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AN ANALYSIS OF THE POPULATION AGING PHENOMENA IN POLAND FROM A SPATIAL PERSPECTIVE

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ABSTRACT

The processes of socio-economic development are continuously accompanied by the process of population aging. It is seen as a growing percentage share of people aged 65 and over in the general population. It covers the majority of the European Union countries and also refers to Poland. The objective of the paper is to analyse the population aging phenomenon from a spatial perspective. The study has been carried out for 66 subregions (NUTS 3) and covered the period 1995-2012.

Poland is characterized by strong spatial diversification regarding the proportion of senior citizens and its growth rate, and also determinants exerting impact on the demographic aging processes. Demographically the youngest and slowest aging population lives in south-eastern and also central Poland. The most intensive population aging processes are seen in the selected subregions of south-western Poland. Here, we observe extremely low fertility, demographically old working-age population and also significant migration outflow of younger people.

Key words: population aging, socio-economic development, spatial approach, taxonomic analysis, regression analysis.

1. Introduction

The paper discusses the problem of demographic aging of the Polish population. Aging processes are defined as changes in the age structure of population where the percentage of older population compared to the total population number is increasing (Rosset, 1959; Frątczak, 1984; Uhlenberg, 2009). They are accompanied by social, cultural and economic factors; among other things, intentional delaying of procreation time and changing life priorities,

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leading more and more towards a healthy life style, progress in medicine and wider access to medical services, etc.

These processes are present in almost all European Union countries and also refer to Poland (see Kurkiewicz et. al., 2006, 2012; Muenz, 2007; Giannakouris, 2008; Kurek, 2008; Strzelecki, 2009; Lindh and Malmberg, 2009; Kurkiewicz, 2010; Dragan, 2011; Hrynkiewicz, 2012; Pociecha, 2003). The processes of demographic aging are affected by a slow, although often irreversible, change in time. From the perspective of the state policy it is observed as a major problem which strongly determines the situation in the country in terms of its financial, social and economic issues.

In the long-term prospect, without taking appropriate actions in the socio-economic sphere, the population aging processes can lead to a gap in the labour market, disturb the retirement system, decrease the efficiency of social systems (e.g. health care, welfare). The growing proportion of the older population also imposes the need to adapt adequate social policy within the framework of which indispensable care will be offered to people included in this age group (see Golinowska, 2008; Jurek, 2012; Magnus, 2008; Prskawetz and Lindh, 2011; Wilk and Bartłomowicz, 2012).

There are significant regional disparities in socio-economic development processes in Poland. This affects the conditions of the population aging processes. Therefore, we can assume that the dynamics of the population aging processes are also spatially diversified and their conditions are peculiar to particular regions of the country. The objective of the paper is to examine the level and rate of the population aging processes in Poland, and also to reveal their demographic conditions from a spatial perspective.

The analysis of the population aging phenomenon was carried out for 66 subregions (NUTS 3) and covered the period 1995-2012. In the first part of the paper the degrees and rates of the population aging processes in subregions will be discussed. Therefore, the subregions demonstrating significant progress in the population aging processes will be revealed.

In the next part of the paper the econometric model will be constructed. The investigation will be carried out based on the synthetic measure values specified considering the proportion of senior citizens, as well as the growth rate of this proportion. Next, for the selected demographic factors (such as fertility, migrations, etc.), the identification of their relations with the population aging processes will be carried out. In the third part, the demographic conditions of population aging processes in Polish subregions will be presented.

2. The population aging phenomena in Poland

2.1. The background

The overall trends in changing the age structure are shown by the shape of the age pyramid, which is a graphical illustration of the distribution of various age

groups by sex in a population, and its changes in time. It forms the shape of a triangle when the young population is growing, whereas a diagram in the shape of an upside-down vase is characteristic of a demographically old population.

In 1975 the Polish population was relatively young demographically. There was a higher percentage proportion of young people than old people in the total population. The age pyramid formed a shape similar to a pyramid. In subsequent years the shape of the diagram changed; the middle of the pyramid extended while the lower part narrowed. The percentage share of young population significantly decreased in the period before 2012 while the number of older people increased (see Figure 1).

