

CHANGES IN AGEING OF COMMUNES (LAU2s) IN POLAND BETWEEN 1995 AND 2014

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Abstract. The paper presents statistical and spatial analysis of changes in the ageing level in 2,478 LAU2s in Poland occurring between 1995 and 2014. The results show that the average share of the young decreased from 32.4 to 22.1% and the average share of the old increased from 12.5 to 14.1%, both of which resulted in a considerable increase of the average value of the ageing index, i.e. from 39 to 66 old people per 100 young. The share of the young decreased in all LAU2s in Poland, while the share of the old increased in 65% of LAU2s. However, the increase in the share of the old had a stronger impact onto the increase of the ageing index than the decrease of the share of the young. The process of ageing was most intensive in Opolskie and Śląskie Voivodships, in the south-eastern part of Poland and in the south-western part of Podlaskie Voivodship. Population ageing process in other parts of the country had a diversified intensity.

Key words: ageing of population, Poland, LAU2

INTRODUCTION

Population ageing process, meaning the decrease of the share of the old (age 65+), and more and more often also the “very old” (75+) and even “the oldest old” (age of 85+), accompanied by the decrease of the share of the young in the total population, has already been recognised as a global problem [UNFPA no date]. Numerous social and economic implications caused by the population ageing in the global and regional contexts were the reason why the UNO declared it one of the three main challenges of the 21st century – next to global climate changes and global terrorism [Rakowska 2015].

Population ageing causes changes in many social and economic fields, both on the national, regional and local levels. The main demographic and societal consequence of

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this process is population decline [Bucher and Mai 2005]. Especially in the case of areas lagging behind in social and economic development the ageing of local populations not balanced by the immigration of exogenous population can lead to a significant decrease in the number of inhabitants, and in extreme situations even to depopulation of such areas in a relatively short time [Rakowska 2015]. Together with the demographic consequences, population ageing brings in changes in practically every aspect of social and economic existence of the society [Niewiadomska and Sobolewska-Poniedziałek 2015]. It poses most serious challenges to the national systems due to the decreasing labour force [Lange 2008, MPiPS 2011] generating decreasing tax income and contributions to different social welfare and social protection systems. These will be consequences to the retirement system based on the principle of solidarity of generations and PAYG rule as well as to the health care system and welfare system, which will have to be adjusted to meet the increasing needs of the ageing society. Population ageing is also of crucial importance for the local development, where one can observe both the effects of its impact on the national systems as well as on the local markets, local social and economic conditions and most of all on the structure of families and households.

The economic and social effects of population ageing make it a big challenge for planning and realisation of development strategies and policies on all administrative levels – from the national to the local one. To effectively implement such policies it is necessary to analyse the still on-going population ageing process. It should be done both in static approach showing the differentiation of population ageing at a given moment [Rakowska 2015], and in dynamic approach reflecting changes in the increasing number of the old and the decreasing number of the young in a specified time range [Długosz 1998, Kurek 2008].

The beginning of population ageing in Poland is dated at the early 1990s [Ciura and Szymańczak 2012]. Just like in other Central and East European countries, it coincides with the beginning of the social and political transformation. Although it started in Poland later than it did in the countries of the West Europe, it is more intense and of wider range [EC 2011, Hoff 2011, Okólski and Fihel 2012, Żołędowski 2012]. Because of the lowest fertility level and high net emigration rate from Poland the perspective of getting out of deep demographic depression seems very distant [MPiPS 2011, Rządowa Rada Ludnościowa 2011], if possible at all. Some analysis even forecast point-black that Polish population ageing will intensify over the next four decades and in 2020 will rank Poland as the second oldest nation in EU, based on the second highest population age median [Giannakouris 2008]¹.

The fact that ageing is most diverse on a local level makes a rationale for undertaking the study on ageing at the LAU2 (commune) level².

¹ For 27 member states because the study was carried out in 2008.

