

**DEMOGRAPHIC DETERMINANTS OF POTENTIAL
LABOUR FORCE SUBSTITUTION IN POLAND
AND EUROPE**

Jerzy T. Kowaleski, Anna Majdzińska

Unit of Demography and Social Gerontology

Faculty of Economics and Sociology

University of Lodz

e-mail: jerzykowaleski@wp.pl; a_majdzinska@uni.lodz.pl

Key words: potential labour force, working-age subpopulation, changes in the population age structure, population aging process.

A b s t r a c t

This article presents the levels of the potential labour force in European countries resulting from the inflow of young cohorts into the age group 15+ and the outflow of people aged 65 years and older from the labour market. The purpose of the analysis is to assess the replacement of the present and future potential labour force in European countries, particularly in Poland. This study is at the level of voivodeships and poviats.

**DEMOGRAFICZNE UWARUNKOWANIA ZASTĘPOWALNOŚCI POTENCJALNYCH
ZASOBÓW PRACY W POLSCE I W EUROPIE**

Jerzy T. Kowaleski, Anna Majdzińska

Zakład Demografii i Gerontologii Społecznej

Wydział Ekonomiczno-Socjologiczny

Uniwersytet Łódzki

Słowa kluczowe: potencjalne zasoby pracy, ludność w wieku produkcyjnym, zmiany w strukturze wieku populacji, proces demograficznego starzenia się.

A b s t r a k t

W opracowaniu przedstawiono bilanse potencjalnych zasobów pracy w krajach europejskich, wynikające z napływu młodych roczników do grupy 15 lat i więcej oraz odpływu poza rynek pracy roczników w wieku 65+ lat. Celem analizy jest ocena zastępowalności (rotacyjności) obecnych i przyszłych potencjalnych zasobów pracy w krajach europejskich, ze szczególnym uwzględnieniem Polski (w której przypadku analizy są prowadzone na poziomie województw i powiatów).

Introduction

According to economic criterion, the potential labour force and the working-age subpopulation are equivalent. However, the definitional heterogeneity of working age (especially of the mandatory retirement age) causes international comparisons of the potential labour force to be identified as the age group of 15–64 years (following the biological division into age groups). The real labour force consists of all economically active people regardless of their age.

The size of the potential labour force and of the real labour force depends on many factors: demographics (the size of a population inhabiting an area, population structure by sex, age and educational attainment), economics (the level of wages and the supply of products and their prices), legal aspects (the working-age band determined by the number of obligatory school years and official retirement age, etc.), and socio-cultural determinants (the prevailing traditions and customs, including the family model and the attitudes people hold to engaging in economic activity) (KRYŃSKA, KWIATKOWSKI 2013, p. 87–90).

Changes in the age structure of most European populations, e.g. the shrinking of the potential labour force, are caused by population aging, i.e. a steadily expanding share of older people in relation to other age groups. The main factors in this process are low fertility rates (much below the generation replacement levels)¹ and rising average life expectancy. Their combined influence on an area is frequently made worse by negative net migration².

This article presents the size of the potential labour force in European countries as determined by the entry of younger birth cohorts and the withdrawal of older birth cohorts from the labour market³, and estimates the current and future potential labour force replacement ratios for European countries and Poland (by voivodeship and powiat).

The population age structure in European countries and Poland is analysed based on information from years 2005, 2010, 2014, 2020, 2025, 2030,

¹ One reason why fertility rates have been declining in highly-developed economies over the last several decades is changes in the matrimonial and procreative models. The most important of them are delayed decisions to marry and older age at first child-birth, an increasing proportion of couples choosing to live in free unions, a falling percentage of multi-child families, and an increasing percentage of couples deciding against having offspring at all. The family formation changes are explained in the context of the second demographic transition (see: KOTOWSKA 1999, KURKIEWICZ 2008, LESTHAEGHE 2010, VAN DE KAA 2002).

² For more on population aging, the causes, consequences and course of this process in different countries of the world (see: UHLENBERG 2005, p. 143–167, *International handbook of population aging* 2009).

³ The literature contains also other ways of determining how potential labour force relates to labour demand projections (see PODOGRODZKA 2015).

2035, 2040⁴ derived from the Eurostat online statistical database and the quinquennial data on Polish voivodships and poviats from the years 2005–2040 published by the Central Statistical Office (GUS).

A comparative analysis of potential labour force in European countries

The 2005 percentages of population aged 15–64 years (representing the potential labour force) were relatively high in the majority of European countries, the highest in Poland, Slovakia and the Czech R. (Tab. 1). Over the next decade, they decreased in most countries excluding Cyprus and Luxemburg (where they slightly rose). Among the EU countries, in 2014 they were the highest in Slovakia, Poland, Luxemburg and Cyprus, and the lowest in Sweden and France.

In the next several to ten-plus years, changes in the population age structure will reduce potential labour force in all European countries. The largest falls are predicted to take place between 2014 and 2020 in Poland, the Czech Republic, Slovenia and Malta (in these countries the age group 16–54 years will be smaller by 5%), and in the years 2014–2030 and 2014–2040 in Germany and Lithuania. Eurostat forecasts for the EU countries show that in 2030 and 2040 relatively high percentages of this population will be noted in Cyprus, Luxemburg and Slovakia, while the Lithuanian rate will be the lowest (Tab. 1).

Compared with other EU countries, Poland has today and will have in the future a relatively large potential labour force. However, its size will be gradually decreasing over time. A downward trend will be particularly clear after 2040, due to large birth cohorts of post-baby boomers born in the early 1980s leaving the subpopulation aged 15–64 years.

