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Aging of the society: the European perspective

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Abstract. Population aging is a key risk for the future of Europe. The Old Continent has to face ever-stronger new demographic trends and find effective strategies to address them. In this study, we evaluate the progress of population aging in Europe in the period of 2008–2021. The broad time span of our considerations concerns the years 1960–2100. We present our new typological approach to the areas of unbalanced age structure. Its classification includes four groups of countries with various distribution of aging measures, i.e., the percentage of people aged 65 and over and the dynamics of its growth. We observe that the largest group is composed of countries exceeding arithmetic means for both above-mentioned aging measures, which are located mainly in Eastern and Southern Europe. According to stages of aging by median age, most of these countries reached the stage of very old population in the 1990s.

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1. Introduction

Population aging is a serious problem of the contemporary world. It is affected by three factors. These are past and present trends in fertility, mortality and migrations (Preston et al., 1989). Declining number of births – a basic aging factor – deeply affects changes in percentages of the youngest and the oldest population groups in a society. Moreover, lower mortality rates, within older age groups in particular, prolongs the average life expectancy. Migrations modify the dynamics and advancement of processes included in vital statistics, especially given the fact that migrating populations are largely dominated by younger persons. When it comes to immigration areas, migrations stimulate vital statistics by neutralizing population decreases caused by low (or negative) rates of natural increase and are also associated with an increase in birth rates. In countries with negative net migration rates, there are no compensation possibilities – population movements boost and increase their aging.

According to scholars, Europe is demographically divided in the east–west and north–south directions, with the lowest fertility at about 1.3 in the east (Poland, Romania, Slovakia) and south (Portugal and Italy), and the highest at over 1.8 in the west (France, Ireland) and north (Denmark, Norway, Sweden) of the continent (Lipczyńska, 2015). Population aging in Europe is forecast to increase until the 2030s (*The Revision of World Population Prospects*, 2022). Birth rate per 1,000 population will decline to 9.8, then within two decades it will slightly increase and at the end of the century it should amount to 11.2. Mortality is expected to increase until 2060 (13.7 deaths per 1,000 population) and before the year 2100 it will decrease (11.3). From the 2020s onwards, the number of inhabitants will gradually decline in Europe – the continent metaphorically, historically and demographically referred to as "old". This is already visible, with the population of Europe having decreased by 0.1% year by year in the period 2020–2021.

Apart from such issues as climatic changes and globalization, the changing demographic profile of the "old" continent seems to be the key problem. The problem of population aging in Europe is mainly described with a view on future risks. It is impossible to ignore the fact that demographic changes are also affecting other areas of the world. Most developed and developing countries have already been facing or will have to face the same irreversible process. It will put a premium on the awareness of the problem as well as the appropriate active attitude towards problem-related risks. Europe may become a model area in terms of successful initiatives aimed at neutralizing the negative impacts of new demographic trends.

The state and progress of population aging may be observed and described with two approaches – dynamic (as a sequence of events) or static (as a population group with its acquired demographic, social or medical features). These interpretations are always set in a particular period of time or geographical space. Such an approach was used by the first scholars studying the problem and is used now by contemporary researchers. The first studies on demographic aging appeared in the second part of the 20th century and referred to France, whose population aging originated as early as in 1851 (Pressat, 1966). Moreover, Rosset (1978) describes France as the cradle of population aging. Along the development of this process, multidimensional analyses began to appear. Subjects of studies focus on theoretical and empirical issues, analysing the impact of population aging on demographic processes (e.g., Coulson, 1968; Cheal, 2000; Sanderson & Scherbov, 2007, 2013; Walford & Kurek, 2008; Długosz, 2003; Długosz & Biały, 2013; Gregory & Patuelli, 2015; Horn & Schweppe, 2016). Since the 1980s, studies focused on migration of seniors have contributed considerably to the development of this academic subject (e.g., Newbold, 1996; King et al., 1998; Gaag et al., 2000; Marr & Millerd, 2004; Bahar et al., 2009) and are still being explored by academic scholars (e.g., Atkins, 2017; Pytel, 2017; Rallu, 2017; Neumann, 2018). Presently, there are more interpretations set in various contexts, including the issue of changes in spatial and functional structure of urban and rural areas due to population aging (e.g., Bloom et al., 2015; Stjernborg et al., 2015). One key issue is to evaluate the impact of changes in demographic structure on the labour market (e.g., Green & Collis, 2006; Loretto & White, 2006; Temple & McDonald, 2017). Scholars are interested in the forms of social policies aimed at aging population and organization of elderly care (e.g., Ranci & Pavolini, 2015; Broek & Dykstra, 2017; Ejdys & Halicka, 2018). They also analyse relations between population aging and changing living conditions (e.g., Marmot et al., 2003; Soja & Stonawski, 2008; Santini et al., 2020). Another important subject connected with the welfare state is the access to education and health services within different age groups (Bambra, 2006; Bell & Rutherford, 2013; Barglowski et al., 2015). There is an increasing focus on health inequalities and poverty among elderly people (Mackenbach et al., 2003; Arber, 2004; Kunst et al., 2005; Chandola et al., 2007; Pongiglione & Sabater, 2016). It should

be noted that it is difficult to list each and every work on the subject, but they all contribute to better understanding of the phenomenon, and to the recognition of its reasons and socio-economic consequences.

It should be noted that geographical studies concerning the typology of population aging occupy an important place (Długosz, 1996; Kurek, 2008). These analyses were most often carried out on the basis of various measures for assessing the degree of demographic aging. Moreover, these works deal primarily with the demographic aspect of the population aging process and show its dynamics in spatial differentiation (Długosz, 1997, 1998; Kurek, 2003; Podogrodzka, 2014, 2016; Wójtowicz et al., 2019).

A demographic approach to population aging provides an opportunity to assess the dynamics of the phenomenon in a particular period in a given area. It may be an administrative unit, state or other area. Such an approach has its autonomous academic value and it provides a foundation useful for evaluations and describing non-demographic consequences of the issue. Thus, the goal of our study is to assess how demographically advanced population aging is in Europe. We also demonstrate our new classification of European countries with unbalanced age structure. The conclusions from the research have a real potential to develop social policies of various areas focused on neutralizing the negative consequences of population aging.

2. Materials and methods

The study is based on empirical data from secondary sources including: a database supervised by the Population Division of the United Nations Department of Economic and Social Affairs (2022), comprising, e.g., *World Population Prospects: The 2022 Revision*; from the World Bank Open Data (2022); from Eurostat (2022); and from the Organisation for Economic Co-operation and Development (2022). We base the description of analysed phenomena on classic demographic measures and population aging measures, with the use of components of actual increase, economic dependency ratio, the percentage of persons aged 65 and over, the internal structure of the post-working-age sub-population, and the average life expectancy at the moment of birth. The wider time span comprises the years 1960–2100, whereas our quantitative analysis refers to the period 2008–2021.

In order to meet the goal of the study, we employ our own typology of areas with unbalanced age structure. We distinguish four groups of European countries that differ from one another in the progress of the issue in question in 2021:

- Type A – countries with the percentage of people aged 65 and over exceeding 19.3%,
- Type B – countries with a 3.7-point increase in the percentage of people aged 65 and over,
- Type C – countries meeting both conditions – A and B,
- Type D – countries meeting neither condition A nor B.