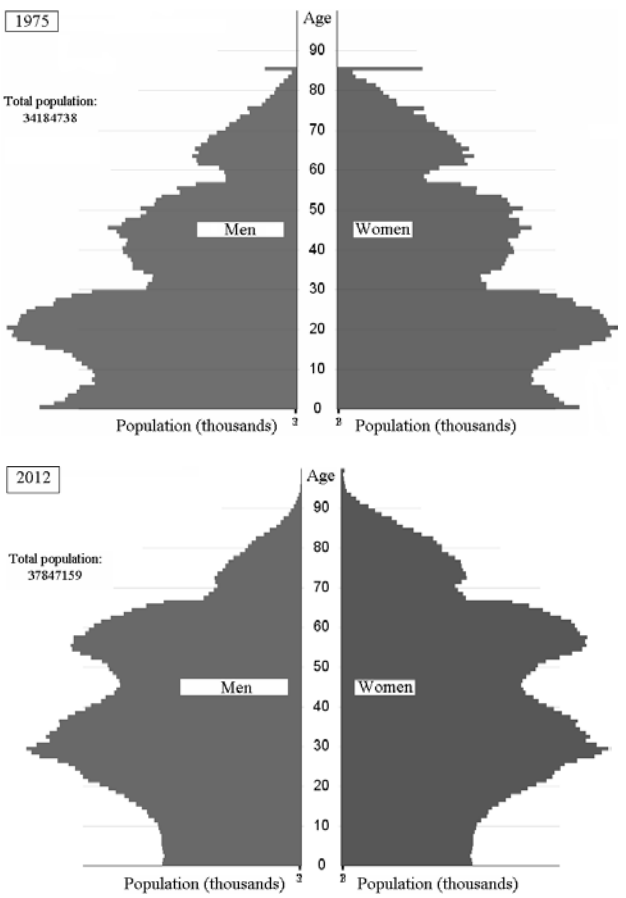


Figure 1. Age pyramids for Poland in 1975 and 2012

Source: See Central Statistical Office of Poland, http://www.stat.gov.pl/PI_gus/ludnosc_piramida/struktura_ludnosci.svg.

2.2. The proportion of senior citizens and its growth rate in Poland 1995-2012, by subregions

Population aging is demonstrated by a high proportion of senior citizens (people aged 65 and over) and also by the dynamics of this proportion. The proportion indicates the current state of the population aging processes in a region (saturation), while the growth rate indicates the direction of changes and their dynamics. Both variables function as stimulants of the population aging processes. High values of these variables confirm the advancement (intensity) of the population aging processes in a region.

In 2012 the proportion of senior citizens in the total population of Poland reached 14.24%, which was approximately 3.0 percentage points more than in 1995. This implies 1.41% yearly increases (see Table 1). Polish subregions demonstrated diversified proportion of senior citizens, from approximately 10.0% in Gdański subregion to approximately 19.0% in the city of Łódź. Positive increase rates of the proportion, to a greater or lesser degree, were observed in all subregions in the period 1995-2012. The values of the growth rate near to zero were observed in Krakowski (0.23%) and Sandomiersko-Jędrzejowski (0,26%) subregions, while very high dynamics were demonstrated by Rybnicki (3.44%) and Gliwicki (3.19%) subregions.

Table 1. Basic statistics for the proportion of senior citizens and its growth rate

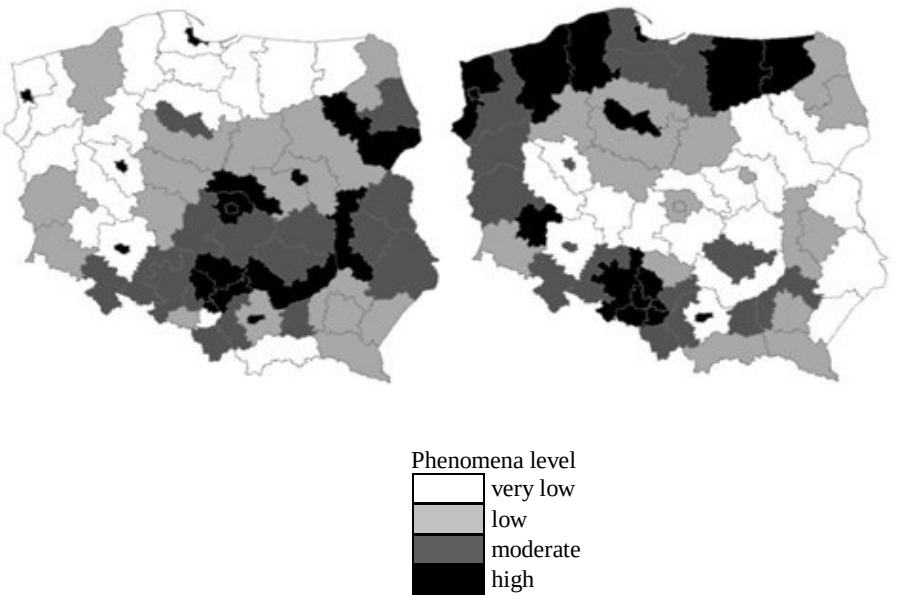
Specification	The proportion of senior citizens (population aged 65 and over) in 2012 (%)	The growth rate of the proportion of senior citizens in the period 1995-2012 (%)
POLAND	14.24	1.41
Minimum	9.9	0.23
Maximum	18.6	3.44
Coefficient of variation (%)	12.2	46.6
Pearson's correlation [-1, 1]	0.08	

Source: own estimation based on data provided by the Local Data Bank of the Central Statistical Office of Poland.