² LAU2 (Local Administrative Units 2) in Poland corresponding with NTS 5, i.e. communes [Rakowska 2013].

MATERIAL AND METHODS

The presented study is a continuation of the analysis of the level of ageing of Polish population in 2013 [Rakowska 2015]. Its aim is to define the spatial differentiation of population ageing on the local LAU2 level in Poland between 1995 and 2014 as well as to look into the relations between the applied measures. The time range of the study depends on availability of two categories of statistical data: those closest to the transformation, i.e. as of December 31, 1995, and the latest ones available when undertaking the study, i.e. as of December 31, 2014. The spatial range of the study includes 2478 LAU2s, i.e. all communes existing in Poland in 1995–2014. Only Jaśliska LAU2 was excluded from the study because it was established in 2010 and for this reason did not match the time range of the study. The data for the study was obtained from the Local Data Bank of the Central Statistical Office of Poland. The category used is specified there as “population by age and gender, data according to the place of residence”, by the administrative division of Poland as of December 31, 1995 and December 31, 2014.

As this study is a continuation of the analysis of the level of ageing of Polish population in 2013, the applied methods are optimally coherent. Application of measures [1], [2], [3], [4], [5] and [6] enables defining the changes in the share of the old and the young in the population as well as changes in the relation of the old to the young. The statistical data for 1995 aggregate the subpopulation of 70+ into one group, not specifying the functional subgroups. That is why it is impossible to define changes in the sub-population of “the oldest”, which consequently precludes defining the changes of the double ageing index between 1995 and 2014.

The applied measures:

1. The share of the old in the total population (U_{LS}) in 1995 and in 2014:

$$U_{LS^0} = \frac{L_{St^0}}{L_t^0} \cdot 100\% \quad \text{and} \quad U_{LS^1} = \frac{L_{St^1}}{L_t^1} \cdot 100\%$$

2. The indicator of changes of the share of the old in the total population (ZU_{LS}) between 1995 and 2014:

$$ZU_{LS} = U_{LS^1} - U_{LS^0} \quad (\text{p.p.})$$

3. The share of the young in the total population (U_{LM}) in 1995 and 2014

$$U_{LM^0} = \frac{L_{Mt^0}}{L_t^0} \cdot 100\% \quad \text{and} \quad U_{LM^1} = \frac{L_{Mt^1}}{L_t^1} \cdot 100\%$$

4. The indicator of changes of the share of the young in the total population (ZU_{LM}) between 1995 and 2014:

$$ZU_{LM} = U_{LM^1} - U_{LM^0} \quad (\text{p.p.})$$

5. Ageing index by A. Sauvy (W_{SD}) meant as the number of the old per 100 young in 1995 and 2014:

$$W_{SD^0} = \frac{L_{St^0}}{L_{Mt^0}} \cdot 100 \quad \text{and} \quad W_{SD^1} = \frac{L_{St^1}}{L_{Mt^1}} \cdot 100$$

6. Indicator of changes in the ageing index by A. Sauvy (ZW_{SD}) meant as an increase or a decrease in the number of the old per 100 young:

$$ZW_{SD} = W_{SDt^1} - W_{SDt^0}$$

where: L – the total population;

L_M – the young, i.e. between 0 and 19 years of age;

L_S – the old (i.e. 65+);

t^1 – as of December 31, 2014;

t^0 – as of December 31, 1995.

The intensity of population ageing shown by ZU_{LS} , ZU_{LM} and ZW_{SD} indices was classified into five groups. In stage one the interval series generated for each analysed variable and including data for each LAU2 were divided into three equal ranges, called:

1. Range A, if: $ZU_{LS}, ZU_{LM}, ZW_{SD}, \in \langle y_1, y_2 \rangle$.
2. Range B, if: $ZU_{LS}, ZU_{LM}, ZW_{SD}, \in \langle y_2, y_3 \rangle$.
3. Range C, if: $ZU_{LS}, ZU_{LM}, ZW_{SD}, \in \langle y_3, y_4 \rangle$;

where: y_n – the border values of subsequent ranges, assuming that:

y_1 – the minimal value of the interval series,

$$y_2 = y_1 + d,$$

$$y_3 = y_2 + d,$$

y_4 – the maximal value of the interval series,

$$d - \text{the span of the ranges, independent for each analysed variable, i.e. } d = \frac{(y_4 - y_1)}{4}.$$

In stage two, in cases where the distribution of the analysed LAU2s in specified ranges was significantly uneven, i.e. if any of the basic three ranges included 75% or more of the analysed LAU2s, such range was divided into another three equal sub-ranges, according to the method described above.

The results of such obtained five-range classification are presented in the maps and the distribution of the analysed group of LAU2s by more detailed ranges in histograms.

The statistical average and median were also used to identify the intensity of changes in population ageing. Pearson's correlation coefficient was used to look into the relations between all the applied variables [1], [2], [3], [4], [5] and [6]. The results are shown in correlation matrix.

RESULTS

The results of the analysis prove that values of ZU_{LS} , ZU_{LM} , ZW_{SD} , ranged as shown in Table 1 and that of them had a cumulation of more than 75% of LAU2s in one of the three general ranges. Thus according to the applied method such ranges were divided into another three sub-ranges presented in Table 2.

Table 1. The general classification – ranges of the analysed variables and the number of LAU2s

Variable	The ranges			The number of LAU2s in each sub-range		
	A	B	C	A	B	C
ZU_{LS}	$\langle -7.1; -0.4 \rangle$	$\langle -0.4; 6.3 \rangle$	$\langle 6.3; 12.9 \rangle$	493	1 876	108
ZU_{LM}	$\langle -22.1; -15.4 \rangle$	$\langle -15.4; -8.7 \rangle$	$\langle -8.7; -2 \rangle$	38	1 898	541
ZW_{SD}	$\langle -22; 40 \rangle$	$\langle 40; 102 \rangle$	$\langle 102; 165 \rangle$	2 103	371	3

Explanation: in bold the number of LAU2s making 75% or more of the analysed units.

Source: Own elaboration.

Table 2. The detailed classification for the ranges of the general classification including 75% or more of the analysed LAU2s, i.e. range B for ZW_{SD} , ZU_{LS} and range A for ZU_{LM}

Variable	The sub-ranges			The number of LAU2s in each sub-range		
	1	2	3	1	2	3
$ZU_{LS}B$	$\langle -0.4; 1.8 \rangle$	$\langle 1.8; 4.1 \rangle$	$\langle 4.1; 6.3 \rangle$	989	589	298
$ZU_{LM}B$	$\langle -15.4; -13.7 \rangle$	$\langle -13.7; -10.9 \rangle$	$\langle -10.9; -8.7 \rangle$	952	820	126
$ZW_{SD}A$	$\langle -22.0; -1.3 \rangle$	$\langle -1.3; 19.3 \rangle$	$\langle 19.3; 40.0 \rangle$	10	885	1 208

Source: Own elaboration.

The share of the old in 1995 in Polish LAU2s equalled from 3 to 29%, and in 2014 from 7 to 39%. Both the statistical average and median increased between 1995 and 2014, correspondingly from 12.5 to 14.1% and from 11.9 to 13.9%.

The values of ZU_{LS} ranged from -7.1 to 12.9 p.p. The share of the population aged 65+ decreased in 470 LAU2s (19% of all analysed LAU2s), of which the highest decrease of between -7.1 to -4 p.p. was observed only in 14 units located in different parts of Poland. In 403 LAU2s (16%) no significant changes were observed, while in the remaining 1,605 (65%) communes ZU_{LS} increased, of which in 345 of more than 5 p.p., showing the highest intensity of the ageing process. Between 1995 and 2014 both the statistical average and median of ZU_{LS} increased from 12 to 14%. Figure 1³ shows changes in the distribution of communes by more detailed values of ZU_{LS} in 1995 and in 2014. Figure 2 shows the spatial differentiation of ZU_{LS} classified as explained in Tables 1 and 2. The spatial analysis proves that LAU2s characterised by the highest (6.3, 12.9 p.p.) increase of the share of the old in the total population are located in the near-border part of south-eastern Poland and in the south of Poland in opolskie and śląskie voivodships. Jointly with LAU2s characterised by the increase of U_{LS} of (4.1, 6.3 p.p.), they make the biggest cluster of communes with the highest increase of the old in Poland (Fig. 2).