In this typology, the value of the percentage of elderly people (19.3%) is calculated as the arithmetic mean for the analysed group, whereas the applied level of increase in the percentage of this social group is expressed as the average difference for the period of 2008–2021.

The age value of 65 and over adopted for the classification is based on the old age threshold often adopted in the literature. It should be noted, however, that this limit is not fixed and is gradually increasing due to the progress of this process. A similar situation applies to the adopted thresholds for determining the states of demographic old age (Rosset, 1959; Długosz, 1998). Therefore, there is no clearly defined limit from which demographic old age is determined. Its value may change depending on the moment of the study and the comparative analyses conducted.

In the study, for certain types of countries characterized by a disturbed age structure, we also used the comparative procedure the reference point of which was the classification of the advancement level of the aging of the European society by Kurkiewicz (2012). It was based on the median age of the population, on the basis of which basis four stages of population aging were determined:

1. Median age in the range of 20–24 years – young population;
2. Median age in the range of 25–29 years – the population is aging;
3. Median age in the range of 30–34 years – population advanced in the aging process (old);
4. Median age in the range of at least 35 years – very old population.

This classification procedure made it possible to determine the dependence of the types of age structure in relation to the last stage of population aging according to the median age in the European countries in the years 1960–2020. Therefore, we

presented the differentiation in the advancement stages of the aging level of the studied population.

In our work, we also used graphic methods, especially choropleth maps. We distinguished subsets of countries on the choropleth maps in accordance with the Jenks natural breaks classification method. These objective grouping methods allowed us to depict countries with very high, high, average, low and very low intensity of the studied phenomena. The choropleth maps were created with the use of ArcGis software version 10.3.

For the analysis, we use an objective division of Europe according to geographic location of countries. Comparisons in such an approach provide numerous interpretation possibilities. They constitute the foundation for assessment of relations between territorial proximity, historical background and political conditions. Therefore, we select the following groups of countries:

- Northern Europe (10 countries): Denmark, Estonia, Finland, Ireland, Iceland, Latvia, Lithuania, Norway, Sweden, United Kingdom;
- Eastern Europe (seven countries): Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, Ukraine;
- Southern Europe (11 countries): Croatia, Cyprus, Greece, Italy, Malta, Montenegro, North Macedonia, Portugal, Serbia, Slovenia, Spain;
- Western Europe (eight countries): Austria, Belgium, France, Germany, Liechtenstein, Luxembourg, Netherlands, Switzerland.

We do not include the remaining countries in the analysis due to incomplete statistical data. For linguistic reasons, the population aged 65 and over is also referred to as: elderly people, seniors, pension-age population, or post-working-age population.

3. Results and discussion

For many years, scholars describing demographic phenomena have identified a number of population issues registered in Europe. In demographic forecasts, this continent is the only one with a declining population. As shown in Table 1, in the period 2008–2021, one third of the analysed countries registered a population decline. Eastern Europe faced the most significant drop, where five countries suffered a -5.8% population decrease on average. However, Western Europe generally showed the opposite trend – there was no population decline in any country. In Northern and Southern Europe this parameter was much more diversified. In Northern Europe, declining population dynamics were seen in the Baltic States (-9.1% on average), whereas other countries from that region reported increasing rates. A slightly lower balance was observed in Southern Europe, where four countries recorded declining rates (-4.8% of their populations).

As we mentioned before, the rate of natural increase and migrations, i.e. elements shaping the dynamics of population changes, in certain negative conditions boost population aging. The majority of depopulating European countries recorded a population decrease resulting mainly from natural decline, with good examples in Eastern Europe (Table 2). In 2021, the negative rate of natural increase in all countries of the region amounted to -7.0 per 1,000 population on average. We observe a similar distribution of this element in Southern Europe, where nine countries recorded values of -5.0 per 1,000 population on average. In the two remaining regions, the picture was much better. In Northern Europe, natural decline was recorded in three Baltic States and in Finland. This region had the country with the highest rate of natural increase in 2021, i.e., Iceland (6.9). In Western Europe, only Germany and Austria reported a natural decrease.

Regarding migrations, with the synthetic approach, the area of most immigration is Western Europe, because in 2021 all these countries had positive net migration rates, at the average level of 5.7 per 1,000 population (Table 3). A similar tendency was observed in Northern Europe, where all the states (except for Latvia) showed a positive migration (the average rate at about 5.8 per 1,000 population). One reason is the increasing number of immigrants from Africa and the Middle East. Therefore, a very high net migration rate, from about 9.0 to 13.3, with the rate of natural increase between -8.7 and 6.9, can be found in Malta, Portugal, Lithuania, Iceland and Luxembourg. At the opposite end of compensation abilities, with negative net migration rate, there were four Southern European countries (North Macedonia, Croatia, Greece, Montenegro) and two Eastern European countries (Slovakia and Romania). These two regions are the most affected by population decrease due to emigration, strengthened by a negative rate of natural increase (the average rates being -10.3 and 1.0 per 1,000 population, respectively). The discussed components of population changes and population resources in the period 2008–2021 for the whole Europe are presented in Fig. 1.

The issue of population aging can be analysed in terms of various parameters – e.g., the percentage

Table 1. Dynamics (%) of population changes in Europe, 2008–2021

Region	Country	Dynamics of population changes[a]
Northern Europe	Latvia	**86.4**[b]
	Lithuania	87.0
	Estonia	99.4
	Finland	104.4
	Denmark	106.7
	United Kingdom	108.9
	Ireland	112.3
	Sweden	113.0
	Norway	113.8
	Iceland	116.9
Eastern Europe	Ukraine	89.7
	Bulgaria	92.0
	Romania	93.1
	Hungary	96.9
	Poland	99.3
	Slovakia	101.6
	Czech Republic	103.5
Southern Europe	Serbia	93.3
	Croatia	93.6
	Greece	96.5
	Portugal	97.6
	Montenegro	100.8
	Italy	101.0
	North Macedonia	101.2
	Spain	103.8
	Slovenia	104.9
	Cyprus	115.4
	Malta	126.5
Western Europe	Germany	101.1
	France	105.7
	Netherlands	106.5
	Austria	107.5
	Belgium	108.4
	Liechtenstein	110.5
	Switzerland	114.2
	Luxembourg	**131.2**[b]

a Countries in each region are listed from lowest to highest values.
b The lowest and the highest values are emphasized.
Source: own calculations based on Eurostat Database

of population aged 65 and over, the percentage of pension-age population, or the demographic dependency ratio. In order to describe population aging in Europe, we present this phenomenon in spatial distribution. In 2008, the countries from this study had diversified percentages of population aged 65 and over (Fig. 2). Using the Jenks natural breaks classification method, we divide countries into five groups: with very high, high, medium, low and very low progress of aging. This process was the strongest (the percentage equal to or higher than 16.6%) in Southern Europe (e.g., Serbia, Greece and Italy) and Northern Europe (the Baltic States, Sweden). The group with low percentage of seniors (up to 14.0%) is composed of 10 countries (e.g., Ireland, Slovakia, Montenegro, Poland and Luxembourg).

