REGIONAL PATTERNS OF POPULATION AGING IN ROMANIA (2011-2021)

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Abstract

The study aims at analysing the last decade's changes regarding demographic ageing at the level of regions and the residential environment in Romania. The demographic data we worked on in the study are those from the national statistical database, Tempo-online. Births, deaths and migration generally influence the dynamics of demographic ageing. However, a more critical role at the regional level, compared to the one identified at the international level, is played by migration, a result deduced based on linear regression equations.

Keywords: demographic ageing; demographic ageing indicators; regional patterns; linear regression

1. Demographic Ageing - Introduction

Demographic ageing is an universal process present in all current populations. As society faces a significant decrease in fertility, especially against the background of economic and value changes, the share of the elderly increases and the population enters the process of demographic ageing (Rotariu, 2010). Fertility and mortality combine in many ways, giving rise to different demographic ageing profiles. In the first phases of the process, the most substantial effect is the decrease in fertility, which directly affects the base of the age pyramid. It otherwise implicitly increases the share of the elderly in the total population.

The increase in the number of older people during demographic ageing depends very much on how large the birth cohorts were over six decades ago and their chances of survival over their lifetimes. An unlikely reversal of the demographic

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ageing trend is possible under effective pronatalist policies and the attraction of external populations (immigrants).

Medical progress and health care, the well-being of a society are reflected, for the first time, in the decrease in the risk of death in children. Furthermore, the risk of death among the elderly population also decreases, which leads to increases in the number and percentage of older people.

The intensification of migration, especially encouraged by the hope of a better life in another country or region, contributes to the change in the population's age structures. Moreover, since it is primarily young people who leave and who can quickly integrate who leave, the intensification of migration benefits, in particular, the more prosperous countries and regions, which "rejuvenate", and the poorer regions and countries "age".

When the number of deaths exceeds the number of births, the natural increase is negative, and the population decreases. The only resources for growth are those given by migratory growth. At the level of localities and regions, where changes of residence and domicile are easier to achieve, the age structure is more affected by migration than at the international or national level. Driven by internal or external migration, some localities and regions are ageing, while others may even be getting younger, demographically speaking.

The effects of demographic ageing on current human populations are quite different. Some countries can better bear the "old age burden" due to modernisation, technology, education and the high incomes of the elderly. The elderly in these societies are generally more adaptable and more resilient. Advanced societies have robust, mature social security and protection systems capable of dealing with the different needs of the elderly. In less developed societies and economies, the elderly have low access to quality socio-medical services and supportive technologies, the social security and protection system is weak, the economy is fragile, and many of them will be a significant burden on society. Thus, demographic ageing effects on communities depend not only on the number and share of the elderly but also on their quality of life (Rotariu, 2010).

The analysis of demographic ageing and its consequences can change radically if the threshold for entry into old age, or chronological age threshold, is redefined. Various definitions of demographic ageing based on criteria other than chronological age have been proposed (Ryder, 1975; Kii, 1982; Bourdelais, 1993). These approaches can lead to very optimistic conclusions, such as the one formulated in a study by D'Albis and Collard (2013), that the percentage of the elderly has not increased in the last 50

years in developed countries. Rethinking demographic ageing in this way, although attractive, does not take into account the fact that the threshold of ageing (60 or 65 years) is not chosen arbitrarily but represents, for many years, a moment from which accelerated changes begin for the individual and society (Marina, 2003).

2. Data and Research Methodology

The demographic theory of the demographic causes that lead to the ageing of the age structure of a population is a substantial one, verified by multiple models of population evolution. According to the demographic theory, the most important reason is the decrease in fertility, significantly below the generational replacement limit (CHU, 1997; Bongaarts, 2009; Rotariu, 2010; Hugo, 2013; Murphy, 2017). We do not dispute this indubitable fact. However, the demographic and sociological reality of demographic ageing within the regions of a country can be more nuanced. Mathematical models of demographic ageing can be contradicted in the medium and short term by a pandemic, such as the current one of COVID-19. A sudden increase in deaths among the elderly can rapidly change the age structure of a population in the sense of rejuvenating it. War also brings about rapid changes in the demographic structure by increasing mortality and migration. Regionally, uneven socioeconomic development intensifies migration flows and leads to the rejuvenation of some regions and the ageing of others. It is the case in China, Poland, Australia, and other countries. (Kurek, 2011; Chan and al, 2018; Goodhart and Pradham, 2020).

