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TAXONOMIC ANALYSIS OF LABOUR MARKET IN LIGHT OF DEMOGRAPHIC REGIONAL CHANGES OCCURRING IN POLAND AND GERMANY

INTRODUCTION

Demographic potential is a significant factor determining regional development. It is mostly often defined as a „drive force” embedded in human resources so, first and foremost, in number of population and average age values. Demographic low caused by a low rate of natural increase or populace migration exerts an immense effect on demographic structure of a given region. Significant decrease of labour supply and an increase of population at retirement age are some of the consequences stemming from these changes.¹

The purpose of the article is to indicate regional, demographic transformations and their influence on the labour market of Poland and Germany and to formulate conclusions concerning regional policies adopted in Poland and Germany. Quantitative (statistical) and qualitative (descriptive) research methods were applied to achieve this goal. Z. Hellwig's taxonomic method was used as the first one. Data obtained from various general and specialist sources was utilised to describe influence of particular factors on the studied regions, their nature and changes occurring within them. The analysis included years 2000-2015.

LOCATION AND DEMOGRAPHIC SITUATION IN POLAND AND GERMANY BY REGIONS

As far as surface area is concerned, Poland is one of the bigger states in the European Union (see map 1). In 2015, the territory of Poland amounted to 312. 7 thousand km², which constituted 7.1% of UE-28 area. Poland is the fifth biggest country in EU. At the beginning of 2015, Mazovia was the biggest province (11.4% of country area) and the smallest – Opole (3%). According to Eurostat data, Poland was placed

¹ J. Józwiak, *Demograficzne uwarunkowania rynku pracy w Polsce*, [w:] R. Kielkowska (ed.), *Rynek pracy wobec zmian demograficznych*, „Zeszyty Demograficzne”, Wydawnictwo Instytut Obywatelski, Warszawa 2013, p. 7.

Bremen (0.12). At the beginning of 2015, this area was populated by ca. 81.2 mln of people 16% of UE-28 population), placing Germany at the top of UE-28 list. North Rhine-Westphalia had the greatest share of population in 2015 (21.7% of Germany population), the smallest one was recorded in Bremen (0.8%). Berlin had the highest population density among the union lands (3838 people per km²), Hamburg was second (2312). The eastern lands had the smallest amount of people per km²: Saxony-Anhalt (110), Brandenburg (83) and Mecklenburg-Vorpommern (69).

Poland is significantly different from Germany as far as demographic situation is concerned (see table No. 1). In Germany, in the course of 2000-2015, population decline can be observed. In 2015, in comparison to 2000, that number decreased by 1062, i.e. 1.29% of total Germany population.

Similar decline could be observed in as many as 9 lands; the biggest one in Sachsen-Anhalt (-14.5%), Thüringen (-11.3%) and Mecklenburg-Vorpommern (-9.9%) Population growth in the analysed period was recorded only in 7 lands (Bremen, Hesse, Schleswig-Holstein, Hamburg, Baden-Württemberg, Bavaria and Berlin), including the biggest one in Bavaria (increase by 3.8%). At the beginning of 2015, population in Poland amounted to 38478 thousand of people, i.e. 225 thousand more than in 2000. Despite the small increase in the number of births and decline in the number of deaths, a negative rate of natural increase is still prevailing. Population decline in the analysed period was recorded in 7 among 16 provinces; the biggest one in Opole (-6.2%), Łódź (-4.7%) and Silesia (-3.6%). Whereas 9 provinces recorded an increased number of citizens, the biggest one in Pomerania (6%), Małopolskie (4.31%) and Mazovia (4.29%).³

Table 1

Population of Poland and Germany in 2000-2015, number of population expressed in thousands

Area	Year								Change in a number of populace in 2015 in comparison to 2000, in %
	2000	2002	2005	2008	2010	2011	2013	2015	
Poland	38254	38219	38157	38136	38530	38538	38496	38478	0,59
Germany	82260	8248	82438	82002	81752	81844	80768	81197	-1,29

Source: own study on the basis of: *Statistisches Jahrbuch. Deutschland und Internationales*, Statistisches Bundesamt, Wiesbaden 2014, p. 26; Main Statistical Office (GUS) data: http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; 7.11.2015.

³ Prepared on the basis of: http://www.statistikportal.de/statistik-portal/de_jb01_jahrtabl.asp and http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; 7.11.2015.

Between 2000 and 2014, in Germany, the number of deaths exceeded the number of births, causing a negative rate of natural increase. In 2000, a rate of natural increase in Poland remained positive, although at a very low level, amounting to 0.3 people per 1000. In 2014, a rate of natural increase per 1000 of people was decisively higher in Poland (-0.03‰) than in Germany (-1.9‰) (see table No. 2). A positive rate of natural increase was recorded in 8 of the Polish provinces, the highest one in Pomorania (2.0‰), Wielkopolskie (1.7‰) and Małopolskie (1.4‰). Whereas in Germany, a positive rate of natural increase – although only slightly greater than zero – was recorded in only two countries having a status of lands – Berlin (1.5‰) and Hamburg (1.3‰). The lowest rate of natural increase in Poland was recorded in Łódź Province (-2.8‰) and in Germany, in Saxony-Anhalt (-6.2‰).

Table 2

Rate of natural population increase in Poland and Germany between 2000 and 2015

Area	year	live births	deaths	natural increase
		Per 1000 people		
Poland	2000	9.8	9.5	0.3
	2015	9.8	9.9	-0.03
Germany	2000	9.3	10.2	-0.9
	2015	8.8	10.7	-1.9

Source: calculations on the basis of: *Statistisches Jahrbuch 2002 für die Bundesrepublik Deutschland*, Statistisches Bundesamt, Wiesbaden 2002, p. 68; Main Statistical Office (GUS) data: http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; https://www-genesis.destatis.de/genesis/online/logon?language=de&sequenz=statistiken&selectionname=12*; 7.11.2015.

The excess of births over deaths has not been recorded in Germany since 1970. The studies indicate that by 2060, the current number of 80 mln inhabitants of Germany may drop to 70 mln.⁴ Whereas in Poland, population forecasts project a decline in population number by 5 mln of people by 2050. According to UN, Germany as a country will quickly start to experience the problems related to demographic decline. The eastern lands are in particular danger. Currently, ca. 28% at the west of the country and 16% at the east are childless. Demographic transformations caused, i.a. that the group of 20-25 year-olds has been replaced by the group of 28-35 year-olds as the age range characterized by the highest women fertility rate. Consequently, the average age of first birth has been increased to 30.9 as of 2014 (27, in comparison with Poland⁵). This kind of situation stems mainly from unstable employment conditions, especially in the case of non-continuous and unpredictable working hours.⁶ In 2014, fertility rate in Germany amounted to 38.64 (live births per 1000 women at the age of 15-49), (39.72 in Poland).

⁴ *Bevölkerung Deutschlands bis 2060*, Statistisches Bundesamt, Wiesbaden 2009, p. 46.

⁵ <https://www-genesis.destatis.de>, www.stat.gov.pl, 07.11.2015.

⁶ *Przemiany demograficzne i starzenie się społeczeństwa: konsekwencje dla lokalnych rynków pracy w Polsce*, Ministerstwo Rozwoju Regionalnego, Warszawa 2013, p. 26-27.

Number of births, deaths, population immigration and emigration shape not only a number of citizens in a given country, but also its gender and age patterns. In Germany, population age pattern between 2000 and 2014 indicated a decrease in the number of people in 15-64 age group by 3.08 percent, reaching the level of 65.88 % (whereas in Poland, an increase has been observed; respectively, by 1.17 percent, reaching the level of 69.75%), (see table No. 3).

Table 3

Population structure in Poland and Germany between 2000 and 2014, according to age, expressed in %

Age	Area			
	Poland		Germany	
	2000	2014	2000	2014
below 14	19.06	14.98	14.40	13.11
between 15 and 64	68.58	69.75	68.96	65.88
65 and more	12.35	15.26	16.65	21.00

Source: based on the data of: Statistisches Bundesamt: <https://www.destatis.de/DE/Startseite.html>, http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; 07.11.2015.