The subregions were divided, on the basis of quartiles, into four classes representing very low, low, moderate and high proportion of senior citizens. The same procedure was conducted in respect to the growth rate of the proportion of senior citizens. Figure 2 presents the results of this classification. Relatively high proportions of senior citizens were observed for subregions located in eastern, central and also in a part of south Poland. In particular, this situation occurred in the biggest cities of Poland such as the cities of Warsaw, Łódź, Poznań, Wrocław, Szczecin, Tricity and Cracow.

Relatively high and moderate levels were recorded within Łódzkie, Śląskie, Lubelskie, Opolskie, Świętokrzyskie and Podlaskie voivodeships (NUTS 2). Conversely, very low proportions of senior citizens were observed within

Zachodniopomorskie, Wielkopolskie, Pomorskie, Lubuskie and Warmińsko-Mazurskie voivodeships, and low proportions within Mazowieckie and Podkarpackie voivodeships.



a) the proportion of senior citizens in the total population in 2012

b) the growth rate of the proportion of senior citizens in the period 1995-2012

Figure 2. Spatial diversification of the proportion of senior citizens and its growth rate Source: own compilation based on data provided by the Local Data Bank of the Central Statistical Office of Poland

The situation is quite different regarding the growth rate of the proportion. Relatively high or moderate dynamics were characteristic of the subregions of Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie, Lubuskie, Opolskie and Śląskie voivodeships. A very low or low growth rate was true for Wielkopolskie, Łódzkie, Mazowieckie, Podlaskie, Lubelskie and Podkarpackie voivodeships. The highest dynamics were recorded in northern, western and south-western Poland, and also in selected bigger cities.

It is also interesting that discussed indicators are not statistically correlated (see Table 1). Therefore, we cannot conclude that the higher the growth rate, the bigger (or lower) the proportion of senior citizens in Polish subregions. The exception is Śląskie voivodeship, for which the values of both variables represent a relatively high percentage share. This is manifested in the intense advancement of the population aging processes occurring in this subregion.

3. Modelling the population aging processes in Poland

3.1. The dependent variable

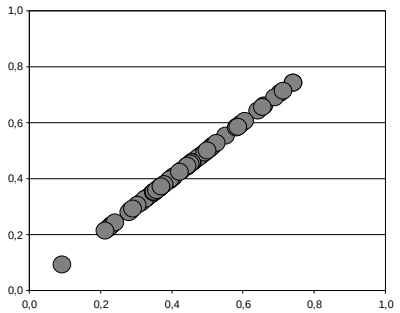
In order to examine the advancement of the population aging processes in Poland and their conditions the regression analysis was applied. The synthetic measure of the intensity of the population aging processes served as the dependent variable while several significant demographic indicators formed a set of explanatory variables. The application of a synthetic measure in cause-effect models was proposed in Hellwig, Siedlecka and Siedlecki, 1995.

The approach using a taxonomic measure of development (TMD) was applied to assess the spatial diversification of the population aging processes in Polish subregions. It allows us to cover a set of indicators at the same time and to provide the synthetic description of the situation regarding the analyzed phenomenon (see Grabiński, Wydymus and Zeliaś, 1989; Nowak, 1990; Młodak, 2006).

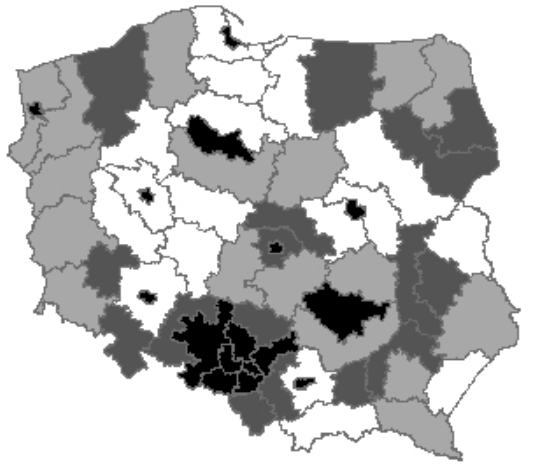
The construction of TMD was based on two diagnostic variables presented above, such as the proportion of senior citizens in 2012 and also the growth rate of the senior citizens proportion in the period 1995-2012. Both variables function as stimulants of the population aging processes. Therefore, the highest values of variables reached by the Polish subregions served as the features of the pattern object, while the lowest values of variables determined the coordinates of the anti-pattern object. These two ideal objects (the pattern object and anti-pattern object) constituted referring points in the comparative analysis.

