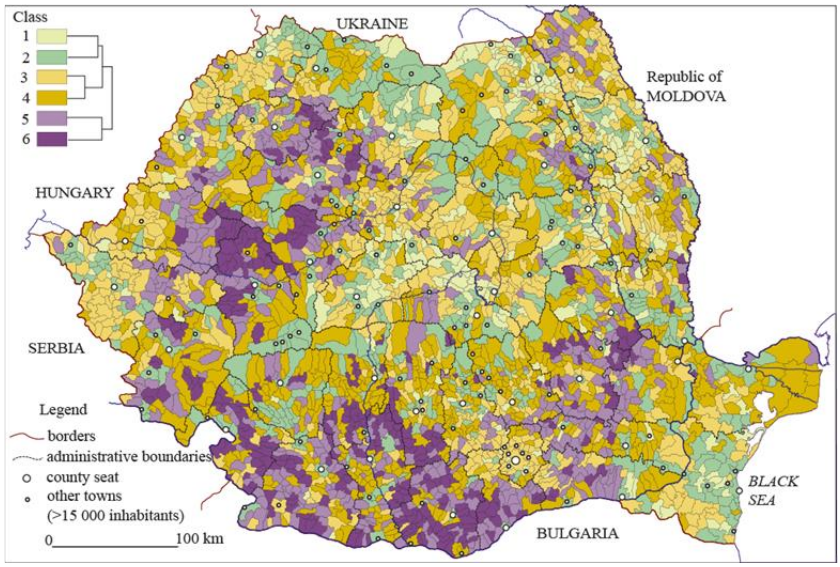

Figure 3. Typology of median age
(Source: RPL 1992, 2002, 2011, 2021, INS)

Table 3. Profile of classes

Class	1992	2002	2011	2021
	ani			
1	32,7	33,9	35,2	35,9
2	32,7	35,8	39,4	42,0
3	36,8	37,8	39,2	40,1
4	38,1	40,0	42,5	44,2
5	42,1	43,3	44,6	44,9
6	44,3	46,8	48,9	49,9
National average	**34,9**	**37,8**	**40,6**	**42,4**

Factorial analysis

From the descriptive analysis, a number of local or regional particularities, general trends, forms of restructuring generated by the social-economic transformations of the last decades have emerged. These cannot be properly interpreted without a multivariate analysis based on PLS multiple regression. The 14 variables retained were tested for each of the four censuses carried out after 1990 (1992, 2002, 2011 and 2022), with the ageing index as the dependent variable, which, as the three typological analyses showed, has a more homogeneous distribution, likely to be easier to interpret in a correlational analysis than the average age or the weight of certain age categories.

The quality of the PLS analysis is illustrated by the coefficient of determination R2 which, with its high values, attests to the validity of the factor analysis (Table 4). It should be noted that between 1992 and 2002, the value of this coefficient seemed to decrease, corresponding to the

upheaval caused by the fall of the communist regime and the manifestation of a variety of forms of adaptation. Subsequently, however, its value increases steadily, showing a strong interaction with most of the factors included in the analysis.

Table 4. Matrix of Ageing Index correlations with explanatory factors

Variables	Ageing Index				
	1992	2002	2011	2021	Trend
BA	**0,333**	0,070	**0,240**	0,155	decreasing
MA	**0,252**	0,156	0,017	**0,653**	growing
TA	**0,606**	**0,593**	**0,661**	**0,651**	high stable
OO	0,091	0,156	**0,251**	**0,338**	growing
ALT	0,114	0,071	0,023	-0,011	low stable
FS	**0,413**	**0,383**	**0,328**	**0,275**	decreasing
LMC	0,191	**0,214**	**0,212**	0,195	middle stable
AMT	**0,283**	**0,309**	**0,273**	**0,246**	middle stable
PEA	**0,343**	**0,349**	**0,285**	0,195	decreasing
NHB	**0,218**	**0,201**	0,195	**0,209**	middle stable
BI	**0,430**	**0,413**	**0,350**	**0,246**	decreasing
El	**0,275**	**0,244**	0,158	0,039	decreasing
INC	**0,273**	**0,239**	0,171	0,058	decreasing
PR	0,103	0,168	**0,268**	**0,333**	growing
Coefficient R_2	*0,5364*	*0,4661*	*0,5692*	*0,6264*	decreasing