Our primary hypothesis in this study is that in the medium term, migration dynamics can strongly affect demographic ageing at the level of NUTS 2 regions (development regions) and residential environment (urban/rural). However, our hypothesis does not rule out the overwhelming importance of fertility in influencing demographic ageing at the regional level. To test the hypothesis, we will use a linear regression equation and dynamic ageing indicators built according to the model proposed by Dlugosz (1998) and continued by Kurek (2011).

The data we used were those extracted from the Tempo-online database of the National Institute of Social and Economic Statistics of Romania[1]. For the analysis of the regression coefficients, we used the software SPSS 21.0.

[1] http://statistici.insse.ro:8077/tempo-online/. Accessed October 2022.

We used data from the Ministry of Labor and Social Solidarity regarding the distribution at the county and regional levels of the capacities (places) of social services for the elderly (from homes for the elderly, social canteens and home care services). We aimed to observe how prepared we were at the country level for the consequences of demographic ageing[1].

3. Results and Discussions

We used the following indicators to describe the picture of demographic ageing at the level of NUTS2 regions (separated by urban and rural):

- I1: *demographic ageing rate (*percentage of people aged 65 and over in the total population*)*;
- I2: *relative demographic ageing rate (*percentage of people aged 80 and over in total population aged 65 and over*)*;
- I3: *demographic dependency ratio* (total population aged 0-14 years and 65 years and over compaed to the population aged 15-64);
- I4: *demographic ageing index* (the ratio between the population aged 65 and over and the population aged 0-14);
- I5_2016: *dynamic ageing indicator in 2016 compared to 2011*;
- I6_2021: *dynamic ageing indicator in 2021 compared to 2011*.

Dynamic ageing indicators are calculated according to a mathematical formula proposed by Dlugosz (1998) and adapted by Kurek (2011):

$$I_{da} = \left[P(65+)_{t+n} - P(65+)_t \right] - \left[P(0-14)_{t+n} - P(0-14)_t \right] \quad (1)$$

I_{da} - dynamic ageing index;

$P(0\text{-}14)_t$ -share of the population aged 0–14 at the beginning of the period studied;

$P(0\text{-}14)_{t+n}$- share of the population aged 0–14 at the end of the period studied;

$P(65+)_{t+n}$-share of the population aged 65 and more at the end of the period studied;

$P(65+)_t$ -share of the population, aged 65 and more at the beginning of the period, studied.

Demographic ageing rates were calculated by means, regions and at three different points in time (2011, 2016 and 2021), as seen in Table 1. There are three populations

[1] https://mmuncii.ro/j33/index.php/ro/2014-domenii/familie/politici-familiale-incluziune-si-asistenta-sociala/4848, Accessed October 2022.

for which demographic ageing is progressing to more than 20 % elderly over 65, all from rural areas: South-West Oltenia, West and North-West. In all the analysed populations, over the three years, demographic ageing has advanced faster in rural areas than in urban areas. The exception is the rural population in the Bucharest-Ilfov region, which is undergoing a demographic rejuvenation process.

Table 1. Demographic ageing rates by region and residential environment in 2011, 2016 and 2021

NUTS Region & residence	**Year**		
	2011 (%)	***2016 (%)***	***2021 (%)***
Bucharest_Ilfov_rural	15.23	14.11	13.64
Bucharest_Ilfov_urban	13.93	15.66	17.66
Center_rural	15.80	15.85	16.21
Center_urban	12.58	14.74	18.12
North-East_rural	16.44	15.91	15.35
North-East _urban	10.54	12.24	14.65
North-West_rural	**20.13**	**20.33**	**20.31**
North-West _urban	11.41	13.43	16.36
South_East_rural	17.70	17.47	17.65
South_East _urban	11.75	14.15	17.73
South_Muntenia_rural	19.58	19.54	19.46
South_Muntenia_urban	11.89	14.31	17.83
South-West Oltenia_rural	**21.03**	**21.37**	**21.41**
South-West Oltenia_urban	10.48	12.81	16.04
West_rural	**19.61**	**20.11**	**20.69**
West_urban	12.78	14.96	17.90

The relative demographic ageing rate (the percentage of significantly older people in the total elderly population) gives us a more precise picture of the economic and social risks associated with demographic ageing at the regional level. Four populations age a lot at the top of the age pyramid, all from the countryside: North-East, South-East, South-Muntenia and South-West Oltenia. Interestingly, the urban in the four regions have a much lower percentage of very old adults. See Table2.