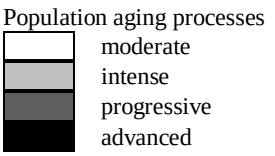
The values of the variables were normalized, using the unitization with zero as the minimum, to standardize their implementation intervals. For each subregion the distances to the pattern object and anti-pattern object were calculated using Euclidean distance. Application of the TOPSIS formula (see Hwang and Yoon, 1981) resulted in determination of the TMD value for each subregion. High TMD values confirm the advancement of the population aging process in a subregion while its low values are seen as a moderate intensity of the phenomenon.

TMD takes values of [0, 1] while the Polish subregions recorded values from approximately 0.20 to approximately 0.70, apart from Gdański subregion which took the value of 0.91 (see Figure 3a). The situation in Poland is relatively highly diversified from a spatial perspective; the classical coefficient of variation took the value of 32%. On the basis of the calculated TMD values the subregions were divided into four classes using quartiles. The obtained classes illustrate advanced (TMD took values above 0.52), progressive (between 0.42 and 0.51), intense (between 0.36 and 0.41) or moderate (up to 0.35) levels of the population aging processes advancement (see Figure 3b).



a) the dispersion of TMD values in Polish subregions





b) classes of Polish subregions according to TMD values

Figure 3. Spatial diversification of the population aging processes in Poland
Source: Own compilation.

Advanced population aging processes are observed in south-western Poland. In particular the advanced and progressive situation is typical of Śląskie and Opolskie voivodeships. Moderate or intense progresses relate to Mazowieckie, Wielkopolskie, Lubuskie, Pomorskie and selected subregions of Małopolskie voivodeship.

3.2. Explanatory variables

High territorial disparities of population aging processes in Poland are seen in the specificities of Polish subregions which differ in the social and cultural conditions: the dynamics of economic growth and socio-economic development, and also in respect of the resources of the natural environment and its condition (see, e.g. Müller-Frączek and Pietrzak, 2009a, 2009b; Bal-Domańska and Wilk, 2011; Pietrzak, 2012; Wilk and Bartłomowicz, 2012; Wilk, Pietrzak and Matusik, 2013). This affects the economic and financial situation of households, the lifestyle led and priorities held, health condition of society, access to medical services, etc.

All these factors have a significant influence on demographic processes occurring in subregions; this is reflected in statistical data. Propensity to procreate and the duration of life are regarded as the basic determinants of the population aging processes from the perspective of the state. The migration outflow of the young (working-age) population to other regions or abroad can also be a significant factor, as seen from the regional perspective.

The population aging processes are also intensified by the aging of the working-age population (population aged between 18 years and retirement age). The higher the proportion of people aged 45 and over in this group, the bigger the "portion" of people who will supply the population of senior citizens in the future. The population aging processes and their economic consequences are also determined by the proportion of the oldest-old population (population aged 80 and over) in the population of senior citizens, and also its growth rate. Table 2 presents a set of accepted explanatory variables.

Table 2. The set of explanatory variables

No.	Variable name	Definition
1	Total fertility rate (person)	The mean number of children that would be born alive to a woman during her lifetime if she were to pass through her childbearing years conforming to the fertility rates by age of a given year
2	Life expectancy of men at the age of 65 (year)	The mean number of years still to be lived by a man who has reached the age of 65, if subjected throughout the rest of his life to the current mortality conditions (age-specific probabilities of dying)
3	Net migration rate of population aged 20-59 (person)	Net migration of people aged between 20 and 59, expressed per 10 000 inhabitants in this age group. Data covers registered migration inflows and outflows for permanent residence between subregions and abroad
4	Working-age population aging rate (%)	The percentage share of immobile working-age people in the working-age population. The working-age population is defined as people aged 18 to 59 (women) and 18 to 64 (men), while the group of people aged 45 and over is seen as immobile working-age population
5	Oldest-old-age population rate (%)	The percentage share of people aged 80 and over in the total population aged 65 and over

Source: Own compilation according to the definitions of Central Statistical Office of Poland.

Extremely low fertility has been typical of Poland for many years and does not provide the so-called simple generation substitutability which is seen as the level 2.1 of total fertility rate. Although a slight increase of the indicator value was observed within the last 10 years, in 2012 the value reached only 1.3 in Poland (see Table 3). However, in the majority of Polish subregions (apart from Gdański subregion) there were only 1.5 children per woman. In respect to the current socio-economic processes occurring in Poland, we cannot expect rapid changes to this situation even in the long-term perspective. On the other hand, we notice a decrease in regional disparities regarding the fertility level within Poland.