In 1992, there is a strong dispersion of correlations, with 10 of the 14 factors having a value above a level indicating a significant influence (0.2). The variables TA, FS, BI and PEA were the most important, illustrating the differences between urban and rural environments, the latter being characterised by a more fragmented habitat, a lower quality of housing comfort and a high proportion of the population in agriculture. The strongest influence was exerted by ageing at the top, imposed by the accumulation of elderly population, against the background of the massive decline in the birth rate which, as indicated by the BA value, also generated significant ageing at the base, together with the median ageing (MA) generated by the massive rural exodus specific to the communist period. The reduced influence of other factors can be specifically explained. Thus, OO expresses the stagnation of life expectancy in the last two decades of the communist period which did not allow for an additional accumulation of population over 80 years. The low level of correlation with ALT indicates the generalisation of the ageing process, regardless of the geographical context as well as the position in relation to the main urban centres, their polarising capacity being limited by communist planning. The cultural factor, expressed here by the share of the Roma population, is not strongly expressed, with much smaller gaps in demographic behaviour compared to the majority population.

In 2002, the explanatory valence changes visibly, with the accumulation of the elderly population (AP) remaining the main driver of the evolution of the ageing index. The onset of peri-urbanisation, stimulated by the decline in industrial activities and the rise in unemployment as a result of privatisation measures, increases the influence of the PMC factor, with distance from the city becoming a significant variable in the change in the age structure. The factors that illustrated the differences between urban and rural areas retain their explanatory value (AMT, PEA, BI, etc.), proving the manifestation of an inertia generated by the massive accumulation of young people in cities during the last decades of communism.

The year 2011 brings new changes, following pre- and post-accession transformations. The resumption of the decline in the birth rate with the increase in international migration for work, facilitated by the relaxation of travel formalities in the Schengen area, is boosting ageing at the bottom and the significant increase in life expectancy (from 70.8 years in 2002 to 74.2 years in 2011, the fastest increase since 1990) has accentuated ageing at the top. This is also reflected in the

increased significance of the correlation of the Oldest Old variable, which certifies for the first time in Romania's history, a strong increase in the population aged over 80 (between 1992-2002 it had even decreased, from 280 534 to 258 400, to reach 726 069 people in 2011; as a percentage, from only 1.2% in 1992-2002 it reached 3.6% in 2011). Variables expressing urban-rural relations maintain their importance, except those related to education, income and the dynamics of new housing construction. The role of cultural factors, expressed by the proportion of Roma communities, becomes more important, closely linked to their demographic conservatism, which requires resistance to the ageing process.

At the end of the study period, in 2021, further changes attest to the importance of the socio-economic transformations that have taken place since accession to the European Union. The influence of the economic crisis of 2008-2011 or, finally, the pandemic crisis can also be invoked, the consequences of the latter being too early to be seen in the age structure. Thus, the importance of population mobility becomes more important than ever, the median ageing generated by the massive departure of the young adult population after 2001, mostly permanent, being the main explanatory factor of the acceleration of demographic ageing, together with the increasingly strong accumulation of the elderly population, including the oldest old category (4.5% of the total in 2021), attesting to the continuation of the upward trend in life expectancy (stopped, however, in the years marked by the pandemic, especially in 2020 and 2021). The disparities between the urban and rural environments are limited, the explanatory value of the factors related to the relationships between them or the specificity of some socio-economic variables is reduced. At the same time, the share of the Roma population increases its explanatory value, showing the importance of some socio-cultural variables, more difficult to notice on a detailed scale of analysis.

The analysis of the evolution trends of the explanatory capacity of the 14 variables highlights a constant increase or a spectacular return of three of them towards the end (MA, OO and RR) but also stability at a high level in the case of TA. Three other variables (PMC, AMT and NHB) stand out for their relative stability, having an average explanatory capacity, six others following a downward trend. Thus, a relative stabilization of the fertility level is attested, the variation in the birth rate, which in the first post-communist decade fueled the bottom ageing, reducing its importance. Fragmentation of the settlements, access to modern transport routes, the share of the agricultural population or the urban variables, although they know a downward trend, maintain their explanatory role at the limit, possibly related to the constant amplification of the processes of peri-urbanization and metropolisation. The massive reduction in the explanatory role of the income or educational variables, possibly due to interference with cultural factors, illustrated by the RR variable, is debatable. The high income and the higher level of education thus seems rather related to a high level of ageing, possibly related to the massive emigration of the young population, especially the highly qualified one.