As we can see in Fig. 3, in 2021 the distribution of the issue in question was similar. High or very high values of at least 19.4% were recorded in a line of countries from Scandinavia (except Norway) and the Baltic States, southwards through Germany and France to the Italian Peninsula, the Balkan Peninsula and the Iberian Peninsula.

Table 2. Rate of natural increase per 1,000 population in Europe in 2008 and 2021

Region	Country	The rate of natural increase	
		2008	2021[a]
Northern Europe	Latvia	-3.02	-9.07
	Lithuania	-3.83	-8.73
	Estonia	-0.48	-4.00
	Finland	1.97	-1.46
	Denmark	1.91	1.08
	United Kingdom	3.49	1.61
	Sweden	1.94	2.15
	Norway	3.97	2.61
	Ireland	**10.52**	5.07
	Iceland	9.03	**6.92**[b]
Eastern Europe	Bulgaria	-4.36	**-13.06**[b]
	Ukraine	**-5.28**	-10.68
	Romania	-1.52	-8.12
	Hungary	-3.07	-6.38
	Poland	0.92	-4.97
	Slovakia	0.78	-3.09
	Czech Republic	1.41	-2.63
Southern Europe	Serbia	-4.57	-10.83
	Croatia	-1.95	-6.49
	Greece	0.93	-5.43
	Italy	-0.14	-5.23
	North Macedonia	1.94	-4.77
	Portugal	0.03	-4.39
	Montenegro	4.14	-3.41
	Spain	2.94	-2.38
	Slovenia	1.75	-2.03
	Malta	1.89	0.45
	Cyprus	5.17	3.39
Western Europe	Germany	-1.97	-2.74
	Austria	0.32	-0.66
	Netherlands	3.02	0.48
	Belgium	2.12	0.52
	France	4.48	1.20
	Switzerland	2.04	2.13
	Liechtenstein	4.10	2.66
	Luxembourg	4.14	3.47

a Countries in each region are listed from lowest to highest values in 2021.
b The lowest and the highest values are emphasized.
Source: own calculations based on Eurostat Database

Another factor useful in analysing population aging is the percentage of pension-age population. The retirement age in European countries differs, as Table 4 shows. The latest data show that it will be raised in all countries except Poland. The highest retirement age is in Ireland and the United Kingdom (68 years). Germany has recently raised this age for both sexes to 67 years, but the government plans to reach 71. The predominating, average retirement age outside Eastern Europe is 65 years. Half of the countries from our study plan to raise it for women and men. Within this group, eight countries (e.g., Denmark, Spain, Belgium) plan to raise it to 67 years or more.

For the percentage of pension-age population, following the Jenks natural breaks classification method, we distinguish five subgroups of countries: with very high, high, medium, small and very

Table 3. Net migration rate with statistical adjustment per 1,000 population in 2008 and 2021

Region	Country	Net migration rate	
		2008	2021[a]
Northern Europe	Latvia	**-10.20**[b]	-0.15
	Norway	9.14	3.68
	United Kingdom	4.16	4.06
	Finland	2.90	4.07
	Denmark	4.60	4.63
	Sweden	6.05	4.89
	Estonia	-1.53	5.30
	Ireland	3.74	5.65
	Lithuania	-5.12	12.42
	Iceland	3.36	**13.31**[b]
Eastern Europe	Slovakia	0.40	**-1.50**[b]
	Romania	-7.94	-0.40
	Poland	-0.39	0.06
	Ukraine	0.32	0.51
	Bulgaria	-2.40	1.84
	Hungary	1.64	2.09
	Czech Republic	6.55	4.67
Southern Europe	North Macedonia	-0.25	-107.42
	Croatia	1.44	-32.47
	Greece	2.12	-1.57
	Montenegro	-1.52	-1.51
	Serbia	0.42	0.00
	Italy	6.07	0.95
	Slovenia	9.24	1.18
	Spain	9.55	3.10
	Cyprus	**21.36**[b]	6.31
	Malta	5.70	8.99
	Portugal	0.89	9.61
Western Europe	France	0.88	1.54
	Germany	-0.65	3.73
	Liechtenstein	2.49	3.82
	Switzerland	12.23	5.51
	Austria	2.93	5.84
	Belgium	5.96	6.08
	Netherlands	1.88	6.11
	Luxembourg	15.92	13.34

a Countries in each region are listed from lowest to highest values in 2021.
b The lowest and the highest values are emphasized.
Source: own calculations based on Eurostat Database

small values. In 2008, areas of very high and high values (42.0% in total) were most concentrated in Southern and Northern Europe (Fig. 4). Within this group there were 14 countries in which at least one quarter of the population was pension age (exceeding the median by 1.3 percentage points) and they primarily included (in descending order): Italy, Germany, Greece, Croatia, Sweden and Portugal. Low percentages of old age pensioners (19.9% and less) could be observed in, for example, Malta, Poland, Liechtenstein, Slovakia and Ireland.

In 2021, this process intensified. The number of countries with at least one quarter of its population at pension age (lower than the median by 5.4 percentage points) doubled to 30, and this group included such new countries as Finland, Slovenia, Denmark, Czech Republic and Hungary (Fig. 5). Moreover, the number of countries with the

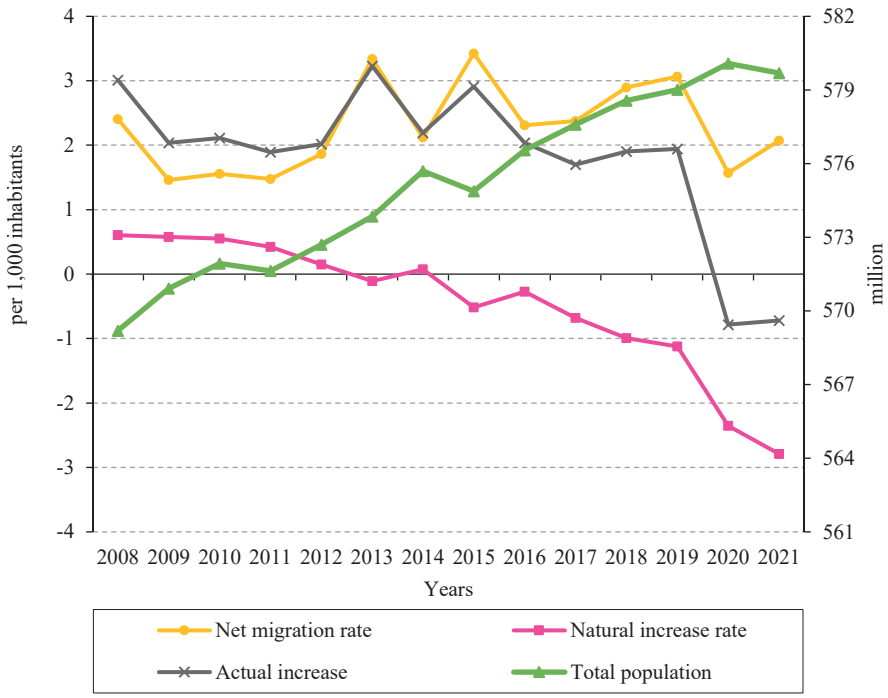

Fig. 1. Components of the dynamics of population changes and population resources in Europe, 2008–2021
Source: own elaboration

