



Original article

European integration as an important factor in shaping the demographic potential of border regions in Germany and Poland

Marta Gwiaździnska-Goraj

University of Warmia and Mazury in Olsztyn, Institute of Spatial Management and Geography, Prawocheńskiego 15, 10-720 Olsztyn, Poland
E-mail address: marta.gwiazdzinska-goraj@uwm.edu.pl
ORCID iD: <https://orcid.org/0000-0002-6993-7235>

ABSTRACT

Border regions constitute the periphery of individual countries. Their location far from economic centres is often associated with an unfavourable economic structure, low technical and social infrastructure, and poor quality of life. However, border regions should not always be associated with the negative characteristics of peripheral regions. The question of whether a given border region is attractive for living largely reflects its demographic potential. The aim of this study was to identify demographic diversity in border regions in the context of the changing function of the state border associated with European integration. The study area comprised border regions in Germany and Poland, analyzed against the national background in 1995 and 2023. To capture the direction and pace of demographic changes, diagnostic indicators were used, and a demographic potential index was constructed using the zero-unitization method. The research conducted has shown that the changes that have occurred in the demographic potential of border regions in the context of the evolving function of the state border associated with European integration are visible spatially. This applies particularly to the border that historically ran between two political and economic systems. The current diversity in demographic potential is influenced by the external border of the European Union. The research results have shown that the ongoing demographic processes in the spatial dimension were influenced by historical conditions, superimposed on the core-periphery system, which plays an increasingly important role.

KEY WORDS: spatial demography, comparative perspective, border regions, socio-economic geography, spatial planning

ARTICLE HISTORY: received 21 August 2025; received in revised form 27 December 2025; accepted 7 January 2026

1. Introduction

After World War II, organizations were created in Europe to integrate states politically, militarily, and economically. An important role in this process was played by the creation of European communities such as the European Coal and Steel Community (EWWiS), European Economic Community (EWG) and the European Atomic Energy Community (EWEA). In 1992, the Treaty on European Union (EU) (Maastricht Treaty) was signed and entered into force on 1 November 1993 (PODRAZA, 1999). Until the 1990s,

the process of European integration was essentially limited to Western Europe (NUGENT, 2012). By 2023, the EU had 28 member states, and its largest enlargement took place in 2004. As subsequent countries joined the European Union, the course of its external border, which served as the demarcation line between the EU and its neighbouring countries, changed. Consequently, EU border regions are highly diverse both geographically (land and sea) and in terms of their neighbouring countries (EU Member States, candidate countries, or non-EU countries). Moreover, they are in a state of constant

transformation resulting from the reallocation of activities, opportunities, and threats, as well as changes in their role and socio-economic significance (ANDERSON & O'DOWD, 1999; TOPALOGLOU ET AL., 2005). As a result, border regions are particularly insightful places for social research. Their spatial accessibility, which results from the region's distance from economic centres, means they can be viewed through the lens of peripheral regions (GUTIÉRREZ & URBANO, 1996). In the literature on the subject, one can distinguish various definitions and theoretical approaches to the issue of peripheral areas (PÉNZES ET AL., 2015; KWACIŃSKA, 2017; TUZIAK, 2019; POČIŪTĖ-SEREIKIENĖ, 2019). And the criterion of peripherality may also include the following dimensions: socio-economic (FRIEDMAN, 1966; COPUS, 2001), political (COAKLEY, 2008), and cultural (MARADA ET AL., 2006). Peripheral regions are often characterized by demographic decline, unfavourable economic structure, low level of technical infrastructure, and low level quality of life of the population (WESOŁOWSKA, 2011; STROJNY & NIEWIADOMSKI, 2023; UBAREVIČIENĖ ET AL., 2025). As a result, these problems accumulate, which is associated with additional costs for residents in order to maintain a decent standard of living (LADOS ET AL., 2024). Therefore, it is necessary to pursue an active policy and take well-thought-out actions aimed at fully utilizing endogenous potentials, and in particular eliminating or neutralizing barriers to socio-economic development (CHURSKI, 2014; KAWAŁKO, 2015). However, border regions should not always be associated with the negative characteristics of peripheral regions. The function of the border plays a significant role in this case. It is most often perceived as a "line or zone dividing an area or marking the end of "something" on one side and the beginning of "something" on the other" (BAŃSKI, 2010). The border is, therefore, a dividing line between areas with different political, administrative, cultural, social, institutional, competence and environmental affiliations (RYKIEL, 1995; MISZCZUK, 2013; HEFFNER, 2023; TAUBENBÖCK ET AL., 2023). The significance of national borders can change dramatically over time and space. In an attempt to identify similarities and differences in the cross-border integration of the European mosaic of border regions, DURAND & DECOVILLE (2019) developed a synthetic indicator. Based on this, they distinguished six geographical groups of border regions with different characteristics of cross-border integration. The Western Continental model, which primarily encompassed the Rhineland countries (Germany's

western border), was characterized by very strong functional integration and a high level of trust. Meanwhile, the eastern borderland of the German-speaking world, located in the zone of contact between the countries of the former Soviet bloc, designated as the Central European model of cross-border integration, was characterized by a relatively low mutual propensity for social trust in one another's neighbours. In this context, Germany, the country with the largest number of neighbouring countries in Europe, occupies a special role as a research field. Issues of territorial intensification and integration in Germany are addressed in the works of, among others, JURCZEK (2009), HARTZ ET AL. (2010), BERTRAM ET AL. (2025). Research is conducted both in border areas where cross-border co-operation has existed for a long time, covering mainly the western border of Germany (PALLAGST & HARTZ, 2018), including cross-border German-Dutch co-operation (VERFÜRTH ET AL., 2021), and German-French co-operation (PEYRONY ET AL., 2023). This co-operation takes on various dimensions, particularly in the areas of education (DÖRRENBÄCHER, 2020), the labour market (PILGER ET AL., 2011), and communication (WILLE, 2009; ADOLPHI ET AL., 2022; BOUSONVILLE ET AL., 2023). An important thread in German literature is also the research on border regions on its eastern border, including with Poland, conducted, among others, by WILLERS (1992), KRÄTKE (1998, 1999), HEIMPOLD (2003), MILDENBERGER (2007), HENNIG (2021). The literature on the subject has repeatedly addressed the characteristics of the demographic potential of border regions (FLAGA & WESOŁOWSKA, 2018; TAGAI ET AL., 2018; GWIAZDZIŃSKA-GORAJ ET AL., 2020; AVDIĆ ET AL., 2022; PODADERA-RIVERA ET AL., 2023; LADOS ET AL., 2024), however, this issue has rarely been addressed in the context of "long duration." Therefore, it seemed extremely interesting from a research perspective to examine the pace and directions of these demographic processes in border regions in Germany and Poland, which have become participants in both the integration process and the isolation process. Because the border regions of Eastern Germany and Western Poland have become regions within the EU, and the border regions of Eastern Poland have largely become regions of its external border, the author attempted to present the issue from this perspective, adopting as her primary goal an examination of the changes in the demographic potential of the border regions of Germany and Poland in connection with the change in the European

Union border, using a retrospective approach (1995-2023). In achieving the main objective of the work, it was helpful to formulate the following specific research questions:

- Do border regions with a similar geographical location in relation to the state border of Germany and Poland stand out from the rest of the country in terms of population distribution and the directions of change in their numbers?
- What directions of change and relations between natural increase and migration balance were recorded in shaping the actual increase in the border regions of Germany and Poland compared to the country?
- Is the process of population ageing in border regions more advanced than in the rest of the country?
- Does the feminization coefficient differ significantly in border regions due to their location at the eastern or western state border?
- Are the changes that have taken place in the demographic potential of border regions in the context of the changing function of the state border related to European integration visible in the spatial aspect?

In the literature on the subject, there have been numerous studies on demographic changes affecting Poland and Germany (GOŁATA & JONDA, 2008; SZYMAŃSKA ET AL., 2009; ŚRODA-MURAWSKA, 2013; JEZERSKA-THÖLE, 2018; PASTUSZKA, 2018) and the problem discussed in this article extends to the

research on border regions (GWIAZDZIŃSKA ET AL., 2020).

Apart from the introduction, the article consists of five sections: materials (spatial and temporal scope of the research and data sources), methods (research procedure and method of its implementation), results (main research findings), discussion (review of the obtained results in the context of previous research), conclusions.

2. Materials

The study area is located in the European Union and includes border regions in Germany and Poland. The research adopted an administrative criterion covering both regions (in Germany these are *bundesländer*, and in Poland *voivodeships*) and counties (in Germany *Kreise* and *Kreisfreie Städte*, and in Poland *powiats* and cities with *powiat* status). These regions, both in Germany and Poland, are characterized by similar natural conditions and economic structure, in which agriculture plays an important role. In Germany, the analysis covered the *länder*: Niedersachsen, Schleswig-Holstein (western border of the country) as well as Brandenburg and Mecklenburg-Vorpommern (eastern border of the country) while in Poland the voivodeships: Lubuskie, Zachodniopomorskie (western border of the country) and Pomorskie, Warmińsko-mazurskie, Podlaskie (eastern border of the country) (Fig. 1).