The consequence of the subpopulation of children aged 0–14 years being smaller and smaller in most European countries, including Poland, is that the potential labour force receives increasingly small birth cohorts. At the same time, more and more people reach the threshold of demographic old age at 65 years. Changes in the age structure of populations that are potentially ready to “enter” or “exit” the labour market can be measured using a labour force replacement ratio, which is calculated as a quotient between the number of people aged 15–24 years and the number of people aged 55–64 years.

Labour force replacement ratios greater than 1 show that in 2005, the first year of the analysis, the subpopulation of people that could enter the potential

⁴ The data on the age structure of European populations are presented in Poland as on 31 Dec. each year, but in the Eurostat database, they are dated 1st Jan. of the next year.

Table 1
 Proportion of population aged 15–64 years in EU countries and some other European countries between 2005 and 2040 [%] and its change in the years 2005–2014 (2005 = 1.0) and 2014–2040 (2014 = 1.0)

Country	2005	2010	2014	2020	2025	2030	2035	2040	2014/2005	2020/2014	2030/2014	2040/2014
1	2	3	4	5	6	7	8	9	10	11	12	13
EU countries												
Austria	67.7	67.6	67.2	65.9	64.0	61.7	60.1	59.6	0.99	0.98	0.92	0.89
Belgium	65.7	65.9	64.9	63.5	62.4	61.2	60.6	60.4	0.99	0.98	0.94	0.93
Bulgaria	69.1	68.3	66.1	63.9	62.9	62.3	61.2	59.3	0.96	0.97	0.94	0.90
Croatia	66.7	67.0	66.5	64.2	62.6	61.3	60.6	59.9	1.00	0.97	0.92	0.90
Cyprus	68.5	70.5	69.0	66.8	65.0	64.0	63.7	63.0	1.01	0.97	0.93	0.91
Czech Republic	71.1	69.9	67.0	63.6	63.4	63.0	62.6	60.3	0.94	0.95	0.94	0.90
Denmark	66.1	65.3	64.4	63.3	62.3	60.5	59.4	58.9	0.97	0.98	0.94	0.91
Estonia	68.1	67.2	65.3	62.6	61.8	61.0	60.3	58.8	0.96	0.96	0.93	0.90
Finland	66.7	66.0	63.7	61.0	59.8	58.9	58.8	59.3	0.95	0.96	0.93	0.93
France	65.1	64.7	63.0	61.5	60.3	58.9	57.9	57.2	0.97	0.98	0.94	0.91
Greece	66.6	66.1	64.6	63.8	63.1	61.8	59.3	56.8	0.97	0.99	0.96	0.88
Spain	68.9	67.9	66.3	65.4	64.5	62.7	60.0	56.7	0.96	0.99	0.95	0.86
Netherlands	67.5	67.0	65.5	63.9	61.9	59.7	57.9	57.4	0.97	0.98	0.91	0.88
Ireland	68.5	67.2	64.9	63.3	63.3	63.0	61.7	59.1	0.95	0.98	0.97	0.91
Lithuania	67.1	67.2	66.7	63.7	60.2	57.5	56.1	55.3	0.99	0.96	0.86	0.83
Luxembourg	67.5	68.5	69.2	67.8	66.5	65.1	64.0	63.5	1.02	0.98	0.94	0.92
Latvia	68.5	67.4	65.6	63.6	61.8	60.3	59.4	58.1	0.96	0.97	0.92	0.89
Malta	69.1	69.3	67.2	63.6	61.2	60.2	60.6	60.6	0.97	0.95	0.90	0.90
Germany	66.6	66.0	65.8	63.9	61.6	58.7	56.5	56.2	0.99	0.97	0.89	0.85
Poland	70.5	71.1	69.5	66.0	64.2	63.7	63.4	62.0	0.99	0.95	0.92	0.89
Portugal	66.8	66.2	65.3	64.5	63.3	61.3	59.1	56.4	0.98	0.99	0.94	0.86
Romania	68.4	68.0	67.5	65.3	64.1	63.9	61.5	59.8	0.99	0.97	0.95	0.89

cont. Table 1

1	2	3	4	5	6	7	8	9	10	11	12	13
Slovakia	71.5	72.0	70.7	67.9	66.4	65.5	64.7	62.5	0.99	0.96	0.93	0.88
Slovenia	70.2	69.3	67.3	63.7	62.1	60.9	59.8	58.3	0.96	0.95	0.90	0.87
Sweden	65.4	64.9	63.1	61.5	60.9	60.3	60.2	60.2	0.96	0.97	0.96	0.95
Hungary	68.8	68.7	67.6	65.1	64.1	63.7	62.6	60.8	0.98	0.96	0.94	0.90
United Kingdom	66.1	66.0	64.6	62.8	61.8	60.7	59.9	59.6	0.98	0.97	0.94	0.92
Italy	66.0	65.4	64.5	63.7	62.9	61.2	59.2	57.4	0.98	0.99	0.95	0.89
Other selected European countries												
Belarus	70.3	71.3	69.8	.	.	.	.	.	0.99	.	.	.
Montenegro	66.8	68.0	67.8	.	.	.	.	.	1.02	.	.	.
Iceland	66.5	66.8	66.1	63.5	61.9	60.5	60.1	59.7	0.99	0.96	0.92	0.90
Macedonia	69.4	70.8	70.5	.	.	.	.	.	1.02	.	.	.
Moldavia	71.8	73.6	73.7	.	.	.	.	.	1.03	.	.	.
Norway	65.7	66.2	65.8	64.6	63.7	62.6	61.8	61.4	1.00	0.98	0.95	0.93
Serbia	67.1	68.4	67.1	.	.	.	.	.	1.00	.	.	.
Switzerland	68.0	68.0	67.3	65.4	63.7	61.8	60.6	60.2	0.99	0.97	0.92	0.89
Ukraine	69.3	70.5	69.3	.	.	.	.	.	1.00	.	.	.

Source: Eurostat; developed by the authors.