Table 2. Relative demographic ageing rates by region and residential environment in 2011, 2016 and 2021

NUTS Region & residence	Year		
	2011 (%)	*2016 (%)*	*2021 (%)*
Bucharest_Ilfov_rural	23.98	26.00	25.26
Bucharest_Ilfov_urban	26.70	26.93	24.71
Center_rural	24.21	26.12	26.15
Center_urban	20.34	21.40	21.29
North-East_rural	**24.27**	**28.59**	**30.94**
North-East _urban	19.87	20.87	19.99
North-West_rural	21.81	24.27	25.42
North-West _urban	18.72	19.53	19.59
South_East_rural	**23.47**	**28.10**	**29.03**
South_East _urban	19.36	20.84	19.87
South_Muntenia_rural	**23.53**	**27.22**	**29.65**
South_Muntenia_urban	19.71	20.94	20.46
South-West Oltenia_rural	**22.12**	**26.01**	**30.52**
South-West Oltenia_urban	18.99	19.72	19.65
West_rural	23.37	24.07	25.03
West_urban	20.32	21.03	21.63

Regarding the dependency ratio, rural populations in all regions have a more dependent population (in a demographic sense) than urban populations. We have the highest percentage of dependent people in the rural areas of the Oltenia and Centre regions. Furthermore, on this indicator, the Bucharest Ilfov region has the best situation among all rural populations. See Table 3.

Table 3. Demographic dependency ratio by region and residential environment in 2011, 2016 and 2021

NUTS Region & residence	**Year**		
	2011 (%)	***2016 (%)***	***2021 (%)***
Bucharest_Ilfov_rural	42.85	42.89	44.21
Bucharest_Ilfov_urban	36.51	41.39	47.06
Center_rural	**51.52**	**50.42**	**50.53**
Center_urban	36.01	40.23	47.18
North-East_rural	**57.18**	**51.61**	**47.52**
North-East _urban	34.58	37.69	42.64
North-West_rural	**51.89**	**50.55**	**49.76**
North-West _urban	34.35	37.98	43.98
South_East_rural	**53.68**	**50.37**	**48.94**
South_East _urban	33.77	37.96	44.74
South_Muntenia_rural	**54.52**	**52.49**	**51.31**
South_Muntenia_urban	34.65	38.74	45.62
South-West Oltenia_rural	**57.09**	**54.12**	**52.51**
South-West Oltenia_urban	32.07	35.48	41.42
West_rural	**46.89**	**46.70**	**47.79**
West_urban	35.56	39.06	45.01

Compared to the demographic ageing rate, the demographic ageing index is better at showing us what may happen to the populations analysed from the perspective of demographic decline. This index shows how many older people (65 years and over) return to 100 children between 0 and 14 years old. The more the index exceeds 100, the more the population will be demographically ageing, but it will also enter a sharp demographic decline. We note that this time the urban populations in 7 regions will be more affected, compared to the rural ones, from the perspective of demographic decline. An exception is the Southwest Oltenia region, where the rural population will experience an even sharper decline than the region's urban population.

Table 4. Demographic ageing index by region and residential environment in 2011, 2016 and 2021

NUTS Region & residence	**Year**		
	2011 (%)	***2016 (%)***	***2021 (%)***
Bucharest_Ilfov_rural	103.19	88.73	80.21
Bucharest_Ilfov_urban	**108.62**	**115.01**	**123.11**
Center_rural	86.76	89.64	93.39
Center_urban	**90.54**	**105.63**	**129.99**
North-East_rural	82.49	87.70	91.02
North-East _urban	**69.54**	**80.88**	**96.06**
North-West_rural	96.23	101.25	103.32
North-West _urban	**80.54**	**95.24**	**115.33**
South_East_rural	102.74	108.99	116.03
South_East _urban	**87.07**	**105.88**	**134.50**
South_Muntenia_rural	124.68	131.36	134.64
South_Muntenia_urban	**85.88**	**105.17**	**132.13**
South-West Oltenia_rural	**137.27**	**155.52**	**164.45**
South-West Oltenia_urban	75.95	95.79	121.05
West_rural	108.42	116.91	120.16
West_urban	**94.97**	**113.92**	**136.28**

To test the study's hypothesis, we constructed in addition to indicators of dynamic ageing in 2021 (relative to 2011) and simple indicators of the dynamics of births, deaths and departures/arrivals from the locality between 2021 and 2011 (calculated as volume differences between 2021 and 2011 of demographic events).