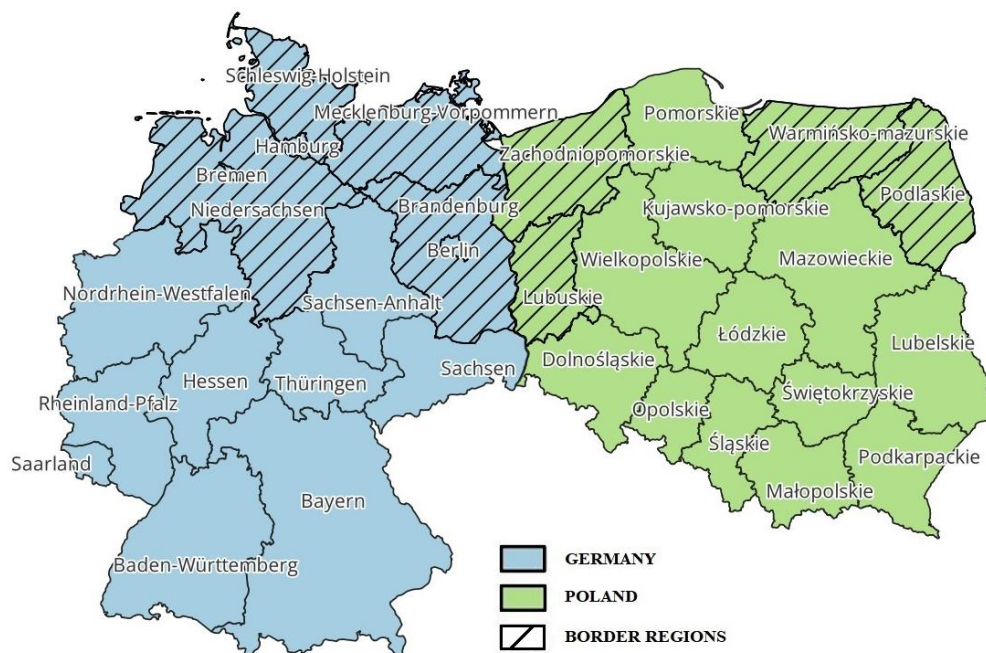


Fig. 1. Map of the research area (Source: own study)

The time frame of the study covered the years 1995 and 2023. In order to compare the results retrospectively, the data were aggregated to the administrative division in force in 2023. This approach required aggregating the baseline data for 1995 in Germany (at the Kreise and Kreisfreie Städte level in Niedersachsen and Mecklenburg-Vorpommern) and in Poland (at the regional and county levels in all analyzed voivodeships). The main source of data for the analyses were the published resources of public statistics of the Federal Statistics Office of Germany (<https://www.destatis.de/>) and the Central Statistics Office in Poland (<https://stat.gov.pl/>). In order to conduct analyses and visualize spatial data, the software QGIS 3.40 Bratislava an open source Geographic Information System (GIS) was used (<https://qgis.org/>).

3. Methods

The research procedure adopted determined the direction and dynamics of demographic changes in selected border regions in Germany and Poland in connection with European integration:

Step I: Statistical and spatial analysis of the border regions in terms of population change and its distribution in relation to other regions in the country (Table 1). For this purpose, diagnostic indicators were used, illustrating population density (2023) and the dynamics of population change (1995-2023), were calculated on the basis of the relationship of the initial year's data compared to year 100 of the data for the final year, which is given in percentage points. Values below 100 are indicative of population decrease, whereas values above 100 are indicative of a population increase in the analyzed period. An important element of the analyses conducted was the spatial distribution of regional differentiation in terms of population density and changes in the population size.

Step II. This was an in-depth statistical analysis of the direction of the demographic changes in the border regions in relation to other regions in the country based on the size of diagnostic indicators illustrating the actual increase and demographic structure by age and sex for the years 1995 and 2023 (Table 1).

Table 1. Diagnostic indicators of demographic change (Source: based on literature: Stanny, 2013; Gwiaździńska-Goraj et al., 2020)

Name	Description	Typ
Real movement		
Natural increase	Ratio of the difference between the number of live births and the number of deaths to the number of population to the population status in that period – expressed in ‰ (i.e. per 1,000 population)	Stimulant
Net migration	Ratio of the difference between the inflow (immigration) and outflow (emigration) of people from a given area in a given time - expressed in ‰ (i.e. per 1,000 population)	Stimulant
Structure by age and sex		
Aging index	Ratio of the population aged 65 and older to the population aged 0 to 14 x 100. This indicator provides information about the future potential of young people in relation to seniors	Destimulant
Feminization rate	Number of women per 100 men in a given area (20-34 year old), which provides information about the reproductive potential of a population	Stimulant

Step III: Then, using the zero unitarization method (KUKUŁA, 1999), a synthetic indicator was constructed, illustrating the differentiation of the demographic potential between 1995 and 2023 (at the regional level). This method allows for replacing several diagnostic indicators (Table 2) with one synthetic indicator. Among the indicators, stimulants were distinguished, the high values of which are beneficial from the point of view of the essence of the analyzed phenomenon, and destimulants, for which low values are desirable. Diagnostic indicators

are expressed in different units and cannot be directly compared or added together, therefore, these indicators were normalized with the following formula:

- for stimulants:

$$v_{ij} = \frac{x_{ij} - \min x_{ij}}{\max x_{ij} - \min x_{ij}} \quad (1)$$

- for destimulants:

$$v_{ij} = \frac{\min x_{ij} - x_{ij}}{\max x_{ij} - \min x_{ij}} \quad (2)$$

Synthetic index P_d is developed as the arithmetic mean of the normalized values of diagnostic indicators:

$$P_d = \frac{1}{m} \sum_{j=1}^m v_{ij} \quad (3)$$

where:

- P_d – synthetic index of demographic potential in quantitative terms,
- x_{ij} – value of the j^{th} diagnostic indicator of an i^{th} object,
- $maxx_{ij}$ – maximum value of the j^{th} diagnostic indicator,
- $minx_{ij}$ – minimum value of the j^{th} diagnostic indicator,
- $maxx_{ij} \neq minx_{ij}$,
- $i = 1, 2, \dots, n$, n – number of units,
- $j = 1, 2, \dots, m$, m – number of diagnostic indicators.

The synthetic index P_d takes on values in the range of [0, 1]. The closer the value of P_d (constructed from diagnostic indicators j) is to 1, the higher the demographic potential is for object i .

Then, the studied units were linearly sorted and four classes were determined using the arithmetic mean and standard deviation of the synthetic index value defining the demographic potential (P_d) (Table 2). This indicator was calculated separately for both countries in 1995 and 2023. Adopting this approach allowed for determining the direction of changes in demographic potential based on the regions' affiliation to particular classes. For the purposes of assessing the changes in demographic potential, a spatial perspective was used, which is so important in the analysis of demographic processes and results (MATTHEWS & PARKER, 2013).

Table 2. Assessment criteria for the synthetic index (Source: based on literature: Kaczmarek & Parysek, 1977)

Class	Separation criterion	Assessment
I	$D_i \geq \bar{D}_i + S_{D_i} * \frac{1}{2}$	Favourable
II	$\bar{D}_i \leq D_i < \bar{D}_i + S_{D_i} * \frac{1}{2}$	Moderately favourable
III	$\bar{D}_i - S_{D_i} * \frac{1}{2} \leq D_i < \bar{D}_i$	Moderately unfavourable
IV	$D_i < \bar{D}_i - S_{D_i} * \frac{1}{2}$	Unfavourable

D_i - diagnostic index,

$\bar{D}_i$ - arithmetic mean for the diagnostic index,

S_{D_i} - standard deviation of the diagnostic index.

Step IV: Based on the results obtained for the analyzed border regions compared to other regions in the country, the research was further refined at the county level for Germany and Poland. This approach allowed for the analysis of changes in demographic potential within the border regions (which, especially on the German side, are characterized by large areas). The procedure discussed in Step III was adopted to determine the demographic potential at the county level in 1995 and 2023.

4. Results

Statistical analysis conducted in the first step of the research procedure showed that the average population density in Germany was higher than in Poland, but in both countries a lower population density was recorded in the border regions in relation to the national average (Table 3). At the same time, a relationship was noted in both countries that the analyzed border regions at the western border were characterized by a higher average population density than at the eastern border. The lowest population density was recorded in the regions located along the eastern border of Poland.

The dynamics of population change showed that in the period between 1995 and 2023, Germany recorded an increase in population (3.5%) and Poland a decrease (2.5%). Similar differences were noted in the relationship between the national average and the border regions. In Germany, in the regions on the western border, the population increase was higher than the national average, while in the regions located on the eastern border, this value was lower than the national average (Table 3). However, while in Brandenburg there was an increase in population (which was influenced by the location of the German capital Berlin within the region), Mecklenburg-Vorpomen recorded a decrease. In Poland, on the other hand, the analyzed border regions recorded a decrease in population, which was below the national average.