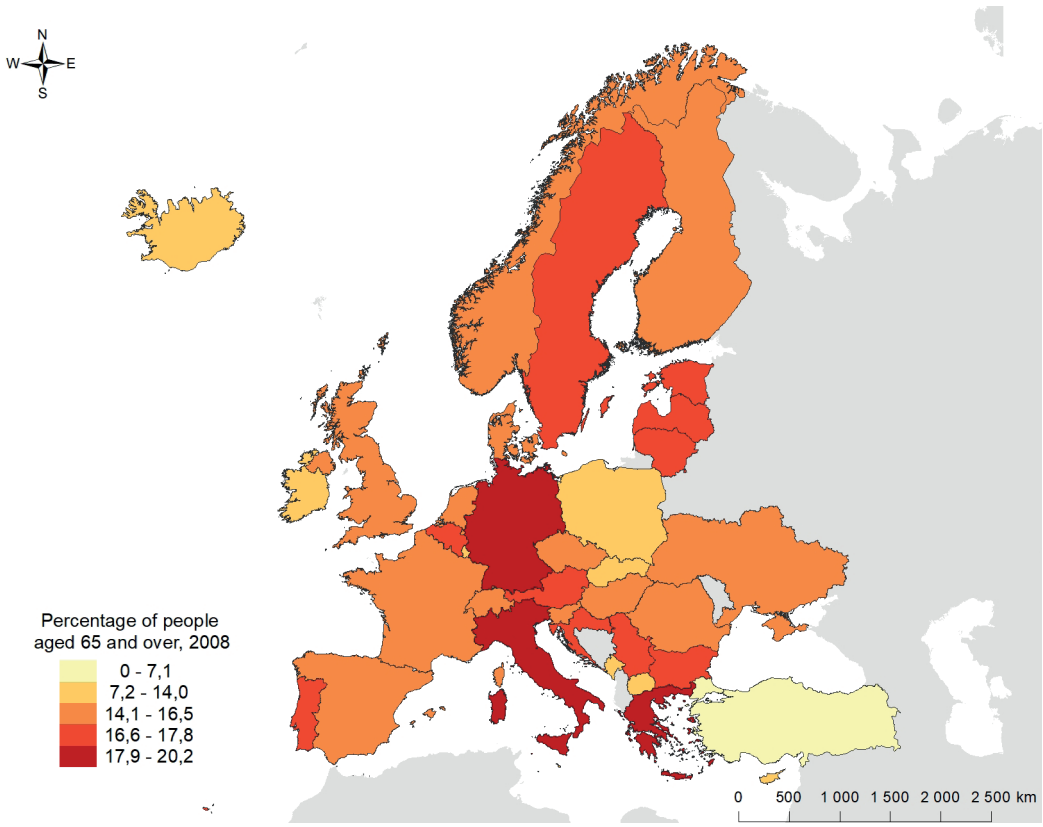

Fig. 2. Percentage of people aged 65 and over in Europe in 2008
Source: own elaboration

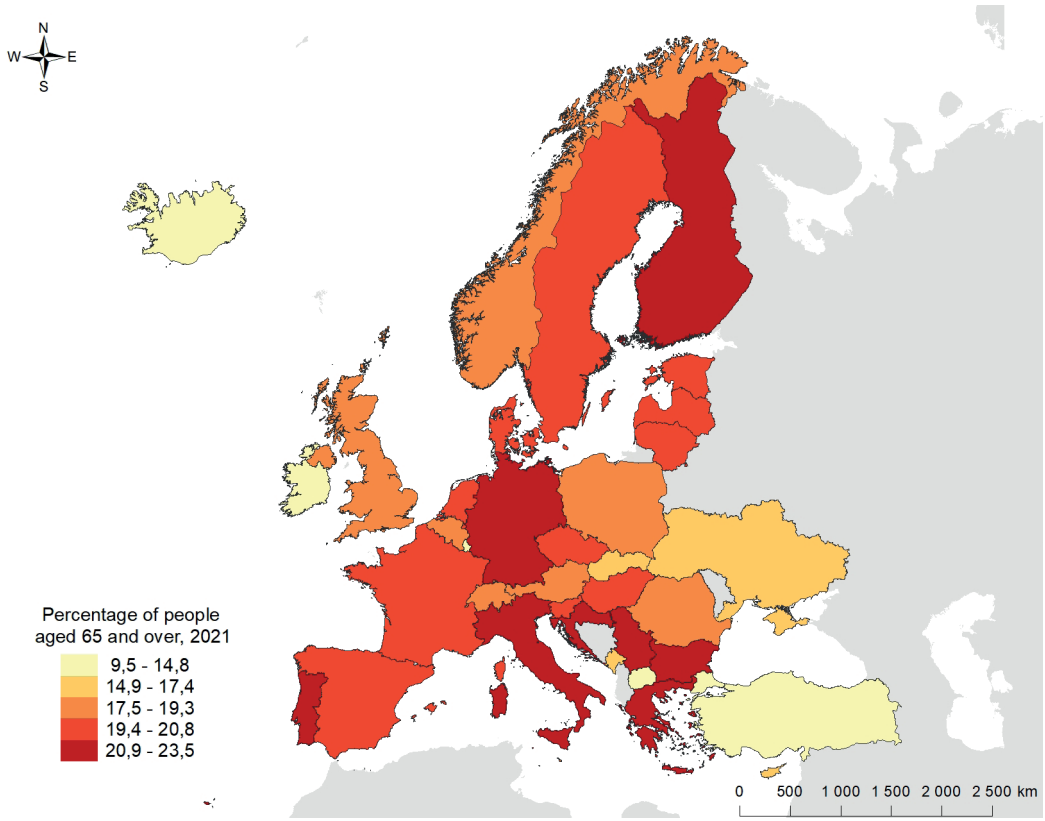

Fig. 3. Percentage of people aged 65 and over in Europe in 2021
Source: own elaboration

percentage of pension-age population at 30.0% or more increased from two to 20. The oldest in that respect was still Italy (37.0%). The highest rises in the percentage of pension-age population – over 9.5 percentage points on average when compared to 2008 – can be found in nine countries: Finland, Portugal, France, Slovenia, Czech Republic, Netherlands, Poland, Liechtenstein and Slovakia (ranging between 25.5% and 36.8%).

Population aging depends also on ratios such as post-working-age population to working-age and pre-working-age populations. Mutual relations between the size of age groups in particular European countries are visible in the spatial diversity of economic dependency ratio on a regional scale as well. Using the Jenks natural breaks classification method, we produced five groups of countries with different economic dependency ratios. In 2008, very high economic dependency ratios – seniors to working-age population (from 43.4% to 47.3%) – were found in Italy, Sweden and Germany (Fig. 6). The group of countries with high economic dependency ratio (40.8–43.3%) was twice as big, and the three of them were located in Southern Europe (Croatia, Portugal, Greece). Out of 14 areas with the ratio of post-working-age population per 100 persons of working age amounting to 40.0% or more (exceeding the median by 1.2 percentage points), almost half are located in Northern Europe, compared against over one quarter in Southern Europe. Very low rates for the dependency ratio in question (not exceeding 30.9%) were found in eight countries including Iceland, Poland and Liechtenstein.