The share of the young in 1995 ranged from 18 to 43%, and in 2014 from 13 to 33% (Fig. 3). The average and median in 1995 were of quite similar value, correspondingly

³ To better visualise the results, histograms (Figs 1, 3 and 5) show only the values observed in the analysed group, excluding the nominal values not shown in the observations.

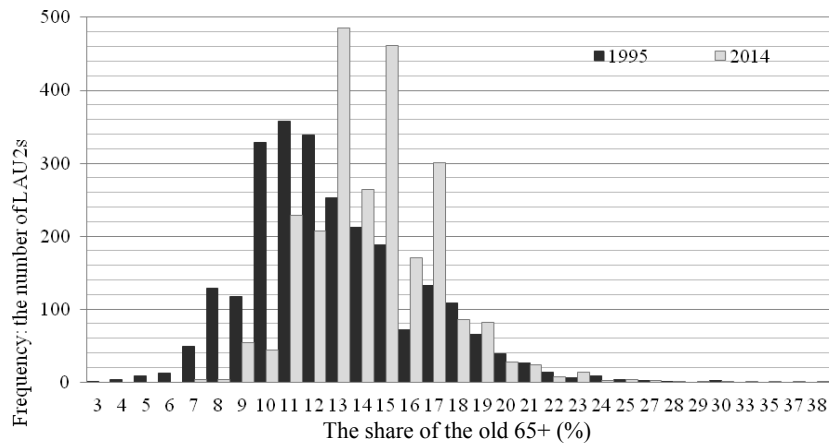


Fig. 1. Histogram of the distribution of LAU2s by the share of the old (65+) in total population (U_{LS}) in 1995 and 2014

Source: Author's calculation based on data from the Local Data Bank of the CSO.