Low fertility is accompanied by extending life duration in Poland. According to statistical data, a man aged 65 is expected to live a further 15.4 years. It means that in average terms he would be up to a little more than 80 years old. The situation differs for Polish women who, on average, live 4.3 years longer than men. Statistical correlation between values of these two indicators (for men and women) is relatively high; Pearson's correlation took a value above 0.7, while territorial disparities are slightly higher for men.

In the period 2007-2012 yearly increases in life expectancy of men aged 65 were recorded by all subregions. However, their dynamics is territorially diversified; the difference between subregions reaches 2.7 years. The shortest expected life duration in 2012 was typical of men living in Skierniewicki (79.2 years), Elbląski and Łódzki (79.3 years) and also Starogardzki (79.4 years) subregions. The longest life expectancy of men at the age of 65 is observed in big agglomerations, such as the cities of Warsaw and Wrocław, where an average man is expected to live for 82 years.

In some regions of Poland the population aging processes are significantly affected by migration outflows of young people. Approximately, three in four subregions showed a negative balance of migration flows in 2012. The highest intensity of the phenomenon is typical in Łomżyński subregion, where the net migration coefficient reached -55.2. A similar situation (negative net migration rate under 50.0) was in Puławski subregion, which is, as Łomżyński subregion, located in eastern Poland, and also adjoins Mazowieckie voivodeship.

Very high positive values (above 50.0) of net migration coefficient were presented by 7 subregions while extremely high value (100.2) was observed in Poznański subregion, which surrounds the city of Poznań. This means that many more young people settle down in this subregion than leave it. This results from the suburbanization processes (see e.g. Matusik, Pietrzak and Wilk, 2012; Pietrzak et al., 2012; Pietrzak, Drzewoszewska and Wilk, 2012; Pietrzak, Wilk and Matusik, 2013a, 2013b; Pietrzak and Wilk, 2013; Wilk and Pietrzak, 2013; Pietrzak, Wilk and Siekaniec, 2013).

Table 3. Basic statistics for explanatory variables

No	Variable name	Year*	POLAND	Minimum	Maximum	Coefficient of variation (%)
1	Total fertility rate (person)	2002	1.249	0.893 (Wrocław)	1.614 (Nowosądecki)	13.3
		2012	1.299	1.091 (Kraków)	1.632 (Gdański)	8.4
2	Life expectancy of men at the age of 65 (years)	2007	14.6	13.6 (Włocławski)	16.4 (Warszawa)	4.1
		2012	15.4	14.2 (Skierniewicki)	16.9 (Warszawa)	4.0
3	Net migration rate of population aged 20-59 (person)	1995	x	x	x	x
		2012	x	-55.2 (Łomżyński)	100.2 (Poznański)	x
4	Working-age population aging rate (%)	2009	37.8	33.7 (Nowosądecki)	41.7 (Łódź)	4.4
		2012	37.4	34.4 (Nowosądecki, Rzeszowski)	41.1 (Sosnowiecki)	4.1
5	Oldest-old-age population rate (%)	2005	20.3	16.2 (Rybnicki)	24.2 (Sandomiersko-jędrzejowski)	8.3
		2012	26.3	19.5 (Rybnicki)	31.3 (Łomżyński)	8.4

* according to the availability of statistical data.

Explanations: "x" – not applicable.

Source: Own estimation based on data provided by Local Data Bank of Central Statistical Office of Poland.

In Poland we can observe a relatively high percentage share of old people within the working-age population. In 2009-2012 more than one in three people at the working age was 45 years old or over. The youngest working-age populations live in Nowosądecki and Rzeszowski subregions (34.4% immobile working-age people) while the oldest population lives in Sosnowiecki subregion (41.1%).

Oldest-old population is also increasing in Poland; the growth rate of the oldest-old-age population coefficient is relatively high. The proportion of this group in the population of senior citizens increased by 6 percentage points within the last 7 years. Values of this indicator are spatially diversified; the differences reach over 10%. The highest proportion of the oldest-old-age people is typical of Łomżyński subregion, where one in three senior citizens represents an oldest-old-age person. Relatively high values of this indicator are also observed for the Sandomiersko-Jędrzejowski subregion (30.1%), the city of Warsaw (29.9%), Bialski subregions (29.8%) and Suwalski subregion (29.7%).

4. Demographic conditions of the population aging processes in Poland

The estimated values of the structural parameters of the regression model, representing explanatory variables impacts, were estimated using the least squares method. In this way the significance and the impact direction of the adopted variables on the phenomenon of population aging in the Polish subregions was analysed.