An intensification of population aging in 2021 was reflected in the economic dependency ratio – pension-age population to working-age population. The number of countries with at least 40.0% (exceeding the median by 9.0 percentage points) doubled to 31. This group increased its area proportionally in Northern, Southern and Western Europe (Fig. 7). Moreover, there was a very high economic dependency ratio (exceeding 50.0%) in 16 countries, particularly in Southern and Northern Europe. These were, in decreasing order: Finland, Italy, Greece, Portugal, Germany, Croatia, France, Bulgaria, Latvia, Serbia, Slovenia, Estonia, Lithuania, Denmark, Netherlands and Sweden. The

Table 4. Retirement age in Europe by sex

Region	Country	Retirement age	
		Men	Women
Northern Europe	Denmark	65/67[a]	65/67
	Estonia	63/65	63/65
	Finland	65	65
	Iceland	67	67
	Ireland	66/68	67/68
	Latvia	62/65	62/65
	Lithuania	63/65	61/65
	Norway	67	67
	Sweden	65	65
	United Kingdom	65/68	62/68
Eastern Europe	Bulgaria	64/65	61/65
	Czech Republic	60-63[b]	50-63
	Hungary	62/65	62/65
	Poland	65	60
	Romania	65	63
	Slovakia	62	62
	Ukraine	60/62	57/60
Southern Europe	Croatia	65/67	61/67
	Cyprus	65	65
	Greece	67	67
	Italy	66	66
	Malta	62/65	62/65
	Montenegro	67	67
	North Macedonia	64	62
	Portugal	66	66
	Serbia	65	60
	Slovenia	64/65	64/65
	Spain	65/67	65/67
Western Europe	Austria	65	60/65
	Belgium	65/67	65/67
	France	65/67	65/67
	Germany	65/67	65/67
	Liechtenstein	64	64
	Luxembourg	65	65
	Netherlands	65/67	60/67
	Switzerland	65	64/65

a Values separated with "/" indicate retirement age after reforms in a given country.
b Retirement age strictly depends on contribution years.
Source: own calculations based on OECD Data

group of countries with high ratios (48.9–51.9%), unlike in 2008, was dominated by Northern Europe. The highest increase for this ratio, of between 14.0 and 17.2 percentage points, was found in Poland (maximum increase), Liechtenstein, Slovenia, Finland, Serbia, Slovakia and Portugal. The analysed phenomenon has its background in the increasing number of post-working-age population and the population transfer from the working-age group to the pension-age group. The lowest increase in this negative trend (from 1.8 to 6.1 percentage points up) concerned highly developed countries in Northern Europe (Sweden, United Kingdom, Norway) and Western Europe (Luxembourg, Switzerland).

The figures for the United Kingdom may result from its labour market conditions being better than in most European countries. This is connected with the well-developed and effective government policy

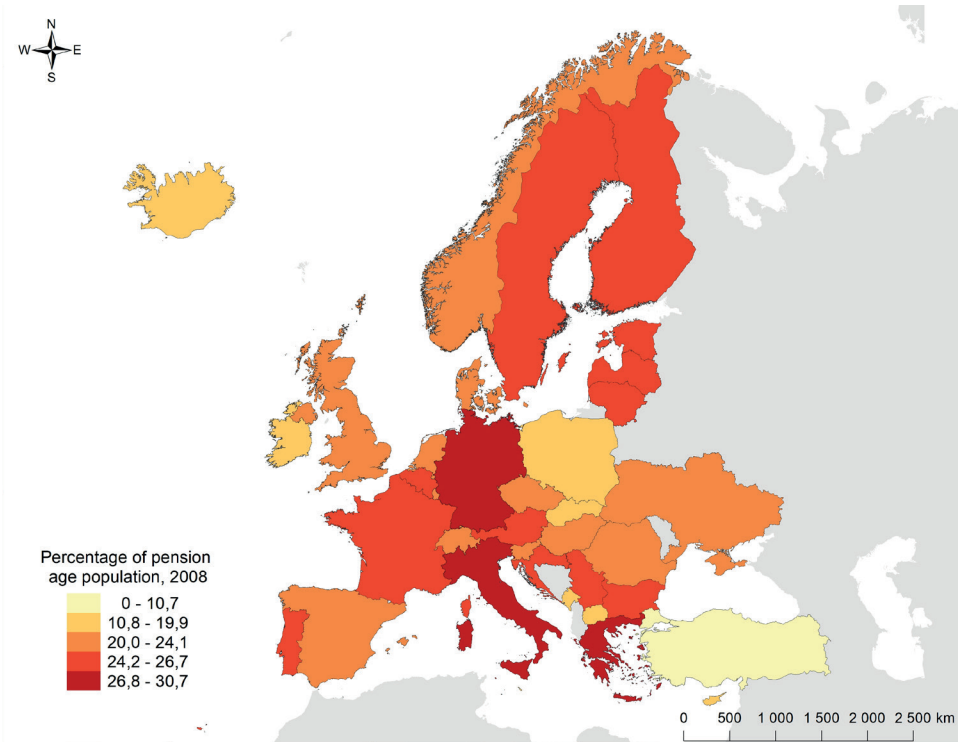

Fig. 4. Percentage of pension age population in Europe in 2008
Source: own elaboration

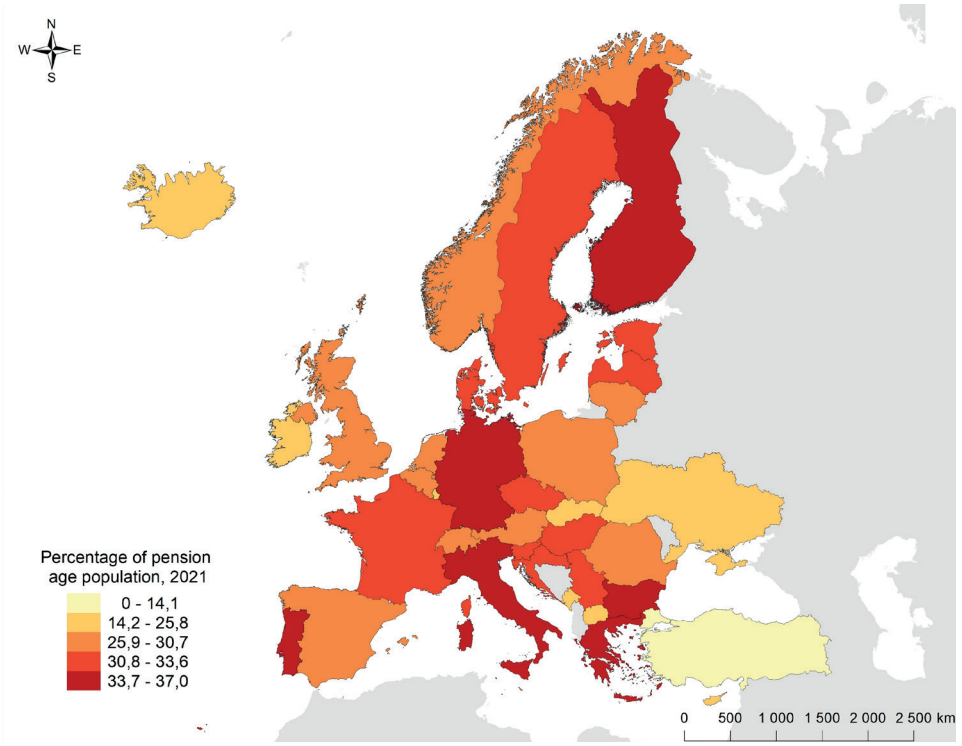

Fig. 5. Percentage of pension age population in Europe in 2021
Source: own elaboration