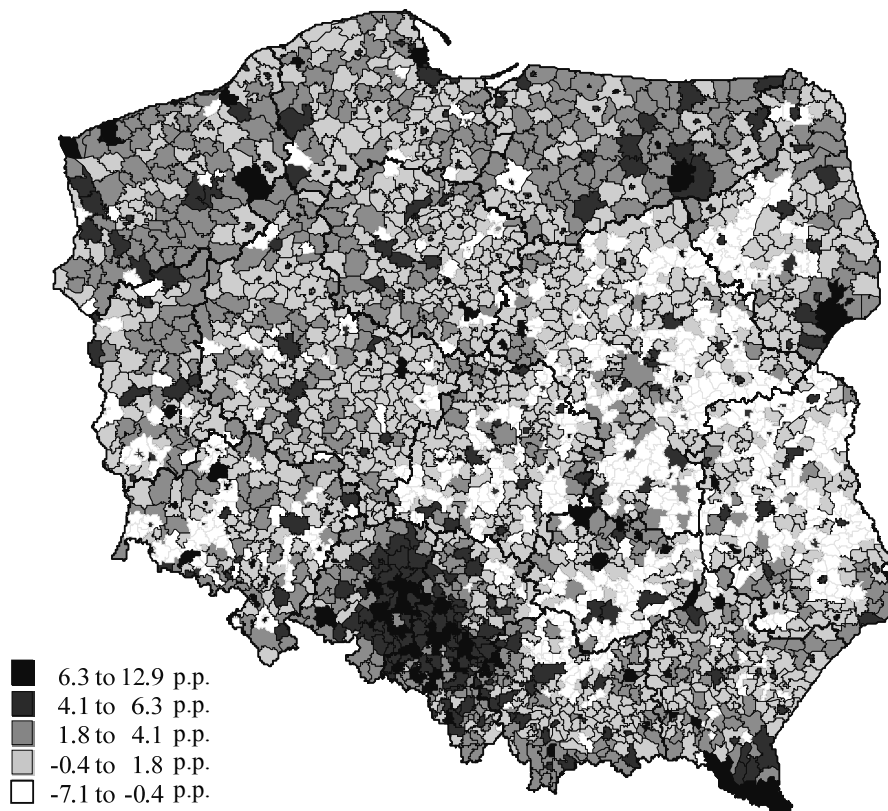


Fig. 2. Changes in the share of the old (65+) (ZU_{LS}) between 1995 and 2014

Source: Author's calculations based on data from the Local Data Bank of the CSO.

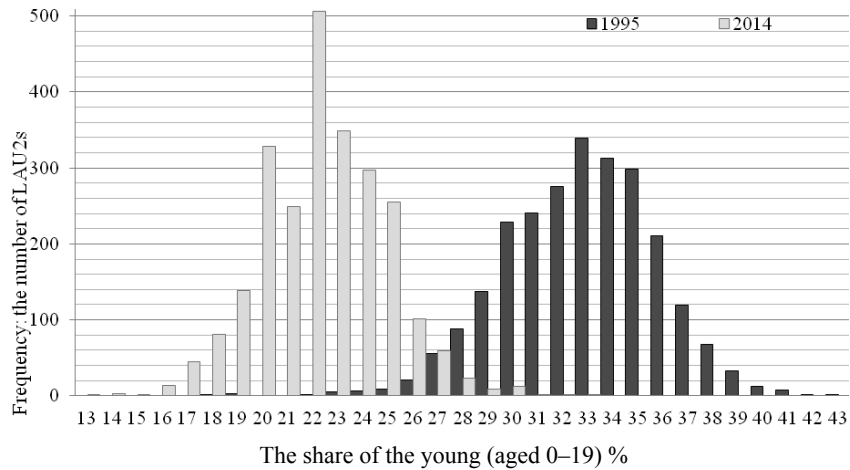


Fig. 3. Histogram of the distribution of LAU2s by the share of the young (age 0–19) in total population (U_{LM}) in 1995 and 2014

Source: Author's calculations based on data from the Local Data Bank of the CSO.

32.4 and 32.6%, and they both significantly decreased in 2014 to correspondingly 22.1 and 22.2%. The share of the young declined in all (!) LAU2s in Poland. The values of this index decreased by from 2 to 22 p.p. Clusters of LAU2s with the highest decrease of the share of the young occur only in the near-border part of south-eastern part of Poland and covers mostly the same area as that characterised by the highest increase in the share of the old (Fig. 4). The lowest decrease in the share of the young can be observed in Central Poland. Other values of the index are dispersed all over the country without any identifiable pattern.

The ageing index by A. Sauvy, showing the number of the old per 100 of the young ranged in 1995 from 9 to 153, and in 2014 from 25 to 306 (Fig. 5). In 1995–2014 the index decreased only in 13 LAU2s, in 6 it did not change and in the remaining 2,459 it increased by different values: from 1 up to 164 old people per 100 of the young (Fig. 5). In 1,811 of the ageing LAU2s the value of the index increased by 2 to 99%, in 551 from 100 to 199%, in 81 from 200 to 299%, in 9 from 300 to 399%, in 2 LAU2s it increased five times and in 1 six times. The average for all LAU2s in 1995 equalled 39 old people per 100 of the young (median 36), and in 2014 it increased by 69.2% to 66 old per 100 young (median 63), which proves that the population ageing process was intensive. The clusters of communes with the highest values of the changes are located in the near-border part of the south-eastern Poland, in the south of the country in Opolskie and Śląskie voivodships and in the south-eastern part of Podlaskie Voivodship. This is nearly the same area, as that characterised by the highest increase in the share of the old in the total population (Figs 2 and 6).