Between 2000 and 2014, as a result of structural changes, economic dependency ratio, considered as a quotient of a number of people at non-working age (14 and less, 66 and more) and a number of people at working age (15 to 65 year-old women and men). At the end of 2014, in Germany, for every 100 people at working age, there were 31.9 people at retirement age (22 in Poland) – 7 more than in 2000 (in Poland, 4 more people than in 2000). According to the analysis of demographic dependency ratio by regions in Poland, at the end of 2013, the best results were recorded in Warmia-Masuria Province, where, on average, for every 100 people at working age, there were 25.3 people at retirement age, the worst ones in Łódź Province (32.7 people) and Świętokrzyskie Province (31.1). Whereas in Germany, this ratio was lowest in Hamburg (27.7 people) and Berlin (28.2), whereas, the highest in Saxony (39.7), Saxony-Anhalt (39.1) and Thuringia (37.4).⁷

Between 1990 and 2014 considerable changes have occurred in elderly citizens group (65 year-old and over, women and men) – both their number and general population rate increased (see table No. 4). At the end of 2014, in Germany, the rate of people over 65 was by 4.4 percent higher (by 2.91 percent in Poland) than the rate recorded in 2000 (16.6 %, 12.4 % in Poland) and since 1990, the rate has increased by more than 5.9 percent (4.63 percent in Poland).⁸

⁷ *Bevölkerung, Familien, Lebensformen. Statistisches Jahrbuch 2014*, Statistisches Bundesamt, Wiesbaden 2014, p. 31; www.stat.gov.pl; 07.11.2015.

⁸ *Podstawowe informacje o rozwoju demograficznym Polski do 2013 roku*, GUS, Warszawa 2014, p. 16; *Ältere Menschen in Deutschland und der EU*, Statistisches Bundesamt, Wiesbaden 2011, p. 9.

Table 4

Growing rate of citizens over 65 in Poland and in Germany between 1990 and 2014

Area	Difference between 1990 and 2014, in %	65 and more, in thousands.	
		1990	2014
Poland	+51.1	3887.1	5874.1
Germany	+43.2	11912.1	17054.7

Source: *Rocznik demograficzny*, GUS, Warszawa 2012, p. 129; *Statistisches Jahrbuch 2002 für die Bundesrepublik Deutschland*, Statistisches Bundesamt, Wiesbaden 2002, p. 58; GUS: http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; <https://www.destatis.de>; 07.11.2015.

Decline in number of citizens is also associated with migration. The United Nations estimate that almost 3% of the world's population, i.e. ca. 190 mln of people, live outside their mother countries. Since mid 1970s the number of immigrants in their respective populations almost doubled, up to 8.3%, whereas in less-developed countries this index is at significantly lower level.⁹

At the end of 2014, 2320 k of Polish citizens stayed outside the country temporarily. The number is higher than in 2013, by 124 k. In 2014, ca. 2013 k people stayed in Europe and majority of them lived in the EU member states. The number increased by 112 k in relation to 2013. Among the EU states, stays in Great Britain (685 k.), Germany (614 k), Ireland (113 k) Netherlands (109 k) and Italy (96 k) remained the most popular.¹⁰ In 2014, the foreign net migration rate regarding permanent stays per 1000 citizens was positive only in two voivodeships: Mazovia and Świętokrzyskie (0.01‰ each). In other regions of Poland, this rate was negative; the lowest one recorded in Opole (-0.87‰). Whereas in Germany, since 2010, the foreign net migration rate regarding permanent stays is positive (see table No. 5).

Table 5

Abroad migrations for permanent stays in Poland and Germany between 2000 and 2014

Area	Year	Influx	Loss	Net migration rate
		per 1000 people		
Poland	2000	0.19	0.71	-0.51
	2014	0.32	0.73	-0.41
Germany	2000	10.22	8.19	2.03
	2014	18.10	11.26	6.78

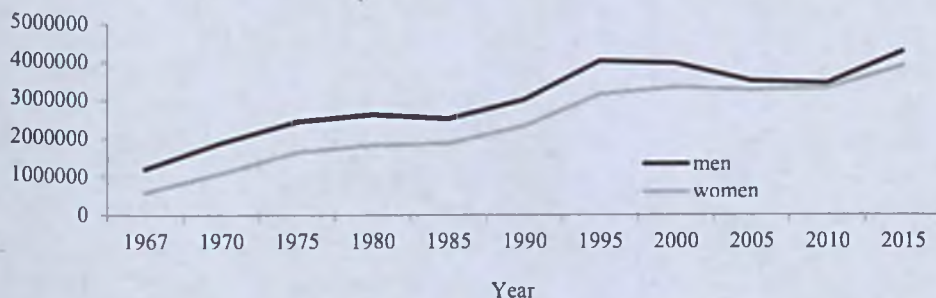
Source: calculation on the basis of: *Bevölkerung und Erwerbstätigkeit. Vorläufige Wanderungsergebnisse*, Statistisches Bundesamt, Wiesbaden 2015, p. 12; Main Statistical Office (GUS) http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794; 7.11.2015.

⁹ B. Keeley, *International Migration. The Human Face of Globalisation*, Organisation for Economic Co-operation and Development, France 2009, p. 12-15.

¹⁰ *Informacja o rozmiarach i kierunkach czasowej emigracji z Polski w latach 2004-2014*, Główny Urząd Statystyczny, Warszawa 2015, p. 2.

The migration processes are one of the elements of globalization.¹¹ Influx of immigrants from Africa and Asia has undoubtedly exerted a significant influence of the demographic situation of both Poland and Germany. According to the data from Bundesamt für Migration und Flüchtlinge, at the beginning of 2015, there were 8.2 mln of foreigners living in Germany, which is 10% of overall population in Germany (see graph No. 1).

Graph 1
Number of citizens in Germany between 1967-2015, as per sex



Source: calculation on the basis of: <https://www.destatis.de>; 07.11.2015.

The Turks are definitely the largest group (more than 1.5 mln of people, i.e. 18.7% of general foreign population in Germany), followed by the Poles (ca. 675 k of people, i.e. 8.3%) and the Italians (574 k of people, i.e. 7%).¹² It also needs to be stated that a large number of Turks has the German citizenship. In comparison to 2014, the number of foreigners in 2015 increased by 519 k, i.e. by 6.8%. At the end of September 2015, the greatest number of immigrants came from Syria (more than 70 k of people, i.e. by 199% more than during this period time last year), Albania (more than 44 k of people, i.e. increase by 704%) and Kosovo (more than 31 k of people, i.e. increase by 891%).¹³ With reference to regions in Germany, at the beginning of 2015, the most foreigners (per 1000 of citizens) migrated to three cities having the land status: Hamburg (149 people), Bremen (147 people) and Berlin (146 people)¹⁴. Statistical data confirm that the foreigners are concentrated regionally, very often in large ethnic groups in urban agglomerations.¹⁵

¹¹ T. K. Wong, *Conceptual Challenges and Contemporary Trends in Immigration Control*, [w:] *Controlling immigration: A global perspective*, J. F. Hollifield, P. L. Martin, P. M. Orreniuss (ed.), Stanford University, California 2014, p. 40.

¹² *Bevölkerung, Familien, Lebensformen*, Statistisches Bundesamt, Statistisches Jahrbuch 2015, Wiesbaden 2015, p. 40.

¹³ *Asylgeschäftsstatistik für den Monat September 2015*, Bundesamt für Migration und Flüchtlinge, Nürnberg 2015, p. 3.

¹⁴ *Ausländische Bevölkerung*, <https://www.destatis.de>; 07.11.2015.

¹⁵ M. Kwiecień, *Polityka migracyjna Niemiec*, „Studia Ekonomiczne” Nr 211, Uniwersytet Ekonomiczny w Katowicach, Katowice 2015, p. 84.

Migration abroad are very often caused by social and economic factors and their number and direction depend on numerous causes, which most often include willingness to take up a job, improvement of material situation. The migration also brings immeasurable consequences.¹⁶ In 2014, the prevailing migration destination among Germans were: the United States, Switzerland, Austria and Great Britain. Migrations were mostly observed among the 25-55 age group, exerting a negative impact on the population age pattern.¹⁷

2014 was the year of increasing number of Polish immigrants in other countries, following a period of a noticeable decline in the number of Polish citizens staying temporarily abroad between 2008 and 2010. The scale of migration undoubtedly indicates a problem of continuously growing unemployment rate in Poland, especially among the people in 25-39 age group. Among the countries which have been the main destinations of Polish immigrants, there has been a considerable increase in numbers of Poles migrating to Germany (by 54 thousand, almost by 10%) and increase in the case of migrations to Great Britain (6.7%). Full opening of the German labour market, the borderland with Poland, low unemployment rate in Germany entice the Polish citizens to visit this country more frequently. Moreover, the growth of Polish immigrants has also been observed in Netherlands.¹⁸ At the same time, people also migrated to the countries that are not the UE states, including Norway – in 2014 79 k people stayed there.¹⁹

Demographic changes observed during the recent years indicate that population situation in Poland is problematic, yet still a bit better than in Germany. Nevertheless, no significant changes that could ensure a stable demographic development may be expected in the nearest future. Low total fertility rate, increase of average life span and low-profile economic activity rate of people aged more than 50 can cause a decrease in labour supply on the labour market and difficulties in social security system.²⁰

PROFESSIONAL ACTIVITY, EMPLOYMENT AND UNEMPLOYMENT

At the end of 2014, economic activity rate in Poland reached the level of 56.2% and was as much as 21.5 percent lower than in Germany (see graph No. 2).