Table 2

Potential labour force replacement ratios for EU countries and some other European countries, 2005–2040

Country	2005	2010	2014	2020	2025	2030	2035	2040
EU countries								
Austria	1.08	1.05	0.96	0.73	0.68	0.76	0.88	0.88
Belgium	1.07	0.99	0.94	0.87	0.92	1.01	1.06	1.07
Bulgaria	0.99	0.82	0.71	0.68	0.72	0.71	0.67	0.66
Croatia	1.08	0.88	0.81	0.76	0.77	0.81	0.79	0.75
Cyprus	1.54	1.44	1.24	0.89	0.88	0.93	0.90	0.82
Czech Republic	0.97	0.84	0.77	0.76	0.87	0.82	0.71	0.75
Denmark	0.84	0.97	1.05	0.95	0.91	0.91	0.96	1.11
Estonia	1.31	1.03	0.81	0.72	0.86	0.90	0.84	0.78
Finland	0.92	0.84	0.87	0.85	0.91	1.02	1.04	0.98
France	1.16	0.97	0.94	0.98	0.98	1.00	1.05	1.11
Greece	1.16	0.93	0.83	0.76	0.74	0.70	0.65	0.64
Spain	1.13	0.94	0.82	0.72	0.72	0.68	0.61	0.62
Netherlands	0.98	0.93	0.94	0.86	0.81	0.83	0.94	1.00
Ireland	1.58	1.28	1.06	1.13	1.16	1.17	1.04	0.97
Lithuania	1.39	1.25	0.99	0.68	0.65	0.78	0.97	1.10
Luxemburg	1.15	1.08	1.05	1.01	0.98	1.05	1.12	1.13
Latvia	1.38	1.10	0.81	0.67	0.78	0.84	0.87	0.86
Malta	1.10	0.94	0.91	0.81	0.87	0.91	0.88	0.85
Germany	1.02	0.90	0.79	0.61	0.56	0.66	0.78	0.77
Poland	1.56	1.00	0.82	0.77	0.91	0.89	0.74	0.64
Portugal	1.07	0.89	0.82	0.76	0.71	0.64	0.58	0.61
Romania	1.30	0.92	0.81	0.95	0.85	0.71	0.73	0.79
Slovakia	1.52	1.09	0.89	0.78	0.82	0.79	0.65	0.57
Slovenia	1.14	0.84	0.69	0.66	0.73	0.82	0.78	0.74
Sweden	0.94	1.05	1.05	0.92	0.96	1.02	1.10	1.15
Hungary	1.06	0.90	0.82	0.86	0.85	0.73	0.66	0.74
United Kingdom	1.11	1.11	1.10	0.90	0.89	1.01	1.10	1.08
Italy	0.85	0.79	0.78	0.71	0.68	0.68	0.71	0.78
Other selected European countries								
Belarus	1.80	1.19	0.86	.	.	.	.	.
Montenegro	1.52	1.17	1.02	.	.	.	.	.
Iceland	1.53	1.37	1.23	1.08	1.17	1.25	1.24	1.24
Macedonia	1.62	1.32	1.11	.	.	.	.	.
Moldavia	2.27	1.63	1.12	.	.	.	.	.
Norway	1.06	1.09	1.11	1.05	1.00	1.01	1.08	1.13
Serbia	1.10	0.78	0.72	.	.	.	.	.
Switzerland	0.98	0.99	0.93	0.78	0.75	0.86	0.96	0.96
Ukraine	1.54	1.12	0.84	.	.	.	.	.

Source: Eurostat; developed by the authors.

labour force (15–24 years) was larger than the proportion of people nearing retirement (55–64 years) in most EU countries (Tab. 2). By 2014, there were only six of them (Cyprus, Denmark, Ireland, Luxemburg, Sweden and the UK). In the other countries, the older group outnumbered the younger group. The largest differences between the two populations were observed in Slovenia, Bulgaria, Germany and Italy.

Ireland's percentage of children is high today, so in 2020 and 2025 it will be the only country where the subpopulation aged 15–24 years will be significantly larger than the age group of 55–64 years. However after 2030, the first subpopulation will decrease and the other will increase. With the difference between them growing increasingly small, within a decade (in 2040) the older group will be larger. In 2040, the potential labour force replacement ratios will be relatively good in Luxemburg, Denmark, France, Lithuania and Sweden. The lowest ratios will be noted in Slovakia, Portugal, Greece, Spain and Poland, where the subpopulation aged 15–24 years will be almost half as small as the age group 55–64 years (Tab. 2).

A comparative analysis of potential labour force in Poland

In 2015, the Polish population of people aged 15–64 years (the potential labour force) was counted at nearly 27 million (69.2% of the entire population), but projections show that over the following years it will decrease. Between 2005 and 2015, it diminished by 285,800 people (in rural areas it increased by 691,200 people, mainly due to urban-to-rural migrations and smaller outflows from rural areas than in previous years). It is estimated that in the years 2015–2030 and 2015–2040 it will be smaller by 1,320,000 and 4,670,000, respectively. In the analysed years (2005–2040), it will most likely decrease by almost 5 million (Tab. 3)⁵.

The proportion of population aged 15–64 years was falling in Poland from the beginning of the second decade of the 21st c. (in urban areas the process started somewhat earlier)⁶. The trend will probably continue into the future. Although before 2013 a higher percentage of this subpopulation was noted in towns, in 2014 the rural and urban percentages were the same. GUS projections indicate that in the following years the rural percentage will be slightly higher (Fig. 1).

⁵ Tables 3 and 1 show different rates of population aged 15–64 for Poland, because of differences between GUS and Eurostat.

⁶ The percentage of this population was lower in the 1980s and 1990s than it is today (in 1990 it was 65.4%), because today's potential labour force has been strengthened by a relatively large subpopulation of children.