Table 4 presents the results of the estimation. They turned out statistically significant for of all explanatory variables. This means that each of the examined factors exerts a significant impact on the population aging processes in Poland. The resulting value of the determination coefficient confirms high adjustment of the model to the empirical data.

Table 4. Results of the estimation of the parameters of the regression model

No	Variable name	Estimate	*p*-value*
1	Total fertility rate	-0.4013	0.0034
2	Life expectancy of men at the age of 65	0.1539	0.0001
3	Net migration rate of population aged 20-59	-0.0071	0.0169
4	Working-age population aging rate	0.0492	0.0001
5	Oldest-old-age population rate	0.0259	0.0001
Determination coefficient		0.7356	

* at 5% degree of significance.

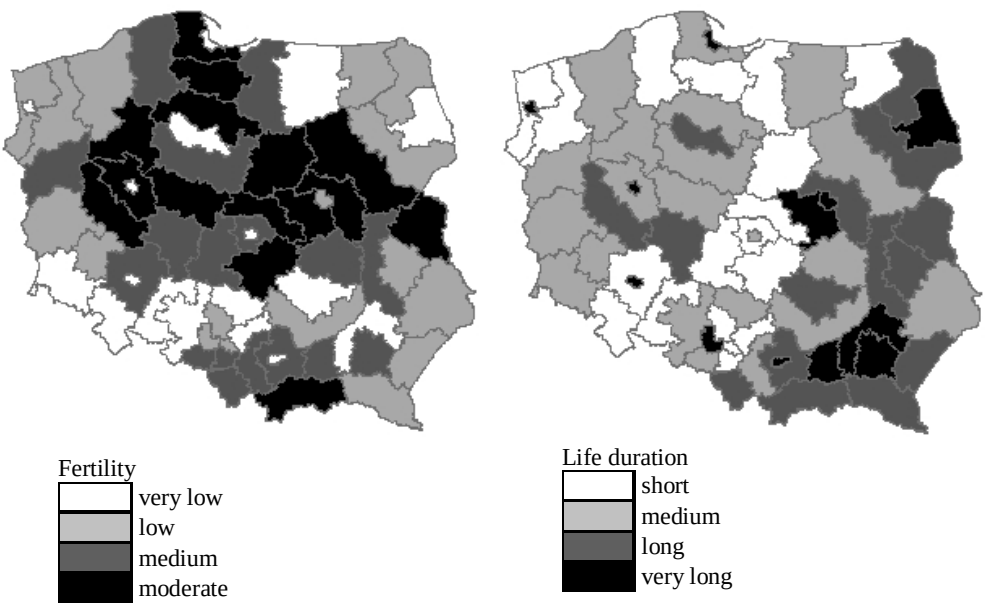
Source: Own estimation based on data provided by Local Data Bank of Central Statistical Office of Poland in R-CRAN.

The highest estimate (considering absolute values) was determined for the total fertility rate. A relatively high value of the structural parameter was also showed by the indicator of life expectancy. The negative estimate was determined for the total fertility rate, while the positive value is typical of the life expectancy. This indicates inversely proportional influence of fertility and directly proportional relations between life expectancy and the synthetic measure. Therefore, the progress in the population aging processes in the Polish subregions is most significantly affected by low fertility and extending the duration of life.

The subregions were divided into four classes (according to quartiles), representing very low (the indicator takes values of [1.00, 1.22)), low [1.22, 1.30), medium [1.30, 1.37) and moderate [1.37, 1.65] level of fertility (see Figure 4a). It can be seen that moderate or medium level is present in the subregions of Pomorskie, Wielkopolskie, Mazowieckie, Łódzkie and Małopolskie voivodeships. Additionally, moderate intensity of births occurs for the following subregions: Grudziądzki (Kujawsko-pomorskie voivodeship), Skierniewicki and Piotrowski (Łódzkie voivodeship), Nowosądecki (Małopolskie voivodeship) and Bialski (Lubelskie voivodeship).

On the other hand, it is quite characteristic to observe a very low level of fertility in the case of the largest Polish cities. Extremely low fertility was also recorded in Opolski region, as well as in Jeleniogórski and Wałbrzyski (Dolnośląskie voivodeship), Częstochowski and Sosnowiecki (Śląskie voivodeship), Kielecki (Świętokrzyskie voivodeship), Tarnobrzeski (Podkarpackie voivodeship), Białostocki (Podlaskie voivodeship) and Olsztyński (Warmińsko-mazurskie voivodeship) subregions.