Analyzing the spatial distribution of regions with regard to population diversity, existing relationships were found (Fig. 2). Both in Germany and in Poland, the regions located in the northern part are characterized by lower values than in the south. The highest population density in Germany was recorded in the cities of Berlin, Hamburg and Bremen. At the same time, there is a noticeable division in terms of the recorded population density values in

the west (a population density of 156 people per km² and higher prevails) and in the east (with the exception of the Sachsen region, a population density of 155 people per km² and lower prevails). This relationship is reflected in the results recorded for the analyzed border regions. In Poland, the distribution of population density had a different

dimension. Lower values were recorded primarily in the border regions (including the analyzed ones) than in the centre. The exception is the Silesia region, where the high population density was influenced by the formation of the Silesian conurbation which was associated with the development of the mining industry in the past.

Table 3. Population dynamics 1995-2023 and density 2023 in selected border regions compared to the country (Source: https://www.regionalstatistik.de/genesis/online?operation=themes&levelindex=0&levelid=1766680448726&code=12#abreadc_rumb/; OECD (2013) *Zuwanderung ausländischer Arbeitskräfte: Deutschland*, OECD Publishing, Paris, https://www.oecd.org/content/dam/oecd/de/publications/reports/2013/02/recruiting-immigrant-workers-germany-2013_g1g25310/9789264191747-de.pdf; <https://bdl.stat.gov.pl/bdl/dane/podgrup/temat>

Specification	Population density in 2023	Dynamics of change 1995-2023 in percentage points
Germany including:	236.8	103.5
Border regions at the state's western border (internal EU border)		
Schleswig-Holstein	187.7	108.8
Niedersachsen	171.1	104.9
Border regions at the state's eastern border (internal EU border)		
Meklemburg-Vorpommer	69.9	89.4
Brandenburg	87.1	101.6
Poland including:	119.9	97.5
Border regions at the state's western border (internal EU border)		
Zachodniopomorskie	71.2	94.8
Lubuskie	69.7	96.1
Border regions at the state's eastern border (external EU border)		
Warmińsko-Mazurskie	56.2	93.5
Podlaskie	56.4	93.2

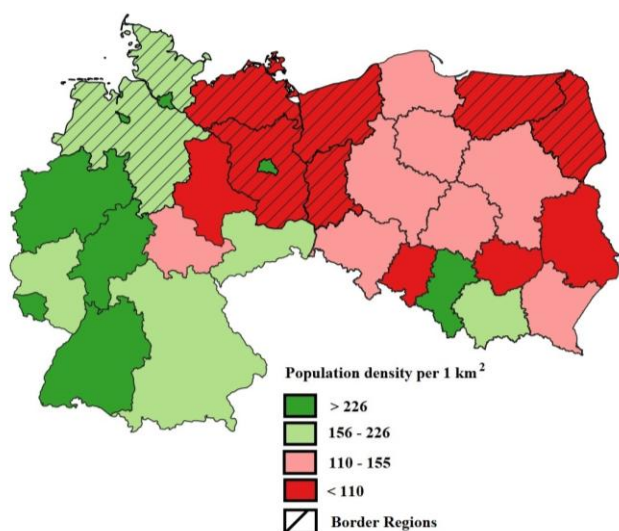


Fig. 2. Population density in Germany and Poland 2023 (Source: own study)

When analyzing the distribution of the indicator illustrating the dynamics of population changes

between 1995 and 2023, significant differences were noted, which had a quantitative and spatial dimension. Firstly, in Germany, regions with an increase in population predominate (11), while in Poland, regions with a decrease predominate (12) (Fig. 3). Secondly, in Germany, the recorded results largely refer to the spatial distribution of population density, where the population increase was noted in the west and the decrease in the east. The highest population increase of over 9% was noted in the länder Bayern as well as Baden-Württemberg (located in the southwestern part of Germany) and Hamburg, (located in its north-western part). On the other hand, a population decline of over 9% was recorded in regions located in the eastern part of Germany. The dynamics of changes in the border regions referred to the spatial dimension recorded in the country except for Brandenburg, for which an increase in the population was recorded. In Poland, the dynamics of population changes between 1995

and 2023 referred to the spatial distribution related to population density, but a slow tendency to organize space in a centre-periphery arrangement was clearly visible. The highest population growth was recorded in regions with agglomerations such as: Warsaw (Mazowieckie), Krakow (Małopolskie), Poznan (Wielkopolskie), Tricity: Gdańsk, Gdynia, Sopot (Pomorskie). However, in the remaining regions, including the analysed border regions, both on the western and eastern borders of Poland, a decline in population was recorded.

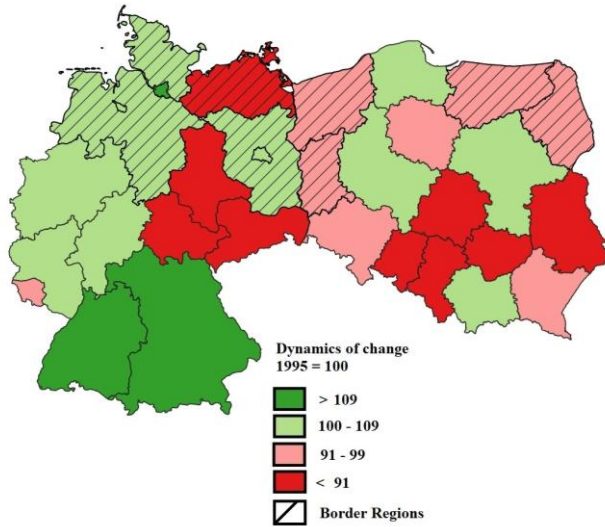


Fig. 3. Population change in Germany and Poland between 1995 and 2023 in percentage points (Source: own study)

Then, in step II, the changes in the actual increase and demographic structure in the border regions were analyzed against the background of the country (Table 3). The change in the actual increase is influenced by the relationship between the natural increase and the migration balance (GAŁKA, 2017). In Germany, a significant role in shaping its size both in 1995 and 2023 was played by a positive migration balance, which supplemented the population loss caused by the decline in the natural increase (Table 4). When analyzing the natural increase rate per 1,000 people for the border regions, it was noted that both in 1995 and 2023, lower values were recorded for the border regions located on the eastern border of Germany than for the western border. On the other hand, the migration balance per 1,000 people in the border regions in 1995 was more favourable than the national average, except for Mecklenburg-Vorpommern. However, interestingly, it was for this region that the highest increase in the migration balance was recorded among the border regions between 1995 and 2023. As a result, in 2023, a

positive migration balance per 1,000 people was recorded in all border regions, which was common in Germany, where the national average increased from 4.9 to 7.9. Moreover, the difference between the regions located on the western and eastern border in 2023 was levelled out. In Poland, in 1995, similarly to Germany, a positive real increase was recorded, however, in 2023, in Poland, unlike Germany, its negative value was already recorded. This situation resulted primarily from the dynamic decline in natural increase. In the border regions the rate of natural increase per 1,000 head of population in 1995 was higher than the national average. The fact that the region was located at the eastern or western state border did not have such significance but rather resulted from historical conditions (GWIAŹDZIŃSKA-GORAJ ET AL., 2025), because the highest value was recorded for the Podlaskie and the lowest for the Zachodniopomorskie. In 2023, a negative natural increase per 1,000 people was recorded, which was characterized by high dynamics both at the national level and in all border regions. On the other hand, the migration balance per 1,000 people in the border regions (except Lubuskie) in both 1995 and 2023 was lower than the national average. However, what is important, is that the differentiation of this indicator is clearly visible if we take into account the location of the regions at the western and eastern state border. Because both in 1995 and 2023, less favourable values were recorded for the regions located at the eastern border of Poland. Moreover, the net migration rate per 1,000 population for the regions located on the western border improved in 2023 compared to 1995, the unfavourable values for the regions located on the eastern border (external border of the European Union) worsened.

Changes in natural and migratory movements have consequences for the demographic structure. In 1995 and 2023, the national average for the ageing index and the feminization rate (20-34 years) in Germany was less favourable than in Poland (Table 3). At the same time, changes in the demographic structure of border regions again had a spatial dimension. Thus, in Germany in 1995, a higher ageing index was recorded, indicating a more advanced process of population ageing, for regions located on the western border than for the eastern one. In 2023, however, this relationship was reversed and less favourable values were recorded in regions located on the eastern border. This indicates that the process of population ageing in these regions has gained a

greater pace. At the same time, in 2023, all border regions recorded a higher value of the ageing index than the average in Germany. In Poland, in 1995, in border regions outside Podlaskie, both in the regions on the western and eastern borders, the values remained at a similar level and were lower than the national average for Poland. Unfortunately, in 2023, the average value of the ageing index for both Poland and border regions increased dynamically, which indicates a rapid pace of the population ageing process (higher than in border regions in Germany). The least favourable value for the ageing index was recorded in Zachodniopomorskie, which increased from 41.8 to 153.3 (i.e. almost four times). Analyzing the value of the feminization rate (20-34 years) and its change between 1995 and 2023, it was noted that

both at the national level and for border regions, a less favourable situation was noted in Germany than in Poland. At the same time, its distribution in Germany once again had a spatial dimension, which, while in 1995 it took on signs of polarization, in 2023 these indicators in border regions were equalized in relation to the national average. In Poland, the feminization rate (20-34 years) was at a similar level in 1995 and 2023, with the values for border regions for both years analyzed being below the national average. However, while in 1995 its differentiation in relation to the location at the western and eastern border was not so visible, in 2023 it was, with the lowest feminization rate (20-34 years) recorded in Podlaskie.