Table 3
Polish population aged 15–64 years between 2005 and 2040 and its change in the years 2005–2015
and 2015–2040 (millions)

Specification	2005	2010	2015	2020	2025	2030	2035	2040	2005–2015	2015–2020	2015–2030	2015–2040	2005–2040
Total	26.9	27.5	26.6	25.3	24.3	23.7	23.0	21.9	-0.29	-1.32	-2.92	-4.67	-4.95
Urban areas	16.9	16.9	16.0	14.8	14.0	13.5	13.0	12.2	-0.98	-1.16	-2.47	-3.73	-4.71
Rural areas	9.9	10.6	10.6	10.5	10.3	10.2	10.0	9.7	0.69	-0.17	-0.45	-0.94	-0.25

Source: GUS; developed by the authors.

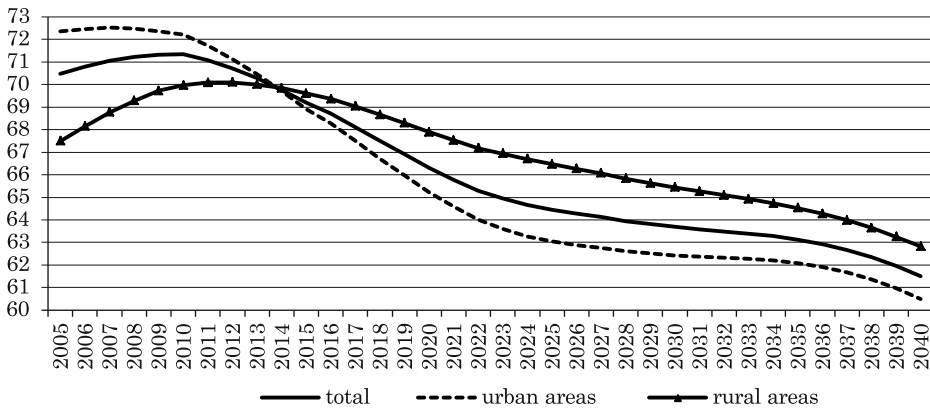


Fig. 1. Proportion of population aged 15–64 years in Poland, years 2005–2040 [%]

Source: GUS; developed by the authors.

In Poland, the percentages of population aged 15–64 years vary territorially, and in most voivodeships they are higher for rural areas than for towns (tab. 4–5). In 2015, the highest percentages were recorded for the Lubuskie, Opolskie, Zachodniopomorskie and Warmińsko-Mazurskie voivodeships, and the lowest in Mazowieckie and Łódzkie. Over the next several to ten-plus years, they will decline in all voivodeships. In 2040, the lowest percentages will be noted in the Opolskie, Podlaskie and Świętokrzyskie voivodeships.

At the beginning of the analysed period and in 2010, towns had a higher percentage of population aged 15–64 years compared with rural areas in all voivodeships (Tab. 5). Today, a reversed situation can be observed in most voivodeships (the exceptions are the Lubelskie, Podkarpackie and Podlaskie voivodeships). After 2020, the rural percentage of this population will be

higher in all voivodeships. In 2040, the lowest proportion of population aged 15–64 years in towns will occur in Świętokrzyskie and the highest in Mazowieckie, and in rural areas in Podlaskie and Pomorskie, respectively.

Table 4
Proportion of population aged 15–64 years in Poland and its voivodeships,
years 2005–2040 – totals [%]

Specification	2005	2010	2015	2020	2025	2030	2035	2040
Poland	70.5	71.3	69.2	66.3	64.5	63.7	63.1	61.5
Dolnośląskie	71.7	72.6	69.7	66.0	63.9	63.4	63.2	61.6
Kujawsko-Pomorskie	70.8	71.9	69.6	66.7	64.7	63.7	63.0	61.4
Lubelskie	68.8	70.2	68.9	66.4	64.5	63.4	62.5	60.8
Lubuskie	71.8	72.8	70.1	66.6	64.4	63.7	63.3	61.7
Łódzkie	70.2	71.0	68.4	65.2	63.3	62.7	62.2	60.6
Małopolskie	69.3	70.3	69.0	66.8	65.3	64.5	63.8	62.3
Mazowieckie	69.8	70.2	68.0	65.2	64.0	64.0	63.8	62.2
Opolskie	71.2	72.2	70.4	67.7	65.4	63.8	62.3	60.4
Podkarpackie	69.0	70.7	69.9	67.7	65.9	64.6	63.5	61.6
Podlaskie	68.7	70.3	69.6	67.4	65.2	63.5	62.2	60.4
Pomorskie	70.8	71.4	69.0	66.1	64.5	63.9	63.5	62.0
Śląskie	72.0	71.8	69.3	65.9	63.7	62.8	62.2	60.6
Świętokrzyskie	69.0	70.7	69.0	66.1	63.9	62.8	62.0	60.2
Warmińsko-Mazurskie	70.7	72.3	70.6	67.6	65.2	63.8	62.9	61.3
Wielkopolskie	71.1	72.0	69.3	66.5	64.9	64.3	63.9	62.4
Zachodniopomorskie	71.8	72.9	70.2	66.6	64.3	63.4	62.9	61.3

Source: GUS; developed by the authors.

The future size of the potential labour force in Poland will be shaped by the present age structure of the population and the relatively low fertility rates in voivodeships, as well as by the directions and volumes of migration flows.

Between 2005 and 2015, the urban percentage of population aged 15–64 fell in all voivodeships, while the rural percentage increased (Tab. 6). The main causes were positive net migration in rural areas surrounding towns and especially large cities (a clearly higher outflow of younger working-age people from rural areas to towns was accompanied by a slightly higher inflow of urban residents to rural areas). In the space of the years 2015–2020, 2015–2030 and 2015–2040, the population aged 15–64 will decrease in the rural areas and towns of all voivodeships. In 2040, the largest decrease when compared to 2015 will be noted in the Opolskie voivodeship (by 14%).