We then created two linear regression equations with the SPSS 21.0 software, with the dynamic ageing indicator as the dependent variable and the dynamic indicators of births, deaths and internal migration as independent variables.

For the rural environment, the statistical model explains 66.7% of the variance of dynamic ageing (R2 = 0.667), and for the urban environment, the model explains the ageing variance very well (R2 = 0.949). These values give us confidence in the validity of the explanatory model. Furthermore, to observe the comparative influence of the various factors introduced in the linear regression models, the standardised Beta coefficients (Sandu, 1992) are excellent, allowing us to draw some conclusions regarding the patterns of ageing at a regional level. See Table 5.

Table 5. Standardised Beta coefficients for linear regression equations with dynamic ageing indicators as a dependent variable for 2011-2021

Independent variables	**Beta standardised coefficients**	
	Dependent variable I_{da} 2011_2021	
	Rural	Urban
The indicator of the dynamics of births	-0.485	-1.390
The indicator of the dynamics of deaths	-0.165	0.618
The indicator of the dynamics of arrivals	0.165	-0.062
The indicator of the dynamics of departures	0.547	0.393
Total variance explained (R^2)	**0.667**	**0.949**

Based on Table 5 of the Beta coefficients from the regression equation, we can extract the following ideas:

- At the regional level, the influence of the birth rate on demographic ageing remains essential, especially in the urban environment. The more births there are, the more likely we are to have a negative dynamic of demographic ageing. That is why programs to stimulate births and young families should be prioritised in cities.
- The volume of departures from the locality reaches second place in urban areas and first place in rural areas, influencing demographic ageing. It follows that at the local level, in the rural environment, great attention should be paid to studying the causes of the departure of the young population.
- Regarding deaths and their influence on demographic ageing, we note an essential difference between urban and rural populations. The urban populations in Romania's regions have aged recently due to the increase in deaths, which could only be explained by the fact that in the urban environment, the incidence of deaths is still significant among the young population. In addition, there are probably still many deaths among children under one year of age and deaths due to accidents among children, young people and adults. It is, again, a situation that needs to be analysed in detail in future studies.

4. Conclusions

The hypothesis of the study is confirmed. The influence of migration (especially of departures with domicile from the locality) ends up being, in the short term, necessary for the profiling of regional ageing patterns.

The two regression equations, presented in Table 5, show us how the dynamics of births, deaths, departures and arrivals influence the dynamics of ageing is quite different between the residential environments of these regions. It follows that some regional patterns need to be well-studied. Therefore, in a future study, we detail the analysis of the current patterns of demographic ageing at the level of counties and even localities.

The study of ageing demographic indicators, presented in Tables 1-4, shows us a differentiated picture of demographic ageing by region. Demographic ageing is accentuated in all rural regions except the Bucharest Ilfov area, which functions as a peri-urban area. A particular case is in the South-West Oltenia Region where, in addition to the increase in the percentage of older adults, a sharp demographic decline is anticipated both at the urban and rural levels. In the South-West Oltenia Region, we have the lowest number of places in homes for the elderly, social canteens and care services (2983), a situation that must be changed quickly.

At the regional level, there should be concerns of political decision-makers to mitigate the dynamics of demographic ageing:

- at the level of rural regions, research programs could be developed to find out the motivations of young people leaving the countryside and feasible measures taken to reduce their exodus;
- at the level of urban populations, programs could be implemented to stimulate young families to settle in the locality and have facilities for the birth and raising of children (maternities, nurseries, etc.);
- developing care capacities for the elderly simultaneously with active ageing programs (Walker and Maltby, 2012; Arpinte, 2019).

Last but not least, policies that can affect demographic ageing (concreted in-laws of parliament, government decisions, ministerial programs, etc.) should be taken with the participation of decision-makers and specialists at the local and regional levels. Furthermore, this is because the demographic trends of demographic ageing can affect the financial vulnerability of localities in very different ways and can lead to intra- and inter-regional economic imbalances (Carbonaro and al, 2018).

5. References

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