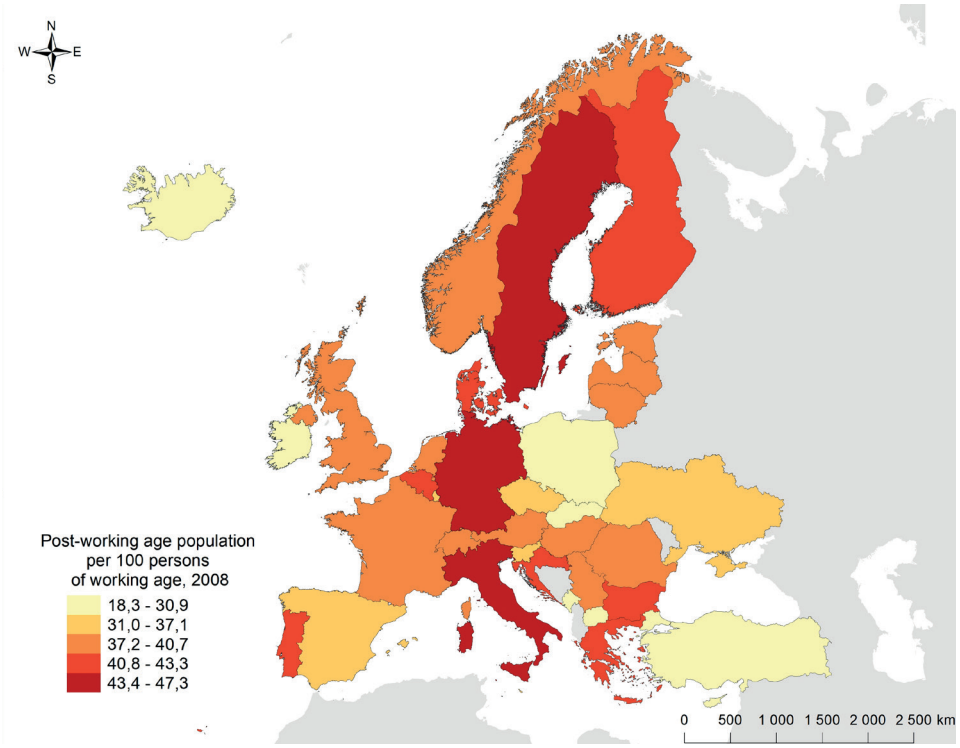

Fig. 6. Post-working age population per 100 persons of working age in Europe in 2008
Source: own elaboration

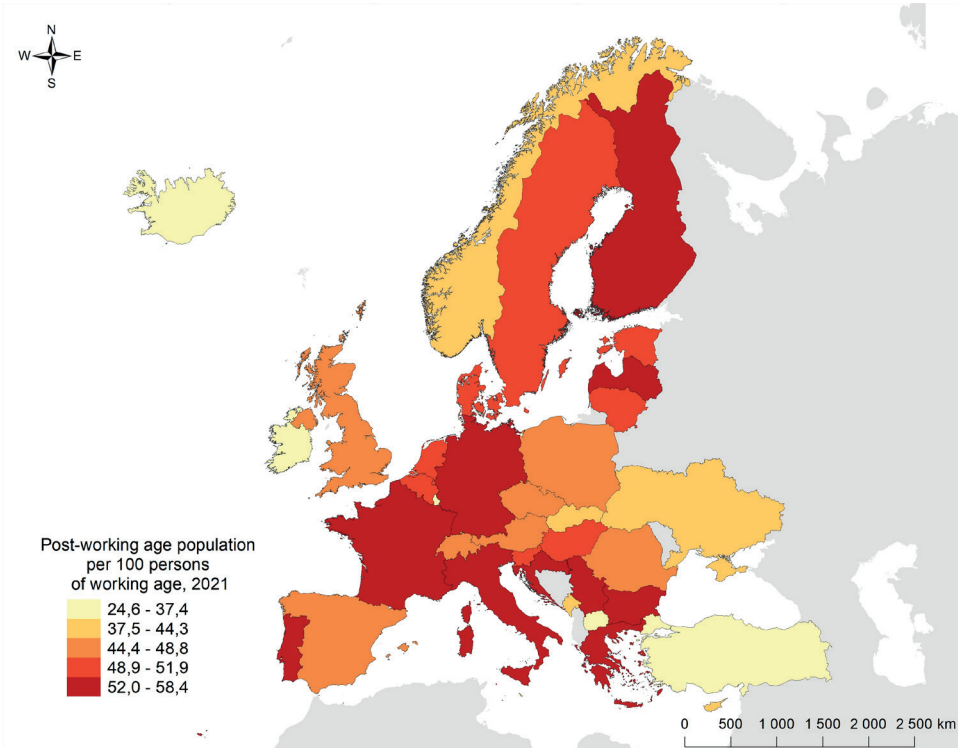

Fig. 7. Post-working age population per 100 persons of working age in Europe in 2021
Source: own elaboration

aimed at labour supply, moving in its social policy from the concept of the "social security country" (welfare state) towards the concept of "well-being of the country based on work" (workfare state). It is also worth mentioning that the United Kingdom has a higher gross domestic product *per capita* than the European average, which improves labour demand. The social policy of that country is directed to the whole working-age population irrespective of socio-economic conditions (Work Programme). However, there are also programmes dedicated to particular groups – e.g., young people (Work Experience Programme) or disabled persons (Access to Work) (Rollnik-Sadowska, 2014). Labour market reforms in the United Kingdom are supplemented with initiatives aimed at upgrading the skills of the society (Leitch, 2006).

Age structure is an important component of demographic condition in particular areas. According to our studies, population aging in Europe is gradually increasing. The professional literature analysing this process offers numerous classifications defining its progress. One example is the classification of aging stages in Europe based on median age since 1960, developed by Kurkiewicz (2012). It defines four consecutive stages of population aging (Table 5).

Our conclusion is that aging in Europe is highly diversified, depending on the location of a region. In Western European countries, the very old population stage prevails. In Eastern Europe, excluding Hungary, we observe three consecutive stages, excluding the young structure. Population aging in Northern Europe is not a homogeneous process. The stage of very old structure was recorded in Sweden and the United Kingdom from the very beginning. The last to enter this stage was Ireland in the year 2020. In Southern Europe, a very old structure first appeared in Greece and Italy, and the last countries to face it were North Macedonia and Montenegro.