Table 5

Population aged 15–64 years in Poland and its voivodeships in urban and rural areas, 2005–2040 [%]

Specification	Urban areas				Rural areas			
	2005	2015	2025	2040	2005	2015	2025	2040
Polska	72.4	68.9	63.0	60.5	67.5	69.6	66.5	62.8
Dolnośląskie	72.5	69.0	62.4	60.5	69.9	71.3	67.0	63.7
Kujawsko-Pomorskie	72.2	69.2	63.3	60.0	68.5	70.2	66.7	63.0
Lubelskie	73.1	69.7	63.1	59.2	65.0	68.3	65.7	62.0
Lubuskie	72.9	69.5	63.0	60.7	69.7	71.2	66.8	63.1
Łódzkie	72.3	68.3	61.9	59.4	66.5	68.5	65.4	62.2
Małopolskie	71.7	68.6	63.6	61.4	66.9	69.3	66.9	63.0
Mazowieckie	71.6	67.6	62.9	62.0	66.5	68.8	65.9	62.6
Opolskie	72.9	69.6	63.4	59.0	69.4	71.3	67.5	61.9
Podkarpackie	72.7	70.3	63.7	59.9	66.5	69.7	67.4	62.7
Podlaskie	72,5	71.0	64.8	60.1	63.2	67.4	65.7	60.9
Pomorskie	71.8	68.3	63.0	60.7	68.7	70.3	67.1	64.0
Śląskie	72.8	69.1	63.0	60.1	69.4	69.7	65.9	62.0
Świętokrzyskie	72.6	68.9	61.6	57.7	66.0	69.1	65.6	61.9
Warmińsko-Mazurskie	72.5	70.3	63.9	60.1	68.1	71.0	67.1	62.9
Wielkopolskie	72.6	68.9	63.4	60.9	69.0	69.8	66.6	63.8
Zachodniopomorskie	72.8	69.5	62.9	60.2	69.4	71.6	67.0	63.3

Source: GUS; developed by the authors.

The potential labour force replacement ratio that was falling from the beginning of the period under consideration was higher in rural areas than in towns (Tab. 7, 8). In 2005, people aged 15–24 years, i.e. theoretically ready to “enter” the potential labour force, outnumbered in the rural areas and towns of all voivodeships those nearing retirement (55–64 years). By 2010, both subpopulations became similar in size (earlier in towns than in rural areas where they became equal only in 2015). In 2040, the ratio between people aged 55–64 years and those in the age group 15–24 years will most likely be 100 to 57. In other words, the outflow of people nearing retirement age will not be compensated for by the inflow of people old enough to start economic activity. This will lead to a further decrease in the proportion of population aged 15–64 years.

In 2015, all voivodeships and towns had a potential labour force replacement ratio below 1 (Tab. 7, 8). In the rural areas of nine voivodeships, the younger of the two subpopulations was in the majority. Over the next several to ten-plus years, the potential labour force replacement ratios are likely to decline more in all voivodeships. In 2040, they will be particularly low in the towns. In some voivodeships, the younger of the two subpopulations will not be

Table 6
Change in the proportion of population aged 15–64 years in Poland and its voivodships, 2005–2014 (2005 = 1.0) and 2014–2040 (2014 = 1.0)

Specification	Total				Urban areas				Rural areas			
	2015/2005	2020/2015	2030/2015	2040/2015	2015/2005	2020/2015	2030/2015	2040/2015	2015/2005	2020/2015	2030/2015	2040/2015
Poland	0.98	0.96	0.92	0.89	0.95	0.95	0.91	0.88	1.03	0.97	0.94	0.90
Dolnośląskie	0.97	0.95	0.91	0.88	0.95	0.94	0.90	0.88	1.02	0.96	0.93	0.89
Kujawsko-Pomorskie	0.98	0.96	0.92	0.88	0.96	0.95	0.90	0.87	1.03	0.97	0.93	0.90
Lubelskie	1.00	0.96	0.92	0.88	0.95	0.94	0.89	0.85	1.05	0.98	0.95	0.91
Lubuskie	0.98	0.95	0.91	0.88	0.95	0.94	0.90	0.87	1.02	0.96	0.92	0.89
Łódzkie	0.97	0.95	0.92	0.89	0.94	0.94	0.90	0.87	1.03	0.97	0.94	0.91
Małopolskie	1.00	0.97	0.93	0.90	0.96	0.95	0.92	0.89	1.04	0.98	0.95	0.91
Mazowieckie	0.98	0.96	0.94	0.91	0.94	0.95	0.94	0.92	1.04	0.98	0.94	0.91
Opolskie	0.99	0.96	0.91	0.86	0.95	0.95	0.89	0.85	1.03	0.97	0.92	0.87
Podkarpackie	1.01	0.97	0.92	0.88	0.97	0.94	0.89	0.85	1.05	0.99	0.95	0.90
Podlaskie	1.01	0.97	0.91	0.87	0.98	0.96	0.89	0.85	1.07	0.99	0.96	0.90
Pomorskie	0.97	0.96	0.93	0.90	0.95	0.95	0.92	0.89	1.02	0.97	0.94	0.91
Śląskie	0.96	0.95	0.91	0.87	0.95	0.95	0.90	0.87	1.01	0.97	0.93	0.89
Świętokrzyskie	1.00	0.96	0.91	0.87	0.95	0.94	0.88	0.84	1.05	0.97	0.93	0.90
Warmińsko-Mazurskie	1.00	0.96	0.90	0.87	0.97	0.95	0.89	0.85	1.04	0.97	0.93	0.89
Wielkopolskie	0.98	0.96	0.93	0.90	0.95	0.95	0.91	0.88	1.01	0.97	0.94	0.91
Zachodniopomorskie	0.98	0.95	0.90	0.87	0.96	0.94	0.89	0.87	1.03	0.96	0.92	0.88

Source: GUS; developed by the authors.

even half as large as the older subpopulation. Naturally, assuming that the PLN 500+ child allowance programme produces positive effects and delivers its promises, the ratios may rise in both rural areas and in towns, but not until after 15 years.