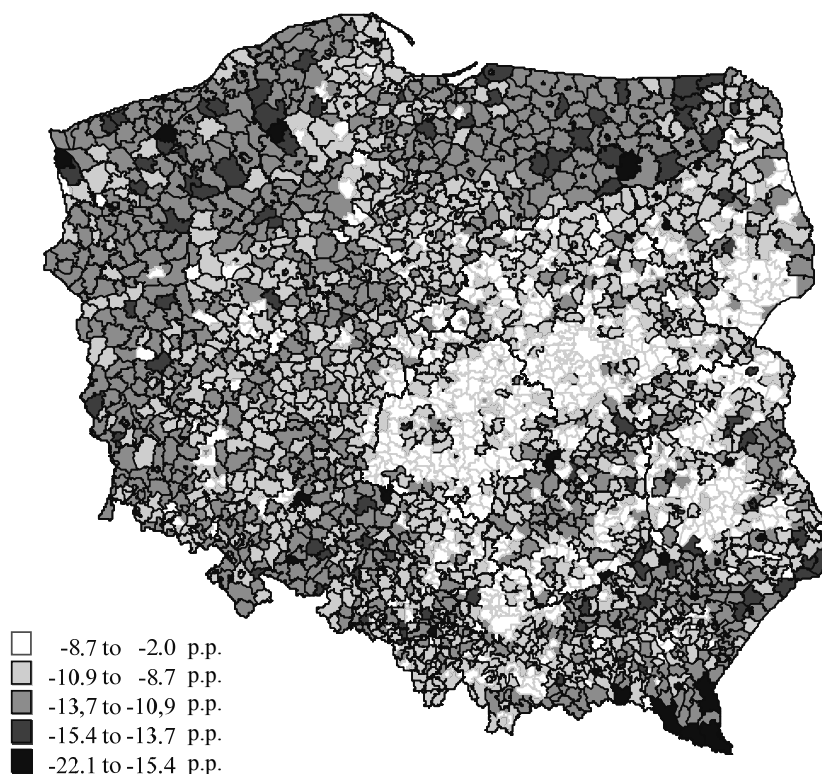


Fig. 4. Changes in the share of the young (age 0–19) in total population (ZU_{LM}) between 1995 and 2014

Source: Author's calculations based on data from the Local Data Bank of the CSO.

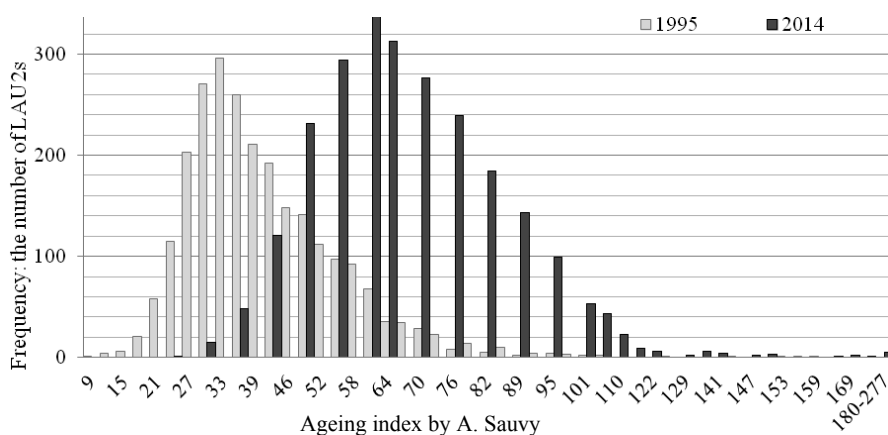


Fig. 5. Histogram of the distribution of LAU2s by Sauvy's ageing index in 1995 and 2014

Source: Author's calculations based on data from the Local Data Bank of the CSO.