¹⁶ R. Hansen, *Migration to Europe since 1945: Its History and its Lessons*, "The Political Quarterly", Nr 74, New York 2003, p. 25.

¹⁷ *Bevölkerung und Erwerbstätigkeit. Vorläufige Wanderungsergebnisse*, Statistisches Bundesamt, Wiesbaden 2014, p. 9.

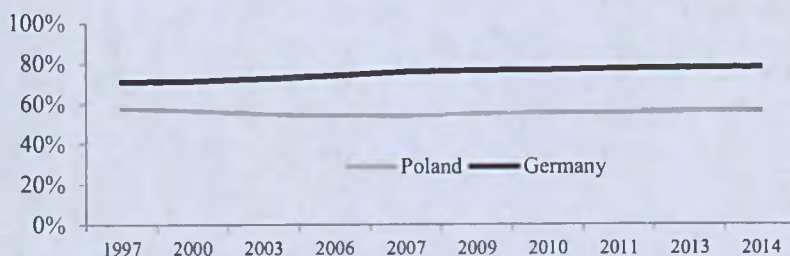
¹⁸ *Informacja o rozmiarach i kierunkach czasowej emigracji z Polski w latach 2004-2013*, GUS, Warszawa 2014, p. 1-4.

¹⁹ *Ibid.*, p. 1-2.

²⁰ *Podstawowe informacje o rozwoju demograficznym Polski do 2013 roku*, GUS, Warszawa 2014, p. 16.

Graph 2

Economic activity rate of people in 15-65 age group in Poland and in Germany, between 1997 and 2014, in %



Source: *Bevölkerung und Erwerbstätigkeit Stand und Entwicklung der Erwerbstätigkeit in Deutschland*, Statistisches Bundesamt, Wiesbaden 2015, p. 144; http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794, 07.11.2015.

Changes occurring in labour supply vary depending on the age of potential employees. In 2014 in Poland, the ratio of business activity in the age group of 15-65 amounted to 56.2%, comprising a decrease by 0.8 percent in relation to 2000; 77.5% in Germany – 6.5 percent increase. According to the analysis of the regional data in Germany, the largest increase of professionally active people (at the age of 15-65), over the span of 2000-2014, was recorded in Baden-Württemberg and Bavaria (11% each), the largest decrease in Saxony-Anhalt (by 16.5%).²¹ While in Poland, in the analyzed period, five provinces recorded increase of professionally active citizens, the greatest one in Silesian Province (by 22%) and the remaining 11 provinces recorded decrease, the largest one in Opole (by -15.5%).

The analysis of professional activity ratio as per sex indicates that this ratio is higher among men than among women. Between 2000 and 2014 in Germany, the ratio of professional activity among women increased by 10.6 percent, up to 74.6% (in Poland it dropped by 1.2 per cent, down to 48.5%); as far as men are concerned, the ratio during this period increased by 3 percent, up to 82.5% (in Poland it increased by 0.6%, up to 64.7%).²²

Professional activity pattern as per age is arranged differently among women and men. In Germany, in 2014, the highest percentage of professionally active women was recorded in the group at the age of 45-50 (873 per 1000 women were working or looking for a job) and the largest percentage of professionally active men – in the group at the age of 40-45 (955 per 1000 men were working or looking for a job).²³ While in Poland, the highest percentage of professionally active women was recorded

²¹ *Bevölkerung und Erwerbstätigkeit Stand und Entwicklung der Erwerbstätigkeit in Deutschland*, Statistisches Bundesamt, Wiesbaden 2014, p. 100, 129-131.

²² *Analyse des Arbeitsmarktes für Frauen und Männer*, Bundesagentur für Arbeit, Nürnberg 2015, p. 2; *Bevölkerung und Erwerbstätigkeit...*, 2015, p. 34.

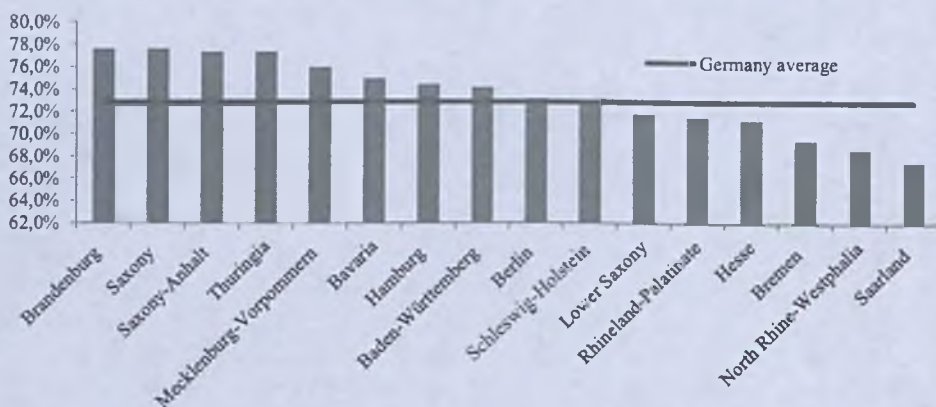
²³ *Ibid.*, p. 16-19.

in the group at the age of 40-45 (904 per 1000 women were working or looking for a job) and the largest percentage of professionally active men – in the group at the age of 35-40 (915, respectively).

As far as regional arrangement of Germany is concerned, between 2010 and 2014, the ratio of professional activity of women decreased in two lands - in Mecklenburg-Vorpommern (by 1.0 per cent, in 2014 – 75.9%) and Brandenburg (by 0.4 per cent in 2014 – 77.6%) (see graph No. 3). The remaining lands recorded increase, the greatest one in Bavaria (by 3 percent, 74.9%) and North Rhine-Westphalia (by 2.9 percent, 68.7%).²⁴

Graph 3

Women professional activity ratio (aged 15-65) in regions of Germany in 2014, expressed in %.



Source: <https://www.destatis.de/DE/ZahlenFakten/GesamtwirtschaftUmwelt/Arbeitsmarkt/Arbeitsmarkt.html>; 07.11.2015.

Between 2000 and 2014 the situation in Poland was different, only two voivode-ships recorded increase in rate of professional activity among women – Mazovia (by 3.2 percent, up to 54.2% in 2014) and Silesia (by 2.7 percent, 46.7%) (see graph 4). While the greatest decline of the analyzed ratio was recorded in Podkarpacie voivode-ship (by 5.9 percent, down to 46.4% in 2014) and Warmia-Mazuria (by 5.2 percent, down to 43.6%).

In the second quarter of 2014, the general employment ratio in Poland amounted to 62.6% and in Germany – to 73.6%, in comparison to the EU-28 average at the level of 65.5%.²⁵ Employment ratios are in general lower among women and older employ-ees. In 2015 men employment ratios in Poland and in Germany were at higher level than women employment ratios. This is characteristic for the European labour market

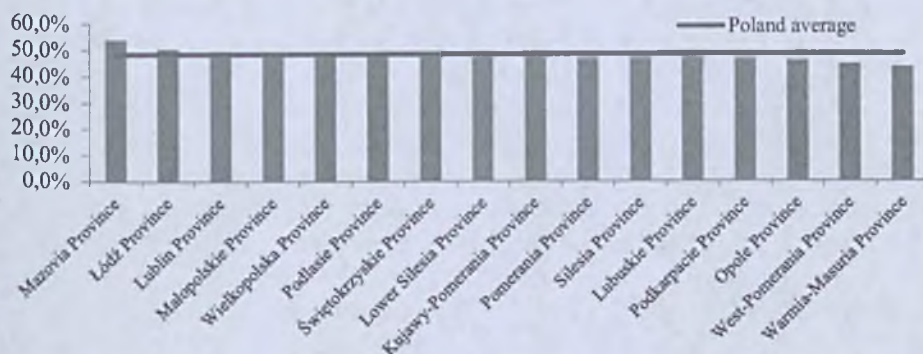
²⁴ *Ibid.*, p. 144.

²⁵ *Erwerbslosigkeit, Bruttoinlandsprodukt, Erwerbstätigkeit*, Statistik der Bundesagentur für Arbeit, Nürnberg 2015, p. 5.

and is i.a. associated with the fact that women are more involved in house chores. Nevertheless, considerable discrepancies were observed: difference between women and men employment ratios in Poland amounted to as much as 13.0 percent and in Germany – to 8.6 percent. From 2004 to 2014 women employment ratio (aged 15-64) in Germany increased by 10.3 percent, up to 69.5% (in Poland - by 9 percent, up to 55.2%) and men employment ratio – by 7.2 percent, up to 78.1% (in Poland – by 11 percent, up to 68.2%).²⁶

Graph 4

Women professional activity ratio (aged 15-65) in regions of Poland in 2014, expressed in %



Source: http://stat.gov.pl/bdl/app/dane_podgrup.dims?p_id=554424&p_token=0.16059189848601818,07.11.2015.