Differences in the dynamics of population aging in Europe are mainly affected by the late beginning of the second demographic transition in Eastern Europe. Reproduction and matrimonial changes, connected with this transition, began in numerous Western European countries about two decades earlier. Therefore, various countries are in different stages of demographic processes.

Our study shows that the intensity of the phenomenon in question depends on the region. In order to define similarities and differences, we classify areas with unbalanced age structure according to the data from 2021. Thus, we distinguish four different types of countries that follow primary assumptions (see: Materials and methods). This classification of the European countries with an unbalanced age structure is shown in Fig. 8.

Nine countries were classified as type A (25.0 % of all studied units). Countries that exceeded the average percentage of pension-age population for a given population form three subgroups of fairly compact areas in Northern, Southern and Western Europe, respectively. Following the classification of population aging by median age, the majority of those countries entered the stage of very old population in the first half of the 1990s, except for Estonia and Lithuania, where the process appeared in the first five years of the 21st century (Table 6).

The period 2008–2021 was a time in which the sub-population of people aged 65 and over increased, which proves higher intensity of population aging. Type B – referring to countries with an increase in the percentage of that population group by at least 3.7 percentage points (the average value for 36 countries) – is composed of (in descending order): Liechtenstein, Poland, Slovakia, Malta, Ireland and Cyprus. This is the smallest group in this classification. These are the countries with medium population aging; however, demographic predictions have it that, by the year 2060, they will face a very sharp increase in the percentage of seniors (Zygmunt, 2014). It is interesting to note that all the countries from the analysed group have started to enter the structure period of very old population only since the beginning of the 21st century (the majority within the first five years), but the process of their population aging has significantly accelerated.

The most advanced population aging is visible in 12 (33.3%) countries that we classify as type C. They are located in various parts of the continent, and the most compact group is composed of Eastern (Bulgaria, Hungary, Romania) and Southern European countries (Greece, Serbia, Slovenia). They have been suffering from demographic decline for many years. Moreover, type C includes mainly countries (66.6% of aggregation) that reached the stage of the very old population structure as early as in the 1990s, mostly in the second half of the decade, except for: Bulgaria, Hungary (the 1980s) and Romania and Serbia (the 2000s).

Nine units are classified as type D, which lacks the criteria in question. In some cases, it may be affected by partial rejuvenation of demographic structure due to intensive migration processes (*inter alia*, Luxembourg, Iceland and Austria).

In the discussion of the results, it is impossible to ignore the huge impact of the COVID-19 pandemic on the course of various demographic phenomena,

Table 5. Stages of population aging in European countries by median age, 1960–2030

Region	Country	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030
Western Europe	Austria	very old			old						very old					
	Belgium	very old			old							very old				
	France				old								very old			
	Germany		old							very old						
	Netherlands			aging			old						very old			
	Switzerland			old							very old					
Eastern Europe	Bulgaria			aging							very old					
	Czech Republic			aging								very old				
	Hungary			old							very old					
	Poland			aging				old					very old			
	Romania	aging				old							very old			
	Slovakia			aging					old				very old			
	Ukraine	aging			old							very old				
Northern Europe	Denmark			old								very old				
	Estonia				old								very old			
	Finland			aging			old						very old			
	Ireland				aging						old				very old	
	Latvia			old							very old					
	Lithuania		aging				old						very old			
	Norway				old								very old			
	Sweden								very old							
	United Kingdom								very old							
Southern Europe	Croatia		aging			old							very old			
	Greece		aging			old						very old				
	Italy				old							very old				
	North Macedonia			young				aging			old			very old		
	Montenegro			young			aging				old			very old		
	Portugal			aging			old						very old			
	Serbia		aging				old						very old			
	Slovenia		aging			old							very old			
	Spain		aging			old							very old			

Notes: Progress scale of population aging based on median is introduced by Maksimowicz (1990).
Source: own elaboration based on Kurkiewicz (2012)

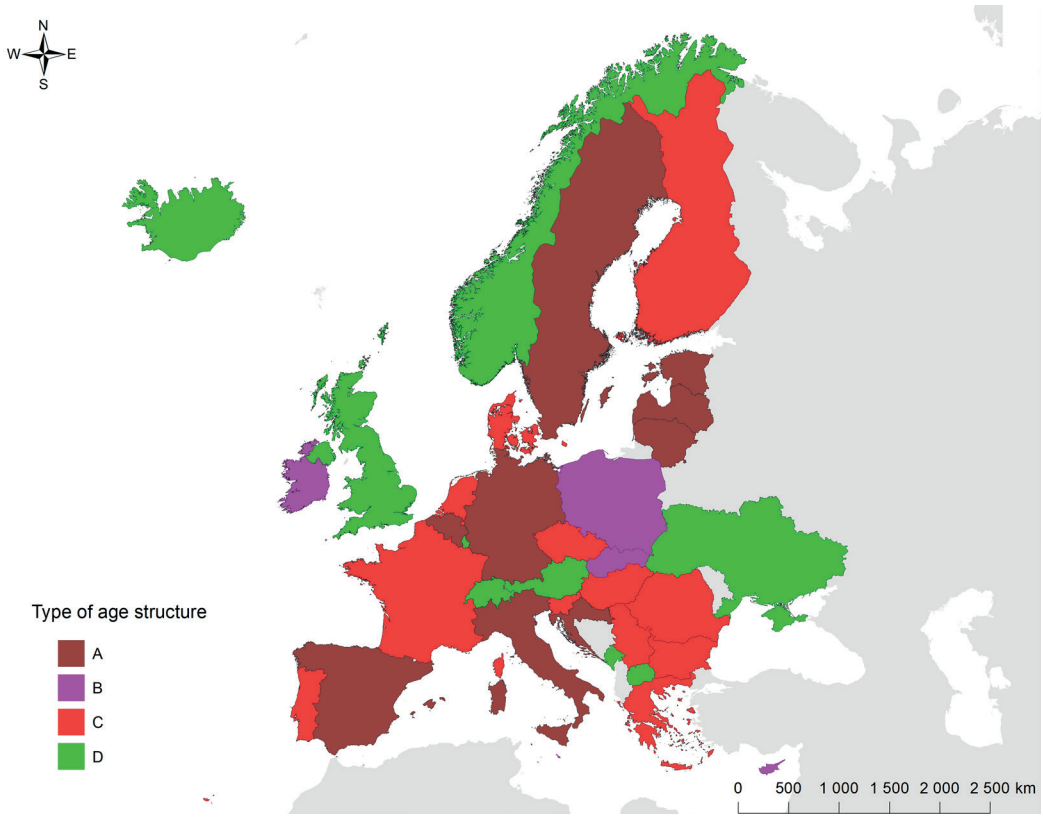

Fig. 8. Classification of European countries with unbalanced age structure in 2021
Types: A – countries with a percentage of people aged 65 and over exceeding 19.3%; B – countries with an increase in the percentage of people aged 65 and over amounting to 3.7 percentage points; C – countries meeting both conditions – A and B; D – countries that meet neither condition A nor B
Source: own elaboration

including the aging of the population. The spread of the SARS-CoV-2 virus has forced countries around the world to take quick and radical measures, including a significant reduction in interpersonal contacts. Spatial mobility was reduced almost immediately. This fact may directly or indirectly exacerbate the aging process. This is because migrations (especially those of an external nature) may not only compensate for the natural decline, but also reduce the pace and scale of population aging by rejuvenating it.