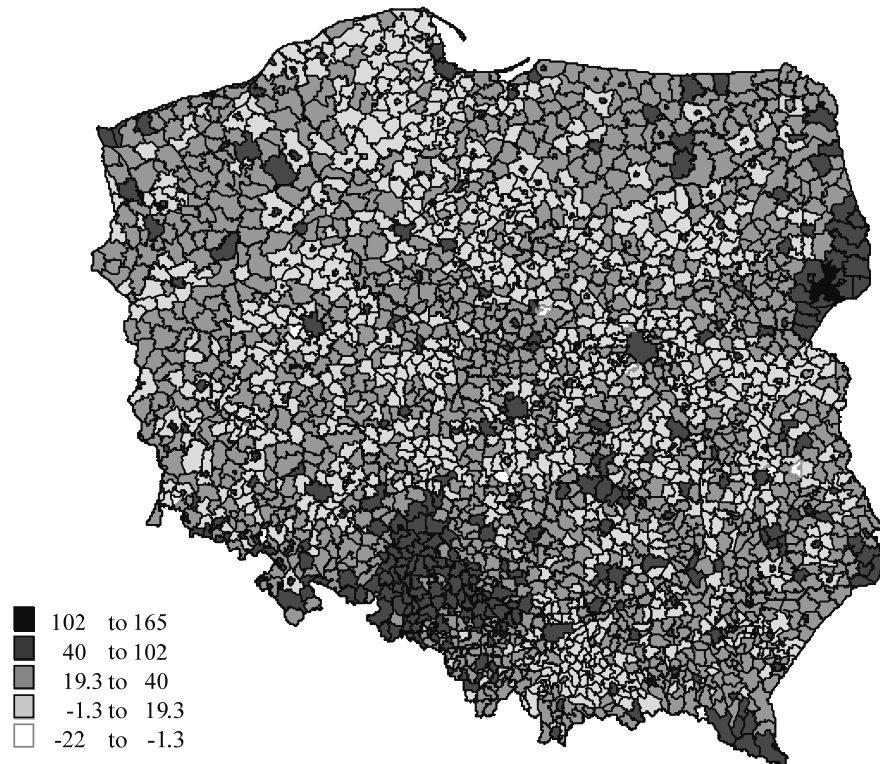


Fig. 6. Changes of the ageing index by A. Sauvy (ZI_{sd}) between 1995 and 2014

Source: Author's calculations based on data from the Local Data Bank of the CSO.

According to the results shown in Table 3, there is a very high positive correlation between the ageing index in 1995 and the share of the old in 2014, as well as between the changes in the share of the old and changes of the ageing index in 1995–2014. Another very high although negative correlation occurs between the share of the young in 2014 and the ageing index in 2014.

There is nearly perfect positive correlation between the share of the old and the ageing index in 1995 and between the same variables in 2014.

The ageing index correlates stronger with the share of the old ($r = 0.96$ in 1995 and $r = 0.95$ in 2014) than with the share of the young ($r = -0.76$ in 1995 and $r = -0.81$ in 2014), although both these correlations are significant, correspondingly – very strong and strong. It is also confirmed by a very strong correlation between the changes in the ageing index and the changes in the share of the old ($r = 0.90$) as well as strong correlation between the changes in the ageing index with the changes of the share of the ($r = -0.68$).

The negative correlation between the share of the young and the ageing index is strong and can be explained by a higher ageing index 58% communes in 1995 and in 62% communes in 2014.