Mazovia voivodeship definitely stands out in comparison to the employment rates in rest of the country. At the end of 2014, this ratio amounted to 57.1% and was highest than the Polish average by 5.9 percent. Central location of this voivodeship exerts a large influence on its economic development.

Comparing the structure of employees according to the economic sectors in Poland, throughout 2010 and 2014, we can observe decreasing number of employees working in agriculture, from 13.04% down to 11.47%, whereas increases were recorded in the sector of services, from 56.6% up to 57.87%²⁷, industry and construction, from 30.29% up to 30.49%. In Germany, all of the economic sectors reported slight declines – in agriculture – from 1.61% down to 1.52%, in industry and construction – from 24.47% down to 24.37% and in services – from 73.92% down to 73.87% in services²⁸.

The spatial analysis of employees structure changes indicates the following patterns. In Poland, the greatest increase of people working in agriculture in 2014 (in comparison to 2010) was reported in the voivodeships: Warmia-Mazuria (by 4.2%),

²⁶ *Employment rates for selected population groups 2004-2014*; ec.europa.eu/eurostat; 07.11.2015.

²⁷ http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794,07.11.2015.

²⁸ *Erwerbstätige im Inland nach Wirtschaftssektoren*, <https://www.destatis.de>; stat.gov.pl, 07.11.2015.

Kujawy-Pomerania (by 2.5%) and West-Pomerania (by 0.4%). While the remaining voivodeships recorded decrease – the greatest one in Lower Silesia (by 29%), Podkarpacie (by 27.6%) and Małopolskie Province (by 24.6%). During the last five years the number of people working in service sectors increased, the greatest increase was recorded in Podkarpacie Province (by 3.5%), Małopolskie (by 3%) and in Lublin (by 2.9%).²⁹ The process of tertialisation – increasing the share of services in employment structure – can be also observed in Germany and its intensity is much higher than in Poland. The greatest increase of employees taking up jobs in service sector was recorded in two cities with land status - Berlin (by 5.3%) and Bremen (by 5.2%).³⁰

Unemployment rate in Poland remained at a significantly higher level than in Germany and, at the end of October 2015, it reached 9.6%, in comparison to 11.3% referring to the same period last year. In Germany these numbers were 6% and 6.3% respectively. Unemployment rate registered in Poland was within the range between 6.1% in Wielkopolska Province and 15.8% in Warmia-Mazuria Province. Whereas in Germany Bremen (10.7%) was the land with the highest unemployment rate, the lowest one was recorded in Bavaria (3.3%). More than half of the unemployed were men, who, at the end of October 2015, constituted 53.4 % of the unemployed in Germany, 47% in Poland. Their number in Poland, in comparison to 2003, grew by 0.5 percent and in Germany, decreased by 2.5 percent.

The correlation analysis of unemployment rate and rate of natural increase between 2004 and 2015 indicates that as unemployment rate in Poland increases, the rate of natural increase drops down and reversely (see chart No. 1). Therefore, it seems necessary to improve the situation of people in the age group between 18 and 45 on the labour market since it could hinder the unfavourable demographic trends. On the other hand, the situation in Germany is reverse; unemployment decrease does not result in a corresponding growth in rate of natural increase. It may stem from various reasons, i.a., from a consumptive, comfort-oriented lifestyle or reluctance to have children. Moreover, the trend of a low rate of natural increase can be observed in a highly developed countries with a stabilised life style.

Demographic transformations and occurring migration processes influence and will still influence the labour market in Poland and Germany. In order to keep the country economically competitive in a couple of years, it will be probably advisable to supplement the shortage of labour that is already surfacing in various sectors. Therefore, Poland should be interested in successive increase of educated foreigners participation in the labour market and the government and local authority bodies should be adequately prepared to handle migration processes. Nevertheless, the scale of immigrant employment in Poland should not exert a negative impact on safety issues and opportunities to find jobs for the citizens of Poland.³¹ As a result of migration

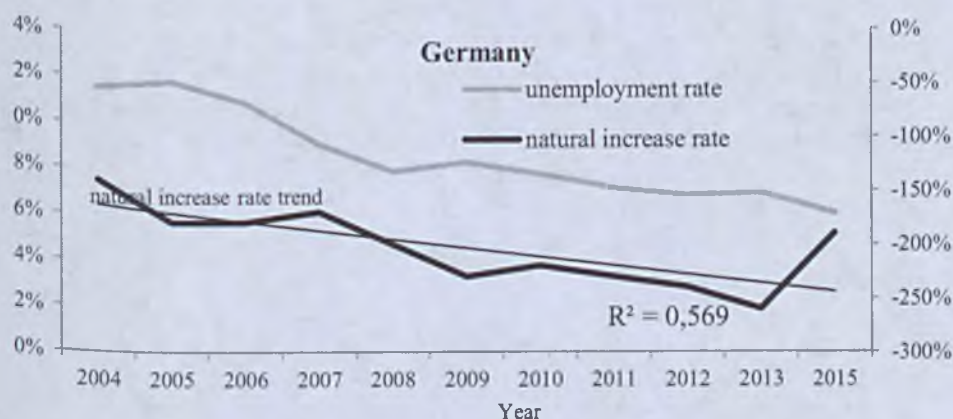
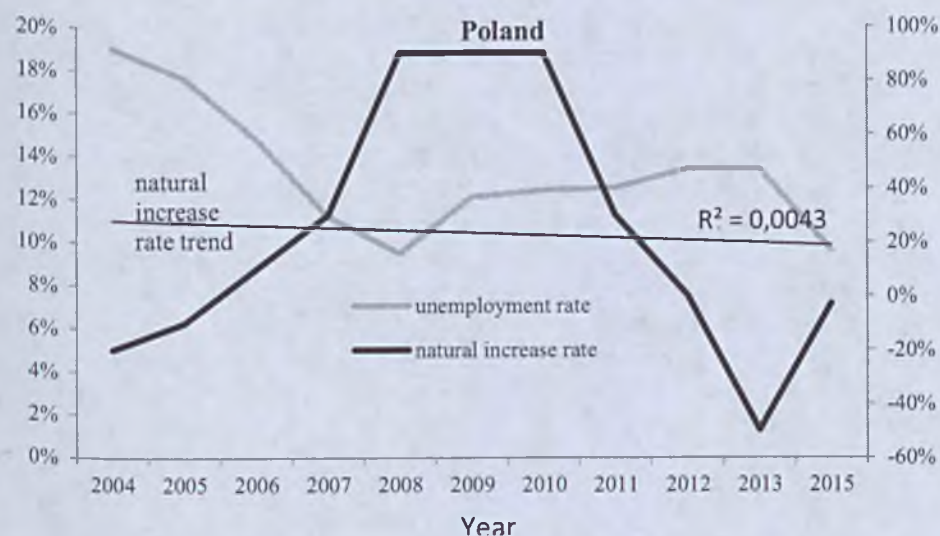
²⁹ http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794, 07.11.2015.

³⁰ *Bevölkerung und Erwerbstätigkeit Stand und Entwicklung der Erwerbstätigkeit in Deutschland*, Statistisches Bundesamt, Wiesbaden 2015, p. 157-162.

³¹ *Polityka migracyjna Polski wobec wyzwań demograficznych*, „Biuletyn. Forum Debaty Publicznej”, Nr 36, Wyd. Kancelaria Prezydenta Rzeczypospolitej Polskiej, Warszawa 2015, p. 72.