Another possible issue is the impact of the COVID-19 pandemic on the exacerbation of the so-called equilibrium gap – the long-term difference between public-sector expenditure and state budget revenues. This situation may initiate or deepen the economic downturn in particular countries. It is therefore necessary to carry out deliberate reform of pension systems. The solution could be to use already developed procedures such as the ones worked out in the projects implemented in Finland for several years that are aimed at reducing the costs of senior care. They consist in, for example, keeping seniors in their homes for as long as possible, rather than moving them to nursing homes. Remote care and parallel development of digital skills among the elderly can be of great help here. In Finland, such care is provided by remote nurses who can visit the patients virtually to identify their problems and needs. In times of a pandemic, such a solution is particularly advantageous as it limits direct contact with people from outside.

This approach has been proved right by recent research conducted in Italy on the topic of a digital coach promoting healthy aging among older adults in transition to retirement (Santini et al., 2020). The authors stated, *inter alia*, that the use of digital health coach technology can influence the development of the sustainability of care systems by capturing the health needs of older people at an early stage and preventing their social isolation, sedentary lifestyle

Table 6. Dependence of types of age structure on the last stage of population aging by median age in Europe, 1960–2020

Type of age structure	Region (acronym)	Country	Estimated period when the stage of very old population[a] began[b]							
			1960	1985	1990	1995	2000	2005	2015	2020
Type A	NE	Estonia	-	-	-	-	+	-	-	-
		Latvia	-	+	-	-	-	-	-	-
		Lithuania	-	-	-	-	-	+	-	-
		Sweden	+	-	-	-	-	-	-	-
	SE	Croatia	-	-	-	+	-	-	-	-
		Italy	-	-	+	-	-	-	-	-
		Spain	-	-	-	+	-	-	-	-
	WE	Belgium	-	-	+	-	-	-	-	-
		Germany	-	-	+	-	-	-	-	-
Type B	NE	Ireland	-	-	-	-	-	-	-	+
	EE	Poland	-	-	-	-	+	-	-	-
		Slovakia	-	-	-	-	-	+	-	-
	SE	Cyprus	-	-	-	-	-	-	-	+
		Malta	-	-	-	-	+	-	-	-
	WE	Liechtenstein	-	-	-	-	+	-	-	-
Type C	NE	Denmark	-	-	+	-	-	-	-	-
		Finland	-	-	-	+	-	-	-	-
	EE	Bulgaria	-	+	-	-	-	-	-	-
		Czech Republic	-	-	+	-	-	-	-	-
		Hungary	-	+	-	-	-	-	-	-
		Romania	-	-	-	-	-	+	-	-
	SE	Greece	-	-	+	-	-	-	-	-
		Portugal	-	-	-	+	-	-	-	-
		Serbia	-	-	-	-	-	+	-	-
		Slovenia	-	-	-	+	-	-	-	-
	WE	France	-	-	-	+	-	-	-	-
		Netherlands	-	-	-	+	-	-	-	-
Type D	NE	Iceland	-	-	-	-	-	-	+	-
		Norway	-	-	-	+	-	-	-	-
		United Kingdom	+	-	-	-	-	-	-	-
	EE	Ukraine	-	-	+	-	-	-	-	-
	SE	Montenegro	-	-	-	-	-	-	+	-
		North Macedonia	-	-	-	-	-	-	+	-
	WE	Austria	-	+	-	-	-	-	-	-
		Luxembourg	-	-	+	-	-	-	-	-
		Switzerland	-	+	-	-	-	-	-	-

a Median age of the population in a given country amounts to 35 years and over.
b The stage began in a given year or between the indicated time intervals, and it still lasts.
- not applicable; + the occurrence of the fourth phase of the advancement of population aging
Source: own elaborations

and mental discomfort, thus hindering the onset of chronic and multi-organ diseases.

It is also worth adding that these types of tools can be effective in integrating seniors and preventing loneliness, a problem that has become particularly important nowadays. The development of the ongoing pandemic required measures aimed at reducing the number of infections and minimizing the risk of death (Górski et al., 2022). The publications (Huang et al., 2020; Rothan & Byrareddy, 2020) on COVID-19 show that the disease is extremely dangerous for people aged over 65 and for patients with multiple diseases. In addition, it spreads particularly quickly in hospitals, nursing homes and chronic medical care homes. The mortality rates in these healthcare facilities are also the highest of all available data. These circumstances forced the implementation of measures to protect seniors against becoming infected. However, their negative effects include social isolation and an increase in the number of people suffering from depression (Shader, 2020). The increase in depressive disorders should probably be associated with the feeling of high stress among the elderly

related to the COVID-19 pandemic and the lack of contact with family and friends (Górski et al., 2022).

4. Conclusions

The demographic revolution that began in the 20th century has continued in the 21st century and led to unprecedented and as-yet unknown social changes. One of its consequences is a vanishing proportion of the percentage of working-age population to the percentage of post-working-age population. In the last few decades, the pace of civilization progress increased. Life expectancy became longer, not only influenced by breakthroughs in modern medicine, but mainly conditioned by changes in lifestyle. One of its consequences is population aging. According to our studies, this process is highly advanced in Europe.

This phenomenon is spatially diversified, with various intensity levels, and is also susceptible to multidimensional fluctuations. In a regional approach, the most advanced increase in senior population is mainly observed in Eastern and Southern Europe. In the remaining parts of the continent it is diversified. Another important finding is the process of double aging of the European population, where the increase in the percentage of elderly people is accompanied by a change in the sub-population structure. The rise in the number of very old persons, i.e., aged 80 and over, is even more dynamic. Moreover, according to the forecasts, life expectancy in Europe in 2030 will amount to 81 years, next to North America (82 years) and Oceania (81 years) – regions that considerably exceed world trends (of 75 years) (*The Revision of World Population Prospects*, 2022).

We have also noted that social policies in most European countries follow the welfare state model founded at the end of the 19th century by Bismarck and later developed by Beveridge. Such a policy may endanger the financial security of millions of people. It is a real challenge for the Old Continent, as it requires that the needs of growing groups of people be met. An increasing demand for new social services, access to specific methods of medical treatment or types of social welfare may practically boost the growth of existing social disparities and cause the emergence of some new ones.

Therefore, demographic studies of the process of population aging are crucial for shaping phenomena of a socio-economic nature, all the more so because the undoubted advantage of the presented typology is its possibility to compare research results both in time and space, their relatively easy interpretation, and data availability. The research therefore requires cyclical model interdisciplinary analyses and forecasts focused on predicting further consequences of this growing problem. The continuation of this research may also contribute to improving the proposed research methodology, including the elimination of drawbacks, which comprise: failure to include information on all age groups, or shifting of population aging thresholds. Nevertheless, the conclusions from these analyses have a real potential to successfully develop social policies of particular areas focused on neutralizing negative consequences of population aging.

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