Table 4. Real increase and structure by sex and age in selected border regions compared to the country 1995 and 2023 (Source: https://www.regionalstatistik.de/genesis/online?operation=themes&levelindex=0&levelid=1766680448726&code=12#abreadc_rumb/; OECD (2013) *Zuwanderung ausländischer Arbeitskräfte: Deutschland*, OECD Publishing, Paris, https://www.oecd.org/content/dam/oecd/de/publications/reports/2013/02/recruiting-immigrant-workers-germany-2013_g1g25310/9789264191747-de.pdf; <https://bdl.stat.gov.pl/bdl/dane/podgrup/temat>

Specification	Real increase				Demographic structure			
	Natural increase per 1,000 population		Net migration per 1000 population		Ageing index		Feminization rate (20-34 year)	
Years:	1995	2023	1995	2023	1995	2023	1995	2023
Germany including:	-1,5	- 4.0	4,9	7.9	96.2	172.0	93.5	92.2
Border regions at the state's western border (internal EU border)								
Schleswig-Holstein	-1.4	- 5.9	7.7	10.5	102.1	188.5	91.6	92.6
Niedersachsen	- 0.7	- 4.7	9.1	7.8	97.9	174.9	94.1	91.7
Border regions at the state's eastern border (internal EU border)								
Meklemburg-Vorpommer	- 5.2	- 9.1	0.1	10.2	70.1	296.1	88.1	89.2
Brandenburg	- 5.5	- 8.1	7.6	11.7	79.6	208.8	88.4	93.3
Years:	1995	2023	1995	2023	1995	2023	1995	2023
Poland including:	1.2	-3.6	-0.5	0.2	49.9	133.2	96.5	96.6
Border regions at the state's western border (internal EU border)								
Zachodniopomorskie	2.8	- 5.0	- 0.7	-0.4	41.8	153.3	95.5	95.5
Lubuskie	2.8	- 4.3	- 0.1	-0.6	41.2	139.2	95.5	94.8
Border regions at the state's eastern border (external UE border)								
Warmińsko-Mazurskie	4.2	- 4.5	- 1.5	-1.7	36.4	133.1	95.5	92.6
Podlaskie	1.6	- 3.3	- 1.1	-1.2	52.2	133.5	93.2	92.4

From the research point of view, it was important to identify spatial changes in the assessment of demographic potential in border regions in comparison to other countries between 1995 and 2023, which was done from step III. The analysis of the spatial distribution of the synthetic index of demographic potential for both countries (Pd) was the result of the impact of historical conditions and the centre-periphery system. In Germany, as has been repeatedly shown by the results obtained, historical

conditions played a significant role in the demographic changes taking place, which had a spatial dimension from west to east, also in relation to the assessment of border regions. The reason for this situation can be seen in the fact that in the past, two different political and economic structures operated in Germany. This spatially established image of the differentiation of demographic potential visible in 1995 was still noted in 2023 (Fig. 4). However, the disproportions in its assessment between the western

and eastern parts of Germany were smaller because the changes in demographic potential are increasingly influenced by its differentiation towards the centre and periphery. Thus, the highest assessment of demographic potential was recorded in the urban

regions of Berlin, Hamburg and Bremen (city regions) and regions located in the southern part of Germany, distinguished by a favourable socio-economic development compared to the country.

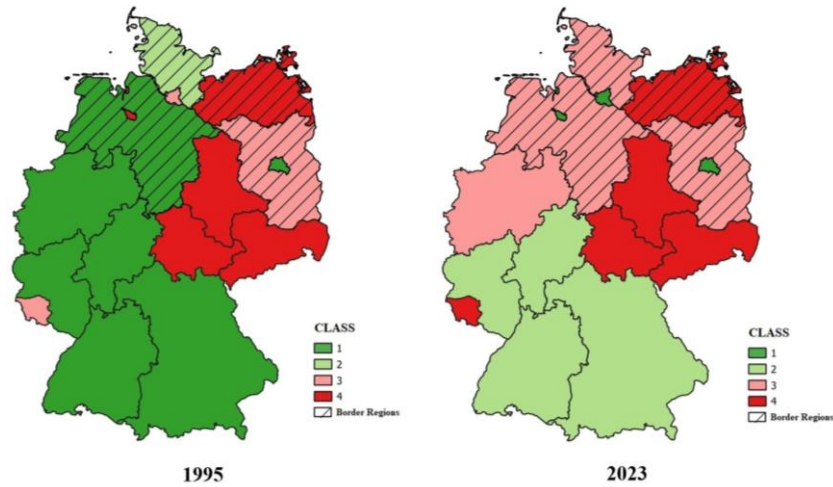


Fig. 4. Demographic potential in Germany in 1995 and 2023 (Source: own study)

The assessment of the demographic potential in Poland in 1995 showed that its existing differentiation in space results mainly from historical conditions (Fig. 5). Class 1 with the most favourable demographic conditions mainly included regions belonging to North-Western Poland, which were distinguished by their demographic youth in relation to other areas in the country, where the regions classified in class 4 largely predominated. As a result, this division translated into the assessment of border regions. A particularly interesting case is the affiliation of the Warmińsko-Mazurskie and Podlaskie voivodeships. On the one hand, they are neighbours at the eastern border of the country, but at that time a greater role in shaping the demographic level was played by the border differentiating regions in terms of demographics in Poland resulting from the change of borders after World War II. The spatial distribution of regions in terms of demographic potential in 2023 was completely different and already showed signs of polarization (with centres and peripheries) (Fig. 5). The highest demographic potential was achieved by regions with urban agglomerations (Warsaw, Poznan, Krakow, Tricity - Gdańsk, Gdynia, Sopot), while in the remaining regions the potential was below the national average. This change contributed to the low demographic level recorded in the border regions. Special attention should again be paid to Warmińsko-Mazurskie, which changed its classification from a region with a favourable

demographic potential (class 1) to a region with an unfavourable assessment (class 4), which indicates a dynamic deterioration of the demographic potential.

Based on the assessment of demographic potential at the county level in 1995, two types of spatial distribution were observed within the regions. Homogeneous, when counties belong to only one class, or diverse, when counties belong to more than two classes (Fig. 6). Counties located in the Mecklenburg-Vorpommern and Brandenburg regions (near Germany's eastern border) were characterized by a uniformly unfavourable assessment of demographic potential. Similarly, in Poland, the counties in the Zachodniopomorskie, Lubuskie, Warmińsko-Mazurskie regions had uniformly unfavourable assessments of demographic potential, but in this case it was favourable. Significant variation in the assessment of demographic potential was noted within the German regions located near the country's western border, and in Poland, in the Podlaskie region, located near Poland's eastern border and the EU's external border. The spatial distribution of demographic potential at the county level in 2023, outside the Mecklenburg-Vorpommern region, which again recorded a predominantly unfavourable assessment of demographic potential, was much more heterogeneous (Fig. 6). However, while this differentiation in Germany has taken a favourable direction in changes in demographic potential, this has not been the case in Poland.

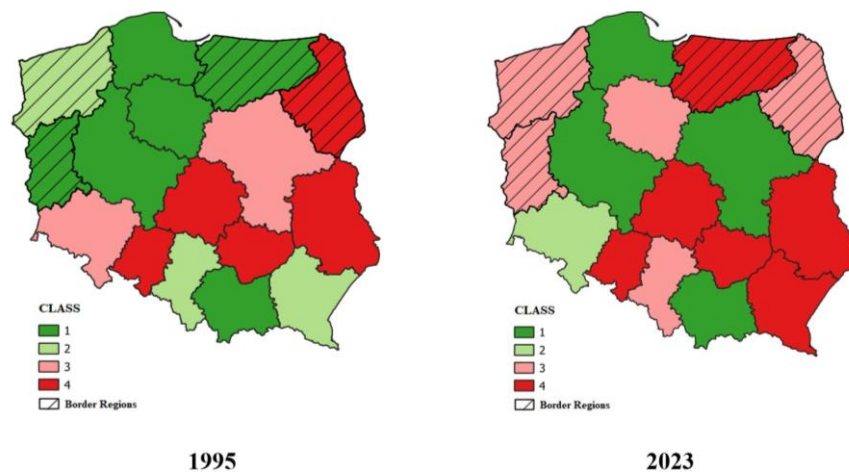


Fig. 5. Demographic potential in Poland in 1995 and 2023 (Source: own study)