Chart 1

Changes in unemployment and natural increase rates in Poland and Germany between 2004 and 2015



Source: *Bevölkerung und Erwerbstätigkeit. Eheschließungen, Geborene und Gestorbene*, Statistisches Bundesamt, Wiesbaden 2014; http://stat.gov.pl/bdl/app/dane_podgrup.hier?p_id=554424&p_token=1185790794, 08.11.2015.

wave growing in force over recent couple of years, mostly to the states of Western Europe, in Poland, the immigrants coming to country for economic reasons, will be accepted only based on unilateral decisions of the Republic of Poland, and not as a result generated by the whole relocation system as proposed by the European Commission. The Polish government is of the opinion that relocating immigrants should be discussed with the EU member states on each occasion. German economy has

been experiencing significant transformations on the labour market throughout the last decade.³² At the beginning of 1960s West Germany started to lack a significant amount of non-qualified workers, which caused an influx of employees from abroad. Seasonal workers were mostly the employees from outside the continent, cheap and ready to take up worse-paid jobs. At that time, West Germany was the destination of workers from Turkey mostly. It is estimated that by the half of 1970s, their number increased to 1.5 mln.³³

In 2014, 43,663 foreign citizens job permits were issued, which is an increase by 11.7% in relation to the previous year. It is the highest to date number of annually issued foreign citizen job permits in Poland. Following the period of decrease in the second half of 2012, the first half of 2013, the number of issued permits started to increase and this tendency continued also throughout 2014. The greatest number of job permits was issued in Mazovia voivodeship (55.77%). The share of job permits issued in 2014 to the citizens of Ukraine in the overall number of the issued permits amounted to more than 60% (in 2013 it was 52%), followed by Vietnam (5.43%), China (4.89%) and Belarus (4.20%).³⁴

METHODS AND RESEARCH AREA

In the labour market analysis, taking into consideration the demographic changes occurring in lands in Germany and provinces in Poland, Hellwig's taxonomic method has been applied. This method allows for systematisation of sets of units under research according to the level of their similarity from the perspective of a selected group of features, as well as to determine positions of given regions in a particular group and, subsequently, divide it into classes.³⁵

Since the variables compared in the observation matrix are not uniform, there is a need to make them comparable through standardization,³⁶ which may be achieved through applying the formula:³⁷

³² N. Engbom, E. Detragiache, F. Raci, *The German Labor Market Reforms and Post-Unemployment Earnings*, International Monetary Fund, IMF Working Paper European Department, 2015, p. 5-6.

³³ W. Haug, *Foreword and executive summary*, [w:] W. Haug, P. Compton i Y. Courbage (ed.), *The demographic characteristics of immigrant populations*, Council of Europe Publishing, Strasbourg 2002, p. 8-9.

³⁴ *Informacja na temat zatrudniania cudzoziemców w Polsce*, GUS, Warszawa 2015, p. 1-2.

³⁵ W. Kosiedowski, *Regiony Europy Środkowo-Wschodniej w procesie integracji ze szczególnym uwzględnieniem wschodniego pogranicza Unii Europejskiej*, Uniwersytet Mikołaja Kopernika w Toruniu, Toruń 2008, p. 153.

³⁶ Obtaining comparable final diagnostic variables is a very important issue in taxonomic studies. It means i.a. that variables need to be deprived of their natural units which express diagnostic features and an order of variables values needs to be made comparable, meaning that ranges of features variability have to be equalized.

³⁷ A. Zeliaś, *Uwagi na temat wyboru metody normowania zmiennych diagnostycznych*, [w:] T. Kufel, M. Piłatowska (ed.), *Analiza szeregów czasowych na początku XXI wieku*, Uniwersytet Mikołaja Kopernika w Toruniu, Toruń 2002, p. 31, 32.

$$z_{ij} = \frac{x_{ij} - \bar{x}_j}{s_j}; \quad (1)$$

where z_{ij} – normalised value of $j^{(th)}$ variable for $i^{(th)}$ object, x_{ij} – j -value of $j^{(th)}$ variable for $i^{(th)}$ object, \bar{x}_j – arithmetic mean of X_j features – standard deviation of X_j feature

Standardised variables were used to form a so-called development model. The development model comprised maximum values of each standardized feature; therefore, before determining a taxonomic development indicator, variable destimulates were converted into stimulators according to the following formula:

$$x_{ij}^* = \frac{X_{\max}}{x_{ij}}; \quad (2)$$

Next, distance of each territorial unit from the model has been determined according to the formula³⁸:

$$c_{io} = \left[\sum_{j=1}^m v_j (z_{ij} - z_{oj})^2 \right]^{1/2}, \quad (i = 1, 2, \dots, n). \quad (3)$$

Where c_{io} is a generalized Euclidean distance of $i^{(th)}$ object from the model, – a value attributed to $j^{(th)}$ variable from a set of diagnostic variables, z_{ij} – normalised value of $j^{(th)}$ variable for $i^{(th)}$ object, z_{oj} – normalised value of $j^{(th)}$ variable for the model object.

On the basis of c_{io} distance a synthetic d_i indicator was expressed as:³⁹

$$d_i = 1 - \frac{c_{io}}{c_o} \quad (4)$$

³⁸ M. Piotrowska-Trybull, *Analiza konkurencyjności polskich województw za pomocą metod taksonomicznych*, [w:] W. Kosiedowski (ed.), *Konkurencyjność regionów w okresie przechodzenia do gospodarki rynkowej. Międzynarodowa analiza porównawcza: Białoruś, Litwa, Łotwa i Polska*, Uniwersytet Mikołaja Kopernika w Toruniu, Toruń 2004, p. 431.

³⁹ Interpretation of d_i quantity is as follows: the greater its value, the higher a level of development achieved by a particular object. Synthetic indicator assumes values within the range [0.1].

where:⁴⁰ $c_o = \overline{c_o} + 2S_o$,

$$\overline{c_o} = \frac{1}{n} \sum_{i=1}^n c_{io},$$

$$S_o = \left[\frac{1}{n} \sum_{i=1}^n (c_{io} - \overline{c_o})^2 \right]^{1/2}.$$

d – value of a synthetic indicator for $i^{(th)}$ object,

c_i – generalized Euclidean distance of $i^{(th)}$ object from the model,

c_o – normalizing factor,

$\overline{c_o}$ – arithmetic mean of generalized Euclidean distances of objects from the model,

s_o – standard deviation of generalized Euclidean distances of objects from the model.

The studies encompassed 16 districts of Poland and 16 union lands of Germany, 32 regions in total.

SPATIAL DIFFERENTIATION OF POLISH AND GERMAN REGIONS WITH REGARDS TO DEMOGRAPHIC PROCESSES AND LABOUR MARKET

The initial set of statistical indicators proposed in comparable analysis included 38 features for 2013; determining their demographic potential and job market. The set of potential diagnostic variables has been created after conducting a substantive-formal analysis of these variables. These variables have been divided into 2 groups corresponding to areas of population life standards. The list of the variables has been presented in table 6.

The first stage of analysis was to conduct particular research in two groups describing demographic conditions and labour market.

In each of the groups, elimination has been carried out in two stages. At the first one, coefficient of variation has been applied, allowing to eliminate those features for which the coefficient limit value has been determined to be below 10%. The second stage of elimination consisted in rejecting the features highly correlated with the other ones. It has been achieved using a correlation coefficients matrix. The critical value of correlation coefficient was determined to be at the level of 0.9.

⁴⁰ K. Sadowska, *Analiza przedsiębiorczości i innowacyjności regionów Europy Środkowo-Wschodniej za pomocą metod ilościowych*, [w:] W. Kosiedowski (ed.), *Przedsiębiorczość i innowacyjność w procesie rozwoju regionów Europy Środkowo-Wschodniej*, Uniwersytet Mikołaja Kopernika w Toruniu, Toruń 2013, p. 270.

Table 6

Set of potential diagnostics variables in the scope of demographics and labour market

Symbol	Variable	Nature of variable	Standard deviation	Coefficient of variation %
Demographics				
X_1	General number of women in population, in %	S	0.385	0.751
X_2	Population per 1 km ² (population density)	S	777.194	197.195
X_3	Rate of natural increase	S	2.035	113.056
X_4	Population at pre-working age (14 and less) against population in general, in %	S	1.390	10.084
X_5	Population at working age (15-64, men and women) against population in general, in %	S	2.569	3.766
X_6	Population at retirement age (65 and more) against population in general, in %	D	3.757	20.872
X_7	Average further life span of men against population in general, in %	S	2.383	3.171
X_8	Average further life span of women, in %	S	0.963	1.178
X_9	Population at non-working age per 100 people at working age, in %	D	3.687	6.753
X_{10}	Population at retirement age per 100 people at pre-working age, in %	D	40.097	29.446
X_{11}	Population at retirement age per 100 people at working age, in %	D	3.488	11.3467
X_{12}	Live births per 1000 people	S	0.960	10.814
X_{13}	Live births per 1000 women at reproductive age, i.e. 15-45 (women fertility rate)	S	3.188	7.008
X_{14}	Deaths per 1000 people	D	1.192	11.203
X_{15}	Infant deaths per 1000 live births (up to the first year of life)	D	0.916	22.931
X_{16}	Deaths of people at the age of up to 65 per 1000 people in the same age group	D	0.662	23.215
X_{17}	Deaths in general per 1000 live births	D	25.570	20.850
X_{18}	Feminisation rate (women per 100 men)	S	1.699	1.616
X_{19}	Net migration rate against permanent stays at pre-working age	S	11.606	521.637
X_{20}	Net migration rate against permanent stays at working age	S	13.371	421.552
X_{21}	Net migration rate against permanent stays at retirement age	S	5.687	2219.381
X_{22}	Marriages per 1000 people	S	0.464	9.989
X_{23}	Divorces per 1000 people	D	0.315	16.725