Table 3. The matrix of correlations between the analysed variables

\times	U_{LM^0}	U_{LM^1}	ZU_{LM}	U_{LS^0}	U_{LS^1}	ZU_{LS}	W_{SD^0}	W_{SD^1}	ZW_{SD}
U_{LM^0}	1	0.68	-0.28	-0.35	-0.37	0.04	-0.33	-0.30	0.06
U_{LM^1}	0.68	1	0.20	-0.19	-0.32	-0.10	-0.21	-0.30	-0.09
ZU_{LM}	-0.59	0.20	1	0.60	0.30	-0.51	0.63	0.15	-0.68
U_{LS^0}	-0.63	-0.21	0.60	1	0.72	-0.60	0.96	0.57	-0.61
U_{LS^1}	-0.78	-0.66	0.30	0.72	1	0.13	0.81	0.95	0.02
ZU_{LS}	0.00	-0.47	-0.51	-0.60	0.13	1	-0.45	0.28	0.90
W_{SD^0}	-0.76	-0.35	0.63	0.96	0.81	-0.45	1	0.71	-0.50
W_{SD^1}	-0.79	-0.81	0.15	0.57	0.95	0.28	0.71	1	0.19
ZW_{SD}	0.11	-0.48	-0.68	-0.61	0.02	0.90	-0.50	0.19	1

Explanation of the colours in the table:

no colour	$r \in \langle 0; 0.2 \rangle$	very weak correlation, practically none
	$r \in \langle 0.2; 0.4 \rangle$	weak correlation
	$r \in \langle 0.4; 0.6 \rangle$	moderate correlation
	$r \in \langle 0.6; 0.8 \rangle$	strong correlation
	$r \in \langle 0.8; 0.9 \rangle$	very strong correlation
	$r \in \langle 0.9; 1.0 \rangle$	nearly perfect and perfect correlation

Source: Author's calculations based on data from the Local Data Bank of the CSO.

CONCLUSIONS

Between 1995 and 2014 the average share of the young fell in the surveyed communes from 32.4 to 22.1%, and the average share of the old increased from 12.5 to 14.1%, which proves that both these factors influenced the ageing process in Poland. Consequently, the average value of the Sauvy's index increased significantly: from 39 old people per 100 young in 1995 to 66 old people per 100 young in 2014.

Analysis of the ageing process in LAU2s in 1995–2014 proves that the share of the young decrease in all communes in Poland, while the share of the old decreased in 65% of communes. However, it is the share of the old, that nearly perfectly positively correlates with the ageing index in 1995 and 2014 (the higher share of the old was related to a higher ageing index in 92% of LAU2s in 1995 and in 81% of LAU2s in 2014). On the other hand, there is a very strong negative correlation between the changes in the share of the young and the changes of the ageing index. It implies that the process of population ageing in Poland in 1995–2014 resulted not only from the small share of the young and its further decrease but also from the big share of the old and its further increase.

The spatial analysis shows that the ageing process was most intensive in Opolskie and Śląskie Voivodships, in the south-eastern part of Poland and in the south-eastern part of Podlaskie Voivodship. In the rest of the country values of the analysed ratios vary and do not form visible clusters of municipalities.

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ZMIANY POZIOMU STAROŚCI DEMOGRAFICZNEJ (LAU2) POLSKI W LATACH 1995–2014 W UJĘCIU LOKALNYM

Streszczenie. Celem artykułu jest statystyczna i przestrzenna analiza zmian poziomu starości w 2478 gminach (LAU2) w Polsce w latach 1995–2014. Wyniki wskazują, że średni udział ludności młodej spadł z 32,4 do 22,1%, a średni udział ludności starej wzrósł z 12,5 do 14,1%, powodując znaczny wzrost średniej wartości wskaźnika starości z 39 do 66 osób starych na 100 młodych. Udział ludności młodej zmalał we wszystkich gminach w Polsce, natomiast udział ludności starej wzrósł w 65% gmin. Jednak to wzrost udziału ludności starej miał silniejszy wpływ wzrost wskaźnika starości niż malejący udział ludności młodej.

Proces starzenia był najbardziej intensywny na obszarze województw opolskiego i śląskiego, w południowo-wschodniej części Polski oraz w południowo-wschodniej części województwa podlaskiego. W pozostałych częściach kraju proces starzenia był zróżnicowany.

Słowa kluczowe: starzenie ludności, Polska, LAU2

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