Table 7
Potential labour force replacement ratios for Poland and its voivodeships, 2005–2040 – totals

Specification	2005	2010	2015	2020	2025	2030	2035	2040
Poland	1.56	1.01	0.79	0.75	0.87	0.83	0.66	0.57
Dolnośląskie	1.48	0.86	0.67	0.67	0.84	0.80	0.61	0.52
Kujawsko-Pomorskie	1.58	1.02	0.82	0.76	0.87	0.83	0.66	0.57
Lubelskie	1.66	1.11	0.87	0.79	0.85	0.80	0.65	0.56
Lubuskie	1.65	0.95	0.75	0.74	0.90	0.86	0.65	0.55
Łódzkie	1.29	0.85	0.71	0.70	0.82	0.78	0.62	0.54
Małopolskie	1.70	1.19	0.92	0.83	0.89	0.86	0.71	0.61
Mazowieckie	1.44	0.95	0.76	0.78	0.94	0.88	0.69	0.59
Opolskie	1.62	1.03	0.75	0.65	0.69	0.69	0.57	0.49
Podkarpackie	1.88	1.26	0.97	0.84	0.86	0.81	0.66	0.57
Podlaskie	1.80	1.24	0.89	0.74	0.79	0.77	0.65	0.56
Pomorskie	1.61	1.03	0.83	0.82	0.96	0.92	0.73	0.64
Śląskie	1.41	0.92	0.69	0.65	0.78	0.79	0.64	0.54
Świętokrzyskie	1.53	0.98	0.78	0.73	0.80	0.75	0.60	0.52
Warmińsko-Mazurskie	1.88	1.13	0.84	0.76	0.87	0.85	0.68	0.58
Wielkopolskie	1.62	1.04	0.84	0.81	0.94	0.90	0.71	0.61
Zachodniopomorskie	1.54	0.90	0.72	0.71	0.86	0.80	0.61	0.53

Source: GUS; developed by the authors.

The above analysis, similar to that performed for European countries, focused on the Polish subpopulation of people aged 15–64 years and the relation between its two outermost, 10-year age groups. This approach, although somewhat simplified, is frequently found in the literature, particularly in international studies. The scope of the next part of the analysis will be widened to account for the working-age subpopulation (defined according to economic criteria)⁷ and changes in the mandatory retirement age⁸.

In 2015, the working-age population in Poland was estimated at 24.9 million (less than 65% of the total population), of which 15 million people lived

⁷ Age groups defined according to economic criteria are also called functional age groups (KRYŃSKA 2006).

⁸ The mandatory retirement age was raised by a pension system reform (before 2012, it was 60 and 65 years for females and males, respectively). In the years under consideration, the following retirement ages will be applied (GUS 2014): men: 2015 – 65.75, 2020 – 67, 2025 – 67, 2030 – 67, 2035 – 67, 2040 – 67; women: 2015 – 60.75, 2020 – 62, 2025 – 63.25, 2030 – 64.5, 2035 – 65.75, 2040 – 67.

Table 8

Potential labour force replacement ratios for Poland and its voivodeships,
2005–2040 – urban and rural areas

Specification	Urban areas				Rural areas			
	2005	2015	2025	2040	2005	2015	2025	2040
Polska	1.40	0.66	0.81	0.52	1.87	1.02	0.94	0.65
Dolnośląskie	1.35	0.60	0.79	0.49	1.89	0.85	0.94	0.57
Kujawsko-Pomorskie	1.41	0.69	0.80	0.51	1.92	1.03	0.98	0.67
Lubelskie	1.62	0.69	0.79	0.50	1.70	1.05	0.90	0.61
Lubuskie	1.51	0.67	0.87	0.52	1.96	0.91	0.94	0.60
Łódzkie	1.19	0.59	0.77	0.48	1.51	0.95	0.89	0.63
Małopolskie	1.47	0.71	0.80	0.52	2.01	1.17	0.97	0.70
Mazowieckie	1.27	0.62	0.92	0.55	1.82	1.03	0.98	0.68
Opolskie	1.43	0.65	0.69	0.46	1.89	0.87	0.68	0.52
Podkarpackie	1.78	0.74	0.80	0.50	1.97	1.18	0.89	0.62
Podlaskie	1.90	0.77	0.76	0.54	1.67	1.10	0.83	0.60
Pomorskie	1.36	0.69	0.87	0.56	2.38	1.14	1.12	0.77
Śląskie	1.35	0.64	0.76	0.52	1.66	0.88	0.83	0.61
Świętokrzyskie	1.36	0.60	0.73	0.44	1.71	0.96	0.86	0.57
Warmińsko-Mazurskie	1.70	0.71	0.82	0.53	2.22	1.07	0.95	0.65
Wielkopolskie	1.44	0.70	0.85	0.53	1.93	1.05	1.05	0.70
Zachodniopomorskie	1.39	0.63	0.82	0.50	2.01	0.92	0.93	0.60

Source: GUS; developed by the authors.

in towns and cities (Tab. 9). It is projected that over the next several to ten-plus years this potential labour force will decrease considerably, more in towns than in rural areas. In a period as short as the next five years (2015–2020), it will most likely be smaller by over one million people, and in the periods 2015–2030 and 2015–2040 by 2 and almost 3 million people, respectively.