Labour market				
X_{24}	Share of registered disabled unemployed in % of unemployed in general	D	1.292	22.878
X_{25}	Share of registered unemployed at the age of 15-25 in % of unemployed in general	D	17.883	104.558
X_{26}	Share of registered unemployed at the age of 55-65 in % of unemployed in general	D	4.009	23.724
X_{27}	Share of registered unemployed males in % of unemployed in general	D	4.637	9.092
X_{28}	Share of registered unemployed females in % of unemployed in general	D	3.443	7.118
X_{29}	Registered unemployed remaining without job longer than 1 year (permanent) in % of unemployed in general	D	4.671	12.904
X_{30}	Unemployed per 1000 people	D	14.624	28.781
X_{31}	Share of registered unemployed remaining without job longer than 1 year in % of professionally active population	D	2.400	35.397
X_{32}	Rate of registered unemployment, in %	D	4.301	37.473
X_{33}	Share of registered unemployed in number of people at working age	D	2.358	30.129
X_{34}	Employment rate (people in 15-65 age group)	S	3.284	6.405
X_{35}	Women employment rate in %, 15 and over	S	5.567	11.974
X_{36}	Men employment rate in %, 15 and more	S	3.389	6.011
X_{37}	Working population per 1000 people	S	140.431	40.220
X_{38}	Economic activity rate (share of professionally active population in general number of people at 15 and over)	S	2.763	4.821

S – stimulator; D – destimulate

Source: own study.

DEMOGRAPHIC CONDITIONS

Demographic potential has been presented with the use of chosen demographic features determining condition and population spread, structure, internal growth and migration trends. Those indicators which may illustrate a differentiation of demographic changes in given regions and can be used for identifying demographic threats in Poland and Germany have been particularly emphasised.

In the course of studying regional development in the scope of demographic situation, 23 initial variables have been determined and, subsequently, subjected to reduction process. As a result of the conducted elimination, the following variables have been deleted: $X_1, X_3, X_4, X_5, X_6, X_7, X_8, X_9, X_{12}, X_{13}, X_{14}, X_{18}$ i X_{22} . 10 variables have been finally included into the study. They have been attributed with weight based on their influence on development of a region (see table 7).

Table 7

Set of diagnostics variables and their weight for the group of demographic potential

Group	Weight attributed to a variable	Variable symbol	Variable name
Demographic potential	0.08	X_2	Population per 1 km ² (population density)
	0.12	X_{10}	Population at retirement age per 100 people at pre-working age, in %
	0.12	X_{11}	Population at retirement age per 100 people at working age, in %
	0.08	X_{15}	Infant deaths per 1000 live births (up to the first year of life)
	0.12	X_{16}	Deaths of people at the age of up to 65 per 1000 people in the same age group
	0.12	X_{17}	Deaths in general per 1000 live births
	0.08	X_{19}	Net migration rate against permanent stays at pre-working age
	0.08	X_{20}	Net migration rate against permanent stays at working age
	0.08	X_{21}	Net migration rate against permanent stays at retirement age
	0.12	X_{23}	Divorces per 1000 people

Source: own study.

The obtained results are presented in table 8.

Table 8

Demographic conditions ranking of regions according to a synthetic development indicator

Region	Distance from the model C_{10}	Synthetic indicator d_i	Rank
Berlin	1.681	0.521	1
Hamburg	1.755	0.499	2
Małopolskie Province	1.860	0.469	3
Pomerania Province	2.146	0.388	4
Podkarpackie Province	2.221	0.366	5
Mazovia Province	2.277	0.351	6
Wielkopolska Province	2.283	0.349	7
Bavaria	2.287	0.347	8
Baden-Württemberg	2.376	0.322	9
Hesse	2.542	0.275	10

Opole Province	2.664	0.240	11
Kujawy-Pomerania Province	2.675	0.237	12
Lower Silesia Province	2.719	0.224	13
Bremen	2.723	0.223	14
West-Pomerania Province	2.728	0.222	15
Lubuskie Province	2.729	0.221	16
Lower Saxony	2.746	0.217	17
Schleswig-Holstein	2.749	0.216	18
North Rhine- Westphalia	2.758	0.213	19
Podlasie Province	2.794	0.203	20
Brandenburg	2.808	0.199	21
Saxony	2.842	0.189	22
Rhineland-Palatinate	2.843	0.189	23
Silesia Province	2.889	0.176	24
Świętokrzyskie Province	2.900	0.173	25
Warmia-Masuria Province	2.909	0.170	26
Lublin Province	3.030	0.136	27
Łódź Province	3.032	0.135	28
Mecklenburg-Vorpommern	3.033	0.135	29
Saarland	3.265	0.069	30
Thuringia	3.297	0.060	31
Saxony-Anhalt	3.478	0.008	32

Source: own study.

Based on the proposed final set of demographic indicators, a synthetic development indicator in demographic potential area has been calculated for each of the regions. The values of taxonomic development indicator for given regions in 2013 have been determined to be within the range between 0.5205941 to 0.0079667. The first position in the ranking has been taken up by the capital city of Germany, the second one by Hamburg. The high value of Berlin and Hamburg development indicator predominantly stems from high population density, positive rate of natural increase and number of the employed per 1000 people at working age. Małopolskie Province scored highest among the provinces (3rd position). Much lower positions have been taken up by the provinces: Silesia, Świętokrzyskie, Warmia-Masuria, Lublin and Łódź (24th to 28th, respectively) – they were mostly characterized by low population density, negative rate of natural increase and high rate of infant deaths per 1000 of live births (up to the first year of life). The union lands found themselves at the last four positions: Mecklenburg-Vorpommern, Saarland, Thuringia and Saxony-Anhalt – those regions deal with ongoing unfavourable depopulation processes. Their demographic potential feature is foremost declining population number caused by a negative rate of natural increase and a negative net migration rate.

In order to maintain the positive rate of natural increase, a new wave of immigrant may be selected. It might be solved through populating the already depopulated eastern lands in Germany (Brandenburg, Saxony, Mecklenburg-Vorpommern). It is estimated that in 15 year's time, the Polish-German boundary will lack ca. one third of officers, blue collar workers and entities running own business activities. Therefore, it is necessary to develop a transparent concept of migration policy.⁴¹

LABOUR MARKET

Changes occurring in population age pattern result in numerous consequences, both social and economic. Labour market transformations are of the underlying significance here. The estimated decline in number of people at working age and accelerating rate of aging will lead to irregularities in age patterns of work force in the future.⁴²

16 initial variables have been chosen to measure levels of regional development in the scope of job market. In the course of reduction process, 5 variables have been eliminated (X_{27} , X_{28} , X_{35} , X_{36} i X_{38}). As a result, 10 diagnostic features have been selected for further studies; they have been attributed with weights (see tab. No. 9).

Table 9

Set of diagnostics variables and their weights for the group of labour market

Group	Weight attributed to a variable	Variable symbol	Variable name
Labour market	0.08	X_{24}	Share of registered disabled unemployed in % of unemployed in general
	0.07	X_{25}	Share of registered unemployed at the age of 15-25 in % of unemployed in general
	0.08	X_{26}	Share of registered unemployed at the age of 55-65 in % of unemployed in general
	0.08	X_{29}	Registered unemployed remaining without job longer than 1 year (permanent) in % of unemployed in general
	0.12	X_{30}	Unemployed per 1000 people
	0.07	X_{31}	Share of registered unemployed remaining without job longer than 1 year in % of professionally active population
	0.1	X_{32}	Rate of registered unemployment, in %
	0.2	X_{33}	Share of registered unemployed in number of people at working age
	0.08	X_{34}	Women employment rate in %, 15 and over
	0.12	X_{37}	Working population per 1000 people

Source: own study.

⁴¹ F. Hüfner, C. Klein, *The German Labour Market: Preparing for the Future*, Organisation for Economic Co-operation and Development, No. 983, 2012, p. 32-33.

⁴² K. Baładynowicz-Panfil, *Współczesne mechanizmy wydłużania okresu aktywności zawodowej na przykładzie wybranych krajów*, [w:] J. Kowalski, P. Szukalski (ed.), *Pomyślne starzenie się w perspektywie nauk o pracy i polityce społecznej*, Uniwersytet Łódzki, Łódź 2008, p. 34.

The obtained results are presented in table 10.