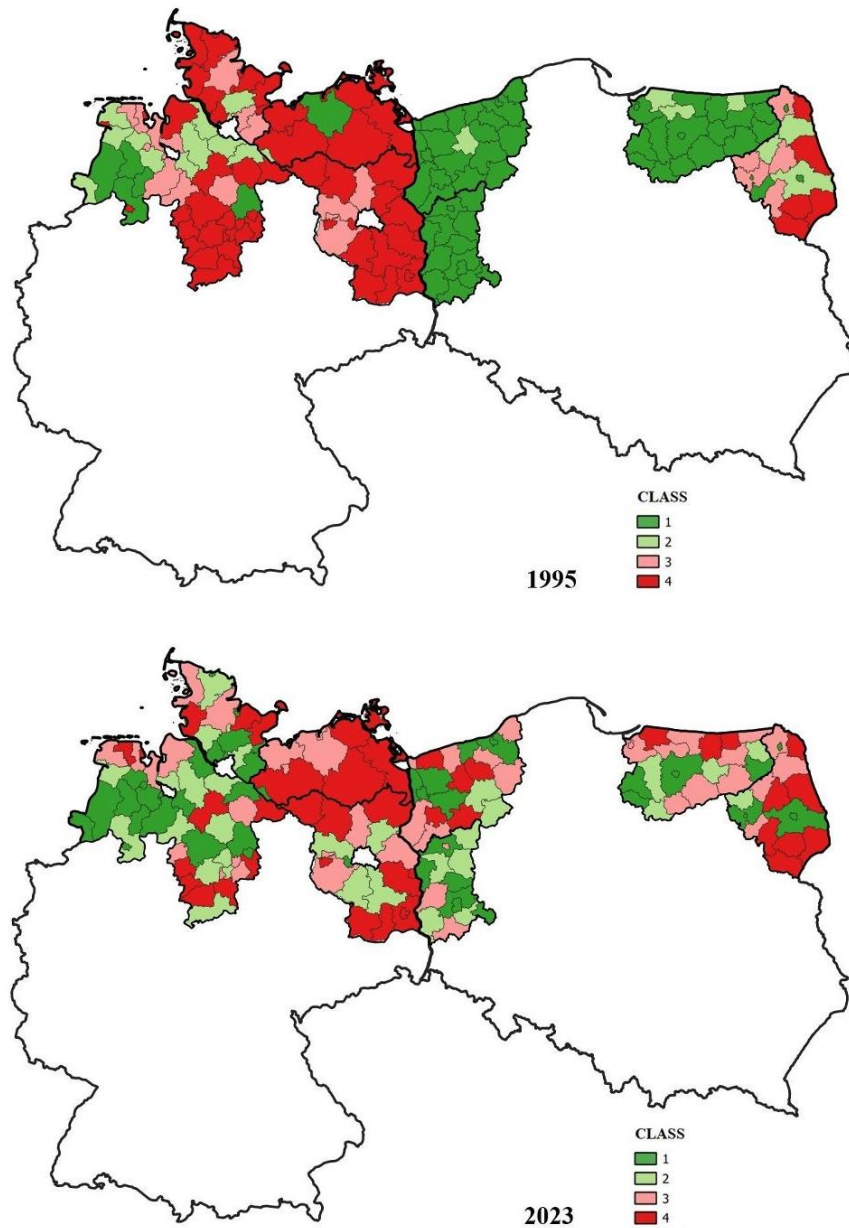


Fig. 6. Demographic potential in selected border regions of Poland and Germany at the county level in 1995 and 2023 (Source: own study)

5. Discussion

The research conducted in this study focused on the analysis of demographic changes in border regions in Germany and Poland, taking into account their location in relation to the state border and the European Union.

The population density indicator was used in the research illustrating the distribution of the populations. The obtained results showed that border areas in both Germany and Poland were characterized by a lower population density than the national average, which is often characteristic of peripheral regions. The spatial distribution of population density in Poland and Germany clearly outlines the border between two different political systems, capitalist and socialist. This location in the edge zone between these systems (DAUGIRDAS & BURNEIKA, 2006) has translated into an attractiveness of residence, which is often reflected in population density (POCIŪTĖ, 2014). The conducted research showed that population density in border regions in both Germany and Poland decreased from west to east. Moreover, the spatial differentiation of population density in Poland showed signs of peripheralization. The lowest values were recorded in the border regions located at the eastern border, which, following Poland's accession to the European Union, constitute its external border. Analyzing the dynamics of population changes in Germany and Poland, differences in the direction of spatial redistribution were found. In Germany, it was noted that the greater the population growth, the higher the level of socio-economic development and, consequently, the quality of life of the inhabitants of a given region. However, this process did not have the characteristics of peripheralization in space but rather resulted from consolidation of the division existing in the past within Germany (SZYMAŃSKA ET AL., 2008; ŚRODA-MURAWSKA, 2013; PASTUSZKA, 2018). Among the analyzed border regions, this differentiation had a similar pattern. Only in the case of the Brandenburg region, located in the eastern part of Germany, was there a significant increase in the number of inhabitants. The reasons for this situation should be sought in the location in its centre of Berlin, which is the capital of the country, designated as a region. As a result, the impact of the agglomeration influenced the increase in the number of inhabitants in the bordering region (JEZIERSKA-THÖLE, 2018). The dynamics of population changes in Poland also had a spatial dimension. The reasons for this situation

should be sought, similarly to many European countries undergoing systemic transformation with transformations of economic and social structures (PÉNZES ET AL., 2015), the most visible result of which was the redistribution of the population (SMITH & TIMAR, 2010; SCHMIDT ET AL., 2015; LANG ET AL., 2015; KRIAUCIŪNAS & BURNEIKA, 2019). The systemic transformation contributed to far-reaching changes in the processes shaping the demographic situation of Poland (TARKOWSKI, 2006). The uneven spatial distribution of population changes in Poland after 1995 confirms that these changes had their spatial consequences, consistent with earlier research results (TARKOWSKI, 2006, GAŁKA, 2017). Polarization is clearly visible, with population growth occurring in regions where the country's capital is located: Warsaw (Mazowieckie) and larger agglomerations: Krakow (Małopolskie), Poznan (Wielkopolskie), Tricity - Gdańsk, Gdynia, Sopot (Pomorskie). These cities quickly joined the network of European cities and developed modern services offering attractive jobs and career prospects for young and educated people (PASTUSZKA, 2018). In contrast, other regions in Poland experienced a decline in their populations. This process, consisting of uneven regional development leading to polarization into central and peripheral regions, was observed in other countries with a similar historical path (GORZELAK, 2002; KÜHN, 2015; KRIAUCIŪNAS & BURNEIKA, 2019; LANG ET AL., 2022). The largest decline in population was observed in the south-eastern part of Poland, which results from historical conditions. In the analyzed border regions on the western and eastern borders of Poland, a similar decline in the population was observed, no more than 9% of the population. Importantly, however, the Mecklenburg-Vorpomen region (eastern border of Germany) and the Warmińsko-Mazurskie and Podlaskie regions (eastern border of Poland and external EU border), where low population density is accompanied by a decline in population, require special attention in the research conducted. This situation causes an increase in the unit costs of social infrastructure and also in the costs of communication connections (ROSNER, 2012). As a result, the living conditions of the population deteriorate (PÉNZES ET AL., 2015; BERNARD & KEIM-KLÄRNER, 2023; UBAREVIČIENĖ ET AL., 2025), which at the same time becomes the effect and cause of the population decline, triggering a vicious circle of dependencies. In answer to the second research question posed by the author, it was found that both in the border regions in Germany

and in Poland, the same direction of change was noted as in the country, i.e. a decrease in natural increase during the analyzed period. However, the changes in the size of the natural increase in both countries differed in pace, which in the border regions in Poland was more dynamic in comparison to the border regions in Germany. This direction of changes associated with the decrease in births is also the effect of cultural and moral changes taking place as part of the second demographic transition, which focused largely on the self-fulfilment of young people, while procreation decisions were often pushed into the background (REHER, 2011). Young people are increasingly more willing to first achieve a certain level of education and economic stability, and then, usually after the age of 30, have children. This phenomenon is referred to as "postponement of birth" (COLEMAN, 2007; PASTUSZKA, 2018). Due to the decrease in natural increase, migration plays an increasingly important role in shaping the actual increase (VAN DE KAA, 2002). The year 2015 became the benchmark for mass migration to the European continent. The conflict in Ukraine, which has been taking place since February 2022, resulted in the arrival of the largest number of refugees to Europe since 1939 (SZKURŁAT & SAŁEK-IMIŃSKA, 2025). In 2024, 996,805 asylum applications were submitted in the EU. The country that registered the largest number of first-time asylum seekers in 2024 was Germany, where 25.2% of all such applications in the EU were submitted. The largest group to obtain protection status in the EU were Syrians (32.3%), followed by Afghans (16.5%) and Venezuelans (7.9%), while Ukrainians constituted 3.2%. The largest number of migrants from Ukraine since February 2022 has been accepted by Germany and Poland (<https://www.europarl.europa.eu/topics/en/article/20170629STO78630/asylum-and-migration-in-the-eu-facts-and-figures#migration-in-europe-key-numbers-in-2024-5>). Migrants treat most European countries as countries of origin. transit and ultimately chose countries with attractive living conditions (DE CASTRO, 2007). Therefore, an unfavourable migration balance is often the first symptom indicating the low attractiveness of living conditions in a given area resulting from the level of quality of life of its inhabitants. The net migration balance and its change allow for the assessment of regional development trends, in which regions with high emigration will appear as clearly problematic in the long term because most young, working-age residents leave, which causes a shortage of labour