Had the working-age band remained as it was before the pension system was changed (i.e. 18-59F/64M), in 2040 Poland would have 19.5 million people of working age (10.9 m in towns and 8.7 m in rural areas), i.e. 2.5 m less than in the GUS projection accounting for new retirement ages for males and females. Due to the possible consequences of the shrinking potential labour force, the raising of the mandatory retirement age seems a rational solution.

In 2015, the working-age population accounted for 64.8% of the country's total inhabitants. Projections show that by 2040 the rate will fall to 61.7% (Tab. 10). Its decrease in the years 2015 and 2040 is estimated at 5% (6% and 4% in towns and rural areas, respectively).

Table 9

Working-age population in Poland allowing for changes in the mandatory retirement age (millions) and its decrease in the years 2015–2040; proportion of the working-age population in Poland and its change between 2015 and 2040 (2015 = 1.0)

Specification	2015	2020	2025	2030	2035	2040	2015–2020	2015–2030	2015–2040
	population at working age (millions)						decrease (millions)		
Total	24.9	23.8	23.1	22.9	22.6	22.0	-1.08	-2.01	-2.90
Urban areas	15.0	14.0	13.3	13.1	12.8	12.3	-0.99	-1.89	-2.63
Rural areas	9.9	9.9	9.8	9.8	9.8	9.7	-0.09	-0.12	-0.27
	proportion of working-age population [%]						change (2015 = 1.0)		
Total	64.8	62.5	61.2	61.6	61.9	61.7	0.96	0.95	0.95
Urban areas	64.6	61.5	59.9	60.4	61.0	60.9	0.95	0.94	0.94
Rural areas	65.1	63.9	63.0	63.2	63.1	62.7	0.98	0.97	0.96

Source: GUS; developed by the authors.

The lowest percentage of the working-age population (18–66 years) in 2040 will occur in the Podlaskie voivodeship. For towns and rural areas, its values will be the lowest in Świętokrzyskie and Podlaskie, respectively (Tab. 10).

Table 10 contains the 2040 values of the potential labour force replacement ratios for Poland and its voivodeships (calculated as a quotient between the population aged 18–24 years and the population aged 60–66 years, taking into account the retirement age changes). The ratios show, again, that the subpopulation of people that will be old enough to start economic activity will not be sufficiently large to replace the subpopulation nearing retirement. In 2040, the countrywide ratio between the number of people aged 18–24 years and the number of people aged 60–66 years will be 62 to 100 (57 and 70 for towns and rural areas, respectively). Among voivodeships, it will most likely be the lowest in Opolskie (in Świętokrzyskie for towns and in Opolskie for rural areas).

The potential labour force varies in size and percentage inside voivodeships as well. For instance, in 2040 the Opolskie voivodeship will have a relatively small proportion of the working age population, while having the largest population of people nearing retirement in relation to people ready to enter the labour force of all voivodeships. The labour market situation in Opolskie is likely to become relatively disadvantageous after 2020, because its potential labour force will be reduced by the present, strong outflow of population from the voivodeship (frequently towards foreign destinations) and very low fertility rates.

Among the Opolskie poviats (NTS4 units), Głubczyce, Kędzierzyn-Koźle and Olesno will probably have the lowest percentages of population aged 18–66 years in 2040 (60%). The highest value of the rate will be noted in Opole (63%). The rural rates will be higher in all poviats. In the same year, the potential

Table 10
Population aged 18–66 years (millions), proportion of the population aged 18–66 years and potential labour force replacement ratios (L_{18-24}/L_{60-66}) for Poland and its voivodeships in 2040

Specification	Population aged 18–66 years (millions)			Proportion of population aged 18–66 years [%]			Replacement ratio L_{18-24}/L_{60-66}		
	total	urban areas	rural areas	total	urban areas	rural areas	total	urban areas	rural areas
Poland	22.01	12.33	9.67	61.7	60.9	62.7	0.62	0.57	0.70
Dolnośląskie	1.64	1.04	0.59	62.1	61.1	63.9	0.57	0.54	0.62
Kujawsko-Pomorskie	1.17	0.63	0.54	61.5	60.5	62.8	0.62	0.55	0.72
Lubelskie	1.14	0.49	0.65	61.1	59.8	62.1	0.61	0.54	0.66
Lubuskie	0.58	0.34	0.24	62.0	61.1	63.2	0.60	0.57	0.65
Łódzkie	1.31	0.75	0.56	61.0	60.2	62.2	0.58	0.52	0.67
Małopolskie	2.09	0.92	1.16	62.2	61.7	62.7	0.67	0.58	0.76
Mazowieckie	3.35	2.12	1.23	62.3	62.2	62.4	0.64	0.60	0.72
Opolskie	0.50	0.24	0.26	61.1	59.8	62.4	0.53	0.49	0.57
Podkarpackie	1.23	0.46	0.77	61.8	60.4	62.8	0.62	0.55	0.67
Podlaskie	0.64	0.39	0.25	60.6	60.3	61.1	0.61	0.60	0.64
Pomorskie	1.43	0.83	0.59	61.9	61.0	63.2	0.70	0.61	0.85
Śląskie	2.42	1.77	0.64	60.9	60.5	62.1	0.59	0.57	0.66
Świętokrzyskie	0.65	0.25	0.40	60.8	58.7	62.2	0.55	0.47	0.62
Warmińsko-Mazurskie	0.80	0.45	0.35	61.4	60.5	62.7	0.63	0.58	0.71
Wielkopolskie	2.11	1.02	1.09	62.3	61.3	63.3	0.67	0.58	0.76
Zachodniopomorskie	0.96	0.62	0.34	61.7	60.8	63.4	0.57	0.53	0.65

Source: GUS; developed by the authors.

labour force replacement ratios will be the lowest in the poviats of Nysa and Opole (46 and 48 people aged 18–24 per 100 people aged 60–66 years, respectively). The highest ratio will be noted in the poviat of Strzelce Opolskie (63).