CONCLUSIONS

As an inevitable process of economic modernization, demographic ageing manifested itself relatively rapidly in Romania, in close correlation with the shock felt following the fall of the communist regime, which hastened it through its effects. If we can talk about the generalization of this process on a national scale, it is a certainty, proven by the almost threefold increase in the ageing index during the analyzed period (from 0.48 to 1.21). Practically, during a single generation, Romania went from a relatively young structure of the population to one marked by accentuated ageing. If in the European context the age structure of the Romanian population may seem more favorable, this is primarily due to the lower life expectancy. Romania is far from the ageing level of Italy or Germany (1.65 and 1.76 respectively in 2021, according to Eurostat) but close to that of France (1.25 in the same year), states with a constant intake of young adult population through immigration. Comparatively, neighboring states such as Hungary or Bulgaria, with similar characteristics from a demographic perspective, appear significantly older (1.39 in

2021). The pace of the ageing process was, however, just as alert in Bulgaria or Hungary (the ageing index was 0.54 and 0.65, respectively, in the early 1990s). Germany was showing a level above unity since 1990 (1.07), Italy was approaching (0.86) and France was in an intermediate position (0.7). If at the national level ageing is beyond any doubt, the typological analyzes highlighted the presence of some conservative areas, where this process is at an early stage. Isolation and predominantly rural character, often marked by a certain ethnic or confessional specificity, can be invoked as explanatory factors, as was partially demonstrated in the factor analysis. The differentiated evolution of the demographic transition, earlier in the southwest of the country and later in the northeast, highlighted for a long time (Trebici & Hristache, 1986), still maintains its imprint. Thus, the aging of the rural population started much earlier, since the interwar period in Banat and southern Transylvania (Muntele, 1994).

Significant gaps in the chronology of the manifestation and the pace of the ageing process were highlighted. The main cleavage opposes the urban environment to the rural environment. In just three decades, Romanian cities went from an ageing index of 0.31 to 1.26. On the contrary, in the rural environment its evolution was slow, from 0.72 in 1992 to 1.16 in 2021. The increase in life expectancy can also be discussed, more consistent in urban areas thanks to higher accessibility to medical services but also relative rural conservatism. The decline in fertility was much steeper in the countryside, or the emphasis on mobility in various forms drains especially the young population of the cities, either to the neighboring rural areas or abroad. The rapidity of urban ageing in post-communist Romania is in stark contrast to the rapid urbanization of the decades of forced industrialization. Is this a sufficient reason for a more detailed analysis of the causes, forms and effects produced by this very little studied phenomenon. The methodological approach of convergence analysis may be of interest, which has highlighted, in other studies, the precariousness of the urban-rural distinction, the demographic processes that change the age structure being much more complex (Kashnitsky, De Beer, & Van Wissen, 2021). Significant gaps also appear according to other criteria, both in urban and rural areas. Hierarchy and administrative status produce distortions in the case of cities, as does the position towards urban localities with an important polarizing role over rural localities. In the case of cities, the differences are not so great but, in a seemingly paradoxical way, the evolution of the ageing index was much faster in urban centers with over 50,000 inhabitants, county capitals in general, compared to medium or small cities (table 5).

Table 5. Evolution of Ageing Index by urban and rural hierarchy
(Source: RPL, 1992, 2002,2011,2021, INS)

Type of localities, by hierarchy	*Ageing Index*			
	1992	*2002*	*2011*	*2021*
Urban localities over 50 000 inhabitants	0,32	0,71	0,99	**1,30**
Urban localities with 10 000 - 50 000 inhabitants	0,28	0,55	0,83	1,19
Urban localities under 10 000 inhabitants	0,41	0,66	0,91	1,22
Rural localities over 10 000 inhabitants	0,40	0,60	0,67	0,64
Rural localities with 1 000 - 10 000 inhabitants	0,73	0,94	1,10	1,20
Rural localities under 1 000 inhabitants	1,23	1,72	2,06	**2,39**

At the same time, the large communes, with over 10,000 inhabitants, located almost exclusively in the vicinity of the main cities experienced a much slower pace, with rejuvenation trends even in the last interval. The transfer of the young urban population to the peri-urban areas is thus certified. This way links can be established between the decline of the urban population and the advance of the ageing process correlated with the formation of metropolitan agglomerations.

The compensation of this decline is often complete in the case of the big poles of development (the capital in the first place). Between the rural localities, the contrasts are strong, the communes with low population, marked by imminent depopulation, being heavily aged.

Reduced accessibility, predominantly agricultural character and more dispersed habitat partially explain this contrast, as certified by factor analysis.

The study highlighted the diversity of the forms of evolution of the population structure by age groups, each constituting an adaptation of the overall transformations produced by the transition. The local scale thus becomes very important for a complete territorial diagnosis from the perspective of human capital analysis. The perspectives opened by this study can be used in the more in-depth research of the specific structures of distinct categories such as cities, metropolitan areas, spaces strongly affected by ageing or, on the contrary, those that preserve a more favorable age structure. Although there were limits imposed by the access or lack of some information, we believe that the objective of finding an answer to the formulated questions, by testing the advanced hypothesis, was achieved.

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