(POCIŪTĖ, 2014). An unfavourable migration balance is often the first symptom indicating the low attractiveness of a given area to live in, based on the quality of life of its residents. In addition, migration - especially internal migration - has become an increasingly important factor influencing population dynamics and contributing to further peripheralisation (UBAREVIČIENĖ ET AL., 2025). The obtained results showed a difference in the direction of changes in migration in the border regions of Germany and Poland. While in the border regions in Germany an increase in the migration balance was noted, in the border regions in Poland, apart from the West Pomeranian region, it decreased. Such a high migration outflow, especially from the border regions located at the eastern border of Poland and the external border of the European Union, can be considered a typical demographic symptom of peripheral areas (KUREK, 2008; POCIŪTĖ, 2014). However, for demographic development, the relationship between natural movement and net migration plays an important role, indicating a positive or negative real increase (WEBB, 1963). Here too, an existing difference was noted, which in Germany had a spatial dimension and in Poland a temporal one. Although a positive real growth was recorded both at the western and eastern borders, the result for the regions located at the western border was more favourable. In Poland, on the other hand, while for the initial year of analysis, both the regions located at the eastern and western border had a positive real increase, it was already negative for the final year of analysis.

The next research question concerned the degree of advancement of the ageing process in border regions compared to the country. The growing share of older people in the population is a major challenge in most developed countries and transition economies (DŁUGOSZ, 2011; PÉNZES ET AL., 2015; GOLDSTEIN & KLUGE, 2016; GRZELAK-KOSTULSKA, 2016) because changes in the population structure will have a negative impact on economic and social development. This results from the fact that with the decreasing share of young and better educated people, professional activity and territorial mobility of the population, entrepreneurship, innovation and productivity decrease, while social expenditure for the growing number of older people increases (PRSKAWETZ, 2005; PASTUSZKA, 2018). The results obtained in these studies indicate that this problem particularly concerns border regions, which is consistent with previous findings (AVDIĆ ET AL.,

2022). At the beginning of the analysis, the ageing process was more advanced than the national average only in the regions located on the western border of Germany. However, for the final year of the analysis, a higher value for the ageing index than the national average was recorded in all border regions both in Germany and Poland. However, the pace of the ageing process deserves special attention. Analysis of the research results showed that it was much higher in the regions which at the beginning of the analysis had a much lower old age index than the national average. As a result, in Germany the process of the ageing of society for the final year of the analysis was more advanced in the regions at the eastern border than in the western one, still maintaining the differentiation of the index value in the spatial dimension west - east. In Poland, the direction of the changes taking place was the same in all border regions. However, the highest pace, almost four times, was recorded for Zachodniopomorskie. The reasons for this state can be seen in the dynamic decrease in the natural increase in the analyzed period for the border regions. This condition resulted from the decrease in both the mortality rate and the number of births resulting from the migration of the population of reproductive age and the resulting decrease in fertility. External migration also causes the erosion of reproductive potential, because the external migration of young women intensifies the effects of the decrease in fertility (JOHANSSON ET AL., 2014). Therefore, it was important to find an answer to the next research question: is there also a spatial differentiation in the relationship between the number of women and men (in the age group 20-34)? The results of the conducted research showed that in the border regions in Poland the feminization rate was lower for the analyzed ones than the average in the country as a whole, although it should be noted that this difference was not significant. On the other hand, in Germany, the differentiation of this indicator in the spatial dimension was again noted, where its unfavourable values were noted for the border regions located at the eastern state border, indicating a disturbance of the gender balance in the so-called "marriageable age". The use of a synthetic indicator that takes into account previously analyzed diagnostic indicators allowed us to answer the last research question, whether the changes that occurred in the demographic potential of border regions in the context of the changing function of the state border related to

European integration are visible in the spatial aspect? The differentiation of the distribution of the demographic potential in Germany showed the existing difference in its assessment. In space, the border that existed before the Reunification of Germany resulting from belonging to two different political and economic blocks (West Germany and East Germany) is clearly outlined. As a result, in 1995, the assessment of demographic potential was higher for regions located in West Germany than in East Germany, as for the analyzed border regions (also at the county level). However, already in 2023, this existing differentiation in the west-east dimension decreased, which should be considered a positive fact. However, special attention should still be paid to regions located in the eastern part of Germany, including Mecklenburg-Vorpomen, where unfavourable demographic potential has been consolidated, as studies have shown. The fact that these changes were also characterized by homogeneity within the region (county level) proves unfavourable. The reasons for this situation can also be found in the fact that until 2004, the regions located on the eastern border constituted the external border of the European Union. At the same time, research has shown that the highest demographic potential was recorded in the Niedersachsen region, whose border location was within the EU in both 1995 and 2023. As research at the county level has shown, a more favourable demographic potential was recorded in counties located directly on the state border than in its eastern part. The reasons for this situation can be traced to favourable living conditions in the border area, resulting from the implementation of good solutions that contributed to raising the standard of living of the population and translated into an improvement in the demographic situation. The border between France and Germany is the subject of intensive cross-border co-operation, within which two Euro-regions operate (the Upper Rhine region and the Greater Region - SaarLorLux). In both of these areas, there are active bodies and entities of co-operation at the regional level, but also at the local level. The new Treaty on Co-operation and Integration between Germany and France signed in 2019 confirms the strength of the Franco-German alliance and the will to put closer relations and a joint commitment to European integration into practice. The Treaty of Aachen recognizes cross-border co-operation as a central element of European integration. The main goal is to remove cross-border barriers in order to

facilitate the implementation of projects and simplify the daily lives of residents of border regions (PEYRONY ET AL., 2023). A common spatial policy (PALLAGST & HARTZ, 2018) seems particularly important from this perspective, which concerns not only the mobility of capital, goods, and services, but also cross-border mobility on the labour market and vocational training (DÖRRENBÄCHER, 2020). These activities are closely linked to the demand for transport (BOUSONVILLE ET AL., 2023). The importance of communication in strengthening border regions and deepening European integration is evidenced by the fact that the European Commission has announced supporting cross-border mobility as one of the five main objectives of its cohesion policy until 2027 (ADOLPHI ET AL., 2022). The existing spatial polarisation of the recorded results in Germany related to historical conditions (east-west) was overlapped, although to a lesser extent, by conditions related to polarisation within the centre-periphery system, as indicated by the fact that the highest potential in 2023 was recorded in the agglomeration regions: Berlin, Hamburg and Bremen. The differentiation of the demographic potential in Poland between the initial and final year of the analysis shows significant changes both at the regional level and within the border regions. In 1995, historical conditions were a significant factor differentiating the demographic potential. As a result, areas located in the north-western part were distinguished by a greater demographic youth. On the other hand, the location of the border regions at the western and eastern borders had a smaller impact on the assessment of their demographic potential, as evidenced by the different assessment of the demographic potential of the two neighbouring regions Warmińsko-Mazurskie (young demographic) and Podlaskie (demographically old). In 2023, the center-periphery system clearly played a dominant role in the distribution of demographic potential differentiation. The highest demographic potential was recorded in regions with agglomerations referred to as the "big five" (ŚLESZYŃSKI, 2021), i.e.: Warsaw (Mazowieckie), Krakow (Małopolskie), Poznan (Wielkopolskie), Tricity agglomeration: Gdańsk, Gdynia, Sopot (Pomorskie), Wrocław (Dolnośląskie). At the same time, it is worth noting that a higher demographic potential was recorded in the border regions in the western than in the eastern part of the country located at the external border of the European Union. In the context of the conducted research, the border region of Mecklenburg-

Vorpommern in Germany and the Warmińsko-Mazurski region in Poland, located on the external border of the European Union, deserve special attention.

6. Conclusions

The research revealed that the changes that have occurred in the demographic potential of border regions in the context of the evolving function of the state border associated with European integration are visible spatially. This is particularly true for the border, which in the past ran between two political and economic systems and now constitutes the external border of the European Union. The research findings indicate that these demographic processes were the result of historical conditions, compounded by the increasingly important core-periphery relationship. In the conducted research, the polarization process noted at the national level was also visible at the European Union level, which was clearly visible in the example of the demographic processes taking place in the regions located at its eastern border. A huge challenge facing Poland and the entire European Union is to create such living conditions for residents of border regions that would prevent their peripheralization from deepening, not only in the demographic aspect. This problem particularly concerns the German border region of Mecklenburg-Vorpommern, where the direction of unfavourable changes in demographic potential is characterized by uniformity at the county level. In Poland, however, the border region of Warmińsko-Mazurski requires special attention due to the dynamic pace of unfavourable changes taking place in demographic potential. The research conducted and the answers to the questions posed may help in the implementation of dedicated social policies in border regions where demographic problems are compounded by unfavourable socio-economic development, which adversely affects the quality of life of their inhabitants.