Conclusion

The deep changes in population age structure in European countries, including Poland, will continue into the future. Their multiple consequences, some of which will be negative, will be particularly observable in the labour market, but the stability of the pension system that mostly depends on redistribution will be affected too. It can be expected that a longer period during which less people will be “entering” the potential labour force than leaving it will make the system’s inefficiencies particularly obvious. In the long

term, the raising of the mandatory retirement age will slow down the downward trend in potential labour force in Poland, rather than reversing it. Higher fertility rates will not make the situation much better either, unless a generation replacement rate (which could significantly halt the trend) is achieved overnight (quite an unrealistic vision, indeed) (JÓZWIAK 2013, p. 20). These circumstances call for actions stimulating fertility growth in the long term, as well economic activity, particularly among women and people at the threshold of retirement⁹.

Changes in the population age structure are usually analysed from a quantitative perspective. However, there is a range of qualitative factors that allow their detrimental impacts to be cushioned. Some of them serve the purpose of promoting economic activity, while others focus on increasing individual productivity (e.g. by the introduction of newer and newer technologies that lead to social productivity improvements). The latter, by reducing demand for labour, make the problem of shortages in potential labour force less painful¹⁰. There is also a solution that goes against the nature of a redistributive pension system and is very difficult to implement. It consists in changing the system in such a way as to allow retired people to have a sufficient share of the capital they have accumulated over pensionable years, and thereby to be independent of the number of economically active people contributing to the pension system.

Translated by JANUSZ KWITECKI
Proofreading by MICHAEL THOENE

Accepted for print 31.05.2017

References

- Bank Danych Lokalnych. 2015. GUS, <https://bdl.stat.gov.pl/BDL/start> (access: 15.07.2016).
- DAŃSKA-BORSIAK B., ŁASKOWSKA I., OLEJNIK A. 2014. *Prognozy liczby pracujących w przekroju województw i grup zawodów*. Polityka Społeczna, Prognozowanie zatrudnienia, 1. Instytut Pracy i Spraw Socjalnych, Warszawa.
- International handbook of population aging*, 2009. Ed. Uhlenberg P., Springer, NY.
- JÓZWIAK J. 2013. *Demograficzne uwarunkowania rynku pracy w Polsce*. In: *Rynek pracy wobec zmian demograficznych*. Ed. M. Kielkowska. Zeszyty Demograficzne, 1, Instytut Obywatelski, Warszawa.

⁹ Many countries attempt to tackle the problems by attracting immigrants, but it is not likely that the use of a migration policy could satisfactorily change the shape of the population age pyramid in Poland. To make up for shortages in real labour force resulting from structural changes, Poland would need to receive 5 million people by 2060 (JÓZWIAK 2013, p. 22 as quoted in Strzelecki). Let us note that unless the general level of fertility increases in the long term, the ultimate outcome of this approach, which is unrealistic to implement in Poland anyway, would be a larger proportion of the retirement age population.

¹⁰ An in-depth analysis of the probable demand for labour in Poland can be found, inter alia, in the studies by KWIATKOWSKI, WŁODARCZYK (2014) and DAŃSKA-BORSIAK et al. (2014).

- KAA D.J. VAN DE. 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, http://www.ipss.go.jp/webj-ad/WebJournal.files/population/2003_4/Kaa.pdf (access: 10.09.2016).
- KOTOWSKA I.E. 1999. *Drugie przejście demograficzne i jego uwarunkowania*. In: *Przemiany demograficzne w Polsce w latach 90. w świetle koncepcji drugiego przejścia demograficznego*. Ed. I. Kotowska. Monografie i opracowania, 461, Oficyna Wydawnicza Szkoły Głównej Handlowej, Warszawa.
- KRYŃSKA E., KWIATKOWSKI E. 2013. *Podstawy wiedzy o rynku pracy*. Wydawnictwo Uniwersytetu Łódzkiego, Łódź.
- KURKIEWICZ J. 2008. *Teoria drugiego przejścia demograficznego jako koncepcja wyjaśniająca przemiany zachowań demograficznych społeczeństwa rozwiniętego*. In: *Spoleczno-ekonomiczne uwarunkowania procesów ludnościowych i kształtowania się potrzeb*. Eds. J. Kurkiewicz, B. Podolec. Prace z zakresu statystyki i demografii, 1, Krakowskie Towarzystwo Edukacyjne – Oficyna Wydawnicza AFM, Kraków.
- KWIATKOWSKI E., WŁODARCZYK P. 2014. *Podstawy teoretyczne analiz i prognoz rynku pracy*. Polityka Społeczna, Prognozowanie zatrudnienia, 1, Instytut Pracy i Spraw Socjalnych, Warszawa.
- LESTHAEGHER R.J. 2010. *The unfolding story of the second demographic transition*. Research report 10-969, January, Population Studies Center, University of Michigan, Institute for Social Research, <http://www.psc.isr.umich.edu/pubs/pdf/rr10-696.pdf> (access: 10.09.2016).
- PODOGRODZKA M. 2015. *Wpływ zmian struktury wieku ludności na zasoby pracy w Polsce*. Edukacja Ekonomistów i Menedżerów. Problemy. Innowacje. Projekty, 1(35), Szkoła Główna Handlowa w Warszawie, Warszawa.
- Prognoza ludności na lata 2014-2050*. 2014. GUS, <http://stat.gov.pl/obszary-tematyczne/ludnosc/prognoza-ludnosc/prognoza-ludnosc-na-lata-2014-2050-opracowana-2014-r-,1,5.html> (access: 15.07.2016).
- Rocznik Demograficzny 2015*. 2015. GUS, Warszawa.
- UHLENBERG P. 2005. *Demography of aging*. In: *Handbook of population*. D.L. Poston, M. Micklin. Kluwer Academic/Plenum Publisher, New York.