The estimate of the regression parameter relating to life expectancy of men aged 65 was 0.1539, which is nearly three times less than in the case of the fertility rate. According to the values of the variables we can distinguish subregions with short (the indicator takes values of [14.1, 14.8)), medium [14.8, 15.2), long [15.2, 15.6) and very long [15.6, 16.9) expected duration of life (see Figure 4b). In this case, very low life expectancy is characteristic of the subregions of Łódzkie voivodeship and some subregions of Zachodniopomorskie, Pomorskie, Warmińsko-Mazurskie, Dolnośląskie and Śląskie voivodeships. Relatively high values of the indicator were recorded in the subregions related to regional capital cities.



a) total fertility rate in 2012 b) life expectancy of men at the age of 65 in 2012

Figure 4. Spatial diversification of the most significant factors affecting the population aging processes in Polish subregions

Source: Own compilation based on data provided by Local Data Bank of Central Statistical Office of Poland.

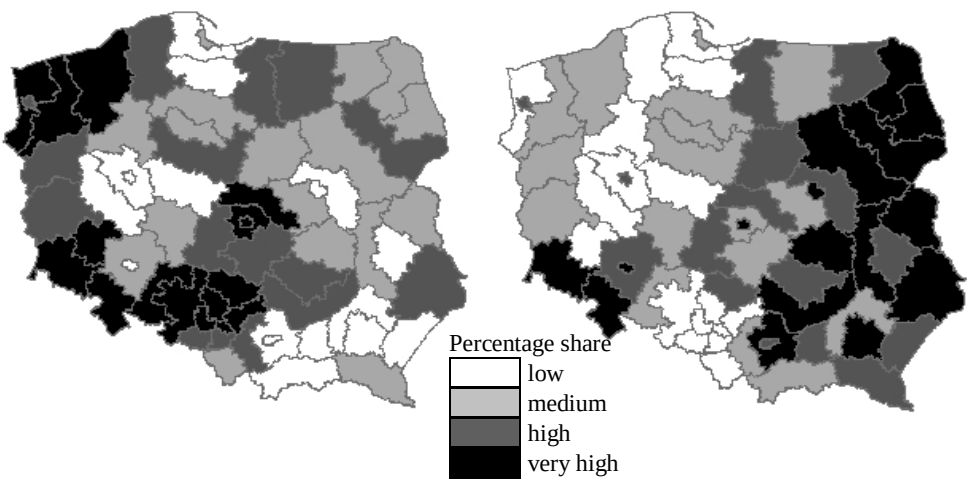
Very low fertility and simultaneously long life expectancy are observed in Białostocki (Podlaskie voivodeship), Tarnobrzeski (Podkarpackie voivodeship) and Gliwicki (Śląskie voivodeship) subregions. A similar situation, resulting from

different reasons (probably due to suburbanization processes) is seen in the following cities: Szczecin, Poznań, Tricity, Wrocław and Cracow.

The conducted regression analysis also allowed observation of the substantial relations between the working-age population aging rate and the oldest-old-age population rate, as well as the intensity of the population aging processes. Slightly higher impact is presented by the working-age population aging rate. The interval of the indicator values was divided into four subintervals representing very high (the indicator takes values of [38.60, 41.10]), high [37.75, 38.60), medium [36.61, 37.75) and low [34.31, 36.61) percentage share of the immobile working-age population in the total working-age population (see Figure 5a).

A relatively high or very high level of this indicator is true for the Zachodniopomorskie, Opolskie and Śląskie voivodeships, and some subregions from Dolnośląskie and Łódzkie voivodeships. A relatively young working-age population lives in the biggest Polish cities (such as Poznań, Warsaw, Wrocław, Cracow and Lublin), as well as in the subregions of Podkarpackie voivodeship.

Figure 5b presents the classes of subregions in relation to the values of the oldest-old-age population rate which can be defined as very high (the indicator takes values of [26,97; 31,30]), high [26,33; 26,97), medium [25,04; 26,33) and low [19,51; 25,04) percentage share of the oldest-old population. Except for a few subregions, relatively high or very high values of the oldest-old-age population rate were recorded in eastern voivodeships, such as: Warmińsko-Mazurskie, Podlaskie, Mazowieckie, Lubelskie, Świętokrzyskie, Małopolskie and Podkarpackie voivodeships, while a low or medium percentage share of the oldest-old seniors relates to the remaining part of the state, in particular western Poland.



a) the working-age population aging rate b) the oldest-old-age population rate

Figure 5. Spatial diversification of the working-age population aging rate and the oldest-old-age population rate in 2012

Source: Own compilation based on data provided by Local Data Bank of Central Statistical Office of Poland.