References

- Adolphi L., Sgibnev W., Weicker T. 2022. *Endstation Grenze?: die aktuelle Situation des grenzübergreifenden ÖPNV*. Nationalatlas aktuell/Leibniz-Institut für Länderkunde, 16(7).
- Anderson J., O'Dowd L. 1999. Borders, Border Regions and Territoriality: Contradictory Meanings, Changing Significance. *Regional Studies*, 33, 7: 593–604.
- Avdić A., Avdić B., Zupanc I. 2022. Socio-demographic analysis of border regions of Bosnia and Herzegovina. *Acta Geographica Slovenica*, 62, 3: 7–19.

- Bański J. 2010. Granica w badaniach geograficznych-definicja i próba klasyfikacji (Border in geographical research studies-definition and an attempts at its classification). *Przegląd Geograficzny*, 82, 4: 489–508.
- Bernard J., Keim-Klärner S. 2023. Disadvantaged and disadvantaging regions: Opportunity structures and social disadvantage in rural peripheries. *Tijdschrift voor Economische en Sociale Geografie*, 114, 5: 463–478.
- Bertram D., Chilla T., Hippe S., Zumbusch K., Zwicker-Schwarm D. 2025. *Kooperationsprofile deutscher Grenzregionen: Themen, Akteure, Governance - Erkenntnisse des BMBF-Projekts CoBo (Cohesion in Border Regions)*. Working Papers FAU Regional Development No. 6.
- Bousonville T., El Gharbi K., Frank R., Keinath S., Manz W., Rösler I., Vogt J. 2023. Automatisierter öffentlicher Verkehr in Grenzregionen: Erkenntnisse aus der Erprobung grenzüberschreitender Angebote für Pendler. *Internationales Verkehrswesen*, 75, 1: 64–68.
- Churski P. 2014. Model polaryzacyjno-dyfuzyjny w przemianach polityki spójności-konsekwencje dla ukierunkowania polityki rozwoju. *Rozwój Regionalny i Polityka Regionalna*, 25: 13–27.
- Coakley J. 2008. Centres peripheries, and party systems: Nested secession processes in Great Britain and Ireland. *Political Geography*, 27: 740–760.
- Coleman D. 2007. The Road to Low Fertility. *Ageing Horizons*, 7: 7–15.
- Copus A.K. 2001. From core-periphery to polycentric development: Concepts of spatial and aspatial peripherality. *European Planning Studies*, 9, 4: 539–552.
- Daugirdas V., Burneika D. 2006. Patterns and problems of peripherality in Lithuania-borderland of the EU. *Europe XXI*, Warszawa: Drukarnia Klimiuk: 119–134.
- De Castro MC. 2007. Spatial demography: An opportunity to improve policy making at diverse decision levels. *Population Research and Policy Review*, 26: 477–509.
- Długosz Z. 2011. Population ageing in Europe. *Procedia-Social and Behavioral Sciences*, 19: 47–55.
- Dörrenbächer H.P. 2020. Die Entwicklung grenzüberschreitender Berufsausbildung im Spannungsfeld unterschiedlicher Dimensionen von Distanz – das Beispiel der Großregion. [in:] F. Weber, C. Wille, B. Caesar, J. Hollstegge (eds), *Geographien der Grenzen. Räume – Grenzen – Hybriditäten*. Springer VS, Wiesbaden: 117–142.
- Flaga M., Wesołowska M. 2018. Demographic and social degradation in the Lubelskie Voivodeship as a peripheral area of East Poland. *Bulletin of Geography. Socio-economic Series*, 41: 7–27.
- Friedmann J. 1966. *Regional Development Policy: A Case Study of Venezuela*. The MIT Press, Cambridge, MA.
- Gałka J. 2017. Wpływ permanentnych migracji zagranicznych na zmiany regionalnych układów zaludnienia w Polsce. *Studia Ekonomiczne*, 309: 95–108.
- Gołata E., Jonda B. 2008. Demographische Entwicklungen in Polen und in Deutschland im Vergleich. [in:] R. Sackmann, B. Jonda, M. Reinhold (eds.), *Demographie als Herausforderung für den öffentlichen Sektor*, Wiesbaden: VS Verlag für Sozialwissenschaften, GVV Fachverlage GmbH: 25–46.
- Goldstein J.R., Kluge F. 2016. Demographic pressures on European Unity. *Population and Development Review*, 42, 2: 299–304.
- Gorzela G. 2002. Polskie regiony w procesie integracji europejskiej. *Studia Regionalne i Lokalne*, 3, 09: 55–73.
- Greta M. 2013. *Euroregiony polskie w procesie integracji europejskiej oraz przewyższaniu peryferyjności i dysproporcji regionalnych*. Wydawnictwo Uniwersytetu Łódzkiego, Łódź.
- Grzelak-Kostulska E. 2016. *Seniorzy w Polsce w świetle procesów modernizacyjnych*. Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, Toruń.
- Gutiérrez J. Urbano P. 1996. Accessibility in the European Union: The impact of the Trans European road network. *Journal of Transport Geography*, 4: 15–25.
- Gwiaździńska-Goraj M., Pawlewicz K., Jezierska-Thöle A. 2020. Differences in the Quantitative Demographic Potential—A Comparative Study of Polish-German and Polish-Lithuanian Transborder Regions. *Sustainability*, 12: 9414.
- Gwiaździńska-Goraj M., Wesołowska M., Jezierska-Thöle A. 2025. Demographic changes in post-state farm localities in Poland. *Quaestiones Geographicae*, 44, 2: 59–76.
- Hartz A., Damm G. R., Köhler S. 2010. Großräumige grenzüberschreitende Verflechtungsräume. *Raumforschung und Raumordnung*, 68, 6: 499–513.
- Heffner K. 2023. Granica-definicje, etymologia, typologia. Ewolucja pojęć i nowe znaczenia. [in:] A. Rykała (ed.), *W kręgu geografii politycznej i dyscyplin „okolicznych”*. Studia dedykowane Profesorowi Markowi Sobczyńskiemu. Wydawnictwo Uniwersytetu Łódzkiego: Łódź: 101–140.
- Heimpold G. 2003. Zur Ausstattung der deutschen Regionen entlang der Grenze zu Polen mit wichtigen Wachstumsfaktoren. *Wirtschaft im Wandel*, 9, 7: 215–221.
- Hennig A. 2021. The spatial dimension of coronavirus crisis management and the role of subnational actors in the German-Polish border region. *European Societies*, 23, S1: 859–871.
- Jezierska-Thöle A. 2018. *Rozwój obszarów wiejskich Polski Północnej i Zachodniej oraz Niemiec Wschodnich*. Wydawnictwo Naukowe Uniwersytetu Mikołaja Kopernika, Toruń.
- Johansson M., Nilsson P. Westlund H. 2014. Demographic and economic trends in a rural Europe in transition. [in:] *Proceedings of the ERSA 2014—54th Congress of the European Regional Science Association*. Saint Petersburg, Russia, 26–29 August 2014.
- Jurczek P. 2009. *Grenzräume in Deutschland: grenzüberschreitende Entwicklung und grenzübergreifende Kooperation*. Europa Regional, 14, 2: 50–60.
- Kaczmarek Z., Parysek J. 1997. Zastosowanie analizy wielowymiarowej w badaniach geograficzno-ekonomicznych. [in:] Z. Chojnicki (eds.), *Metody ilościowe i modele w geografii*. PWN, Warszawa: 94–127.
- Kawałko B. 2015. Program Polska-Białoruś-Ukraina w polityce rozwoju regionów przygranicznych. *Regional Barometer. Analyses & Prognoses*, 13, 2: 7–27.
- Krätke S. 1999. Regional integration or fragmentation? The German-Polish border region in a new Europe. *Regional Studies*, 33, 7: 631–641.
- Kriaučiūnas E., Burneika D. 2019. Functional transformations and socio-demographic differentiation of Lithuanian rural spaces. [in:] J. Bański (ed.), *Three Decades of Transformation in the East-Central European Countryside Cham*, Springer: 217–237.
- Kühn M. 2015. Peripheralization: Theoretical concepts explaining socio-spatial inequalities. *European Planning Studies*, 23, 2: 367–378.
- Kukuła K. 1999. Metoda unitaryzacji zerowanej na tle wybranych metod normowania cech diagnostycznych. *Acta Scientifica Academiae Ostroviensis*, 4: 5–31.