Table 10

Labour market ranking of regions according to a synthetic development indicator

Region	Distance from the model C_{io}	Synthetic indicator d_i	Rank
Baden-Württemberg	1.729488	0.523535	1
Bavaria	1.789479	0.507007	2
Lower Saxony	1.995422	0.450271	3
Hamburg	2.005764	0.447422	4
Hesse	2.007298	0.446999	5
Rhineland-Palatinate	2.376414	0.345309	6
Schleswig-Holstein	2.39021	0.341509	7
Wielkopolska Province	2.50213	0.310675	8
Saarland	2.600068	0.283694	9
Mecklenburg-Vorpommern	2.623833	0.277147	10
Berlin	2.646166	0.270994	11
North Rhine-Westphalia	2.650279	0.269861	12
Thuringia	2.656876	0.268044	13
Silesia Province	2.706956	0.254247	14
Małopolskie Province	2.799837	0.228659	15
Saxony-Anhalt	2.831042	0.220062	16
Pomerania Province	2.842457	0.216917	17
Opole Province	2.868904	0.209631	18
Bremen	2.869424	0.209488	19
Mazovia Province	2.871636	0.208878	20
Saxony	2.872783	0.208562	21
Brandenburg	2.914678	0.19702	22
Lower Silesia	3.006296	0.17178	23
Lubuskie Province	3.04312	0.161635	24
Lublin Province	3.153946	0.131103	25
West-Pomerania Province	3.170275	0.126605	26
Łódź Province	3.209221	0.115875	27
Podlasie Province	3.211947	0.115124	28
Świętokrzyskie Province	3.245922	0.105764	29
Kujawy-Pomerania Province	3.258266	0.102364	30
Podkarpacie Province	3.269293	0.099326	31
Warmia-Masuria Province	3.376377	0.069825	32

Source: own study.

Baden-Württemberg scored highest on the labour market ranking; the region was characterized by the highest rate of economic activity, sharing position No. 1 with Bayern in this regard, and low unemployment rates. Taking up 8th position, Wielkopolskie Province scored highest among the Polish provinces. What is significant is that all regions occupying the last bottom positions on this list were Polish provinces. It is reflected in the labour market ratios, i.a. unemployment rate, the highest one in Warmia-Masuria voivodeship (15.8%). This situation indicates significantly lower pace of social and economic development of this region in comparison to the rest of the country. The analysis of the unemployment rate in Germany by regions indicates that Bremen (10.7%) and Berlin (10.2%) have the highest unemployment rates, they are also characterized by high population density, which undoubtedly translates into issues with finding employment. Bavaria (3.3%) is the region with lowest unemployment rate – it is one of the best economically-developed regions in Germany. Slightly worse result in this respect was recorded in other southern land – Baden-Württemberg. Increase of service sector share in employment is characteristic for these regions where citizen's income reached a certain level allowing for increase of supply and demand regarding particular services.

LABOUR MARKET IN LIGHT OF DEMOGRAPHIC CHANGES

Having conducted the analysis of each two areas separately, the same method has been applied to study them inclusively. The initial set of features included 38 variables in total (see tab. 6), among which some variables were eliminated because of their insufficient discriminating capacity ($V_i < 0.1$). These were the following features: X_1 , X_5 , X_7 , X_8 , X_9 , X_{13} , X_{18} , X_{22} , X_{27} , X_{28} , X_{34} , X_{36} and X_{38} . The next step of elimination consisted in rejecting the features highly correlated with the other ones. It has been achieved using a correlation coefficients matrix. The critical value of correlation coefficient at the level of 0.9 caused that two subsequent features, X_4 and X_6 have been excluded from the set of diagnostic variables.

Finally, 24 features, chosen among the initial 38, have been subjected to further research procedures. All variables have been attributed with weights, according to their significance in demographic process and labour market (see tab. No. 11). Since 15 of the included features: X_{10} , X_{11} , X_{14} , X_{15} , X_{16} , X_{17} , X_{23} , X_{24} , X_{25} , X_{26} , X_{29} , X_{30} , X_{31} , X_{32} i X_{33} functioned as destimulates, they have been converted to stimulators according to formula no. 2. Synthetic indicator has been calculated for each of the units (regions) under analysis and subsequently, based on the received values, a position of a given region has been determined with regards to the achieved level of development in terms of labour market in comparison with demographic changes. Achieved results were collected in the table 12.

Table 11
Set of diagnostic variables and their weights

Group	Weight attributed to a group	Variable symbol	Variable name
Demographic potential in comparison to labour market	0.03125	X_2	Population per 1 km ² (population density)
	0.0625	X_3	Rate of natural increase
	0.0625	X_{10}	Population at retirement age per 100 people at pre-working age, in %
	0.0625	X_{11}	Population at retirement age per 100 people at working age, in %
	0.0625	X_{12}	Live births per 1000 people
	0.03125	X_{14}	Deaths per 1000 people
	0.03125	X_{15}	Infant deaths per 1000 live births (up to the first year of life)
	0.03125	X_{16}	Deaths of people at the age of up to 65 per 1000 people in the same age group
	0.03125	X_{17}	Deaths in general per 1000 live births
	0.03125	X_{19}	Net migration rate against permanent stays at pre-working age
	0.03125	X_{20}	Net migration rate against permanent stays at working age
	0.03125	X_{21}	Net migration rate against permanent stays at retirement age
	0.03125	X_{23}	Divorces per 1000 people
	0.03125	X_{24}	Share of registered disabled unemployed in % of unemployed in general
	0.03125	X_{25}	Share of registered unemployed at the age of 15-25 in % of unemployed in general
	0.03125	X_{26}	Share of registered unemployed at the age of 55-65 in % of unemployed in general
	0.0625	X_{29}	Registered unemployed remaining without job longer than 1 year (permanent) in % of unemployed in general
	0.0625	X_{30}	Unemployed per 1000 people
	0.03125	X_{31}	Share of registered unemployed remaining without job longer than 1 year in % of professionally active population
	0.0625	X_{32}	Rate of registered unemployment in %
	0.0625	X_{33}	Share of registered unemployed in number of people at working age
	0.03125	X_{34}	Job offers per 100 unemployed
	0.03125	X_{36}	Women employment rate in %, 15 and over
	0.0625	X_{38}	Working population per 1000 people

Source: own study.

Table 12

Synthetic indicators regarding level of development in terms of job marker in comparison with demographic changes in Polish and German regions (according to development model method)

Region	Distance from the model C_m	Synthetic indicator d_i	Rank
Berlin	2.049582	1	1
Hamburg	1.739124	0.963894	2
Bremen	2.761805	0.920105	3
North Rhine-Westphalia	2.660694	0.828791	4
Saarland	3.039198	0.81524	5
Silesia Province	2.607097	0.813846	6
Baden-Württemberg	1.964631	0.80559	7
Hesse	2.188632	0.804381	8
Małopolskie Province	2.272212	0.797156	9
Saxony	2.870553	0.797044	10
Rhineland-Palatinate	2.571406	0.794906	11
Bavaria	1.936376	0.792418	12
Schleswig-Holstein	2.584529	0.792304	13
Lower Saxony	2.396986	0.790712	14
Mazovia Province	2.4708	0.789114	15
Lower Silesia Province	2.684409	0.788656	16
Łódź Province	3.02669	0.78774	17
Thuringia	2.9533	0.78728	18
Pomerania Province	2.326799	0.786245	19
Podkarpace Province	2.687599	0.785554	20
Wielkopolska Province	2.181071	0.785208	21
Kujawy-Pomerania Province	2.789587	0.785208	21
Saxony-Anhalt	3.210886	0.784515	23
Świętokrzyskie Province	2.993492	0.784283	24
Opole Province	2.64521	0.784168	25
Lublin Province	2.952553	0.781731	26
Brandenburg Province	2.935337	0.781382	27
West-Pomerania Province	2.756884	0.78045	28
Lubuskie Province	2.628663	0.780216	29
Mecklenburg-Vorpommern	2.759725	0.779749	30
Warmia-Masuria Province	2.911759	0.778696	31
Podlasie Province	2.883741	0.778579	32

Source: own study.

Table 13
Rankings of regions in particular research areas

Region	Demographic conditions	Labour market	General level of labour market development in comparison with demographic changes
	Rank		
Baden-Württemberg	9	1	7
Bavaria	8	2	12
Berlin	1	11	1
Brandenburg	21	22	27
Bremen	14	19	3
Hamburg	2	4	2
Hesse	10	5	8
Mecklenburg-Vorpommern	29	10	30
Lower Saxony	17	3	14
North Rhine-Westphalia	19	12	4
Rhineland-Palatinate	23	6	11
Saarland	30	9	5
Saxony	22	21	10
Saxony-Anhalt	32	16	23
Schleswig-Holstein	18	7	13
Thuringia	31	13	18
Łódź Province	28	27	17
Mazovia Province	6	20	15
Małopolskie Province	3	15	9
Silesia Province	24	14	6
Lublin Province	27	25	26
Podkarpacie Province	5	31	20
Podlasie Province	20	28	32
Świętokrzyskie Province	25	29	24
Lubuskie Province	16	24	29
Wielkopolska Province	7	8	21
West-Pomerania Province	15	26	28
Lower Silesia Province	13	23	16
Opole Province	11	18	25
Kujawy-Pomerania Province	12	30	21
Pomerania Province	4	17	19
Warmia-Masuria Province	26	32	31

Source: study based on tables 8, 10 and 12.