Statistically, there are no significant relations between the working-age population aging rate and the oldest-old-age population rate; the Pearson's correlation coefficient took the value near to zero (-0.142). However, there are subregions in which both indicators take relatively high values: subregions of Świętokrzyskie voivodeship, Jeleniogórski and Wałbrzyski subregions (Dolnośląskie voivodeship), Sieradzki and the city of Łódź (Łódzkie voivodeship), Częstochowski (Śląskie voivodeship), Elbląski (Warmińsko-Mazurskie voivodeship), Łomżyński (Podlaskie voivodeship) and Chełmsko-Zamojski subregions (Lubelskie voivodeship).

The process of population aging in many Polish subregions is also deepened by migration outflow of young people (negative estimate). The higher the negative migration rate coefficient, the stronger the processes of population aging in a region. The values of quartiles served in defining four classes of subregions (see Figure 6):

- high outflow (the indicator took values of [-55,30; -29,40)), resulting from a much higher migration outflow than inflow of young people,
- medium outflow (the indicator took values of [-29,40; -20,62)),
- low outflow or slight inflow; the coefficient took relatively low absolute values within the interval [-20,62; 4,21),
- high inflow (the indicator took values of [4,21; 100,30]), resulting from a much higher migration inflow than outflow of young people.

High positive balance of migration flows occurs in subregions related to big agglomerations and their neighbouring subregions (the city of Szczecin and Szczeciński subregion, the city of Wrocław and Wrocławski subregion, the city of Warsaw and Warszawski Wschodni and Warszawski Zachodni subregions, the city of Cracow and Krakowski subregion). A similar situation is observed in subregions which contain a bigger city inside, such as Bielski (Śląskie voivodeship), Rzeszowski (Podkarpackie voivodeship), Białostocki (Podlaskie voivodeship), Bydgosko-Toruński (Kujawsko-pomorskie voivodeship), and also Szczeciński subregions.

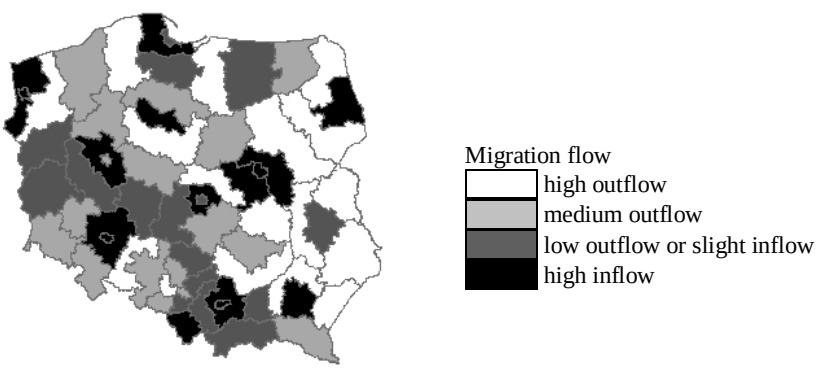


Figure 6. Spatial diversification of the net migration rate values referring to population aged 20-59 in 2012

Source: Own compilation based on data provided by Local Data Bank of Central Statistical Office of Poland.

This indicates a progressing processes of concentrating population in the economically well developed areas and their surroundings, and also depopulation of economically poor regions. An alarmingly high outflow of young people is noticeable for the voivodeships of eastern Poland, such as Podlaskie, Lubelskie and Podkarpackie voivodeships, as well as selected subregions of Mazowieckie and Świętokrzyskie voivodeships. A similar situation is also seen in subregions (e.g. Stargardzki subregion in Zachodniopomorskie voivodeship, Słupski subregion in Pomorskie voivodeship, etc.) which are located close to bigger cities and their nearest neighbours.

5. Conclusions

The population aging processes result in long-term consequences in the socio-economic sphere relating to public finance, regional labour markets, increasing demand on selected goods and services, organizational problems, etc. Therefore, they affect the socio-economic aspects of the functioning of territorial units and formation of their policies of regional development. The results of the conducted empirical research allow drawing the following conclusions which can provide significant support in these cases.

Population aging is usually a consequence of a few simultaneously occurring phenomena. The most significant factor in progressing the population aging processes is extremely low fertility which is also supported by extension of life expectancy in the Polish subregions. A significant role is also played by aging processes of the working-age population and increasing number of oldest-old people within the population of senior citizens. The majority of subregions also struggle with a significant migration outflow of younger people, which deepens the population aging processes.

High territorial diversification of the population aging processes, according to the senior citizens proportion and its growth rate, and also demographic conditions of these processes, occur in Poland. The most advanced population aging processes are observed in south-western Polish subregions, in which the most significant problems are very low fertility, relatively old working-age population and also a significant migration outflow of younger people. On the other hand, the youngest and slowest aging population lives in south-eastern and central Poland. It is characterized by higher fertility but shorter life expectancy, and also a younger working-age population.

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