- Kurek S. 2008. Typologia starzenia się ludności Polski w ujęciu przestrzennym. Wyd. Naukowe Akademii Pedagogicznej, Kraków.
- Kwarcińska K. 2017. Centra i peryferie jako rama analityczna i pojęciowa. *Zeszyty Naukowe Uniwersytetu Ekonomicznego w Krakowie*, 963, 3: 5–22.
- Lados G., Nagy D., Horeczki R. 2024. Economic and demographic dynamics in Central European border regions between 2014–2020. *DETUROPE – The Central European Journal of Regional Development and Tourism*, 16, 3: 99–120.
- Lang T., Burneika D., Noorkõiv R., Plüschke-Altöf B., Pociūtė-Sereikienė G., Sechi G. 2022. Socio-spatial polarisation and policy response: Perspectives for regional development in the Baltic States. *European Urban and Regional Studies*, 29, 1: 21–44.
- Lang T., Henn S., Ehrlich K., Sgibnev W. (eds). 2015. *Understanding geographies of polarization and peripheralization: Perspectives from Central and Eastern Europe and beyond*. Springer.
- Marada M., Chromý P., Jančák V., Havlíček T. 2006. Space polarization and peripheral regions in Czechia. *Europe XXI*: 29–34.
- Matthews S. A., Parker D.M. 2013. Progress in spatial demography. *Demographic Research*, 28: 271.
- Mildenberger M. 2007. Grenznahe Kooperation zwischen Deutschland und Polen. *Polen-Analysen*, 10: 2–6.
- Miszczuk A. 2013. Geopolityczne uwarunkowania rozwoju regionów przygranicznych. *Prace Geograficzne*, 242: 117–144.
- Nugent N. 2012. *Unia Europejska*. Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków.
- Pallagst K., Hartz A. 2018. Raumplanung in Grenzregionen: Gratwanderung zwischen neuen Leitbildern und alten Planungstraditionen? [in:] K. Pallagst, A. Hartz, B. Caesar (Hrsg.), *Border Futures - Zukunft Grenze - Avenir Frontière*. Zukunftsfähigkeit grenzüberschreitender Zusammenarbeit, Hannover: 70–87.
- Pastuszka S. 2018. Spatial Differentiation of Demographic Processes in Germany and Poland. *Barometr Regionalny. Analizy i Prognozy*, 16, 1: 151–162.
- Pénzes J., Pásztor IZ., Tátrai P. 2015. Demographic Processes in Developmentally Peripheral Areas of Hungary. *Stanovništvo*, 53, 2: 87–111.
- Peyrony J., Sielker F., Perrin T. 2023. Grenzüberschreitende territoriale Zusammenarbeit zwischen Frankreich und Deutschland: Entwicklung, Konvergenz und Perspektiven. [in:] E. Gustedt, U. Grabski-Kieron, C. Demazière, D. Paris (eds), *Städte und Metropolen in Frankreich und Deutschland*. Verlag der ARL-Akademie für Raumentwicklung in der Leibniz-Gemeinschaft, Hannover: 198–220.
- Pilger C., Meindl M., Hamann S. 2011. *Grenzüberschreitender Arbeitsmarkt Straßburg-Ortenau, 1999 und 2007: Entwicklung und Struktur der Einpendlerzahlen nach Deutschland* (No. 01/2011). IAB-Regional. IAB Baden-Württemberg.
- Pociūtė-Sereikienė G. 2014. Trends of imbalances of demographic and socioeconomic development in the post-reform period in Lithuania, [in:] P. Churski (ed.), *Social and economic growth vs. the emergence of economic growth and stagnation areas*. Bogucki Wydawnictwo Naukowe, Poznań: 129–150.
- Pociūtė-Sereikienė G. 2019. Peripheral regions in Lithuania: the results of uneven development. *Regional Studies, Regional Science*, 6, 1: 70–77.
- Podadera-Rivera P., Calderon-Vazquez F.J. 2023. Borders, cross-border cooperation and depopulation: the case of the Spanish-Portuguese North-Central Border. *Open Research Europe*, 3, 200.
- Podraza A. 1999. *Unia Europejska*. Redakcja Wydawnictw Katolickiego Uniwersytetu Lubelskiego, Lublin.
- Prskawetz A. 2005. Will Population Ageing Decrease Productivity?, *Vienna Yearbook of Population Research*, 3: 1–3.
- Reher D.S. 2011. Economic and social implications of the demographic transition. *Population and Development Review*, 37: 11–33.
- Rosner A. 2012. *Zmiany rozkładu przestrzennego zaludnienia obszarów wiejskich: wiejskie obszary zmniejszające zaludnienie i koncentrujące ludność wiejskiej*. IRWiR PAN, Warszawa.
- Rykiel Z. 1995. Europejskie granice badań przestrzennych. *Europejskie Badania Przestrzenne i Polityka*, 2, 1: 35–47.
- Schmidt S., Fina S., Siedentop S. 2015. Post-socialist sprawl: A cross-country comparison. *European Planning Studies*, 23, 7: 1357–1380.
- Śleszyński P. 2021. Demograficzne i planistyczne uwarunkowania i skutki rozwoju stref podmiejskich. [in:] P. Śleszyński, M.J. Nowak, P. Legutko-Kobus, A. Hołuj, P. Lityński, A. Jadach-Sepioło, M. Blaszkę (eds.), *Suburbanizacja w Polsce jako wyzwanie dla polityki rozwoju 2021*. Polska Akademia Nauk. Komitet Przestrzennego Zagospodarowania Kraju, Warszawa: 29–70.
- Smith A., Timár J. 2010. Uneven transformations: Space, economy and society 20 years after the collapse of state socialism. *European Urban and Regional Studies*, 17, 2: 115–125.
- Środa-Murawska S. 2013. Przestrzenne różnicowanie poziomu rozwoju społeczno-gospodarczego Niemiec. *Nierówności społeczne a wzrost gospodarczy*, 31: 308–317.
- Stanny M. 2013. *Przestrzenne różnicowanie rozwoju obszarów wiejskich w Polsce*. IRWiR PAN, Warszawa.
- Strojny J., Niewiadomski M. 2023. Uwarunkowania rozwoju społeczno-gospodarczego środkowoeuropejskich regionów peryferyjnych UE. *Rozwój Regionalny i Polityka Regionalna*, 63: 103–122.
- Szkuřat I., Satek-Imińska A. 2025. Migracja jako zagrożenie dla bezpieczeństwa w trzeciej dekadzie XXI wieku. *Journal of Modern Science*, 61, 1: 669–687.
- Szymańska D., Środa-Murawska S., Świdarska K., Adamiak C. 2009. Internal migration in Germany in 1990 and 2005. *Bulletin of Geography. Socio-economic*, 12: 109–120.
- Tagai G., Bernard J., Šimon M., Koós B. 2018. Two faces of peripherality: labour markets, poverty, and population dynamics in Hungary and Czechia. *Regional Statistics*, 8, 2: 19–45.
- Tarkowski M. 2006. The demographic changes in Poland in the core-periphery layout during the period of the systemic transformation. *Bulletin of Geography. Socio-economic Series*, 5: 33–49.
- Taubenböck H., Otto C., Gülzau F., Mau S. 2023. Border regions across the globe: Analyzing border typologies, economic and political disparities, and development dynamics. *Applied Geography*, 151: 102866.
- Topaloglou L., Kallioras D., Manetos P., Petrakos G. 2005. Typologia regionów granicznych w rozszerzonej Unii Europejskiej. *Journal of Borderlands Studies*, 20, 2: 67–89.
- Tuziak A. 2019. Peryferyjność a nierówności i dysproporcje rozwojowe na poziomie regionalnym. *Nierówności społeczne a wzrost gospodarczy*, 59: 131–148.
- Ubarevičienė R., Žinys T., Kriauciūnas E. 2025. Migration's Role in Shaping Socio-Demographic Structure in the Peripheral

- Rural Regions: A Case Study of Lithuania. *Population, Space and Place*, 31, 2: e70010.
- van de Kaa D.J. 2002. *The idea of a Second Demographic Transition in industrialized countries*. Paper presented at the Sixth Welfare Policy Seminar of the National Institute of Population and Social Security, Tokyo, Japan, 29 January 2002.
- Verfürth P., Helwing V., Franz M. 2021. Barrieren grenzüberschreitender Unternehmenskooperationen in deutschen Grenzregionen-das Beispiel der deutsch-niederländischen Euregio. *Europa Regional*, 26, 4: 31–45.
- Webb J.W. 1963. The natural and migration components of population changes in England and Wales 1921–1931. *Economic Geography*, 2: 130–148.
- Wesołowska M. (ed.) 2011. Wiejskie obszary peryferyjne – uwarunkowania i czynniki aktywizacji. *Studia Obszarów Wiejskich*, 26. Komisja Obszarów Wiejskich PTG, IGiPZ PAN, Warszawa.
- Wille C. 2009. Zum Modell des transnationalen sozialen Raums im Kontext von Grenzregionen: theoretisch-konzeptionelle Überlegungen am Beispiel des Grenzgängerwesens. *Europa Regional*, 16, 2: 74–84.
- Willers D. 1992. Wirtschaftliche Zusammenarbeit zwischen Deutschland und Polen im Oder-Neiße-Grenzgebiet als regionalpolitisches Problem. *Raumforschung und Raumordnung Spatial Research and Planning*, 50, 3, 4: 168–174.
- Statistical data:**
- <https://www.europarl.europa.eu/topics/pl/article/20170629-ST078630/azyl-i-migracja-w-ue-fakty-i-liczby> [22.10.2025].
- OECD 2013. *Zuwanderung ausländischer Arbeitskräfte: Deutschland*. OECD Publishing, Paris.
- <https://stat.gov.pl/> [5.06.2025].
- <https://www.destatis.de/> [5.06.2025].