The compared study results indicate that the regions taking up the highest positions in the demographic potential ranking, simultaneously occupy lower positions in the labour market ranking and the other way around. The first group includes: Berlin (1st place in the demographic conditions ranking and 11th in the labour market ranking), Małopolskie (respectively: 3rd and 15th place in the rankings), Pomerania (4th and 17th place), Podkarpacie (5th and 31st) and Mazovia (6th and 20th). What is noticeable, this group includes mostly Polish provinces, characterized by much better demographic indicators and worse labour market indicators at the same time.

Considering both the values of variables used to calculate the demographic potential and the labour market, it can be stated that advancing in the analyzed ranks mostly depended on: net migration rate and unemployment rate. High net employment rates were recorded in Mazovia voivodeship, Berlin, Bremen and Hamburg, which indicates that these regions are attractive to settle in. A positive image of Mazovia region, being the largest and most developed area of Poland, emerging from statistical data may be however misleading, since Warsaw is the city which impacts the statistics of the voivodeship in a significant manner⁴³. Moreover, taking account of the fact that scale and direction of migration are most often determined by the level of economic development, the high net migration rate may result from the immigrant's need to search for better job conditions. Furthermore, the statistics of the capital regions are boosted by their administrative, financial and intellectual functions, leaving the other regions far behind. The conducted analysis confirms that large agglomerations have significant impact on the level of demographic and economic potential of particular regions. The strength of their impact is however highly variable.

CLASSIFICATION

Synthetic indicators allow for a linear classification of objects. It consists in distinguishing the groups which include elements that are similar in terms of synthetic development indicator.⁴⁴ The classification has been made according to a standard deviation method, based on applying two parameters of synthetic indicators (z_i): arithmetic mean (\bar{x}) and standard deviation (s_z). According to the method of object classification used in the analysis, 4 classes can be distinguished:

- class 1 (high development level): $z_i \geq \bar{x} + s_z$
- class 2 (medium-high development level): $\bar{x} + s_z > z_i \geq \bar{x}$;
- class 3 (medium-low development level): $\bar{x} > z_i \geq \bar{x} - s_z$;
- class 4 (low development level): $z_i < \bar{x} - s_z$.

⁴³ *Wpływ potencjału demograficznego i gospodarczego miast wojewódzkich na kondycję województwa*, Mazowiecki Ośrodek Badań Regionalnych, Warszawa 2013, p. 3-20.

⁴⁴ E. Nowak, *Metody taksonomiczne w klasyfikacji obiektów społeczno-gospodarczych*, PWE, Warszawa 1990, p. 93.

As a result of classification, three different classes of regions development have been distinguished. Three regions have been placed in both the first and the second class, whereas 26 regions have been allocated to the third class. No regions have been classified into the fourth class (see tab. No. 14).

Table 14

Classification of regions with regards to demographic changes and labour market

Class and development level	Classification ranges	Regions
class 1	$z \geq 0.859756$	Berlin, Hamburg, Bremen
class 2	$0.859756 < z_i \leq 0.807036$	North Rhine-Westphalia, Saarland, Silesia Province
class 3	$0.807036 < z_i \leq 0.754317$	Baden-Württemberg, Hesse, Małopolskie Province, Saxony, Rhineland-Palatinate, Bavaria, Schleswig-Holstein, Lower Saxony, Mazowieckie Province, Lower-Silesia, Łódź Province, Thuringia, Pomerania Province, Podkarpacie Province, Kujawy-Pomerania Province, Wielkopolska Province, Saxony-Anhalt, Świętokrzyskie Province, Opole Province, Lublin Province, Brandenburg, West-Pomerania, Lubuskie Province, Mecklenburg-Vorpommern, Warmia-Masuria Province, Podlasie Province
class 4	$z_i > 0.754317$	-----

Source: own study based on tab. 12.

The first class was characterised by a very high labour market development level in comparison to demographic changes has been formed by three cities functioning on the basis of union state administrative division: Berlin, Hamburg and Bremen. As far as population density is concerned, these regions occupy the first three places among all Polish and German regions (Berlin – 1st place, Hamburg – 2nd and Bremen – 3rd). Berlin and Hamburg have also scored highest with regards to a positive net migration rate and rate of natural increase. Positive net migration rate undoubtedly illustrates Berlin and Hamburg attractiveness, wide access to various services and good labour market situation. The third place has been taken by Bremen, recording low indicators of the registered unemployed at the age between 55 and 65 and, simultaneously, a negative rate of natural increase and net migration rate. The values of synthetic indicator in this class varied from 1 for Berlin to 0,919265 for Bremen.

Map 2. Illustrates cartographic representation of the results.

Map 2

Development level of Poland and Germany with regards to demographic changes and labour market

Source: own study based on tab. 14.

The second class, of medium-high development level, has been formed by two union lands – North Rhine-Westphalia and Saarland – and one Polish region – Silesia Province. In 2013, these lands were mainly characterised by low indicators of the unemployed at working age and men. Demographic indicators in these lands were unfavourable, i.a.: low share of people at working age in the number of general population and a low women fertility rate. Whereas Silesia Province was characterised by a low share of the unemployed remaining without a job for more than 1 year in percentage of professionally active population (3rd place) and recorded much worse results with regards to average further life span of men (29th place) and women (32nd place). The values of synthetic indicator varied from 0.826991 for North Rhine-Westphalia to 0.811889 for Silesia.

The third class, of medium-low development level, has turned out to be most numerously represented, encompassing 26 regions. It included 11 union lands and 15 provinces. Baden-Württemberg was the leader among German union lands and Małopolskie – the leader among Polish provinces. Mecklenburg-Vorpommern has scored the lowest rank among German regions and Podlaskie – lowest among Polish provinces. Both with regards to rate of natural increase and percentage of population in the age group between 15 and 65, German union lands were characterised by very

low values. Moreover, the lands under study had unfavourable women fertility rate, which is one of the more important factors conditioning the process of population reproduction. Therefore, these lands recorded much lower rate of natural increase in comparison to provinces. In 2013, the lowest rate of natural increase per 1000 people was registered in Saxony-Anhalt (-5.9‰). Most of variables concerning demographic situation were more favourable in provinces than in lands. I mostly pertains to rate of natural increase and population age pattern – significantly less people at the age of 65 and over in Poland than in Germany. Whereas, most of the variables concerning labour market were much more favourable in lands than in provinces. In this class, the values of synthetic indicator varied from 0.803546 for Baden-Württemberg to 0.77625 for Podlasie Province.

SUMMARY

The conducted comparison analysis of Poland and Germany has indicated that demographic situation occurring in particular regions is significantly variable since each of the regions deals with different demographic problems. In the case of provinces, population increase happens when labour market situation improves. It is important for young people to combine professional ambitions and family aspirations. Thus, the role of state needs to consist in shaping better conditions to implement pro-family policy. Whereas, union lands deal with a totally different situation – netter labour market conditions do not guarantee increase in number of births. Comfortable life-style and cultural transformations cause the German youth not to hurry with regards to making their decisions on parenthood. Decrease in population at working age can undoubtedly result in slowing German economic growth down and encumber the system of social insurances. Despite the fact that the number of births remains at a low level and constantly increasing life span, Poland currently belongs to the European countries characterised by a relatively slow population aging process. It is estimated that by 2020 Poland will not yet be facing job shortage, whereas in 2030 its scale will significant⁴⁵.

It is necessary to underline that the conducted comparative analysis of Poland and Germany by regions is only preliminary in nature. It may be used as groundwork for strengths and weaknesses of the studied units, whose identification is required for determining strategic goals of their development. The wave of immigrants coming from other continents undoubtedly exerts influence on demographic situation and labour market in Polish and German regions. The integration of immigrants is currently a hot topic, especially in European countries and large agglomerations. International migration trends turn out to be highly difficult to forecast, since they depend on numerable variables. Therefore, Poland and Germany, and other countries as well, face numerous crucial challenges.

⁴⁵ *Sytuacja demograficzna Polski*, GUS, Warszawa 2004, p. 47-48.

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Słowa kluczowe: rynek pracy, demografia, metody taksonomiczne, regiony Polski i Niemiec

Słowa kluczowe: job market, demography, taxonomic analysis, Polish and German regions

ABSTRACT

The article analyses the job market in the context of demographic changes that affect the regions of Poland and Germany, measures the regions' development using selected taxonomic methods, explores similarities and differences between them, as well as shows other regional disparities. The study comprised 16 Polish provinces and 16 German states (so-called Länder), a total of 32 regions. Covering an area that is highly diversified not only economically but also demographically and in terms of the job market, the regions are here subjected to a multidimensional statistical analysis.